Invivo5

Invivo5.4 Mac Reference Manual

English

Anatomage

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InVivoDental software is dependent on its hardware requirements. The life-cycle is limited only by the availability of the required hardware.

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About Anatomage and InVivoDental Software

This version of InVivoDental was released as a Mac compatible version of the original InVivoDental software from Anatomage, Inc. In this document, InVivoDental refers to the latest version of the Anatomage InVivoDental software and is synonymous with the terms "Invivo," "Invivo5," and "InVivoMac." To learn more about Anatomage, access the Anatomage website (www.Anatomage.com).

Intended User

InVivoDental is designed to be used by medical and dental professionals who have been appropriately trained to use 3D CT imaging devices and read the image data generated by the devices.

Language

The original language of this manual is English. Other versions may be available. Please contact Anatomage for more information.

Caution: Federal law restricts this device to sale by or on the order of medical and dental clinicians.

Indications for Use

InVivoDental is a software application used for the display and 3D visualization of medical image files from scanning devices, such as CT, MRI, or 3D Ultrasound. It is intended for use by radiologists, clinicians, referring physicians, and other qualified individuals to retrieve, process, render, review, store, print, assist in diagnosis and distribute images, utilizing standard PC hardware. Additionally, InVivoDental is a preoperative software application used for the simulation and evaluation of dental implants, orthodontic planning, and surgical treatments.

This device is not indicated for mammography use.

General Precautions

Warning: InVivoDental is a medical software device. Attempts to use the device out of the scope of its intended use may lead to surgical delays or complications. Please seek appropriate training and instructions prior to using the software.

Warning: Please ensure all hardware devices with the software are password-protected from unauthorized use and all patient information is secure.

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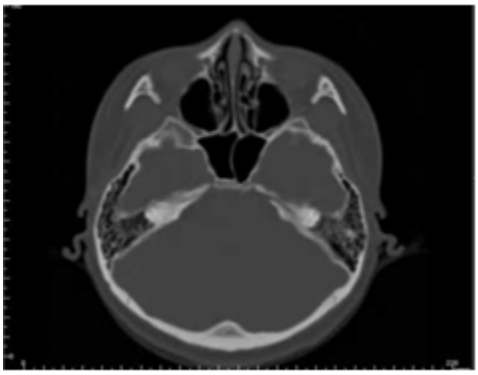
Introduction

InVivoDental Imaging Software



Anatomage, Inc. is a medical imaging company composed of a cross-functional team consisting of the most elite researchers, mathematicians, engineers, software developers, business analysts, industry leaders, academic faculty, and dental specialists. We believe that InVivoDental software will enable the profession to initiate a revolution of unimaginable scope and magnitude. Ultimately, our mission is dedicated to developing simple and refined software specially designed for dentists to utilize the most advanced cutting edge software and technology to better serve their patients. With InVivoDental software, doctors can create 3D volume renderings on their own computers, get cross sections, trace nerves, place implants, print images, save images, and many more functions. The software is designed to reconstruct these 3D volume renderings from DICOM files generated by CBCT, Medical CT, and MRI radiography machines. InVivoDental is intended for use as a planning and simulation software in the placement of dental implants, orthodontics, and surgical treatment.

This manual is intended to provide supplementary information to your direct training with the Anatomage support team. For correct and safe use, training is available to all InVivoDental users and is highly recommended. In this document, InVivoDental refers to the latest version of the Anatomage Invivo software and is synonymous with the terms "Invivo," "Invivo5" and "InVivoMac." For more information, please contact the Anatomage customer support team at (408) 885-1474 or email support@anatomage.com

System Requirements

Below are the minimal and recommended system configurations.

Having an adequate computer system is essential to using InVivoDental efficiently and generating the highest quality images possible for enhanced analysis and presentation for your patients and colleagues. The most important element is the video card (3D graphics chip or GPU). If your system does not have an appropriate video card, you can purchase and install video cards for desktop computers.

InVivoDental has minimal system requirements; however, Anatomage recommends the following configurations to fully utilize all the features within the InVivoDental Software.

Summary

Important: InvivoMac is not compatible with i-Phone, i-Pad, i-Pad Mini, and Apple Watch. InvivoMac may not be compatible with systems older than 2011.

	Minimum	Recommended
System	2011 editions of • Macbook • iMac • Mac Mini *With Intel HD 5000 or higher*	• Latest editions of the Macbook Pro, Macbook Air, Macbook, iMac, or Mac Pro

Minimum Requirements

	Minimum	Recommended
CPU	Intel Core i5	Intel Core i7 or comparable multi-core processor
Graphics Card	Intel HD 5000 *or* ATI Radeon HD 4650 *or* Nvidia GeForce 9800 GT	ATI Radeon HD 6750 *or* Intel Iris 5100 *or* comparable
RAM	3 GB	4 GB
Hard Disk	100 GB	500 GB
OS	OS X v. 10.10 Yosemite	

Note: *Please check the system preferences for the mouse or trackpad. Right-click operations in the PC version are performed by the Mac's secondary click input. Devices such as the Apple Mouse or the Trackpad may impede software navigation. Keyboard commands may also vary depending on the keyboard manufacturer.*

Installing Invivo

About the License Type

The authorization code provided for activation should be one of the two license types below. If the license type is not known, please contact the distributor of the license, which can be either Anatomage or a partner CBCT scanner manufacturer that bundles Invivo licenses.

Perpetual Licenses

- This is a single-use license for one computer. Internet connection will be required for the initial installation but not during subsequent use of the software. If Internet access is not available, the license can be manually activated by the distributor's tech support.

Network Licenses

- This license can install up to four computers that are on the same Internet network as at least one perpetual-licensed computer. Hence, a network license can only be used after a perpetual computer is installed. Internet connection will be necessary to launch the software.

Note: Please ensure each code is entered on the desired computer. Once a code has been activated, you must contact the distributor of the license to transfer the license. Invivo licenses are not interchangeable between the PC and Mac versions.

Internet Requirement

While perpetual computers only need Internet connection during the initial installation, network computers will require Internet to access the software. If the Internet connection becomes unavailable, the network computers will fall onto a grace period of eight hours. After the grace period ends, the license will be inactive until Internet connection linked to a perpetual computer is reestablished.

Website Installation Instructions

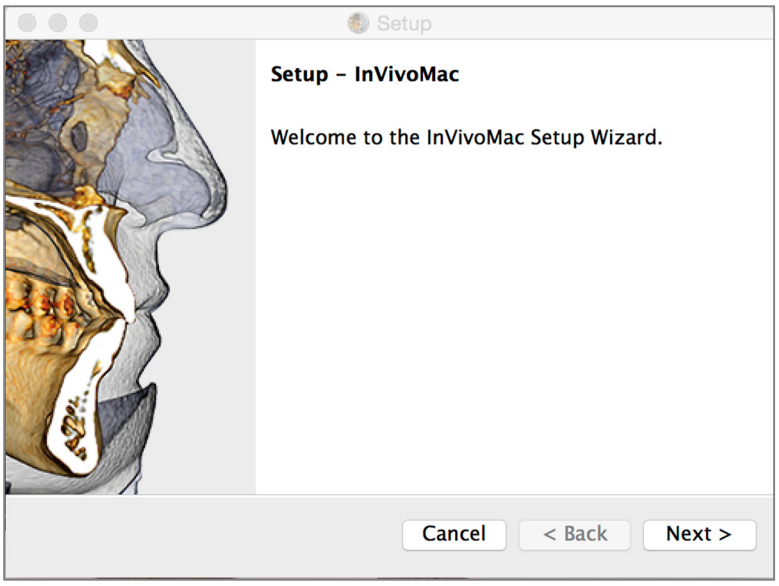
1. Go to www.Anatomage.com
2. Select "Dr. Login."
    - Username: invivomac
    - Password: apple1101
3. Click on the Invivo Installer for Mac.
4. Click "Save File."
5. Run File.

InVivoDental Setup Wizard

Before proceeding, please ensure the computer is connected to the Internet.

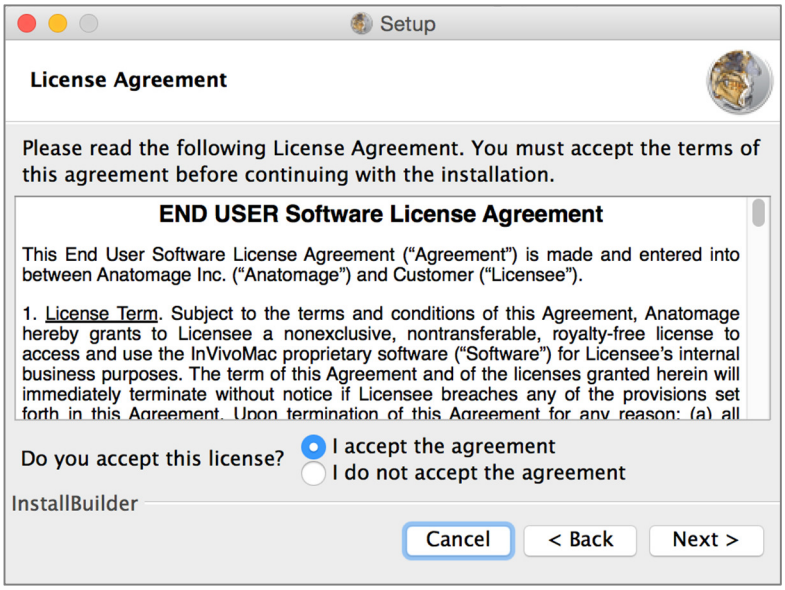
Run the InVivoDental Installer.

Click **Next** to continue.



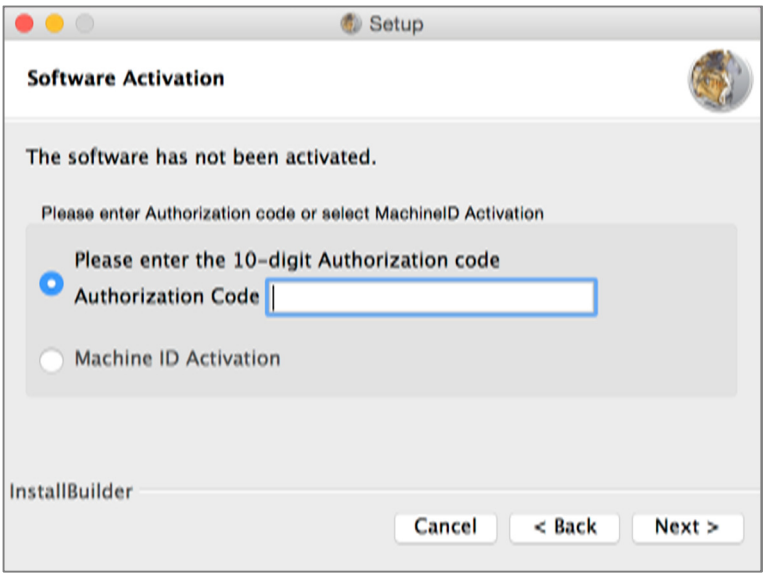
Review the End-User License Agreement and accept the terms if desired to proceed with the installation.

Click **Next** to continue. The program will proceed with installation until completed.



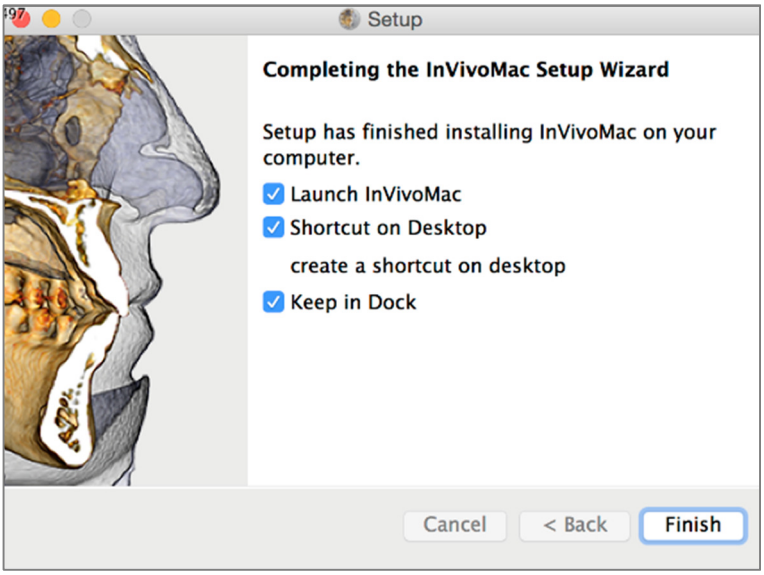
Enter the numerical authorization code. If you have an alphanumeric license key, choose the Machine ID Activation option instead.

Click **Next** to continue.



Once the installation is complete, the wizard will provide options before exiting.

Click **Finish** to exit the installation wizard.



Feature List

An overview of the various features provided by Invivo.

- **Directly Opens DICOM Data from Any CT Machine**
- **Invivo File Compression**
- **Section and Multislice View Operations**
- **Volume Rendering of Scan Data**
- **Linear, Angular, Circumferential, Area, and Volumetric Measurements***
- **Image Capture and Export**
- **Movie Creation**
- **Implant, Abutment, and Restoration Treatment Planning**
- **Bone Density Evaluation**
- **Quick Airway Volume Measurement and Evaluation**
- **Automatic Superimposition and Mirroring**
- **Platform for the AnatoModel Service**

* All measurements are performed with the metric system.

Software Layout

The following is a description of how Invivo is organized by Menu Bar, Toolbar, View Tabs, Property Page, and Rendering Window.

Menu Bar

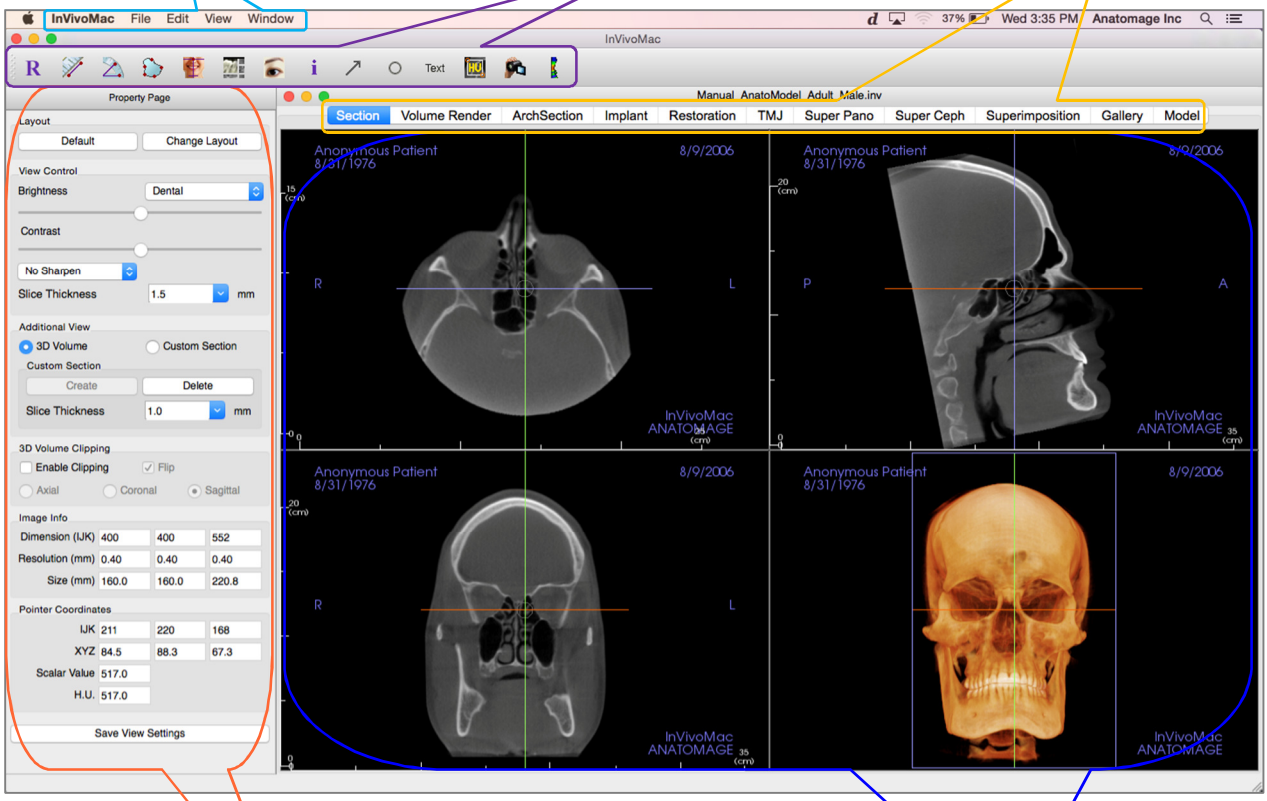
The **Menu Bar** allows you to perform application operations such as open, save, close, print, capture, etc.

Toolbar

Tools can be accessed to perform certain functions on patient images. Sets of tools are associated with a specific **View Tab**.

View Tabs

The **View Tabs** allow you to perform specific tasks or look at specific subjects of interest by adjusting the **Toolbar** and **View Controls**



Property Page

The **Property Page** is the region where patient images can be manipulated and controlled. The **Property Page** is associated with a specific **View Tab**.

Rendering Window

Rendering Window is the region where patient images are displayed. This window can be customized within many of the **View Tabs** by using the **Toolbar**.

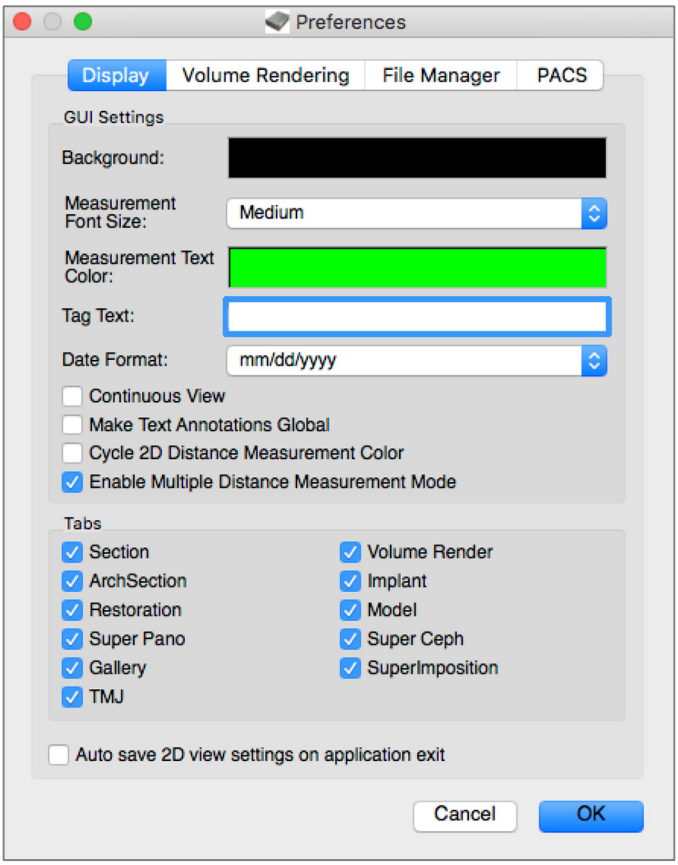
Invivo Preferences

This section will explain the different options within the Preferences window of Invivo. The Invivo preferences include options for Display settings, Volume Rendering settings, as well as File Manager settings.

Accessing the Invivo Preferences:

- In the Menu bar of the Invivo, select "InVivoMac."
- Select "Preferences" from the "InVivoMac" drop-down.

Display Preferences



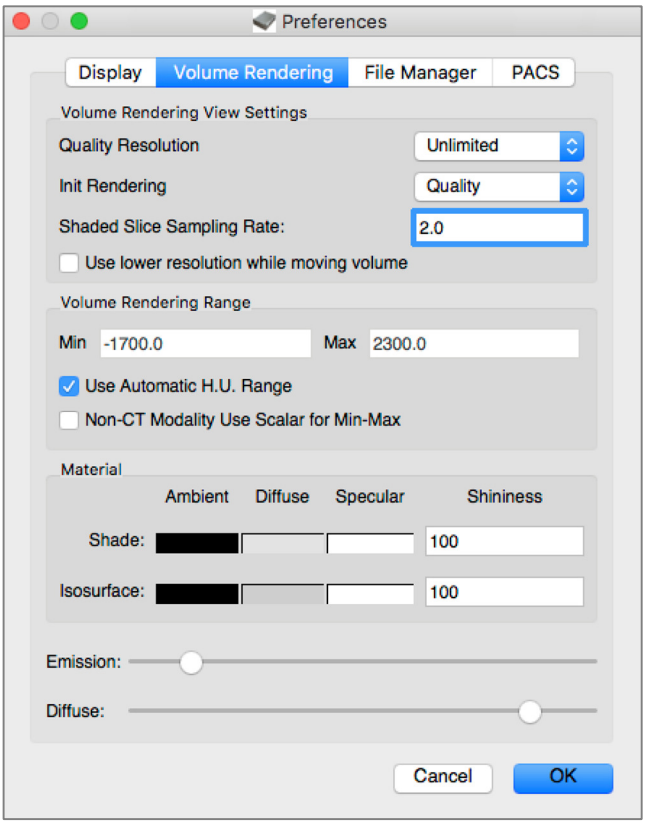
GUI Settings

- Background: Sets the background color for the rendering window.
- Measurement Font Size: Sets the measurement font size to a size preset: small, medium, or large.
- Measurement Text Color: Sets the text color for measurement notations.
- Tag Text: Provides an additional label to the right hand corner of the rendering window.
- Date Format: Current date format for case information display.
- Continuous View:
  - Checked – Switching between view presets for volume renderings will show intermediate volume positions.
  - Unchecked – Switching between view presets will not show intermediate positions; the volume will "jump" to the final position.
- Make Text Annotations Global: When checked, previously placed or new text annotations added to any 2D slice view except group slices (TMJ, ArchSection) will be visible when scrolling past the slice the measurement was placed on.
- Cycle 2D Distance Measurement Color: Measurement colors will cycle with every measurement that is added.
- Enable Multiple Distance Measurement Mode: Distance Measurement will become a toggle on/off button for measurement mode. Toggling "on" this mode will continue to pick beginning and end points for linear measurements with each click after the first measurement has been created.
- Tabs: This section determines which tabs are seen by the user when the program is running. Checked boxes will be available while unchecked boxes will hide those tabs. Changes are made after restarting the program.

- Auto save 2D view setting on application exit: This setting will determine if 2D view settings made in each of the applicable tabs will be saved automatically upon program closure and be reloaded with the next opened case. If left unselected, the user will have to manually save the configuration by clicking **Save View Settings** in the working tab. The specific 2D view settings that will be saved in each tab are given in the table below:

Section	Rendering presets, custom Brightness/Contrast (if the Dental preset is chosen), Sharpen Filter, Volume Clipping, Slice Thickness
Implant	Layout, Restoration Lock, View Preset, Brightness/Contrast, Sharpen Filter, Volume Clipping, and Remove Crown
ArchSection	Slice Interval, Cross Section Width/Interval/Thickness, Auto R-L, Pano Image Type, Pano Ruler Enabled, Brightness/Contrast mode, Layout (including Axial vs. Cross Series and Print Layout), Sharpen Filter, Color Preset, Nerve Diameter, and Nerve Visibility
TMJ	Lateral Width/Interval/Thickness, Pano Ruler, Brightness/Contrast mode and settings, Layout (including sequence type and Print Layout), Sharpen Filter, Color Preset, Focal Trough Thickness and Symmetry, Pano Render Mode

Volume Rendering Preferences



Volume Rendering View Settings

- Quality Resolution: Sets the limit for the resolution of the image. This can be set to either a user-defined number or set to Unlimited.
- Init (Initial) Rendering: Sets the rendering quality upon opening Invivo.
- Shaded Slice Sampling Rate: Accepts a numerical value that sets the sampling rate to improve image quality at the cost of performance.
- Use lower resolution while moving volume: Positional changes of the volume will be rendered at a low quality resolution while maintaining the quality resolution setting in the final position.

Volume Rendering Range

- The user can define the range of Hounsfield Units that will be rendered. This cannot be set when "Use Automatic H.U. Range" is checked.
- Checking "Non-CT Modality Use Scalar for Min-Max" will allow the user to define the minimum and maximum scalar units that will be rendered.

Material

- Various properties can be adjusted to change the appearance of a volume rendering. Ambient, Diffuse, and Specular effects can be rendered in different colors.
- The degree of Emission and Diffuse can be adjusted with the respective slide bars.
- Shininess is set to a number – higher numbers denote less shininess.

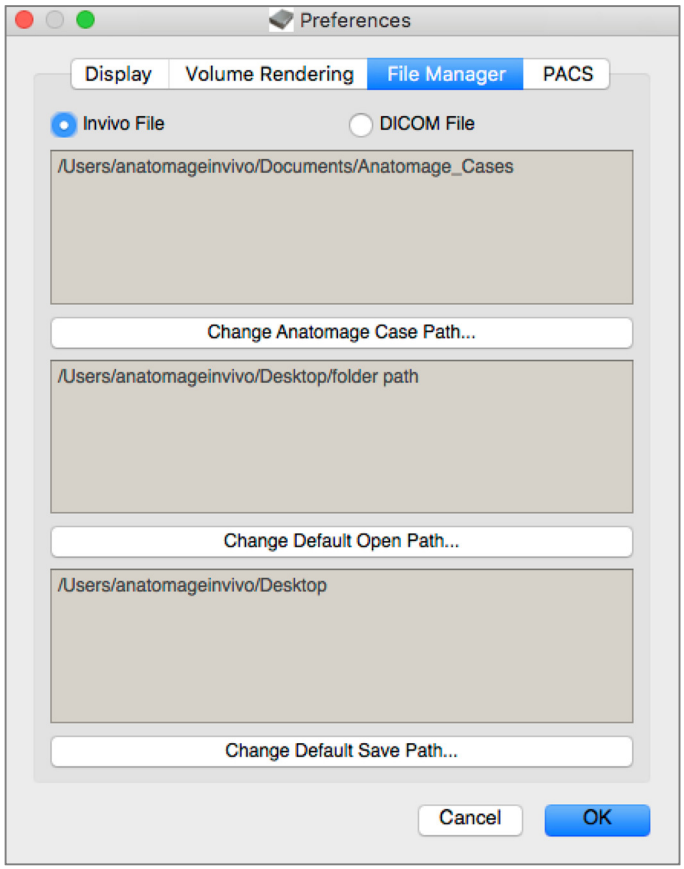
File Manager Settings

File Type-Associated Folder Paths

Folder paths can be set for each of the Invivo and DICOM file type options. When one mode is selected, the program will use the file paths associated with that file type mode, but the user may still save or open either file type at any time.

File Path Preferences for Different Users

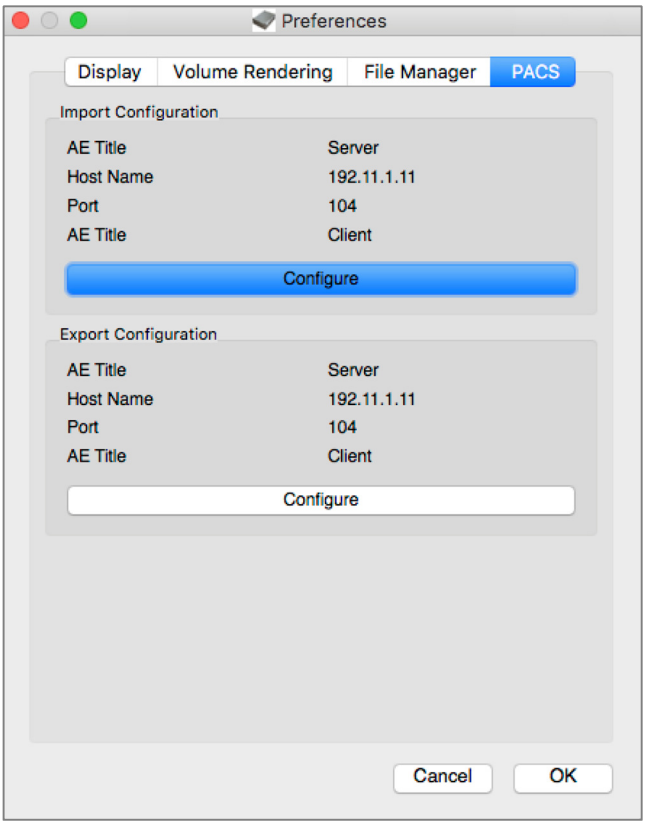
In the situation that there are multiple users on a single computer with Invivo5 installed across multiple user accounts, the file paths may be set for each account independently.



File Paths

- Anatomage Case Path: Starting the program will open a window showing a list of cases within this location.
    - Can also serve as a backup folder for all opened cases.
- Default Open Path: This is the starting location for attempting to open a case through File → Open in the Menu bar.
- Default Save Path: This is the starting location for saving a case file in Invivo.

PACS Settings



Import Configuration

- **Configure**: Click to edit the server and client information from which cases will be imported.

Export Configuration

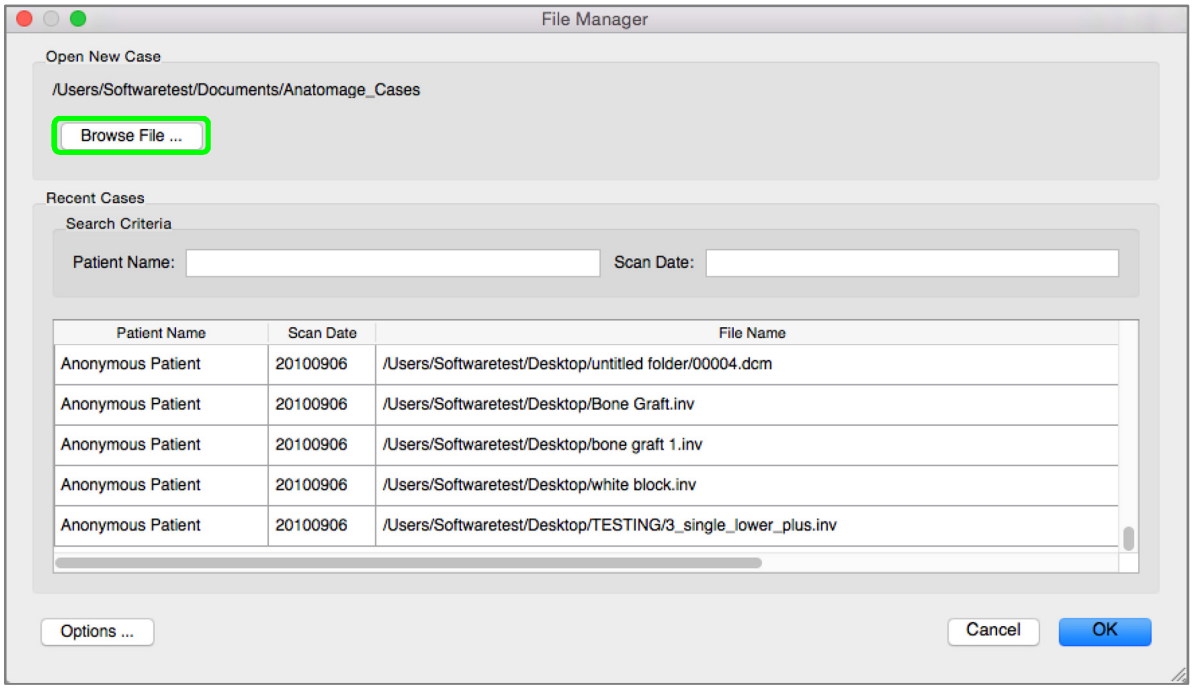
- **Configure**: Click to edit the server and client information to which cases will be exported.

Basic Features

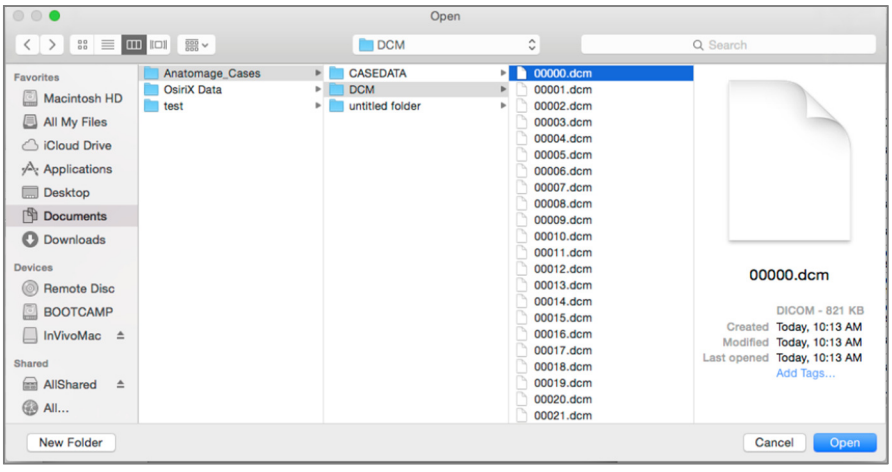
The following is a detailed explanation of the various features provided by Invivo.

DICOM & Invivo File Loading with the File Manager

To open a DICOM data set or Invivo-associated file type (.inv, .amg, .apj), first launch the Invivo software. The File Manager will appear upon startup, allowing you to open the data.

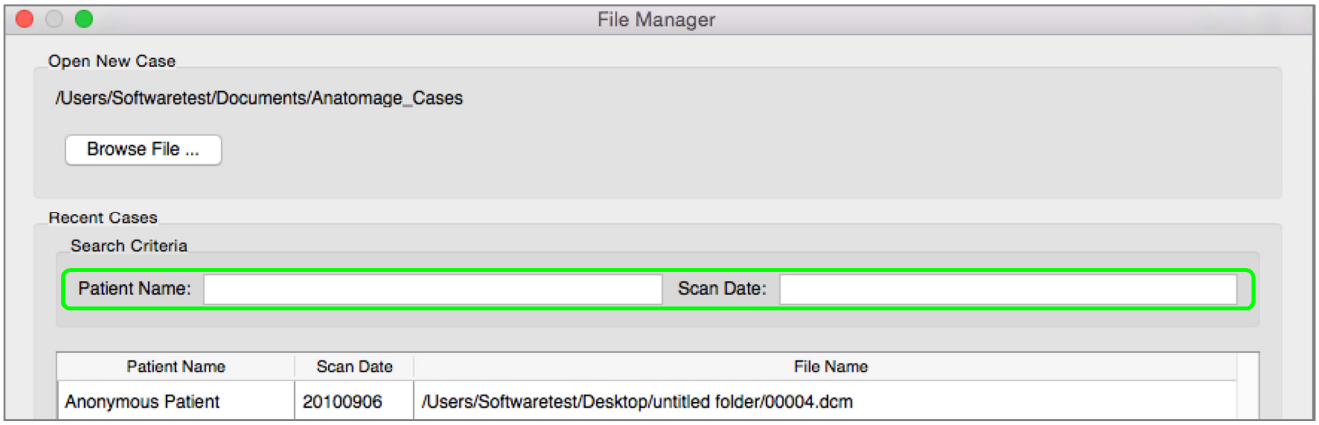


Click the **Browse File** button to search manually for the data you would like to open. If you are opening DICOM data, as shown to the right, simply highlight one of the .dcm files and click **Open**. **It does not matter which DICOM file you choose**, just click one and the software will open all the files within the data set present in that folder. If you are opening an Invivo file just click it and press **Open**. Invivo files can also be compressed and opened.



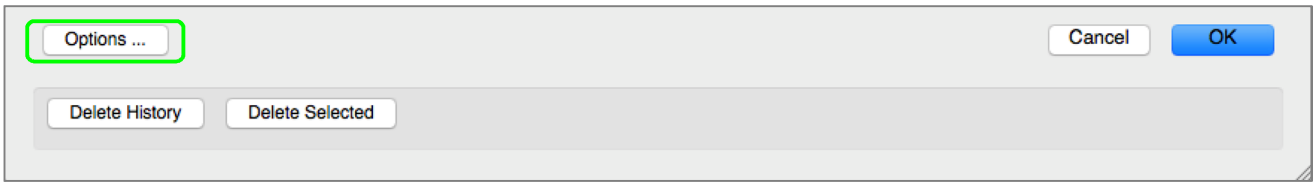
The File Manager allows you to automatically store and reopen recently viewed cases. This allows for quicker access to cases. By default, files will be saved in the "Anatomage Cases" folder, located in "My Documents." This location can be changed in the Menu Bar → InVivoMac → Preferences → File Manager.

Invivo allows you to quickly search through your recent cases by typing in the Patient Name or Scan Date in the search fields (shown right). You can also remove the selected Recent Cases from your Recent Case List by selecting the **Options...** button and using the additional boxes (shown below). This will also allow you to completely clear your Recent Cases list.



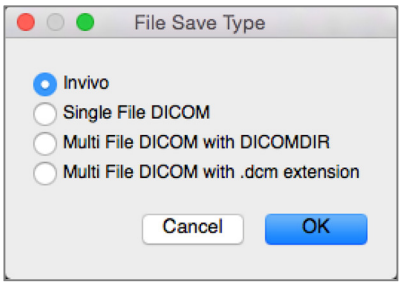
If you close a case and want to reopen another one, click on "File" → "Open" and the File Manager will appear again.

Selecting **Options…** will display additional options to delete the recent case history or to delect select cases from the list. This will only modify the cases that are displayed on the File Manager and does not delete the actual files from where they are saved.



Invivo/DICOM File Saving

Invivo provides four options for saving and each type differs in the size of the saved file and its compatibility with other software. Choosing "File" → "Save As..." for any file will present the dialog on the right. Choosing "File" → "Save" when a DCM file is open will save an INV in the specified location or simply overwrite the same file if it is of the INV file type.

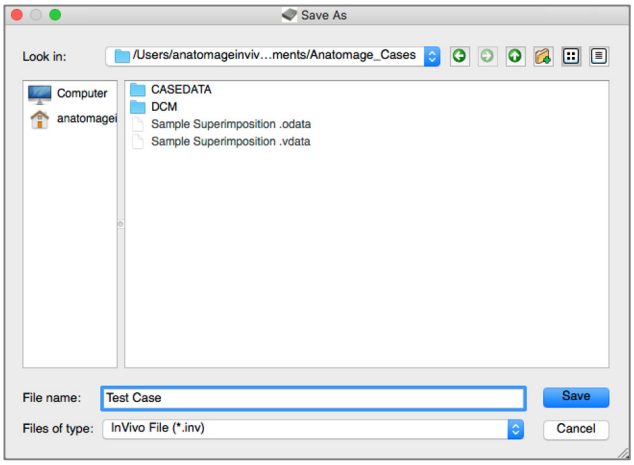


Invivo

The following work can be saved as an Invivo file (.inv).

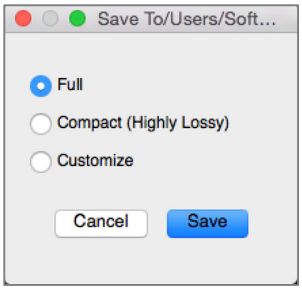
- Case Information & Patient Orientation
- Traced Nerves
- Implants & Implant Measurements
- Volume Measurements, Landmarks, and Annotations
- Images captured within the Gallery
- Sculpting Operations
- †Models imported from Medical Design Studio
- †Tracings performed in 3DAnalysis

†These functions require the installation and activation of additional software modules.



Click "File" → "Save As...," browse to the folder you would like to save, name the file (default is the patient's name), then click **Save**.

The following save dialog box will show up. Select the default "Full" option for saving everything without losing any information.



DICOM

When the DICOM file type is chosen, the output options are either a single lossless DICOM or a multi-file DICOM (with DICOMDIR) accompanied with an Invivo workup file containing workup data and a folder of exported Gallery images in DCM format.

For single-file DICOMs (Figure 1), the save dialog will ask for a location to save the files. For multi-file DICOMs (Figure 2), you will have to create or choose a folder to save the slices and DICOMDIR file. The DICOMDIR file presents the directory of slices to Invivo to accelerate the loading speed.

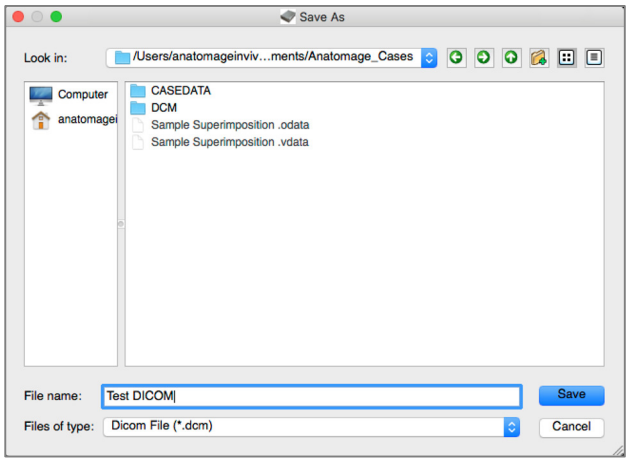


Figure 1: Single-file DICOM Save Dialog

The DICOM File Save Option dialog (Figure 3) will present numerous options for saving the file. Compression will reduce the size of the file (at the cost of increased saving and loading speed), "Lossless" or "Lossy" determines the quality (amount of data) of the file that is saved. Resampling will change the resolution by a factor in each orthogonal plane. The workup file description will be used to differentiate between workup files on PACS.

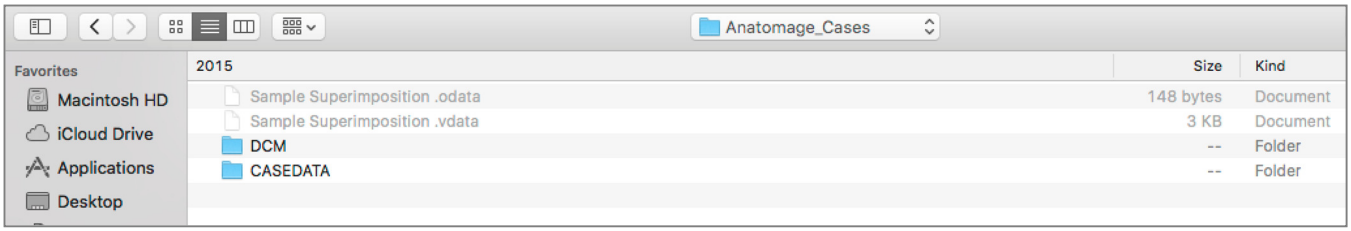


Figure 2: Multi-file DICOM Save Dialog

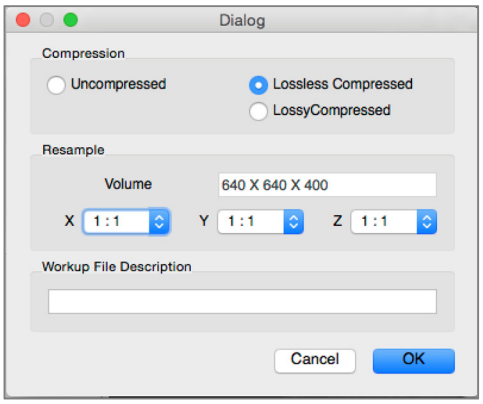
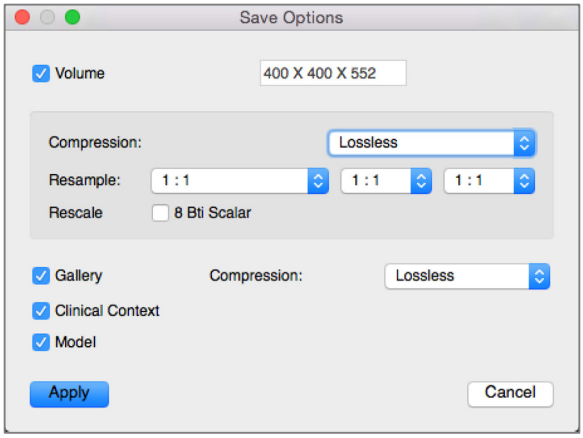


Figure 3: DICOM File Save Options

Custom Saving Dialog

Available for Invivo file saving: By selecting the "Customize" option, the custom saving dialog shows up. In the dialog box, one can compress the data. For the main volumetric image, you can select to save it as "LossLess" or "Lossy" compression. With LossLess compression, the volume is compressed to about 1/3rd – 1/4th of the original size. With the Lossy compression option, the file size can be dramatically reduced, but the image is altered. Resampling the data will greatly reduce its size by combining voxels to reduce the overall voxel count. Rescaling the image will reduce the number of shades of gray in the image. You can also choose to selectively compress images in the gallery, the clinical content (such as implants and nerve tracings), and the models.



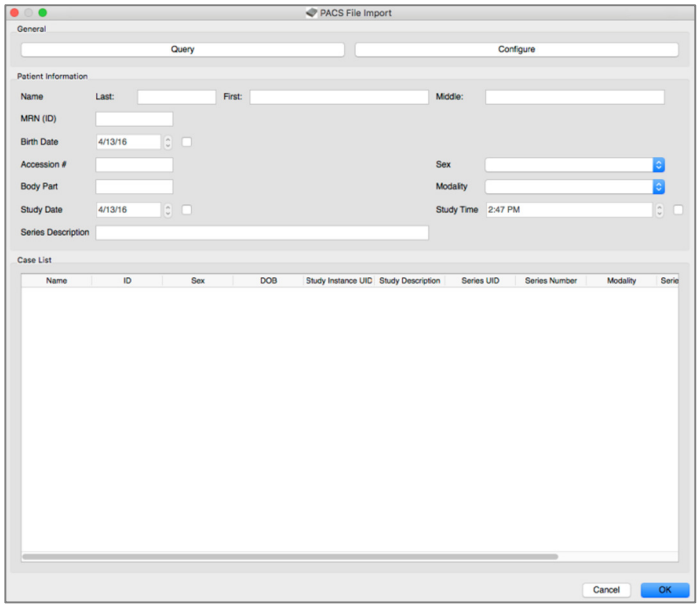
Warning: Saving files in lossy format degrades image quality.

Saving As an Invivo Project File

Click "File" → "Save As Project..." to save the case as an APJ, Invivo Project file. This file will **only** save changes made to the original scan data. It requires a reference data (.dcm scan data or .inv file) when opening. If Invivo cannot locate the reference data, it will ask you to locate the data again. Because it is saving only the changes to the original, APJ files save much faster than full INV files.

DICOM File Loading with PACS

If you chose to install the PACS mode of Invivo, upon launch, the PACS File Import window will open instead of the File Manager. At initial launch, the settings will need to be configured to connect with the database, but this information will be retained subsequently.



Without installing under PACS mode, this interface can still be accessed by choosing "File" → "Import PACS."

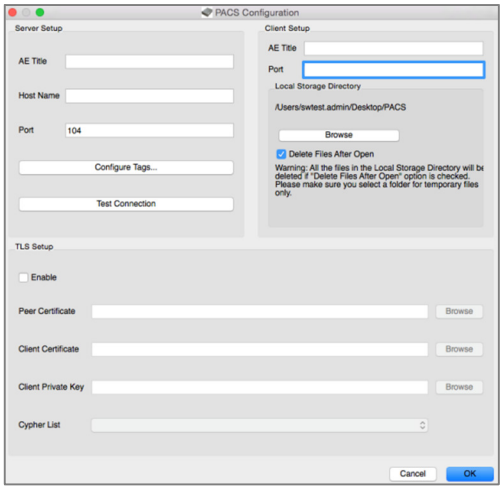
PACS Configuration

Click **Configure** to set up the connection to PACS. Input the appropriate server data and test the connection to verify the information.

Scans from PACS will be stored locally in the Local Storage Directory folder while they are open. The option to delete the files locally after opening them is available.

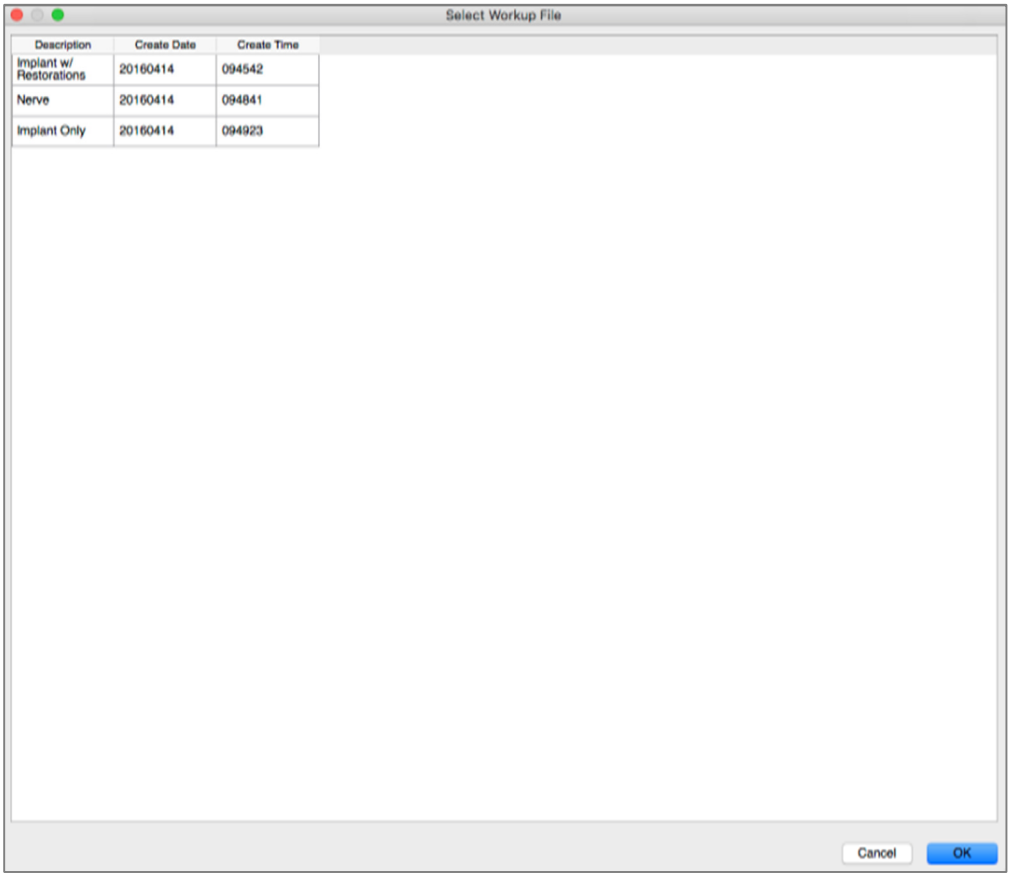
Transport Layer Security (TLS) setup can also be configured.

Once the information is complete, click **OK**. This data will be saved until manually reconfigured.



PACS File Loading

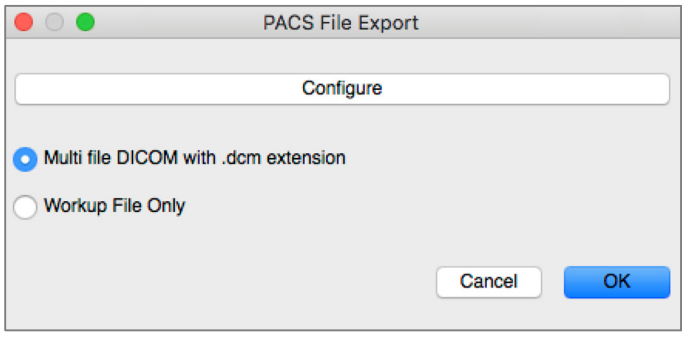
Click **Query** to load the cases stored on PACS. Filter cases using the patient information fields. Select a case from the Case List and click **OK**. Invivo will search for any workup files associated with the patient. Select an existing workup file and click **OK** or click **Cancel** to open the raw patient scan.



PACS File Saving

Click on File → "Export PACS" to save the file onto PACS.

- **Configure:** Opens the PACS Configuration dialog.
- For descriptions of the different DICOM types, refer to page 24.
- Without installing under PACS mode, this interface can still be accessed by choosing "File" → "Import PACS."



Case Information Display

To display or hide the Case Information for a specific patient, go to the "File" → "Case Info." Click **Anonymize** then click **OK** to save the changes.

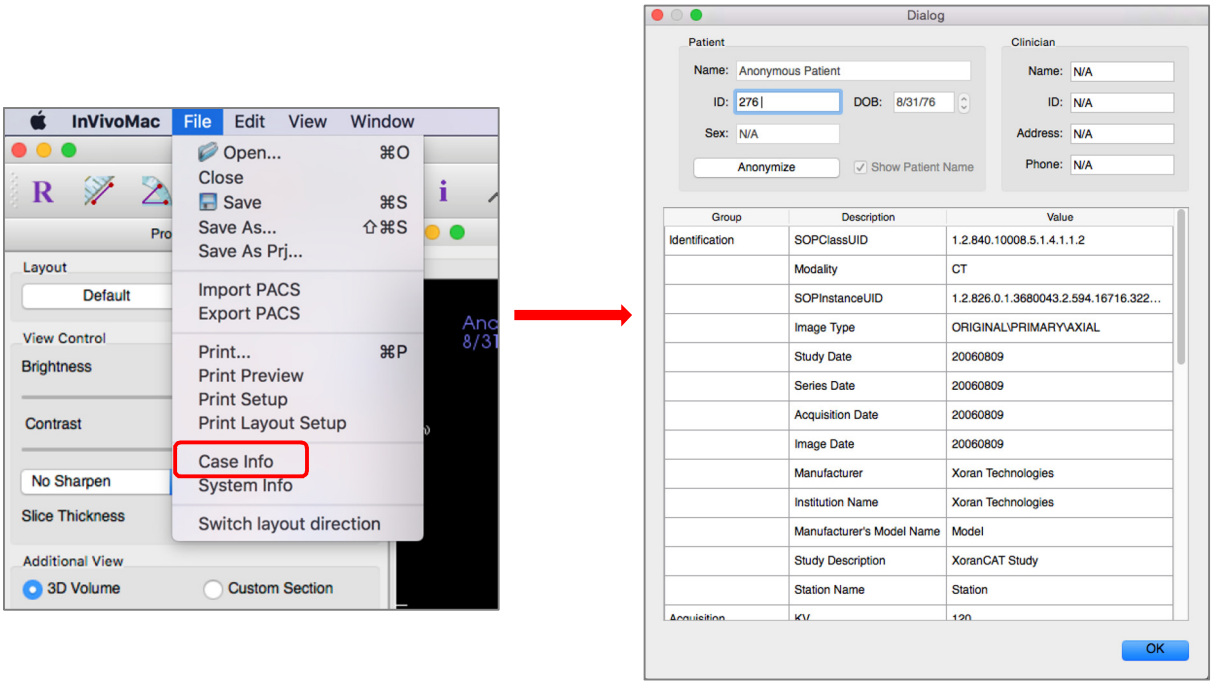


Image Capture to File

To capture an image of the active display to file, click "View" → "Capture to File." Browse to the location where you want to save the image, type the name of the file, choose the file type on the "Files of type" drop-down, and click **Save**. The file can be saved as bmp, jpg, or png format. Jpg is the most popular file format for images, but there is a small amount of color degradation. Bmp preserves the image, but the file size is big. Png is an effective lossless format that does not degrade the color.

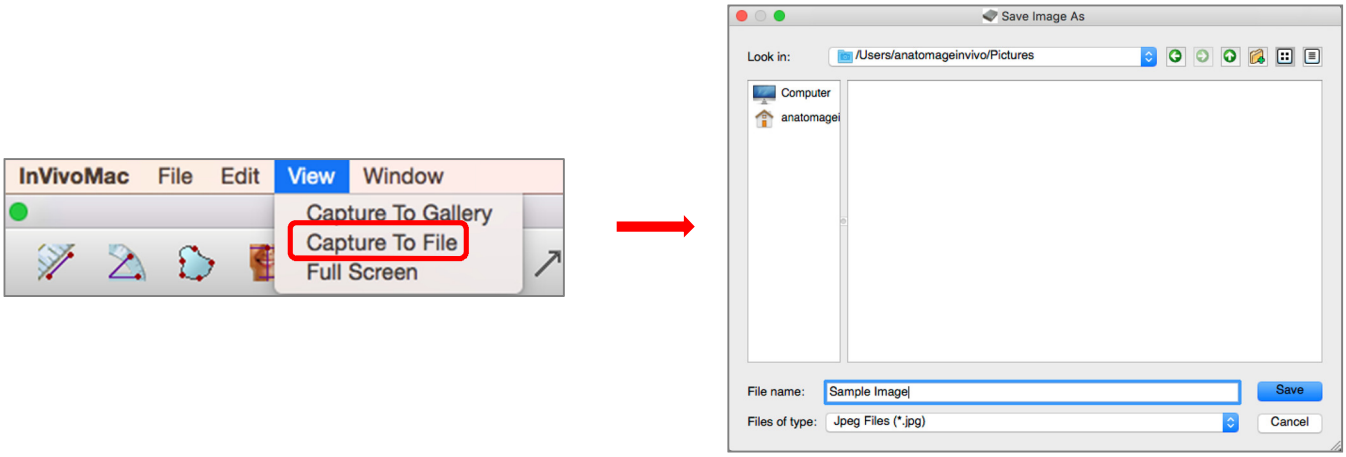


Image Capture to Gallery

Selecting "Capture To Gallery" will capture an image of the rendering window and save it to the Image List (see Gallery Tab features for additional information, pg. 115).

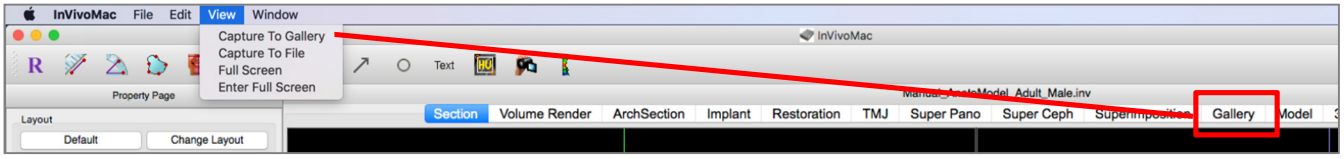


Image Navigation

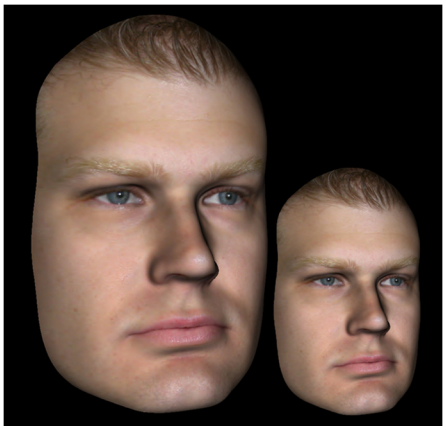
Below is an explanation showing how to manipulate images in the rendering window with the keyboard and mouse. Please check the system preferences for the mouse or trackpad. Commands may vary depending on the secondary click input and the keyboard manufacturer.

Slider Bar Scroll

- Click the mouse cursor over any slider bar (e.g. axial slice, brightness, etc.) and move it to adjust the image.
- Click the slider and keep the mouse cursor in the Property Page before scrolling with two fingers wheel forward or backward to achieve the image adjustment you like.

Zoom In/Out

- Place the mouse cursor in the center of the image you want to zoom.
- Hold down the "Command" key + mouse button.
- While holding down the buttons indicated above, move the mouse up and down on the screen.
- This shrinks/enlarges the image: Down vertically zooms out. Up vertically zooms in.



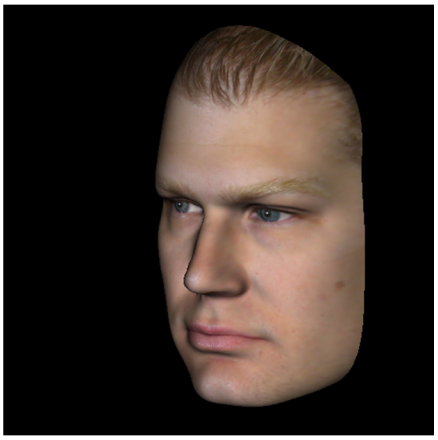
Pan (Shift)

- Place the mouse cursor in the center of the image you want to shift.
- Hold down the "Shift" key + mouse button.
- While holding down the buttons indicated above, move the mouse any direction to achieve the desired image displacement.

Free Rotate

Applicable only for 3D images.

- Place the mouse cursor in the center of the image you want to shift. Hold down the mouse button.
- While holding down the mouse button, move the mouse in any direction to achieve the desired rotational position.



Free Rolling

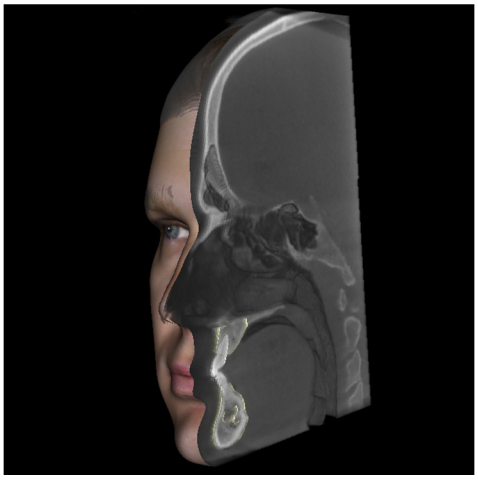
Applicable only for 3D images.

- Hold down the "Space" key + mouse button.
- While holding down the buttons indicated above, move the mouse up and down to rotate the image about a central axis.

Anatomical Plane Clipping

Applicable only for 3D images.

- Place the mouse cursor over the center of the image, then scroll the mouse forward or backward to clip the anatomic plane as you like (after enabling clipping in the Property Page).

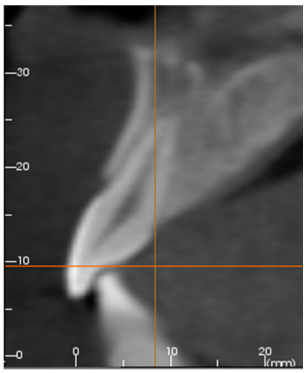


Scroll Slice

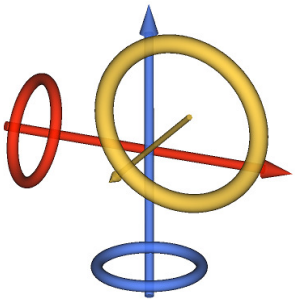
Use when you would like to move through the series of sections when in either the Section, ArchSection, or Pano views.

- Place the mouse cursor in the center of the image then scroll the mouse wheel forward or backward to move one section at a time as you advance through the data slices.

*Note: In the **ArchSection Tab**, you must first create an arch spline to activate this feature.*

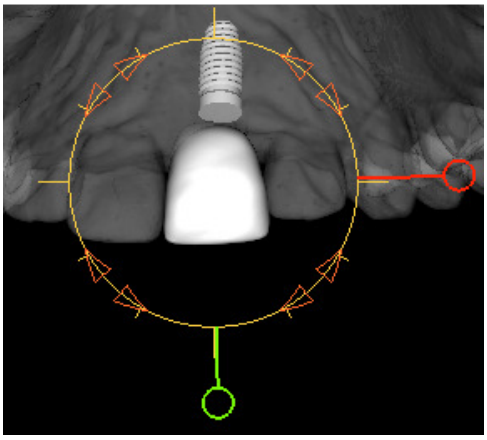


Move/Rotation Widget



- **Superimposition View:** Click on either the ring or the arrows circling the patient and move it in the direction you want the patient to be oriented.
- **Model View:** Use to move a model through a portion of the volume for simulation creation. Click on either the ring or the arrows circling the model and move/rotate it in the direction you want it to move.

3D Restoration Widget



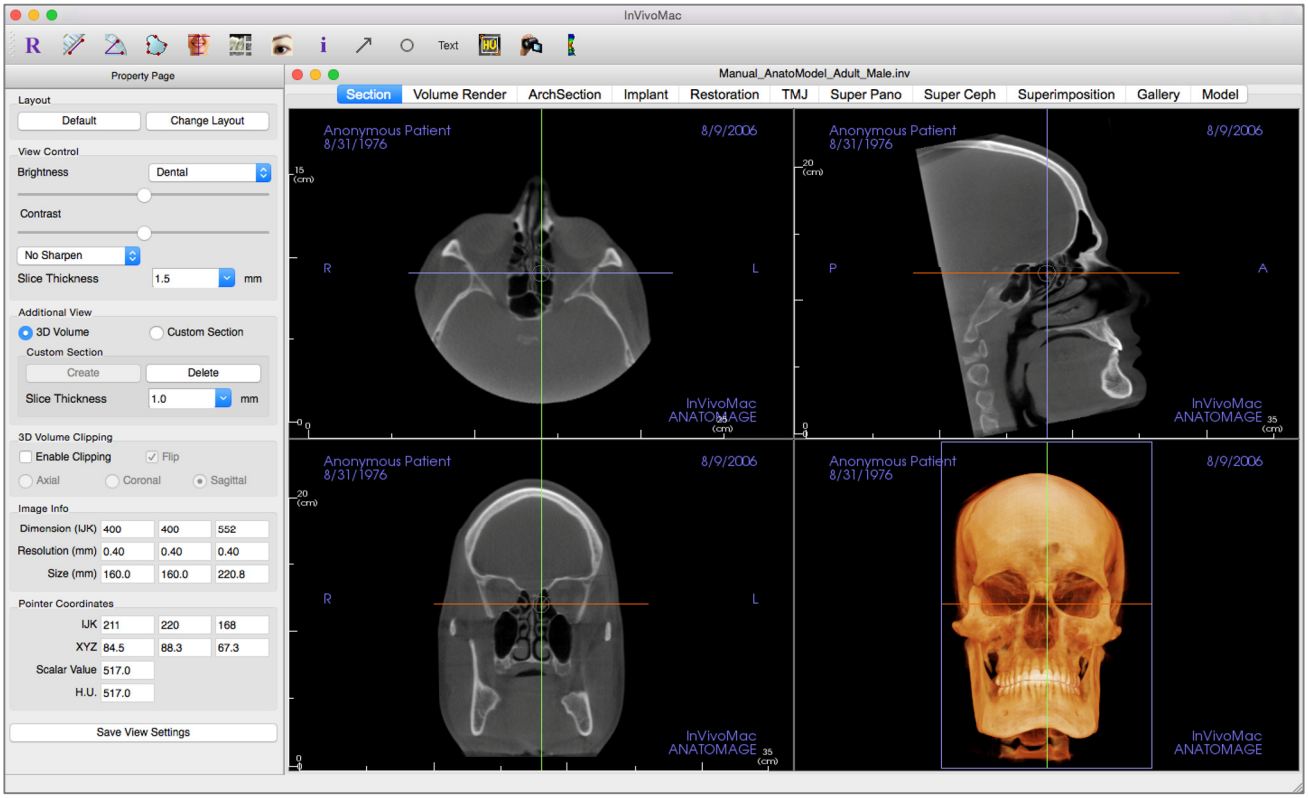
The 3D Restoration widget is designed to maximize visibility in the renderer and provide a high level of versatility in crown positioning and sizing. The resizing handles only appear when the camera perspective is within a range of angles that is relatively orthogonal to it.

- The rotation circle appears on the same plane as the two resizing tools that are close to orthogonal to each other and the camera perspective and feature eight arrows for rotation.
- The red resizing handle can be selected and dragged toward/away from the crown to reduce/expand the mesiodistal size of the crown.
- The green resizing handle can be selected and dragged toward/away from the crown to reduce/expand the height of the crown.
- The blue resizing handle (not shown) can be selected and dragged toward/away from the crown to reduce/expand the buccolingual size of the crown.
- The crown can be clicked and dragged freely along a plane orthogonal to the camera angle.

The View Tabs:

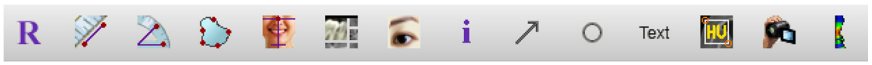
Section View Features

*The **Section View Tab** gives the ability to view the X, Y, and Z sections (axial, coronal, sagittal) and user-created, custom sections simultaneously for 2D visualization, measurements, and the utilization of several image enhancement features. Invivo also integrates 3D functions in the Section View Tab.*



Section: Toolbar

Shown below are the Toolbar and tools that are loaded with the Section View Tab:



Reset View: Resets the rendering window to the original view size.

Distance Measurement: After selecting this tool, click two points to mark the desired distance. A number in millimeters will automatically display. Click on the measurement and press the "delete" key to delete it.

Angle Measurement: After selecting this tool, click the first point, then click the vertex, then click the last point to create an angle. A number in degrees will automatically display. Click on the measurement and press the "delete" key to delete it.

Area Measurement: After selecting this tool, click multiple points along the boundary of the desired area. Double-click or right-click to end the measurement. A number in millimeters squared will be automatically display. Click on the measurement and press the "delete" key to delete it.

Reorientation: Click this button to re-orient the image. A circle will show up in each section. Grab the arrow widgets and rotate the image to the desired orientation.

Layout: Creates a different layout to your preference. After clicking on the layout icon, a list of various layout options will appear. Click on the layout of your preference to apply it.

Toggle Cursor Visibility: Turns cursor on and off.

Information Display: Displays or hides case information embedded in the data.

Arrow Notation: Allows an arrow to be drawn on the image.

Circle Notation: Allows a circle to be drawn on the image.

Text Notation: Allows text to be written and edited on the image.

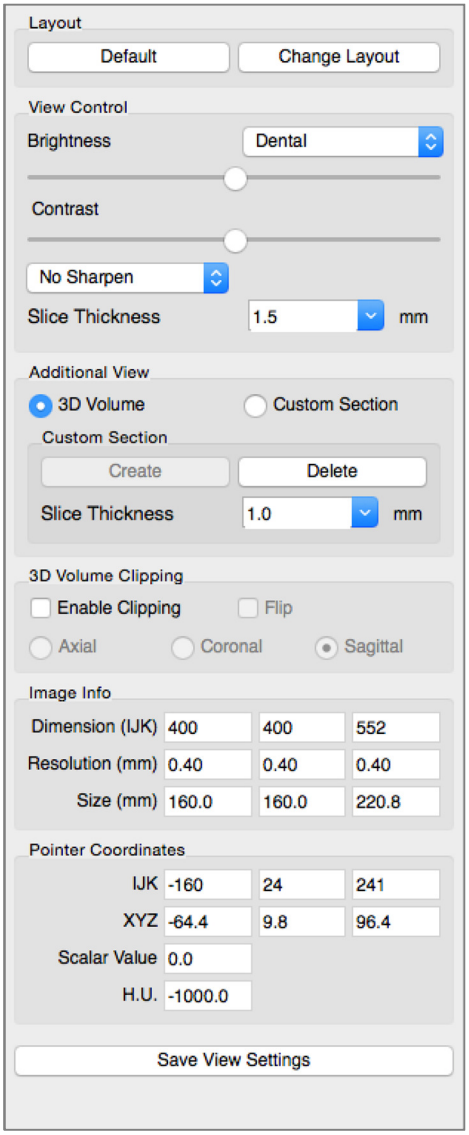
H.U. Measurement: Calculates the HU value of an area within a bounding box. The measurements will display alongside the rectangle and can also be repositioned by dragging. The information updates when the box is moved or if the user scrolls.

View Sequence: Allows for the creation of custom camera sequences and AVI file movie capturing. Refer to the **Volume Render View Sequence** section (pg. 50) for additional information and description.

Airway Measurement: This button will open the airway volumetric measurement interface. More details can be found in the **Airway Measurement** section (pg. 38).

Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. Software reports the value based on user-picked points. Due to the nature of medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

Section: Property Page



Layout:

- **Default:** Reset to the original layout.
- **Change Layout:** Click to choose custom layout.

View Control:

- Brightness & Contrast: Can be adjusted for each of the presets to enhance your image.
- Rendering Preset (drop-down list): The presets either load a brightness/contrast setting that is optimized for a particular tissue type or a color preset.
  - Brightness/Contrast Presets: Dental (custom), Abdomen, Bone, Brain CT, Liver, Lung, Mediastinum, and Grayscale.
  - Color Presets: Allows better visualization of certain anatomic structures, soft tissue profiles, airway, etc. The color rendering is only for visualization. The colors are based on densities but DO NOT represent the density value of the bone.
- Sharpening Filter: Applies the selected sharpening filter from the drop-down menu to the 2D slice renderers.
- Slice Thickness: Uses ray sum when reconstructing the 3D image along each orthogonal plane.

Additional View:

- 3D Volume: This option allows 3D volume rendering in the fourth corner of the window.
- Custom Section: This option allows for the creation of a custom section.

Custom Section:

- Click **Create** to start a custom section. By clicking two points, a customized section can be created on any cross section to better visualize anatomy along that axis. The custom section can be navigated by clicking and dragging the arrows to rotate, the endpoints to lengthen, or the center point to drag the entire section freely.
- **Delete:** Removes the custom cross section made in the rendering window.
- Slice Thickness: Adjusts the slice thickness of the custom section. Slice thickness can also be adjusted using the circular handles flanking the center of the section.

3D Volume Clipping:

When 3D volume is enabled, this option allows you to clip the volume to see the internal anatomy. The clipping plane will be synchronized with section cursors.

Image Info:

- Dimension, resolution, and field of view size are summarized.

Pointer Coordinates:

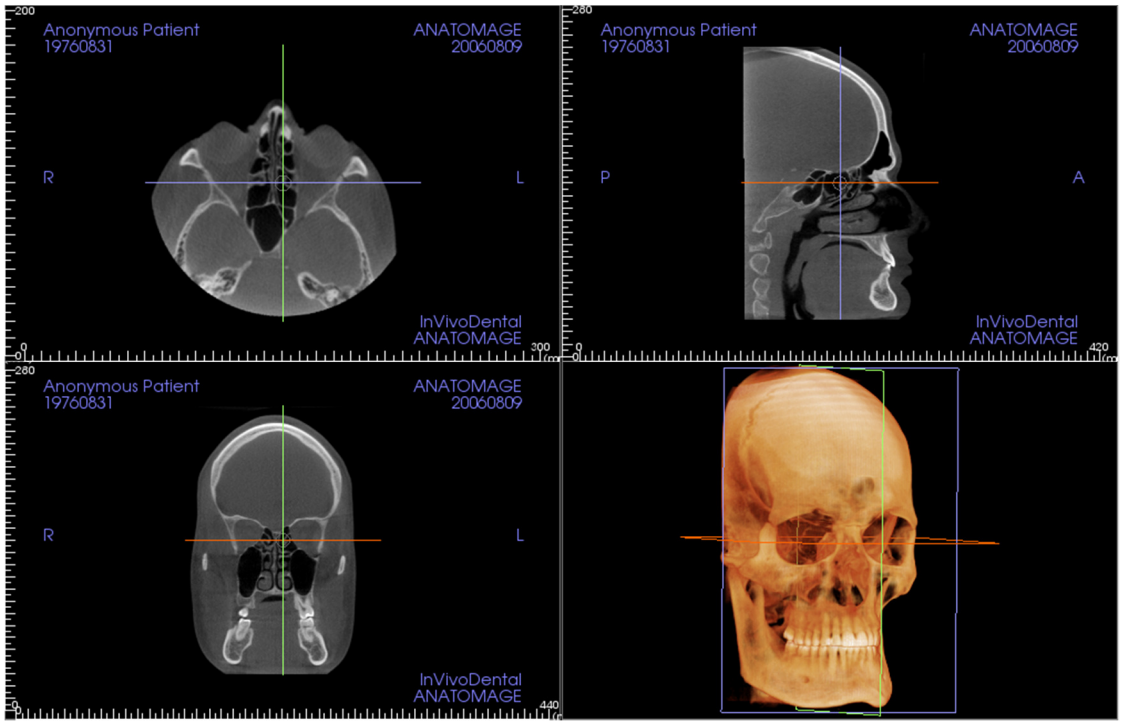
- IJK or XYZ: coordinates give the user the ability to examine the coordinate of the cursor upon the absolute coordinate system.
- Scalar Value is the gray scale value of the voxel pointed by the cursor pointer. H.U. or Hounsfield unit, is an approximate value of the voxel calculated by "Rescale Slope" and "Rescale Intercept" in DICOM information. *H.U. value approximations may not be as accurate if your CT hardware calibration is off. Contact your hardware manufacturer for more information about H.U. accuracy.*

Save View Settings

- Saves the current 2D View settings to be reloaded upon opening any case. See the Display Preferences section in **Preferences** (pg. 17) for more information on which settings are saved for this specific tab.

Section: Rendering Window

This window allows viewing of the X, Y, and Z sections (axial, coronal, sagittal) and custom sections or a 3D view simultaneously. This allows the clinician to have very accurate 2D visualization and 2D measurements.



Scroll wheel: Move mouse pointer to the desired cross section. Use the scroll wheel to move the slice up and down.

Cursor: Grab one of the cursors (axial, sagittal or coronal). Move the cursor in the desired direction. The corresponding image will be updated.

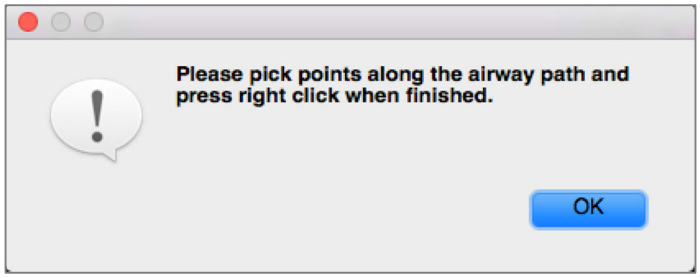
Center Circle: Pick a point inside the center circle. Move the circle in the desired direction. The other two images will be updated.

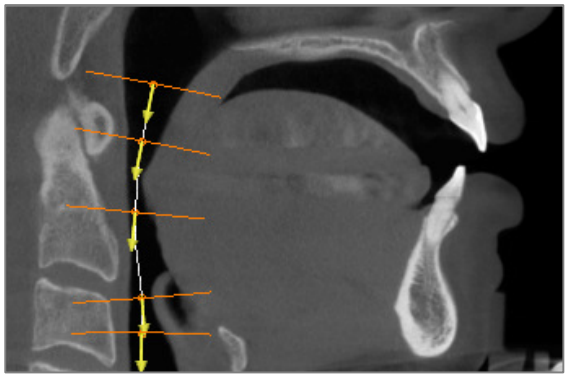
Zoom: Click and hold the left-click mouse button on the image and the "Command" key on the keyboard. Drag the mouse cursor up and down to zoom in and out.

Pan: Click and hold the left-click mouse button on the image and the "Shift" key on the keyboard. Drag the mouse cursor to move the image.

Section: Airway Measurement

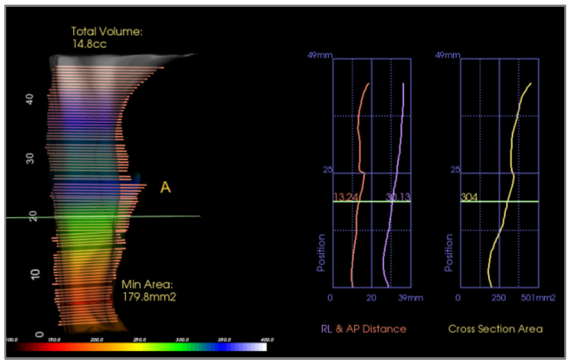
Airway Measurement: Selecting the icon will prompt the dialog box below. Click **OK** to continue.





Tracing the Profile:

- Scroll to locate the mid-sagittal plane.
- Pick points along the airway in the sagittal section to define your measurement path with the left-click button.
- Right-click when finished.



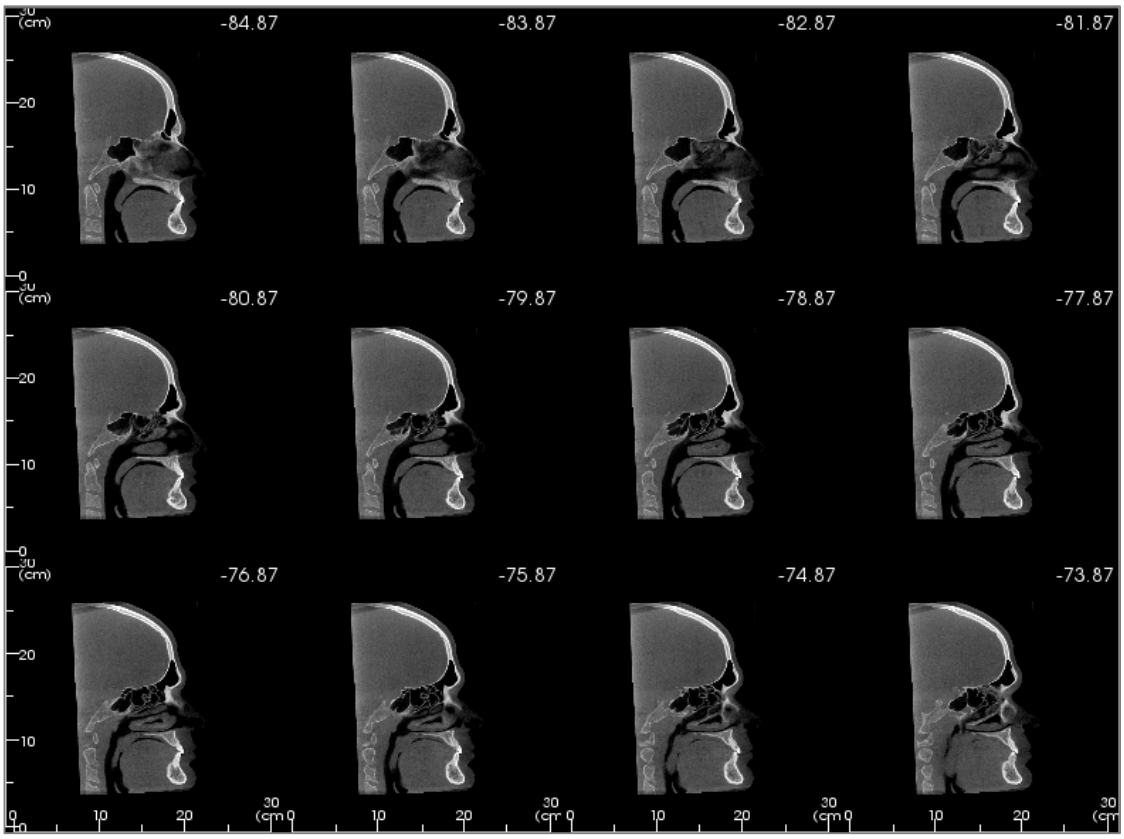
Viewing the Volume Measurement:

- Invivo will convert your profile tracing into a volume rendering and superimpose it onto the scan data. An isolated airway can be examined in the variable window.
- The minimum cross-sectional area and total volume are displayed next to the airway measurement.
- Graphs of the RL and AP distance as well as the cross-section area are displayed. Individual values can be obtained by clicking on the graphs.
- The airway volume and measurement values can be deleted by left-clicking once on the airway, then pressing "delete" on the keyboard.

Important: The measurement values may not be true anatomical volumetric measurements. Due to the nature of the imaging, there are imaging artifacts such as white noise, scattering, beam hardening, ring noise or off scale H.U. The software measurement tool cannot distinguish the imaging artifact from the true anatomy. Furthermore, the measurement value depends on threshold values; thus, user must set proper thresholds to get the best estimate of the desired structure. The measurements must not be used as the sole metric for any treatment.

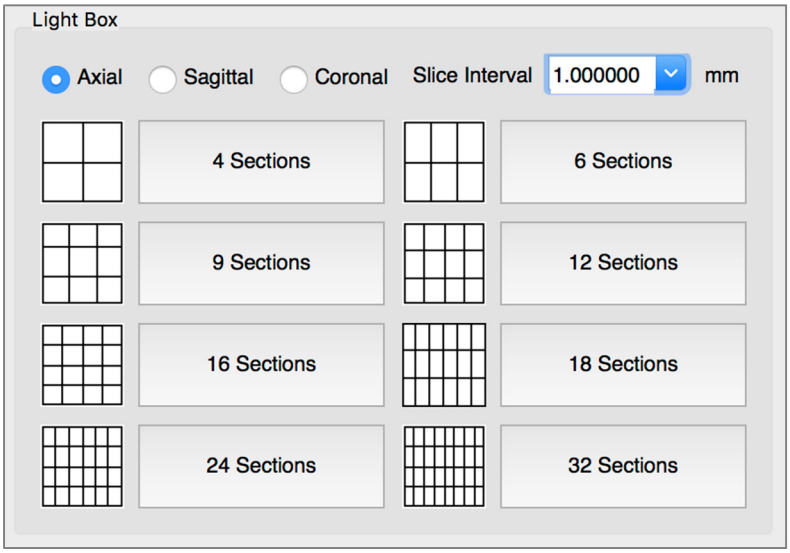
Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. Software reports the value based on user-picked points. Due to the nature of medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

Section: Light Box



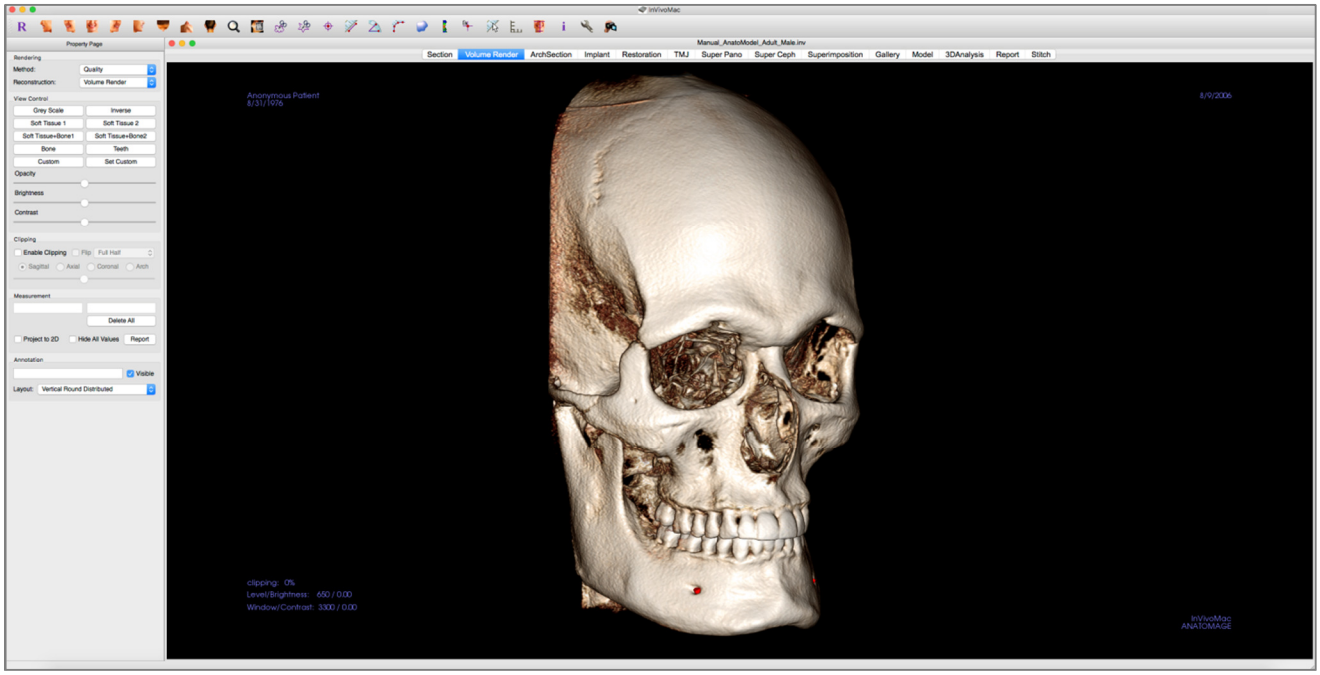
Change Layout has the option to change the Section view format to a "Light Box" style.

- The Light Box is composed of 4-32 sections of either axial, sagittal, or coronal views.
- The user may also define the Slice Interval by selecting a drop-down option between 0.1-20.0mm or by manually entering a number within that interval on the keyboard.



Volume Render View Features

*The **Volume Render Tab** shows the patient in three-dimensionally reconstructed views and allows you to explore the internal structures and never-before-seen views of the patient.*



Volume Render: Toolbar

Shown below are the Toolbar and tools that are loaded with the Volume Render View Tab:

Reset View: Resets the rendering window to the original view size.

Left View: Automatically orients the volume so the patient is facing left sagittal.

Left ¾ View: Automatically orients the volume so the patient is facing 45° left sagittal.

Front View: Automatically orients the volume so the patient is facing the front.

Right ¾ View: Automatically orients the volume so the patient is facing 45° right sagittal.

Right View: Automatically orients the volume so the patient is facing right sagittal.

Top View: Automatically orients the volume so you are oriented above the patient.

Bottom View: Automatically orients the volume so you are oriented below the patient.

Back View: Automatically orients the volume to the posterior view.

Quick Zoom: Click the zoom icon, then the point on the volume to zoom in. Use Reset View icon to go back to normal size.

Quick Slice: Once activated, clicking on a point on the volume will open a 2D zoom window in that location. The zoom window can be scrolled through using the mouse wheel.

Freehand Sculpture: Freely outline an area and remove the volume perpendicular to the plane of the screen. The volume inside or outside the selection can be chosen by clicking in the respective areas.

Polygon Sculpture: Outline an area by placing a series of points and right-clicking. The volume perpendicular to the plane of the screen will be removed. The volume inside or outside the selection can be chosen by clicking in the respective areas.

Mark Measurement: Select this option to mark a point on the volume and X,Y,Z coordinates (axial, sagittal, vertical) will appear. Clicking on the point and moving the cursor can modify points. Click on the point and press the "delete" key to delete it. Property Page features allow the values to be hidden or exported to a report.

Distance Measurement: Select this option and mark two points on the volume and distance will appear. Clicking on the point and moving the cursor can modify points. Click on the measurement and press the "delete" key to delete it. Property Page features allow the values to be projected to 2D, hidden, or exported to a report.

Angle Measurement: Select this option and mark three points on the volume and the angle between them will appear. Clicking on their control points and moving the cursor can modify measurements. Click on the measurement and press the "delete" key to delete it. Property Page features allow the values to be projected to 2D, hidden, or exported to a report.

Polygonal Measurement: When selected, you may mark an unlimited number of points on the volume and the total between the first point and the last point will appear. Right-click your mouse to indicate that you have marked your last point. Clicking on the point and moving the cursor can modify points. Click on the measurement and press the "delete" key to delete it. Property Page features allow the values to be projected to 2D, hidden, or exported to a report.

Volume Measurement: This button will open the volumetric measurement window.

Airway Measurement: This button will open the airway volumetric measurement interface. More details can be found in the **Airway Measurement** section (pg. 49).

Comment Marker: Pick a point in the volume and enter comments. Enter the text you would like to appear in the Insert Comment window and press **OK**.

Quick Measurement: Click to activate a ruler at the tip of the cursor. Click again to turn off.

Grid: Toggles between four different grid layouts for simple assessment of size, measurement, and spatial location.

Patient Orientation: Click to change patient orientation.

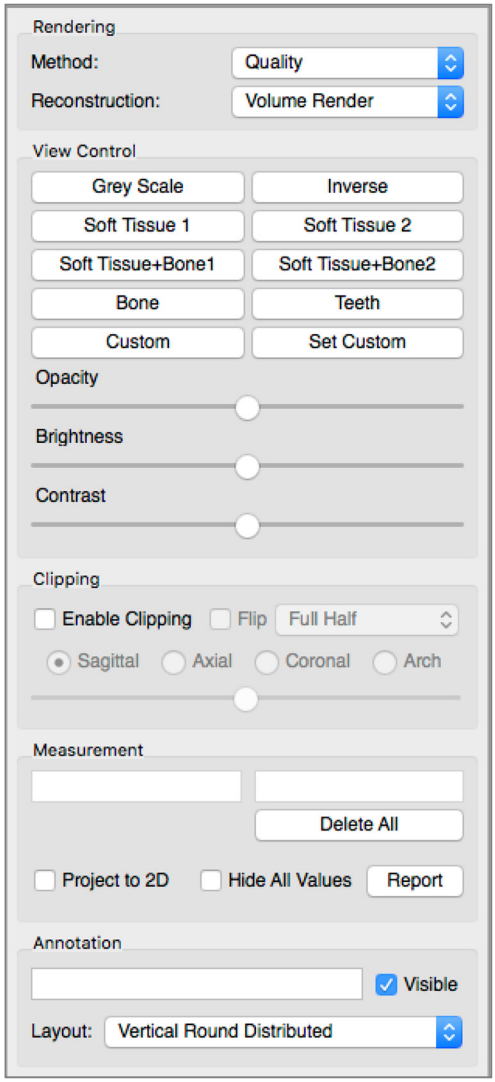
Information Display: Displays or hides case information embedded in the scan data.

Setup View: Allows option to view either parallel or perspective views in 3D. For Airway Measurement, you can set the threshold and displayed color range.

View Sequence: Allows for the creation of custom camera sequences and AVI file movie capturing. Refer to the View Sequence description in the Volume Render View section (pg. 50)

Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. Software reports the value based on user-picked points. Due to the nature of medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

Volume Render: Property Page



Rendering:

You can select different methods of rendering to suit your needs.

- Method: "Performance" is fast but there are some rendering artifacts. "Quality" gives the highest level of detail, but response is slower. "Default" is in between the other two options.
- Reconstruction: There are three possible reconstruction methods: Volume Rendering, Maximum Intensity Projection, and X-ray.

View Control:

- Color Presets: Gray Scale, Inverse, Soft Tissue 1, etc. allow better visualizations of certain anatomic structures, soft tissue profiles, airway, etc. This is achieved by displaying specific densities with specific colors.
- Opacity: Allows for the translucency/opacity to be adjusted.
- Brightness & Contrast: Can be adjusted for each of the presets to enhance the image.

Clipping:

- Click the "Enable Clipping" box to slice the image along the predefined anatomical planes (sagittal, axial, coronal, and arch).
- Select the size of the clipping amount, from a 5mm slab to a full half.
- Scrolling the mouse wheel or slider bar will move the clipping plane.
- To switch a view to the opposite side, click "Flip."

Measurement:

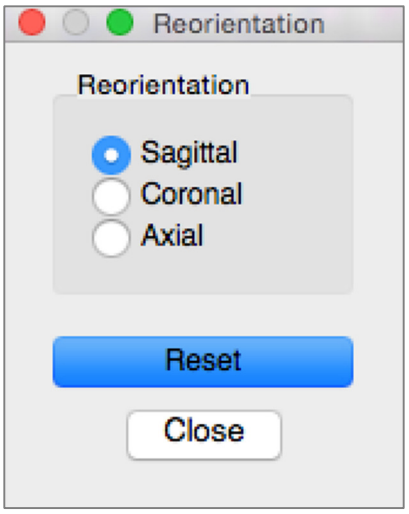
- Once landmarks or measurements are defined, the text can be edited in the edit box.
- Measurements can be projected as 2D values or hidden by clicking the appropriate box.
- **Delete All** will delete all measurements within the rendering window.
- **Report** exports the values and annotations to a .CSV file for viewing and/or performing computations as a spreadsheet.

Annotation:

- Edits selected comment/annotation in the text field.
- You can toggle added comments on/off by selecting "Visible."
- Layout: Sorts all added comments in the rendering window based on selected setting (Horizontal, Stick to Point, User Dragged, Vertical, Vertical Even Distributed, Vertical Round Distributed).

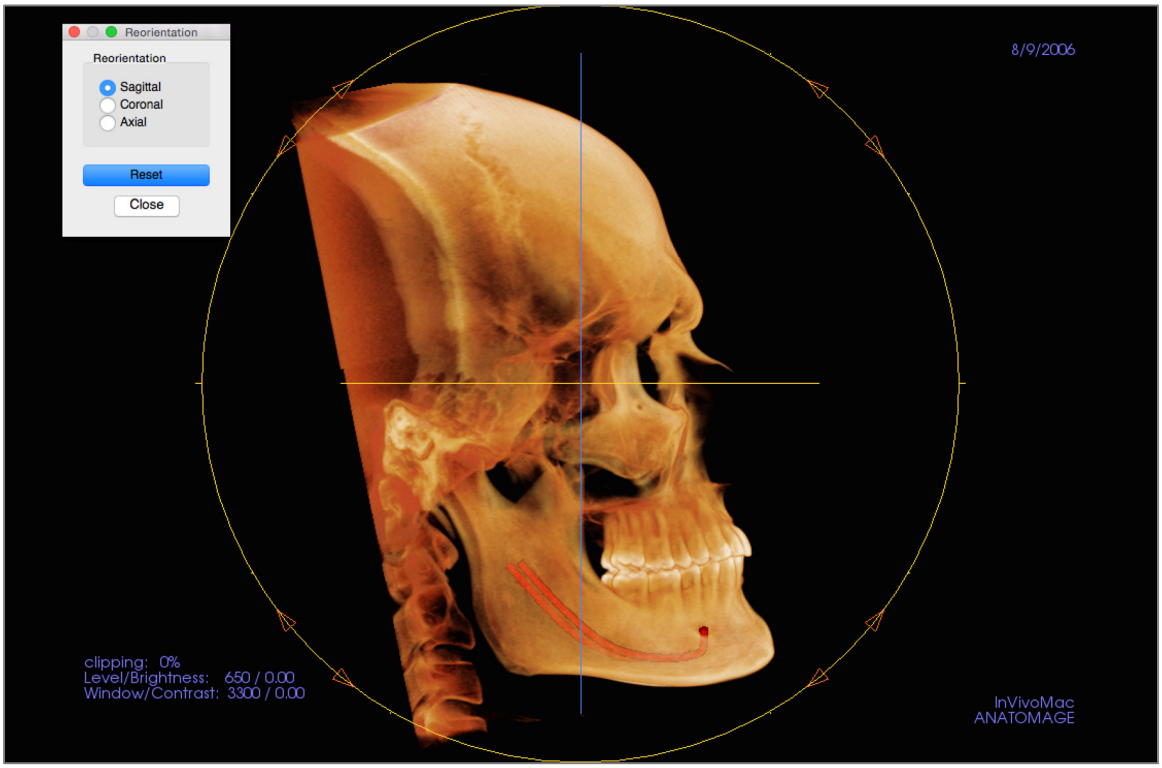
Volume Render: Patient Orientation

The reorientation tool provides the user a way to orient the volume through each orthogonal view (sagittal, coronal, axial) using references lines as well as to reset the image to the default coordinate system.



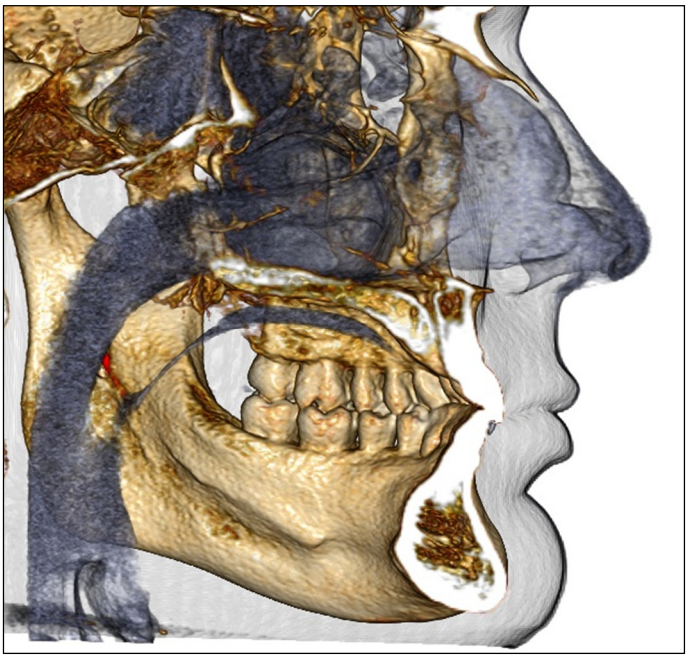
- After selecting the reorientation icon in the toolbar, left-click and drag each reference line to the approximate proper location on the volume (ex. Frankfort Horizontal in sagittal view).

- Left-click and drag the rotation handles to rotate the volume to match the reference line. Continue through each view until the desired orientation is achieved.



Volume Render: Render Window

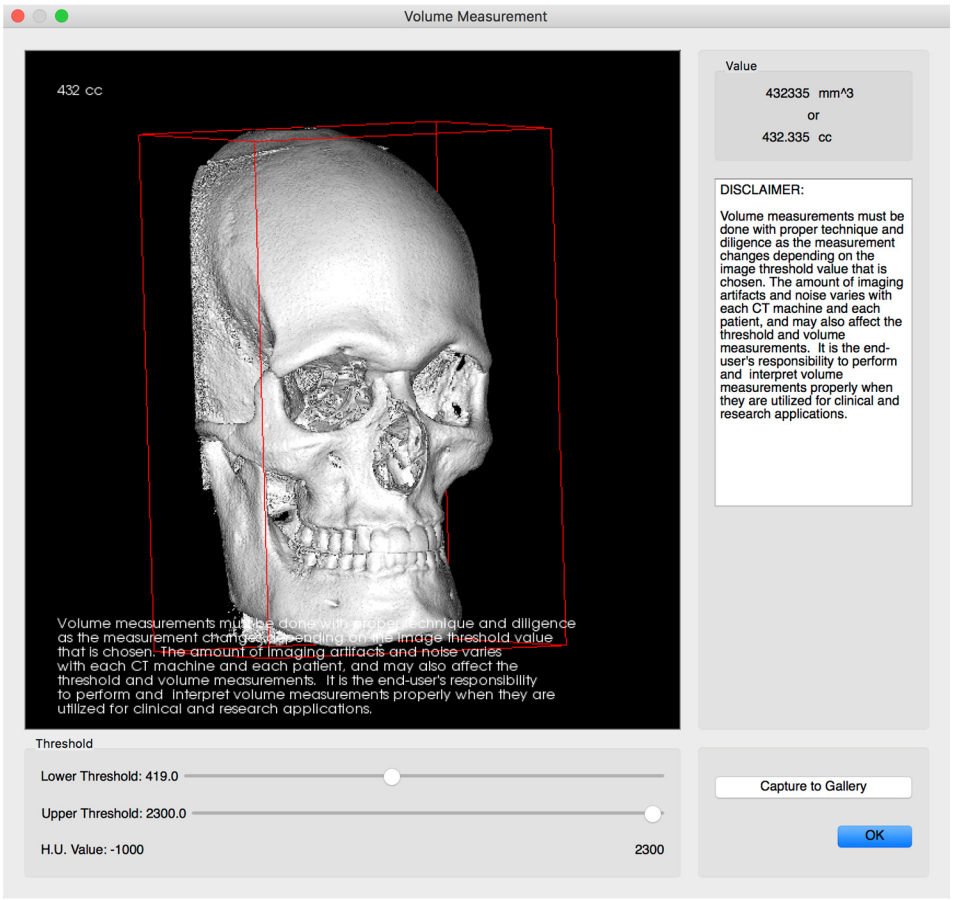
One of the most powerful features of Invivo is the remarkable rendering quality and speed at which the software works. The simplicity of this window is that it only displays the volume, patient information (if desired), and the opacity, brightness and contrast values.



Please refer to Image Navigation (pg. 30) for information about controlling and adjusting these images.

Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. Software reports the value based on user-picked points. Due to the nature of medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

Volume Render: Volume Measurements



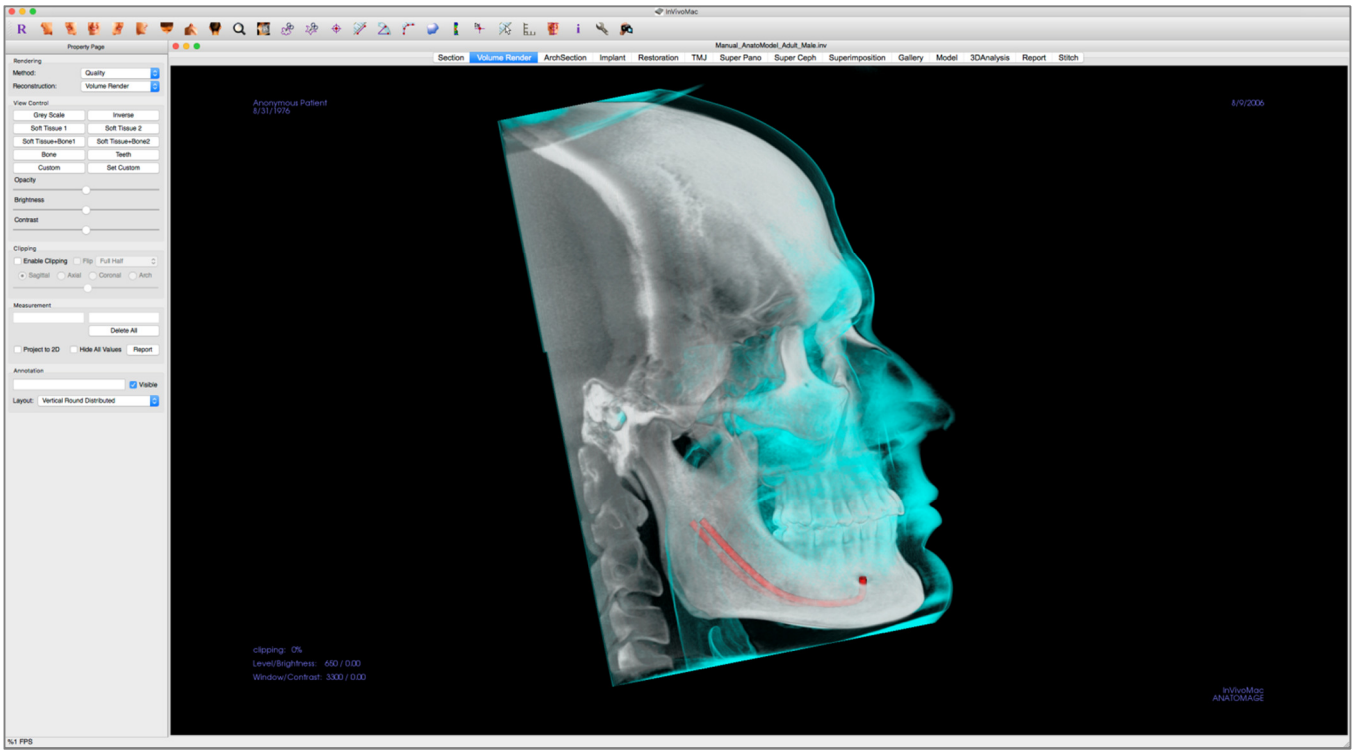
The Volume Measurement interface allows you to estimate displaced volume (cc or cubic millimeters) of a specific anatomical structure. You must first perform sculpting operations to isolate the desired anatomical structure.

Then, press the **Volume Measurement** button. The new window will open and the volumetric measurement value will be displayed. Finally, you can adjust the threshold values to obtain desired measurements. The volume measurement function is linked to rendering; the Inverse rendering preset can be used to take volumetric measurements of air.

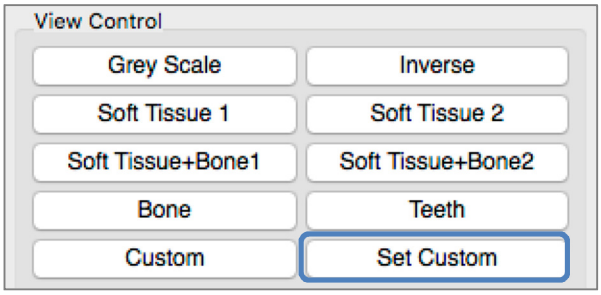
Important: The measurement values may not be true anatomical volumetric measurements. Due to the nature of the imaging, there are imaging artifacts such as white noise, scattering, beam hardening, ring noise or off scale H.U. The software measurement tool cannot distinguish the imaging artifact from the true anatomy. Furthermore, the measurement values depend on threshold values; thus, user must set proper thresholds to get the best estimate of the desired structure. The measurements must not be used as the sole metric for any treatment.

Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. Software reports the value based on user-picked points. Due to the nature of medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

Volume Render: Custom Volume Rendering

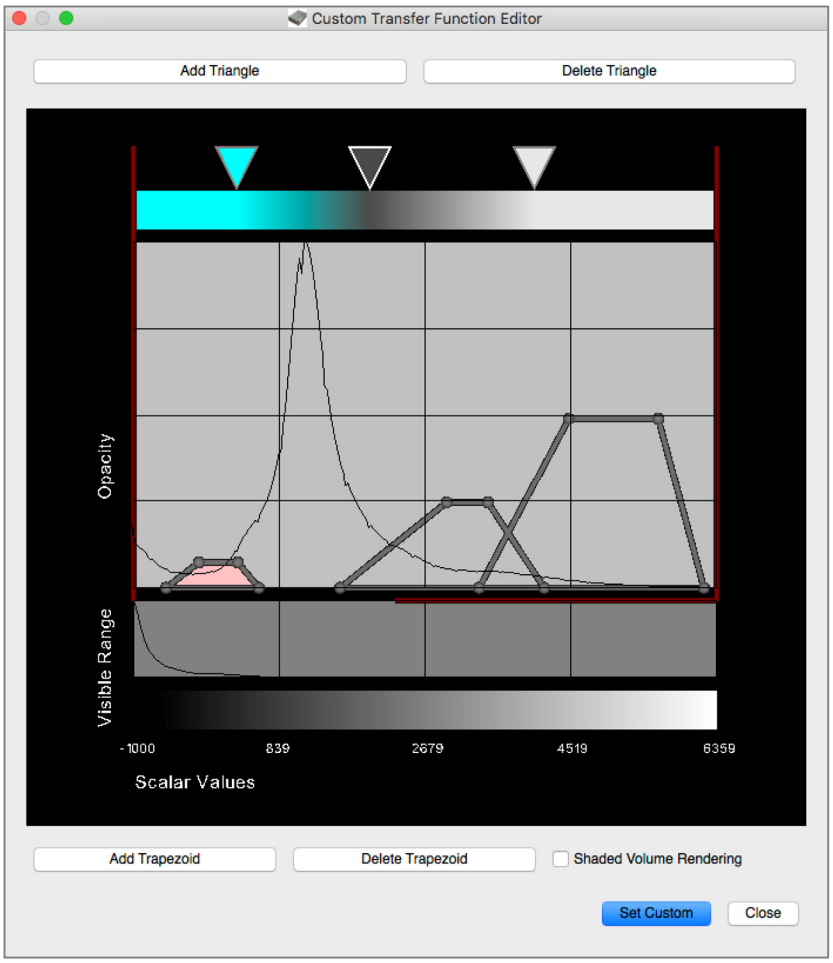


Invivo provides several rendering options for viewing the 3D volume. However, a custom rendering type can be configured and saved within the software.



To begin creating a custom rendering type, click on **Set Custom** under View Control on the Property Page.

This will open the the Custom Transfer Function Editor.



This dialog displays the density distribution of the scan on different scalar values. The left portion of the graph corresponds to lower scalar values which correspond to the dimmer portions of the scan such as the soft tissue, whereas the right portion corresponds to the higher scalar values which corresponds to the brighter portions of the scan such as the teeth.

Note: Scalar values are relative measures of density within a scan.

Trapezoids

- Each trapezoid contains the amount of data that will be visible.
- Trapezoids may be added or deleted.
- Trapezoid shape and size may be adjusted by clicking and dragging the nodes or the upper border.
- The height of the trapezoid determines the opacity of the data set.
- To show varying opacities, multiple trapezoids can be added.

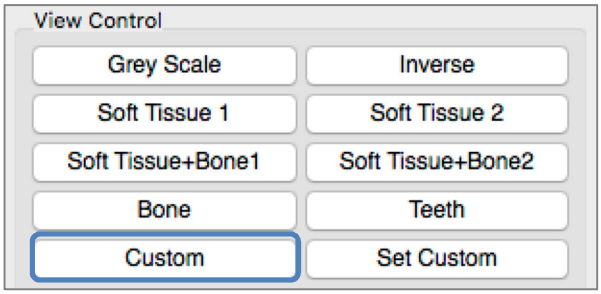
Triangles

- Each triangle is designated a color that can be selected by clicking on it.
- Triangles may be added or deleted.
- The triangle determines the color applied to the corresponding scalar value and may be slid across the gradient.
- Gradients will be created between adjacent triangles.

Shaded Volume Rendering

- When checked, this applies a filter such that the volume appears glossy and shaded.

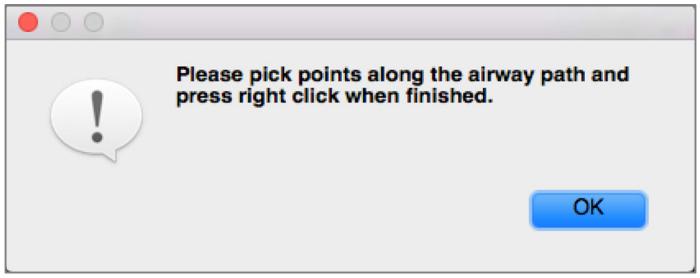
Set Custom: Saves the current custom settings.

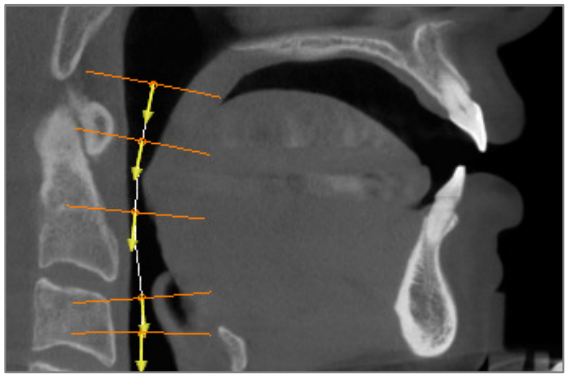


- From the View Control section of the Property Page, select **Custom** to display the custom rendering type for the 3D volume.

Volume Render: Airway Measurement

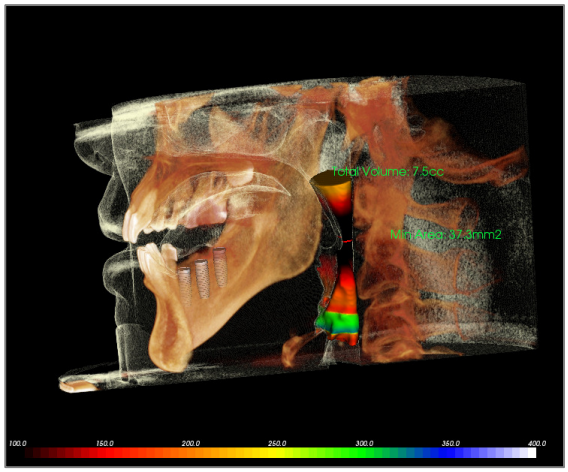
Airway Measurement: Selecting the icon will prompt the dialog box below. Click **OK** to continue.





Tracing the Profile:

- Scroll to locate the mid-sagittal plane.
- Pick points along the airway to define your measurement path with the left-click button.
- Right-click when finished.



Viewing the Volume Measurement:

- Invivo will convert your profile tracing into a volume rendering and superimpose it onto the scan data.
- The minimum cross-sectional area and total volume are displayed next to the airway measurement.
- The color range and threshold can be adjusted by selecting the **Setup View** icon in the Toolbar: 
- The measurement data can be hidden by checking the box for "Hide All Values" in the Property Page.
- The airway volume and measurement values can be deleted by left-clicking once on the volume, then pressing "delete" on the keyboard.

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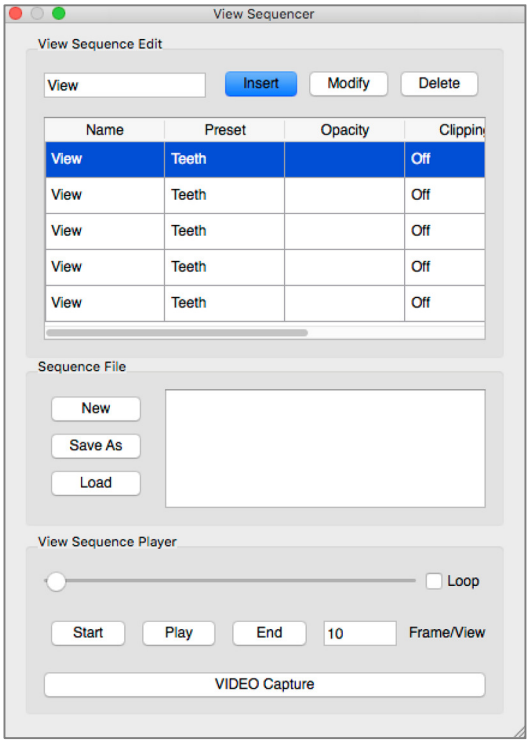
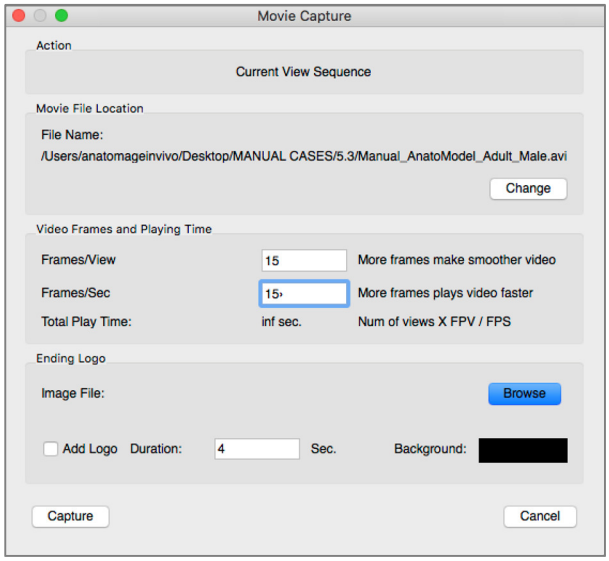
Volume Render: Customized View Sequences



View Sequence:

- Allows you to create your own sequences by clicking on **Insert** for each step you want the volume to move in your sequence. .
- You can integrate multiple, different rendering presets so that it switches not only in sequence, but also in colorizations.
- Video sequences can be saved for future use and then loaded using the **Load** and **Save As** buttons under Sequence File.



Movie Capture:

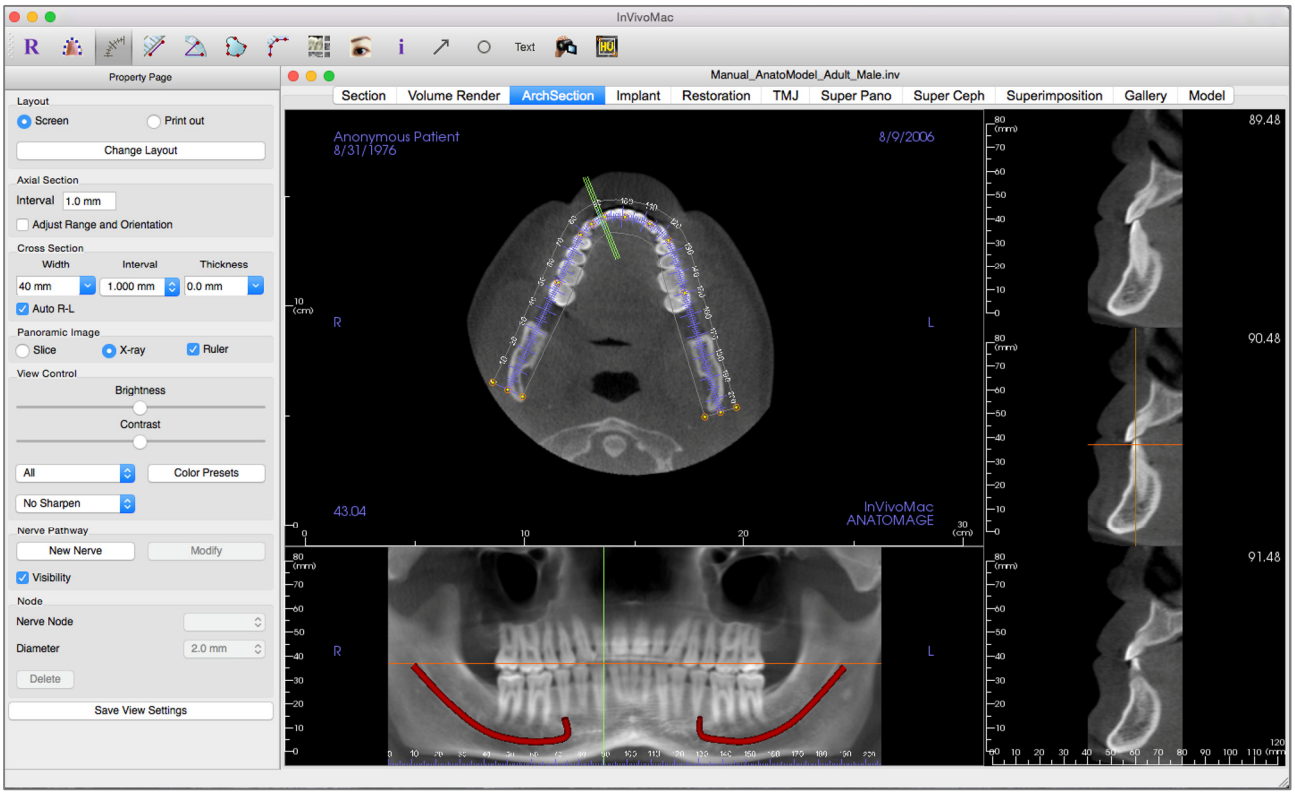
*The **VIDEO Capture** button allows you to customize, capture, and export an AVI (movie) file of the volume rendering sequence.*

- Select **Change** to determine the AVI file name and save location.
- Various codecs that are on your computer can be used to capture the movie at different qualities. If you experience any trouble with the video quality, a different codec may be better.
- Set your frames/view and frames/sec to desired values.
    - *More frames/view will make the video smoother.*
    - *More frames/sec will make the video run faster.*
- Add an ending logo by selecting **Browse** and choosing an image file to display at the end of your video.
    - *Select "Add Logo" to add the ending image.*
    - *Set your duration and background color.*

  Click **Capture** once everything is set up to automatically export the video to the specified location with the specified name.

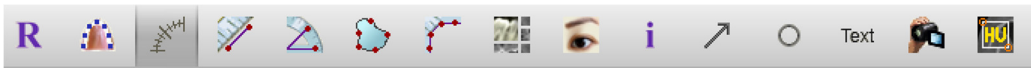
ArchSection View Features

ArchSection View Tab *is a sectional image exploration view. Instead of conventional X-Y-Z sections, this view allows the user to review the image in dentally meaningful perspectives using multiple cross sections, traversing the lengths of the dental arches.*



ArchSection: Toolbar

Shown below are the Toolbar and tools that are loaded with the ArchSection Tab:



Reset View: Resets the window to the original view.

Create Arch Spline (Focal Trough): After selecting this tool, you can create a new arch spline or edit an existing arch spline. First, left-click on the point you would like to start and continue adding points by left-clicking. After you have marked your final point, right-click or double-click to finalize the arch spline. When modifying an existing arch spline, drag the control points to the desired positions.

Arch Spline (Focal Trough) Ruler: Places ruler along the arch spline for easy reference.

Distance Measurement: After selecting this tool, click two points to mark the desired distance. A number in millimeters will automatically display.

Angle Measurement: Select this option and mark three points on the volume and the angle between them will appear. Clicking on their control points and moving the cursor can modify measurements. Click on the measurement and press the "delete" key to delete it.

Area Measurement: After selecting this tool, click multiple points along the boundary of the desired area. Double-click or right-click to end the measurement. A number in millimeters squared will be automatically display. Click on the measurement and press the "delete" key to delete it.

Polygonal Measurement: When selected, you may mark an unlimited number of points on the volume and the total between the first point and the last point will appear. Right-click your mouse to indicate that you have marked your last point. Clicking on the point and moving the cursor can modify points. Click on the measurement and press the "delete" key to delete it.

Layout: Creates a different layout to your preference. After clicking on the layout icon, a list of various layout options will appear. Click on the layout of your preference to apply it. These options allow for different case workup images.

Toggle Cursor Visibility: Conceals or displays cursors.

Information Display: Displays or hides case information embedded in the data.

Arrow Notation: Allows an arrow to be drawn on the image.

Circle Notation: Allows a circle to be drawn on the image.

Text Notation: Allows text to be written and edited on the image.

View Sequence: Allows for the creation of custom camera sequences and AVI file movie capturing. Refer to the **Volume Render View Sequence** (pg. 50) section for additional information and description.

HU Measurement: Calculates the HU value of an area within a bounding box. The measurements will display alongside the rectangle and can also be repositioned by dragging.

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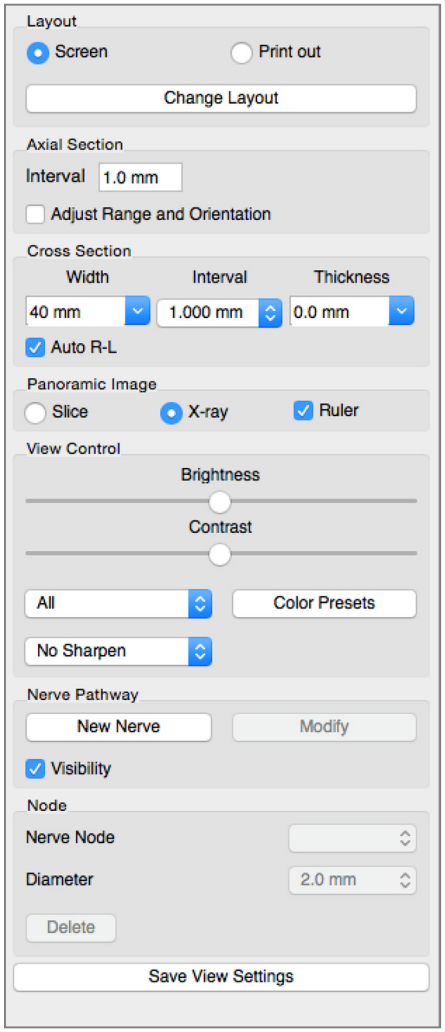
ArchSection: Property Page



Layout:

- "Screen" layout is optimized for viewing the image on the computer screen. "Print Out" layout is optimized for printing the image on paper. With Print Out layout, what you see on screen will be printed on the paper in life-size. First, capture to Gallery, then print from Gallery to ensure the image is life size.
- **Change Layout** allows you to adjust the layout with different amounts of slices and orientations.

Axial Section:

- Interval: Distance between the subsequent axial sections.
- "Adjust Range and Orientation" will switch to a mode allowing for the adjustment of the upper and lower limit of pano and cross sections. You can also reorient the image in this view.

Cross Section:

- Width: Cross-section width.
- Interval: Distance between the subsequent cross sections.
- Thickness: Allows for the cumulative thickness of the slices to be viewed in the cross sections.
- Auto R-L: This will allow the cross section to be oriented to a consistent R-L orientation on the screen. If turned off, the cross-section orientation will be consistent to the arch spline.

Panoramic Image:

- Slice mode will show you a single cross section along the panoramic curve (yellow). This mode is used for tracing the nerve.
- X-ray will show the ray sum (reconstructed x-ray) in the focal trough.

View Control:

- Brightness and Contrast allow you to adjust the image.
- The All drop-down allows you to adjust brightness/contrast in different areas independently.
- Different Color Presets can be used to view the images in color.
- Sharpening Filter applies the selected sharpening filter from the drop-down menu to the 2D slice renderers.

Nerve Pathway:

- **New Nerve:** Starts a new nerve tracing.
- **Modify:** Allows editing of the selected nerve tracing.
- Visibility: Controls the visibility of the nerve in the section and X-ray renderers.
- Nerve Node: Select a specific node for modification.
- Diameter: Selects the diameter of the nerve that has been traced or a specifically selected node.
- **Delete:** Deletes the last placed node during the tracing or the entire nerve if Modify is active.

Save View Settings

Saves the current 2D View settings to be reloaded upon opening any case. See the Display Preferences section in Preferences (pg. 17) for more information on which settings are saved for this specific tab.

ArchSection: Creating A Nerve Pathway

Creating a Nerve Pathway (e.g. Inferior Alveolar by following the mandibular canal to its exit).

- Click **New Nerve**.
- Left-click the mouse where you want the nerve to start.
- Move the mouse to the next point along the nerve path and left-click again.
- Click **Delete** to remove the last-placed node if it is mispositioned.
- Repeat this procedure for the entire length of the nerve.
- **2.0mm** is the default diameter of the nerve pathway, but you may adjust it for your preference.
- Press **Done** to finish.

Editing a Nerve Pathway

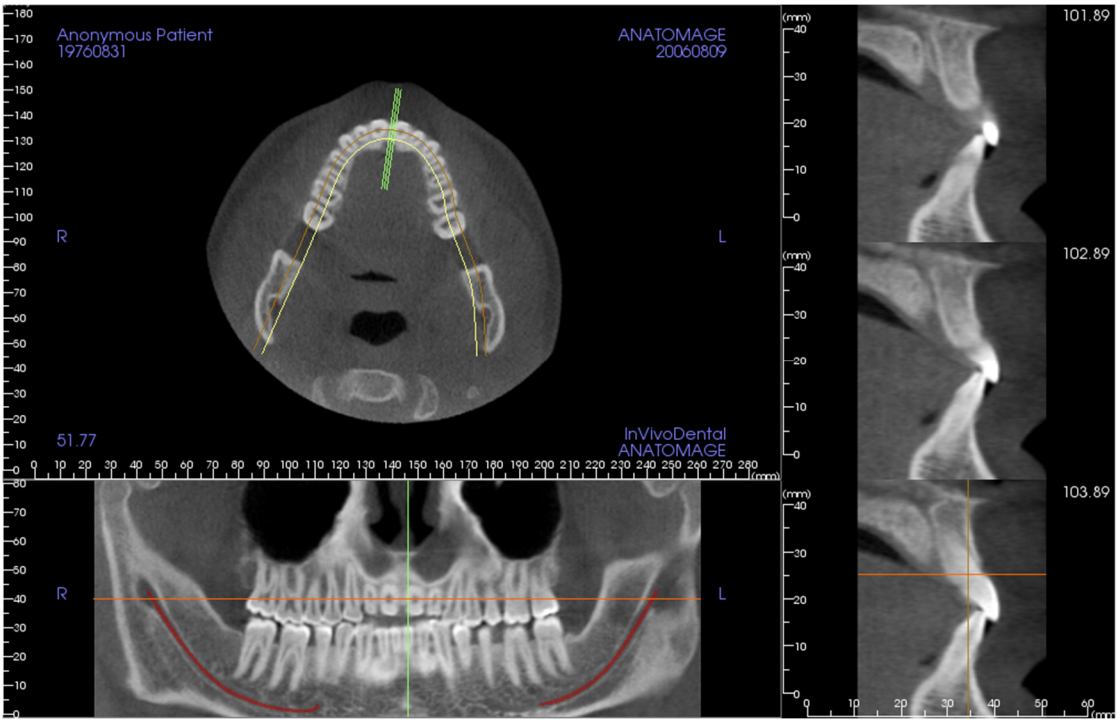
- Click on a nerve tracing to select it. This highlights it in a brighter red color.
- Set the Nerve Node drop-down menu to "All" or a specific node.
- If "All" is selected, the entire nerve tracing's diameter can be adjusted.
- If a single node is selected, it will be highlighted in the scan, and its diameter and position may be adjusted independently. The nerve node diameter is adjusted in the Diameter drop-down menu. The highlighted node can be moved by clicking and dragging it across the scan.

Deleting a Nerve Pathway

- The **Delete** button can be used if a point was plotted in the wrong spot; it will delete the last point added.
- Once a nerve has been completed and **Done** has been clicked, the nerve can be deleted by clicking on it and pressing the "delete" key on the keyboard or the **Delete** button.
- Visibility will turn the nerve on or off from view.

Warning: Any nerve that is traced in a way that does not conform to the actual pathway of the nerve can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based off of the incorrect tracing. It is critical for the end user to learn how to properly perform nerve tracings correctly. If you notice any inconsistencies or software problems with nerve tracing or have further questions or concerns about nerve tracing, please contact Anatomage support at (408) 885-1474 or email us at info@anatomage.com

ArchSection: Rendering Window

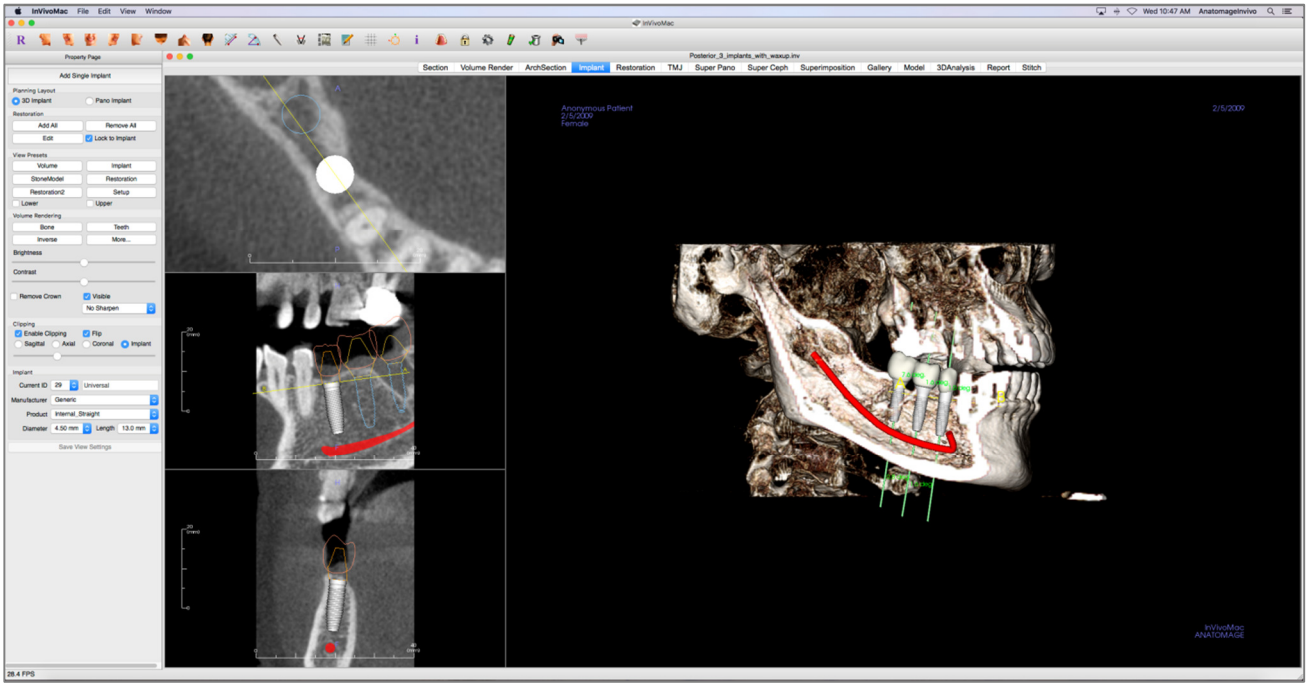


Arch Cursor: Notice the green, orange, and brown coordinate indicators. These ArchSection coordinate indicators show where you are spatially located within the ArchSection modeling window.

- **Cross Section Indicator:** The green lines give the location of the cross sections along the arch spline.
- **Axial Slice Indicator:** The orange line shows the axial coordinate position within the section.
- **Arch Spline:** The brown spline in the center of the arch spline represents the current position where the arch section has moved.
- **Cross Section:** Mouse scrolling within any one of the three sagittal frames advances the slices to the patient's right or left and causes the green coordinate indicator to move anteriorly or posteriorly in the axial and pano sections simultaneously.
- **Axial Section:** Mouse scrolling within the axial section advances the sections superiorly or inferiorly and causes the red coordinate indicator to move superiorly or inferiorly in the cross or pano sections simultaneously.
- **Pano Section:** Mouse scrolling within the coronal frame advances the slices buccally or lingually and causes the brown coordinate indicator to move buccally or lingually in the axial and cross sections simultaneously.

Implant View Features

*The **Implant View Tab** allows you to access the full-featured implant planning module.*



Implant: Toolbar

Shown below are the Toolbar and tools that are loaded with the Implant View Tab:

Reset Views: Resets the rendering window to the original view.

Left View: Automatically orients the volume so the patient is facing left sagittal.

Left ¾ View: Automatically orients the volume so the patient is facing 45° left sagittal.

Front View: Automatically orients the volume so the patient is facing the front.

Right ¾ View: Automatically orients the volume so the patient is facing 45° right sagittal.

Right View: Automatically orients the volume so the patient is facing right sagittal.

Top View: Automatically orients the volume so you are oriented above the patient.

Bottom View: Automatically orients the volume so you are oriented below the patient.

Back View: Automatically orients the volume to the posterior view.

Distance Measurement: Select this option and mark two points on the volume and distance will appear. Clicking on the point and moving the cursor can modify points. Click on the measurement and press the "delete" key to delete it. Property Page features in Volume Render Tab allow the values to be projected to 2D, hidden, or exported to a report.

Angle Measurement: Select this option and mark three points on the volume and the angle between them will appear. Clicking on their control points and moving the cursor can modify measurements. Click on the measurement and press the "delete" key to delete it. Property Page features in Volume Render Tab allow the values to be projected to 2D, hidden, or exported to a report.

Insert Implant: To place an implant, first click the **Add Implant** icon, select the Tooth ID for the implant, then left-click the mouse on the spot that you want the implant to be placed. Note: specific manufacturers measure the implant from different points, so a measurement in the software might not be the same as the actual measurement of the specific implant design.

Show Implant Angle Dialog: Opens a window displaying all the angles between placed implants.

Change Layout: Toggles the rendering window layout.

Create Summary: Creates an Implant summary of images that is added to the Gallery. Images contain ID (FDI), implant product, diameter, and length information in the lower right hand corner of the screenshot.

Toggle Grid: Toggles between two different grid layouts for use in the upper two section frames allowing quick assessment of measurements and spatial location.

Toggle Move Widget: Toggles the implant orientation widget on and off.

Information Display: Displays or hides case information embedded in the data.

Change Model Visibility: Allows various models to be turned on or off from view.

Treatment Lock: Locks the implants in place so that they are not accidentally moved when viewing the 3D images.

Preferences: Allows you to adjust the different rendering, color, and visibility preferences.

Density Profile Control: Adjust the settings for the displayed density profile around planned implants.

Check Sleeves: The program will search for collisions between the sleeves, instruments, and stone models.

Generate View Sequence: Opens a dialog that provides view sequence presets to create a video.

Visualize Bone Graft Volume: Simulates a bone graft near the apex of an implant and displays its volume.

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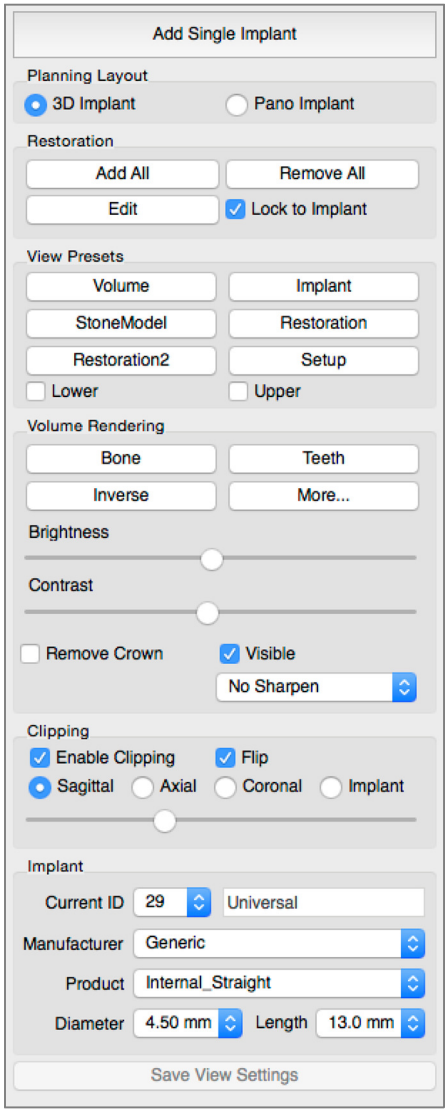
Warning: Any implants and restorations that are incorrectly visualized in InVivoDental may lead to surgical complications or treatment delays. If you notice any inconsistencies or software problems with implant or restoration planning or have further questions or concerns, please contact Anatomage support at (408) 885-1474 or email us at info@anatomage.com

Warning: Any implant planning that is performed incorrectly in any aspect including but not limited to implant location, orientation, angle, diameter, length, and/or manufacture can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based off of the implant planning error(s) in question. It is critical for the end user to learn how to use the implant treatment planning tools correctly. If you notice any inconsistencies or software problems with implant planning or have further questions or concerns about correct utilization of implant planning, please contact Anatomage support at (408) 885-1474 or email us at info@anatomage.com

Implant: Property Page



Add Single Implant:

- Click to add single implant to the 3D volume.
- Adjust the implant orientation and placement using the move widget that appears on the selected implant.

Planning Layout:

- 3D Implant: Place and adjust individual implants on 3D volume.
- Pano Implant: Add multiple implants using the Pano view, select "3D Implant" to exit Pano view and re-adjust individual implants.

Restoration:

- **Add All:** Adds default restorations to all the implants.
- **Remove All:** Removes all restorations.
- **Edit:** Transfers the current progress to the Restoration Tab for advanced crown placement and design. See the **Implant: Advanced Restoration Design** section (pg. 69) for more information.
- Lock to Implant: When selected, the implant and restoration will move as a single unit.

View Presets:

- **Setup:** Opens a dialog where the view presets can be configured.
- **Presets:** Preset toggles that display the selected features as configured in the **Setup**.
- Upper/Lower: Toggles the visibility of the stone models if present.

Volume Rendering:

- Rendering Types: Different settings allow for better visualization of certain anatomic structures, soft tissue profiles, hard tissue, etc. This is achieved by displaying specific densities with specific colors.
- Brightness & Contrast: Can be adjusted for each of the presets to enhance your image.
- Visible: Allows the 3D Volume Rendering to be turned on or off from view.
- Remove Crown: Only applicable with surgical guide-related modeling service options.
- Sharpening Filter: Applies the selected sharpening filter from the drop-down menu to the 2D slice renderers.

Clipping:

Click the "Enable Clipping" box to slice the image along the predefined anatomical planes (sagittal, axial, coronal, and arch). Scrolling the mouse wheel or moving the slider bar will move the clipping plane. To switch a view to the opposite side, click "Flip."

Implant:

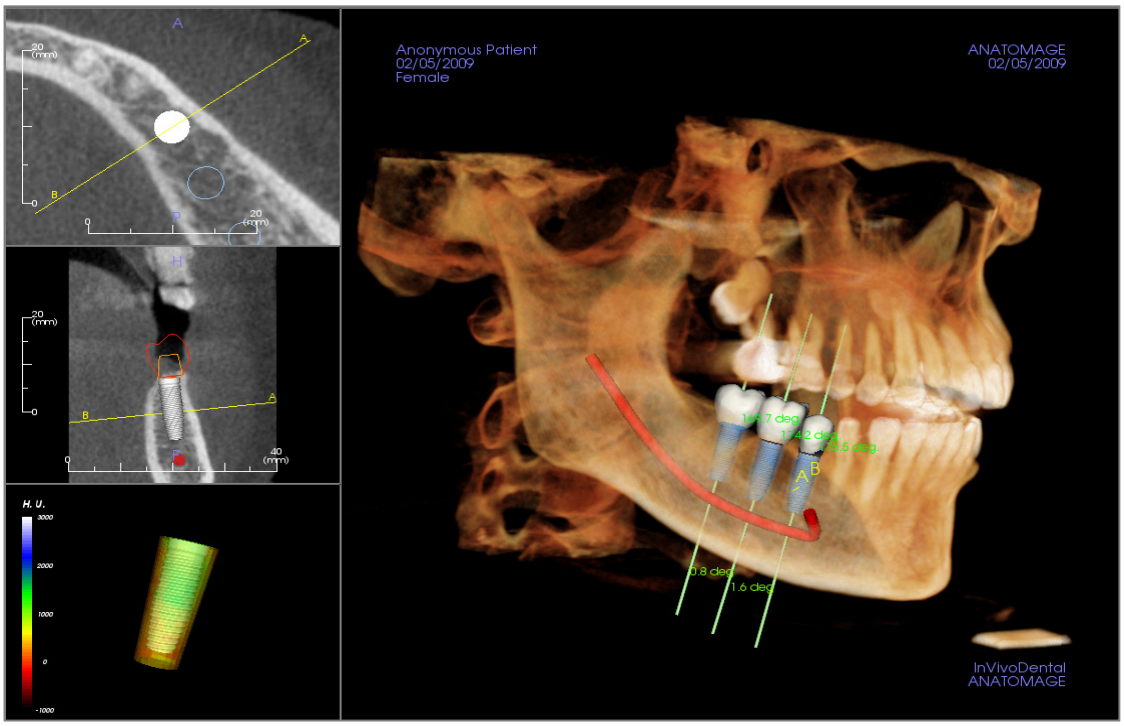
The implant section can be configured to only show specific implants as defined by the user. For more information, look at the Preferred Implant settings further in this section.

- ID: Use the drop-down menu to select an implant to manipulate. The active implant will appear lighter in color than the others.
- Manufacturer, Product Name, Diameter, and Length: The default is generic, but you may select a specific implant manufacturer, diameter, and length.

Save View Settings

Saves the current 2D view settings to be reloaded upon opening any case. See the Display Preferences section in Preferences (pg. 17) for more information on which settings are saved for this specific tab.

Implant: Rendering Window



Used for more precise control and final detailed touches to implant treatment planning. Using the navigation discussed below, you can visualize all aspects of the implant in the 3D volume. For further information on implant position and sizing using the implant widgets, please refer to the next section of the manual. **Once an implant is added, it will also appear in the Volume Render View.**

Axial Section: Top left window. This section is the view from the top of the implant. The yellow line passing through the axis creates the view seen in the sagittal view. Scrolling the mouse wheel after clicking inside the axial window, or clicking and dragging the line will change the cross section seen in the sagittal view as the line rotates about the axis of the implant. Asymmetrical (STL) implants can be rotated about the long axis in this view (see the next section).

Sagittal Section: Middle left window. This section is the view from the side of the implant. The A-B line passing through the implant creates the cross-section view that appears in the axial view and is set by default to be positioned at the level of the implant emergence point. Scrolling the mouse wheel after clicking inside the sagittal window, or clicking and dragging the line will change the cross section seen in the axial view. The implant widget in this view allows for quick resizing of implant length and diameter (see the next section).

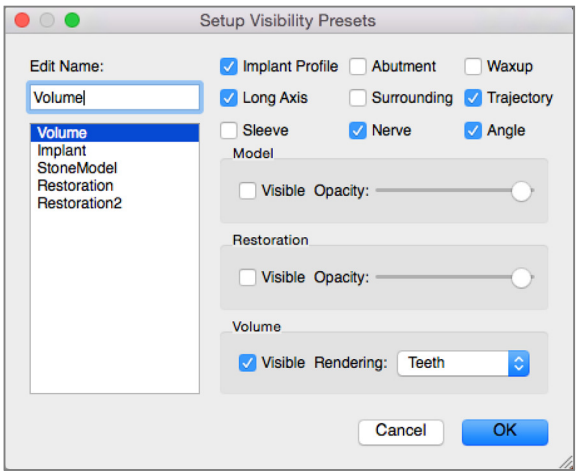
Density Profile: Lower left window. Displays a real-time visualization of the volume density immediately surrounding the implant.

Volume Rendering: Right window. This frame allows user to change the implant position and orientation with the orientation widget within the 3D volume rendering.

Warning: Any implant planning that is performed incorrectly in any aspect including but not limited to implant location, orientation, angle, diameter, length, and/or manufacture can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based off of the implant planning error(s) in question. It is critical for the end user to learn how to use the implant treatment planning tools correctly. If you notice any inconsistencies or software problems with implant planning or have further questions or concerns about correct utilization of implant planning, please contact Anatomage support at (408) 885-1474 or email us at info@anatomage.com

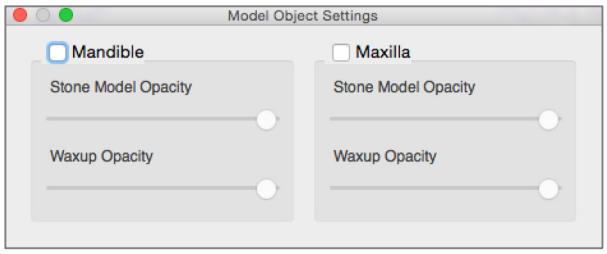
Implant: View Preset Setup

Visibility presets allow for easy switching between set views during implant planning. To configure these settings, click on **Setup**. These presets may also be modified in the Restoration Tab.



- **Edit Name:** Click on any preset to select it. Type the new name into the field.
- Visibility checkboxes hide or show features in the rendering window.
- **Implant Profile:** Controls the visibility of the solid implant cross section in the 2D renderers. When activated, the currently selected implant will have a red profile and the unselected implants will have blue profiles. When not activated, the selected implant will show an opaque cross section of the implant and the unselected implants will show as blue profiles.
- **Abutment:** Controls the visibility of the abutment 3D model in the volume renderer or the colored profile in the 2D slice renderers.
- **Waxup:** Controls the visibility of the profiles in the 2D renderers and 3D models on the volume. Option is only available after they have been added by an Anatomage technician as part of a surgical guide case workup.
- **Long Axis:** Displays a colored rod running through the long axis of the implant in the volume render.
- **Surrounding:** Displays the surrounding volume around an implant. The collision zone is determined by the allowance defined in the preferences.
- **Trajectory:** Displays the simulated trajectory of the implant during surgical placement.
- **Sleeve:** Controls the visibility of the profiles in the 2D renderers and 3D models on the volume. Option is only available if the mandibular and maxillary models are available as well as after the Check Sleeve action has been performed.
- **Nerve:** Displays a 3D nerve in the volume render or a cross section of the nerve in the 2D section renderers.
- **Angle:** Controls the visibility of the angle between the long axes of adjacent implants as well as the angles of the abutment for each implant.
- **Model:** Controls the visibility of the stone models. Varying degrees of transparency can be obtained with the Opacity slider bar.
- **Restoration:** Controls the visibility of the 3D waxup models in the volume renderer and the colored profile in the 2D section renderer. The colored profile of the selected restoration or restoration associated with the selected implant will be red while the unselected restorations will be pink. Varying degrees of transparency can be obtained with the Opacity slider bar.
- **Volume:** Controls the visibility of the volume render as well as the rendering type.

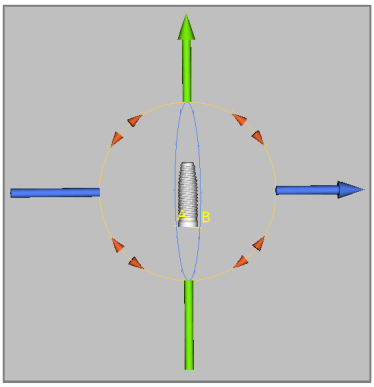
Implant: Model Visibility



The **Change Model Visibility** function will open the Model Object Settings dialog.

- The "Mandible" and "Maxilla" checkboxes control all of the model visibility options (except Profile Only and Density) and allow the user to turn off the set of models for each jaw independently. *Note: The visibility checkboxes in Model Object Settings will not always match the checked/unchecked status of the visibility checkboxes in the Property Page.*
- The Stone Model and Waxups Opacity can be adjusted for both jaws.

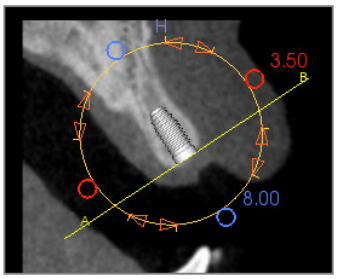
Implant: 3D Implant Widget

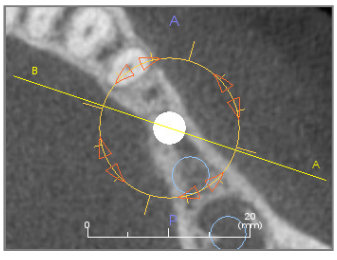


The 3D implant widget is designed to optimize visibility in the renderer and provide a high level of versatility in implant positioning. The linear, colored arrows can be dragged to reposition the implant transversely. These arrows only appear when the camera perspective is close to orthogonal. The implant may also be moved along these directions using the keyboard arrow keys.

- The yellow arrow (not shown) is parallel to the A-B line.
- The blue arrow is orthogonal to the green and yellow arrows.
- The green arrow runs through the long axis of the implant.
- The rotation circle appears on the same plane as the two arrows that are close to orthogonal to each other and to the camera perspective and features eight handles for rotation.

Implant: 2D Implant Widget





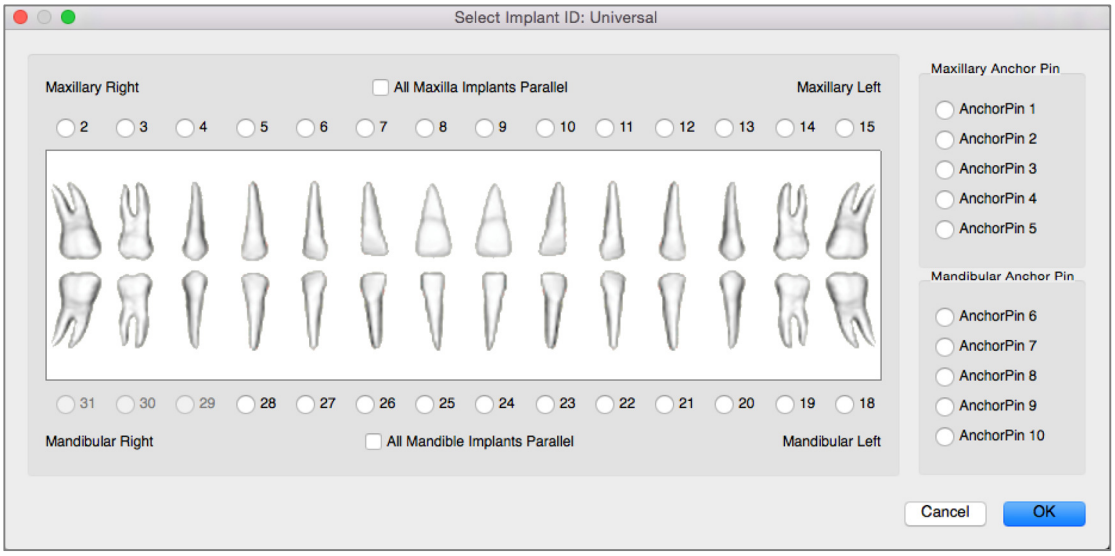
The 2D implant widget is designed to optimize visibility in the slice renderer and provide a high level of versatility in implant positioning and sizing. The implant may also be moved along its long axis or orthogonally with the keyboard arrow keys.

- The rotation circle has eight arrows for implant rotation along the same plane as the currently displayed slice.
- The two red handles can be selected and dragged toward/away from the implant to reduce/expand the diameter of the implant sequentially through any available options for that implant model.
- The two blue handles can be selected and dragged toward/away from the implant to reduce/expand the length of the implant sequentially through any available options for that implant model.
- The implant model itself can be selected and dragged in any direction along the same plane as the currently displayed slice.
- A rotation circle appears when the product cross section is selected that allows for implant rotation about the long axis of asymmetrical (STL) implants in the top left section renderer. Please contact Anatomage for an updated list of asymmetrical (STL) implants.

Implant: 3D Implant Planning

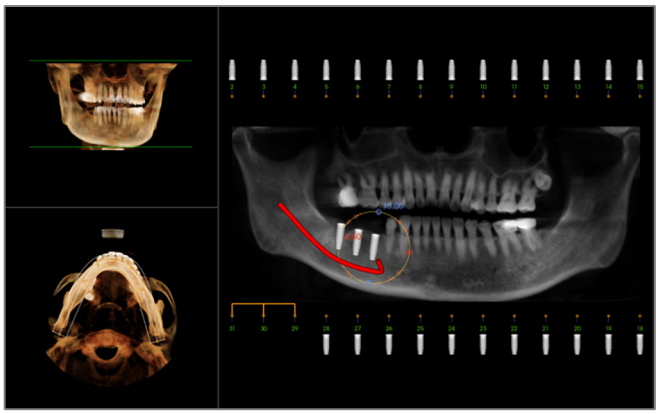
- In the Property Page, click the **Add Single Implant** button. 

- The implant ID dialog will show up (image below).
- Select the implant ID to be inserted. Press **OK**, and a new implant will appear on the mouse pointer.
- Drag and drop the implant in 3D view onto the surgical site. (It helps to have the volume rotated so that the surgical site is centered.)
- In axial view, align the yellow line such that the lower cross-section view becomes the view along mesiodistal direction.
- In cross-section view, re-orient and position the implant so that its angle is as desired.
- In axial view, align the yellow line such that the cross-section view becomes the view along the buccolingual direction.
- In cross-section view, re-orient and position the implant so that its angle is as desired.
- Review the final implant position in 3D view.
    - To delete an implant, select the desired implant in the 3D view and press the "delete" key on the keyboard. The implant will be removed.



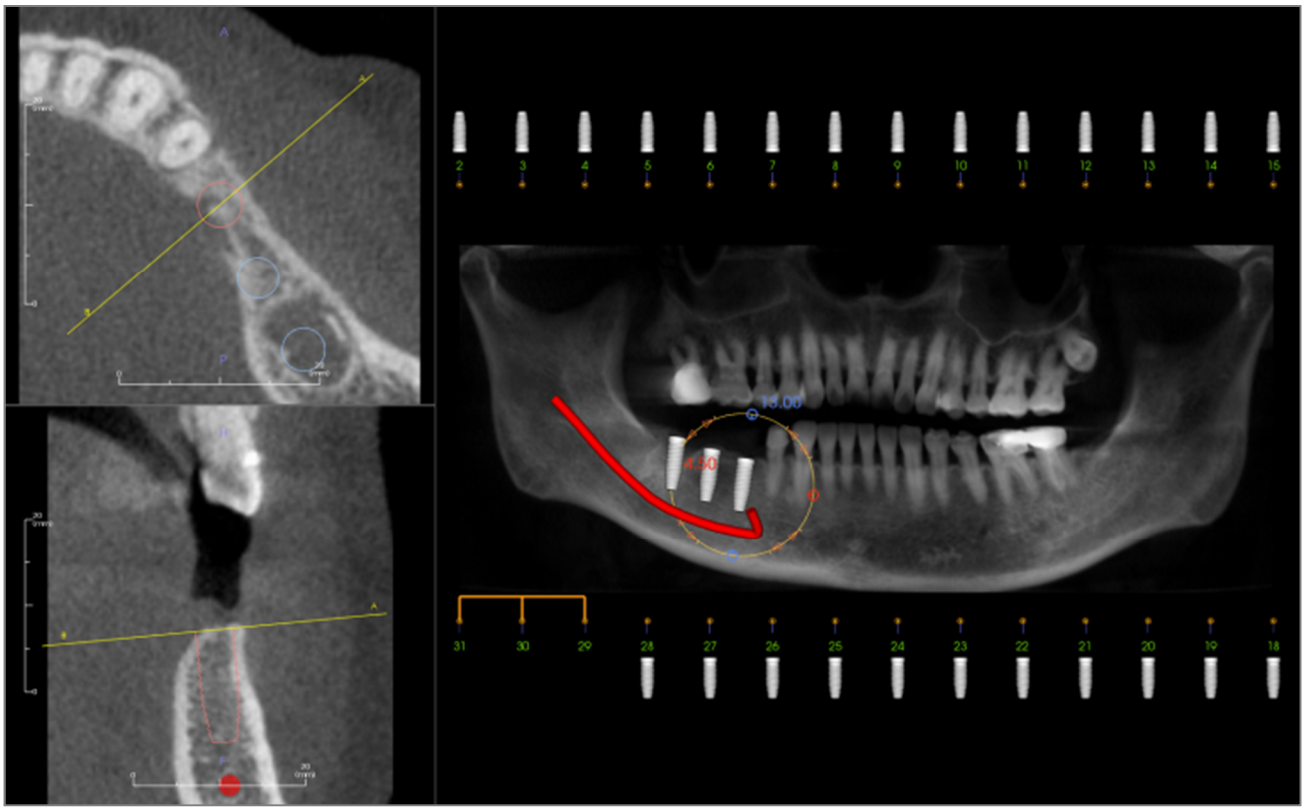
A similar procedure can be done to add anchor pins to your 3D volume. Select which anchor pin you would like to add and follow similar steps for adjusting its position.

Implant: Pano Implant Planning



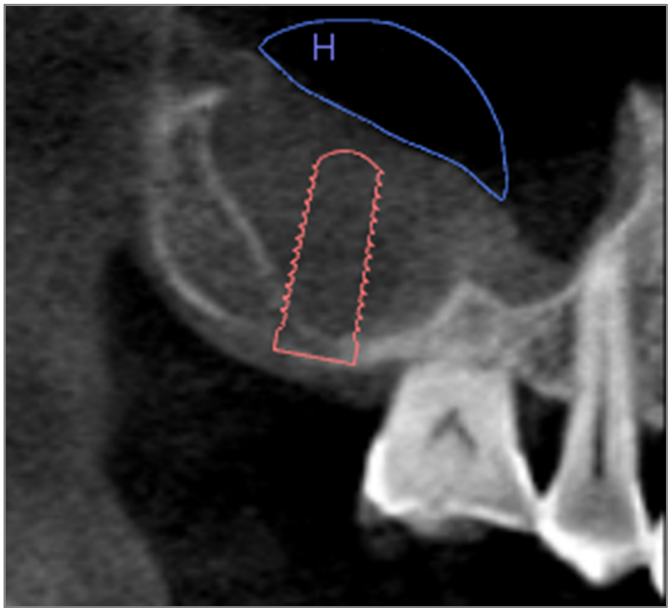
- Select Planning Layout: Pano Implant under the Property Page in the Implant Tab.
- Rendering window updates to pano view (left).
- Adjust the ArchSection focal trough such that the middle profile passes through the dentition.
- Drag implants to their desired locations and adjust their angles.
- Click to select implants and manipulate them in the cross sections.

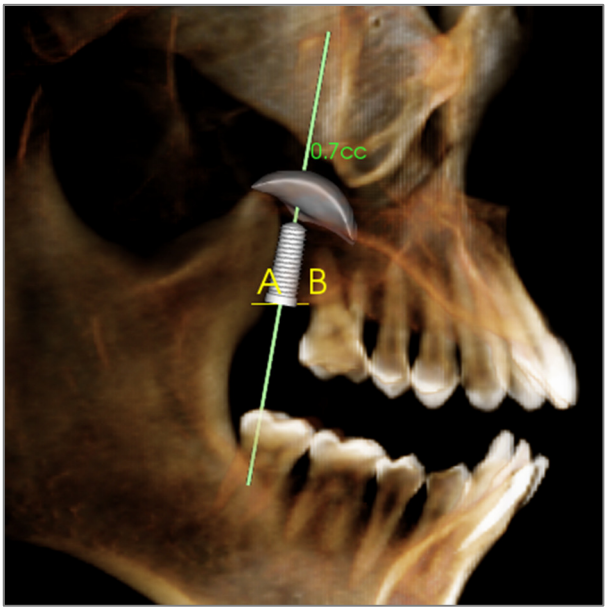
- Click the nodes above the implant identification numbers and connect them with other implants to create parallel implant groups. Remove the implants from these groups by clicking on the nodes again.
- Repeat for all desired implants.
- Select Planning Layout: 3D Implant to exit Pano-Mode and further adjust individual implants.



Implant: Bone Graft Simulation

- Select the implant that requires a bone graft and click the **Visualize bone graft volume** tool  .
- The graft simulation tool will appear as an arc that moves along the central axis of the implant in the sagittal cross section.
- Click to place the graft in the desired position.
- Use mouse scrolling to adjust the graft's diameter.
- The resulting graft will appear in the 2D sections in blue and in the volume rendering in off-white.
- The volume of the graft will be displayed in the volume rendering.
- The graft can be deleted by clicking on it to select it and pressing the "delete" key on the keyboard.





Important: The measurement values may not be true anatomical volumetric measurements. Due to the nature of the imaging, there are imaging artifacts such as white noise, scattering, beam hardening, ring noise or off scale H.U. The software measurement tool cannot distinguish the imaging artifact from the true anatomy. Furthermore, the measurement value depends on threshold values; thus, user must set proper thresholds to get the best estimate of the desired structure. The measurements must not be used as the sole metric for any treatment.

Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. Software reports the value based on user-picked points. Due to the nature of medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

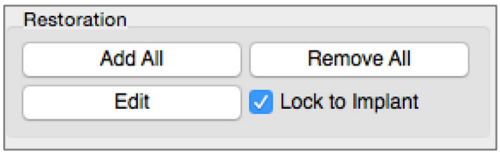
Implant: Advanced Restoration Design

Invivo features advanced restoration design functions located in the Restoration Tab (see the **Restoration** section for more information on this tab, pg. 76). Compatibility between files saved in different Invivo versions will cause certain behaviors that accommodate this new functionality, as described below:

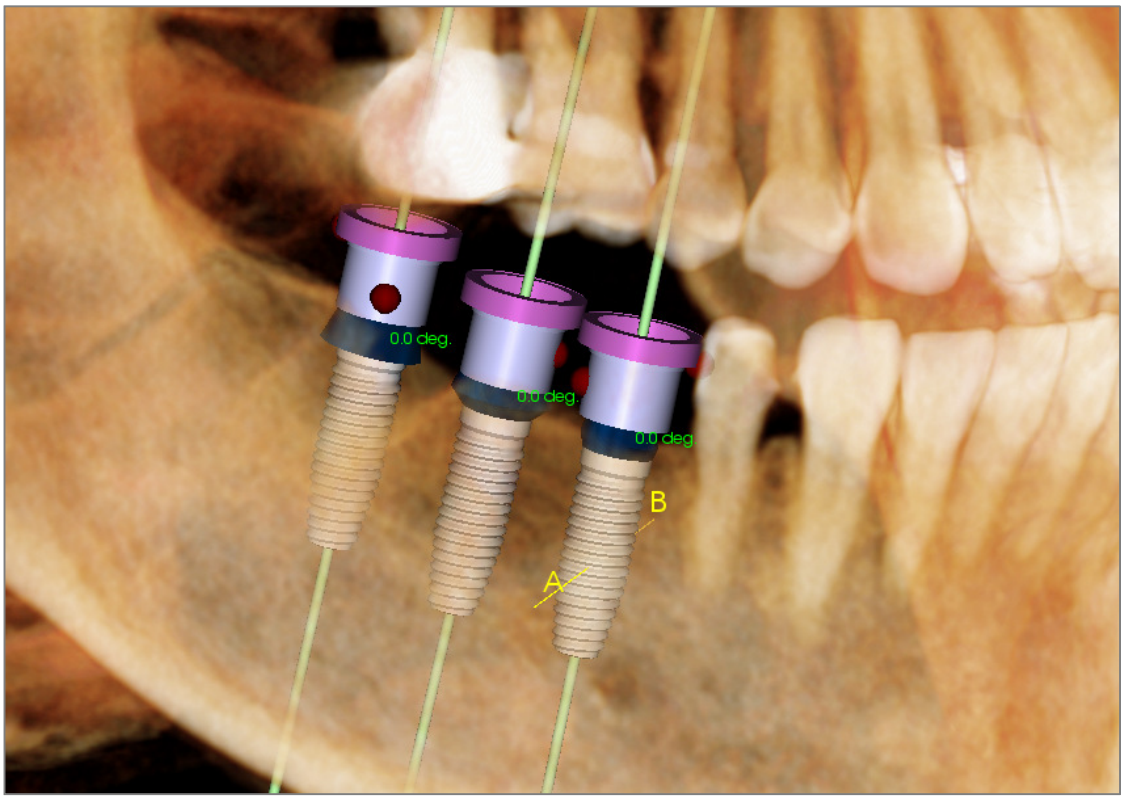
Scenario:	Consequence:
1. Opening an Invivo file containing a restoration workup from any version prior to 5.3:	1. The Implant tab will display these restorations as they were last saved. Upon going to the Restoration Tab, the program allows the user to convert the original restorations into crowns from the new library. If the user chooses not to convert the restorations, crowns will not be present.
2. Opening an Invivo file saved in Invivo 5.3 or a later version with an implant and restoration workup in earlier versions of Invivo:	2. The earlier versions of Invivo will not be able to display the restoration crowns in the Implant or Model Tabs.
3. Opening an Invivo file saved with implants from any earlier version, but no restorations:	3. The implant workup will be loaded, and the user will be able to add restorations from the Restoration teeth library.

Implant: Adding Restorations

Restorations can be added directly to all the implants using the **Add All** button. A default restoration will be placed on each implant that does not yet have a restoration. The **Remove All** button will remove all the placed restorations. The **Edit** button will present the option to do further editing in the Restoration Tab. Locking the restorations to implant will automatically move the restorations when the implants are moved. Restorations may also be added, edited, or removed in the Restoration Tab (see **Restoration** section for more information, pg. 76). The Restoration Tab view is synchronized with the Implant Tab view for ease of editing between the two tabs.



Implant: Check Sleeves

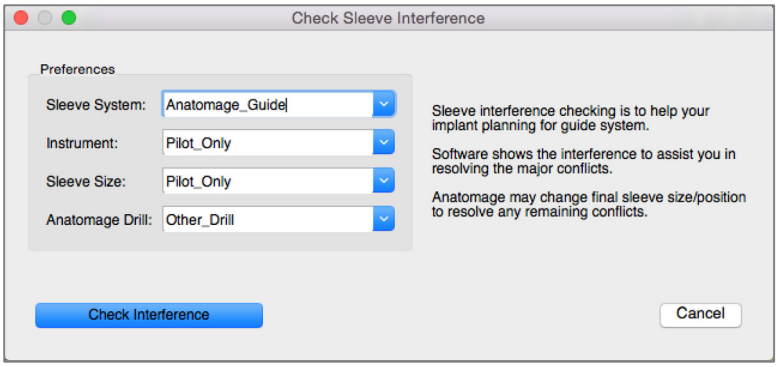


The **Check Sleeves** function can be performed to determine the position of where sleeves would be if a surgical guide was produced for implant placement. This function will simulate possible collisions that may occur between:

- Sleeves and other sleeves
- Sleeves and the instrument
- Sleeves and the stone model
- Instrument and the stone model

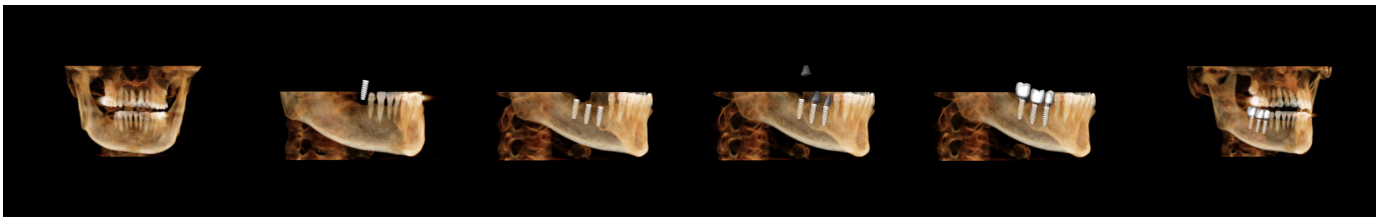
Interference: Demonstrated visually by a dark red-colored sphere. **These interference indicators are not updated in real-time and will only be rechecked after each instance that Check Sleeves is performed.**

Check Sleeve Interference: The user can change certain preferences to simulate the actual procedure that will be performed better, such as sleeve system, instrument, sleeve size, and drill. Solution options are to change implant planning, change sleeve preferences, or to allow a technician to try to resolve the interference.

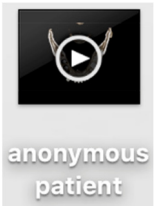


The option to check sleeves will automatically appear when attempting to save Anatomage Surgical Guide planning files.

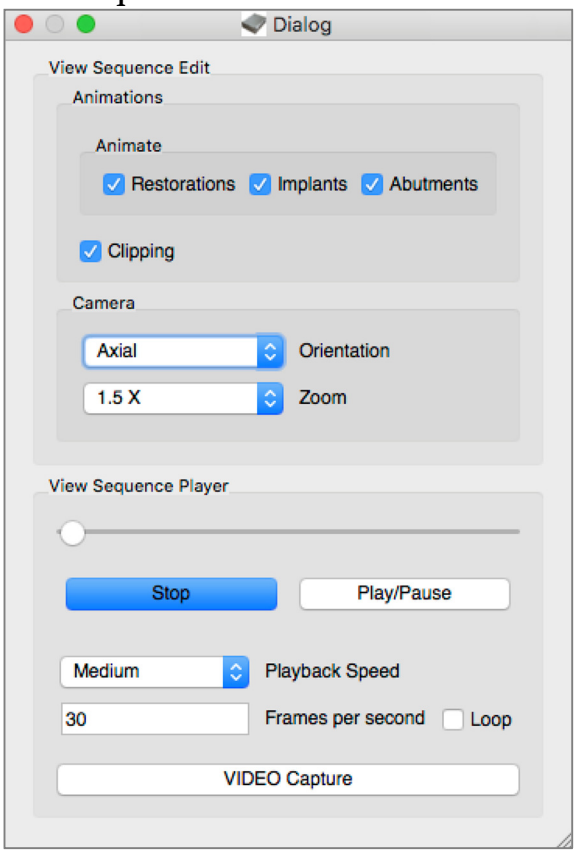
Implant: View Sequencer



- The  implant view sequencer is a movie-creating tool that contains both an axial and buccal (shown above) preset sequence of view positions and rotations.
- The sequence is adapted to be used with any case and immediately played as a preview.
- A movie file (.avi) that resembles the preview can be captured.



View Sequencer



Animation

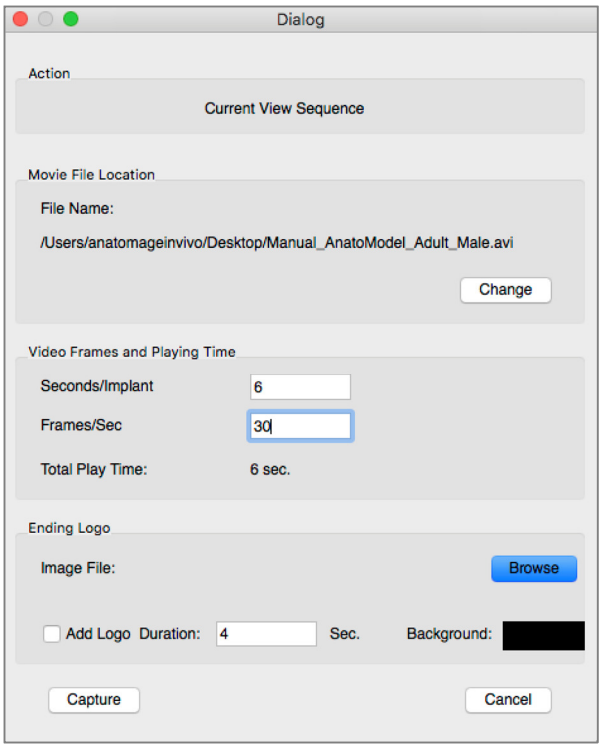
- Animate: Set the sequence to animate the placement of implants, abutments, and restorations.
- Clipping: Set the sequence to include the preset clipping actions.

Camera

- Orientation: Set the orientation to be axial or buccal.
- Zoom: Set the zoom level of the rendering window (None, 1.5X, 2.0X).

View Sequence Player

- Slider: Shows the current progress through the video while allowing navigation through the preview by clicking and dragging.
- **Stop:** Stop the preview.
- **Play/Pause:** Starts the video/pauses the video/resumes the video.
- Playback speed: Speed of playback (slow, medium, fast).
- Frames per second: Sets the smoothness of the preview playback.
- Loop: Sets the preview to loop at the end of playing the sequence.



Action

The current view sequence will be captured into a movie file.

Movie File Location

Choose the location to save the file by clicking **Change**.

Available Codecs Installed In This Computer

Choose from a drop-down list of the available codecs installed on the computer. Click **Configure** to choose from more recording options.

Video Frames and Playing Time

- Seconds/Implant: Length of sequence for displaying each implant.
- Frames/Sec: Smoothness of the video.
- Total Play Time: Calculates the total play time for the options selected.

Ending Logo

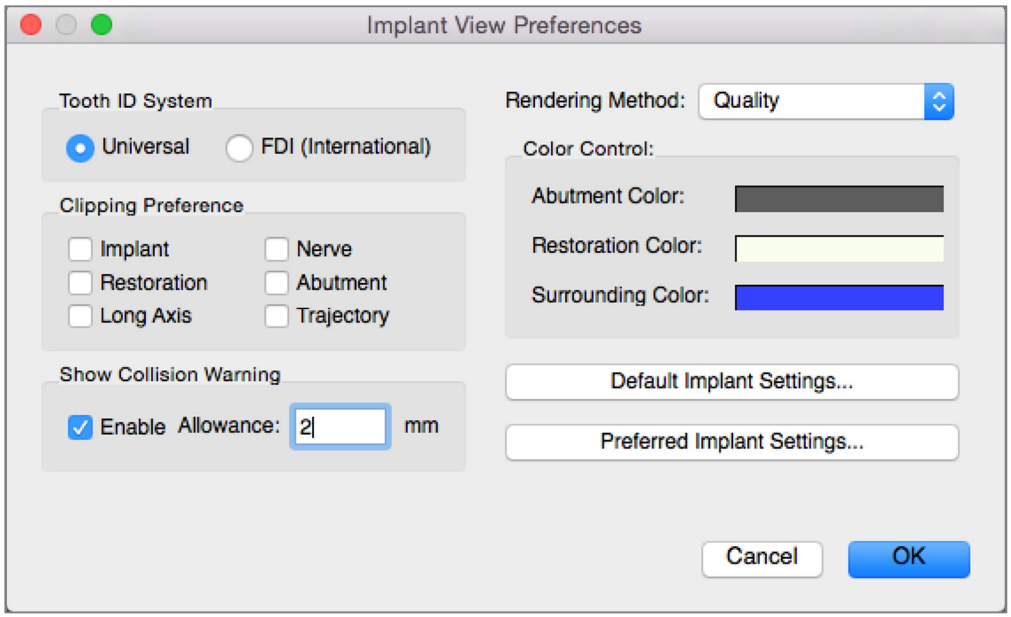
- Image File: Click **Browse** to select the location of the logo file.
- Add Logo: Select the checkbox to add in a logo segment to the movie.
- Duration: Set the length of time to show the logo.
- Background: Set the background color for the logo segment.

Capture

Creates a video file from the selected sequence and video recording settings. Click **Cancel** to exit this dialog without recording the video.

Implant: Settings and Preferences

Selecting the **Preferences** tool  opens up a customization window within the Implant Tab:



Tooth ID System:

You can set the ID to either the Universal or FDI(International) standard.

Clipping Preference:

Options for which models to include in volume clipping.

Show Collision Warning:

You can define whether or not to display a proximity warning between implants at an allowed tolerance.

Rendering Method:

Choose which rendering method (Default, Performance, and Quality) you would like to use in the Implant Tab.

Color Control:

Set the various colors for the abutment, restoration, and collision colors.

Detailed Implant Settings:

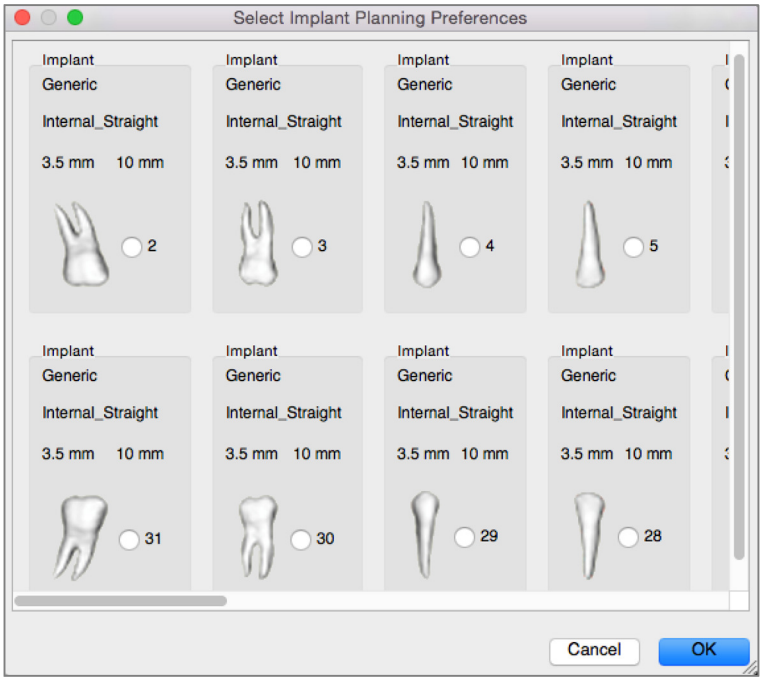
Adjust default settings for individual implants. See more information below.

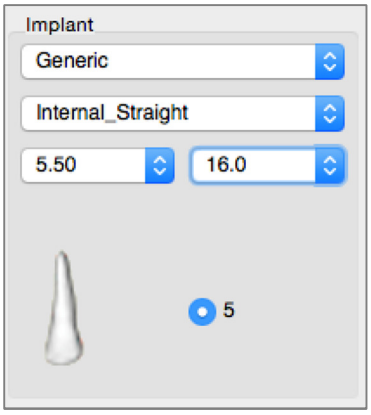
Preferred Implants Settings:

Used to modify which implants will be displayed in the drop-down menus in the Property Page. See more information in the **Preferred Implant Settings** section (pg. 74).

Detailed Implant Settings

When you select **Detailed Implant Settings**, you are able to adjust the default settings for individual implants in the Implant Planning Preference Window.



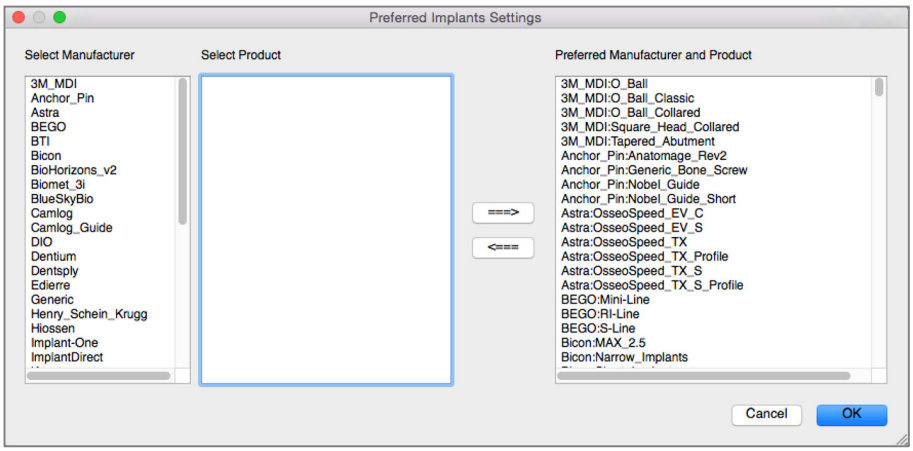


Clicking once anywhere in the region above will activate drop-down menus for the various implant characteristics. *Options will not appear for implants not in the preferred list (see below).*

Click **OK** to save these preferences and the designated implant will be selected automatically when choosing a tooth in the Add Single Implant menu.

Preferred Implants Settings

The user can hide certain implants from populating the lists to simplify the drop-down menus. By default, all implant manufacturers and types are selected as "preferred." **To remove an implant, select it in the list on the right-hand side and use the left arrow button to remove it from the list.**



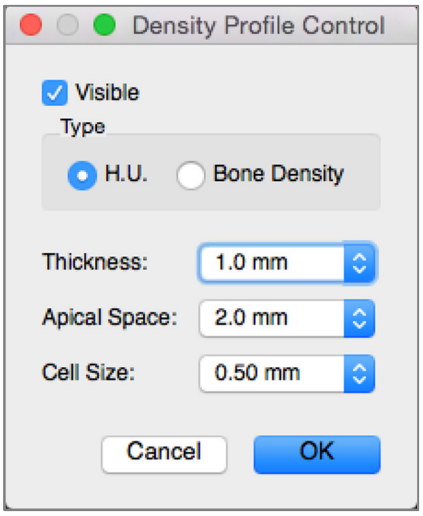
Settings will take effect in the drop-down menu options for Detailed Implant Settings as well as in the Implant section of the Property Page. If there is a case open with implants that are not in the preferred list, the implant will still show up correctly in the renderers and the Property Page. However, the specific settings for this implant cannot be changed and implants of the same type cannot be added.

Adding implants to the preferred list can be accomplished by selecting the implant manufacturer on the list on the

left-hand side, selecting the specific product in the middle column, and pushing the right arrow button to add.

Density Profile Control

By selecting the **Density Profile Control** tool  you can adjust the settings for the Density Profile.



Visible: Toggles the visibility between the Density Profile and the third cross section.

H.U.: Shows the bone density in Hounsfield units.

Bone Density: Shows the density in Misch's bone density units.

Thickness: Changes the sampled volume located around the implant.

Apical Space: Changes the sampled volume located at the apex of the implant.

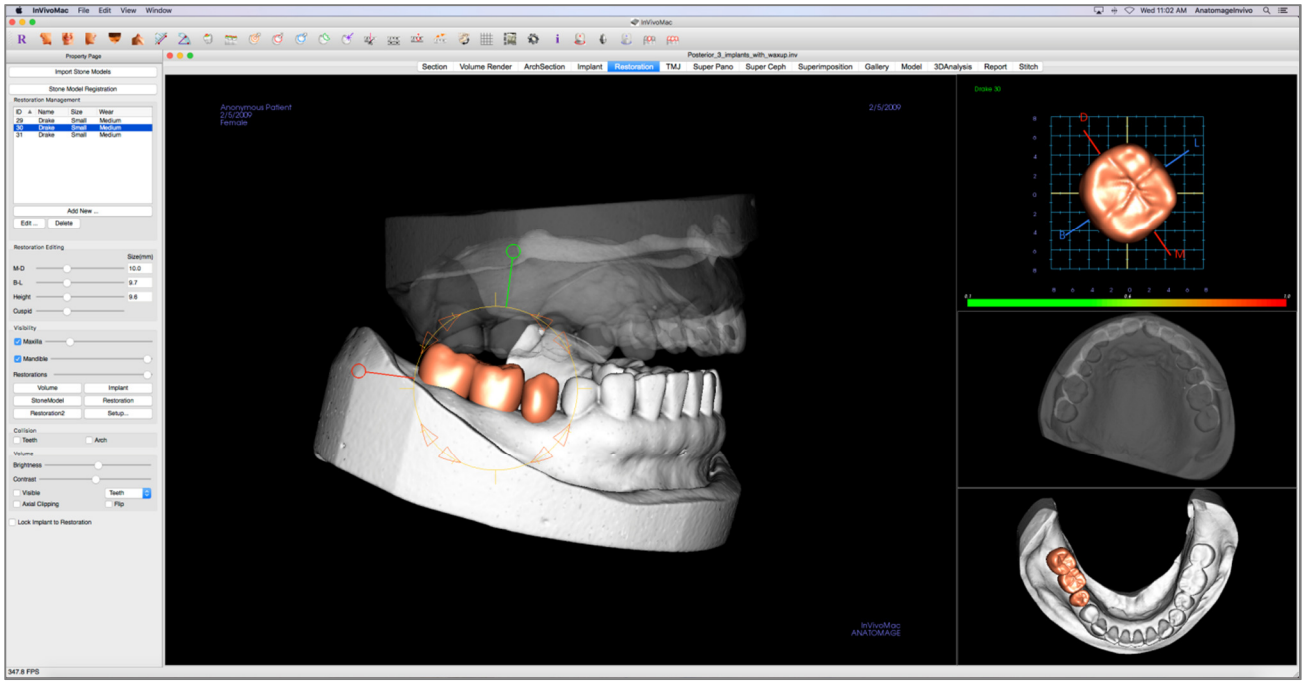
Cell Size: Changes how finely the voxels will be sampled and displayed in the volume around the implant.

Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. Software reports the value based on user-picked points. Due to the nature of medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

Warning: Any implant planning that is performed incorrectly in any aspect including but not limited to implant location, orientation, angle, diameter, length, and/or manufacture can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based off of the implant planning error(s) in question. It is critical for the end user to learn how to use the implant treatment planning tools correctly. If you notice any inconsistencies or software problems with implant planning or have further questions or concerns about correct utilization of implant planning, please contact Anatomage support at (408) 885-1474 or email us at info@anatomage.com

Restoration View Features

*The **Restoration View Tab** is an advanced tool that bridges the gap between implantology and restoration crown design. Users can register the stone models and add teeth directly or onto existing planned implants. With the model collision visibility options, numerous teeth libraries, and mesh editing features, this tab will guide implant surgery toward perfect occlusion.*



Restoration: Toolbar

Shown below are the Toolbar and tools that are loaded with the Restoration View Tab:

Reset View: Resets the rendering window to the original view size.

Left View: Automatically orients the volume so the patient is facing left sagittal.

Frontal View: Automatically orients the volume so the patient is facing the front.

Right View: Automatically orients the volume so the patient is facing right sagittal.

Top View: Automatically orients the volume so you are oriented above the patient.

Bottom View: Automatically orients the volume so you are oriented below the patient.

Distance Measurement: Select this option and mark two points on the volume and distance will appear. Clicking on the point and moving the cursor can modify points. Click on the measurement and press the "delete" key to delete it. Property Page features in Volume Render Tab allow the values to be projected to 2D, hidden, or exported to a report.

Angle Measurement: Select this option and mark three points on the volume and angle between them will appear. Clicking on their control points and moving the cursor can modify measurements. Click on the measurement and press the "delete" key to delete it. Property Page features in Volume Render Tab allow the values to be projected to 2D, hidden, or exported to a report.

Show Collision: Turns on/off the collision between teeth restorations and the opposing/working stone models or restorations.

Show inter-arch collision: Turns on/off the visibility of collisions between the stone models.

Area Drag: Turns on the area drag tool in the rendering and the single tooth renderer windows.

Push Mesh: Turns on the push mesh tool in the rendering and the single tooth renderer windows.

Pull Mesh: Turns on the pull mesh tool in the rendering and the single tooth renderer windows.

Smooth: Turns on the smooth tool in the rendering and the single tooth renderer windows.

Auto collision resolution: Turns on the auto collision tool in the rendering and the single tooth renderer windows.

Plane Cutter: Activates a polygonal cutting tool to cut and close the mesh of stone models in the rendering window.

Cap Model: Applies a capping function to the available open mesh stone models.

Tooth extraction: Enables a polygonal mesh cutting tool for use on a stone model in immediate extraction cases.

Adjust occlusion: Turns on the stone model adjustment widget for manually moving the stone models and their dependent restorations in the rendering window.

Articulation: Opens the Articulation dialog to open/close the jaws with a simulated biting motion.

Toggle Grid: Turns on/off the 2D grid for simple assessment of size, measurement, and spatial location.

Change Layout: Toggles the rendering window layout.

Preferences: Opens the Preferences dialog for selecting color, collision, and default tool size settings.

Information Display: Displays or hides case information embedded in the data.

Fit to Margin: Opens a dialog to adjust the interface between a restoration and a prepped tooth on the stone model.

Custom Abutment: Opens a dialog that provides options for abutment design.

Fit to Custom Abutment: Opens a dialog to adjust the interface between a restoration and a custom abutment.

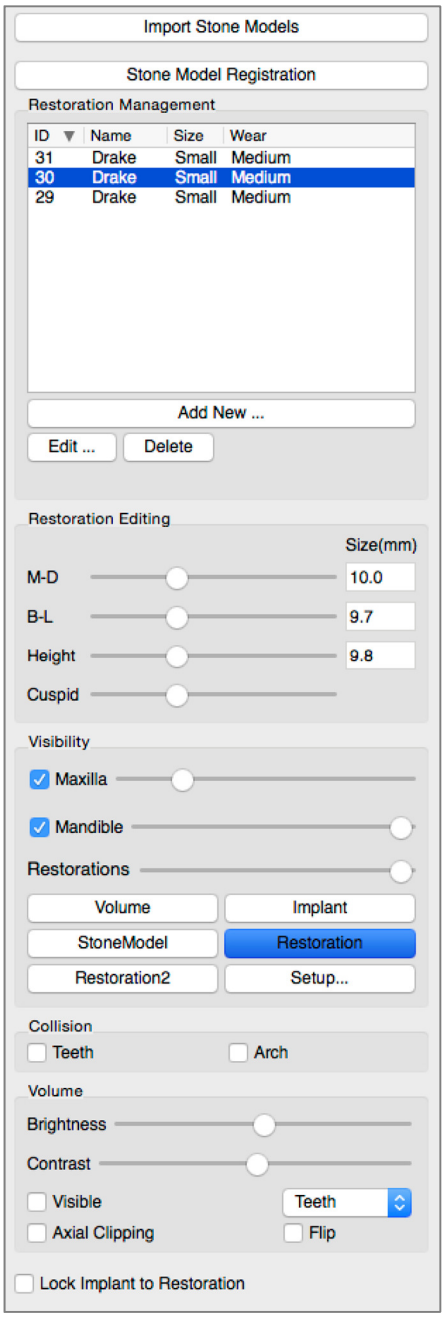
Create Pontic with Gingiva: Opens a dialog to modify the base of a pontic to fit to or offset from the stone model.

Create Bridge Connector between Selected Restorations: Creates a bridge linking all of the selected restorations. This bridge group can be deleted and converted back into the individual restorations.

Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. Software reports the value based on user-picked points. Due to the nature of medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

Warning: Any implants and restorations that are incorrectly visualized in InVivoDental may lead to surgical complications or treatment delays. If you notice any inconsistencies or software problems with implant or restoration planning or have further questions or concerns, please contact Anatomage support at (408) 885-1474 or email us at info@anatomage.com

Restoration: Property Page



Import Stone Models

Initiates a sequence of steps to import and register a stone model. For more information, see the **Restoration: Stone Model Registration** section (pg. 80).

Stone Model Registration

Opens the Register Stone Models to Volume dialog to restart the registration for the imported stone models.

Restoration Management

- **Add New…:** Opens the teeth library for restoration selection and placement.
- **Edit…:** Opens the teeth library to change the currently selected restoration.
- **Delete:** Removes the currently selected restoration from the rendering window.

Restoration Editing

- M-D Size(mm): Adjusts the mesiodistal dimension of the restoration.
- B-L Size(mm): Adjusts the buccolingual dimension of the restoration.
- Height Size(mm): Adjust the height of the restoration.
- Cuspid: Adjusts the cusp dimensions from low to high.

Visibility

- Maxilla: Adjust the visibility/opacity of the maxilla.
- Mandible: Adjust the visibility/opacity of the mandible.
- Restoration: Adjusts the opacity of the restorations.
- **Setup:** Opens a dialog where the view presets can be configured.
- **Presets:** Preset toggles that display the selected features as configured in the **Setup**.

Collision

- Teeth: Turns on the visibility of collisions between the restorations and the opposing/working stone model or restorations.
- Arch: Turns on the visibility of collisions between the stone models.

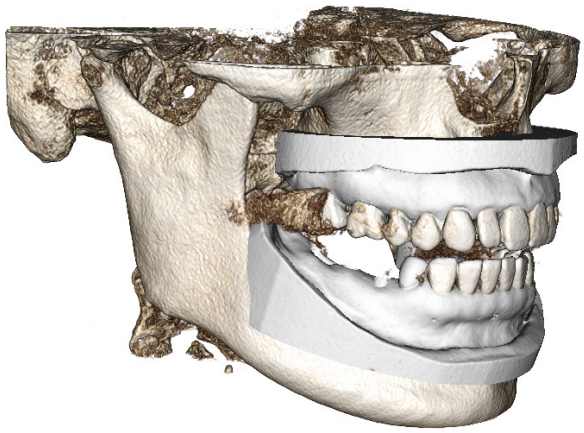
Volume

- Brightness & Contrast: Can be adjusted for each of the presets to enhance your image.
- Visible: Turns on/off the visibility of the DCM volume.
- Axial Clipping: Turns on/off axial clipping and the Axial Clipping widget.
- Rendering (drop-down): Chooses the rendering preset between the options of Teeth and Bone.
- Flip: Flips the clipping direction.

Lock Implant to Restoration: When selected, the implant and restoration will move as a single unit.

Restoration: Stone Model Registration

The **Import Stone Model** function will guide you step-by-step through the importing and registration of upper and lower stone models. If stone models are already present in the workup, this function will serve to replace the existing models.

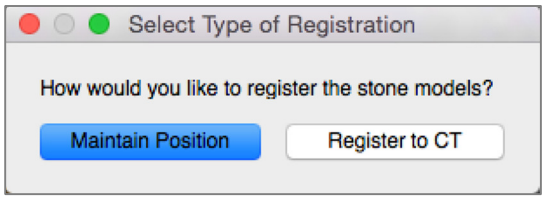


Step 1: Import Stone Models

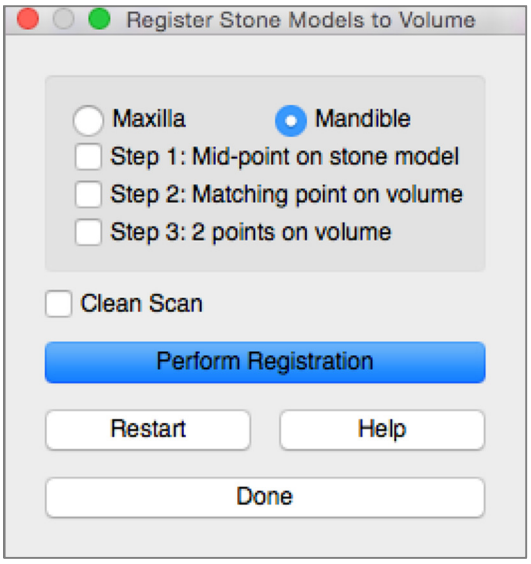
- Click **Import Stone Models** in the Property Page.
- Choose the .stl or .ply file in the Select Stone Model File dialog.
- Select the type of model as Upper (maxilla) or Lower (mandible).
- Move onto the next step. At the end of registration, click **Import Stone Models** once more if the opposing stone model needs to be imported or if a stone model registration needs to be redone.

Step 2: Select Type of Registration

- **Maintain Position:** The software will apply the transformation data from the registration of the opposing arch to this STL. This option is useful if a pair of STLs (upper and lower) have been registered in another program (intraoral scans may have close bite registration data). In this case, after registering one STL to the DCM (see Register to CT), the second STL can be imported and be loaded so that the close bite registration is restored. This will most likely result in an incorrect position relative to the DCM scan for the second STL, since many CBCT scans intended for implant/restorative workups are taken with open patient bites.



- **Register to CT:** This will initiate the first step in registering the STL file to the DCM. The dialog (right, lower) shows the three steps needed to complete the registration. The layout (Figure 1) shows the STL on the left of the rendering window and the DCM on the right with the adjacent clipping tool. Click **Help** to read the embedded document describing how to register different cases.
    - Clean Scan: Check this option when the case has little to no scatter. The registration will use additional points where selected for a more accurate registration.
    - **Restart:** Resets the user back to Step 1 in the dialog.
    - **Perform Registration:** Matches the STL to the DCM based on the points selected.



- **Done:** Closes the dialog.

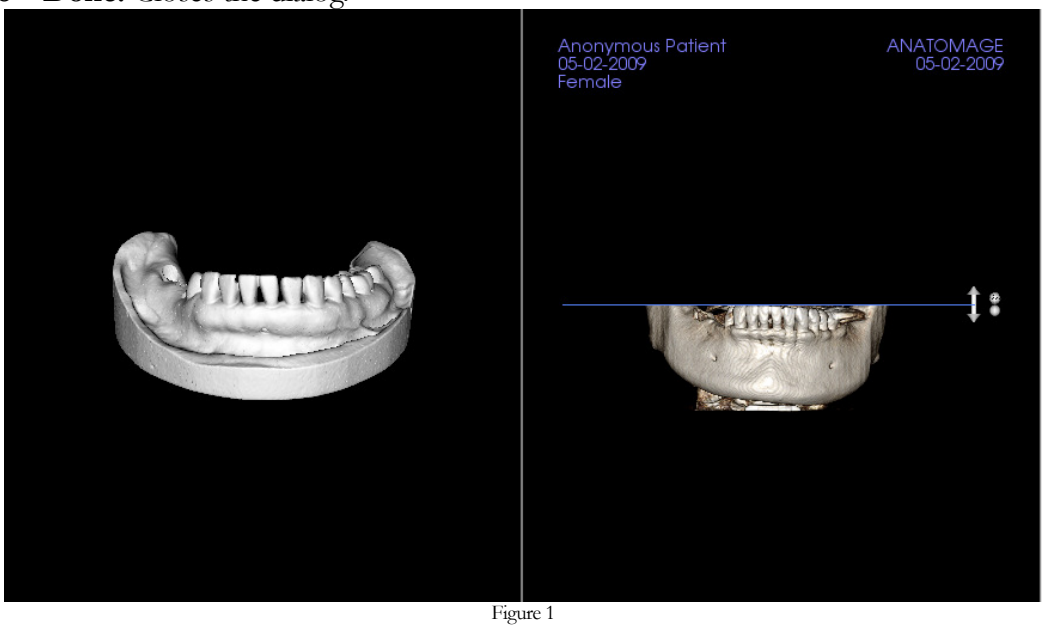


Figure 1

- After clicking **Perform Registration**, the user will be brought to a new layout (Figure 2), which features two volume renderers and three grayscale slice renderers. Use the yellow arrows in the DCM renderer to center the mid-point in the correct position at the front of the scan. After verifying this point in the sagittal grayscale renderer, continue using the other widget arrows and slice renderers to rotate the STL around this mid-point and achieve the proper orientation.

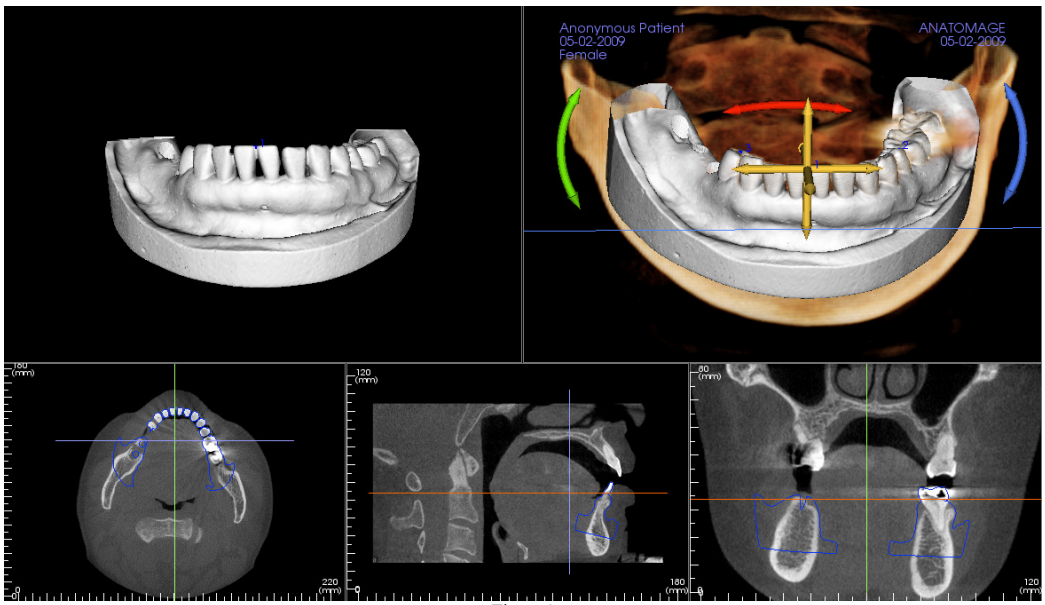
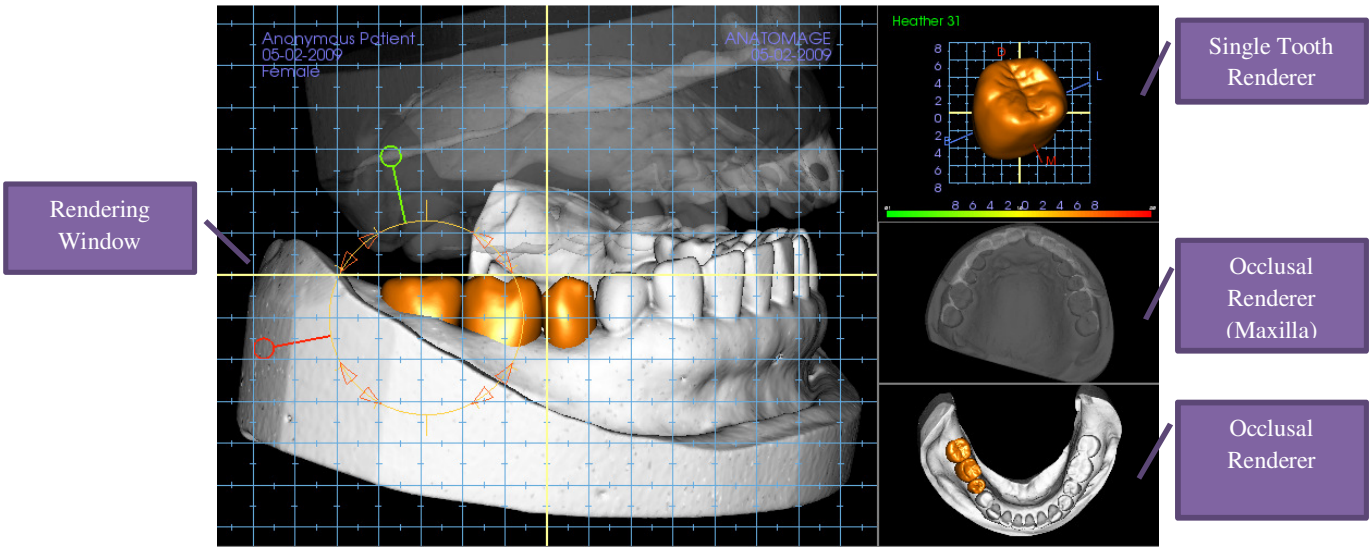


Figure 2

Restoration: Rendering Window & Mesh Manipulation



Rendering Window:

- Displays the stone models, restorations, patient volume, implants, and skin models.
- The restoration can be moved by first left-clicking to select the tooth and then left-clicking and dragging the model to a new location from any view. The angle in which the tooth is viewed determines the plane on which the restoration will translate.
- All the mesh editing functions except **Auto collision resolution** will function in this window.
- **Plane cutter**, **Cap model**, **Tooth extraction**, **Adjust occlusion**, and **Articulation** can be performed in this window.

Single Tooth Renderer:

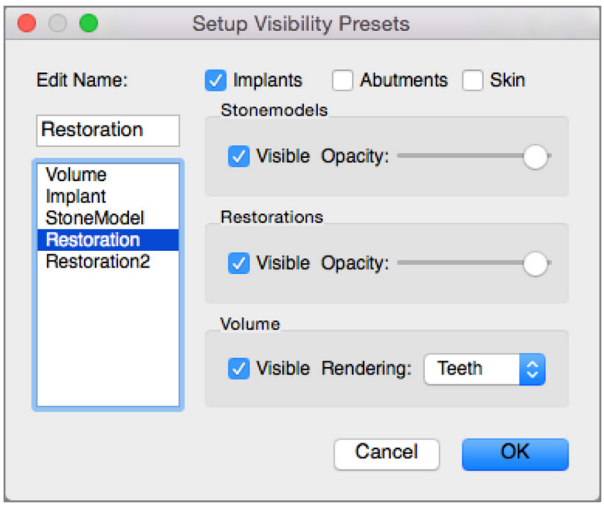
- The tooth model can be independently rotated and zoomed in this view. Clicking on the **D** (distal), **M** (mesial), **B** (buccal), or **L** (lingual) letters will move the restoration in short steps in the selected direction within the rendering window.
- The tooth library type and tooth number will be displayed in the upper left.
- The color scale at the bottom will indicate the depth of the collision with the opposing stone model when "Tooth collision" is activated. The interval for depth(mm) is set to 0.1 to 2mm and can be changed in the Preferences.
- All mesh editing functions including **Auto collision resolution** will function in this window.

Occlusal Renderer (Maxilla and Mandible):

- These renderers will display the STL models, restorations, and the collisions (depth or boundaries) between them. It is intended for viewing purposes and the models cannot be zoomed or rotated but opacity changes will take effect.

Restoration: View Preset Setup

Visibility presets allow for easy switching between set views during implant planning. To configure these settings, click on **Setup**. These presets may also be modified in the Implant Tab.

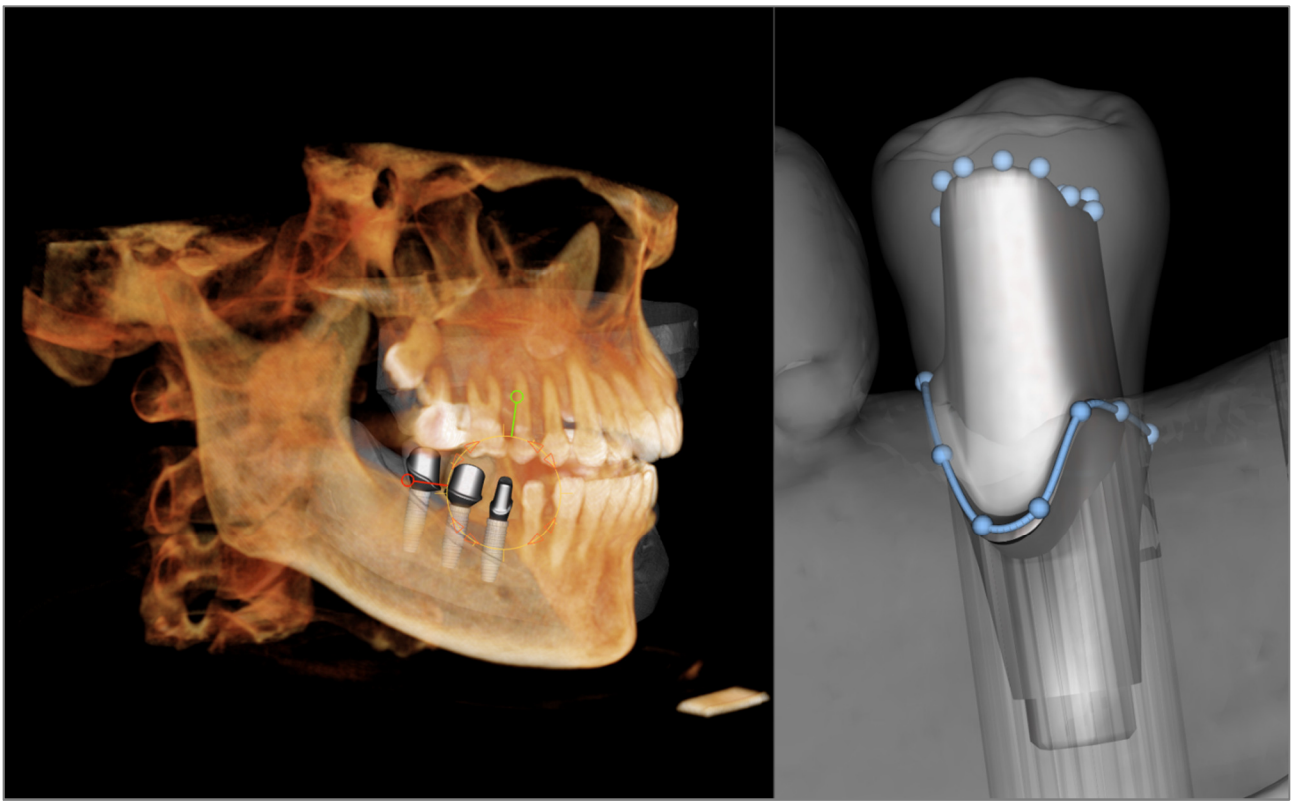


- **Edit Name:** Click on any preset to select it. Type the new name into the field.

Visibility checkboxes hide or show features in the rendering window.

- **Implants:** Toggles the visibility of the implants.
- **Abutments:** Toggles the visibility of the abutments.
- **Skin:** Toggles the visibility of the face photo wrap from the Anatomodel workup file or 3DAnalysis.
- **Stonemodels:** Controls the visibility of the stone models. Varying degrees of transparency can be obtained with the Opacity slider bar.
- **Restorations:** Controls the visibility of the 3D waxup models in the volume renderer and the colored profile in the 2D section renderer. The colored profile of the selected restoration or restoration associated with the selected implant will be red while the unselected restorations will be pink. Varying degrees of transparency can be obtained with the Opacity slider bar.
- **Volume:** Controls the visibility of the volume render as well as the rendering type.

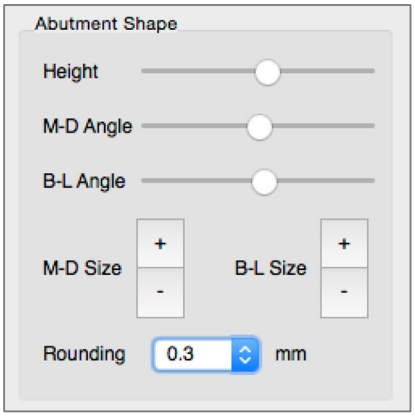
Restoration: Abutment Planning



- The abutment automatically connects the restoration model with the implant model in the rendering window.The currently selected abutment will be displayed enlarged on the right side.

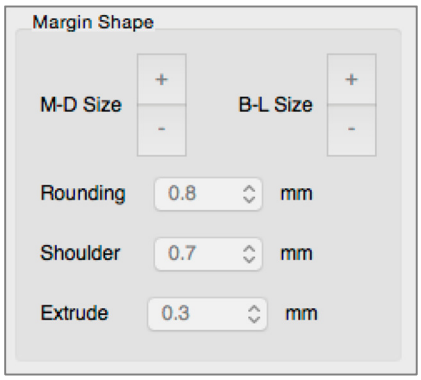
Restoration: Abutment Planning Dialog

Abutment Parameters



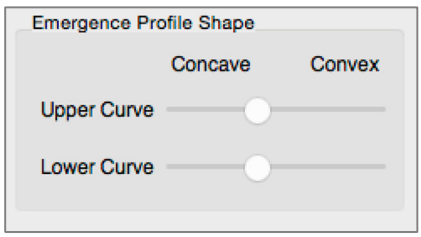
Top Shape

- Height: Adjusts the length of the abutment.
- M-D Angle: Adjusts the mesiodistal angle.
- B-L Angle: Adjusts the buccolingual angle.
- M-D Size: Adjusts the mesiodistal size.
- B-L Size: Adjusts the buccolingual size.
- Rounding: Adjusts the rounding of the abutment.



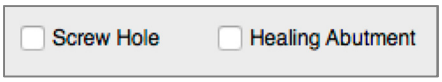
Margin Shape

- M-D Size: Adjusts the mesiodistal size.
- B-L Size: Adjusts the buccolingual size.
- Rounding: Adjusts the rounding of the margin.
- Shoulder: Adjusts the margin between the axial (abutment) tooth surface and finish line.
- Extrude: Adjusts the size of the finish line shape.

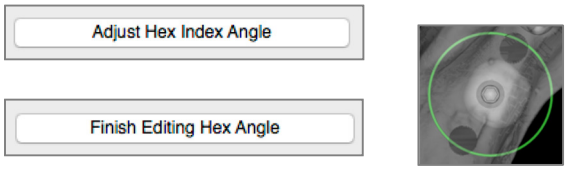


Emergence Profile Shape

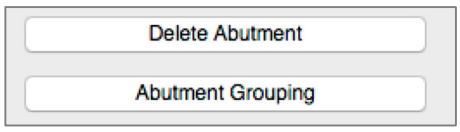
- Top Curve: Adjusts the shape of the upper portion of the abutment base.
- Bottom Curve: Adjusts the shape of the lower portion of the abutment base.



- Screw Hole: Adds a screw hole that exits through the top and bottom of the abutment.
- Healing abutment: Replaces the current abutment with a healing abutment.



- **Adjust Hex Edit Angle**: Inserts a new widget into the renderer to allow rotation of the hex.
- **Finish Editing Hex Index Angle**: Removes the widget from the renderer.

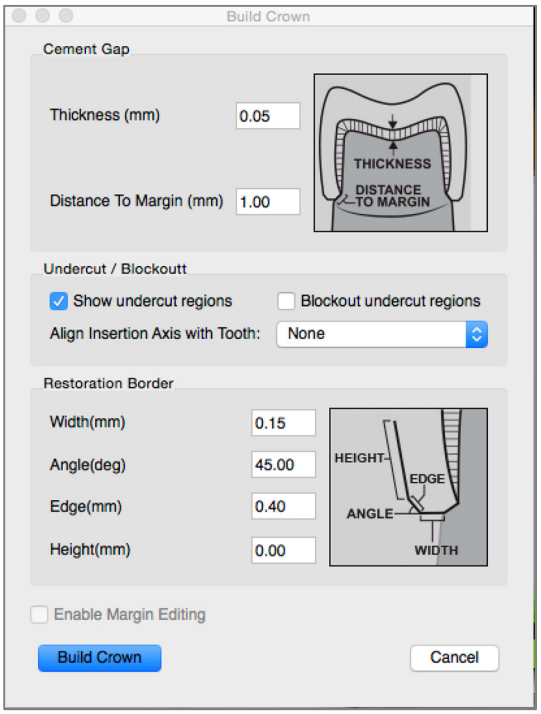


- **Delete Abutment:** Removes the selected abutment.
- **Abutment Grouping:** Opens a dialog where abutments can be grouped such that their insertion angles will be parallel.

Restoration: Crown Types

Crowns for prepped teeth or custom abutments

When using the **Fit to Margin** tool or the **Fit to Custom Abutment** tool, the Build Crown dialog will appear. This dialog allows you to adjust the base of the restoration to interface optimally with the prepped tooth or abutment.



Cement Gap

- Thickness (mm): The distance between the interior of the restoration and the top surface of the prepped tooth or abutment.
- Distance To Margin (mm): The distance between the inner and outer edge of the restoration at the shoulder.

Undercut/Blockout

- Show undercut regions: Highlights the undercut regions in red.
- Blockout undercut regions: Removes undercut regions by adjusting the restoration.
- Align Insertion Axis with Tooth: This option is only available for prepped teeth. Select the appropriate tooth to align the insertion axis of the restoration.

Restoration Border

- Width (mm): Width of the restoration border at the shoulder.
- Angle (deg): Angle of the restoration border.
- Edge (mm): Length of the edge of the restoration border.
- Height (mm): Height of the restoration border.

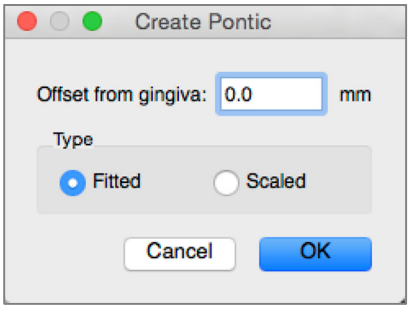
Enable Margin Editing: This option is only available for prepped teeth. Adjust the margin tracing around the prepped tooth.

Build Crown: Calculates and updates the shape of the restoration base.

Cancel: Exits the dialog.

Pontics

Pontic restorations will sit a set distance above the stone model can either retain its original design shape or be fit to the stone model's surface. Click to select the restoration of interest and then click the **Create Pontic with Gingiva** tool.



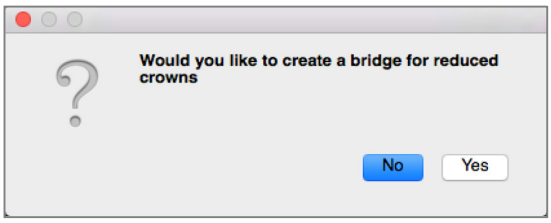
Offset from gingiva: Distance between the bottom of the restoration and the stone model.

Type:

- Fitted: The bottom of the restoration will be reshaped to fit the contour of the stone model.
- Scaled: The restoration size will be scaled such that the bottom is the appropriate offset distance from the stone model.

Bridges

Select a set of restorations by "Command" + clicking each restoration. Click the **Create Bridge Connectors between Selected Restorations** tool  to create a bridge.



Choose **Yes** to create a bridge for reduced crowns. This bridge will have editable connectors.

Choose **No** to create a bridge that links the restorations but does not have connectors.

Restorations cannot be manipulated individually or moved after bridge creation.

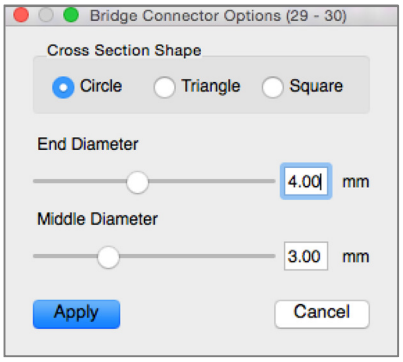
If a bridge for reduced crowns was created, each connector may be edited individually. Click on the connector to select it and open the Bridge Connector Options and display the editable nodes.

Bridge Connector Options

Cross Section Shape: Choose the shape of the cross section of the connector.

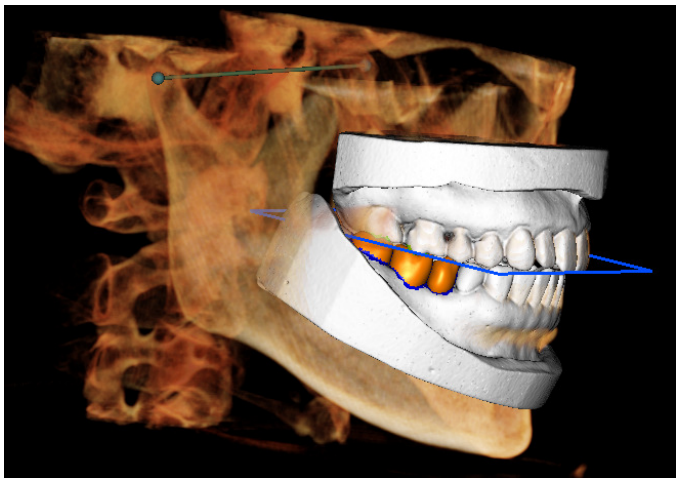
End Diameter: Set the diameter of the ends of the connector that contact the adjacent restorations.

Middle Diameter: Set the diameter of the middle of the connector.



Warning: Incorrect crown fitting may cause inaccurate crown shape and positioning. This may lead to surgical complications or delays if treatment planning.

Restoration: Articulation and Adjust Occlusion



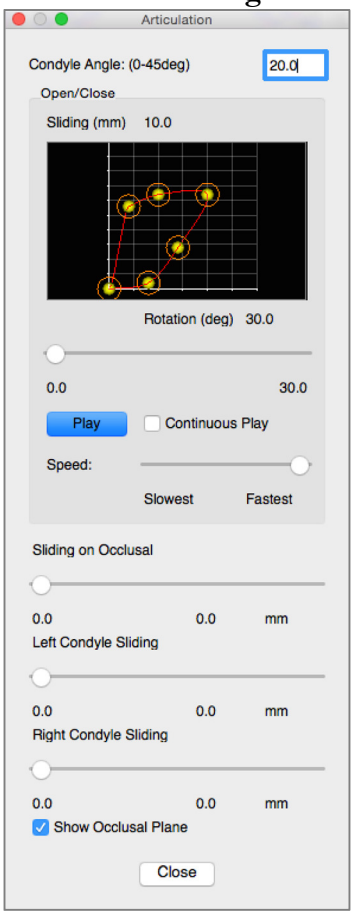
Articulation

For best results, first adjust the occlusion using the **Adjust Occlusion** tool  . The **Articulation** function will determine a closed-bite orientation for the two STL models and define an occlusal plane. The STL models can then be opened, closed, or slid across each other to simulate anatomical jaw operations. (The closed-bite registration is determined by a best-fit of the two STLs during specified interactions.)

Activation of this feature will turn on:

- A widget for editing the position of the condyles as well as displaying the occlusal plane. The condyle handles can be left-clicked and dragged to the correct positions.
- The Articulation dialog box (below).

Articulation Dialog



Condyle Angle

This determines the angle of the plane below the occlusal plane on which the mandible STL will slide. (Example: if the Condyle Angle is set to 0 deg, the mandible will slide on the occlusal plane.)

Movements

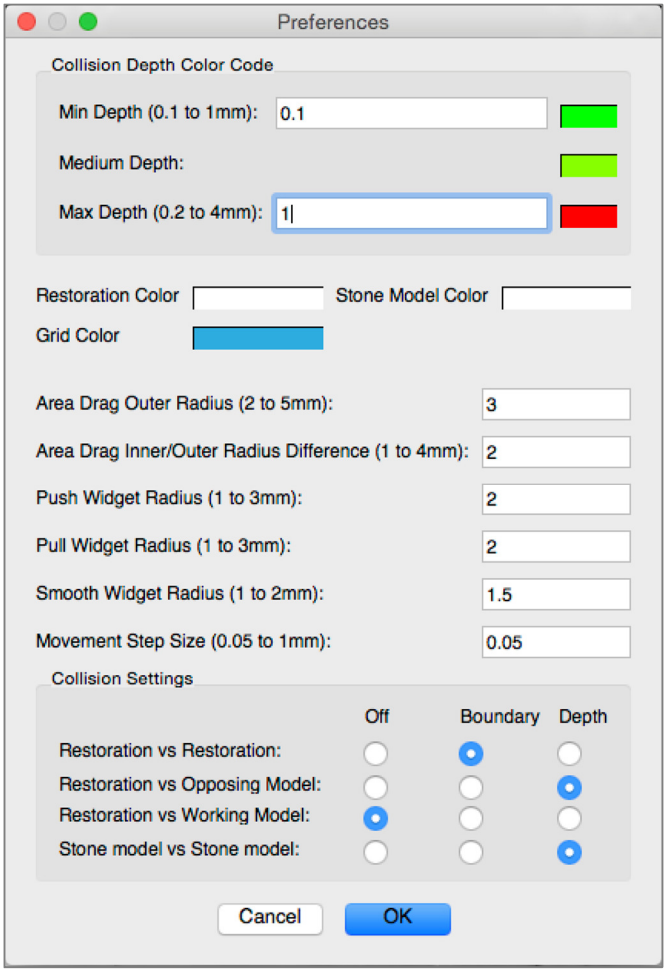
- Open/Close Graph: Changes the angle of "jaw" opening and degree of rotation during the articulation animation.
- Sliding on Occlusal: Slides the mandible along the occlusal plane with an adjusted angle determined by the Condyle Angle.
- Left Condyle Sliding: Slides the left condyle forward along the occlusal plane with an adjusted angle determined by the Condyle Angle.
- Right Condyle Sliding: Slides the right condyle forward along the occlusal plane with an adjusted angle determined by the Condyle Angle.
- Show Occlusal Plane: Displays the blue frame of the occlusal plane in the rendering window.

Close

Closes the dialog box and returns the STLs and restorations to the original registered position.

Restoration: Preferences

Selecting the **Preferences** tool  opens up a customization window within the Restoration Tab:



Collision Depth Color Code

- Min Depth: Sets the minimum mesh collision depth for detection and select the color corresponding to minimal collision.
- Medium Depth: Sets the color corresponding to the medium level of collision based on the depth range.
- Max Depth: Sets the level of collision detected as maximal and select the corresponding color.

Other Settings

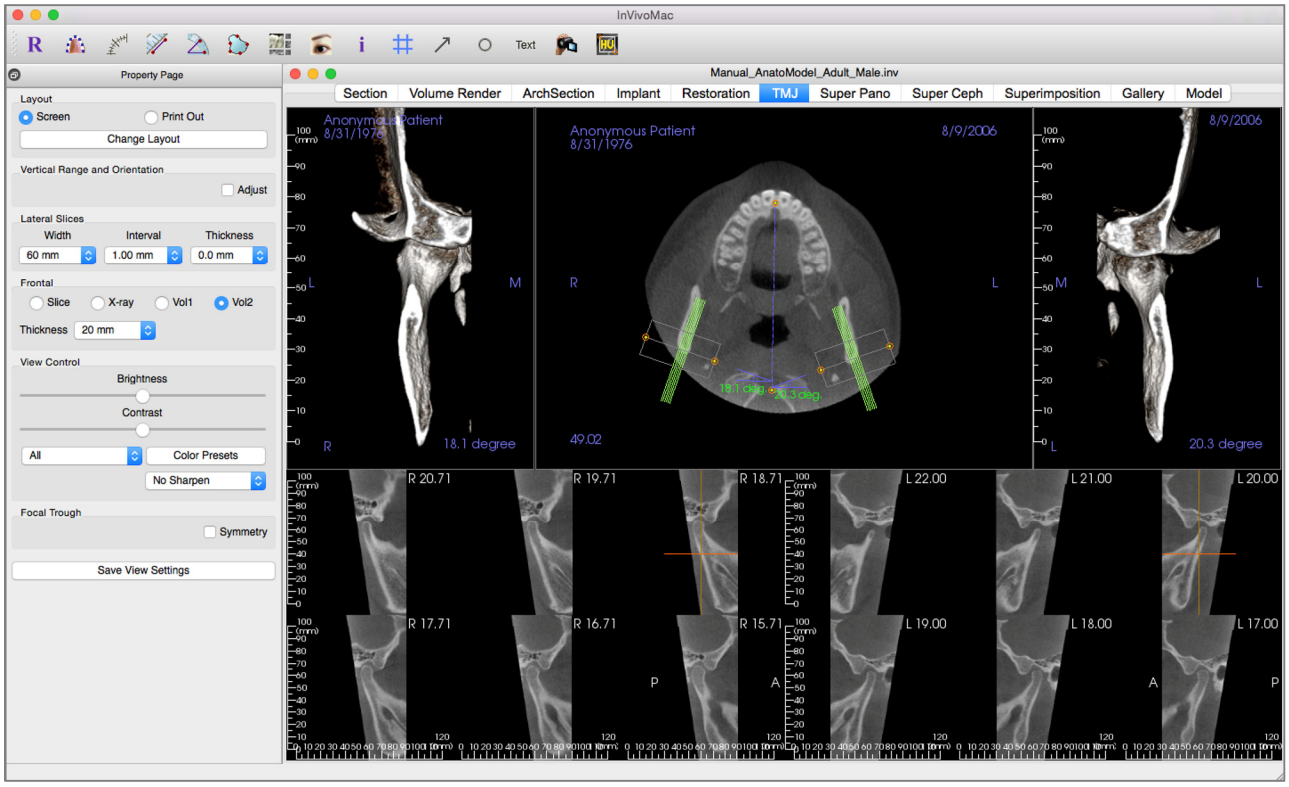
- Restoration color: Sets the color of the restorations.
- Stone Model Color: Sets the stone model color
- Grid Color: Sets the color of the grid on the individual restoration renderer as well as the **Toggle Grid** tool.
- Area Drag Outer Radius: Sets the default **Area Drag** tool's outer radius of effect. Area can still be adjusted using the mouse scroll wheel when the tool is in use.
- Area Drag Inner/Outer Radius Difference: Defines the inner circle of the **Area Drag** tool. The inner circle directly experiences drag whereas the area of the outer circle gets subsequently deformed by the drag force.
- Push Widget Radius: Sets the default **Push Mesh** tool's radius of effect. Area can still be adjusted using the mouse scroll wheel when the tool is in use.
- Pull Widget Radius: Sets the default **Pull Mesh** tool's radius of effect. Area can still be adjusted using the mouse scroll wheel when the tool is in use.
- Smooth Widget Radius: Sets the default **Smooth** tool's radius of effect. Area can still be adjusted using the mouse scroll wheel when the tool is in use.
- Movement Step Size: Adjusts the amount the selected restoration moves using the arrow keys.

Collision Settings

- Off: Collision between the structures will not be shown.
- Boundary: Shows only the boundary of collision in blue.
- Shows the depth of collision in the range of colors set in the Collision Depth Color Code section.

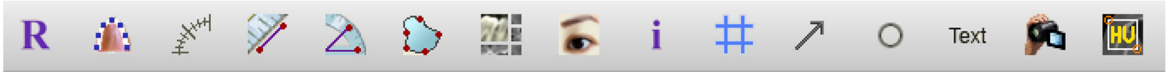
TMJ View Features

*In the **TMJ View Tab** you can view the TMJ region with two independent focal troughs allowing you to get cross sections of each TMJ in one view, along with corresponding coronal and axial views. The TMJ View Tab also lets you see the TMJ in 3D volume renderings with automatic segmentation.*



TMJ: Toolbar

Shown below are the Toolbar and tools that are loaded with the TMJ View Tab:



Reset View: Resets the rendering window to the original view.

Create Arch Spline (Focal Trough): Select this tool to create or edit the arch spline. Left-click to place the first point and continue left-clicking along the arch. After you have marked your final point, right-click or double-click to finalize the arch spline. When modifying an existing arch spline, drag the control points to the desired positions.

Arch Spline (Focal Trough) Ruler: Places ruler along the arch spline for easy reference.

Distance Measurement: After selecting this tool, click two points to mark the desired distance. A number in millimeters will automatically display.

Angle Measurement: After selecting this tool, click the first point, then click the vertex, then click the last point to create an angle. A number in degrees will automatically display.

Area Measurement: After selecting this tool, click multiple points along the boundary of the desired area. Double-click or right-click to end the measurement. A number in millimeters squared will be automatically displayed.

Layout: Creates a different layout to your preference. After clicking on the layout icon, a list of various layout options will appear. Click on the layout of your preference to apply it. These options allow for different case workup images. In this window, you can also choose how many millimeters you want the cross-section interval to be. If you choose 1.0 mm, for example, there will be a space of 1.0 mm between each cross section.

Show/Hide Cursor/Implant/Nerve: Conceals or displays cursors.

Information Display: Displays or hides case information embedded in the data.

Positioning #: Allows for a positioning grid to toggle on/off the cross sections.

Arrow Notation: Allows an arrow to be drawn on the image.

Circle Notation: Allows a circle to be drawn on the image.

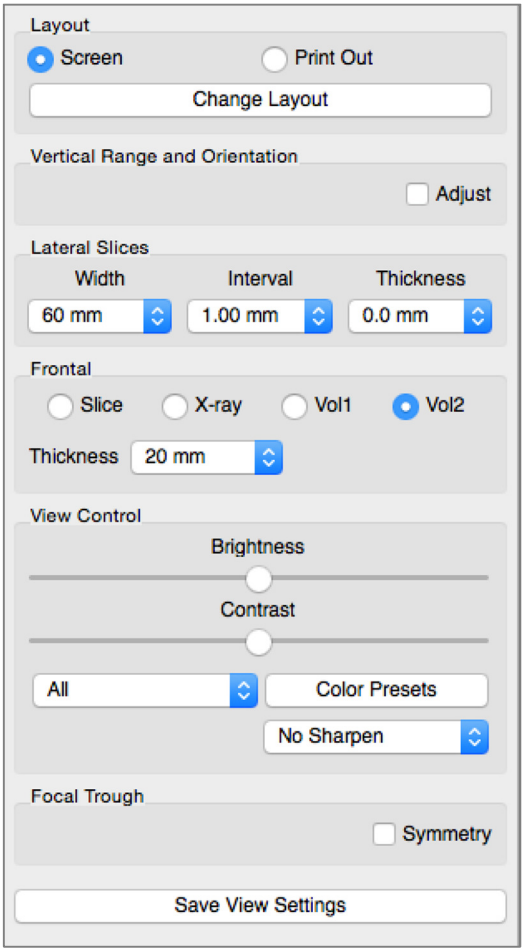
Text Notation: Allows text to be written and edited on the image.

View Sequence: Allows for the creation of custom camera sequences and AVI file movie capturing. Refer to the **Volume Render View Sequence** (pg. 50) section for additional information and description.

Select Region: Calculates the HU value of an area within a bounding box. The measurements will display alongside the rectangle and can also be repositioned by dragging.

Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. Software reports the value based on user-picked points. Due to the nature of medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

TMJ: Property Page



Layout

- "Screen" mode shows the rendering window in full size but not life size.
- "Print Out" mode shows the image in life size and allows you to capture and print in life size.
- **Change Layout:** Lets you switch to different layout orientations.

Vertical Range and Orientation

Select "Adjust" to change the rendered volume range and orientation.

Lateral Slices

- "Width" allows you to change the width of the slices.
- "Interval" allows you to change the interval between the cross-sectional slices.
- "Thickness" allows you to add multiple slices together for ray sum visualizations.

Frontal

- This lets you adjust the view visualizations of the coronal slices of the TMJ.
    - Slice – Gray Scale rendering
    - X-ray – X-ray rendering
    - Vol1 – Teeth rendering
    - Vol2 – Bone rendering
- Using the Thickness drop-down, you can create a ray sum view.

View Control

- Brightness and Contrast allow you to adjust the image.
- The "All" drop-down allows you to adjust brightness/contrast in different areas independently.
- Color Presets can be used to view the images in different colors.
- Sharpening Filter: Applies the selected sharpening filter from the drop-down menu to the 2D slice renderers.

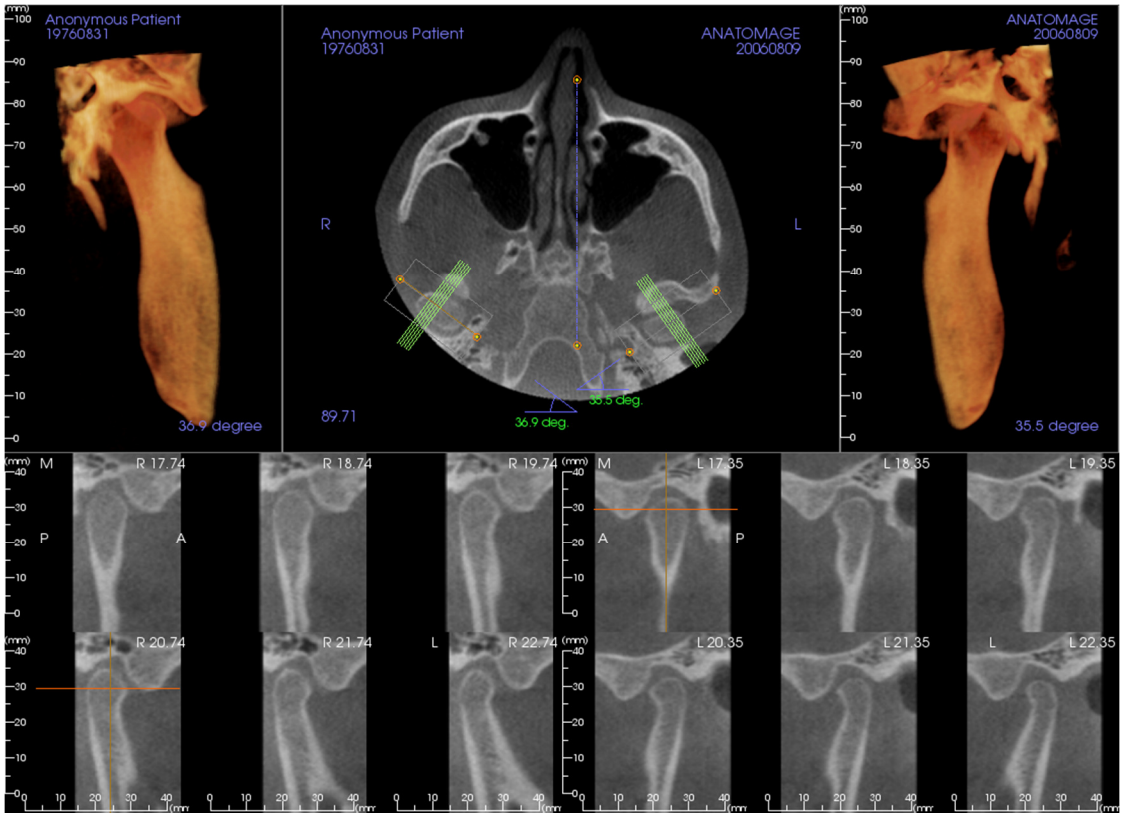
Focal Trough

Click on the "Symmetry" box to keep the focal trough angles symmetrical.

Save View Settings

Saves the current 2D View settings to be reloaded upon opening any case. See the Display Preferences section in Preferences for more information on which settings are saved for this specific tab (pg. 17).

TMJ: Rendering Window



Please refer to **Image Navigation (pg. 30)** for information about controlling and adjusting these images.

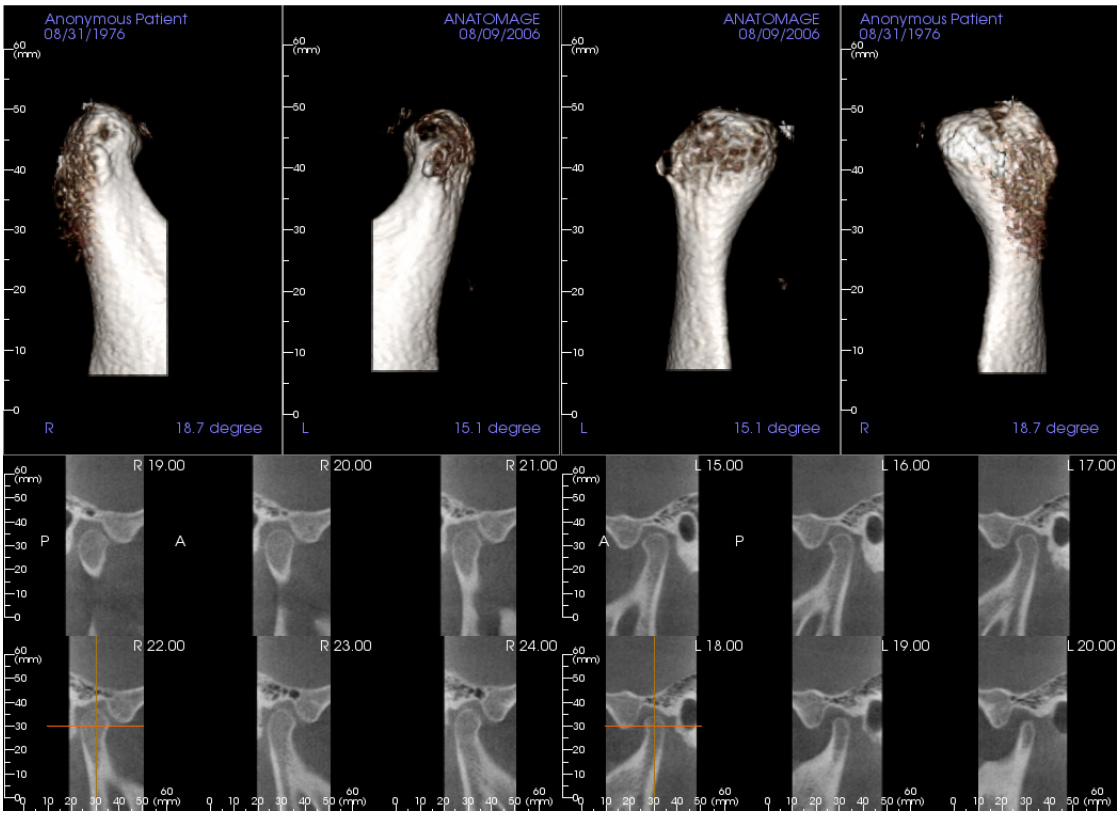
Arch Spline (Focal Trough) Navigation

- Endpoints: Clicking and dragging either endpoint of the focal trough can shorten/lengthen the focal trough or rotate the focal trough, depending on the direction that it is dragged.

  Warning: Sequence direction depends on the focal trough direction. Medial and lateral may be flipped if the focal trough angle is in the opposite direction.

- Cross Section Indicators: Clicking and dragging the stack of green lines will scroll the cross sections through the focal trough in that direction.
- Focal Trough Box: Clicking and dragging any one of the lines forming the shape of the focal trough will move the entire focal trough.

TMJ: Layout

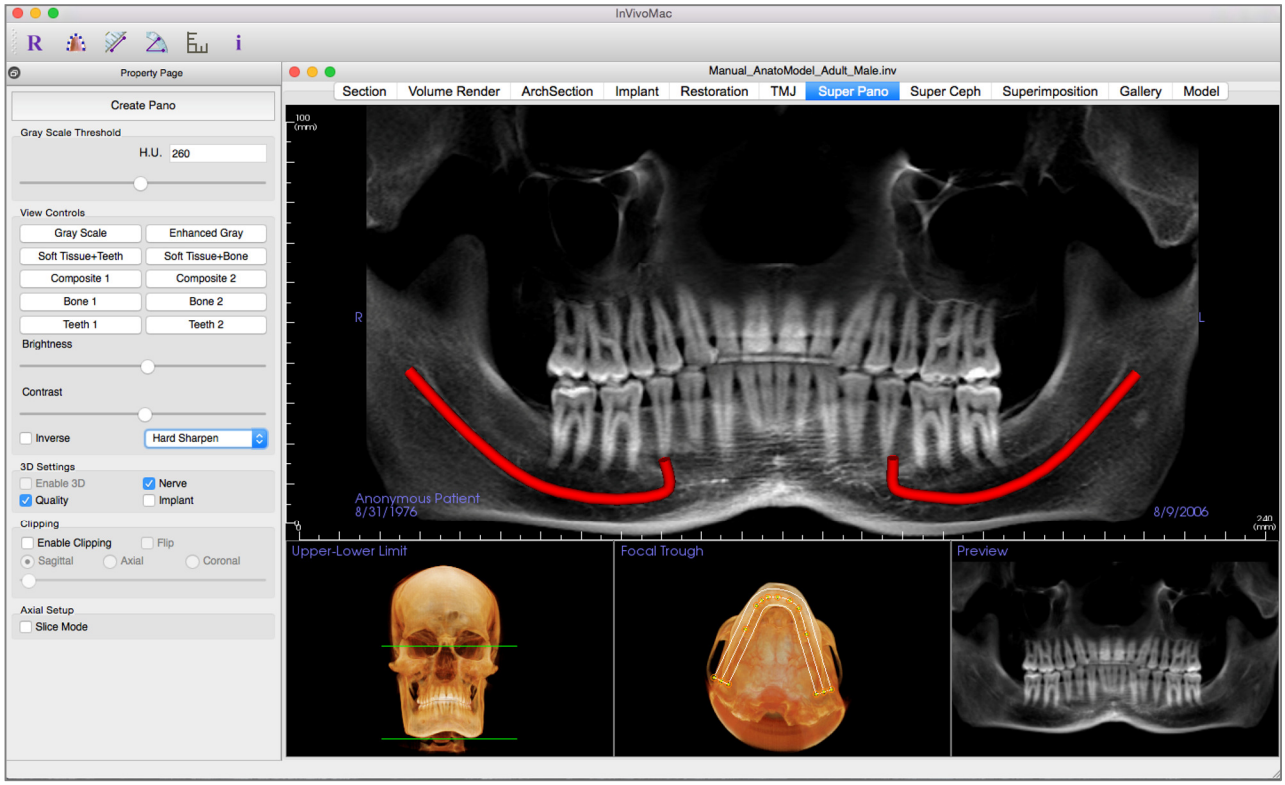


Many of the various layout options of the TMJ Tab feature frontal views of the condyle. Some layout features include:

- Two frontal volume views for each condyle, as seen above.
- Free rotation of the volumes after Vol1 or Vol2 have been activated.
- Sculpting operations carry over from Volume Render: The condyles can be segmented out using sculpting tools in the Volume Render Tab. These operations are carried over automatically to the TMJ Tab.

Super Pano View Features

*The **Super Pano View Tab** gives you the ability to construct and view an enhanced version of a panoramic radiograph, take measurements, and utilize several image enhancement features. It also has the ability to render a pano into a volumetric 3D image that can be rotated for greater visual advantages.*



Super Pano: Toolbar

Shown below are the Toolbar and tools that are loaded with the Super Pano View Tab:

Reset View: Resets the rendering window to the original view.

Create Focal Trough: Sets the boundaries of the Super Pano. A focal trough is automatically set but can be adjusted or recreated entirely. Use the yellow dots to stretch, widen, or reshape the focal trough. The focal trough selects only the objects you want to appear in the Super Pano and excludes others such as the spine, which traditionally appears in panoramic radiographs as background noise.

Distance Measurement: After selecting this tool, click two points to mark the desired distance. A number in millimeters will automatically display.

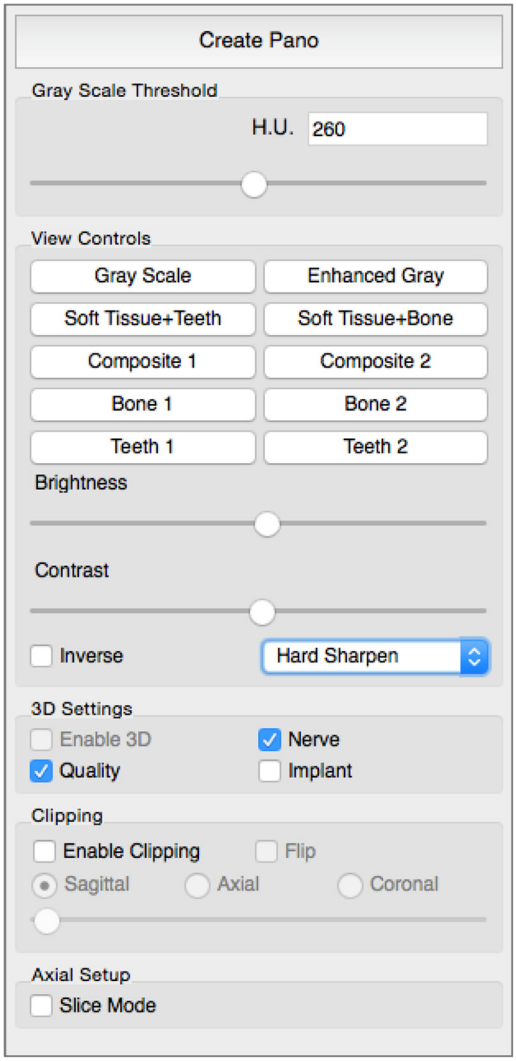
Angle Measurement: After selecting this tool, click the first point, then click the vertex, then click the last point to create an angle. A number in degrees will automatically display.

Grid: Toggles between two different grid layouts for use in all of the section frames allowing quick assessment of measurements and spatial location.

Information Display: Displays or hides case information embedded in the data.

Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. Software reports the value based on user-picked points. Due to the nature of medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

Super Pano: Property Page



Create Pano

- The lower-upper limit is adjusted by left-clicking on a green line and dragging with the mouse. It specifies the vertical dimension of the pano that is being created.
- The focal trough is adjusted by left-clicking on the yellow points and dragging with the mouse. The length, width, and shape of the focal trough are adjusted to specify what will appear in the pano.
- A preview is also shown in the rendering window.
- The **Create Pano** button should be pressed after the lower-upper limit and focal trough are first adjusted.

Gray Scale Threshold

- This threshold sets the density limit in the pano.
- For noisy images, adjust the threshold so that the noise does not contribute to the pano.
- Threshold is usually set slightly below bone density.

View Controls

- Pano can be rendered in multiple visualizations.
- Enhanced Gray sharpens Gray Scale rendering.
- By default, Enhanced Gray is selected.
- Brightness & Contrast: Can be adjusted to enhance your image.
- Inverse: Switches the background to white (switches coloring for Gray Scale Rendering).
- Sharpening Filter: Applies the selected sharpening filter from the drop-down menu to the 2D slice renderers.

3D Settings

- Enable 3D: Select this feature to render the pano as a volumetric 3D image. The pano can be rotated, clipped, etc. like other volumes. (See **Image Navigation**, pg. 30.)
- Quality: Select this to give the highest level of detail for the generated pano.
- A traced nerve or placed implant can be toggled on/off with the "Nerve" and "Implant" boxes.

Clipping

This option is only applicable when 3D Pano is available. Clipping hides some part of the image so that the internal structure can be visible.

Axial Setup

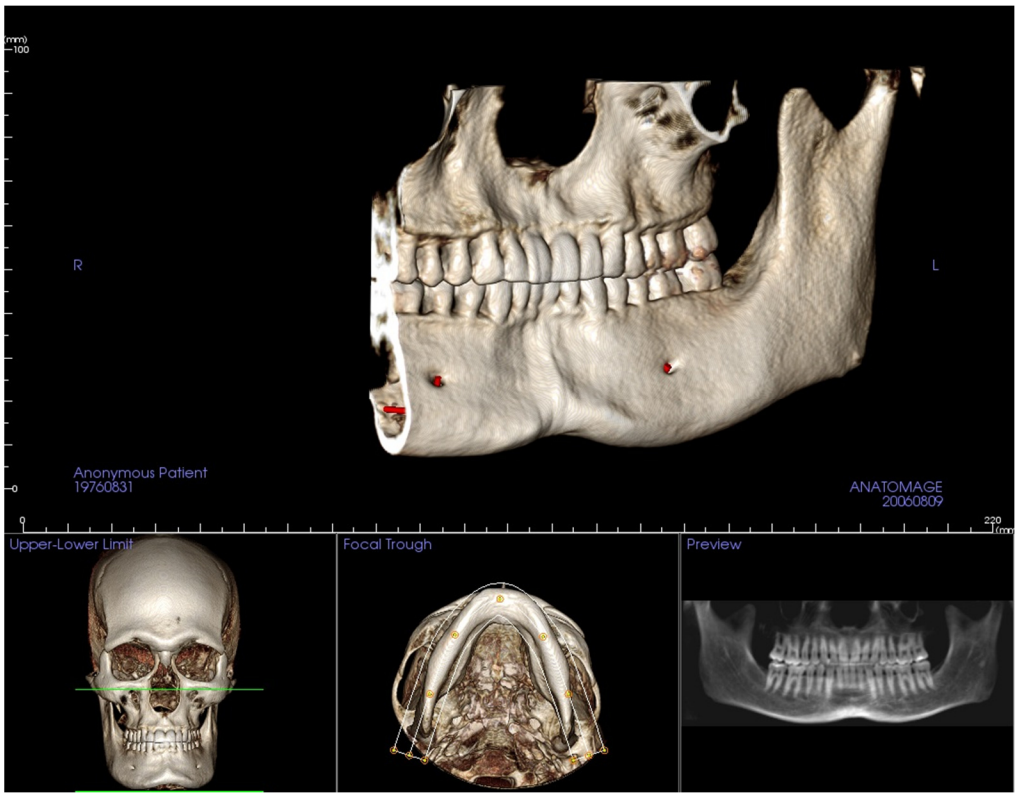
The slice mode box lets you choose how the focal trough will be shown.

Super Pano: Rendering Window

Upper-Lower Limit: The lower left box where the vertical parameter of the Super Pano is set. The green lines indicate the vertical limits. They can be dragged to set the desired upper and lower limit of the Super Pano. When "Slice Mode" is selected, the red line indicates where the focal trough plane is and can also be adjusted.

Focal Trough: The focal trough is adjusted in the lower middle box. Whatever is contained within it will appear in the Super Pano allowing the construction of a panoramic x-ray with minimal background noise. The yellow dots can be left-clicked and dragged to adjust the length, width and shape of the focal trough. The focal trough can be adjusted by dragging the focal trough control points, or a new trough can be created by clicking the trough icon on the toolbar.

Preview: A preview of the Super Pano will be displayed in the lower right box before creating it. This feature allows a Super Pano to be efficiently made with fewer or no adjustments needed afterward.

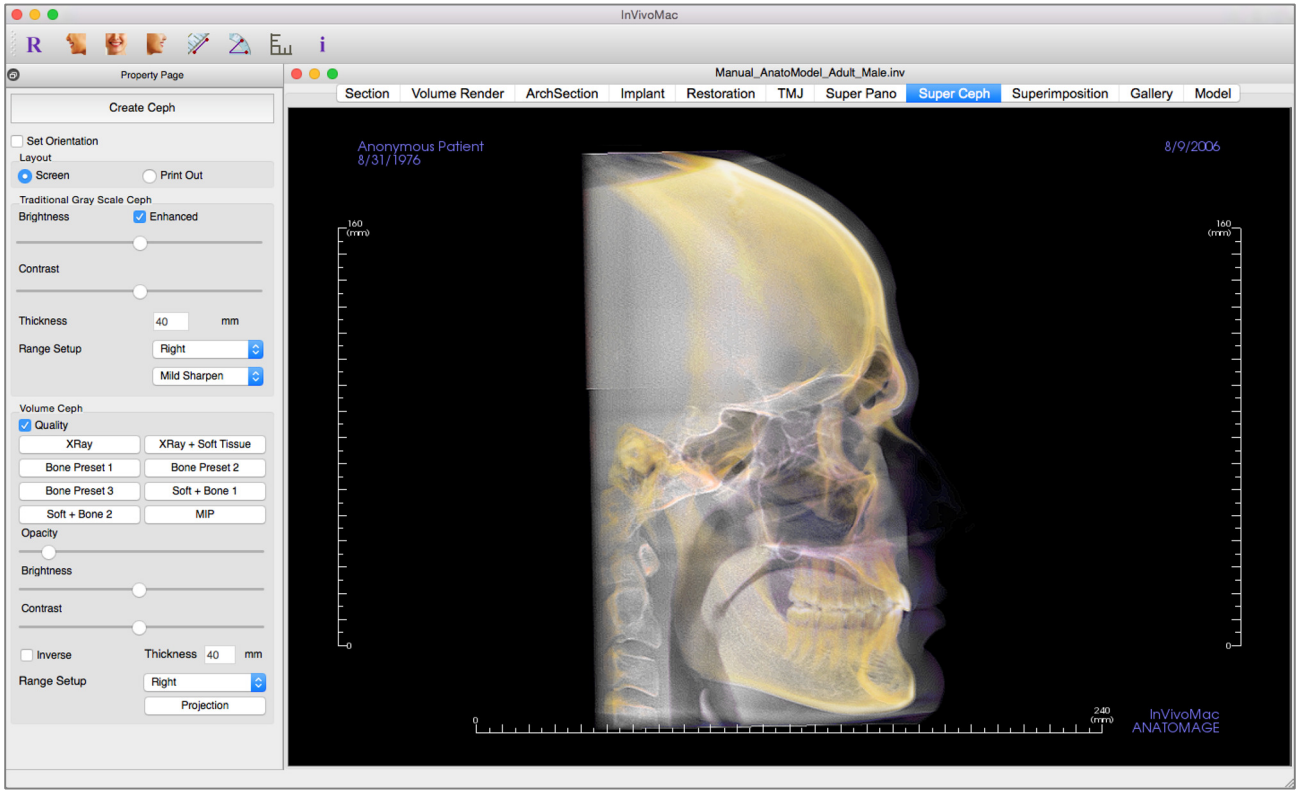


How to make a good Pano?

- Make a U-shaped, narrow focal trough encompassing the arches by adjusting points on the focal trough.
- Adjust Gray Scale threshold to filter soft tissue, so that the image is not too dark or too light.
- Refer to **Image Navigation** (pg. 30) for information about controlling and adjusting these images.

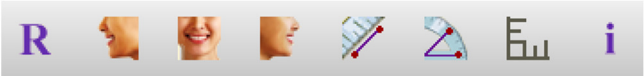
Super Ceph View Features

*The **Super Ceph View Tab** gives the ability to construct and view an enhanced version of a cephalometric radiograph, take measurements, and utilize several image enhancement features, all of which dramatically increases its diagnostic value.*



Super Ceph: Toolbar

Shown below are the Toolbar and tools that are loaded with the Super Ceph View Tab:



Reset View: Resets the rendering window to the original view.

Left View: Automatically orients the volume so the patient is facing left sagittal.

Front View: Automatically orients the volume so that the patient is facing the front.

Right View: Automatically orients the volume so the patient is facing right sagittal.

Distance Measurement: After selecting this tool, click two points to mark the desired distance. A number in millimeters will automatically display.

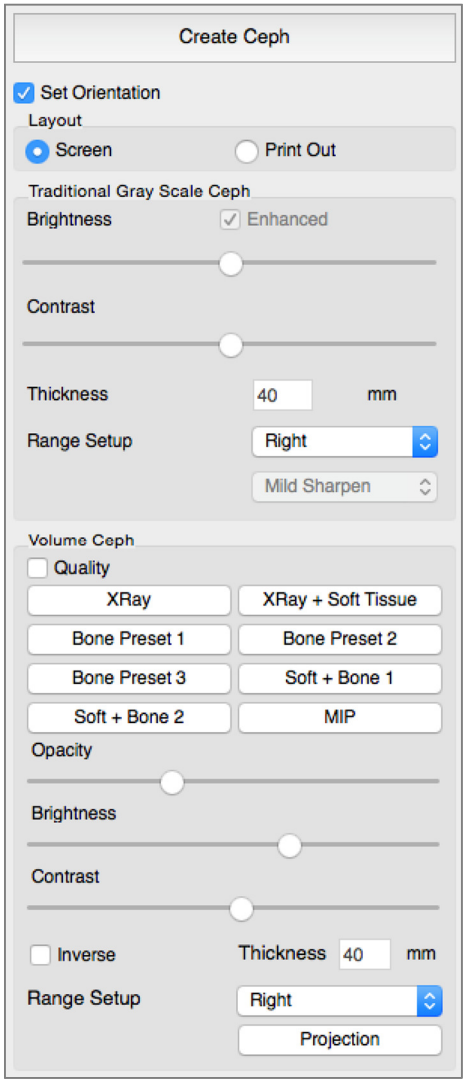
Angle Measurement: After selecting this tool, click the first point, then click the vertex, then click the last point to create an angle. A number in degrees will automatically display.

Grid: Toggles between two different grid layouts for use in all of the section frames allowing quick assessment of measurements and spatial location.

Information Display: Displays or hides case information embedded in the data.

Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. Software reports the value based on user-picked points. Due to the nature of medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

Super Ceph: Property Page



Create Ceph

- The **Create Ceph** button should only be clicked after the orientation of the patient's volumetric image is adjusted in the rendering window.
- The "Set Orientation" box will reset the orientation if a ceph was created incorrectly. Once the image is orientated correctly, press the **Create Ceph** button again.

Layout:

- "Screen" layout is optimized for viewing the image on the computer screen. "Print Out" layout is optimized for printing the image on paper. With Print Out layout, what you see on screen will be what you get on the paper in life-size. First, capture to Gallery, then print from Gallery to ensure the image is life size.

Traditional Gray Scale Ceph

- Brightness and Contrast can be adjusted to enhance your image.
- The "Enhanced" box can be left-clicked on or off to sharpen and enhance the quality of the image.
- Range Setup allows you to select which side of the patient's head the ceph will be created from. Thickness allows you to control how wide the range is.
- When you change the Range Setup, you must recreate the ceph image using the **Create Ceph** button.
- Sharpening Filter: Applies the selected sharpening filter from the drop-down menu to the 2D slice renderers.

Volume Ceph

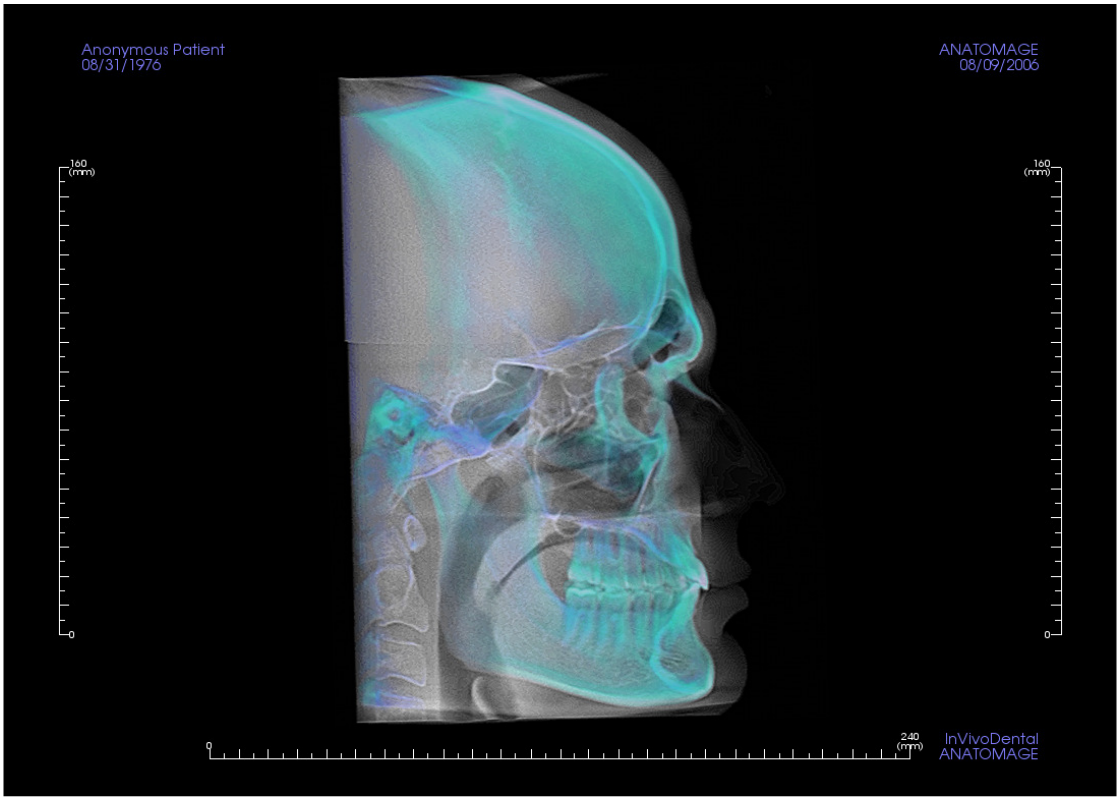
- Increase the Opacity slider bar to superimpose the volume rendering onto the generated ceph.
- Various enhanced views of the ceph can be added; each has different advantages:
- Bone highlights hard-tissue landmarks.
- Soft+Bone emphasizes the soft-tissue on the ceph
- Opacity, brightness, and contrast can all be adjusted for image enhancement.

- Inverse switches the background to white. (Gray Scale coloring switches black/white.)
- Range Setup allows you to select which side of the patient's head the ceph will be created from.
- **Projection** allows you to switch from parallel views of the cephalometric images to perspective views which resemble the magnification found in traditional cephalometric radiographs.

Super Ceph: Rendering Window

This window is where the volumetric image of the patient is orientated to create a ceph and where the ceph will be viewed after creating it.

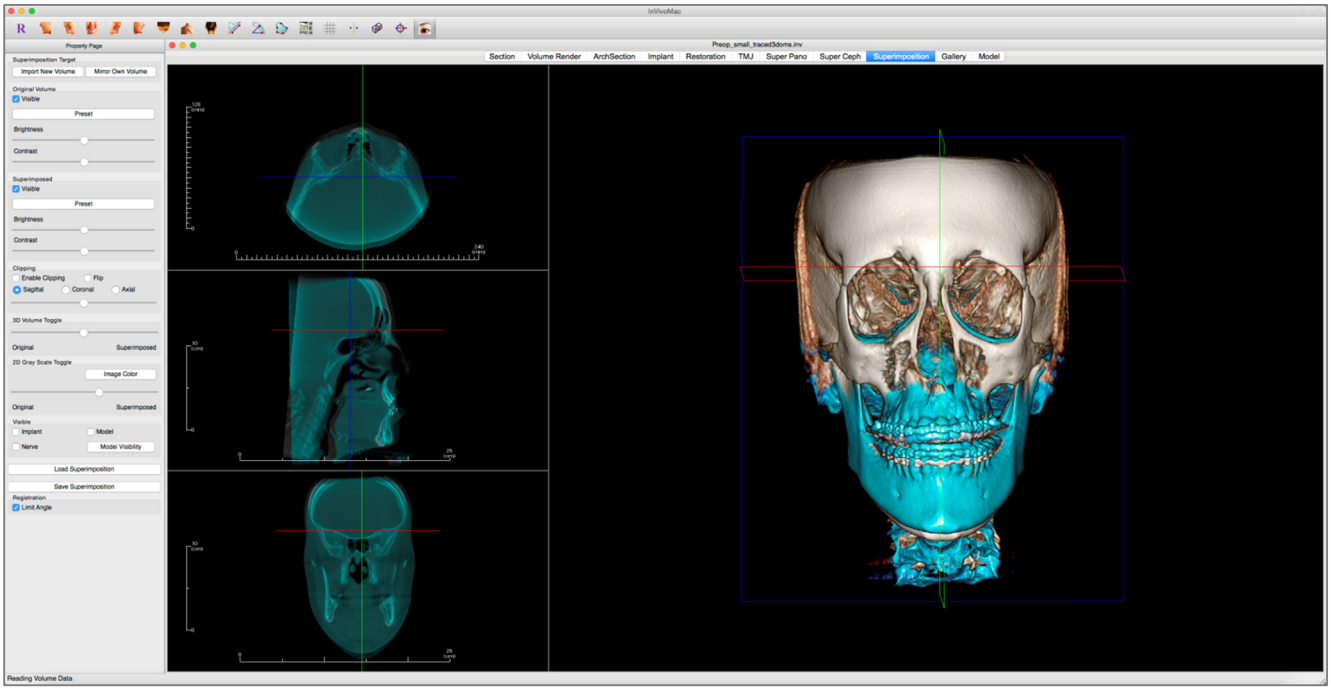
Before clicking on the **Create Ceph** button in the Property Page, the patient's volumetric image must be correctly orientated. The easiest way to do this is to line up the left and right angles of the mandible. If the ceph is created with an improper orientation, it can be adjusted using the "Set Orientation" box in the Property Page.



Please refer to Image Navigation (pg. 30) for information about controlling and adjusting these images.

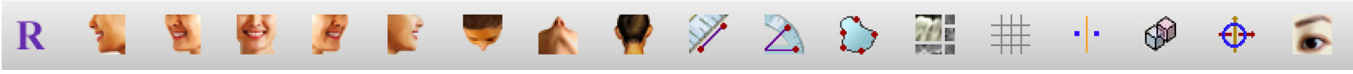
Superimposition View Features

*In the **Superimposition View Tab,** you have the ability to open two different scans at once, view them side by side, and superimpose them. This is especially useful for assessing pre- and post-treatment scans.*



Superimposition: Toolbar

Shown below are the Toolbar and tools that are loaded with the Superimposition View Tab:



Reset View: Resets the rendering window to the original view size.

Left View: Automatically orients the volume so the patient is facing left sagittal.

Left ¾ View: Automatically orients the volume so the patient is facing 45° left sagittal.

Front View: Automatically orients the volume so the patient is facing the front.

Right ¾ View: Automatically orients the volume so the patient is facing 45° right sagittal.

Right View: Automatically orients the volume so the patient is facing right sagittal.

Top View: Automatically orients the volume so you are oriented above the patient.

Bottom View: Automatically orients the volume so you are oriented below the patient.

Back View: Automatically orients the volume to the posterior view.

Distance Measurement: Select this option and mark two points on the volume and distance will appear. Clicking on the point and moving the cursor can modify points. Click on the measurement and press the "delete" key to delete it. Property Page features in Volume Render Tab allow the values to be projected to 2D, hidden, or exported to a report.

Angle Measurement: Select this option and mark three points on the volume and the angle between them will appear. Clicking on their control points and moving the cursor can modify measurements. Click on the measurement and press the "delete" key to delete it. Property Page features in Volume Render Tab allow the values to be projected to 2D, hidden, or exported to a report.

Area Measurement: After selecting this tool, click multiple points along the boundary of the desired area. Double-click or right-click to end the measurement. A number in millimeters squared will automatically be displayed. Property Page features in Volume Render Tab allow the values to be projected to 2D, hidden, or exported to a report.

Change Layout: Toggles the rendering window layout.

Toggle Grid: Toggles between two different grid layouts for use in the upper two section frames allowing quick assessment of measurements and spatial location.

Registration: This icon is used to register the original volume to the second volume. Four or more anatomical points are chosen from each scan to properly align both scans at common, stable landmarks.

Volume Registration: This icon is used to open the Volume Registration interface for automatic superimposed volume registration. Users will define a VOI (Volume of Interest) Box as a reference

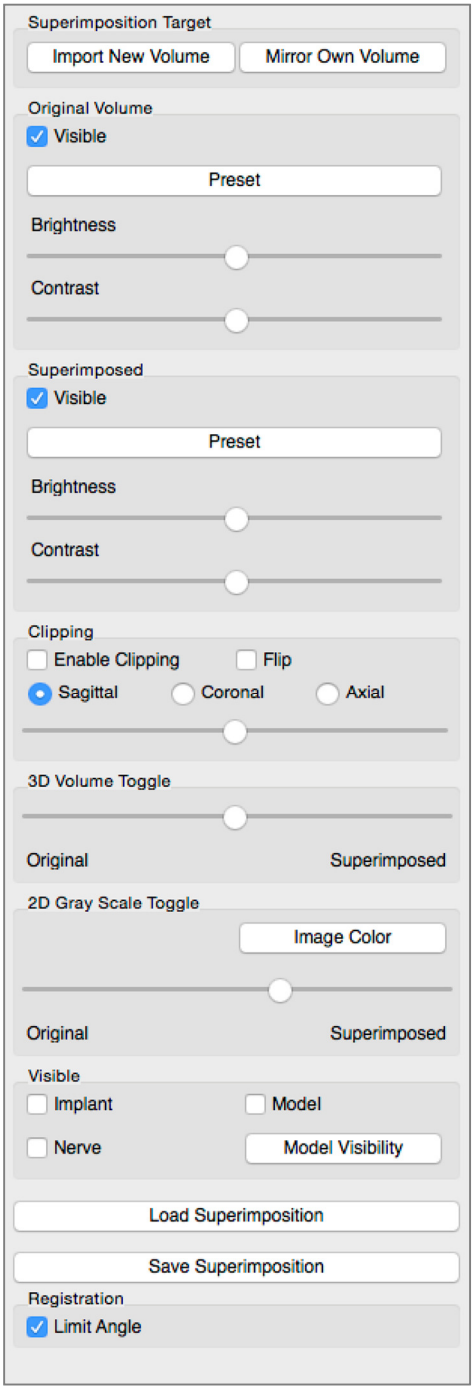
for automated superimposition.

Adjust: This icon is used to make adjustments to better align the two volumes that are superimposed.

3D Cursor: Toggles on/off the cursor lines in the 3D volume rendering.

Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. Software reports the value based on user-picked points. Due to the nature of medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

Superimposition: Property Page



Superimposition Target:

- Select **Import New Volume** to import a second volume. Superimpose either an Invivo file (.inv) or DICOM (.dcm) scan set.
- Volumes will be registered to each other by selecting four or more landmarks on each volume using the **Registration** tool.
- Select **Mirror Own Volume** to mirror the patient's anatomy to check for asymmetries.

Original Volume and **Superimposed:**

- Visible turns on/off either volume independent of each other.
- **Preset** allows you to choose different visualization presets for the volume.
- **Preset** can also be selected independent of each other.
- The Brightness and Contrast in the volume renderings can be adjusted independently and improve the image.

Clipping:

- Select "Enable" to slice the image along predefined anatomical planes (sagittal, coronal, axial).
- Select "Flip" to switch the view to the opposite side.
- Control Clipping with the scroll mouse or slider bar.

3D Volume Toggle:

This slider allows you switch between the original volume and superimposed volume. Set the slider in the middle to visualize both volumes in equal opacity. Set the slider to one side to visualize only one image.

2D Gray Scale Toggle:

This slider allows you switch between the original gray scale slice and superimposed one. Set the slider in the middle to visualize both volumes in equal opacity. Set the slider to one side to visualize only one image. The **Image Color** button allows you to change the slice color.

Visible:

- Selectively control the visibility of the implants, nerves, and models.
- In **Model Visibility**, you can hide/show individual models in the rendering window.

Load Superimposition:

- This allows you to restore saved superimposition.
- Select **Load Superimposition** and choose the correct .vdata file.
- The superimposition file will be reloaded with the saved volume.

Save Superimposition:

- This allows you to save the settings of the superimposition into an external file.
- In the dialog that appears, choose where and what filename to save.
- Invivo will save two files: .vdata and .odata
- .vdata: stores the registration points and superimposed volume information
- .odata: stores the original scan's volume orientation information

Registration:

"Limit Angle" will set limitations within the software during its registration calculations. If you are experiencing inaccurate superimpositions after registering your points due to volume inversions, selecting Limit Angle may resolve some of these issues. It is recommended that you attempt to use different or additional registration points if this does not resolve the volume inversions.

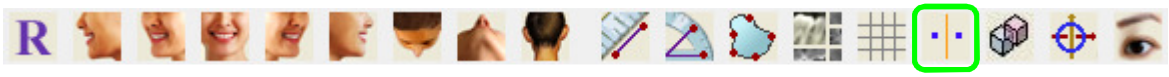
Superimposition: How to Superimpose Two Volumes

Invivo provides easy-to-use tools for superimposition. Although they are easy to use, superimposition is a technique-sensitive procedure with the most critical step being the registration of the new scan via the selection of stable landmarks in both scans. The proceeding sections discuss how to superimpose two scans step by step.

Step 1: Open First File. Open the file that you want to start with. You do not have to open them in any order, but starting with the pre-treatment scan may be recommended for sake of organization. See **DICOM and Invivo File Loading** (pg. 22) section if you are unsure of how to open an Invivo file.

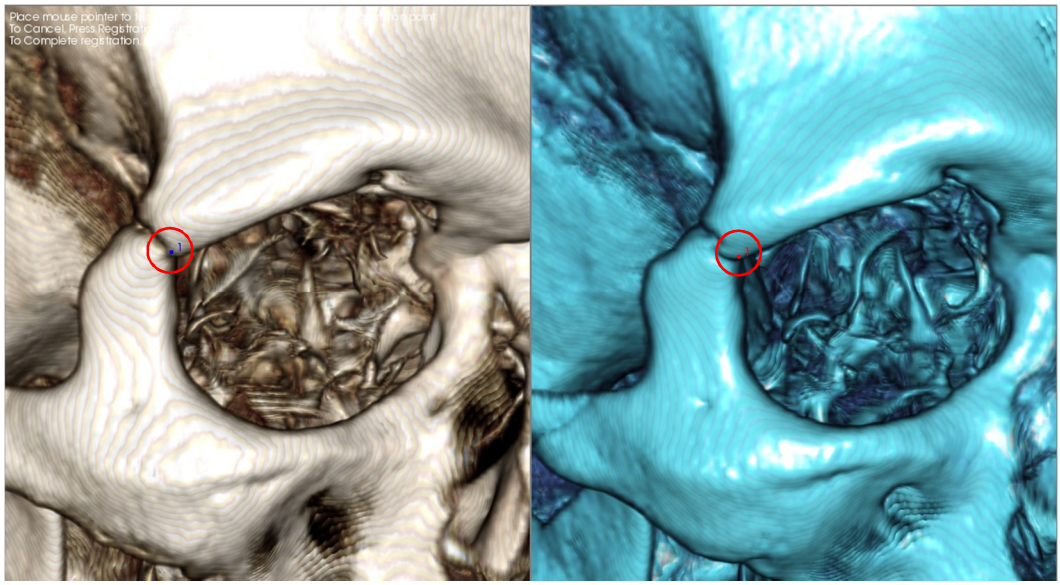
Step 2: Import Volume. Go to the Superimposition Tab and from the Property Page, click on the **Import New Volume** option to select the second file to open. The File Manager will appear allowing you to open either a DICOM file or an Invivo file.

Step 3: Press the Registration icon. It can be found in the Superimposition Toolbar.



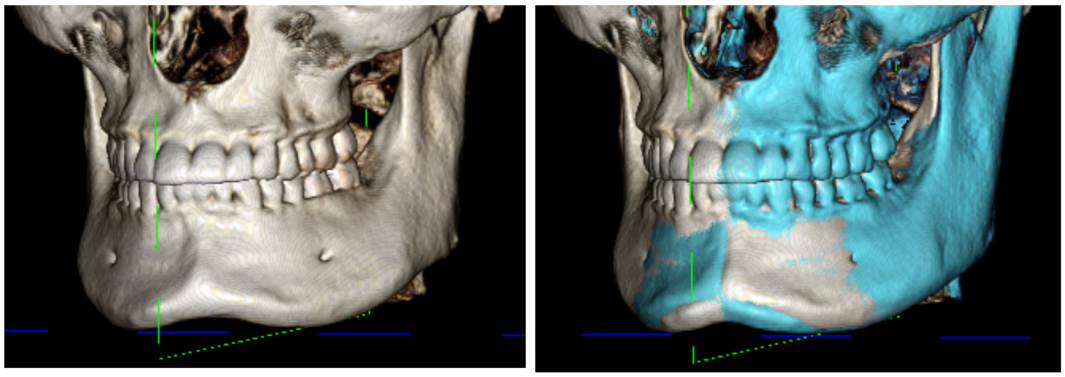
Step 4: Registering the Two Scans to Each Other. In order to superimpose the scans as correctly and precisely as possible, strict attention must be placed in selecting at least four matching and stable landmarks in both scans.

- To select landmarks on each volume:
    - Press down on the center scroll-wheel of the mouse.
    - Or, position the mouse over the landmark and press the space bar on the keyboard.
- Select the first stable landmark on one scan using either method above.
- Select the matching stable landmark on the other scan using either method above.
    - Each point shows up as either a blue or red dot.
    - Points are numbered for easy reference.
- The volume can be rotated using the left-mouse button as before.
- The volume can be clipped by selecting Clipping: "Enable" in the Property Page.
- The volume rendering presets can be adjusted using the **Preset** button.
- Use caution in setting your Brightness and Contrast settings.
    - Be sure the Brightness and Contrast settings for the original and imported volumes are similar.
    - Be sure to use the similar **Preset** settings when registering points.



The image above shows a registration point (Registration Point 1) located on the anterior point of the right zygomaticofrontal suture. The point has been added to both the original scan (white, left) and the new scan (blue, right).

Step 5: Save Points and Finish Registration. Once all points are plotted one by one, click the right-mouse button to register the two scans. It is recommended you practice by opening the same scan twice before trying to superimpose two different scans. You can see how precise the superimposition is by how much the two registered scans overlap using the 2D and 3D toggle tools.



(a) (b)

(a) The above image on the left is of two identical data sets that are registered to each other precisely. Notice there are no overlapping areas of different colors.
(b) The image on the right is of two volumes not registered precisely. Notice the blue and white skeletal boundaries do not line up, and the presence of double images.

Superimposition: Using Superimposition Aligner for Fine Adjustments

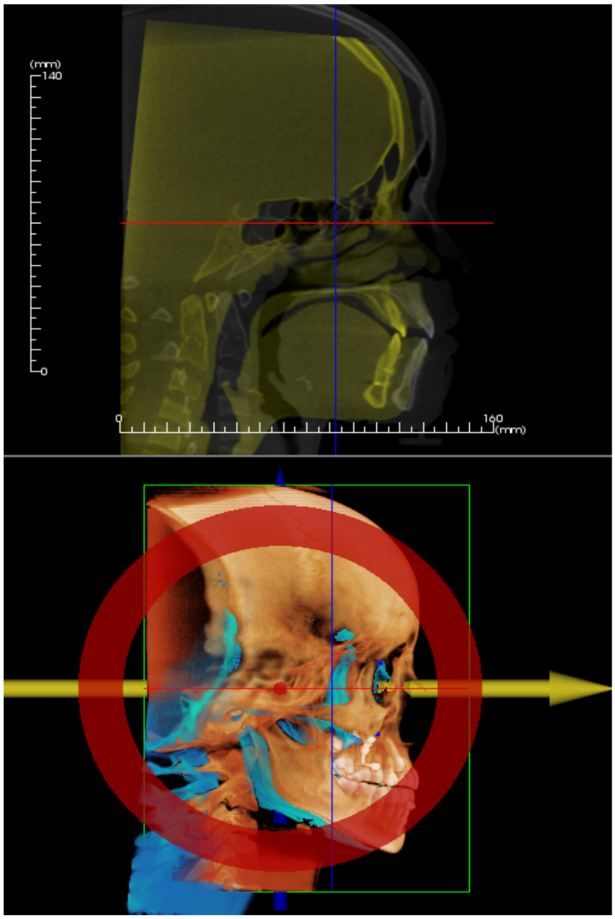
After finishing the landmark registration, you can use the other tools provided in the Superimposition Toolbar to make final adjustments to your superimposition.

To make the cross sections bigger, use the **Change Layout** icon from the Toolbar

To move the volume manually, use the **Adjust** icon from the Toolbar to display the move widget on the superimposed volume

The above tools are available for use prior to using the Landmark Selector; however, it is strongly recommended that you first use the **Registration** tool before using the **Adjust** tool.

Check the cross sections for accuracy by adjusting the Layout (**Change Layout** icon) and the 2D Gray Scale Toggle slide bar (View Controls). The superimposition is shown in 3D as well as in the cross sections. Make the necessary adjustments.



For example, notice in the sagittal section shown to the left that the superimposed volume is not totally overlapped. Using the **Adjust** tool, move the volume in the anterior-posterior direction until the sections align by clicking on the yellow arrow in the move widget and dragging it forwards or backwards.

One should go through each anatomical plane to check for precision. The cranial base should match up perfectly because it is stable; however, the vertebrae will usually be off because the patient's head is always tilted somewhat differently in each scan.

Superimposition: Using Volume Registration for Fine Adjustments

After finishing the landmark registration, you can use the other tools provided in the Superimposition Toolbar to make final adjustments to your superimposition.

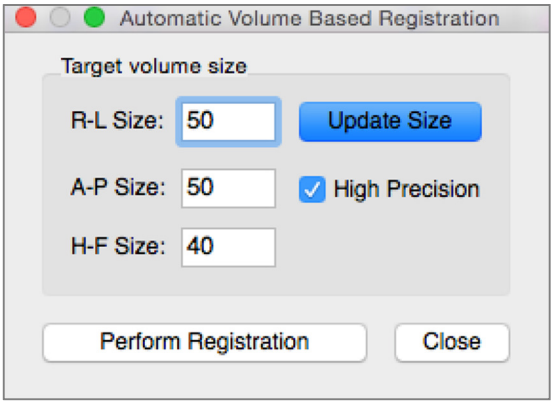
To make the cross sections bigger, use the **Change Layout** icon from the Toolbar

To fine-tune the registered volumes, use the **Volume Registration** icon from the Toolbar to open the Volume Registration interface

The above tools are available for use prior to using the Landmark Selector; however, it is strongly recommended that you first use the **Registration** tool before using the **Volume Registration** tool.

Select the **Volume Registration** icon in the toolbar to open the Volume Registration interface.

Left-click on any of the 2D cross sections to place the center of the VOI (Volume of Interest) Box. The VOI box can be moved at any time by clicking another location in one of the 2D cross sections.



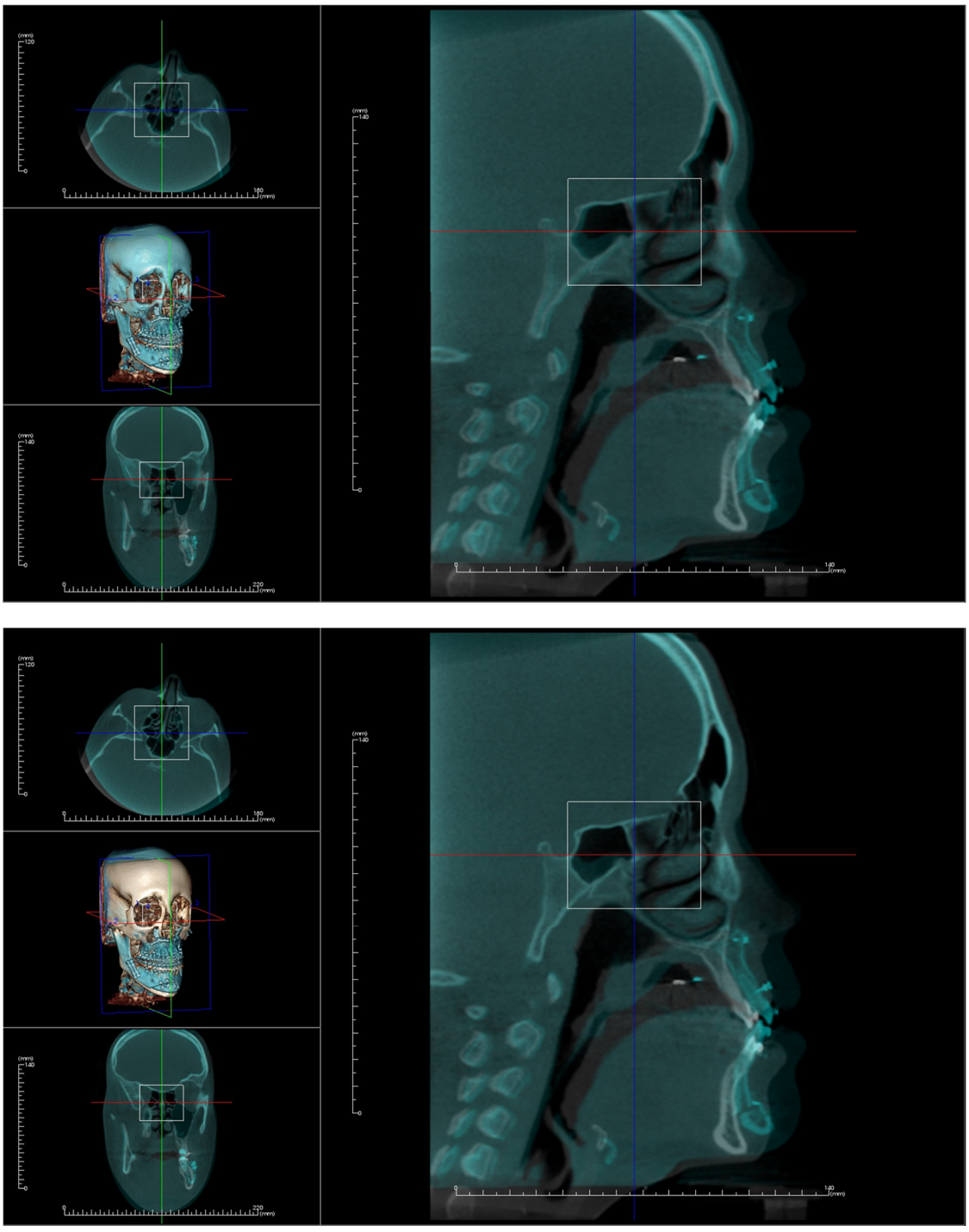
Target Volume Size:

- R-L Size: defines the lateral width (mm) of the VOI Box.
- A-P Size: defines the anterior-posterior width (mm) of the VOI Box.
- H-F Size: defines the inferior-superior height (mm) of the VOI Box.
- Press **Update Size** to show the updated VOI Box size in the rendering window.

Select **Perform Registration** to run the automatic registration process for the VOI Box selected. The process time is based on your computer's hardware components; however, in general, the larger the VOI Box, the more time is required to complete the automatic registration.

The following images show the VOI Box applied near the cranial base of a pre- and post-surgery superimposed scan (top image) and the results of the automatic registration process (bottom image).

Notice that the two cranial base profiles line up exactly following the automatic registration process. The VOI Box used is the default (x, y, z) = 50mm x 50mm x 40mm.



Superimposition: Difference Between .vdata Files and .odata Files

After you have successfully registered a different scan to your original volume data, Invivo allows you to save the superimposition data using the **Save Superimposition** button. This section looks to further define the difference between the output files (.vdata and .odata) and how to use them.

.vdata

Information stored in the .vdata file includes the registration points and the path for finding your superimposed scan data. When you re-open your original scan, in the Superimposition Tab, press the **Load Superimposition** button and load the desired .vdata file. This will allow you to look at the superimposed image without having to re-register your landmarks.

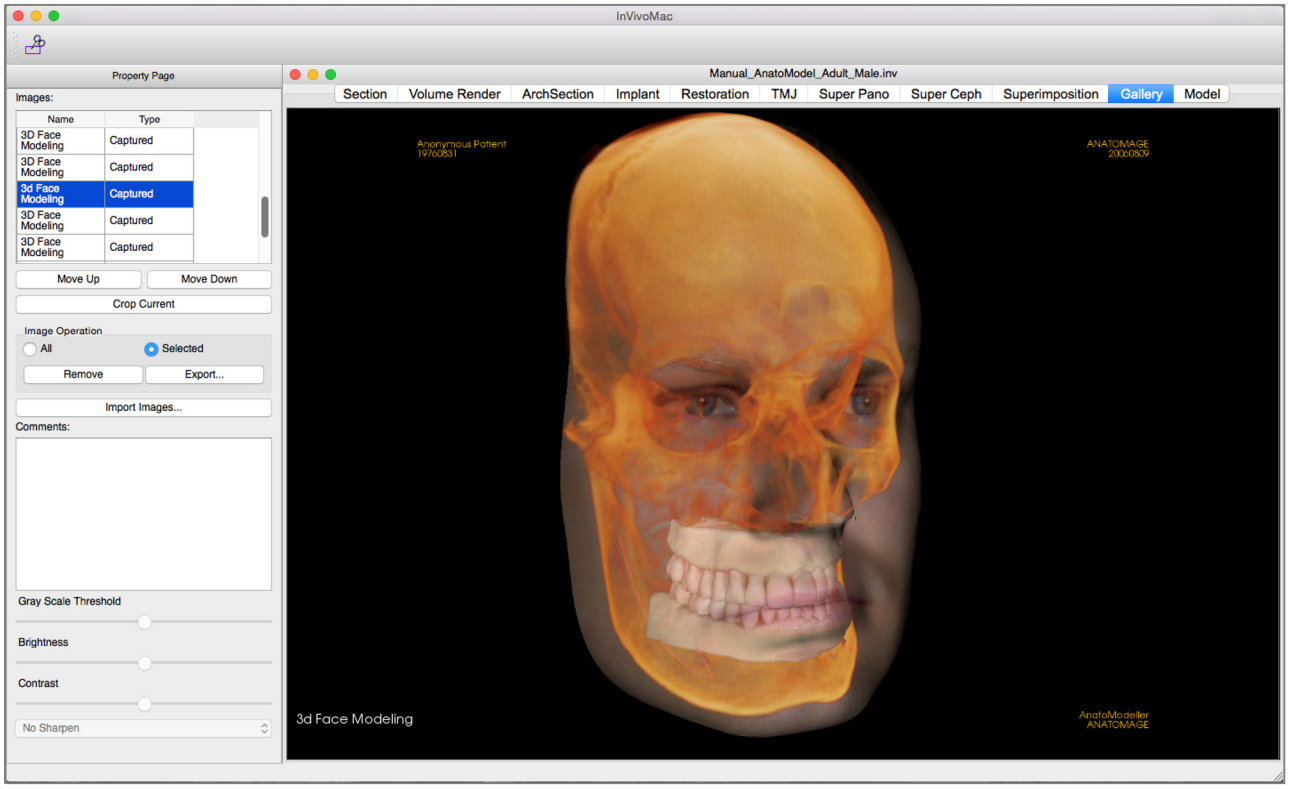
.odata

Information stored in the .odata file includes the orientation information of your original scan data (not your superimposed scan). With this information, you can set specific orientations for other cases as well.

To import a new orientation, go to File in the Menu Bar and select "Import Orientation." Choose your desired .odata file, and your case will automatically reorient itself.

Gallery View Features

*In the **Gallery View Tab** you can retrieve images that have been captured. Additionally, images can be imported into Invivo or exported to the location of your choice. Comments or notes can be added to describe images that have been captured.*

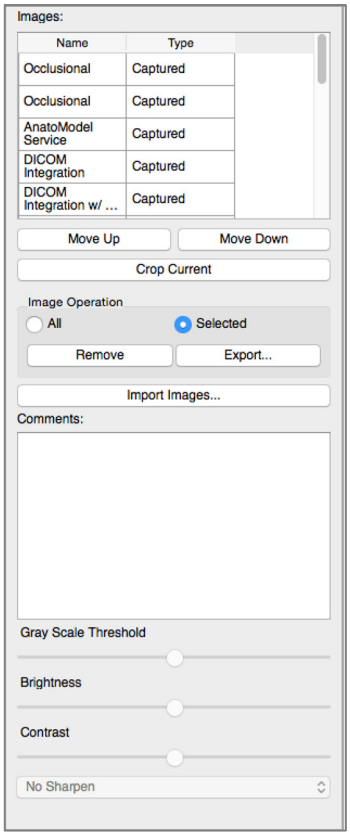


Gallery: Toolbar

Shown below are the Toolbar and tools that are loaded with the Gallery View Tab:

Crop Image: Allows you to crop and save the image that was captured.

Gallery: Property Page



Images: Gives a list of all captured images.

- Each of these images has a "Name" and "Type" which can be renamed by double-clicking on the text.
- **Move Up/Down:** Moves the selected image up or down on the list.
- **Crop Current:** Allows you to crop the currently selected image within Invivo.

Image Operation

- All/Selected: Applies operation to all or a subset of the images from the list.
- **Remove:** Removes images from the Gallery.
- **Export:** Allows you to export the images in the Image List to a path specified in the dialog box that opens. Files can be saved as one of the following formats: .jpg, .bmp, or .png.

Import Images:

- Select to import images (.jpg, .bmp, .png) from an external source into the Gallery Tab.
- Using this, you can import patient photographs into the Invivo software for storage within the Invivo file once saved.

Comments:

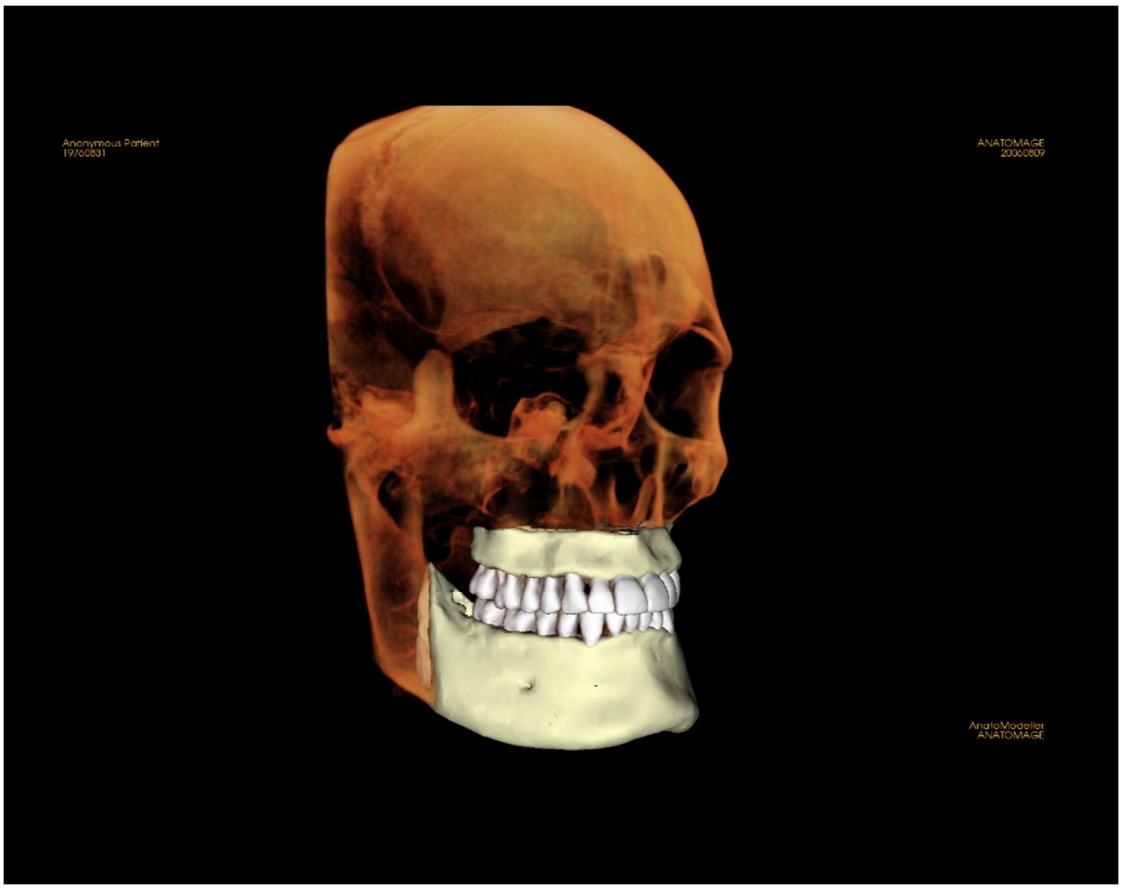
- Text box displays comments about the image displayed in the rendering window.
- Add or change comments by editing the text in the Comments Box.

2D Image Options:

- Controls settings for 2D images. See more information in Gallery: 2D Image Options.

Gallery: Rendering Window

This window allows the viewing of captured and imported images. The Gallery is particularly useful for creating a workup of a particular case. Remember that the Gallery's images will only be saved if you re-save the whole file; otherwise, any captured images will be lost.

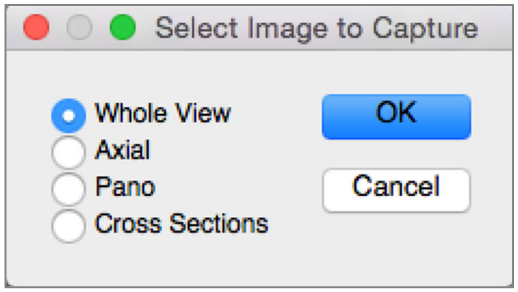


Please refer to Image Navigation (pg. 30) for information about controlling and adjusting these images.

Gallery: Adding Images to the Gallery

Capture any single image to the Gallery. A single image within any view can be captured without including the other parts of the rendering window. When the Capture to Gallery function is used, a dialog will appear on the screen providing the user with options regarding which parts of the rendering window to capture.

The options provided by each dialog will vary according to which Invivo tab is currently displayed; the following example is the dialog that appears within the ArchSection Tab:



Ex. ArchSection Capture to Gallery

Capture to Gallery Dialog:

- Whole View – Captures a screenshot of the rendering window
- Axial – Captures the axial slice view and no other parts of the rendering window
- Pano – Captures the pano view and no other parts of the rendering window
- Cross Sections – Captures a series of slices that are within the rendering window

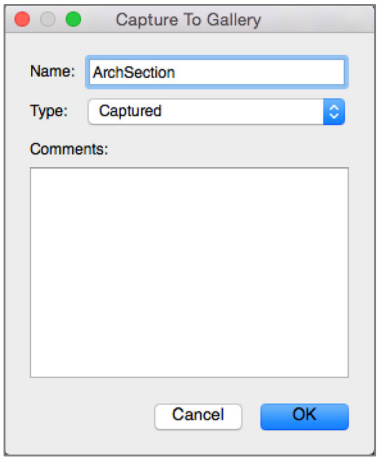
Options within each Select Image to Capture Dialog:

Note: Some options will appear gray (disabled) in the Select Image to Capture dialog. The choices available are determined by the specific layout as well as the view tab.

Section	Whole View Axial, Coronal, Sagittal Slices Cross (Displays Custom Cross Section or 3D Volume)	
Volume Rendering	No Dialog	
ArchSection	Whole View Axial	Pano Cross Sections
Implant	Whole View Main Volume Axial Cross Density	Para Arch Pano Arch Volume Front Volume

TMJ	Whole View Axial Left Pano	Left Cross Section Right Pano Right Cross Sections
Super Pano	Whole View Pano Front Volume	Axial Preview Pano
Super Ceph	No Dialog	
Superimposition	Whole View Main Volume Axial	Coronal Sagittal Imposed Volume
Model	Normal Layout	No Dialog
	Occlusal Layout	Whole View Lower Occlusional Upper Occlusional
	Composite Layout	Whole View Composite 1-9

Capture to Gallery Dialog:



Name: Image label
Note: Image name must be unique from any other captured image in the Gallery and must not contain any special characters.

Type: Image type – can be set from the drop-down to "Captured" or "Photo."

Comments: Additional comments about the image can be added in this section.

Gallery: 2D Image Options

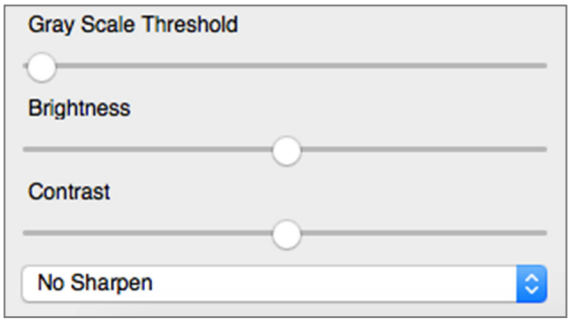
The Gallery Tab is compatible with 2D DICOM images and has several features that allow it to handle this image format better.

Opening 2D DICOM

When instructed to open a 2D DICOM image, Invivo will automatically enter a mode that disables 3D functionality. Only the Gallery Tab will be available within the software and the DICOM will appear as a Gallery image.

If a 2D DICOM is associated with a 3D volume as a scout image, opening the volume will automatically import that scout image into the Gallery Tab.

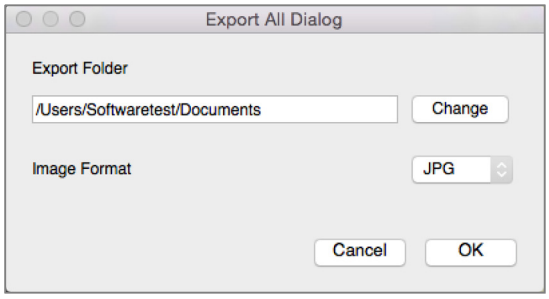
Grayscale Image Options



For grayscale images in the Gallery, the user has the option to adjust several settings such as Gray Scale Threshold, Brightness, Contrast, and Sharpening.

The updates to these images are saved and always reflect the updated settings when the image is selected in the Gallery and also after it has been saved/exported and then opened/imported back into Invivo.

Export to DCM/JPG/PNG/TIF/BMP

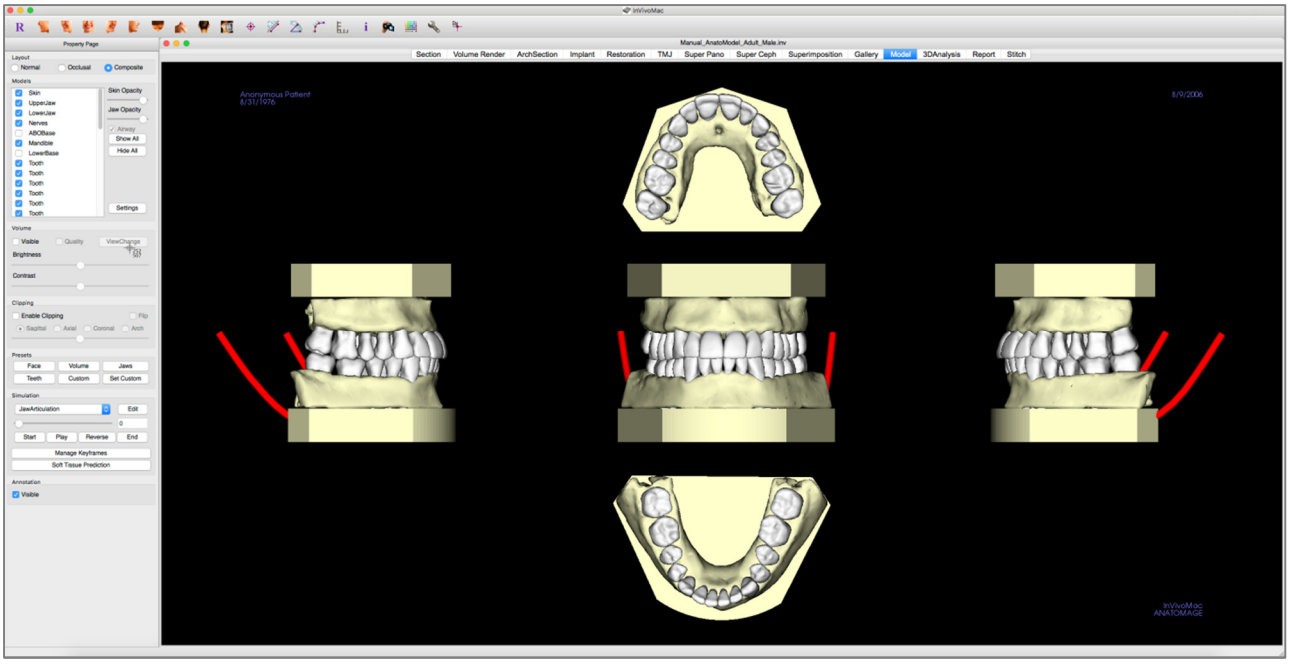


An image in the Gallery can be exported into any of the above formats when using the **Export…** button. When saving individual Gallery images to file, the following image formats will be available (JPG, PNG, BMP).

Model View Features

*The **Model View Tab** allows the user to see the patient's AnatoModel or 3D photograph and create surgical or orthodontic simulations, as well as 3D soft tissue predictions. An AnatoModel is a 3D digital study model that is made by Anatomage on a case-by-case service. The DICOM data of the patient is sent to Anatomage where it is modeled to create the most advanced digital study model available. AnatoModels contain anatomy such as roots, developing teeth, impactions, alveolar bone, and more, while other models merely show the crowns of teeth. The 3D photograph service that Anatomage offers is also viewed here. Anatomage developed the technology to combine a frontal photo of the patient and the CT scan to create a 3D model that overlays the scan data.*

Any nerve tracing, implant planning, or superimposition that has been done will also be visible in the Model Tab. Each item can be independently turned on/off to see how all these systems come together with the scan data.



For additional information about the AnatoModel service, please contact Anatomage at (408) 885-1474 or email us at info@anatomage.com.

Model: Toolbar

Shown below are the Toolbar and tools that are loaded with the Model View Tab:

Reset View: Resets the rendering window to the original view size.

Left View: Automatically orients the volume so the patient is facing left sagittal.

Left ¾ View: Automatically orients the volume so the patient is facing 45° left sagittal.

Frontal View: Automatically orients the volume so the patient is facing the front.

Right ¾ View: Automatically orients the volume so the patient is facing 45° right sagittal.

Right View: Automatically orients the volume so the patient is facing right sagittal.

Top View: Automatically orients the volume so you are oriented above the patient.

Bottom View: Automatically orients the volume so you are oriented below the patient.

Back View: Automatically orients the volume to the posterior view.

Marker: When selected you may mark a point on the volume and X,Y,Z coordinates (transverse, sagittal, vertical) will appear. Clicking on the point and moving the cursor can modify points. Click on the point and press the "delete" key to delete it.

Distance Measurement: Select this option and mark two points on the volume and distance will appear. Clicking on the point and moving the cursor can modify points. Click on the measurement and press the "delete" key to delete it. Property Page in Volume Render Tab features allow the values to be projected to 2D, hidden, or exported to a report.

Angle Measurement: Select this option and mark three points on the volume and the angle between them will appear. Clicking on their control points and moving the cursor can modify measurements. Click on the measurement and press the "delete" key to delete it. Property Page features in Volume Render Tab allow the values to be projected to 2D, hidden, or exported to a report.

Polygonal Measurement: When selected you may mark unlimited number of points on the volume and the total between the first point and the last point will appear. Right-click your mouse to indicate that you have marked your last point. Clicking on the point and moving the cursor can modify points. Click on the measurement and press the "delete" key to delete it. Property Page features allow the values to be projected to 2D, hidden, or exported to a report.

Toggle Grid: Toggles between four different grid layouts for simple assessment of size, measurement, and spatial location.

Information Display: Displays or hides case information embedded in the data.

View Sequence: Allows for the creation of custom camera sequences for movie capturing. Refer to the **Volume Render Tab: View Sequence** (pg. 50) section for additional information and description.

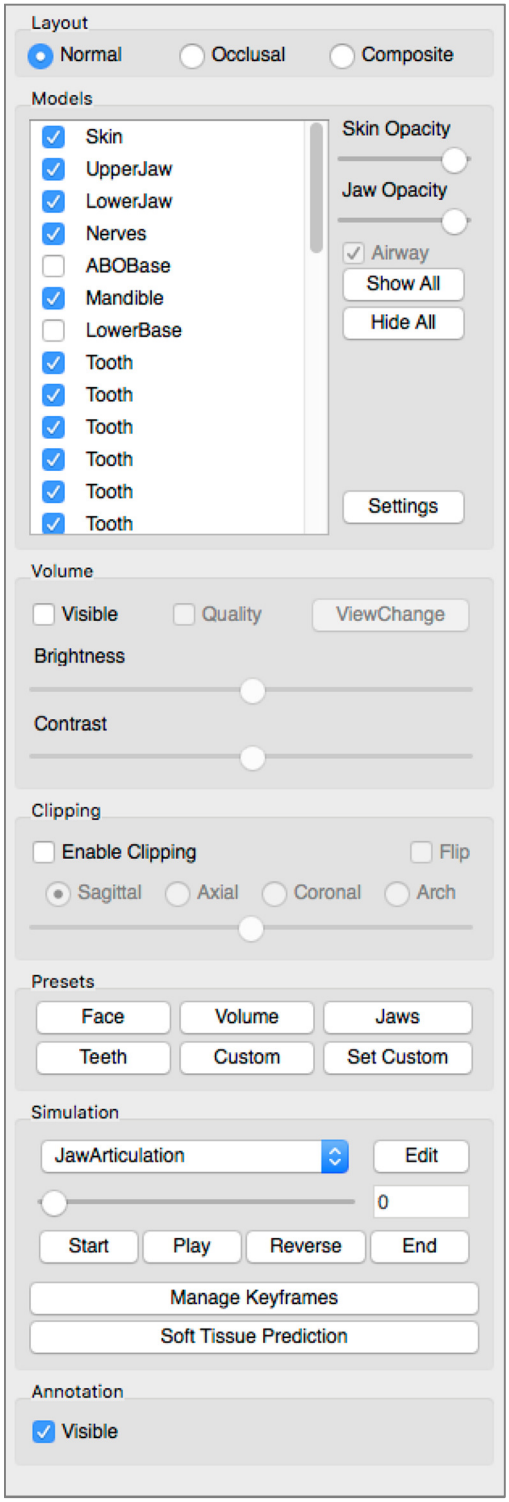
Background: Allows for the background color to be changed.

Setup View: Allows option to view either parallel or perspective views in 3D. You can change the annotation layout options under the Setup View.

Comment Marker: Pick a point in the volume and enter comments. Enter the text you would like to appear in the Insert Comment window and press **OK**.

Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. Software reports the value based on user-picked points. Due to the nature of medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

Model: Property Page



Layout:

- Normal shows the digital models in the normal patient orientation along with the volume rendering if desired.
- Occlusal shows both arches from the occlusal perspective.
- Composite shows a composite of multiple views of the model all at once.

Models:

- Models: The individual, digital models (implants, nerves, teeth, superimposition) can be turned on or off in the rendering window.
- Skin Opacity: Controls the opacity of the Skin model from the Anatomodel service or from 3DAnalysis.
- Jaw Opacity: Controls the opacity of the alveolar bone/ ABO base from the Anatomodel service.
- The Airway checkbox toggles the visibility of the airway measurement if one has been generated in Section Tab or Volume Render Tab.
- **Show All** and **Hide All** toggle the visibility of all the listed models.
- **Settings:** Control settings for items in the Models list. A model must first be selected in this list before the button is pressed.

Volume:

- Select "Visible" to toggle the volume rendering on or off with the digital models.
- The **View Change** button allows volume rendering options, such as Soft Tissue, Teeth, etc.
- The Brightness and Contrast of the images can be adjusted with the slide bar.

Clipping:

- Select "Enable Clipping" to slice the image along the predefined anatomical planes (sagittal, axial, coronal). Control the clipping with the scroll mouse or the slider bar.
- To switch a view to the opposite side, select "Flip."

Presets:

Preset toggles that display predetermined views. A custom view can also be set.

Simulation:

To create a new simulation:

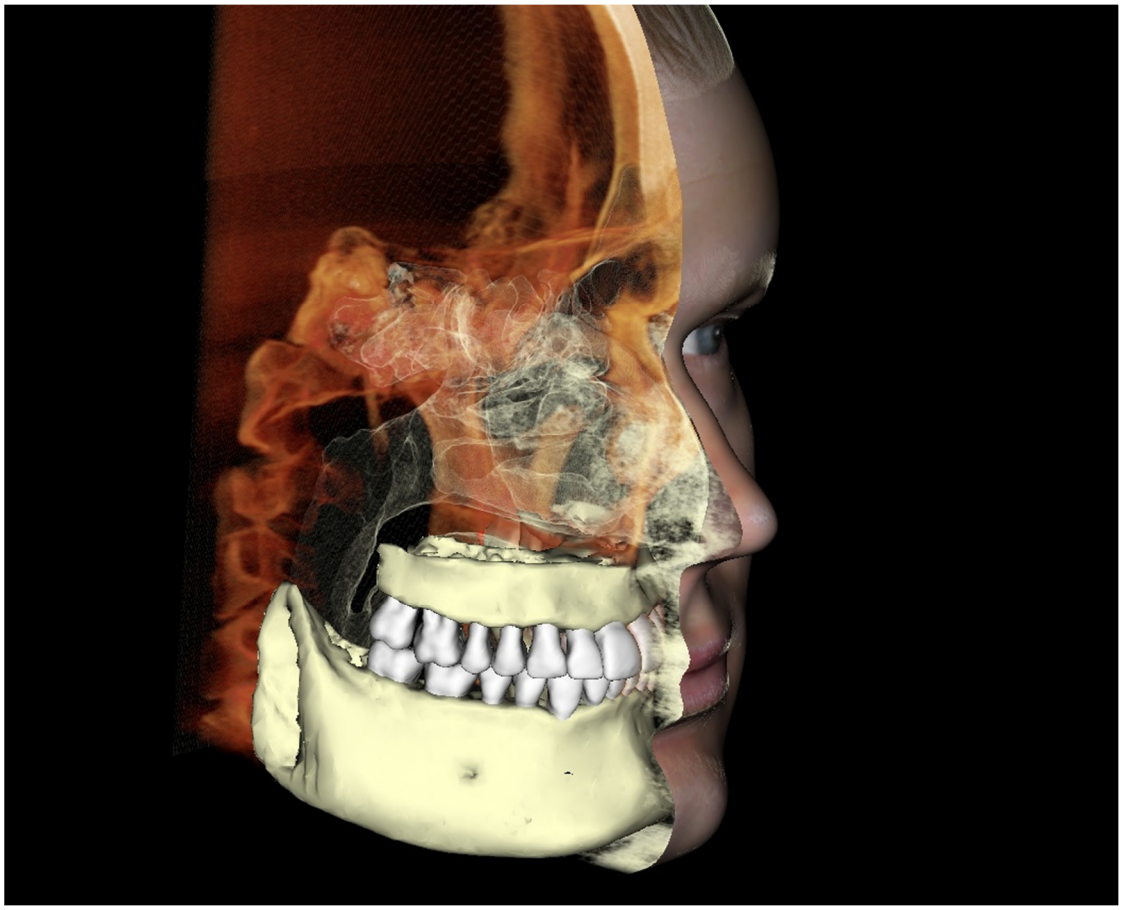
- Select either the TeethMovement or JawMovement simulations, or press **Edit** to create a new simulation.
- Move the slide bar to the right to indicate the ending point.

- Click on a digital model to move it (either individual teeth or whole arches) with the move widget.
- After the final position is reached using the 3D move widget, press **Start** to go back to frame one.
- Press **Play** to view your simulated movement.
- **Manage Keyframes** lists the frames that compose the simulation for the selected model. (See page 128.)
- Press **Soft Tissue Prediction** to create a simulation of the soft-tissue prediction. This is only possible with the use of a 3D Photograph and Skin AnatoModel.

Annotation:

- Controls the visibility of comment markers in the rendering window.

Model: Rendering Window

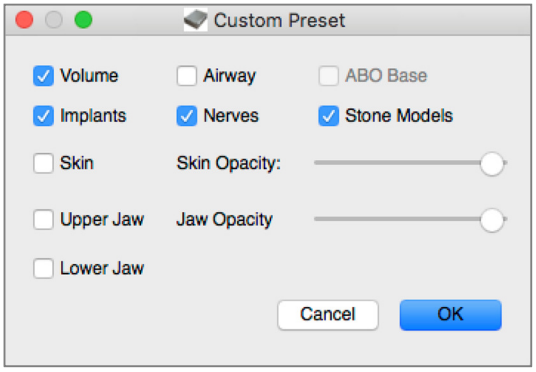


This window allows the viewing of AnatoModels, 3D photographs, and simulation, all of which are services that must be ordered per case for this feature to work. These services provide excellent diagnostic data and case presentation material.

Please refer to Image Navigation (pg. 30) for information about controlling and adjusting these images.

Model: Custom Preset Setup

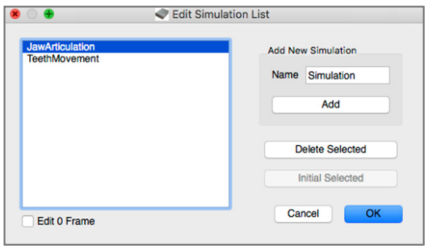
Visibility presets allow for easy switching between set views. The **Custom** option is set manually by the user. To configure these settings, click on **Set Custom**.



- Visibility checkboxes hide or show features in the rendering window.
- Skin Opacity: Controls the visibility of the face photo wrap from the Anatomodel workup file or 3DAnalysis. Varying degrees of transparency can be obtained with the slider.
- Jaw Opacity: Controls the visibility of the jaw models. Varying degrees of transparency can be obtained with the slider.

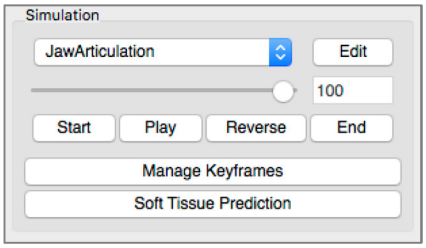
Model: Simulations

Simulations may be created using any of the model objects in the software, such as implants and restorations, as well as models created by the AnatoM odel service.



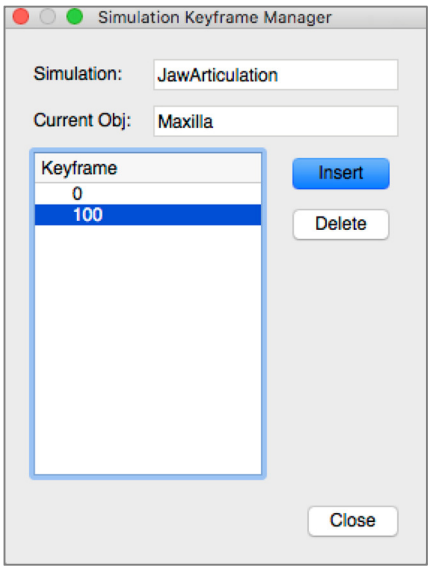
Adding and Deleting Simulations

- Click **Edit** to open a list of all simulations.
- In the Name field, input the name of the new simulation and click **Add**. The new simulation will appear on the list.
- To delete a simulation, click on the simulation on the list to select it, then click **Delete Selected**.
- **Initial Selected** sets the current view state as Frame 0 for the selected simulation.
- If "Edit 0 Frame" is checked, then the initial frame of the simulation will be editable.



Creating Simulations

- Move the slider to Frame 100. This will be the end state of the model.
- Select a model and the move widget should appear.
- Use the move widget to adjust the final position of the model.
- Moving the slider (Frame 0 to 100) will move the model between the initial and final positions.
- To adjust intermediate model positions, move the slider to an intermediate frame (between Frame 0 and 100). Use the move widget to adjust the model position.
- Moving the slider (Frame 0 to 100) will move the model from the initial position, through intermediate positions, and to the final position.



Managing Keyframes

- Any animation frame in which a model position was adjusted becomes a keyframe.
- Keyframe management allows for preexisting keyframes to be easily identified, edited, or deleted as well as the creation of new keyframes.
- Click on **Manage Keyframes** to display a list of the keyframes for the selected model.
- The position of the model at existing keyframes can be edited by selecting the appropriate frame and repositioning the model.
- To insert keyframes, move the slider to the desired frame number and then click **Insert**. The model may then be moved to create a new state for that frame.
- To delete keyframes, click on the keyframe on the list and then click **Delete**.

Note: **Manage Keyframes** does not apply to skinwrap.

Please see page 132 for more information on Anatomodels and simulations.

Common How to Tasks

How to Trace a Nerve

- Go to the ArchSection Tab.
- Make sure the pano is in Slice Mode (not X-ray mode).
- Adjust focal trough such that the nerve pathway is visible in pano image.
- Move pointer to the pano image.
- Review the nerve pathway while using scroll wheel.
- If the nerve pathway is not clearly visible, adjust the focal trough.
- When the nerve pathway is identified through the pano image, press **New Nerve** in the Property Page.
- Starting from the mandibular foramen, click point by point.
- If the nerve is not clearly visible, use the mouse scroll wheel to find the nerve and continue picking.
- Near the mental foramen, move the mouse to cross-section view.
- Use the scroll wheel to find the exit of the nerve.
- Pick points connecting the nerve exit.
- Press **Done** in the Property Page to finish the nerve.

Warning: Any nerve that is traced in a way that does not conform to the actual pathway of the nerve can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based off of the incorrect tracing. It is critical for the end user to learn how to properly perform nerve tracings correctly. If you notice any inconsistencies or software problems with nerve tracing or have further questions or concerns about nerve tracing, please contact Anatomage support at (408) 885-1474 or email us at info@anatomage.com

How to Create Reports In Life Size

- Go to ArchSection Tab.
- Check "Adjust" in Vertical Range and Orientation.
- Adjust upper and lower limit by dragging green lines and then un-check Adjust.
- Adjust focal trough (arch spline) or re-draw arch spline by the clicking the **Create Arch Spline** button.
- Change Layout Mode to "Print Out."
- Change to a desired layout using the **Change Layout** button.
- Adjust cross-sectional width and interval.
- Move cursor to set cross section in desired location.
- In Print Out mode, user cannot zoom the image since it is set to life size.
- If desired structure is not visible in cross section, adjust axial cursor or focal trough.
- Switch pano image to X-ray mode and turn on the ruler.
- Turn on the Arch Spline Ruler and turn off arch spline control points.
- Turn off the cursor if necessary.
- Go to the View menu and choose "Capture to Gallery."
- Go to Gallery Tab.
- See Print Preview in the File menu and print out a test page.
- If you want to change the format, go to "Print Layout Setup" in the File Menu.
- If you want to use your own logo, replace the "printLogo.bmp" file in installation folder. This folder is typically in "Application\Anatomage"
- After the Print Layout Setup is changed, make sure you choose Print Out mode before recapturing the image. Otherwise the image could still be in the previous Print Layout Setup.

Other View Tabs with Life-Size Printing

- Non-whole view, full-screen Section render (double-click a renderer to make full screen)
- TMJ in Print Out mode (Axial slice will not be life-size)
- Pano in Super Pano
- Super Ceph in Print Out mode

Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. Software reports the value based on user-picked points. Due to the nature of medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

How to Create a Positive Airway View

- Go to Volume Render Tab.
- Select the **Inverse** preset.
- Reduce the opacity such that the internal structures start to appear.
- Change the viewpoint to Top View (Press Top View button in toolbar).
- Use sculpting tool to remove the undesired parts.
- Change the viewpoint and repeat sculpting operations.
- After the desired airway is isolated, increase the opacity.
- Adjust Brightness and Contrast to set the right visualization.
- (The **Airway Measurement** tool also shows a positive airway view that is color coded based on area. This inverse method lets you see the airway without color coding.)

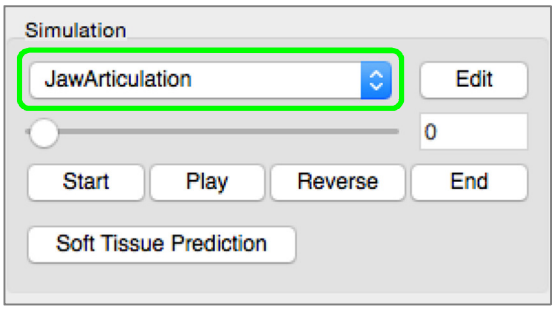
How to Create an AnatoModel Simulation and Video

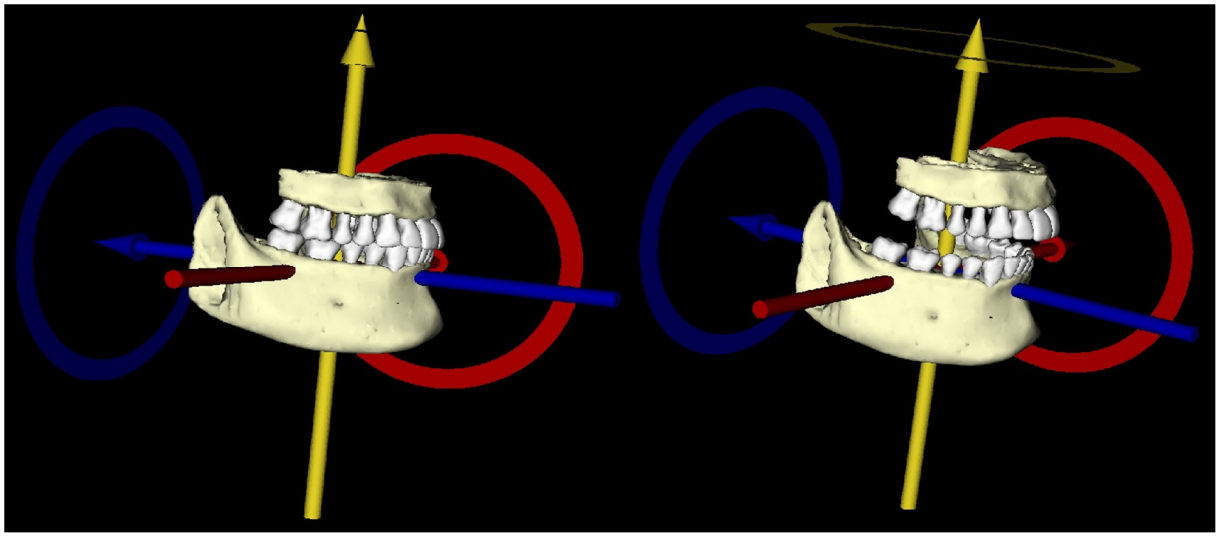
Simulations require the use of the AnatoModel service provided on a case-by-case basis from Anatomage. The AnatoModel service may include some or all of the following features:

- Individually segmented, digital models of patient dentition
- Segmented digital models of patient mandible and maxilla
- 3D photograph overlay on the patient soft-tissue profile

For additional information about the AnatoModel service, please contact Anatomage at (408) 885-1474 or email us at info@anatomage.com.

- Go to Model Tab.
- Property Page: Simulation, from the drop-down menu choose an existing simulation (TeethMovement, JawArticulation) or create your own (select **Edit**).
- Move the slide bar to the very end (Frame 100).

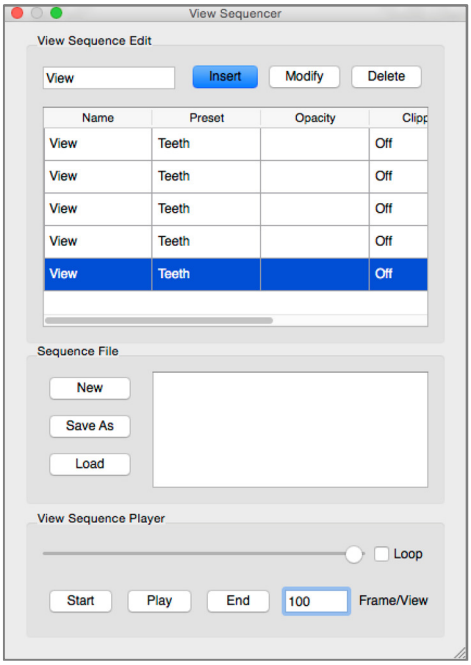




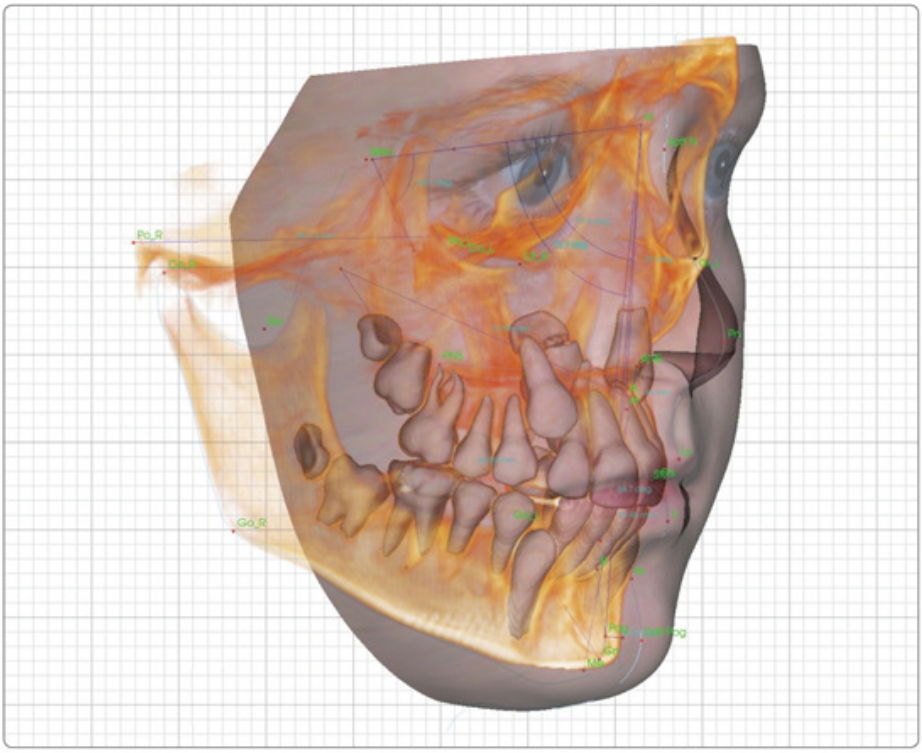
- Select a model adjust and the move widget should appear.
- Use the move widget to adjust the final position of the model.
- Moving the slide bar (Frame 0 to 100) will move the model between the initial and final positions.
- To adjust intermediate model positions, move the slide bar to an intermediate frame (between Frame 0 and 100). Use the move widget to adjust the model position.
- Moving the slide bar (Frame 0 to 100) will move the model from the initial position, through intermediate positions, and to the final position.

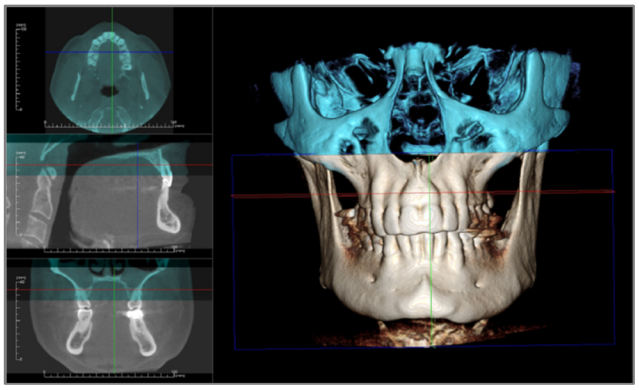
View Sequencer:

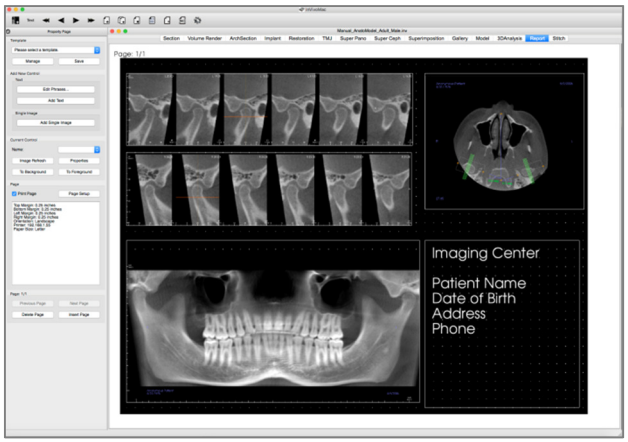
- To create a video of your simulation, select the **View Sequence** button from the **Model Toolbar** to open the View Sequencer Window.
- Much like the **Volume Render View Tab** (pg. 50), you can insert scenes with various volume orientations, clippings, colorizations, etc.
- Adjust rendering window image to desired settings (orientation, volume colorization, etc.) and move the Simulation Slide Bar to Frame 0.
- Press **Insert** in View Sequencer window.
- Adjust rendering window image to desired settings (orientation, volume colorization, etc.) and move the simulation slide bar to Frame 100.
- Press **Insert** in View Sequencer window.
- Test the video using the **Start**, **Play/Pause** and **End** buttons in the View Sequencer window.



Invivo5 Additional Modules



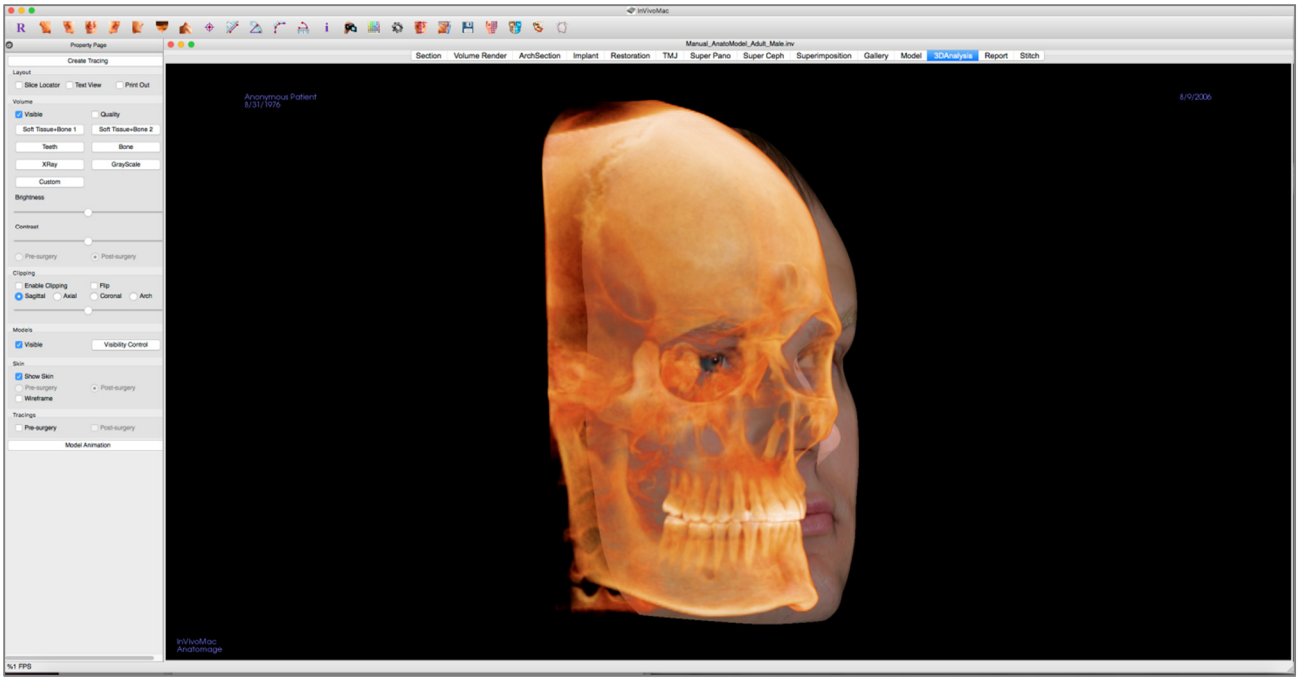




The following modules are sold separately. To find out more information about these modules, please contact Anatomage at (408) 885-1474 or at info@anatomage.com

3DAnalysis Module Features

*The **3DAnalysis View Tab** shows the patient in three-dimensional, reconstructed views and allows you to explore the internal structures and never-before-seen anatomy of the patient. With **3DAnalysis**, the user can construct various landmarks and profiles, calculate 3D and 2D measurements, and report analytical results.*



Warning: 3DAnalysis module is not a medical device and should be used as a reference or presentation tool only.

3DAnalysis: Toolbar

Shown below are the Toolbar and tools that are loaded with the 3DAnalysis View Tab:

Reset View: Resets the rendering window to the original view size.

Left View: Automatically orients the volume so the patient is facing left sagittal.

Left ¾ View: Automatically orients the volume so the patient is facing 45° left sagittal.

Front View: Automatically orients the volume so the patient is facing the front.

Right ¾ View: Automatically orients the volume so the patient is facing 45° right sagittal.

Right View: Automatically orients the volume so the patient is facing right sagittal.

Top View: Automatically orients the volume so you are oriented above the patient.

Bottom View: Automatically orients the volume so you are oriented below the patient.

Marker: When selected you may mark a point on the volume and X,Y, Z coordinates (transverse, sagittal, vertical) will appear. Clicking on the point and moving the cursor can modify points.. Click on the point and press the "delete" key to delete it. Control Panel features allow the values to be hidden or exported to a report.

Distance Measurement: Select this option and mark two points on the volume and distance will appear. Clicking on the point and moving the cursor can modify points. Click on the measurement and press the "delete" key to delete it.

Angle Measurement: Select this option and mark three points on the volume and the angle between them will appear. Clicking on their control points and moving the cursor can modify measurements. Click on the measurement and press the "delete" key to delete it. Control Panel features allow the values to be projected to 2D, hidden, or exported to a report.

Polygonal Measurement: When selected you may mark an unlimited number of points on the volume and the total between the first point and the last point will appear. Right-click your mouse to indicate that you have marked your last point. Clicking on the point and moving the cursor can modify points. Click on the measurement and press the "delete" key to delete it. Click on the measurement and press the "delete" key to delete it. Control Panel features allow the values to be projected to 2D, hidden, or exported to a report.

Arc Widget: Places an arc visual on the volume displaying the arc angle and radius of the circle containing the arc. Requires the placement of three points, the first marking the center of a circle and the last two marking the endpoints of the arc.

Information Display: Displays or hides case information embedded in the data.

View Sequence: Allows for the creation of custom camera sequences and AVI file movie capturing. Refer to the View Sequence description.

Visual Preference: Change color preference and define displaying type (For more information refer to **3DAnalysis Settings**, pg. 165.)

3DAnalysis Settings: Define and change definitions of landmarks, measurements, references**,** analysis, norms, and soft tissue deformation ratios. Define and change other preferences related with 3DAnalysis.

Patient Orientation: Click to change patient orientation.

Tracing Tasks: Perform and edit the tracing tasks defined through series of picking landmarks and/or drawing profiles. (Refer to **3DAnalysis: Tracing Tasks** for more information, pg. 144.)

Save Information: Opens a dialog containing commands for managing the 3DAnalysis configuration files, saving/exporting tracing data, and for building measurement norm data.

Create Face Photo: Opens the Create Face Photo Wrapping dialog. The dialog provides guided steps to producing a 3D photo wrap of the scan volume using textures from a photograph.

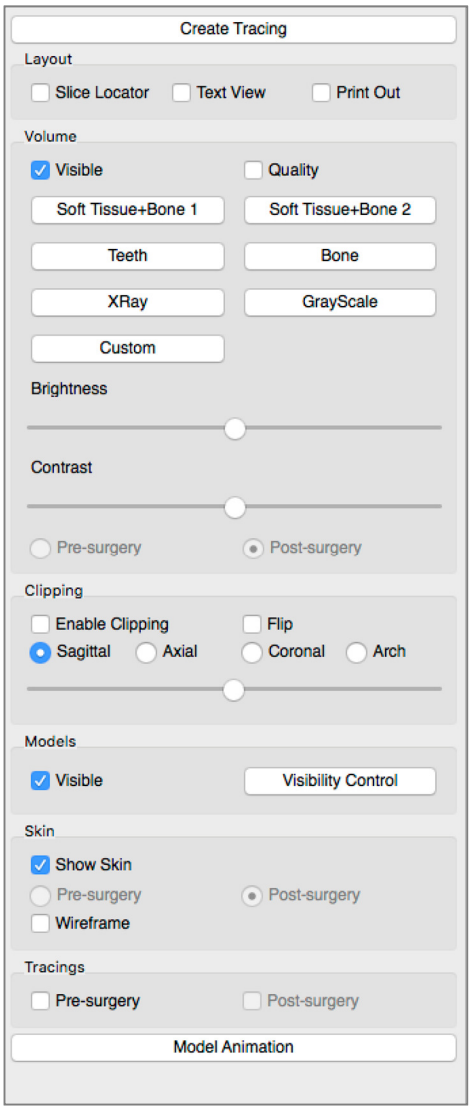
Superimpose Tracing: Opens the Tracing Superimposition dialog. The user can select a case and configure landmarks within this window to perform a landmark-based superimposition. This dialog also contains the Superimposed Tracing Visibility Controls.

3D Surgery: Opens 3D Surgery dialog. Surgical cuts, bone movement, and rotations can be simulated. The post-surgery volume can be further analyzed based on the analysis and the soft-tissue prediction.

Profilogram: Opens Profilogram dialog, converting the the pre- and post-surgery tracings (if available) to profilograms. Certain visibility options are available, and the registration settings can be changed.

Warning: Any measurement that is incorrect can lead to surgical complications if diagnosis, treatment plans and/or actual treatment is based on the incorrect measurements. It is critical for the end user to learn how to perform measurements correctly and employ proper usage of all measurement tools. Measurement accuracy depends on the image data and the hardware scanner that generated the image data. The measurement cannot be more precise than the resolution of the image. The software reports the value based on user-picked points. Due to the nature of the medical imaging, the boundary is not always well defined. The apparent boundary depends on the current brightness and contrast setting. The boundary may shift as the user makes adjustments to brightness and contrast. The user must understand the limitation of the measurement value before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

3DAnalysis: Control Panel



Create Tracing: Perform and edit the tracing tasks that are defined with some series of picking landmarks and/or drawing profiles. (Same as **Tracing Tasks** button on toolbar. For more details refer to **3DAnalysis: Tracing Tasks**, pg. 144.)

Layout: Configure layout options for the rendering window.

- **Slice Locator:** Aid for picking landmark location.
- **Text View:** Provides visibility options and values for landmarks, measurements, reference planes, and analysis configurations.
- **Printout:** Changes rendering window to a life-size printer-friendly version of the volume and tracing. Not compatible with slice locator view.

Volume Control:

- **Visible:** Allows the 3D volume rendering to be turned on or off from view.
- **Quality:** Box can be clicked on or off to further enhance the quality of the image.
- **View Presets:** Different settings allow for better visualization of certain anatomic structures, soft tissue profiles, hard tissue, etc. This is achieved by displaying specific densities with specific colors and transparencies.
- **Brightness & Contrast:** Can be adjusted for each of the presets to enhance your image.

Clipping: Click the "Enable Clipping" box to slice the image along the predefined anatomical planes (sagittal, axial, coronal, and arch). Scrolling the mouse wheel or moving the slider will move the clipping plane. To switch a view to the opposite side, click "Flip." Fine clipping is activated by scrolling with the mouse scroll wheel while the "Cmd" key is pressed.

Model Control:

- **Visible:** Allows the 3D models to be turned on or off from view.
- **Visibility Control :** Select individual 3D Models to be turned on or off from view.

Skin Control:

- **Show Skin:** Turns either pre- or post-surgery skin on or off.
- **Wireframe:** Converts the skin to a wire-mesh form.

Tracings:

- Toggles the visibility of the pre-and post-surgery tracings.

Model Animation:

- Create, edit, or play model simulations within the rendering window.

3DAnalysis: Coordinate System

Context:

The coordinate system is very important for any three-dimensional (3D) system. It defines the structure for subsequent measurements and analyses. Even though the absolute measurements such as linear distance or angular measurement are invariant to the coordinate system, any projected measurement, such as the angle projected to mid-sagittal plane is significantly influenced by the coordinate system. Thus, it is essential to establish a sound coordinate system before any measurements or analysis can be done.

There is a coordinate system for 2D images, too. However, given its simplicity, one may not realize it as a coordinate system but more or less direction. In general, for a two-dimensional system, one simply needs to determine a single axis and the other is often determined as orthogonal to the first. In traditional 2D cephalometrics, the Frankfort horizontal plane could serve as the horizontal axis. By default, the vertical axis is defined from this Frankfort plane.

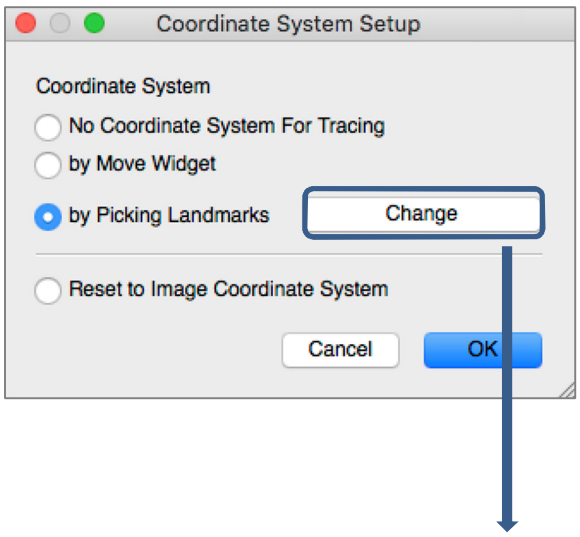
In a 3D coordinate system, however, it is more complicated. One has to define three axes, and (for a typical Cartesian coordinate system) they must be orthogonal to one another. Additionally, the origin of the coordinate system could be anywhere but preferably lying on an anatomical feature. The challenge is that anatomical landmarks and coordinate axes are not necessarily aligned; a line connecting two landmarks may not serve as the correct coordinate axis.

From a mathematical perspective, any coordinate system based on finite number of 3D coordinates is relatively simple linear algebra. Thus, any desired coordinate system can be established by a linear combination of the landmark coordinate values. Such definitions may be difficult to understand for clinicians and may not have anatomical meaning or agree with existing analysis schemata.

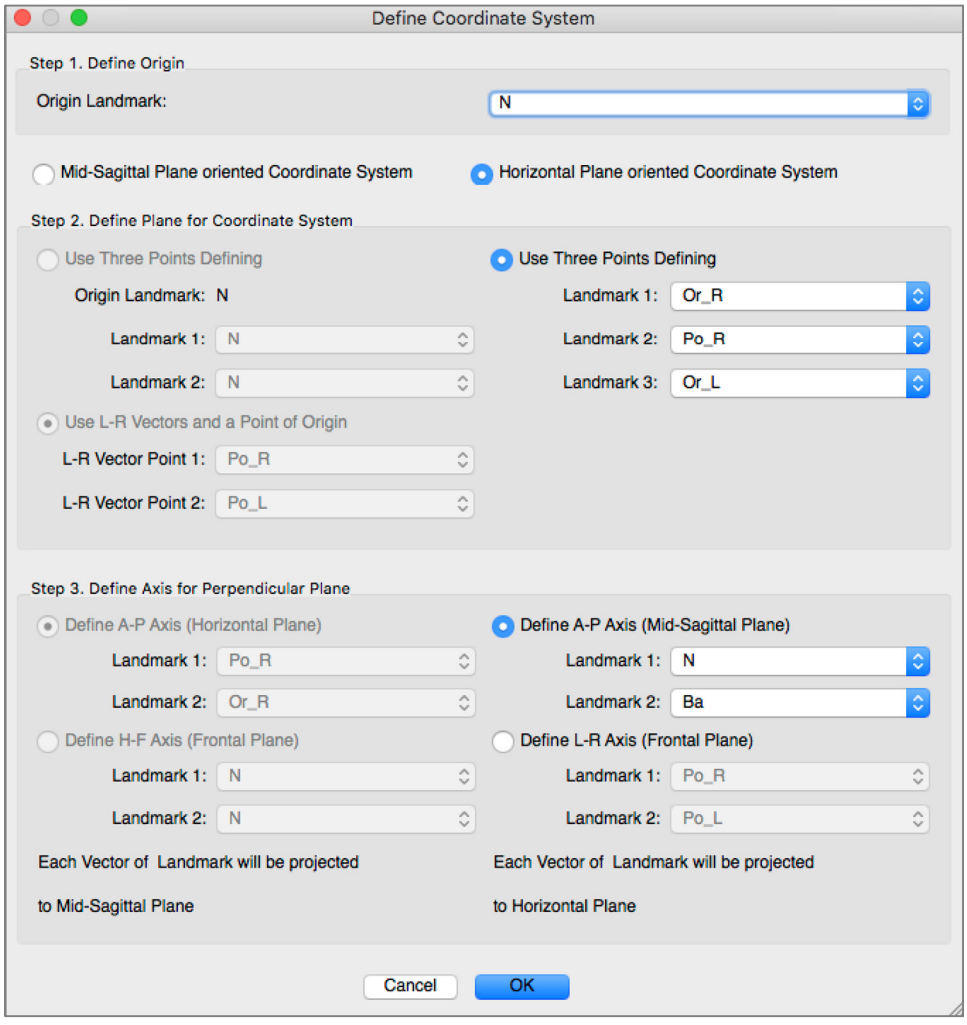
In this software, we propose a coordinate system construction scheme with the following essential goals:

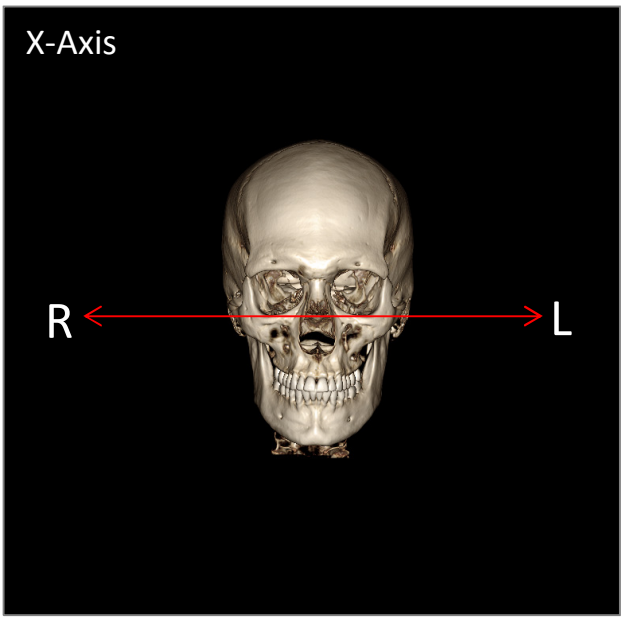
1. Support for existing clinical concepts
2. Freedom to establish user-defined coordinate system(s)
3. Interface that is easy to set up and understand

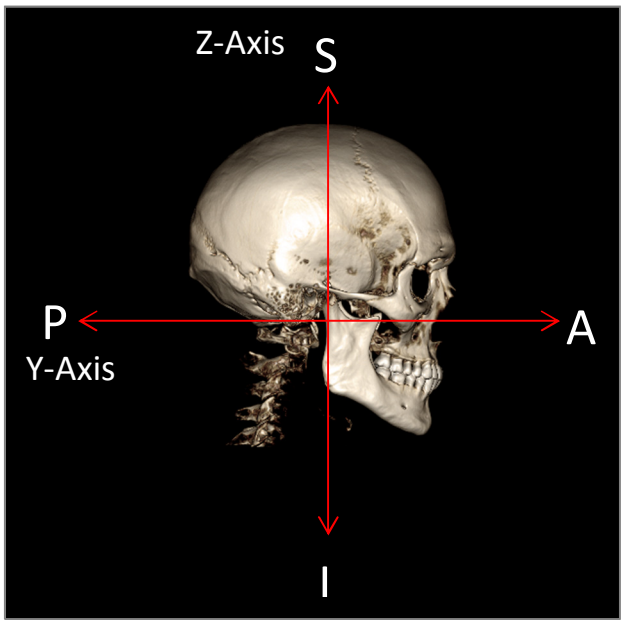
Coordinate System: Click to change coordinate system. (Refer to **3DAnalysis: Coordinate System** for more information, pg. 139.)



- No Coordinate System for Tracing:
  Do nothing to define the coordinate system. Use current coordinate settings.
- by Move Widget: Use the move widget to define the coordinate system before performing tracing tasks.
- by Picking Landmarks: Define the coordinate system by picking landmarks predefined on the Define Coordinate System dialog (below).
- Reset to Image Coordinate System: Cancel the current coordinate system definition and return to the original patient coordinate system.







Defining the Coordinate System by Picking Landmarks:

Two methods of defining the coordinate system are available in 3DAnalysis. You can switch between the methods in the Define Coordinate System window by pressing the **Coordinate System** button in the toolbar, selecting "By Picking Landmarks" and pressing **Change**. Alternatively, the Define Coordinate System window can be accessed in a similar manner but through the Tracing Guide window. The images above show the orientation of axes and anatomical terms of location.

Step 1: Define Origin

Irrespective of which method you choose when defining your coordinate system, you must select a landmark to serve as the origin for measurements, references, and your analysis.

Next, choose the method of determining the coordinate system:

- Mid-sagittal plane-oriented coordinate system
- Horizontal plane-oriented coordinate system

Step 2: Define Plane for Coordinate System (Mid-Sagittal Plane Method)

The mid-sagittal plane can be established by two methods:

1. *Use 3 Points Defining:* Define two additional points. With the origin defined (Step 1), a total of three points defines the mid-sagittal plane.
   Ex: Origin – nasion, two points – anterior nasal spine and basion.

2. *Use L-R Vectors and a Point of Origin:* Choose two points on either side of the volume (left and right sides) to create a vector. The mid-sagittal plane will be set normal to the vector and intersecting the origin.
   Ex: Origin – nasion, two points – left and right porion.

The origin must be located on the mid-sagittal plane. Step 3 will determine the perpendicular axes.

Step 3: Define Axis for the Perpendicular Plane (Mid-Sagittal Plane Method)

From the mid-sagittal plane, the X-axis is defined as normal to the plane. The perpendicular Y- and Z-axes (sitting on the plane) can be determined by projecting a vector onto the mid-sagittal plane to define one and setting the other as normal to this plane. There are two manners of determining the Y- and Z-axes using this method:

1. *Define A-P Axis (Horizontal Plane):* choose two landmarks to connect anterior to posterior and serve as the horizontal plane.
   Ex: Point 1 – right orbital, Point 2 – right porion → Frankfort horizontal plane

2. *Define F-H Axis (Frontal Plane):* choose two landmarks to connect head to foot and serve as the vertical plane.
   Ex: Point 1 – nasion, Point 2 – anterior nasal spine → frontal plane

* * *

Step 2: Define Plane for Coordinate System (Horizontal Plane Method)

The horizontal plane can be established using three landmarks.
Ex: Point 1 – right orbitale, Points 2, 3 – left and right porions
Defines the 3D Frankfort horizontal plane

The origin must be located on the horizontal plane. Step 3 will determine the perpendicular axes.

Step 3: Define Axis for the Perpendicular Plane (Horizontal Plane Method)

From the horizontal plane, the Z-axis is defined as normal to the plane. The perpendicular X- and Y- axes (sitting on the plane) can be determined by projecting a vector onto the horizontal plane to define one and setting the other as normal to this plane. There are two manners of determining the X- and Y-axes using this method:

1. *Define A-P Axis (Mid-Sagittal Plane):* choose two landmarks to connect anterior to posterior and serve as the mid-sagittal plane.
   Ex: Point 1 – basion, Point 2 – nasion

2. *Define L-R Axis (Frontal Plane):* choose two landmarks to connect laterally and serve as the frontal plane.
   Ex: Point 1 – left porion, Point 2 – right porion

When Steps 1-3 are completed, press the **OK** button to save the settings and close the Define Coordinate System window.

Note:

In traditional 2D cephalometry, the sagittal direction is constructed between porions. In 3D cephalometry, there is a dilemma in that the sagittal axis (porion to porion) and the mid-sagittal plane (nasion, anterior nasal spine, sella) cannot be achieved simultaneously.

If you choose porion-to-porion to be the sagittal axis, the orientation of the mid-sagittal plane is defined by the axis and one landmark could define it completely. Consequently, the other landmarks may sit close but not exactly on the mid-sagittal plane.

Alternatively, if you construct the mid-sagittal plane using three landmarks (nasion, anterior nasal spine, sella) then the sagittal axis is defined from the mid-sagittal plane. This axis may not be parallel to the vector connecting the two porion points.

Using 3D cephalometrics allows for more accurate measurements and analysis. However, there are discrepancies with traditional 2D analysis (such as the one listed above, so caution should be used in defining the coordinate system, landmarks, references, etc. to minimize these differences.

3DAnalysis: Tracing Tasks

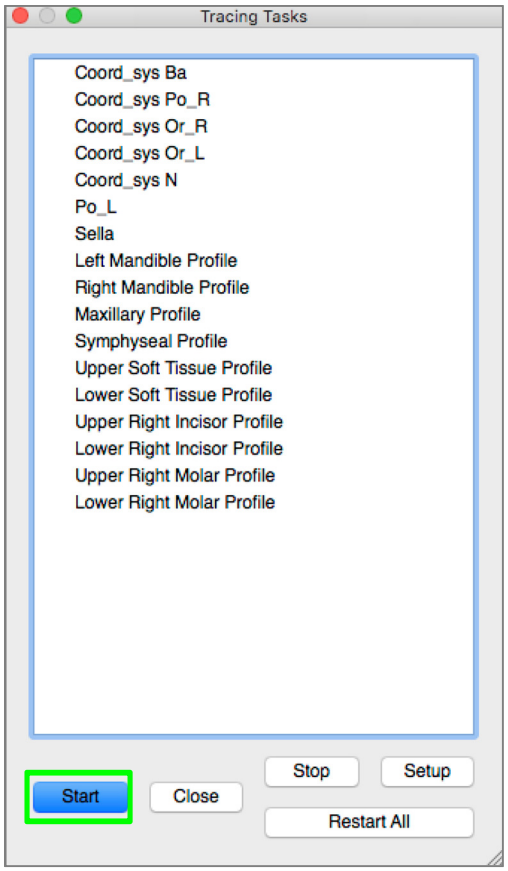
Now that the patient coordinate system is established, start picking points. The first set of points will be your coordinate-system associated landmarks, followed by other landmarks and profiles.

Note: If you are having trouble placing points on the volume due to the predefined rendering, angle, and clipping settings, please refer to the **3DAnalysis: Tracing Guide** section (pg. 176) to edit your view states.

Tracing Tasks:

To begin tracing your rendered volume, press either **Create Tracing** in the Control Panel or the **Tracing Tasks** button in the toolbar.

The Tracing Tasks window should open and list the order of Tracing Tasks to be performed. By default, the window will open in editing mode. (**See Tracing Tasks – Editing Mode**). Once a tracing task has been started, you may begin picking points on the rendered volume to define landmarks and profiles.



Start: Starts the first listed undefined tracing task. The tracing tasks required for defining the coordinate system will be done first and prefixed with "Coord_sys." After defining the coordinate system Tracing Tasks, you can select specified tracing tasks by double-clicking it or pressing the **Start** button. The currently selected tracing task will be marked with a cross-hair symbol and completed tracing tasks will be marked with a check .

- **Close:** Stops current tracing task and closes the Tracing Task window.
- **Stop:** Stops current tracing task and returns to the editing mode in the tracing task window.
- **Setup:** Opens the Tracing Guide window.
- **Restart All:** Discards completed tracing tasks and restarts from the first tracing task.

Tracing Tasks – Editing Mode:

To enter Editing Mode simply open the Tracing Tasks window by clicking on **Create Tracing**. When in editing mode, one can modify completed landmark positions and profile lines. Landmark positions and profile points are highlighted on the volume in the rendering window. Move the mouse over the landmark or profile point. Left-click and drag the landmark or profile point to the new desired location. Releasing the left-button will save the new position of the landmark or profile point on the volume. Selecting a landmark or profile point will also highlight the point on the Slice Locator, where the point can be further adjusted. This technique will help to move and adjust profile lines quickly without re-tracing the entire feature.

Tracing Task Examples and Tips

Notes About Landmarks/Profiles:

- Many common landmarks are associated with profile tracings. These landmarks will therefore only show on the volume and have a coordinate value when the corresponding profile tracing is completed (ex. Condyle point Co_R with the Right Mandibular Profile). Contact Anatomage Support and see the section **Default Tracing Tasks and Landmarks** (pg. 69) for more information about these automatic definitions.

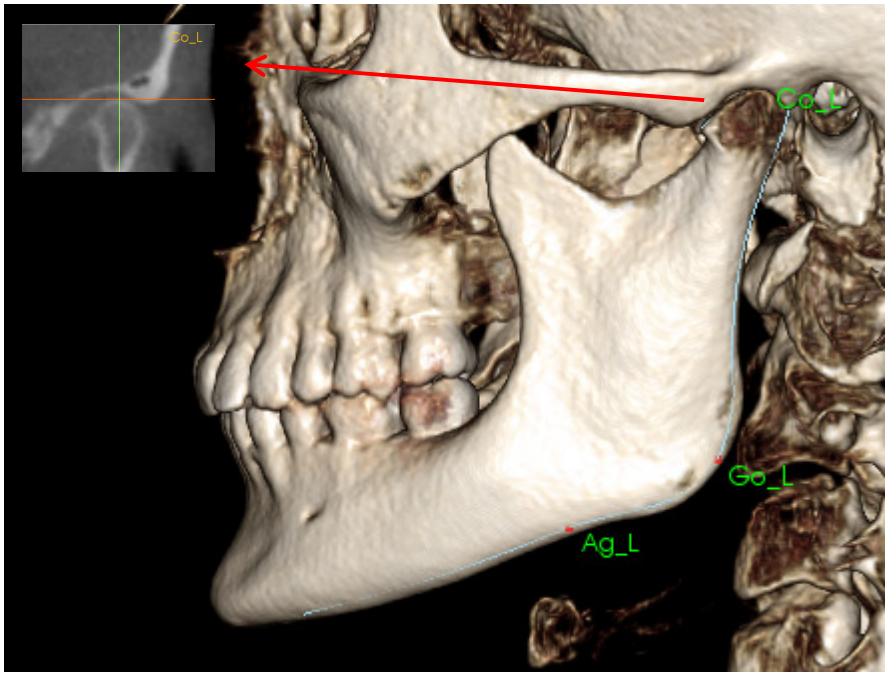
- Users can pick points for landmarks or profiles on models. These models can be in the form of Skin or Tooth Anatomodels as well as models created and/or imported into the Model Tab from Medical Design Studio. (Medical Design Studio is an add-on module for Invivo5.)

The following pages will demonstrate profiles and associated landmarks that are integrated into the default configuration file from the initial installation.

Warning: Results produced by the software's diagnostic and planning tools are dependent on correct selection of landmarks by the user in the 3D volume. The software reports values based on these user-picked points. Due to the nature of medical imaging, the boundaries are not always well defined. The apparent boundaries depend on the current brightness and contrast settings. The boundaries may shift as the user makes adjustments to brightness and contrast. The user must understand the limitations of the measurement values before applying to the patient. If you notice any inconsistencies or software problems with measurements, or have further questions or concerns about correctly using measurement tools correctly, please contact us at (408) 885-1474 or email us at info@anatomage.com

Mandibular Profile

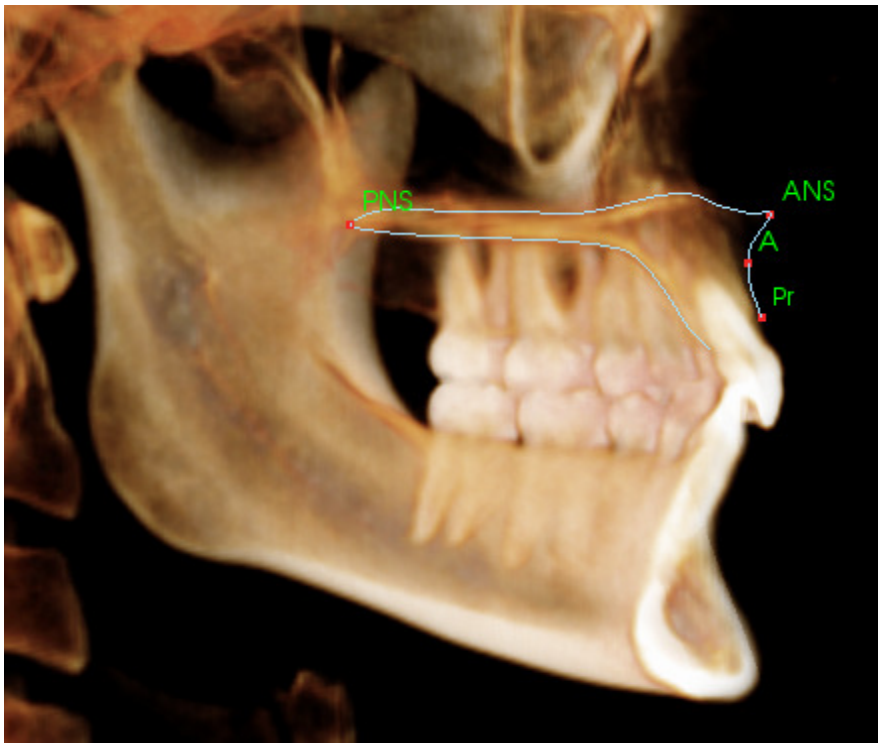
Be sure to include the profiles of the condyle, mandibular notch, and corpus. Follow the curve to include the gonion and antegonion. The antegonion, condyle, and gonion locations will be determined in the software through the profile. Always verify the location of the antegonion; open the tracing task to activate Edit mode and drag to modify.



Structure contains:
Co – Condyle
Go – Gonion
Ag – Antegonion

Maxillary Profile

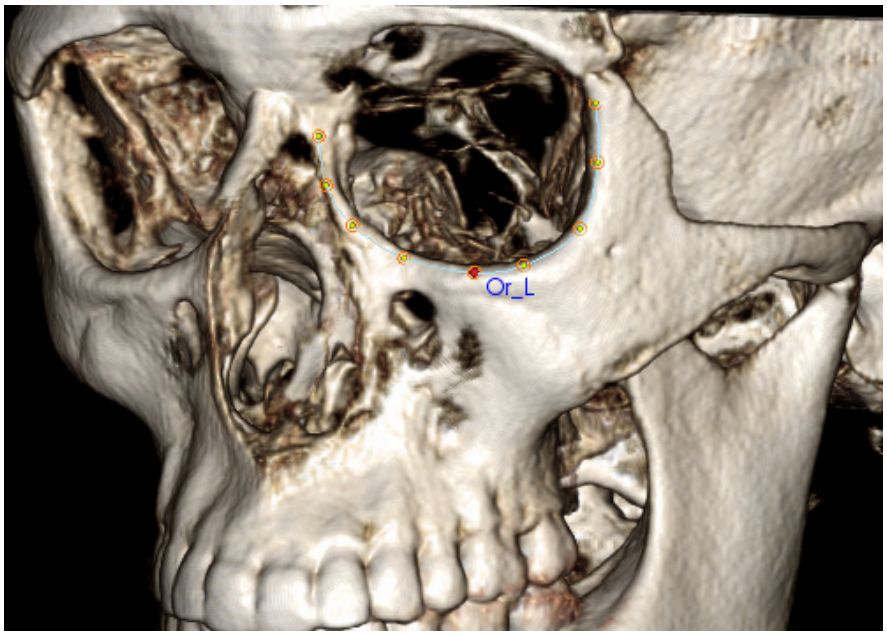
Start the profile near the anterior interface of the upper incisor and follow the profile of the maxilla back to the posterior interface of the incisor. Adjust the brightness and/or contrast levels to show the anterior nasal spine (ANS) and include that in the tracing profile. It is recommended that you place a profile point at or very near the ANS. Note: Using the default user-picked ANS will replace the automatically-defined profile ANS. The Pr point will be placed at the location of the first click.



Structure contains:
ANS – Anterior Nasal Spine
PNS – Posterior Nasal Spine
A – A point
Pr – Prosthion

Orbital Profile

Trace the most anterior part of the ridge usually noticeable based on the brightness (whiteness) of the bone around the orbit. Follow this ridge from the zygomatic suture to about the medio-orbital. If you use the orbitale as a landmark (ex: for Frankfort horizontal), it is recommended that you include this point as a profile point in the tracing. A user-defined Or_L or Or_R landmark will override the automatic Or landmarks.

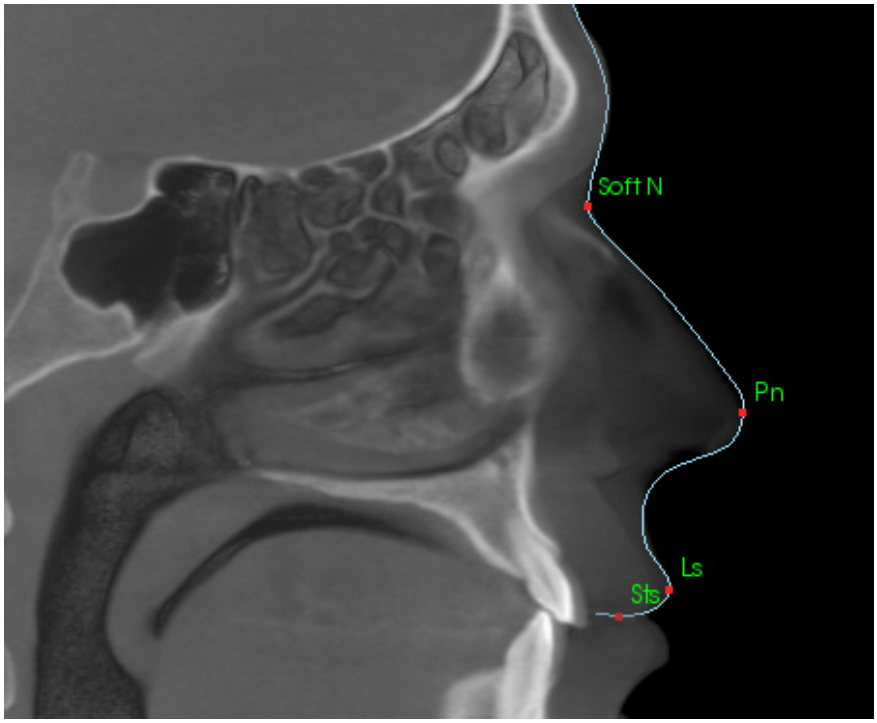


Structure contains:
Or – Orbitale

Soft-tissue Profile

(Upper)

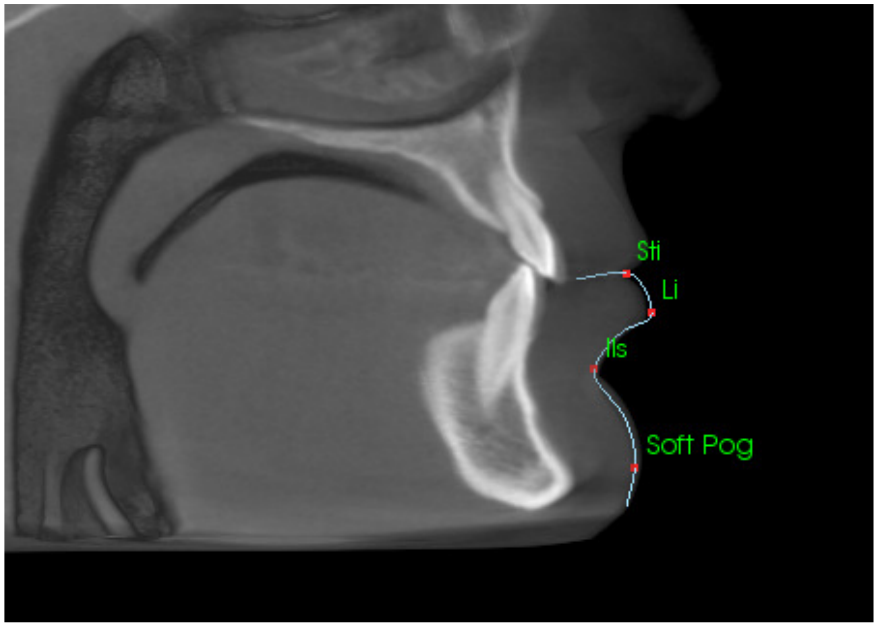
Adjust the brightness and/or contrast of the image to see the soft-tissue profile. Trace it from the top of the head to the lips. The upper soft-tissue should include the profile of the upper lip.



Structure contains:
Soft N – Soft Tissue Nasion
Pn – Pronasale
Ls – Labrale Superius
Sts – Stomion Superius

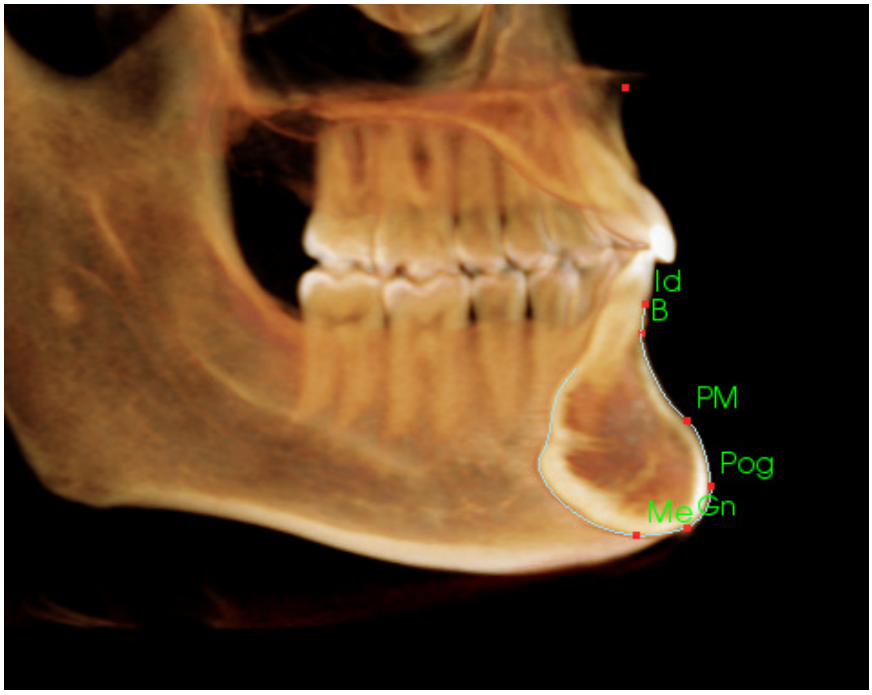
Soft-tissue Profile
(Lower)
Adjust the brightness and/or contrast of the image to see the soft-tissue profile. Trace it from the lips to below the chin. The lower soft-tissue should include the profile of the lower lip.

Structure contains:
Sti – Stomion Inferius
Li – Labrale Inferius
Ils – Soft-tissue B point
Soft Pog – Soft-tissue Pogonion

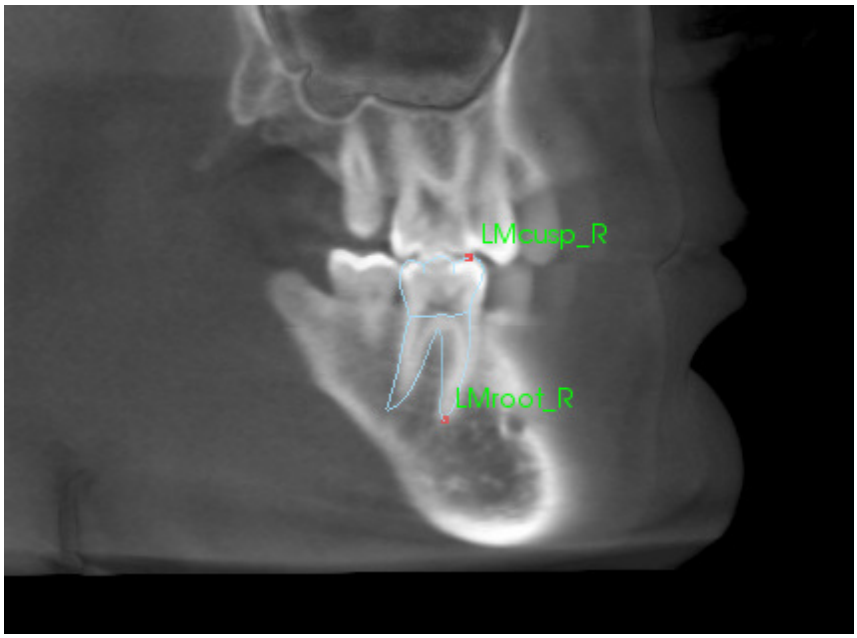


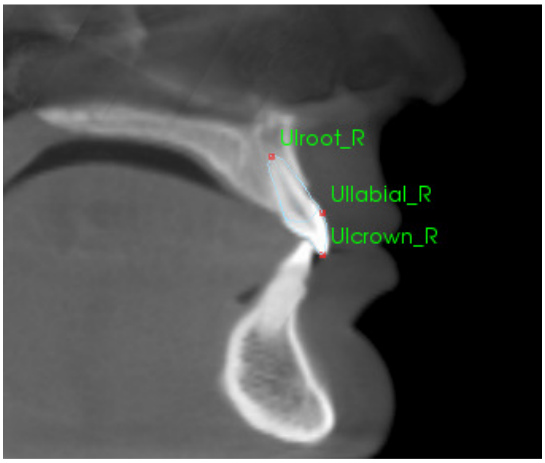
Symphyseal (Mandible) Profile
The profile should start near the anterior interface of the lower incisor, follow the curvature of the symphysis and finish at the posterior interface of the lower incisor. The Id point will be placed at the location of the first click.

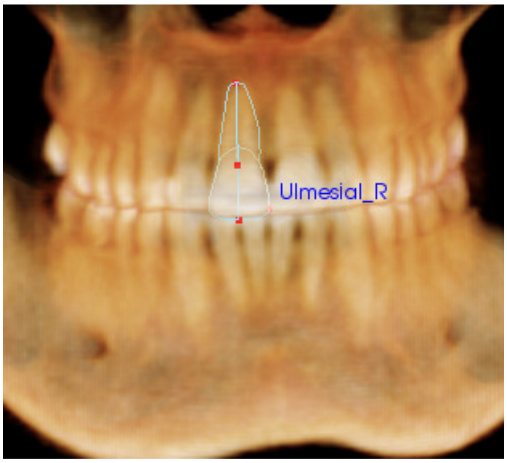
Structure contains:
Id – Infradentale
B – B point
PM – Protuberance Menti
Pog – Pogonion
Gn – Gnathion
Me – Menton



Teeth (Molar)
Place the first point at the tip of the anterior root for the molar. Place the next point at the tip of the anterior cusp. Place the final point at the tip of the posterior cusp. This procedure is applicable to the upper and lower molars (only lower molar shown at right).







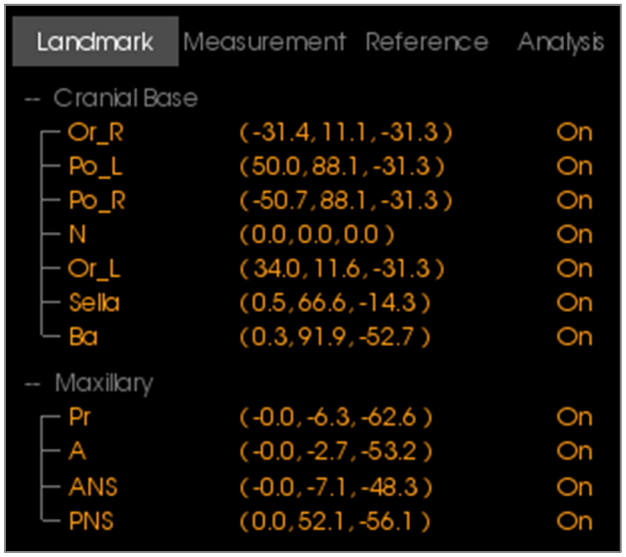
Teeth (Incisor)
Place the first point at the tip of the root for the incisor. Place the next point at the tip of the crown. Place the final point on the most labial side of the tooth. This procedure is valid for both the upper and lower incisors (only upper is shown).

Frontal Incisor Profiles require an additional fourth point, located at the most mesial point of each central incisor. When performing the tracing task, trace the first three points using the sagittal view and then use the frontal view to place the fourth point. Use the toolbar orientation buttons to rotate the volume during a tracing task.

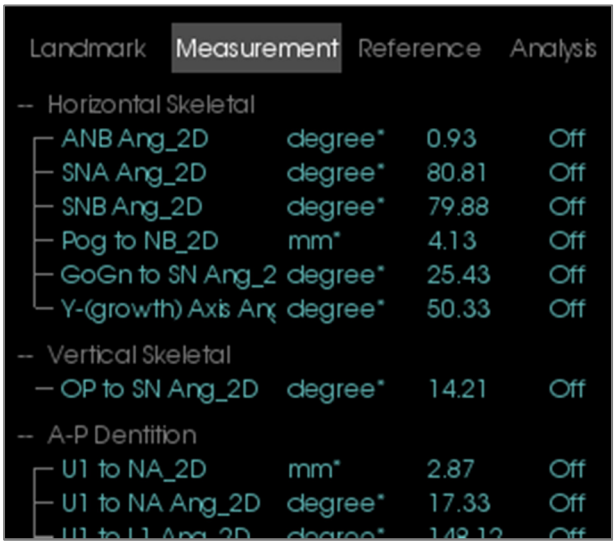
Note: When adding the Frontal Incisor Profiles to the current tracing task list, you must first ensure that the frontal lateral profiles are no longer on the list before they can be added. The two types of frontal incisors are not intended to be used simultaneously.

3DAnalysis: Text View

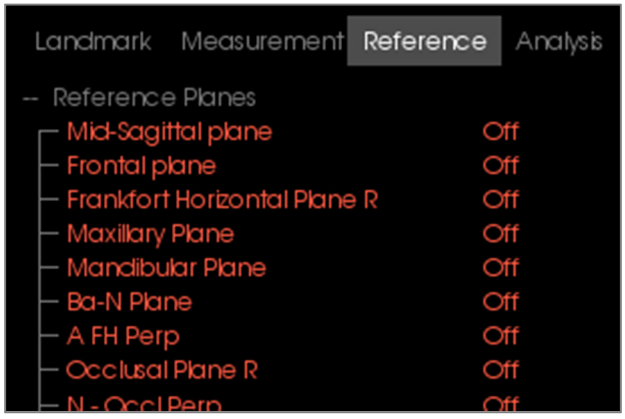
Once the landmarks have been defined on the volume, visualize the results of the analysis. Most of this will happen in the Text View, available under the Layout section of the Control Panel. Once Text View has been checked as visible, a pane will appear on the right side of the screen. If any of the contents extend beyond the bottom of the screen, use the mouse wheel to scroll down the list. Text View includes the following tabs:



Landmark: List of currently traced landmarks and the respective position values. Clicking the landmark line can set the display of the landmark name On/Off on the volume. Clicking the group line can set the display of all landmarks in that group On/Off at the same time.

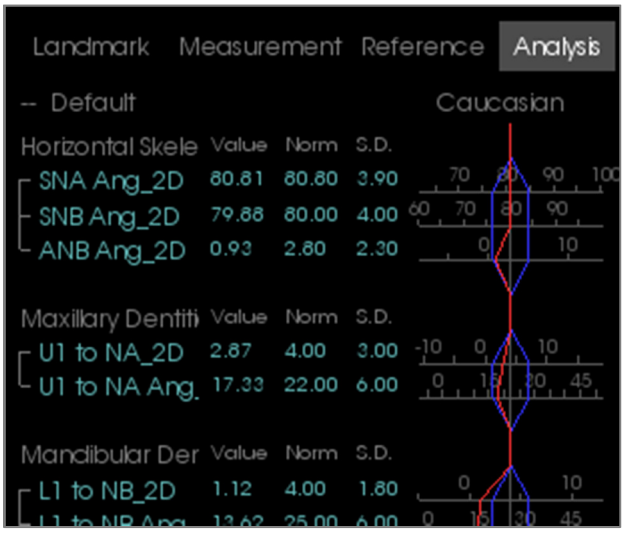


Measurement: List of respective values of available measurements defined in the analysis. Clicking the measurement line can set the display of the measurement name, value, and reference line On/Off on the volume. Clicking the group line can set the display of all the measurements of the group as On/Off at the same time. When measurements are calculated and projected onto a plane, a '*' is shown in the unit column.



Reference: List of currently available references. Clicking the reference line/plane can set the display the name and line/plane of the reference line/plane On/Off on the volume. Clicking the group line can set the display of all references of the group as On/Off at the same time.

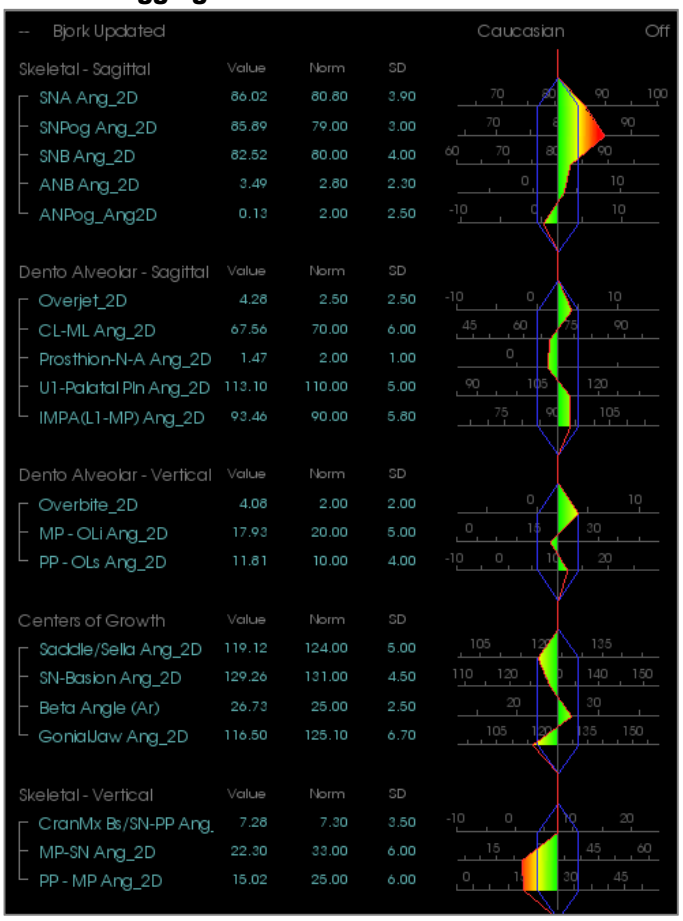
Analysis: Report and wigglegram of currently available measurements in the specified analyses. Display current ethnic norm group. Click the norm group name to change the default ethnic norm group.



Clicking the analysis name ("Default" in the left example) will make all measurements within that analysis visible in the rendering window. Clicking an analysis subgroup name will turn on visibility for any measurements under that subgroup.

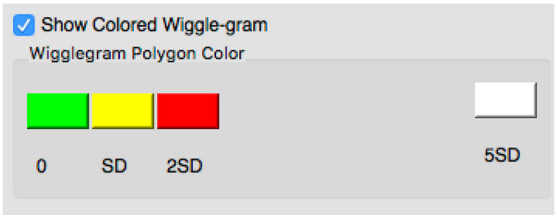
For VCA analyses, clicking the analysis name will turn on visibility for any VCA-configured measurements in the rendering window. Clicking an analysis subgroup name will turn on visibility for any VCA-configured measurements under that subgroup.

Colored Wigglegram



The wigglegram features a user-customizable color gradient to convey analysis results. The color corresponds to the number of standard deviations the measurement value differs from the norm.
Ex. Values that differ between 0 and 1 SD will show up as a blend of green and yellow.

Configure visibility settings in the Visual Preferences dialog:



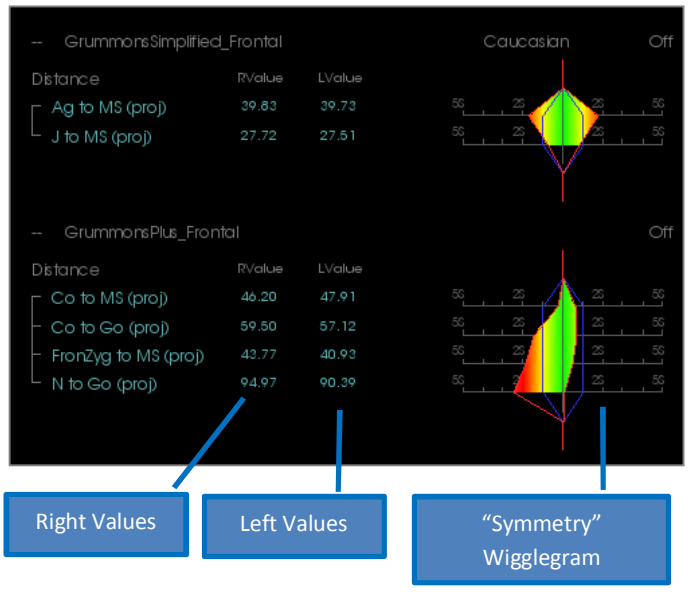
Features:

- (Color) Visibility On/Off
- Customizable 4-Color Gradient
- Color Correlation with VCA Color Indicators
- Compatible with Frontal Analysis Wigglegram (see below).

Warning: The analysis results are dependent on the norm values that are configured within each configuration file, which may contain predefined as well as user-defined data. The predefined norms that are available upon installation may or may not be based on accepted clinical values for the respective measurements. Users must verify the validity of norm values that will be used before applying this function on patient data. For further questions regarding the function, configuration, and validity of norm data, please contact the Anatomage Support Department at (408) 885-1474 or info@anatomage.com.

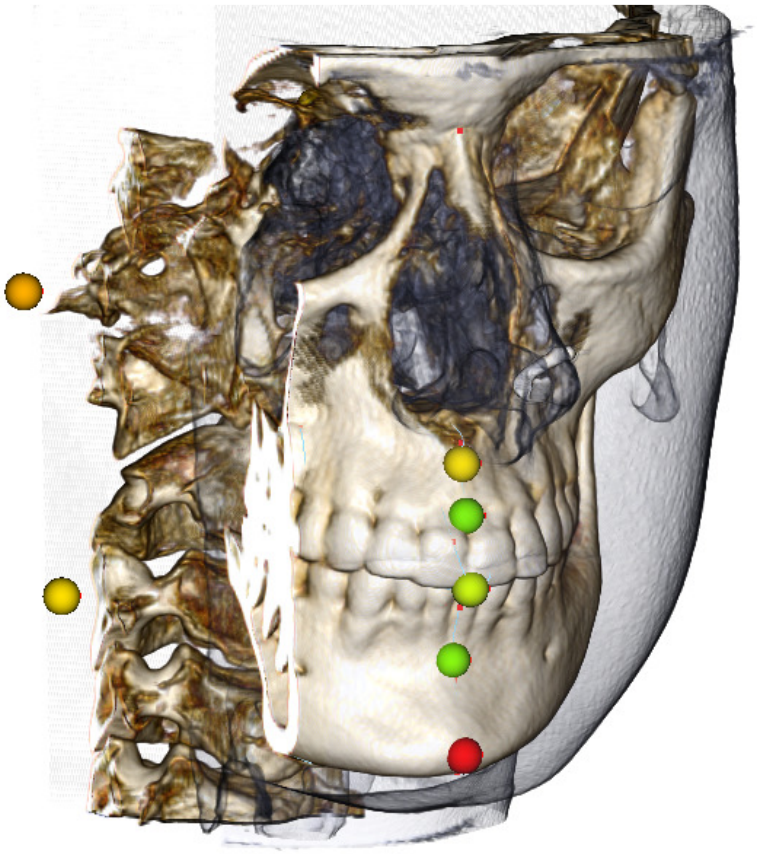
Frontal Analysis Mode:

The measurement values and wigglegram take a new format when an analysis is configured to be of a "frontal" variation. Refer to the **3DAnalysis: Advanced Analysis Configurations** section (pg. 157) for more information.



3DAnalysis: VCA Mode

3DAnalysis capitalizes on the fact that a large part of an analysis can occur visually. With the introduction of VCA (Visual Craniometric Analysis) colored indicators, an analysis can be customized to reveal an overall picture of a patient's clinical state by providing only the necessary level of numerical detail without overburdening the user. While the quantitative information is still available, the colored indicators draw attention back to the most necessary part of the analysis – the volume – while also saving time and effort.



How It Works: VCA colored ball indicators are tethered to individual measurements. When these measurements are selected in the Analysis Tab (by subgroups or analysis name), the VCA ball indicators will appear in the rendering window with a color that is dependent on the deviation of the measurement value from the norm. The proper configuration can allow the user to determine the areas that require attention without needing to see the exact measurement values.

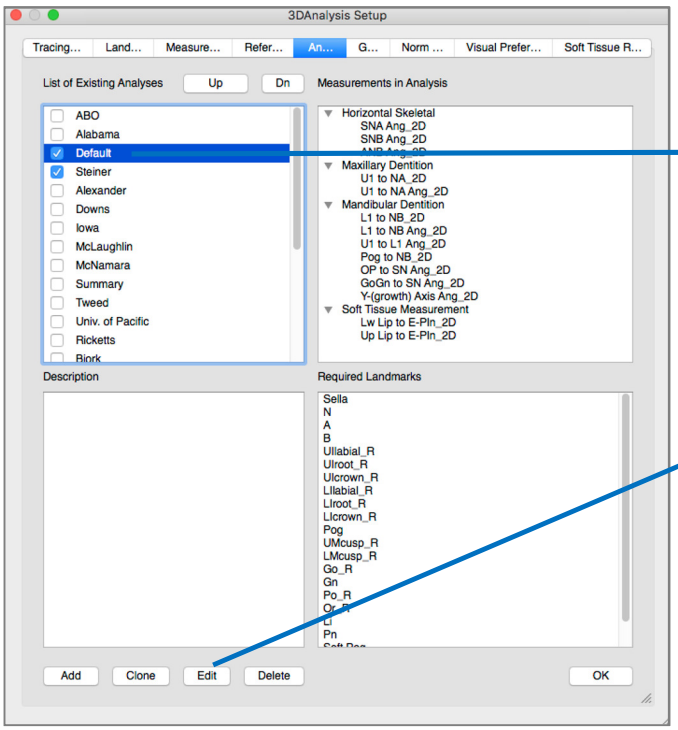
Configuring a VCA:

- Change the name of the analysis to indicate a VCA configuration
- Configure individual measurements values to have VCA landmarks
- Trace the case, turn on VCA landmarks in the Text View

Continue on in the section for more details on these tasks.

Choose An Analysis/Rename to VCA Configuration:

Any analysis can be configured to include VCA indicators. Open the 3DA Setup dialog with the  icon and navigate to the Analysis Tab.

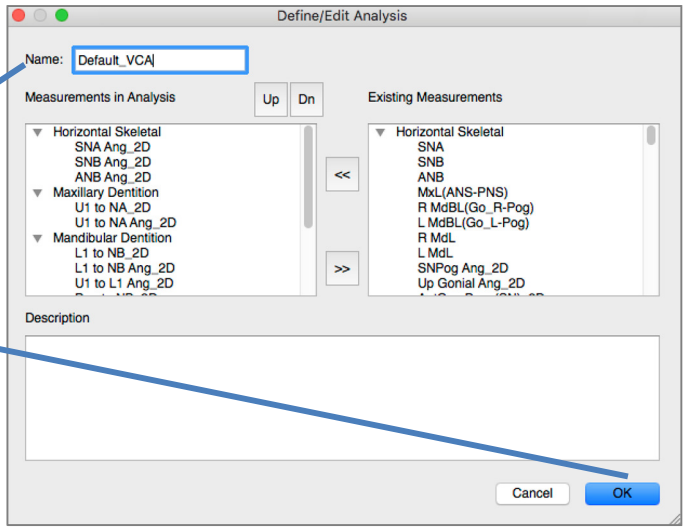


1. Left click on the name of the desired analysis. "Default" chosen in this example.

2. Click the **Edit** button.

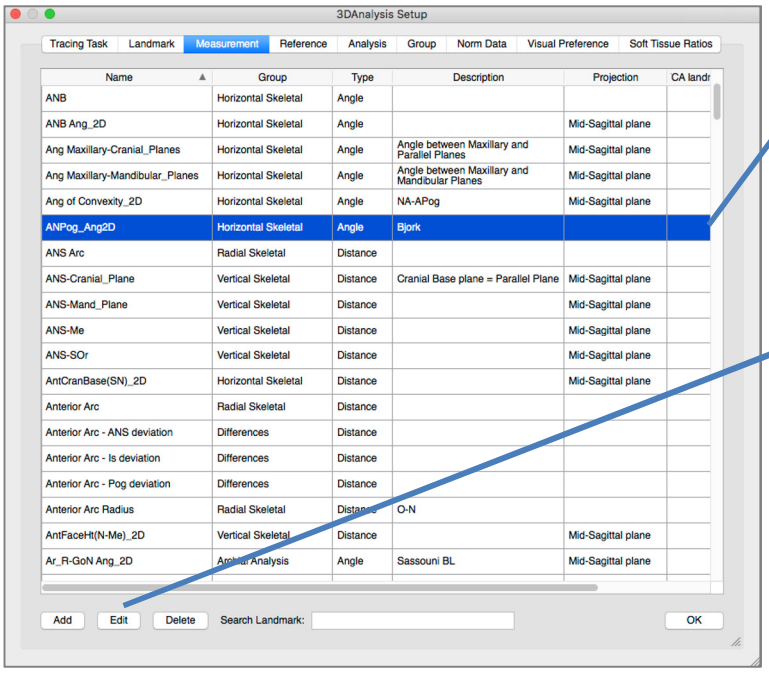
3. The Define/Edit Analysis window will appear. Change the name to end in "_VCA".

4. Click OK to exit the Define/Edit Analysis window. Then, click **OK** to exit 3DA Setup completely.



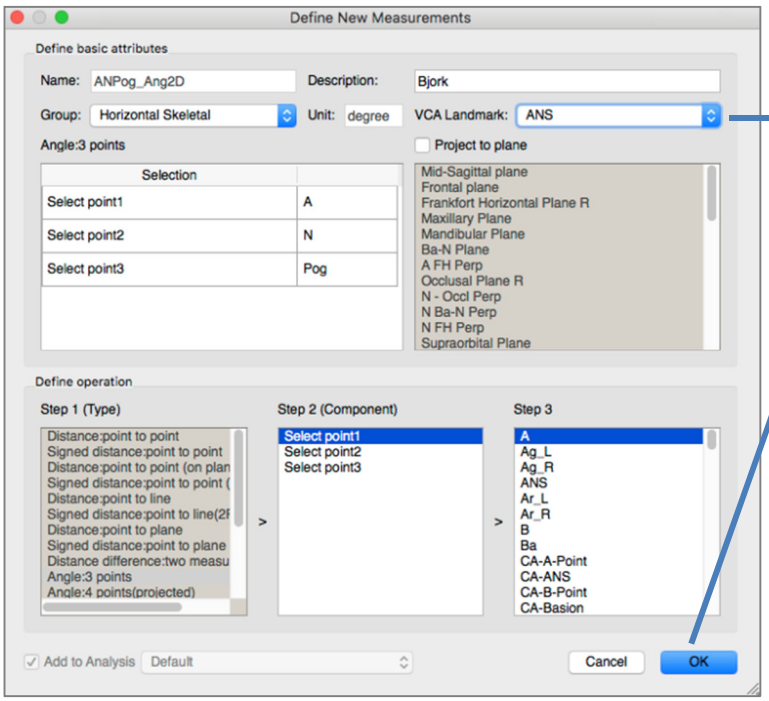
Configure Individual Measurements:

Open the 3DA Setup dialog with the  icon and navigate to the Measurement tab of this window (third from the right). For this step, it would help to have a list of measurements handy as a reminder of which ones to configure.



1. Left-click on the line of a measurement you want to configure.

2. Click **Edit**.

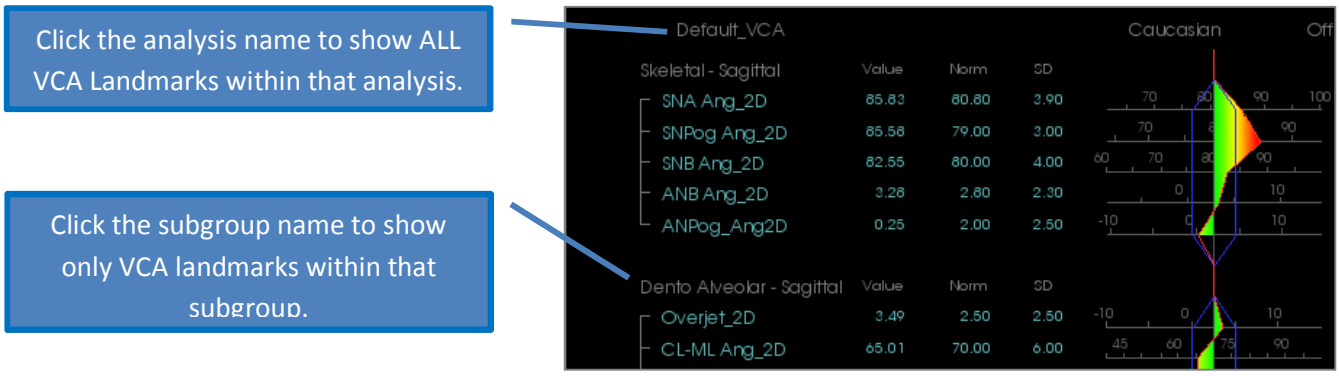


3. Click drop-down next to VCA Landmark; choose a landmark (does not have to be part of the measurement definition).

4. Click **OK** to exit the window. Repeat for additional measurements. (Note: Multiple measurements cannot be configured to the same VCA landmark.)

Trace the Case/Turn on VCA Landmark Visibility:

Trace the case so that the necessary landmarks are completed for the analysis as well as for the VCA landmarks. Alternatively, a pre-traced case can be opened.

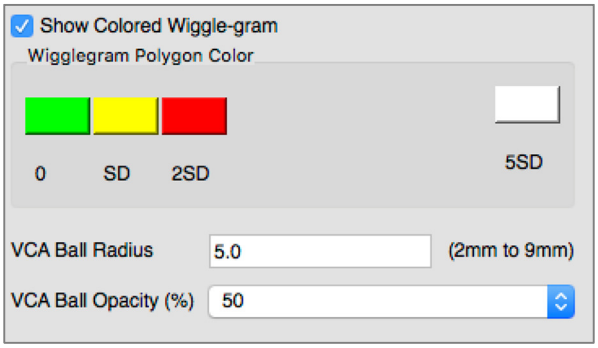


If the VCA landmarks fail to appear, causes may be:

- The analysis name is not properly configured. (See pg. 155)
- The VCA landmarks configured to the measurements are not properly configured or traced. (See pg. 154)
- There is no available norm data for the measurement.

Additional VCA Settings (Visual Preferences) :

- VCA indicator color settings are tethered to the Wigglegram Polygon Color. Change the settings for the colored wigglegram to change the color of VCA indicators.
- VCA indicator ball radius can be set to between 2 and 9 mm.
- VCA indicator ball opacity can be changed to an opacity percentage preset (0, 25, 50, 75, 100).

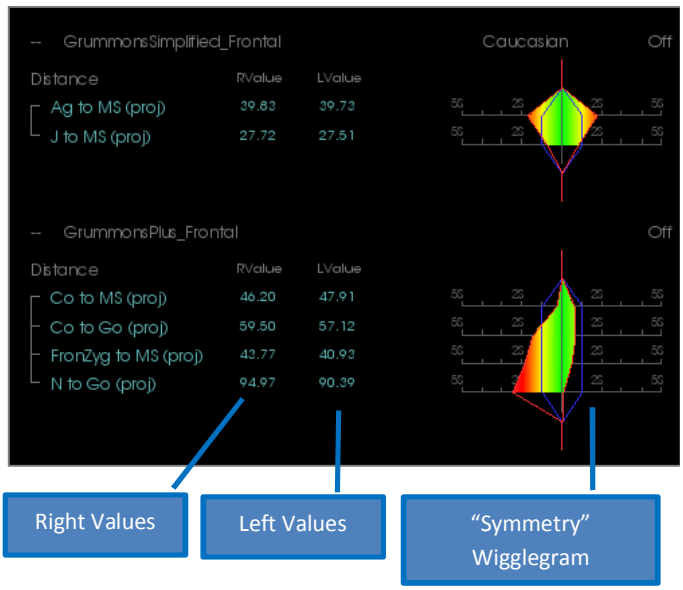


3DAnalysis: Advanced Analysis Configurations

3DAnalysis can be configured to become a more effective tool for certain analyses. Currently, additional features are supported for "frontal" analyses as well as the Sassouni Analysis.

Configuring a Frontal Analysis

The wigglegram features a special "Frontal Analysis" mode to support frontal analyses. The benefit of this mode is a more succinct format of measurement presentation. Both the measurement values and wigglegram adapt to show the left and right values of a certain measurement on the same line.



Two Aspects to Configure:

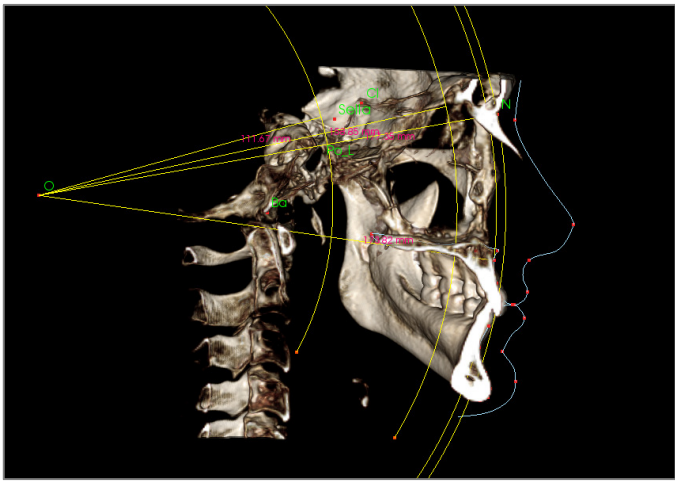
- Measurement pairs that are identical except for a "_R" or "_L" to indicate the left and right side (ex. Co_R to MSP, Co_L to MSP)
- The analysis name must end in "_Frontal".

NOTE: A frontal analysis can only contain pairs of symmetry measurements (_L, _R). If your analysis contains measurement pairs AND singular measurements, you must split the analysis. The singular measurements should be in a separate analysis without the "_Frontal" suffix.

Configuring a Sassouni Analysis

A special feature exists that creates an automatic Sassouni O-Point if the appropriate data is present. The O-Point definition is based on the generally accepted Sassouni principle that states it is the midpoint of the shortest vertical line segment that contacts all four prerequisite planes.

To Automatically Generate O-Point: The following four default planes must be traced: Parallel, Mandibular, Maxillary, and Occlusal Plane R. After tracing these planes, open/close to refresh the Create Tracing window to activate the O-Point. The Sassouni O-Point is a 2nd Tier landmark.



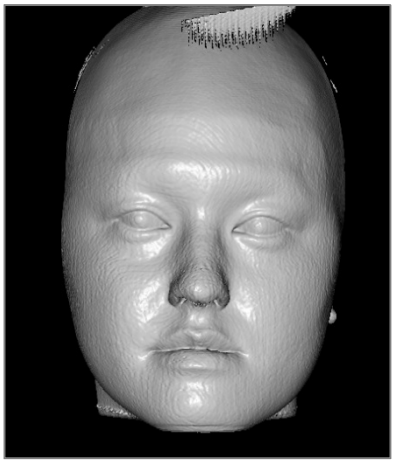
NOTE: The Parallel Plane requires the Supraorbitale Plane to be defined. The following Sassouni-specific landmarks are therefore required: **Si, RO, Cl.**

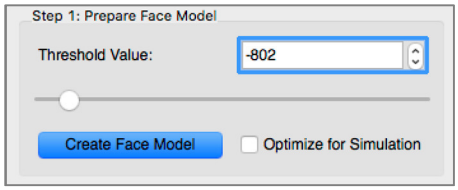
3DAnalysis: Create Face Photo

3DAnalysis allows the user to wrap a common digital photograph over the patient's soft tissue. This creates a realistic 3D "skin" that takes the texture of the photograph and can be used to great effect in performing soft tissue simulations and patient demonstrations. The steps to creating a face photo wrap are as follows:

Click the **Create Face Photo** to open the dialog. There are two methods available.

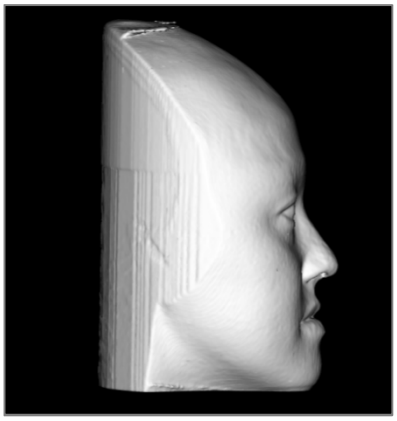
Generate face from photo:

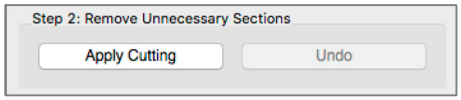




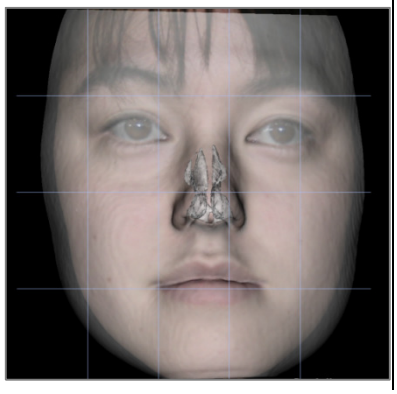
The objective is to move the slider until a smooth soft tissue frontal profile is visible. This setting will determine what level of tissue is used when creating the face model. Click **Create Face Model** when the correct setting is found. The face model will be created and automatically smoothed.

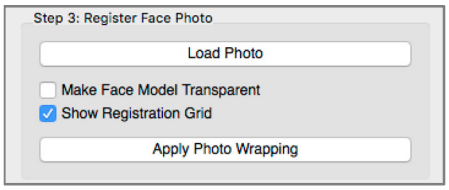
"Optimize for Simulation": When checked, the software will automatically reduce the number of triangles used in the model to 40,000. This is the optimal setting for soft tissue simulations.





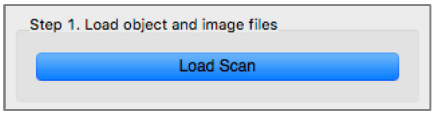
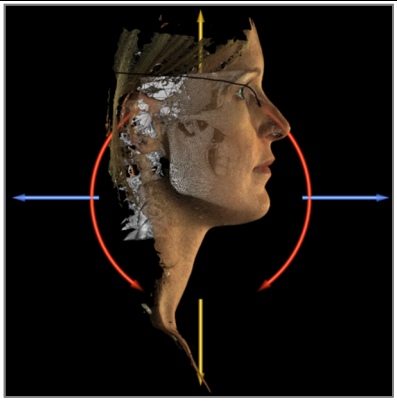
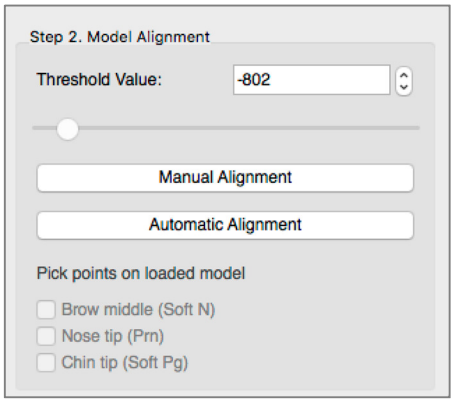
Click **Apply Cutting**. Use three cuts to trim away unnecessary parts of the face (that may cause distortion when the photo is applied). The first will cut through the face coronally just in front of the ear. The second will cut along the jaw line, making sure the cutting plane aligns with the mandibular plane. The third will cut axially across the top of the skull. Use the arrows to move the cutting plane and click the **right mouse button** to perform the cut. Click **Finish Cutting** when all unnecessary sections have been removed.





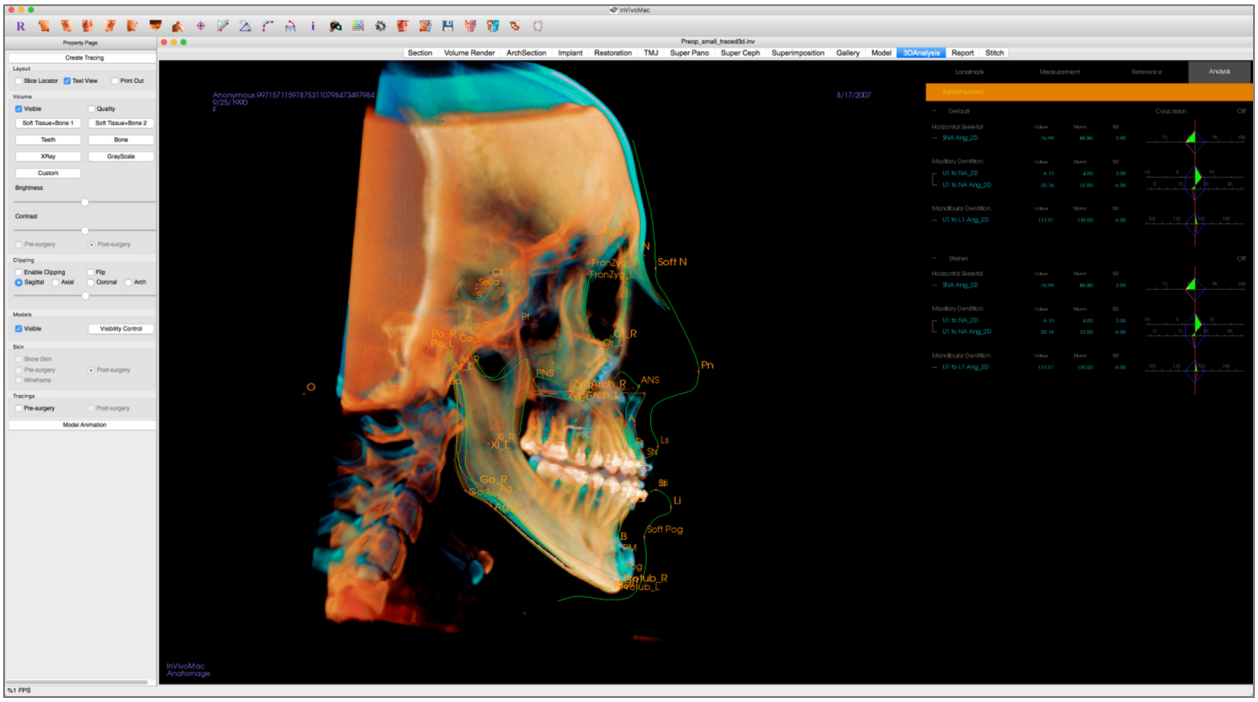
Click **Load Photo** and choose the appropriate photo from the file browser. Check to turn on "Make Face Model Transparent" and "Show Registration Grid" (intersections indicate registration points) and use image navigation shortcuts to align the photo, taking special care in the lip and nose regions. Click **Apply Photo Wrapping** when the correct alignment is found.

Load Face (.obj):

		Load the 3D object file and the corresponding texture file.
		The textured skin model can now be aligned to the volume either manually using the widget tool or automatically if the soft tissue profiles of the case have been traced. The automatic alignment process involves placing landmarks onto the textured skin model.

3DAnalysis: Landmark-Based Superimposition

A superimposition can be performed on the current tracing using any saved tracing (.inv or .ctr) file and user-configured landmarks. This feature combines the visual analysis aspect of volume superimposition with the quantitative details provided by a cephalometric analysis.



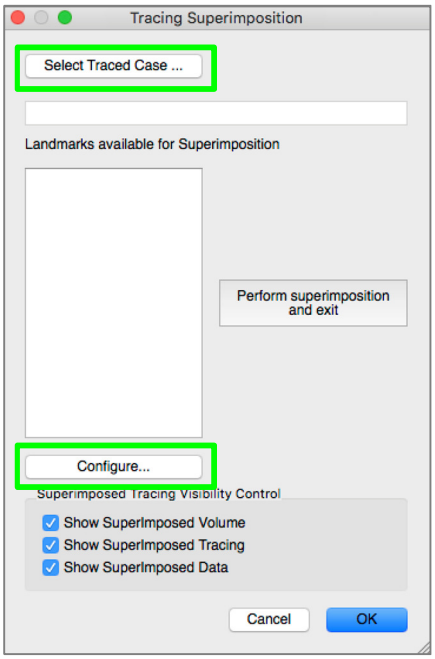
Features:

- View measurements from both volumes in the same window with easy toggle switching
- Visibility On/Off for superimposed volume, tracing, or data
- Automatic superimposition of volumes after one-time landmark configuration setup
- Allows for a template-based analysis (with superimposed saved tracing)
- Compatibility with VCA and frontal configurations
- Orientation synchronization with the Superimposition Tab

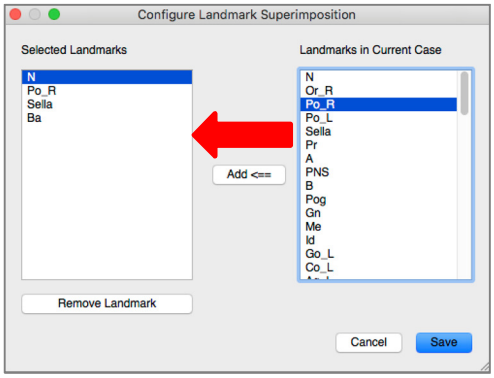
Performing Landmark-Based Superimposition

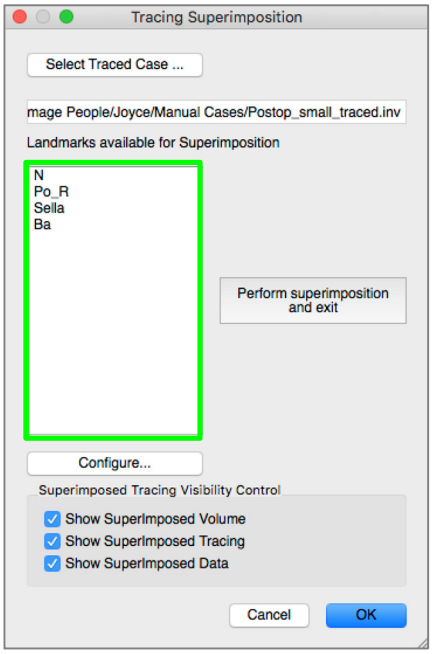
Click the **Superimpose Tracing** icon to open the dialog.

After tracing a case in 3DAnalysis, the user can select another traced case (.inv) or tracing file (.ctr) to superimpose over the original.



- Click **Select Traced Case...** to browse for the file. Select the case or saved tracing and click **Open** to close the browser. If an untraced case is chosen, an error will appear indicating that there is no tracing data.
- Click **Configure…** to open the Configure Landmark Superimposition window:





- Select a minimum of four landmarks from the current landmark list and click **Add** to move them to the left. Landmarks on the left will be checked with the superimposed tracing. If they have been traced, these landmarks will be used to register the two scans. Click **Remove Landmark** to remove landmarks if you are editing your saved configuration. Click **Save** to Exit.
- **Verify the available landmarks**. If the configured landmarks do not appear in this section, there is no tracing data available for those landmarks in the selected case.
- Click **Perform Superimposition And Exit** to perform the registration with the current configuration. This window will automatically close.
- Revisit this window to perform superimposition with another case (deleting the current superimposition), reconfigure the superimposition landmarks, and to toggle the following visibility options ("Superimposed Volume," "Superimposed Tracing," and "Superimposed Data").

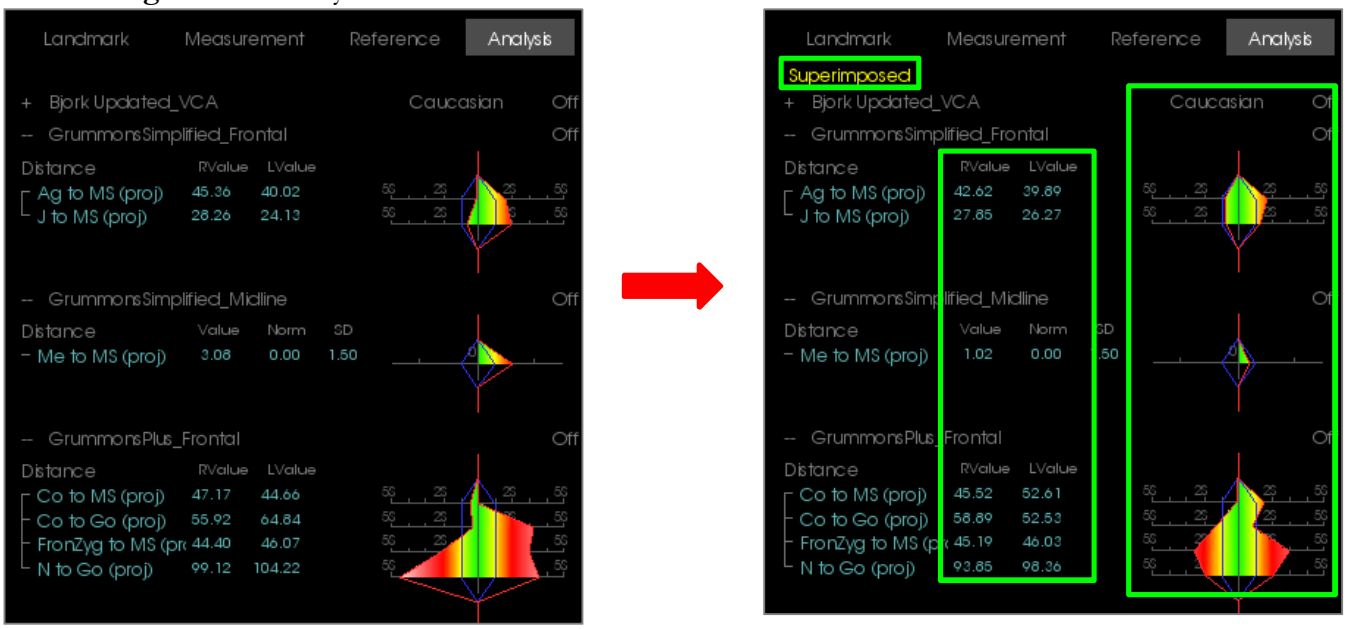
Tip: For performing a template-based analysis, the user can superimpose the saved tracing template to the patient scan using mid-sagittal plane landmarks.

Superimposition Text View

After a superimposition has been performed with a traced case, the Text View can be toggled to show either the tracing/analysis data for the current or superimposed case.

The Text View can be toggled by:

- Checking/unchecking the box next to "Show SuperImposed Data" in the Superimpose Tracing dialog.
- Clicking the "Superimposed" or "Default Tracings" banner above the text data to toggle data sets.
- **Pressing** "s" on the keyboard.



The yellow "Superimposed" text indicates which data set the Text View is currently displaying. If the superimposed tracing contains at least the same amount of corresponding data as the current, differences will only be seen in the measurement value section and the colored wigglegram, allowing the user to easily compare the two sets of data.

If toggling reveals a discrepancy in the available measurements, landmarks, or references, then check to make sure that the two cases contain the same traced landmarks and profiles.

Visual preferences are locked for the superimposed case – only the visual preferences for the current case can be changed. Alter these settings to help differentiate between the two data sets, such as angle and line color. Superimposed tracing color will be yellow by default.

How Does 3DAnalysis Work with the Superimposition Tab?

3DAnalysis landmark-based superimposition and Import Volume within the Superimposition Tab achieve the same basic purpose with some differences only in the available tools and method of superimposition. The compatibility of the two methods of superimposition will be explained below.

Only one superimposition can be supported at a time

- Users can either choose to import a saved tracing using the **Import New Volume** function of Superimposition tab or the **Superimpose tracing** function of 3DAnalysis. The volume will be visible in both views, with additional tracing data visible in 3DAnalysis if it exists.
- Trying to superimpose an additional case in either tab with a superimposition already performed will overwrite the currently superimposed case. **Mirror Own Volume** will also overwrite the current superimposition.
- Changes in orientation performed in one tab will affect the other tab. The benefit of this is that a user can superimpose to landmarks in 3DAnalysis and then move to the Superimposition tab and perform an additional volume-based registration to fine-tune the location of the superimposition.

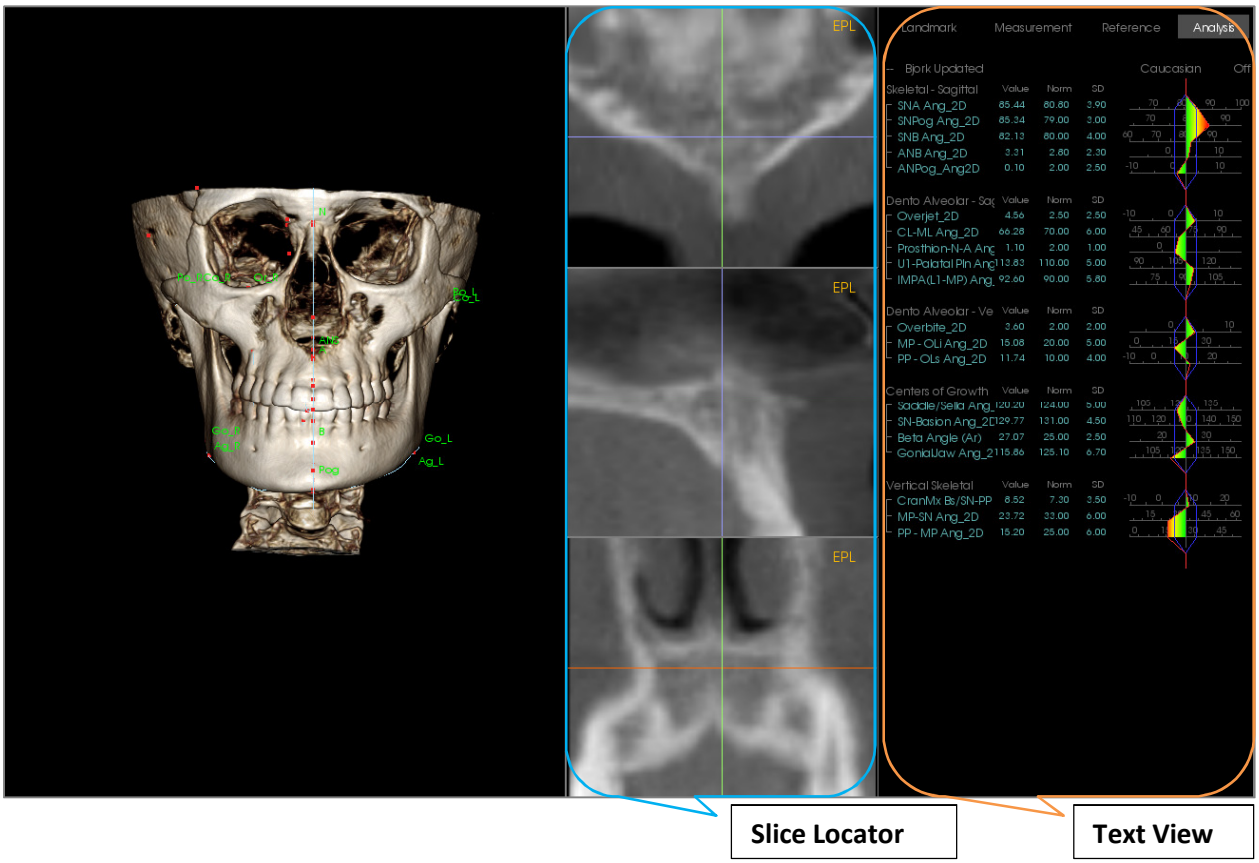
The following settings must be performed in the Superimposition Tab (to take effect in 3DA):

- Clipping
- Volume rendering presets
- Brightness and contrast settings
- Volume Registration
- Adjustments by move widget

The following settings overlap between the two tabs:

- Superimposed volume on/off
- Landmark registration (in 3DA, this is performed automatically with preconfigured landmarks)

3DAnalysis: Layout Options

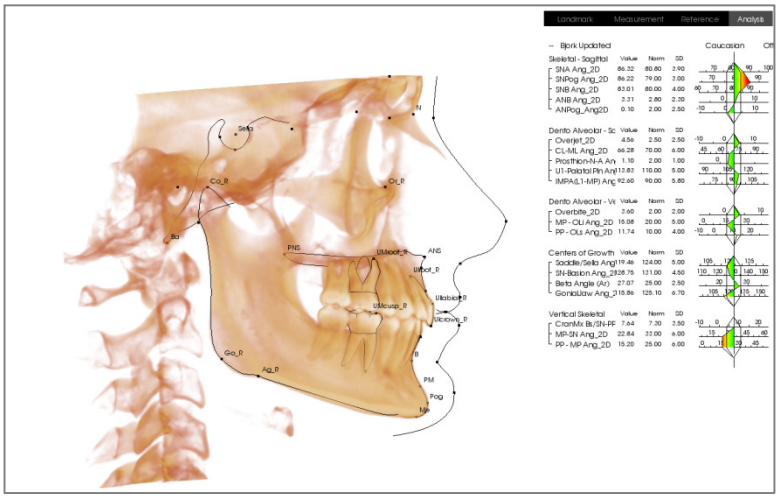


Slice Locator: This three-paned window allows the user to adjust the placement of points using multiple viewing angles of the same location: axial, coronal, and sagittal. This tool is important for placing landmarks that require increased accuracy, such as the top of the condyle head. The panes are zoomed-in to provide additional accuracy.

Text View: Contains visibility controls and values for landmarks, measurements, reference planes, and analysis configurations.

Print Layout: This layout loads preconfigured visibility options that are printer-friendly so the user can easily share or save a physical copy of the analysis results. In this layout mode, printing will automatically occur with the volume in life-size.

Zoom-in and zoom-out features will be disabled to maintain a life-sized volume, and all text and tracing will be black by default. Both the volume and colored wigglegram will maintain color unless configured differently.



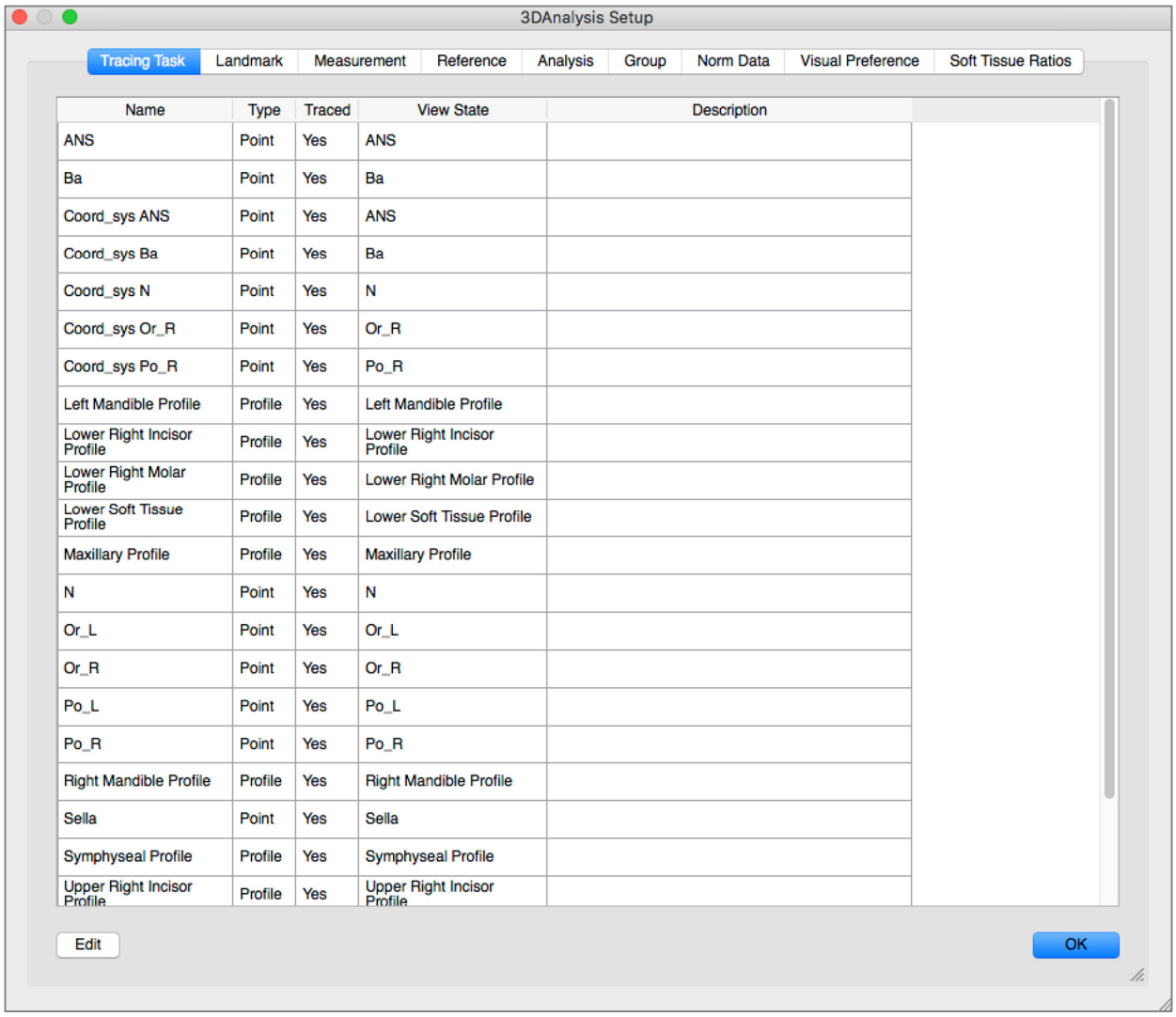
Print Out View

3DAnalysis: 3DAnalysis Settings

Press the 3DAnalysis **Settings** icon and a window will appear allowing you to create and/or define any of the following:

- **Tracing Tasks**
- **Landmarks**
- **Measurements**
- **References (Lines, Planes)**
- **Analyses**
- **Groups**
- **Population Norm Data**
- **Visual Preference**
- **Soft Tissue Ratios**

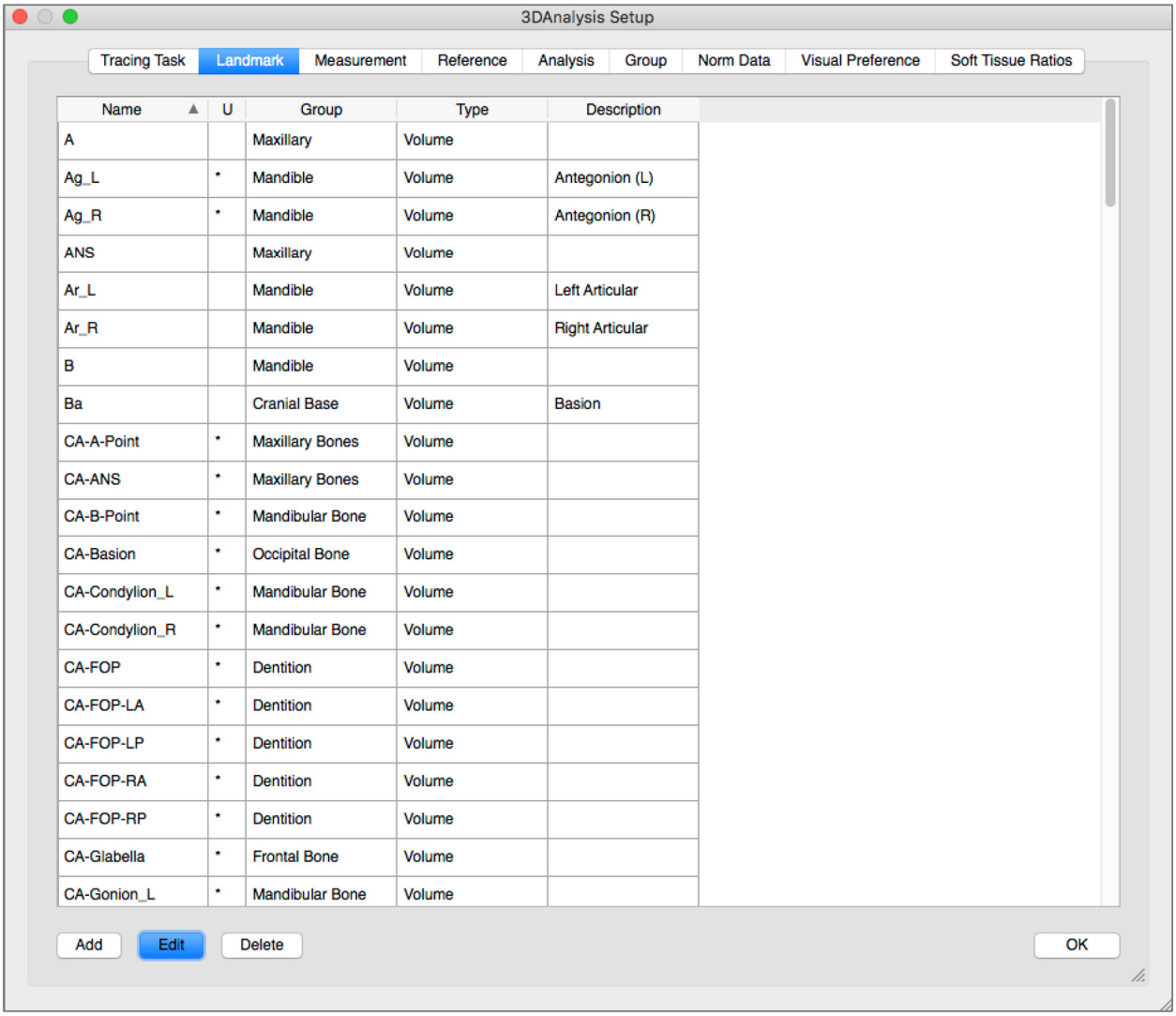
Tracing Task: This tab shows the definition list of current tracing task series. The tracing task will be performed in the order displayed on this list. To change the tracing task order, press the **Edit** button in the bottom left corner of the window. According to the definition of coordinate system, the appropriate coordinate system defining tasks will always be the starting tasks and added automatically.



Name	Type	Traced	View State	Description
ANS	Point	Yes	ANS	
Ba	Point	Yes	Ba	
Coord_sys ANS	Point	Yes	ANS	
Coord_sys Ba	Point	Yes	Ba	
Coord_sys N	Point	Yes	N	
Coord_sys Or_R	Point	Yes	Or_R	
Coord_sys Po_R	Point	Yes	Po_R	
Left Mandible Profile	Profile	Yes	Left Mandible Profile	
Lower Right Incisor Profile	Profile	Yes	Lower Right Incisor Profile	
Lower Right Molar Profile	Profile	Yes	Lower Right Molar Profile	
Lower Soft Tissue Profile	Profile	Yes	Lower Soft Tissue Profile	
Maxillary Profile	Profile	Yes	Maxillary Profile	
N	Point	Yes	N	
Or_L	Point	Yes	Or_L	
Or_R	Point	Yes	Or_R	
Po_L	Point	Yes	Po_L	
Po_R	Point	Yes	Po_R	
Right Mandible Profile	Profile	Yes	Right Mandible Profile	
Sella	Point	Yes	Sella	
Symphyseal Profile	Profile	Yes	Symphyseal Profile	
Upper Right Incisor Profile	Profile	Yes	Upper Right Incisor Profile	

- **Edit:** Opens "Tracing Guide" dialog to edit the tracing task list or adjust the view states for individual tracing tasks. For more information, refer to **3DAnalysis: Tracing Guide** (pg. 176).

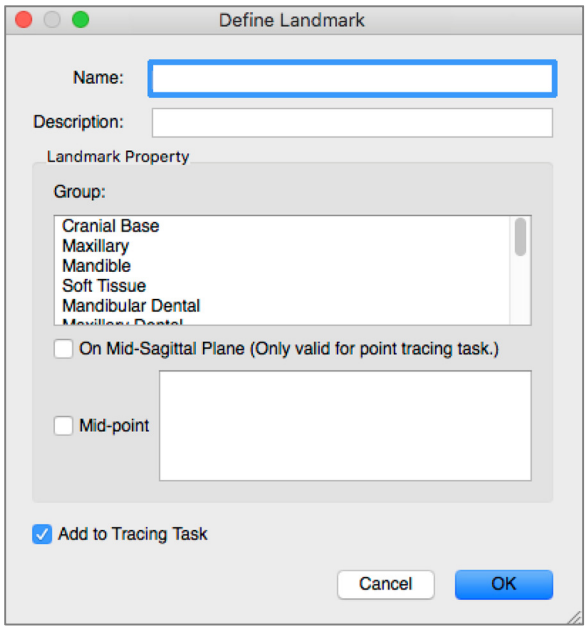
Landmark: This tab shows the definition list of all available landmarks that can be used for defining measurements and references. Each landmark has a unique name and will be displayed in every view within the Rendering Window. Landmarks have a group definition for sorting when Text View is activated. You can add user-defined landmarks, marked with a star (*) in column 'U.' Predefined landmarks cannot be deleted. User-defined landmarks cannot be deleted when used by other measurements or references.



- **Add:** Create a new landmark
- **Edit:** Edit currently selected landmark
- **Delete:** Delete currently selected user-defined landmark

Special Landmark Properties

Underneath the group list, there are two landmark properties that can be modified using the adjacent checkboxes:

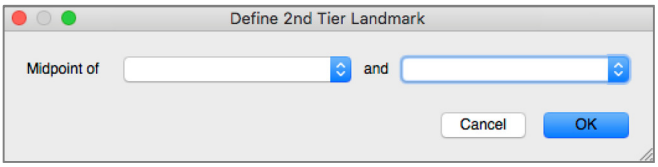


On Mid-Sagittal Plane

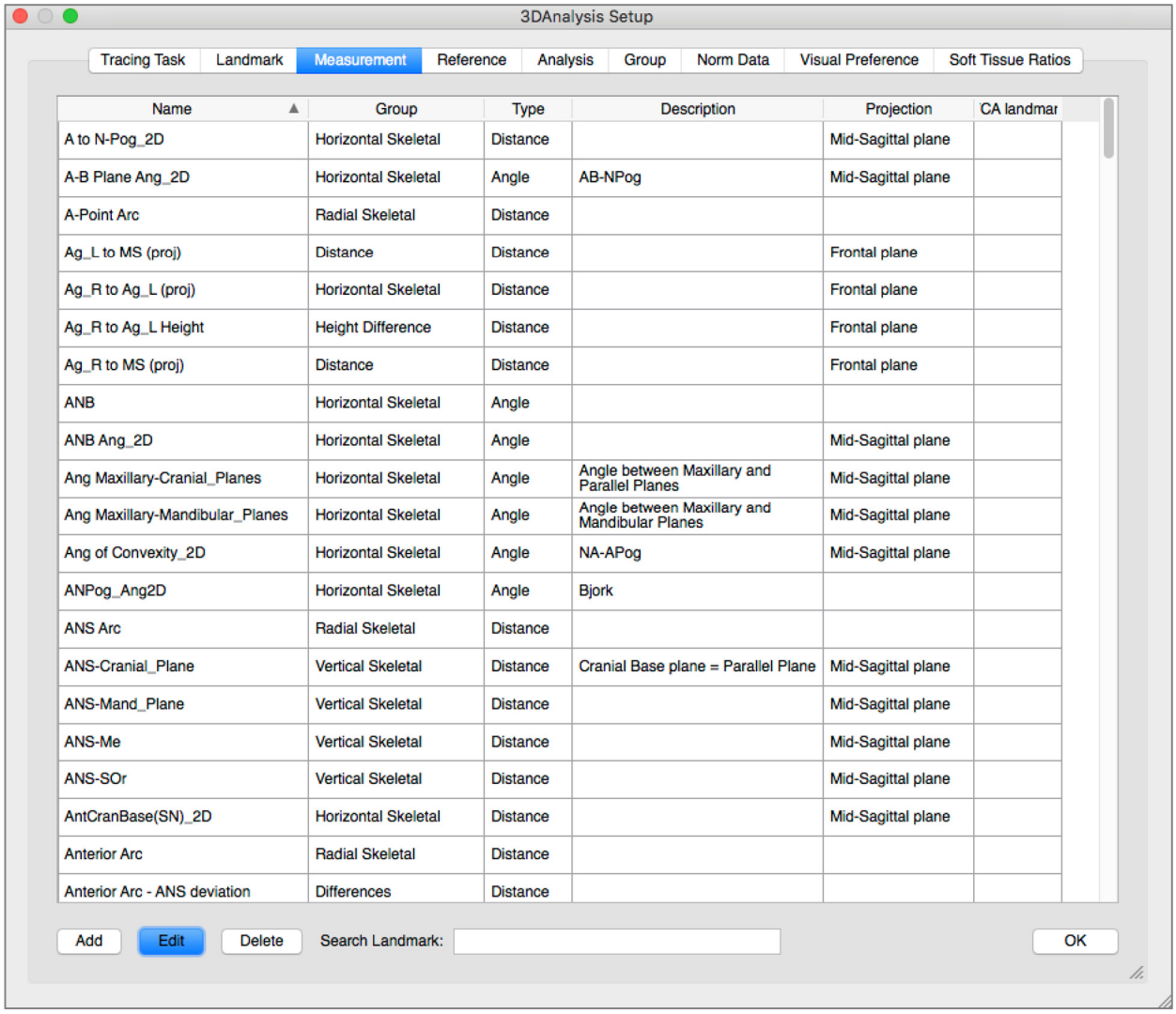
Projects a landmark on any part of the volume directly to the defined mid-sagittal plane. Cannot be used to define the coordinate system.

Midpoint

Automatically creates a midpoint between two landmarks when both are traced; there will be no tracing task option. Clicking the checkbox will bring up a Define 2nd Tier landmark submenu with two drop-down boxes for selecting the landmarks. 2nd Tier indicates that the placement of the landmark is dependent on the placement of other landmarks. Can be used to define the coordinate system.



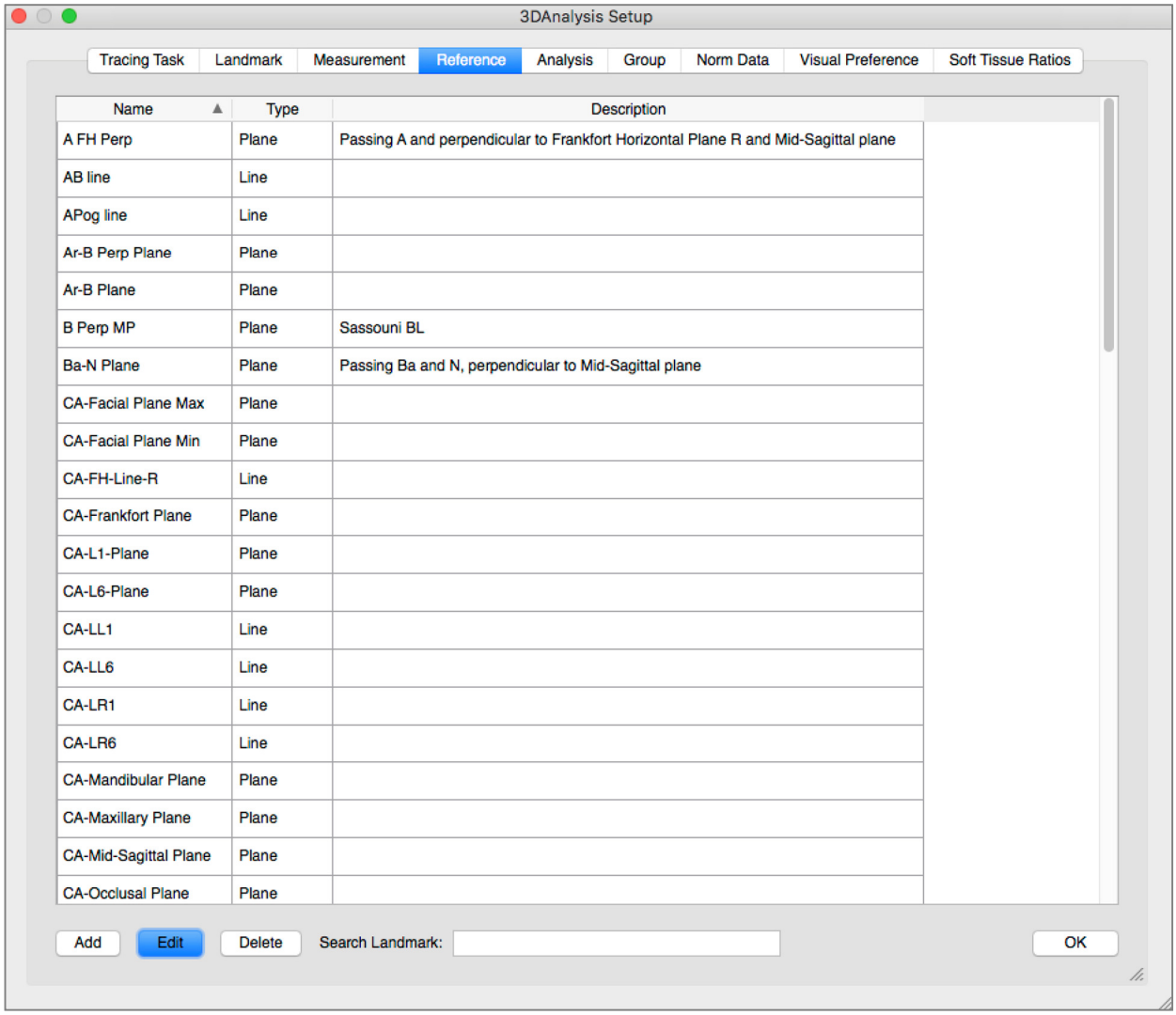
Measurement: This tab shows the definition list of all available measurements. Every measurement has a unique name and will be displayed in every view within the rendering window. Measurements have a group definition for sorting when Text View is activated. Measurements can be defined in several ways using default and/or user-defined landmarks, reference lines, and reference planes. Measurements can be in 3D or projected to a specified reference plane for supporting 2D measurements. Measurements cannot be deleted when used in an analysis.



Name	Group	Type	Description	Projection	CA landmar
A to N-Pog_2D	Horizontal Skeletal	Distance		Mid-Sagittal plane	
A-B Plane Ang_2D	Horizontal Skeletal	Angle	AB-NPog	Mid-Sagittal plane	
A-Point Arc	Radial Skeletal	Distance			
Ag_L to MS (proj)	Distance	Distance		Frontal plane	
Ag_R to Ag_L (proj)	Horizontal Skeletal	Distance		Frontal plane	
Ag_R to Ag_L Height	Height Difference	Distance		Frontal plane	
Ag_R to MS (proj)	Distance	Distance		Frontal plane	
ANB	Horizontal Skeletal	Angle			
ANB Ang_2D	Horizontal Skeletal	Angle		Mid-Sagittal plane	
Ang Maxillary-Cranial_Planes	Horizontal Skeletal	Angle	Angle between Maxillary and Parallel Planes	Mid-Sagittal plane	
Ang Maxillary-Mandibular_Planes	Horizontal Skeletal	Angle	Angle between Maxillary and Mandibular Planes	Mid-Sagittal plane	
Ang of Convexity_2D	Horizontal Skeletal	Angle	NA-APog	Mid-Sagittal plane	
ANPog_Ang2D	Horizontal Skeletal	Angle	Bjork		
ANS Arc	Radial Skeletal	Distance			
ANS-Cranial_Plane	Vertical Skeletal	Distance	Cranial Base plane = Parallel Plane	Mid-Sagittal plane	
ANS-Mand_Plane	Vertical Skeletal	Distance		Mid-Sagittal plane	
ANS-Me	Vertical Skeletal	Distance		Mid-Sagittal plane	
ANS-SOr	Vertical Skeletal	Distance		Mid-Sagittal plane	
AntCranBase(SN)_2D	Horizontal Skeletal	Distance		Mid-Sagittal plane	
Anterior Arc	Radial Skeletal	Distance			
Anterior Arc - ANS deviation	Differences	Distance			

- **Add:** Create a new measurement.
- **Edit:** Edit currently selected measurement.
- **Delete:** Delete currently selected measurement.
- **Search Landmark:** Search for measurements by landmark.

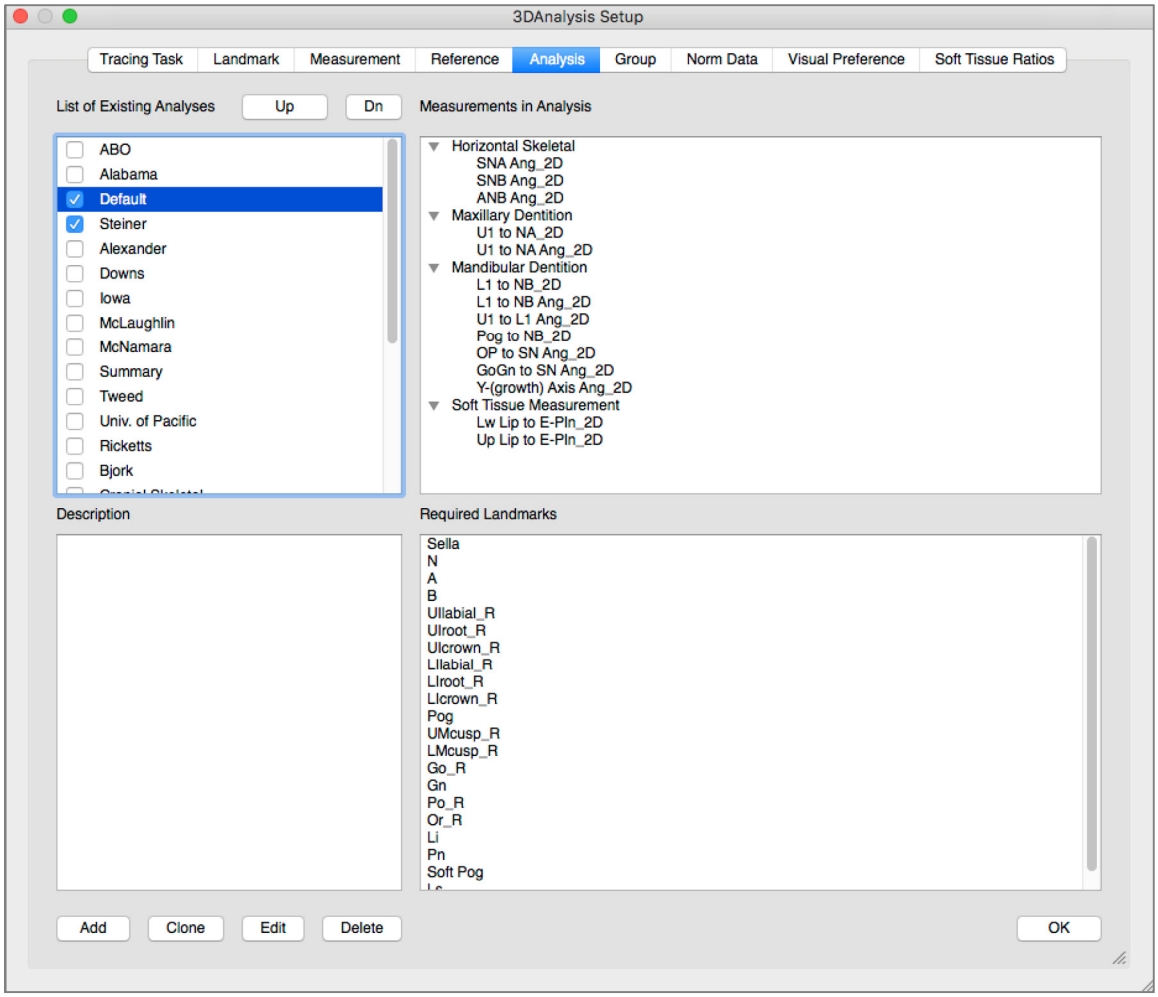
Reference: This tab shows the definition list of all available references. Every reference has a unique name and will be displayed in every view within the rendering window. References have a group definition for sorting when Text View is activated. Reference lines and reference planes can be defined in several ways using landmarks and/or other reference lines and planes. References cannot be deleted when used to define other measurements, references or the coordinate system (ex: mid-sagittal plane and frontal plane).



- **Add:** Create a new reference line or reference plane.
- **Edit:** Edit currently selected reference.
- **Delete:** Delete currently selected reference.
- **Search Landmark:** Search for references by landmark.

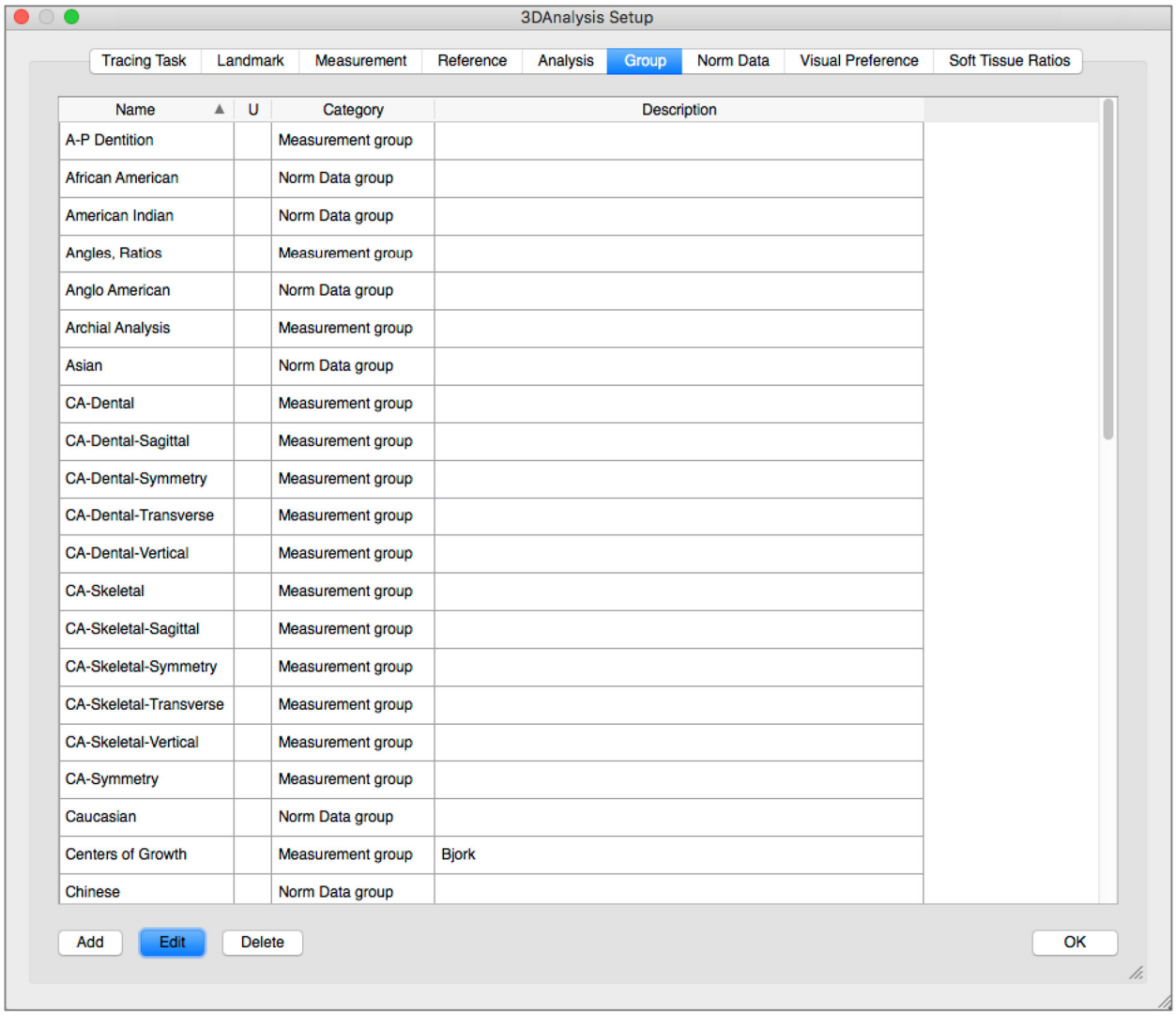
Analysis: This tab shows the definition list of all available analyses. Analyses include existing 2D analysis standards (ex: McNamara, Ricketts, Steiner). You can also create your own analysis using default and/or user-defined measurements. Only checked analyses will be reported within the Text View and only default analyses can be compared to existing data using norm data (compared visually using wigglegram). User-defined analyses can be compared to existing data if the data is added manually (see the **Norm Data** section, pg. 173).

The tracing tasks required for all of the measurements of the selected analysis are displayed under Required Landmarks but may need to be manually added into the Tracing Tasks list (see **3DAnalysis: Tracing Guide**, pg. 176).



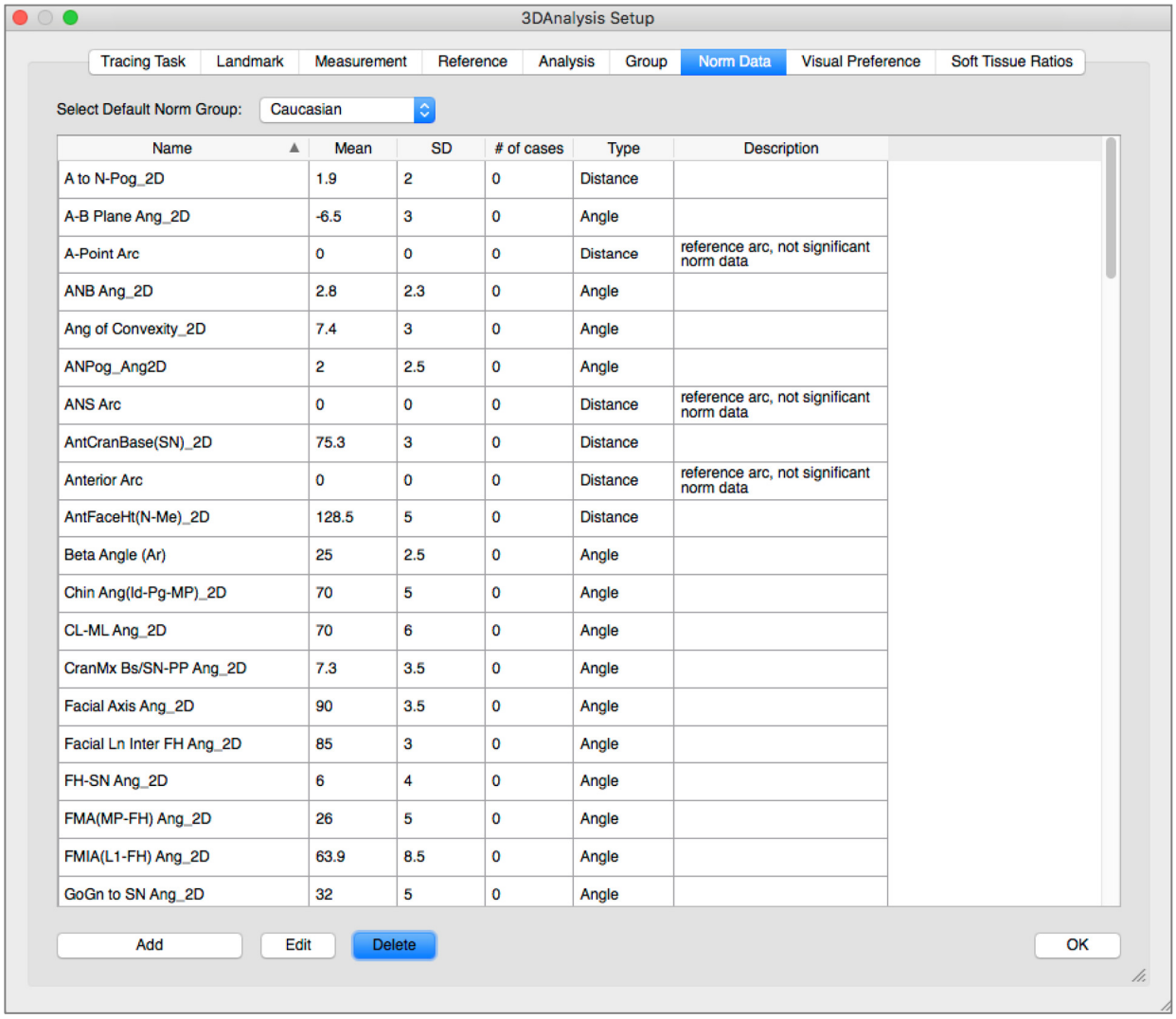
- **Add:** Create a new analysis.
- **Clone:** Make a copy of the currently selected analysis.
- **Edit:** Edit currently selected analysis.
- **Delete:** Delete currently selected analysis.

Group: This tab shows the definition list of all available groups used for landmarks, measurements, and norm data. By default, four predefined user Norm Data Groups (My African American, My Asian, My Caucasian and My Latin) are automatically generated within the definition list. A user-defined Norm Data Group can reference an external norm data file or CSV file. This file can be an accumulated measurement archive file.



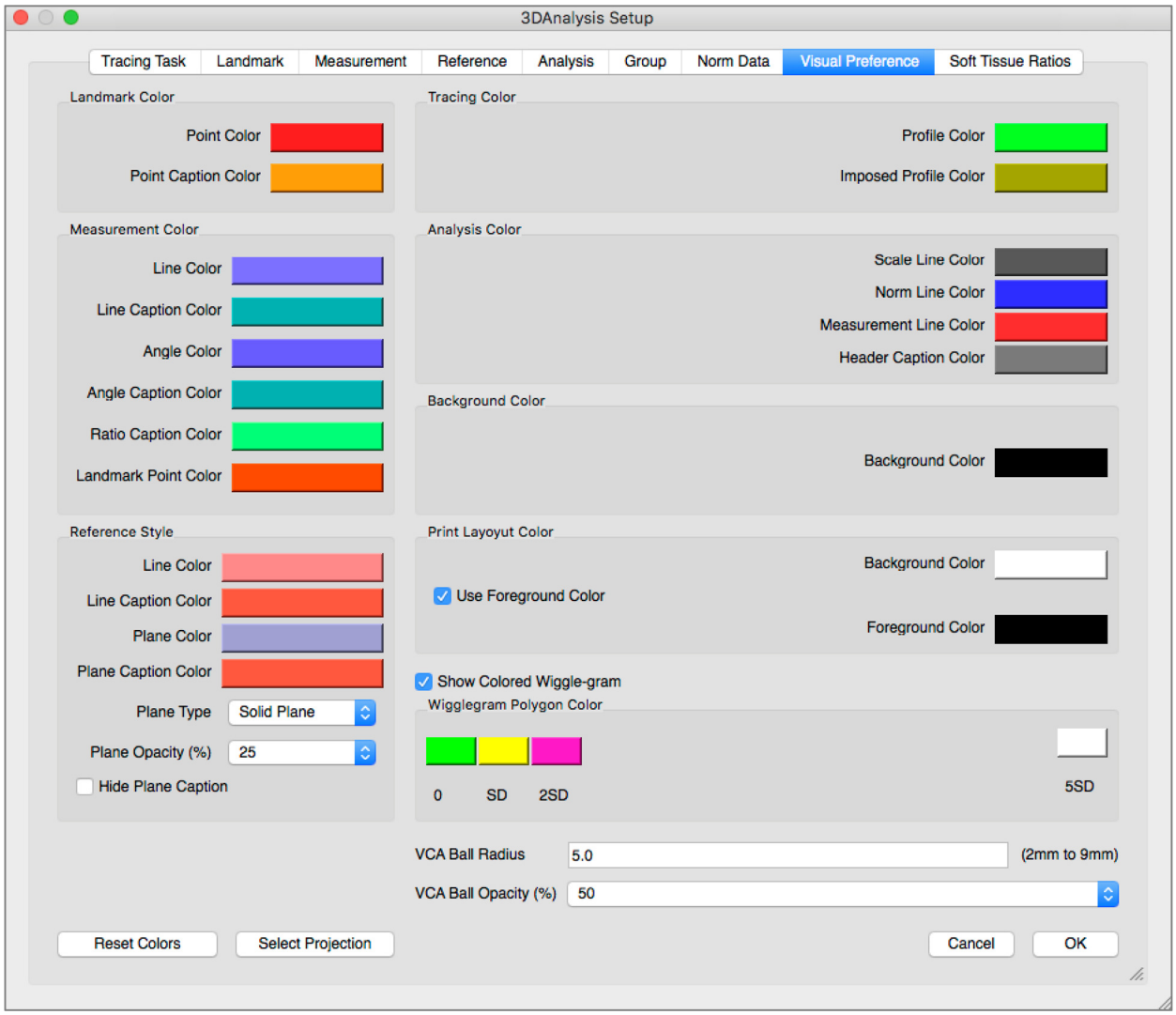
- **Add:** Create a new group.
- **Edit:** Edit currently selected group.
- **Delete:** Delete currently selected group.

Norm Data: This tab shows the norm data (mean and standard deviation of measurements) list of all available ethnic Norm Data Groups that can be used for analysis and displayed graphically using the wigglegram. The norm data can be changed at any time in 3DAnalysis so you can compare the patient's tracings with data from several ethnic groups. The default Norm Data Group is Caucasian, but 3DAnalysis includes norm data for other well-known ethnic groups. Custom Norm Data Groups can be defined using external norm data files (see **Group** section, pg. 172). The mean and standard deviation of new measurements can also be defined manually within the Norm Data tab.

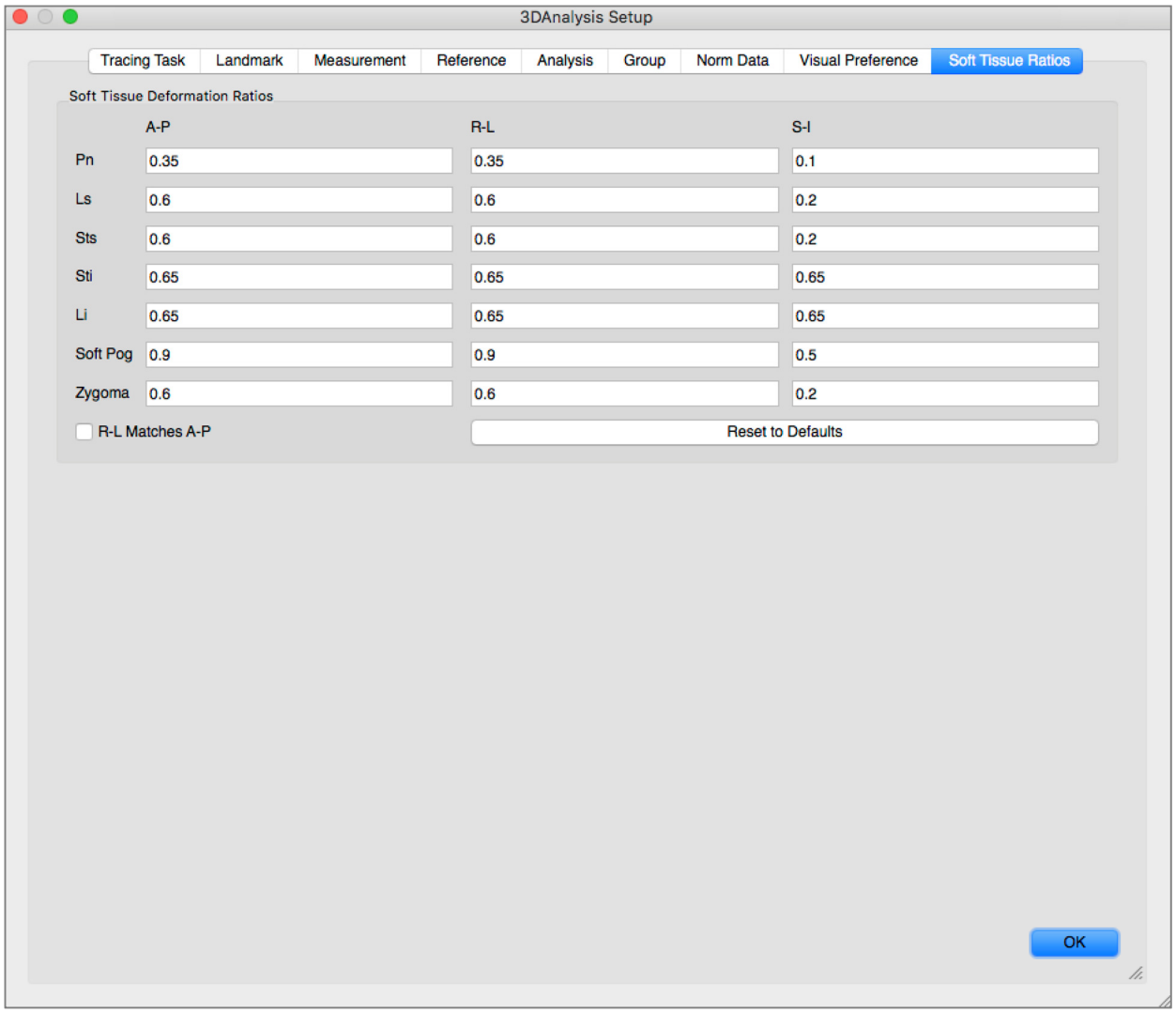


- **Add:** Create a new norm data.
- **Edit**: Edit currently selected norm data.
- **Delete:** Delete currently selected norm data.

Visual Preference: This tab allows you to change the colors and attributes of 3DAnalysis objects and select color usage for Print Layout. **Select Projection** can select projection type of light source from volume object with parallel projection set by default. When "Use Foreground Color" is unchecked, all 3DAnalysis objects (landmarks, measurements, references, etc.) will be displayed in color on Print Layout.



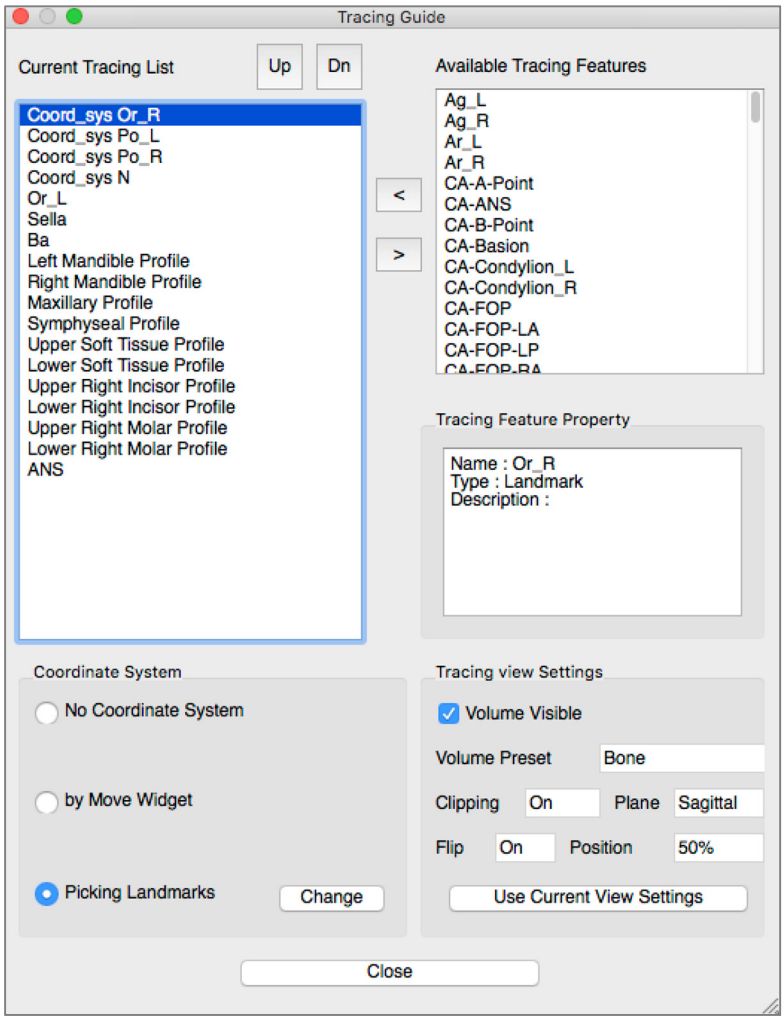
Soft Tissue Ratios: This tab allows you to change the soft tissue deformation ratios across different axes for 3D Surgery manipulations. Checking "R-L Matches A-P" will match the R-L values to the A-P values of the respective landmarks automatically. **Reset to Defaults** will revert the values to the ones shown below.



Warning: Soft tissue prediction is an approximation and may not reflect actual results.

3DAnalysis: Tracing Guide

To open the Tracing Guide window, press either the **Setup** button from the Tracing Tasks window or **Edit** from the Tracing Tasks tab within **Settings**.



Tracing Guide: The Tracing Guide window shows a list of the current Tracing Tasks (left list box) and a list of available Tracing Features (right list box). Within the window, you can add, move, or reorder Tracing Tasks, change the coordinate system and record the best view settings for specific Tracing Tasks.

- **<:** Add the highlighted Available Tracing Feature to the Current Tracing List. All available landmark definitions and predefined profile Tracing Tasks currently not in use are listed in Available Tracing Features box.
- **>:** Remove the highlighted tracing task from the Current Tracing List. Coordinate system tracing tasks and respective landmarks cannot be removed.
- **Up:** Change order to move up that selected tracing task. Tracing tasks near the top of the list take priority when creating tracings. Tracing tasks do not take priority over coordinate system tracing tasks and so cannot move above coordinate system tracing tasks.
- **Dn**: Change order to move down that selected tracing task. Coordinate system tracing tasks cannot move below normal tracing tasks.

- **Coordinate system change:** You can change coordinate system definition by selecting either "No Coordinate System," "by Moving Widget," or "Picking Landmarks." Select **Change** to change which landmarks will define the coordinate system. (See **3DAnalysis: Coordinate System**, pg. 139.)
- **Use Current View Settings:** You can change the default view state of a tracing task. Highlight a tracing task under the "Current Tracing List." Set the Rendering Window to a preferred view by adjusting the brightness, volume visibility (if tracing on models for certain tasks), orientation, clipping, etc. (relative to the current patient coordinate System). Press **Use Current View Settings** to save the current view state. During your tracing, the highlighted tracing task will automatically set itself to the saved view state.

Note: Before adding the frontal incisor profiles to the current tracing task list, you must first ensure that the lateral profiles are no longer on the list.. The two types of incisor profiles are not intended to be used simultaneously.

3DAnalysis: Default Tracing Tasks and Landmarks

Name	Definition	Description
A	A-Point	Deepest midline point on the premaxilla between the anterior nasal spine and prosthion. Point is determined within the software from the maxillary profile.
Ag_L	Left Antegonion	Highest point of the concavity of the lower border of the ramus where it joins the body of the mandible (left side). Point is determined within the software from the left mandibular profile.
Ag_R	Right Antegonion	Highest point of the concavity of the lower border of the ramus where it joins the body of the mandible (right side). Point is determined within the software from the right mandibular profile.
ANS	Anterior Nasal Spine	Anterior point of nasal spine defined by the maxillary profile.
B	B-Point	Deepest midline point on the mandible between infradentale and pogonion. Point is determined within the software from the symphyseal profile.
Ba	Basion	Anterior point of foramen magnum.
Co_L	Left Condyle	Most posterior superior point on the condyle of the mandible (left side). Point is determined within the software from the mandibular profile.
Co_R	Right Condyle	Most posterior-superior point on the condyle of the mandible (right side). Point is determined within the software from the mandibular profile.
Coord_sys ...	Coordinate System Defining Point	The landmark (preceded with "Coord_sys") will be used to define the coordinate system for subsequent landmarks and tracing tasks.
Custom Profile	Custom Profile	Using points with connecting lines, a custom profile can be made to highlight a certain anatomical feature.
Gn	Gnathion	Point on chin between the menton and pogonion. Point is determined within the software from the symphyseal profile.
Go_L	Left Gonion	Most outward point on the angle formed by the junction of the ramus and the body of the mandible (left side). Point is determined within the software from the mandibular profile.
Go_R	Right Gonion	Most outward point on the angle formed by the junction of the ramus and the body of the mandible (right side). Point is determined within the software from the mandibular profile.
Id	Infradentale	Point of transition from the crown of the most prominent mandibular medial incisor to the alveolar projection. Point is determined within the software fom the mandibular profile.
Ils	Soft-tissue B Point	Deepest midline point on the mandible between the infradentale and the pogonion projected onto the soft tissue.Point is determined within the software from the lower soft tissue profile.
Left Mandibular Profile	Left Mandibular Profile	Trace the left-side mandibular profile with a series of points (double-click or right-click to finish tracing). Include the coronoid process, mandibular notch, condyle, and ramus profiles.
Li	Labrale Inferius	Most anterior point of lower lip. Point is determined within the software from the lower soft tissue profile.
Ls	Labrale Superius	Most anterior point of upper lip. Point is determined within the software from the lower soft tissue profile.

Lower Left Incisor Profile	Lower Left Incisor Profile	Define the profile of the lower left incisor using 3 points: 1. Root of lower incisor (LIroot_L) 2. Crown of lower incisor (LIcrown_L) 3. Labial point of lower incisor (LIlabial_L)
Lower Left Molar Profile	Lower Left Molar Profile	Define the profile of the lower left molar using 3 points: 1. Anterior root of lower molar (LMroot_L) 2. Anterior cusp of lower molar (LMcusp_L) 3. Posterior cusp of lower molar
Lower Right Incisor Profile	Lower Right Incisor Profile	Define the profile of the lower right incisor using 3 points: 1. Root of lower incisor (LIroot_R) 2. Crown of lower incisor (LIcrown_R) 3. Labial point of lower incisor (LIlabial_R)
Lower Right Molar Profile	Lower Right Molar Profile	Define the profile of the lower right molar using 3 points: 1. Anterior root of lower molar (LMroot_R) 2. Anterior cusp of lower molar (LMcusp_R) 3. Posterior cusp of lower molar
Lower Soft Tissue Profile	Lower Soft Tissue Profile	Trace the profile of the lower soft tissue with a series of points (double-click or right-click to finish tracing). The lower soft tissue is defined as including the lower lip.
Maxillary Profile	Maxillary Profile	Trace the profile of the maxilla with a series of points (double-click or right-click to finish tracing).
Me	Menton	Lowermost point of the mandibular symphysis. Point is determined within the software from the symphyseal profile.
N	Nasion	Central point along the nasofrontal suture.
Or_L	Left Orbitale	Bottom ridge of the orbitale on the maxilla (left side)
Or_R	Right Orbitale	Bottom ridge of the orbitale on the maxilla (right side)
PM	Protuberence Menti	Point above pogonion at top of crest of the symphysis or at the point of recess of the anterior symphyseal curvature. Point is determined within the software from the symphyseal profile.
Pn	Pronasale	Most anterior point of the nose tip. Point is determined within the software from the soft tissue profile.
PNS	Posterior Nasal Spine	Midpoint of the base of the palatine bones at the posterior margin of the hard palate. Point is determined within the software from the maxillary profile.
Po_R	Porion (right)	Upper ridge of the porion (right side)
Po_L	Porion (left)	Upper ridge of the porion (left side)
Pog	Pogonion	Most anterior point on the symphysis of the mandible. Point is determined within the software from the symphyseal profile.
Pr	Prosthion	Most anterior point of the maxillary alveolar process in the midline. Point is determined within the software from the maxillary profile.
Right Mandibular Profile	Right Mandibular Profile	Trace the right-side mandibular profile with a series of points (double-click or right-click to finish tracing). Include the coronoid process, mandibular notch, condyle, and ramus profiles.
Sella	Sella Turcica	Center of sella turcica

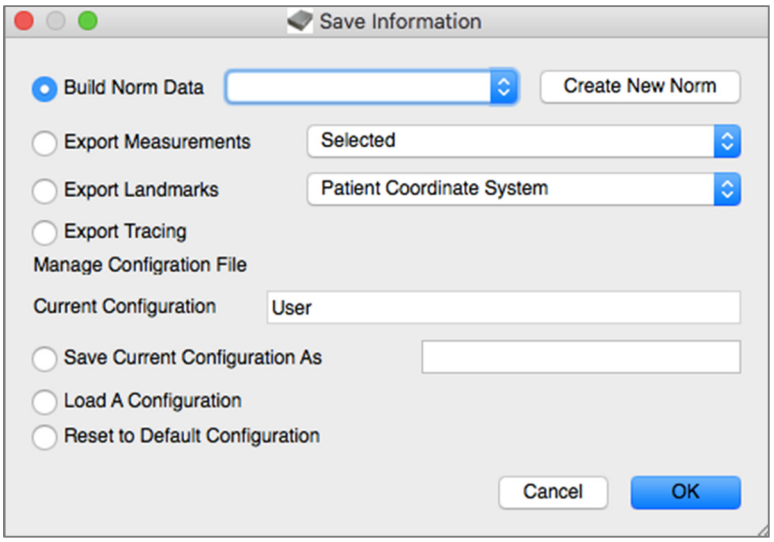
Soft N	Soft-tissue Nasion	Deepest point on the concavity of the soft tissue profile overlying the area of the frontonasal suture. Point is determined within the software from the soft tissue profile.
Soft Pog	Soft-tissue Pogonion	Most anterior point on the soft tissue chin in the mid-sagittal plane. Point is determined within the software from the soft tissue profile.
Sti	Stomion inferius	Most superior point located on the lower lip. Point is determined within the software from the lower soft tissue profile.
Sts	Stomion superius	Most inferior point located on the upper lip. Point is determined within the software from the upper soft tissue profile.
Symphyseal Profile	Symphyseal Profile	Trace the profile of the symphysis with a series of points (double-click or right-click to finish tracing).
Upper Left Incisor Profile	Upper Left Incisor Profile	Define the profile of the upper left incisor using 3 points: 1. Root of upper incisor (UIroot_L) 2. Crown of upper incisor (UIcrown_L) 3. Labial point of upper incisor (UIlabial_L)
Upper Left Molar Profile	Upper Left Molar Profile	Define the profile of the upper right molar using 3 points: 1. Anterior root of upper molar (UMroot_L) 2. Anterior cusp of upper molar (UMcusp_L) 3. Posterior cusp of upper molar
Upper Right Incisor Profile	Upper Right Incisor Profile	Define the profile of the upper right incisor using 3 points: 1. Root of upper incisor (UIroot_R) 2. Crown of upper incisor (UIcrown_R) 3. Labial point of upper incisor (UIlabial_R)
Upper Right Molar Profile	Upper Right Molar Profile	Define the profile of the upper right molar using 3 points: 1. Anterior root of upper molar (UMroot_R) 2. Anterior cusp of upper molar (UMcusp_R) 3. Posterior cusp of upper molar
Upper Soft Tissue Profile	Upper Soft Tissue Profile	Trace the profile of the upper soft tissue with a series of points (double-click or right-click to finish tracing). The upper soft tissue is defined as including the upper lip.

3DAnalysis: Save Information

Whenever you save your file within Invivo, the .inv file will save any tracing tasks and measurements made within 3DAnalysis. The next time you open this .inv file, your measurements, references, etc. will all be saved from your previous session.

In addition, 3DAnalysis allows you to save your measurements to an external file. Press the **Save Information** button to bring up the following options:

- Build Norm Data
- Export Measurements
- Export Landmarks
- Export Tracing
- Save Current Configuration As
- Load A Configuration
- Reset to Default Configuration



Build Norm Data

In the drop-down menu, choose to which norm data file you want your new measurements to be added and press **OK**.

> *Ex. Select "My Caucasian" to add your measurements to the "Caucasian" norm data files (without overwriting the "Caucasian" norm data). The Analysis tab of the Text View will now contain the data from the "Caucasian" norm data and the measurement data from your specific patient. The means and standard deviations will be updated accordingly.*

Press **Create New Norm** to create a new norm data file. The Define Group window will open; fill in an appropriate name and description of your new norm data file and press the **User Define** button to open up the User Define Norm Data window. Browse to where the new norm data file is stored and press **Open**. Press **OK** on the Define Group window to finish and close the window. Press **OK** in the Save Information window to import the new norm data set.

Export Measurements

Select the "Export Measurements" option and press **OK** to export the current measurements of the patient. You will be prompted with the Export Measurements window where you can choose where you want your file to be written and the name of the file. Press **Save** when you have chosen your location and file name and all the current measurements will be saved as a .csv file for your reference. If you select an already existing .csv measurement file, your data will be appended to the end of the document. Using your preferred spreadsheet viewing program, you can open this .csv file to show all measurements in a spreadsheet format for further analysis. The delimiters for columns are semicolons (;).

Export Landmarks

Exports the landmark names and coordinate data to a .csv file that can be opened by a spreadsheet program. The delimiters for columns are semicolons (;). Landmark coordinate values may be exported in the original scan's image coordinate system or the reoriented patient coordinate system if applicable. The transformation data that defines the reorientation can also be exported as a .csv file.

Export Tracing

Select "Save Tracing" and press **OK** to export the position of the current landmark positions and profile drawings in a customized XML format. The Save Tracing Data window will open, and you can choose the location and name of the XML file.

Save Current Configuration As

Saves the current configuration to a user-selected location. The configuration file name can be entered into either the blank box before clicking **OK** or chosen during the actual save to location process. The Current Configuration field will indicate which configuration file is currently being used.

Load a Configuration

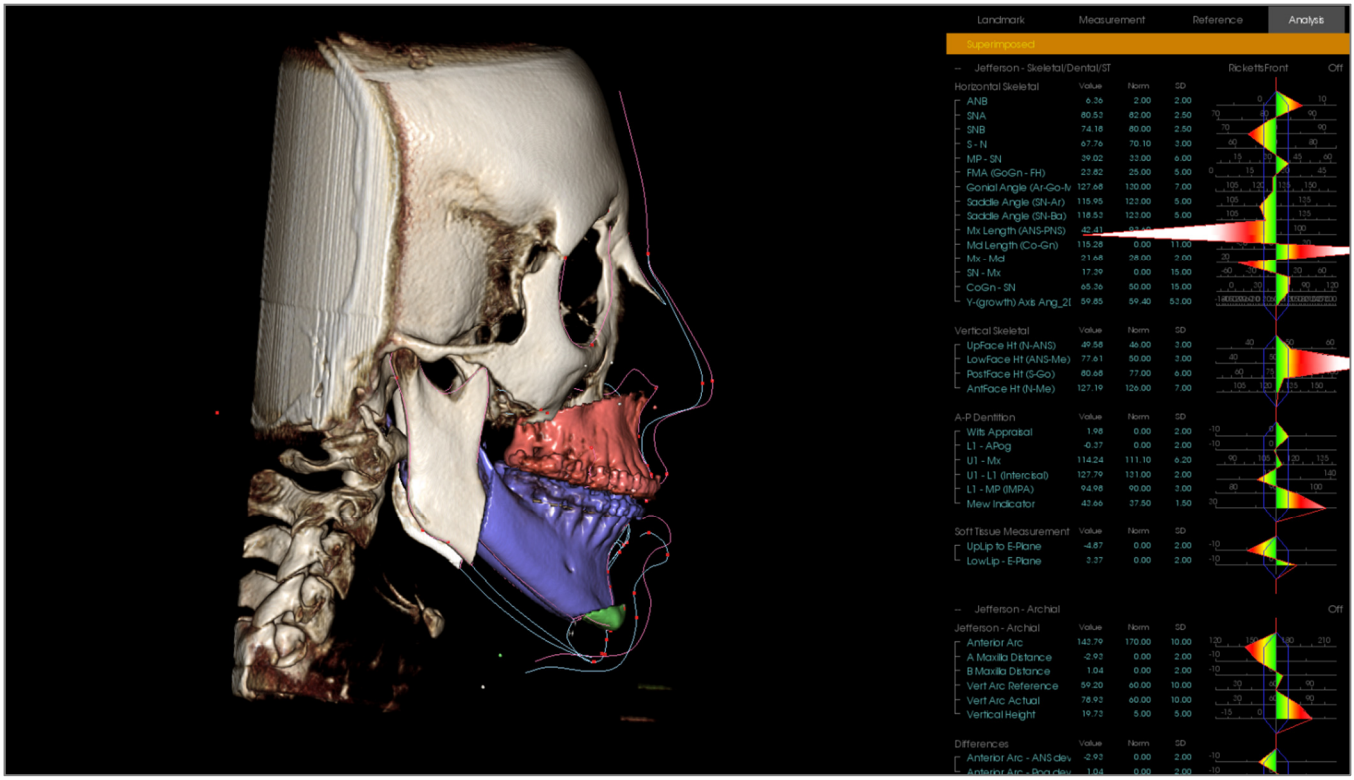
Opens a file browser to select a configuration file to be loaded. The program will provide a warning explaining that the current configuration will be overwritten. It is recommended that the user save the current configuration as a backup before continuing with the load. The Current Configuration field will indicate which configuration file is currently being used.

Reset to Default Configuration

Resets the 3DAnalysis configuration to the installation settings.

3DAnalysis: 3D Surgery Tool

3DAnalysis allows the user to simulate surgical cuts and adjustments to better assess the surgical procedures necessary to achieve facial harmony.



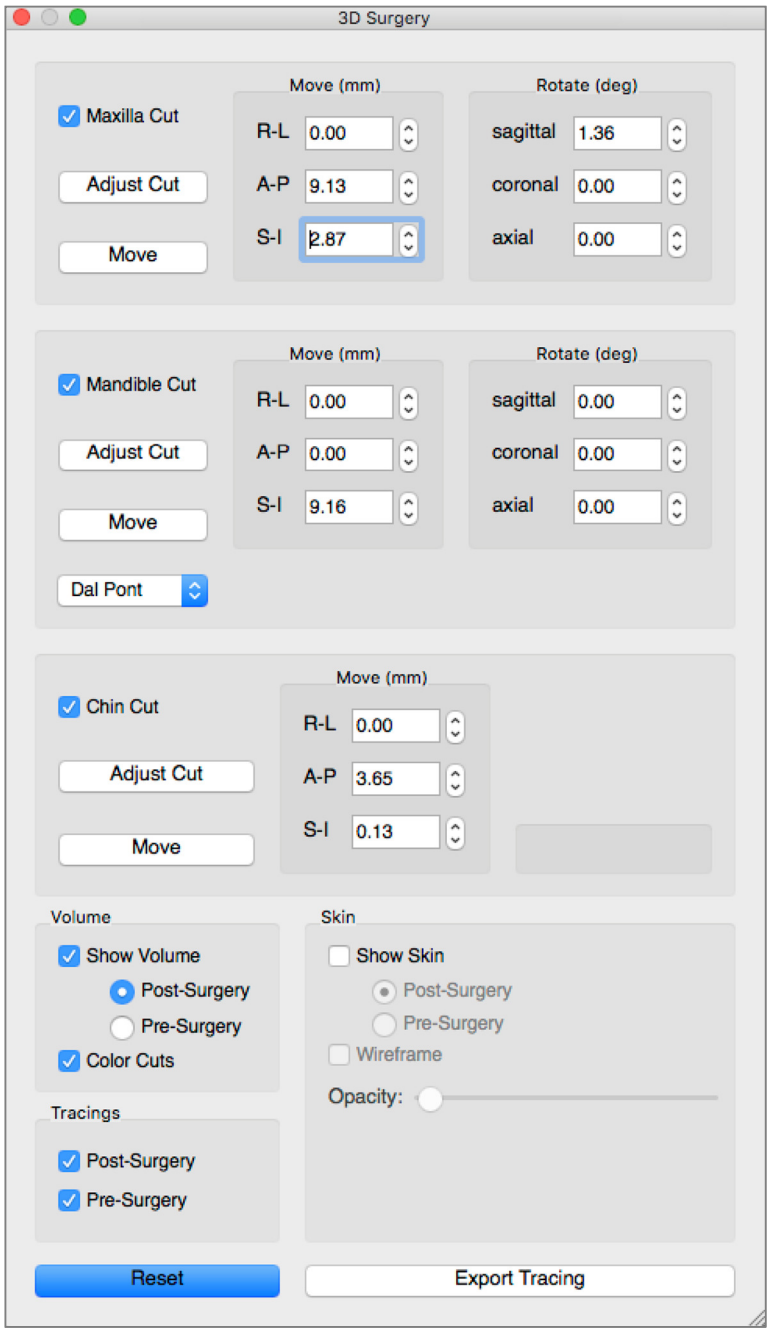
Warning: 3D Surgery tool's intended use is for patient consultation and statistical analysis only. For diagnoses, use Invivo.

Certain tracing tasks must be completed before performing certain surgical cuts or visualizing soft tissue deformation.

Maxilla Cut	Mandible Cut	Soft Tissue Deformation
ANS	Menton	Upper Soft Tissue Profile
PNS	Left Gonion	Lower Soft Tissue Profile
Upper Right Incisal Crown	Right Gonion	
Upper Right Molar Cusp	Upper Right Incisal Crown	
	Upper Right Molar Cusp	
	Lower Right Incisal Crown	

Subsequent adjustment of the tracing after using the **3D Surgery** tool will undo the surgical simulations performed.

To begin, click on the **3D Surgery** tool  to open the 3D Surgery window.



Maxilla, Mandible, Chin Cut: Automatically calculates a surgical bone cut when checked.

Adjust Cut: Adjust the size and angle of the cut by manipulating the volume of the cut. Adjusting the cut after the segment has been moved or rotated will reset its position.

Move: Moves the bone separated by the cut either through the widget tools that appear when the button is toggled on or by inputting values in the Move and Rotate fields.

Cut Type: Choose from Dal Pont, T&O, and Hunsuck cuts for the mandible.

Volume:

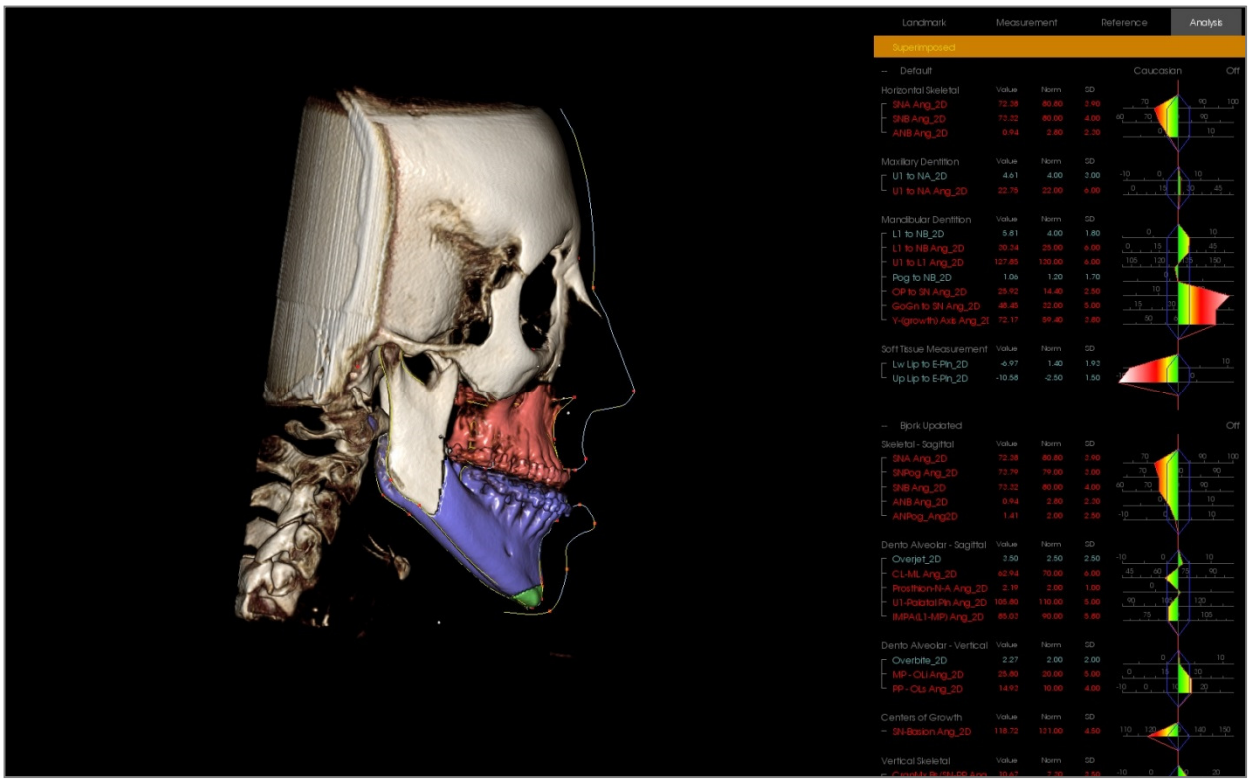
- Show Volume: Toggle the volume on or off and switch between the pre- and post-surgery states.
- Color Cuts: Colors the cut volumes distinctly from the rest of the volume.

Tracings: Toggle the visibility of the pre- and post-surgery tracings.

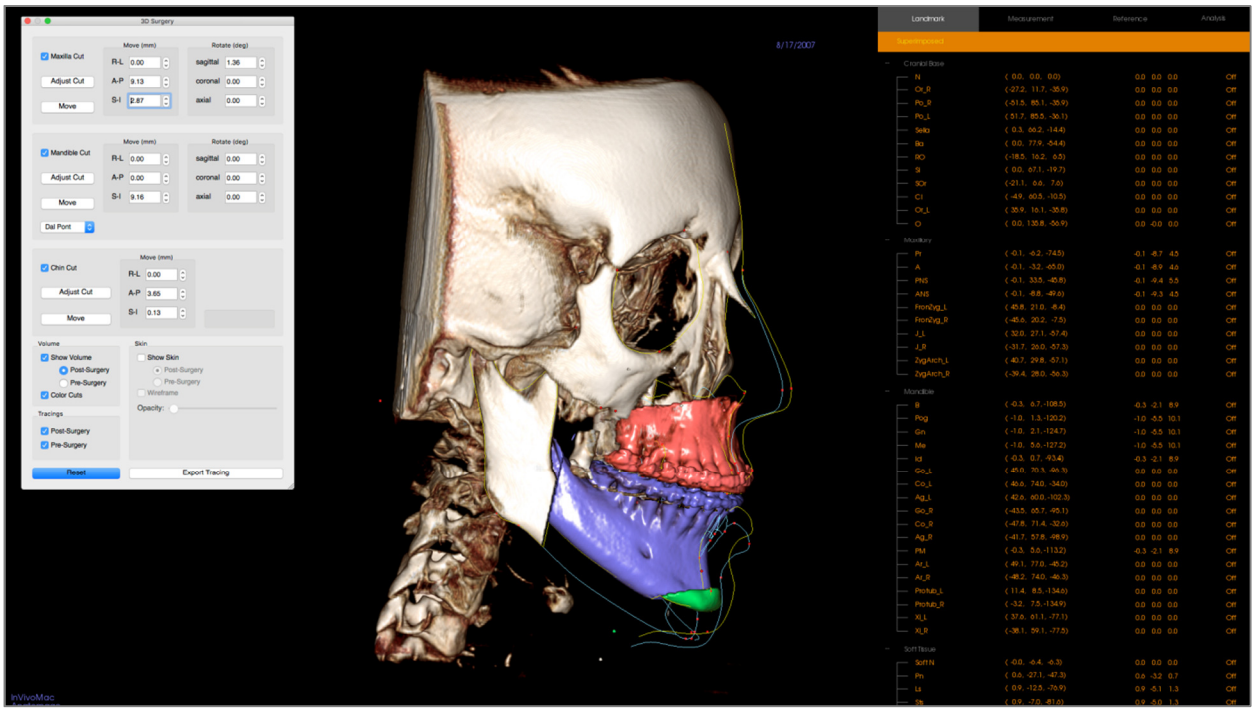
Skin: Toggle the visibility and adjust the opacity of the pre- or post-surgery skin if applicable. The "Wireframe" option will convert the skin to a wire mesh form when selected.

Reset: Resets all move and rotate values to zero.

Export Tracing: Exports post-surgery tracing. An exported tracing can be reimported as a superimposed tracing.



By moving the widget tools or entering values directly into the window, the bone sections can be manipulated. A post-op tracing is created, reflecting the changes. Once the post-op tracing is finalized, close the 3D Surgery dialog. If Text View is selected, the data of the pre- and post-op scans can be toggled by pressing the "s" key on the keyboard or click on the "Superimposed" or "Default Tracing" header below the Text View Tabs. To export the tracing, use **Export Tracing** in the 3D Surgery dialog.

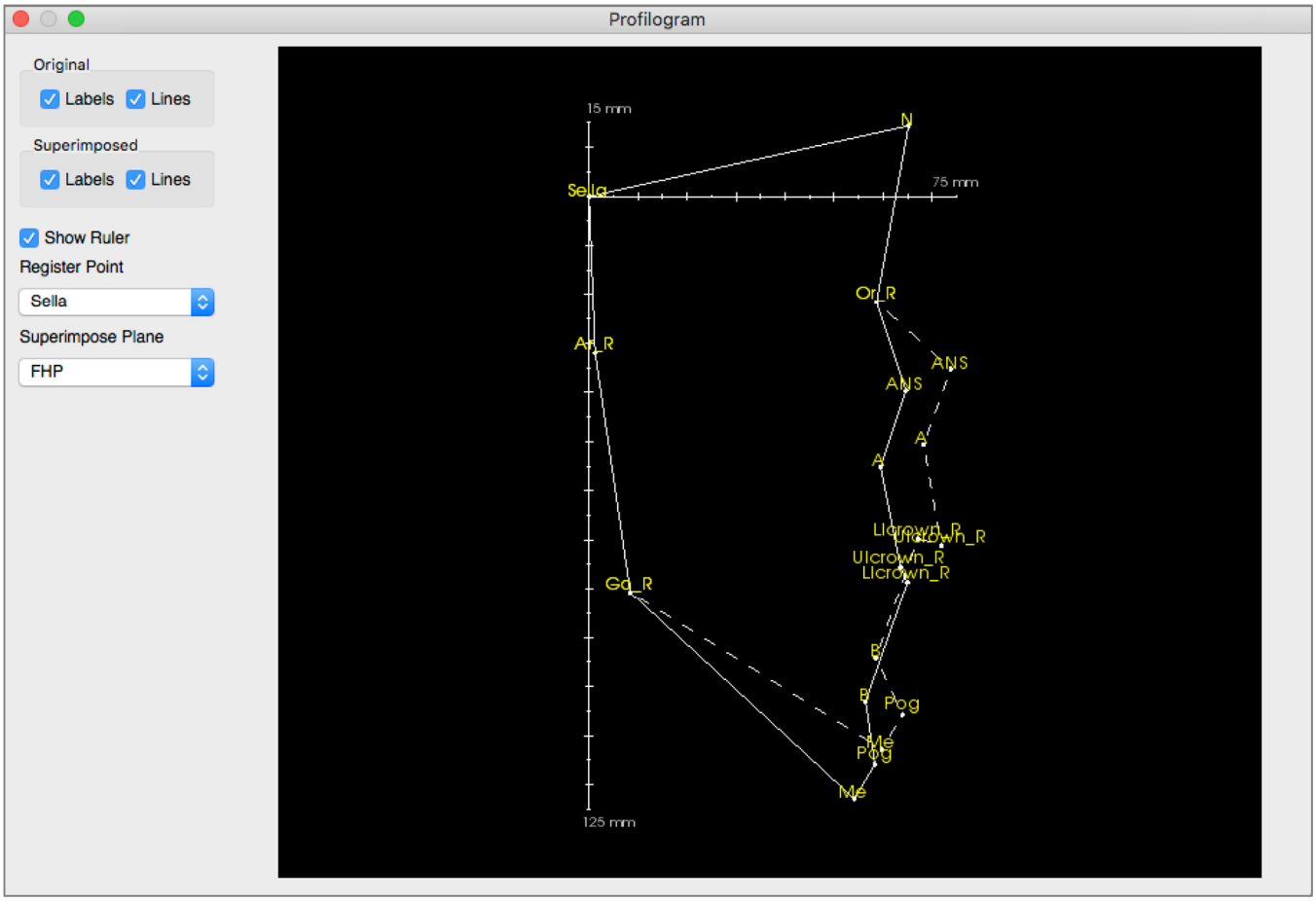


3DAnalysis: Profilogram

The profilogram is a simplified representation of the profile tracing based on a few landmarks. The required landmarks are:

Sella	Nasion
Right Orbitale	ANS
A-point	B-point
Upper Right Incisal Crown	Lower Right Incisal Crown
Pogonion	Menton
Right Gonion	Right Articulare
Right Porion	Left Porion

Once the above tasks are traced, click the **Profilogram**  icon. The graphic will automatically be generated. If 3D Surgery was performed on the patient or if a tracing was superimposed, the original tracing's profilogram will be drawn with a solid line, while the superimposed tracing will be drawn with a dashed line.

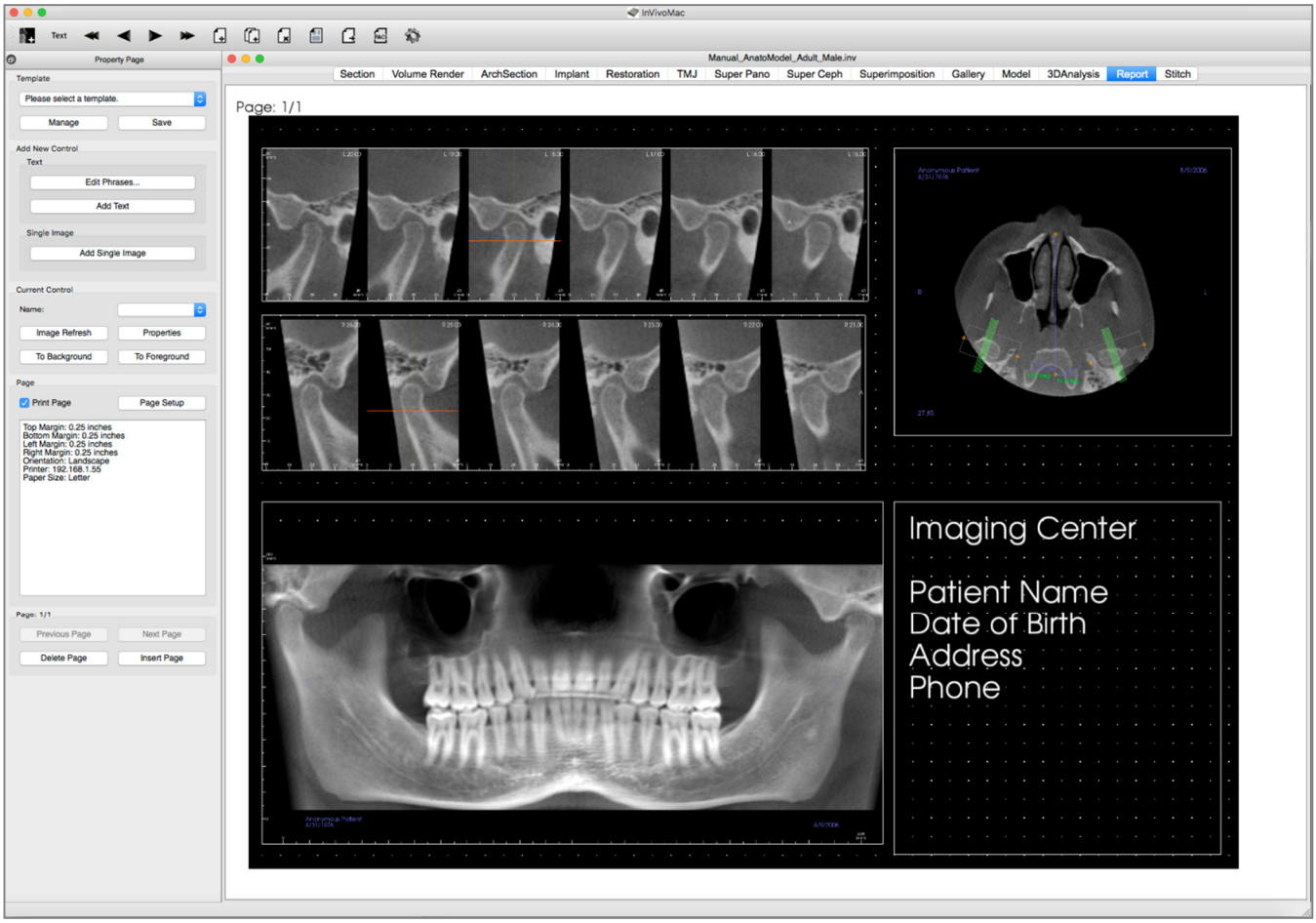


Additional visibility options on the left will allow the user to hide or display labels, lines, and the ruler.

By default, the profilogram will be registered on the sella and superimposed about the Frankfort horizontal plane, but this is customizable in the Profilogram dialog.

Report Module Features

*The **Report View Tab** allows for the creation of templates containing images and text. A template can be applied to any case using this tab. In this picture, the page background is black and represents the page. Several types of items can be placed within this page to create a detailed report for the patient.*



Report: Toolbar

Shown below are the Toolbar and tools that are loaded with the Report View Tab:


Add Image: Adds a control to add a single image.


Add Slices: Adds a control to add single slices or a group of slices.

Add Text: Adds a control to add text.


First Page: Navigates to the first page of the report.


Previous Page: Navigates one page back.


Next Page: Navigates one page forward.


Last Page: Navigates to the last page of the report.


Insert Page: Inserts a page after the current page.


New Page: Adds a page to the end of the report.


Remove Page: Deletes the current page.

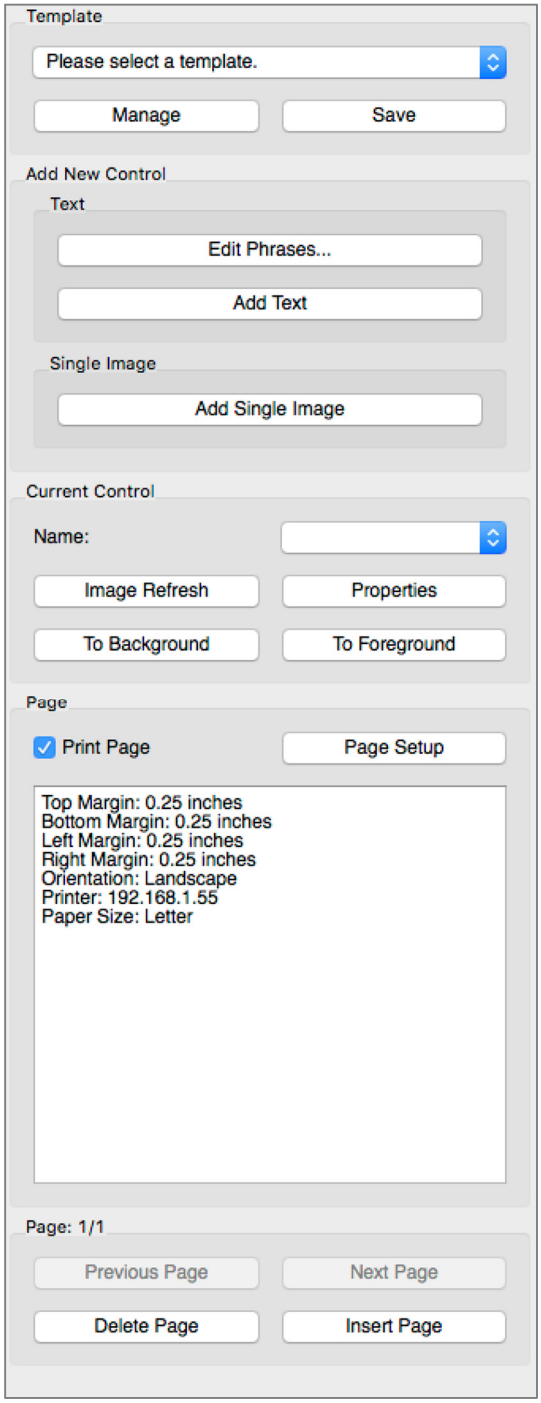

New Template: Creates a blank template.


Export PDF: Saves the report as a PDF file.

Export to PACS: Saves the report as a DICOM onto the PACS server. Requires PACS configuration beforehand.


Preferences: Opens preferences for default colors, default image type, default page setup, grid alignment, and the template save path.

Report: Control Panel



Template

- Template drop-down: Lists the available templates.
- **Manage…:** Displays all of the preset templates. Templates can also be loaded, renamed, and removed in this dialog. See pg. 197.
- **Save…:** Saves the current template. Templates are stored locally and show up on the drop-down.

Add New Control

Text:

- **Edit Phrases…:** Opens a dialog for managing common phrases to be added to text controls. See pg. 193.
- **Add Text:** Adds a control for text.

Slice Group:

- **Slice Group Management:** Allows creation and management of image groups.
- **Add Slice Group:** Adds a control for 2D slices.

Single Image:

- **Add Single Image:** Adds a control for one image.

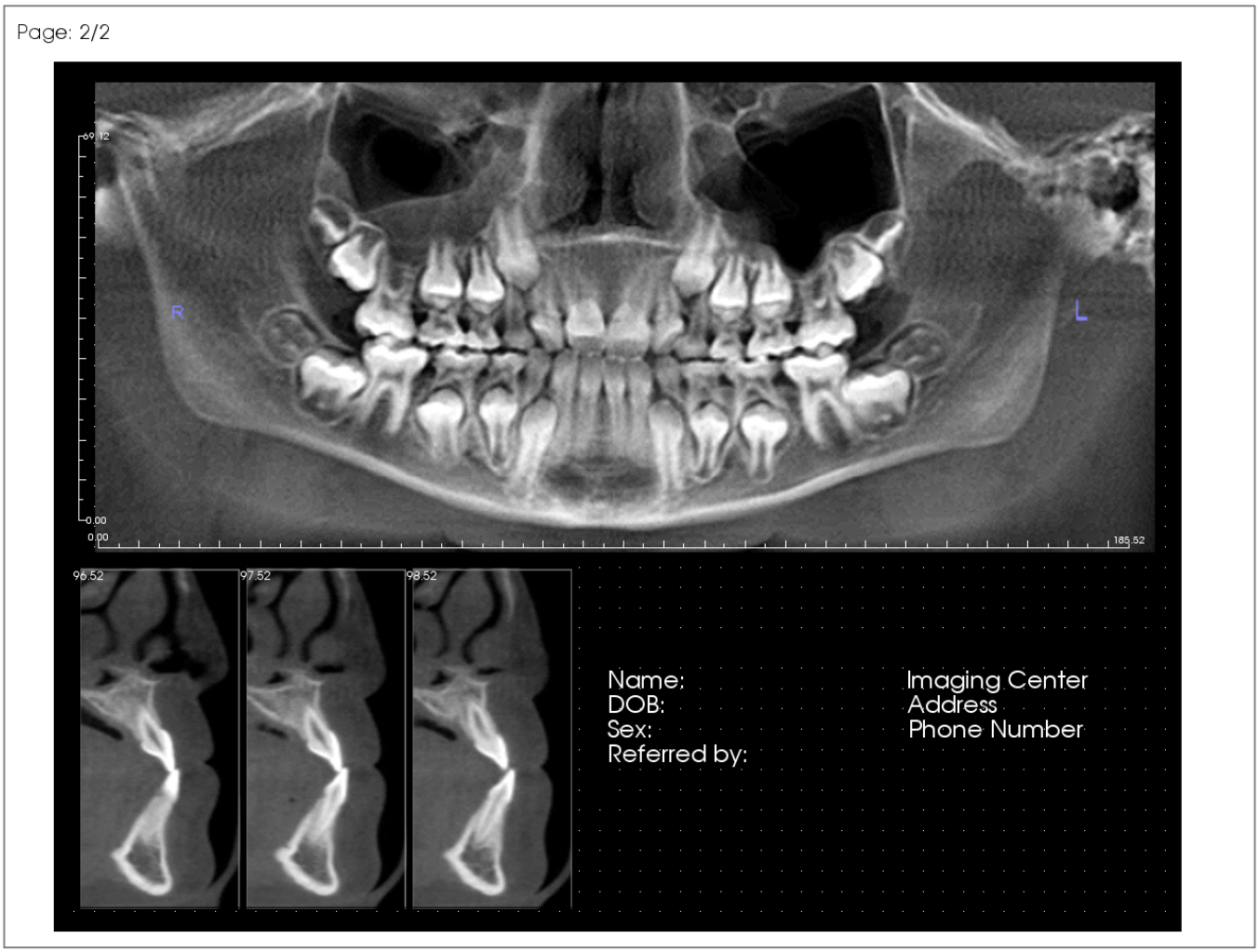
Current Control

- Name drop-down: Shows the name of the currently selected control from a list of controls on this page. Each control can be selected from the drop-down menu instead of clicking the control.
- **Image Refresh:** Updates the image according to the changes in the source image.
- **Properties:** Opens the Properties window for the current control.
- **To Background:** Puts the selected image behind other images.
- **To Foreground:** Puts the selected image in front of other images.

Page Control

- **Print Page:** Enables the current page to be printed.
- **Page Setup:** Opens page setup to allow you to set printer, paper size, margins, and background/border properties of the page.
- Page Information is displayed showing the current settings.
- **Previous/Next Page:** Page navigation controls.
- **Delete Page:** Removes the current page.
- **Insert Page:** Inserts a page after the current page.

Report: Rendering Window



The rendering window displays the report page and is the main area for designing and viewing reports and templates. The page navigation buttons in the toolbar allow the user to switch between pages in a multi-page report to choose which is displayed in the rendering window.

Adjusting the position and zoom of the report within the rendering window uses the same keyboard and mouse combinations as in other Invivo tabs:

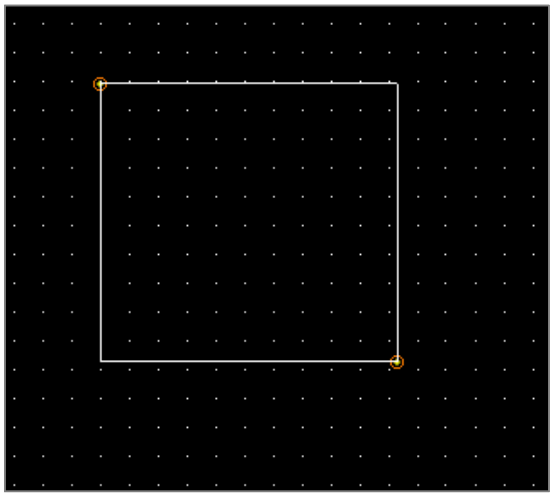
Zoom – Cmd + Left-Click + Drag Mouse

Pan – Shift + Left-Click + Drag Mouse

For additional keyboard and mouse shortcuts relating to the Report Tab, see the **Full Screen and Keyboard Shortcuts** section (pg. 33).

Report: Controls

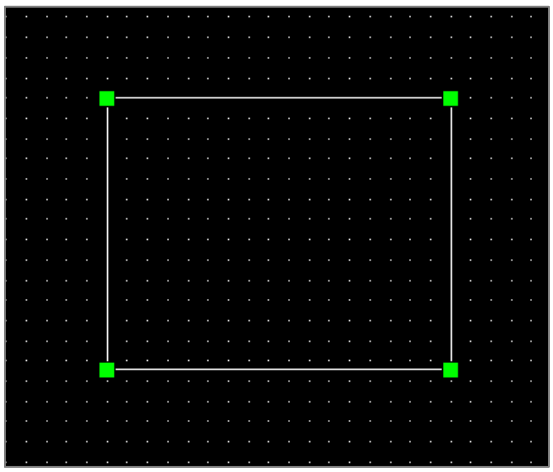
Controls are boxes that display text or image data.



Adding and Sizing

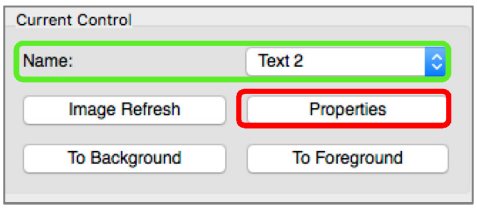
- Navigate the mouse cursor to the Control Panel on the left and select the button labeled **Add Text**, **Add Slice Group**, or **Add Single Image**.
- **Size the control:** The image on the left shows the control rectangle during creation. The control is created by two separate points and will not show up until after the first point has been placed.

Warning: If you create the control outside of the page, you will receive an error message and the control will not be created.



Resizing and Customization

- After creating the control, it will look like the image on the left.
- **Resize the control:** Click and drag the green squares or the borders. Alternatively, set the height and width from the Properties window.
- **Move the control:** Click and drag with the left mouse button or use the arrow keys on your keyboard after clicking inside the control.
- **Select a control:** Click on the control or select it from the **Name** drop-down on the Control Panel. Pressing the Delete key will delete the control. To see the control's properties, press the **Properties** button while it is selected. Double-clicking the control also shows its properties.
- **Select multiple controls:** Click more than one control while holding the "Cmd" key on the keyboard. Supported multi-control operations are movement and deletion.
- **Copy and paste controls:** Select a control, press Cmd + C, then press Cmd + V to paste it at another location.

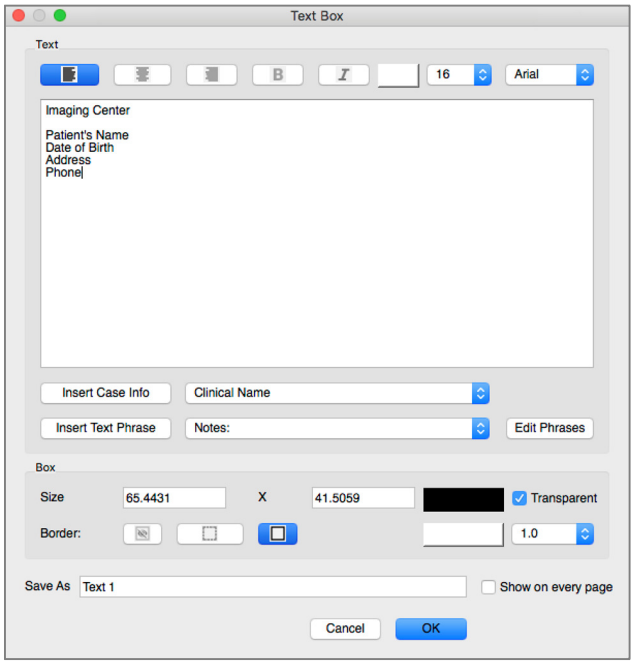


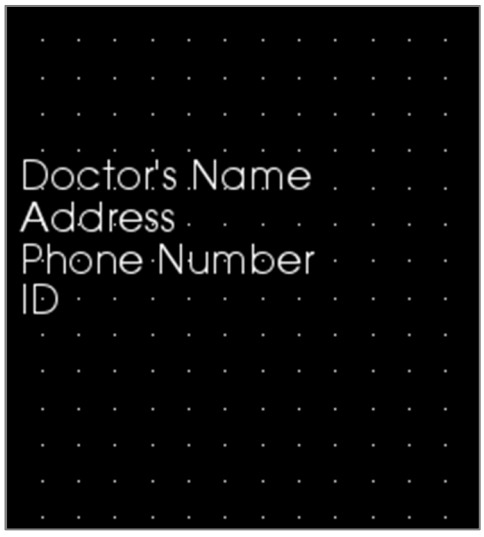
Report: Adding Text Controls

Text Controls contain text that is manually typed in or drawn from the Case Info.

Adding a Text Control:

- Click the **Add Text** button.
- Properties can be changed by clicking **Properties** in the Current Control section of the Control Panel.





Text Box Dialog

This dialog can be opened by double-clicking on a text control or selecting the control and clicking **Properties** on the Control Panel.

Text

- Alignment type: Select the text alignment type.
- Font Options: Family, size, color, alignment, bold, and italics can be changed.
- Text Input Box: Enter text to be displayed in this text box.
- **Insert Case Info:** Inserts the selected data based on the case information or Gallery comments where the cursor is in the Text Input Box.
- **Insert Text Phrase:** Inserts the selected text phrase where the cursor is in the Text Input Box.
- **Edit Phrases:** Opens the Text Phrases dialog (See pg. 193).

Box

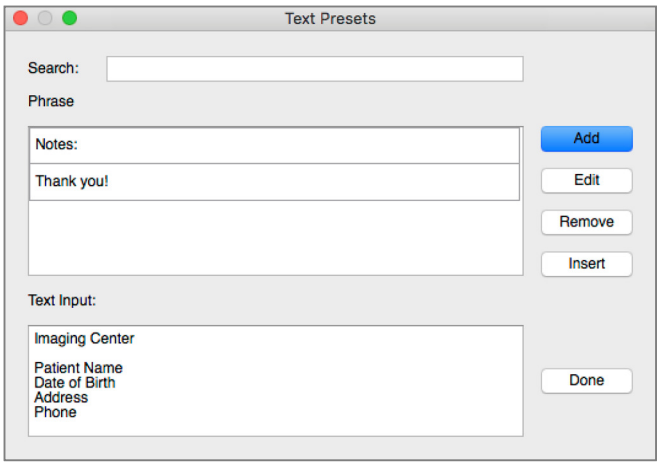
- Size and color: Determines the size of the text control. Unchecking "Transparent" will show the chosen color instead of the report's background color.
- Border: Set the border style, color, and thickness. Style can be dashed, solid, or none (not displayed).

Save As

- Choose the name of the control.

Show on Every Page

- Check this option to show the text in the control on every page of the template.



Text Phrases

Text phrases allow you to store common phrases within the software and insert them into text controls. This dialog can be opened by click on **Edit Phrases**.

- Search: Searches for the term in the list of stored phrases.
- **Add:** Opens a dialog for creating a new phrase.
- **Edit:** Opens a dialog for editing the selected phrase.
- **Remove:** Removes the selected phrase.
- **Insert:** Inserts the selected phrase into the text control.
- Text Input: If a text control is selected, type directly into the box to update the text control on the report.

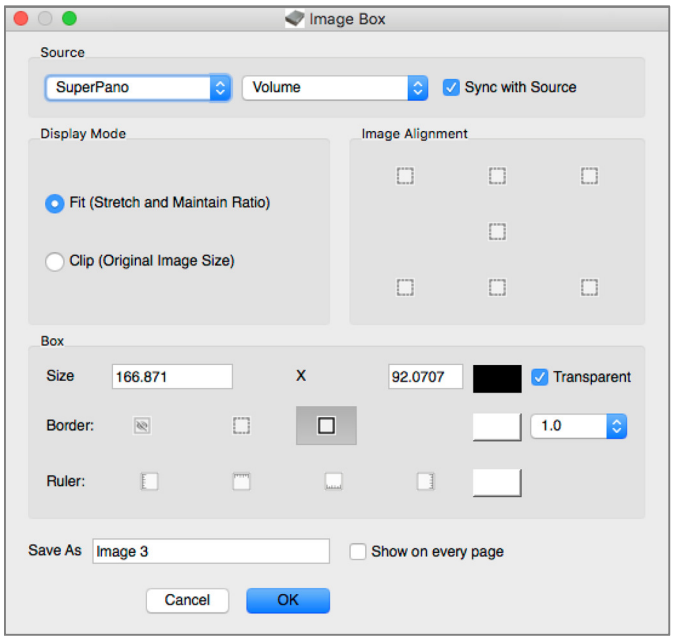
Report: Adding Single Image Controls

Control that holds a single image from a selected source view.

Adding a Single Image Control:

- Click the **Add Single Image** button.
- Properties can be changed by clicking **Properties** in the Current Control section of the Control Panel.

Single Image Box Properties



Source

- Determines the exact image to be displayed from the source view (Note: Images will not be available until the specified source view has been "visited" to provide an image to load. **See Report: Image Type Definitions**, pg. 196, for details on dynamic images.)

Sync with Source, Display Mode, Image Alignment, Box dimensions and properties, Save As, and "Show on Every Page" control the same properties as for Slice Groups (see **Report: Adding Slice Group Controls**, pg. 194).

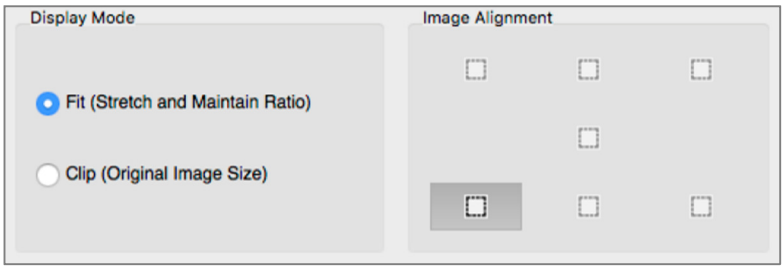
Warning: Bitmaps under 24 bit may not display correctly.

Report: Image Alignment

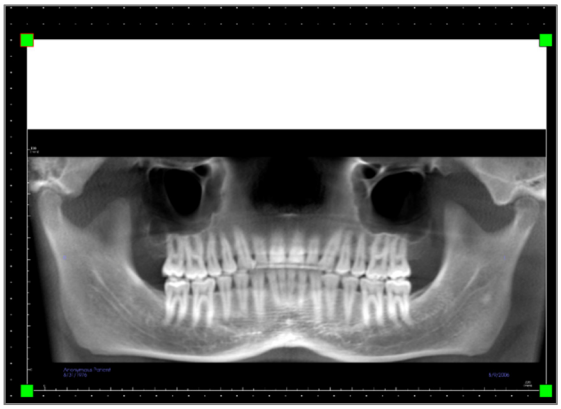
For Slice Group Controls and Image Controls, images may be aligned to the control boundaries by two methods.

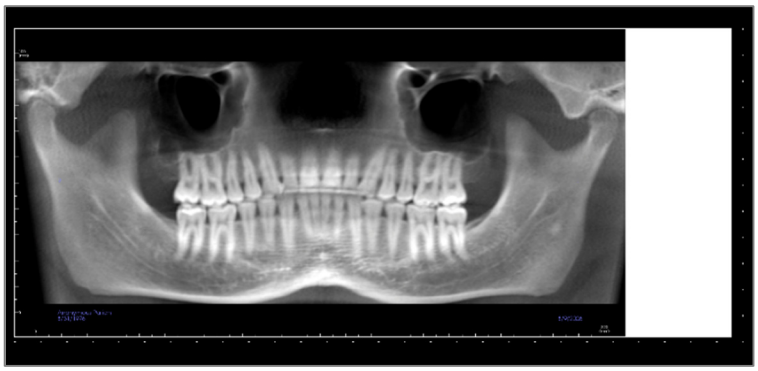
- Fit: Resizes the image to fit within the borders of the control as determined by the Image Alignment settings.

This example is done with a bottom left fit alignment position with a white background.



The image will originate from the bottom left and will show the background above it or to the right when it does not fill the control.





- Clip: The original image size is maintained. The control may need to be resized in order to display the full image.

Report: Image Type Definitions

Dynamic Images:

These images can always be up-to-date with the latest changes performed on them if desired. When adding an image to a control, the user can choose not to auto-update the image, keeping the current image until the auto-update setting is changed or the image is manually refreshed. There are two types of dynamic images.

Note: Capturing images from specific layouts requires that the layout is currently selected when leaving the aforementioned view tab and reloading the Report Tab. Ex. The pano screen in the Implant Tab will not be captured unless the Pano layout is on when leaving the view.

- Single image view sources except Gallery and external images are dynamic.
  - To populate the image source with images, go to a view tab. As you leave the view, images for that view are captured.
  - After an image has been added to a control, it will update when changes are made in that view. For example, if a measurement is added to Section Tab's axial view, the image in the Report Tab will now display that measurement.
  - These images are saved with the case file.
- Slice images
  - These are captured manually.
  - These are the input for the **Add Slice Control**.
  - They have the same dynamic update behavior as above.
  - These images are saved with the case file.

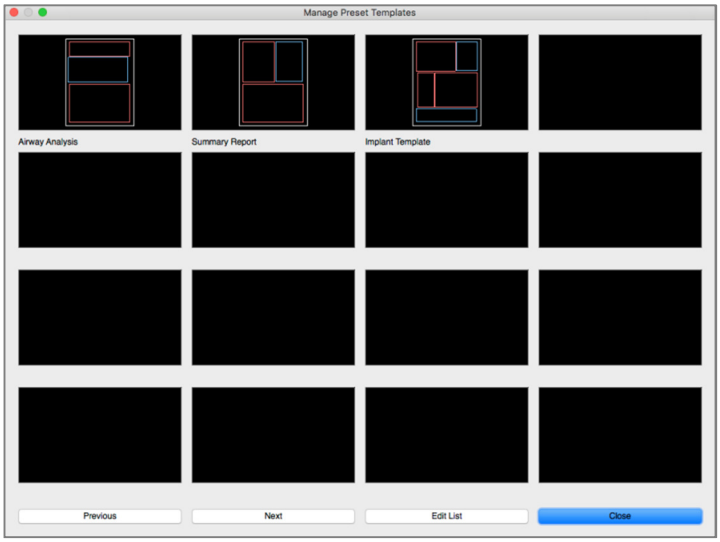
Static Images:

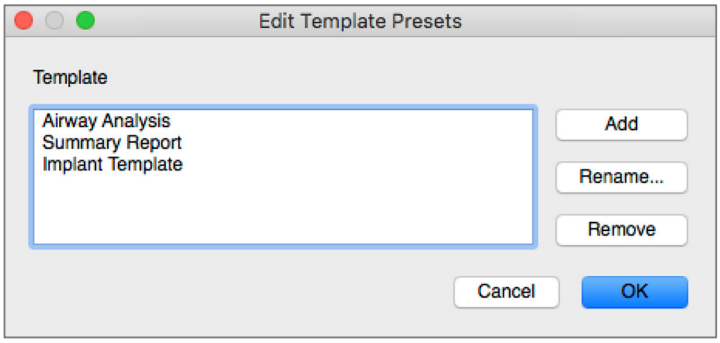
These images will never change unless you manually change the source image. There are two sources of static images.

- Gallery
  - All images in the Gallery are either captured from other tabs or imported by using the **Import Images** function. They will not always be life size.
  - These images are saved with the case file.
- From a File
  - These images come from the local computer or another source. They will never be life size.
  - These images are saved with the template.
  - If an image that already exists in the template is added, the software will prompt whether to replace the image or keep using the older one.

Report: Managing Templates

Once a report layout is created, it can be saved and reloaded in other cases as a template. Templates are saved locally in the file path designated under "Template Path" in the Preferences dialog. These saved templates will automatically appear in the drop-down menu. To display a preview of all the available templates or to edit them, click on **Manage…** on the Control Panel.





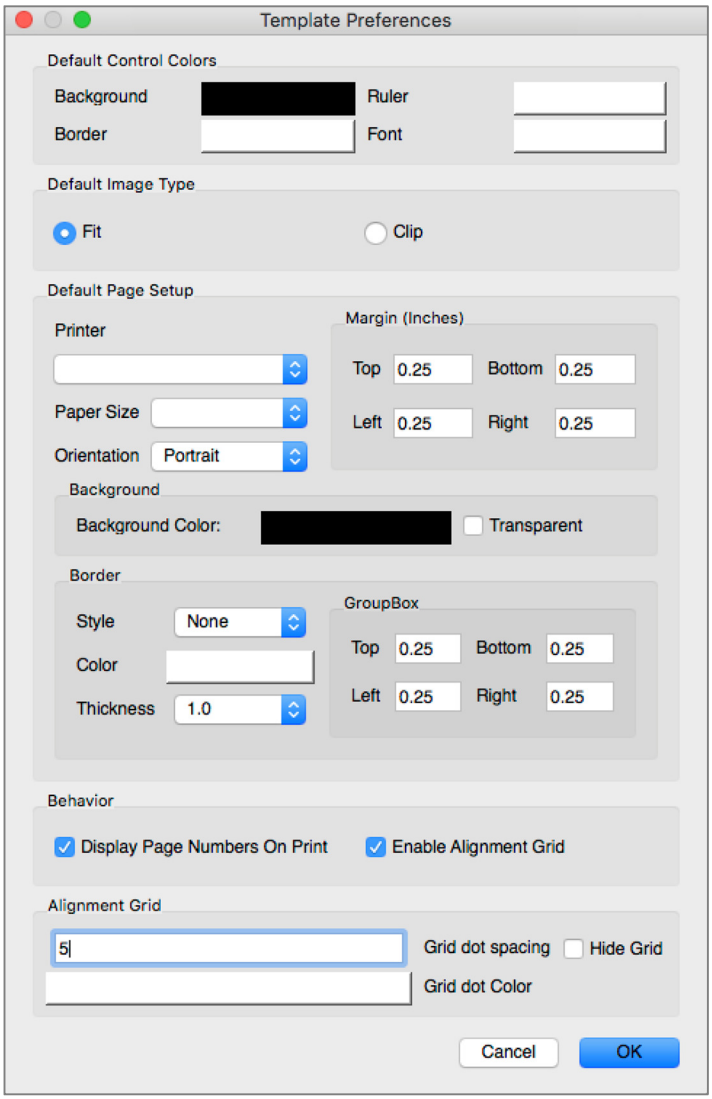
Manage Preset Templates

- All of the saved templates will be shown here.
- Each color represents a different type of control:
  - Blue: Text control
  - Red: Image control
  - Yellow: Slice group control
- Templates may also be loaded from this window by left-clicking on them.
- **Previous/Next:** Goes to the previous or next page of templates, respectively.
- **Edit List:** Opens a dialog for editing template properties.
- **Close:** Closes the dialog.

Edit Template Presets

- **Add…:** Load an existing template that was saved elsewhere.
- **Rename…:** Rename the selected template.
- **Remove:** Remove the selected template.

Report: Preferences



Default Control Colors: Colors for border, background, font, and rulers.

Default Image Type: Choose between "Fit" or "Clip" display modes.

Default Page Setup:

- Printer: Printer in current use. This changes the available paper sizes. This list includes all of the printers available to the computer.
- Paper Size: Uses the printer drivers to set the height and width of the page.
- Orientation: Portrait or landscape setup.
- Margins: Margins (in inches) for the template. Used for where controls can be placed.
- Background: Color and transparent options.
- Border: Color, thickness, and style options for the border. Styles are solid line, dotted line, or no line at all.
- Margins: Margins for the border. This can differ from the page margins.

Behavior: Specifies behavior of the template during design.

- Enable Alignment Grid: If checked, all controls will attach to their top left corner to the nearest grid point. If unchecked, they will be placed wherever the user drags them.
- Display Numbers on Print: If checked, the report page number will be displayed in the printout.

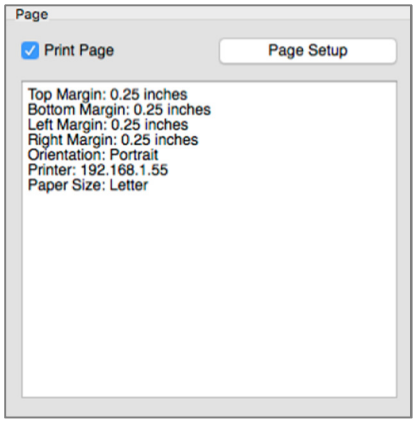
Alignment Grid:

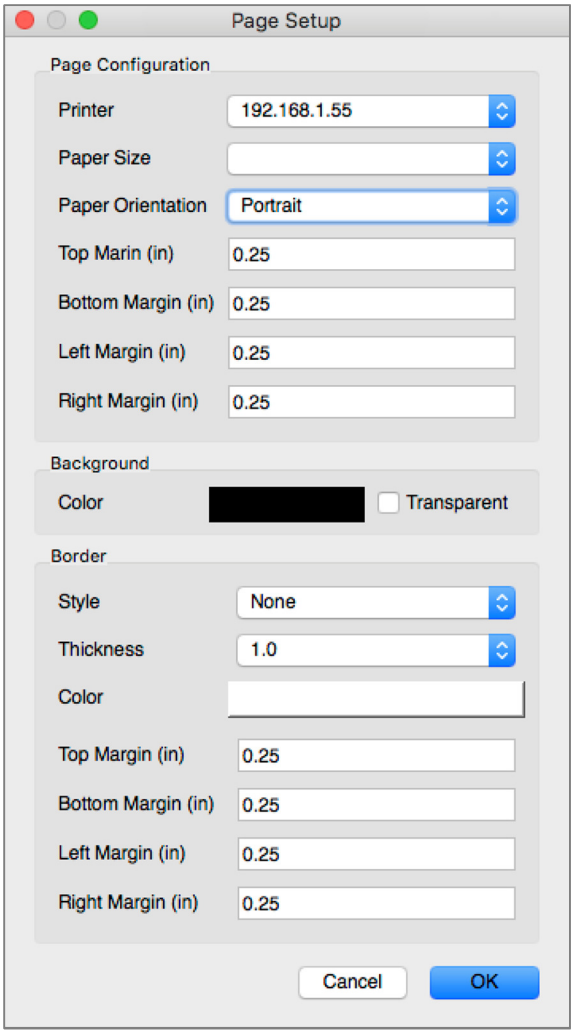
- Grid dot spacing: Defines the distance between grid dots.
- Grid dot color: Set the color of the grid dots.
- Hide Grid: Toggles the visibility of the grid.

Report: Page Setup

This displays and allows configuration of the page settings. These are the settings the template uses. When printing, the correct printer and paper size must be chosen from the print setup.

Note: The first time the software loads, your default printer configuration is used to set the printer and paper size for the report. Report defaults can be changed from the Preferences menu.





Page Setup:

To modify page settings, click the **Page Setup** button in the Control Panel.

Page Configuration:

- Printer: Printer to use for this template.
- Paper Size: Current paper size. Only displays paper sizes for the currently selected printer.
- Paper Orientation: Portrait or landscape orientation. (Note: Margins will not change, so paper may appear to have different proportions when switching between portrait and landscape.)
- Margins: Margins (in inches) for the page.

Background:

- Checking transparent will show the chosen color instead of the background.

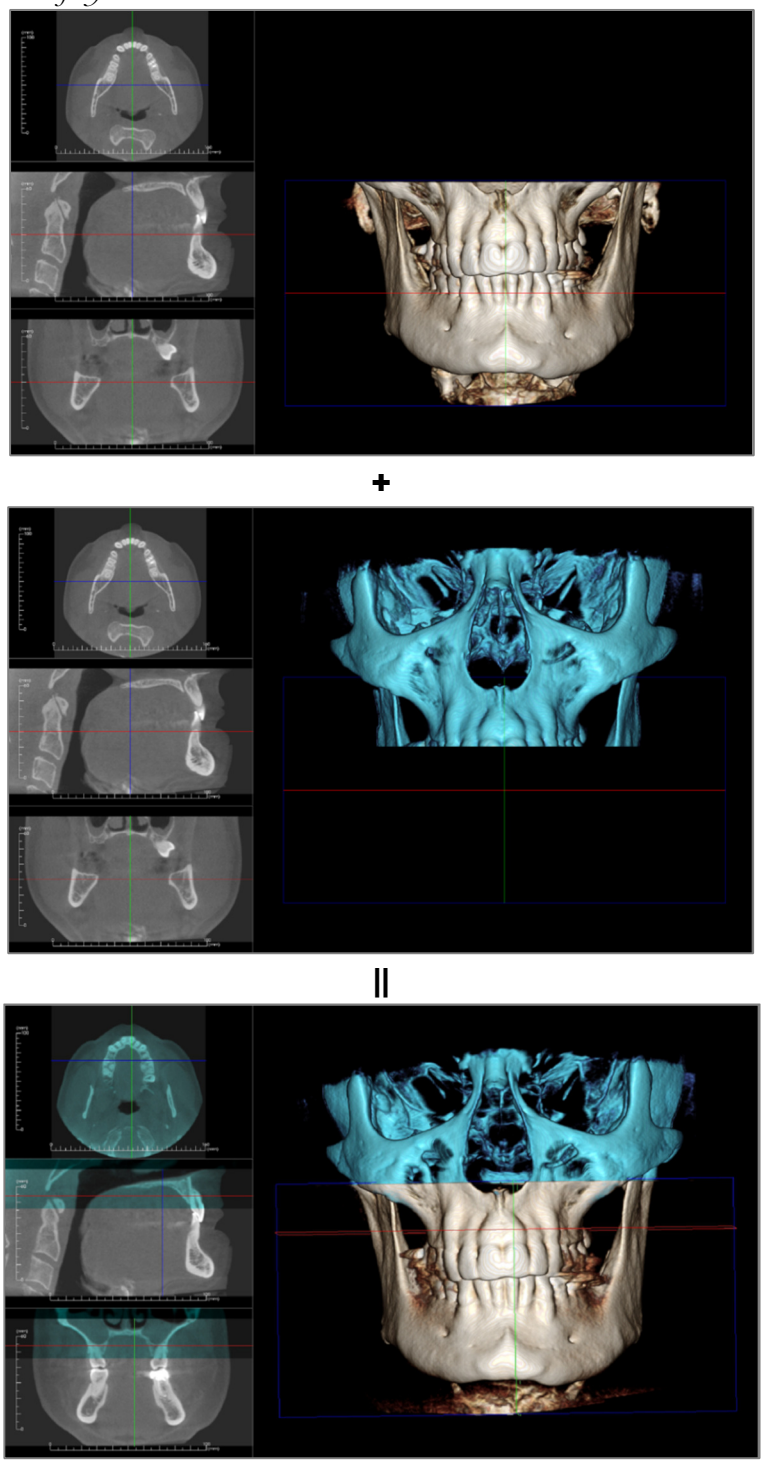
Border:

- Set the border color, thickness, and style.
- Style can be dashed, solid, or none (not displayed).
- **Margins**: Location of the borders.

Page information of the chosen configuration will always be displayed in the Page section of the Control Panel.

Stitching Module Features

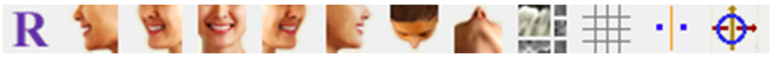
*The **Stitching View Tab** provides the ability to merge two DICOM data sets. This will give you the ability to utilize CBCT machines with smaller fields of view fully.*



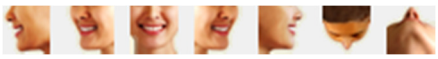
Warning: Stitching module is not a medical device and should be used as a reference or presentation tool only.

Stitching: Toolbar

Shown below are the Toolbar and tools that are loaded with the Stitching View Tab:



Reset: Resets the modeling window to the original view size.



View Angles: Quick view angle presets.

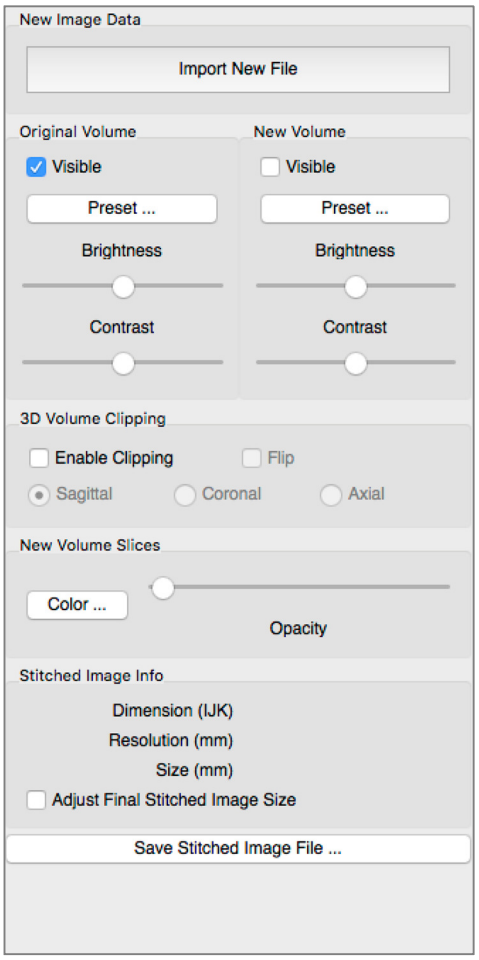
Layout: Toggles the rendering window layout.

Grid: Toggles between different grid layouts on the volume, allowing quick assessment of measurements and spatial location.

Landmark Registration: This tool is used to register the original volume to the imported volume. Four or more anatomical points are chosen from each scan to properly align them.

Move Widget: This tool is used to make adjustments to align the two volumes better.

Stitching: Control Panel



Import New File: Used to import the second volume by opening an invivo file (.inv) or DICOM (.dcm) of your choice.

Original Volume and New Volume: Different viewing options, such as visibility, rendering type, brightness, and contrast for each volume can be selected or adjusted independently.

3D Volume Clipping: Click the "Enable Clipping" box to clip the image along the predefined anatomical planes (sagittal, axial, coronal, and arch). Scrolling the mouse wheel or moving the slider will move the clipping plane. To switch a view to the opposite side, click "Flip."

New Volume Slices: The Opacity slider adjusts the opacity of the superimposed volume. The **Color** button changes the color of the superimposed volume.

Adjust Final Stitched Image Size: This feature will allow you to set new boundaries for the stitched scans. If the stitched volume does not fit into the window or is off centered, you can use this feature to adjust the boundaries.

Save Stitched Image File: This button will save the stitched volumes into an invivo file. Upon saving, the two volumes will be merged and open as a regular Invivo file.

Stitching: How to Stitch Two Volumes

Invivo provides an easy-to-use tool that combines two volumes to create a larger field-of-view scan. Although it is easy to use, it is a technique-sensitive feature with the most critical step being the registration of the scans by selecting stable landmarks. The next section shows how to stitch two scans step by step.

Step 1. Save DICOM Files as Invivo Files.

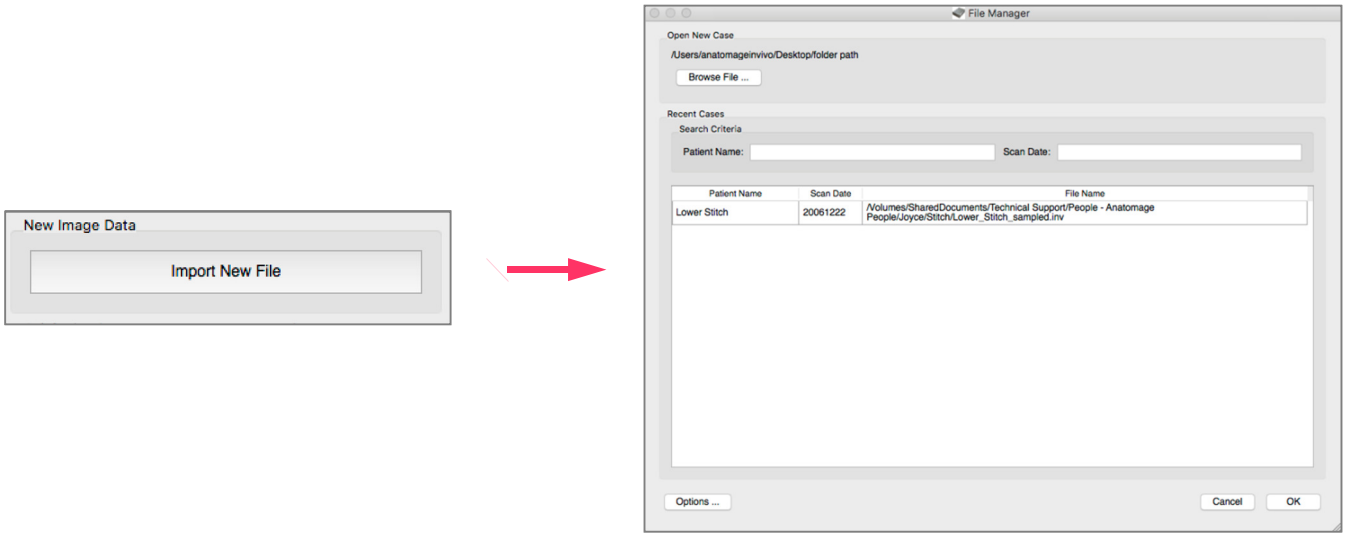
Both scans are recommended to be saved as Invivo files (.inv) before proceeding. See the section on Invivo File Saving if you are not sure how to save your DICOM files as Invivo files.

Step 2. Open the First Invivo File.

Open the first Invivo file. You do not have to open them in any order.

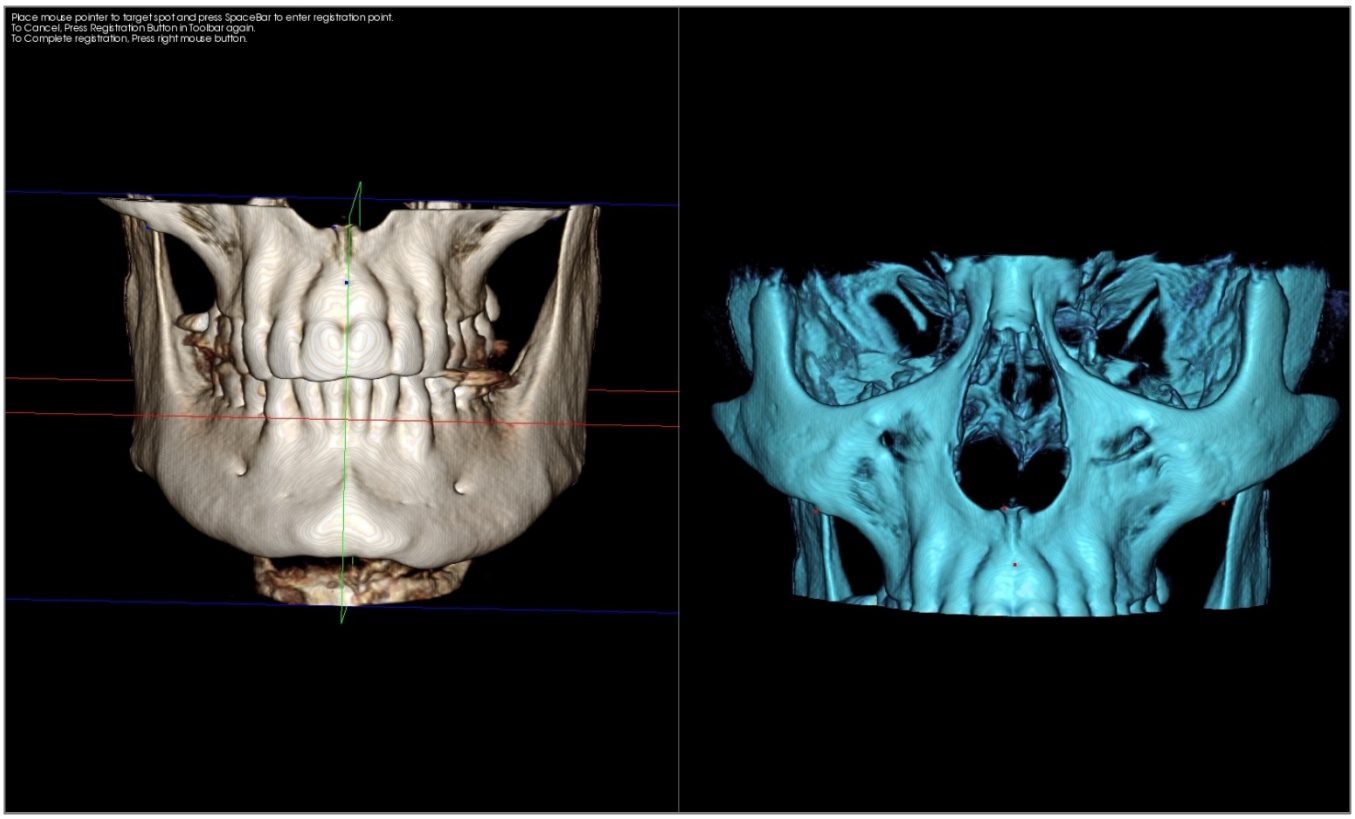
Step 3. Import Volume.

Go to the Stitching Tab. Click on the **Import New File** button on the Control Panel to select the second scan:



Step 4. Registering the Two Scans to Each Other.

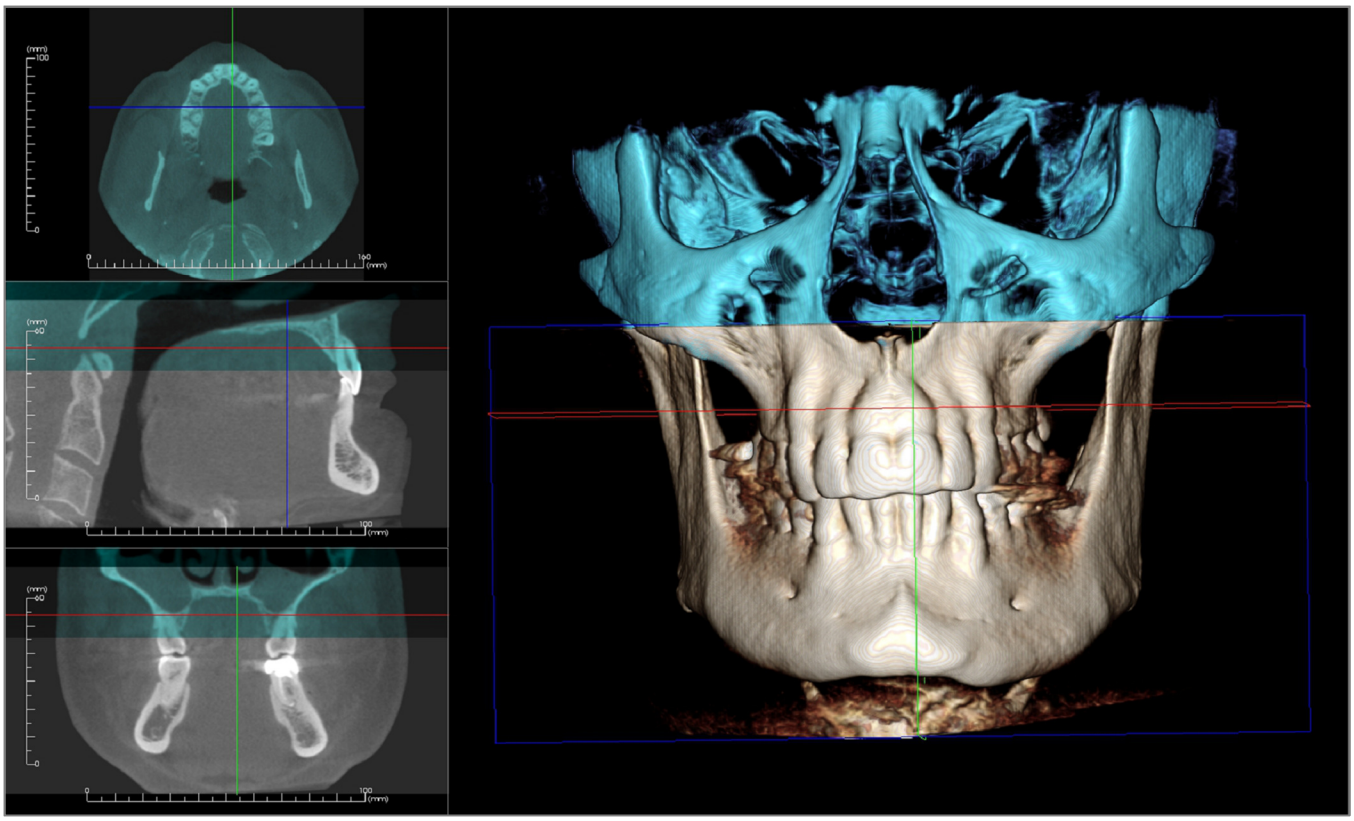
In order to stitch the scans correctly, strict attention must be exercised in selecting at least four matching and stable landmarks in both scans. Use the **Registration** function: 



Select the first landmark on one scan, and then select the exact matching landmark on the other scan. The landmarks are selected by pressing the center scroll wheel of the mouse or by the space bar on the keyboard. Each point shows up as blue or red pixels (above). The image can be rotated with the mouse as usual.

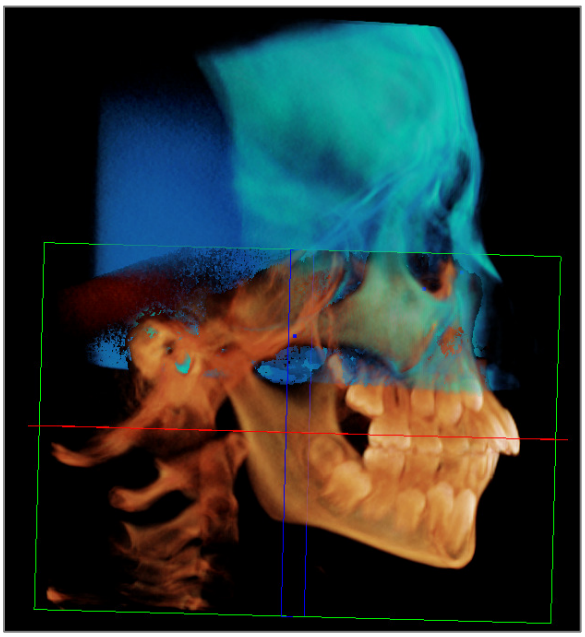
Because the points are plotted on the volume, careful attention must be taken so that the brightness is not too high; otherwise, the point could be offset from the point intended. Clipping the scan may make the selection of the exact point easier and potentially more precise.

Once at least four points are plotted and matched, click the right mouse button to register the two scans.



The above image is of an upper and a lower field of view. The blue outline from the second scan closely overlaps the original bone-colored scan in the shared region.

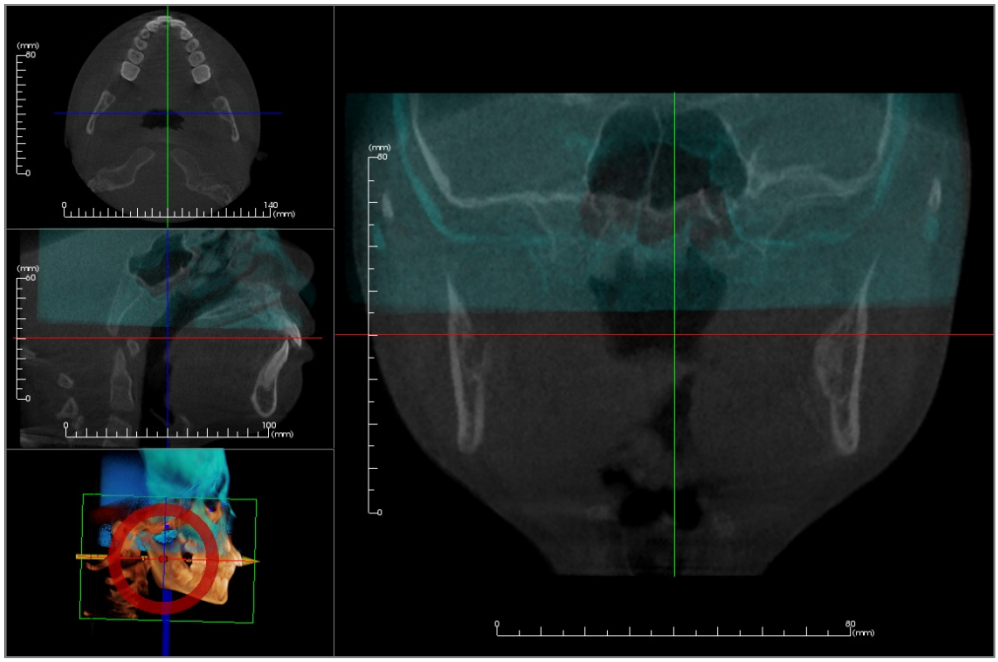
The following image is of two volumes imprecisely registered. The blue and orange skeletal boundaries do not line up, leading to the presence of double images:



Step 5. Making Adjustments for Precision.

The next step is to check the cross sections for accuracy and make the necessary adjustments. The stitching is shown in 3D as well as in the cross sections.

To enlarge the cross sections, use the **Toggle Layout** icon on the toolbar: 

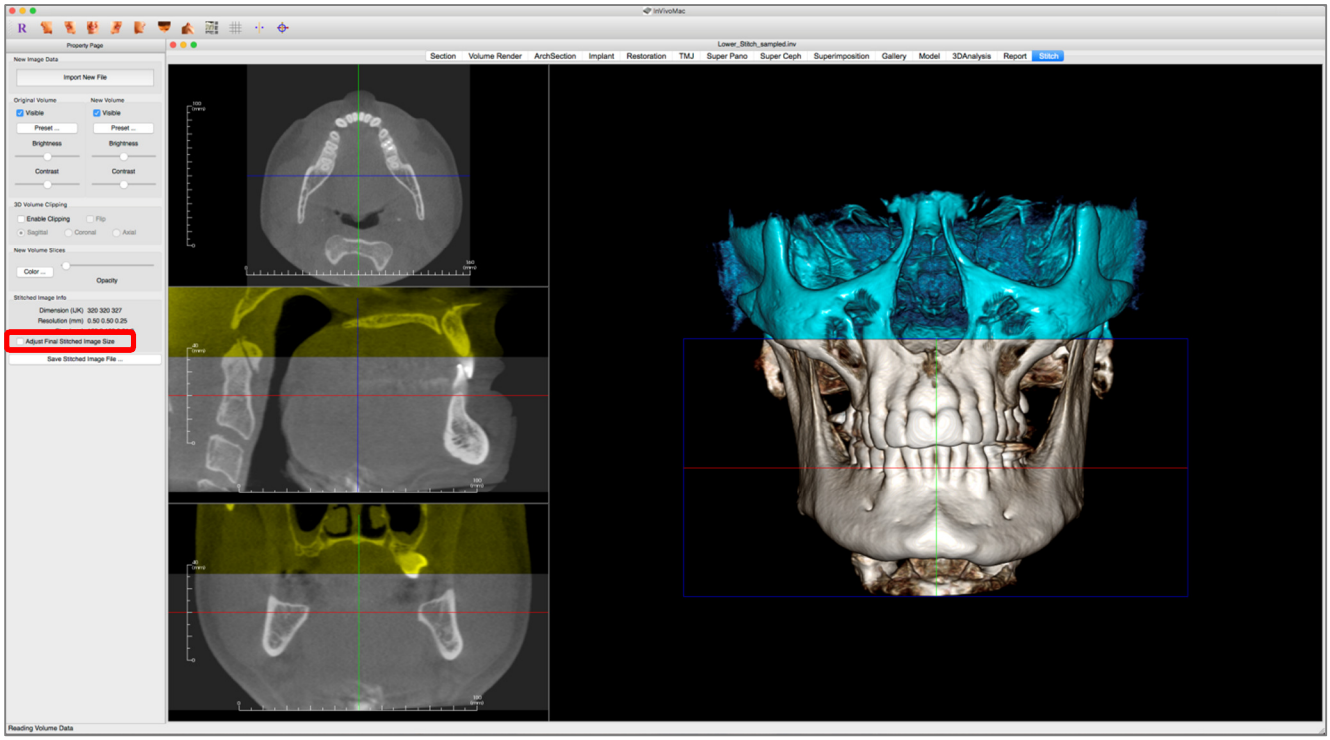


If the stitch is not completely precise in one of the sections, you can move the volume or the cross section for better alignment using the **Adjust** tool: 

Each anatomical plane should be checked for precision. The cranial base should match up perfectly because it is stable; however the vertebrae may not because the patient's head is usually tilted differently in each scan.

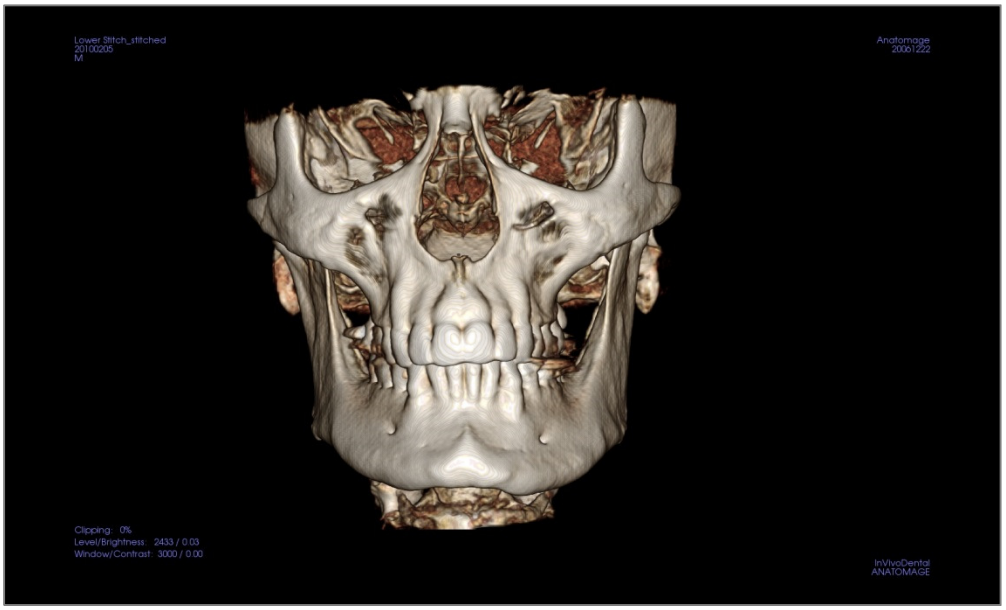
Step 6. Saving Final Stitched Scan

Use the "Adjust Final Stitched Image Size" tool to set the boundaries by dragging the white handles of the bounding box. Make sure the entire volume range is included.



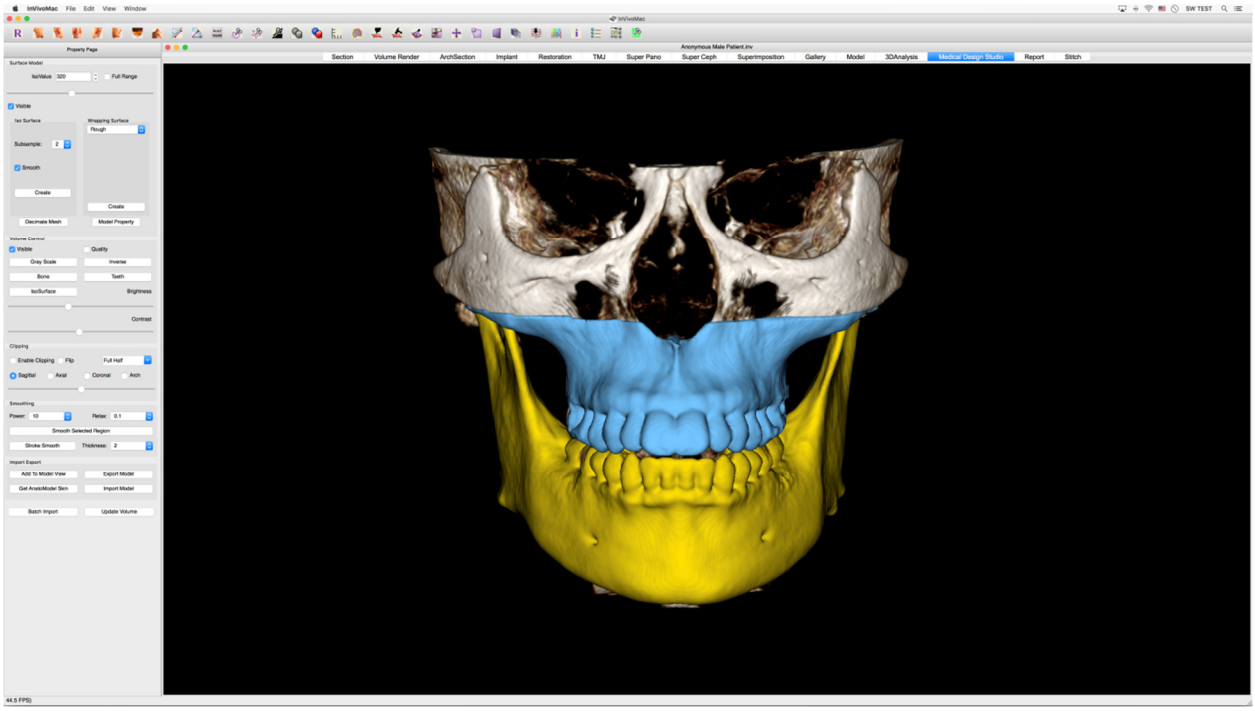
When the bounding box has been adjusted to the size desired, turn off the "Adjust Final Stitched Image Size" function and click the **Save Stitched Image File** button on the bottom left.

This will save an Invivo file (.inv) with the two scans together as one.



Medical Design Studio Module Features

*The **Medical Design Studio View Tab** shows the patient in three-dimenstional, reconstructed views for exploring the internal structures and anatomy of the patient. With Medical Design Studio, surface models of the patient can be created and used for simulations or reference. Models can be exported for use in other design software, and other files (STL, PLY, OBJ) can be imported into this tab.*



Warning: Medical Design Studio module is not a medical device and should be used as a reference or presentation tool only.

Medical Design Studio: Toolbar

Shown below are the Toolbar and tools that are loaded with the Medical Design Studio View Tab:

Reset View: Resets the rendering window to the original view size.

Left View: Automatically orients the volume so the patient is facing left sagittal.

Left ¾ View: Automatically orients the volume so the patient is facing 45° left sagittal.

Front View: Automatically orients the volume so the patient is facing the front.

Right ¾ View: Automatically orients the volume so the patient is facing 45° right sagittal.

Right View: Automatically orients the volume so the patient is facing right sagittal.

Top View: Automatically orients the volume so you are oriented above the patient.

Bottom View: Automatically orients the volume so you are oriented below the patient.

Distance Measurement: Select this option and mark two points on the volume and distance will appear. Clicking on the point and moving the cursor can modify points. Click on the measurement and press the "delete" key to delete it.

Angle Measurement: Select this option and mark three points on the volume and the angle between them will appear. Clicking on their control points and moving the cursor can modify measurements. Click on the measurement and press the "delete" key to delete it.

Reset Volume: Any cutting operations done to the volume are undone. The volume will resume to its original, full shape. (See **Medical Design Studio: Volume Manipulation**, pg. 213.)

Freehand Volume Sculpting: Freely outline an area and remove the volume perpendicular to the plane of the screen. The volume inside or outside the selection can be chosen by clicking in the respective areas. (See **Medical Design Studio: Volume Manipulation**, pg. 213.)

Polygon Volume Sculpting: Outline an area by placing a series of points and right-clicking. The volume perpendicular to the plane of the screen will be removed. The volume inside or outside the selection can be chosen by clicking in the respective areas. (**See Medical Design Studio: Volume Manipulation**, pg. 213.)

Inverse Sculpting: Invert any sculpting operations done on the volume. (See **Medical Design Studio: Volume Manipulation**, pg. 213.)

Volume Objects: Perform Boolean operations using basic shapes on the rendered volume. Shapes include a sphere, block, cylinder, triangle, path-defined pipe, and voxel. (See **Medical Design Studio: Volume Manipulation**, pg. 213.)

Create Mesh Primitives: Create mesh objects of basic shapes. Shapes include a sphere, block, cylinder, and path-defined pipe. (See **Medical Design Studio: Mesh Manipulation**, pg. 225.)

Grid: Toggle between 5 different grid layouts for simple assessment of size, measurement, and spatial location.

Select Area: Outline an area (using a series of points) on the surface mesh. Right-click to finish adding points; Medical Design Studio will automatically connect the last two points to close the area. (See **Medical Design Studio: Mesh Manipulation**, pg. 225.)

Fill Area: After selecting an area on the surface mesh, this tool replaces this area between the points with a new surface mesh, filling in holes in the mesh. (See **Medical Design Studio: Mesh Manipulation**, pg. 225.)

Flatten Area: After selecting an area on the surface mesh, this tool replaces the area between the points with a new surface mesh of constant height, flattening bumps in the mesh. (See **Medical Design Studio: Mesh Manipulation**, pg. 225.)

Pull Area: After selecting an area on the surface mesh, this tool pushes/pulls the selected mesh area. The direction of the pull can be adjusted. (See **Medical Design Studio: Mesh Manipulation**, pg. 225.)

Cut Area: After selecting an area on the surface mesh, choose to remove either the surface mesh area between the points or outside the points. (See **Medical Design Studio: Mesh Manipulation**, pg. 225.)

Move Mesh: Translate and rotate the entire surface mesh relative to the rendered volume. The location and orientation of the surface mesh will be the initial position of the mesh when exported as a model to the Model View Tab. (See **Medical Design Studio: Mesh Manipulation**, pg. 225.)

Mesh Scale: Scale the entire surface mesh either along one axis or in all directions. The "Model Scaling" window will open automatically, and scaling is done by inputting percentages. (See **Medical Design Studio: Mesh Manipulation**, pg. 225.)

Plane Cutter: Cut the mesh along a plane. A widget tool will appear, and the cutting plane will be along the blue-red axes. Position the cutting plane with the widget and right-click to remove any surface mesh behind the plane (opposite side of the yellow arrow). (See **Medical Design Studio: Mesh Manipulation**, pg. 225.)

Mirror Mesh: Mirror the surface mesh about the plane defined by the volume's head-foot axis and posterior-anterior axis. (See **Medical Design Studio: Mesh Manipulation**, pg. 225.)

Register: Register points on the rendered volume. The mesh will orient itself to align on the volume for faster, proper mesh orientation. (See **Medical Design Studio: Mesh Manipulation**, pg. 225.)

Background: Change the background color in the Rendering Window.

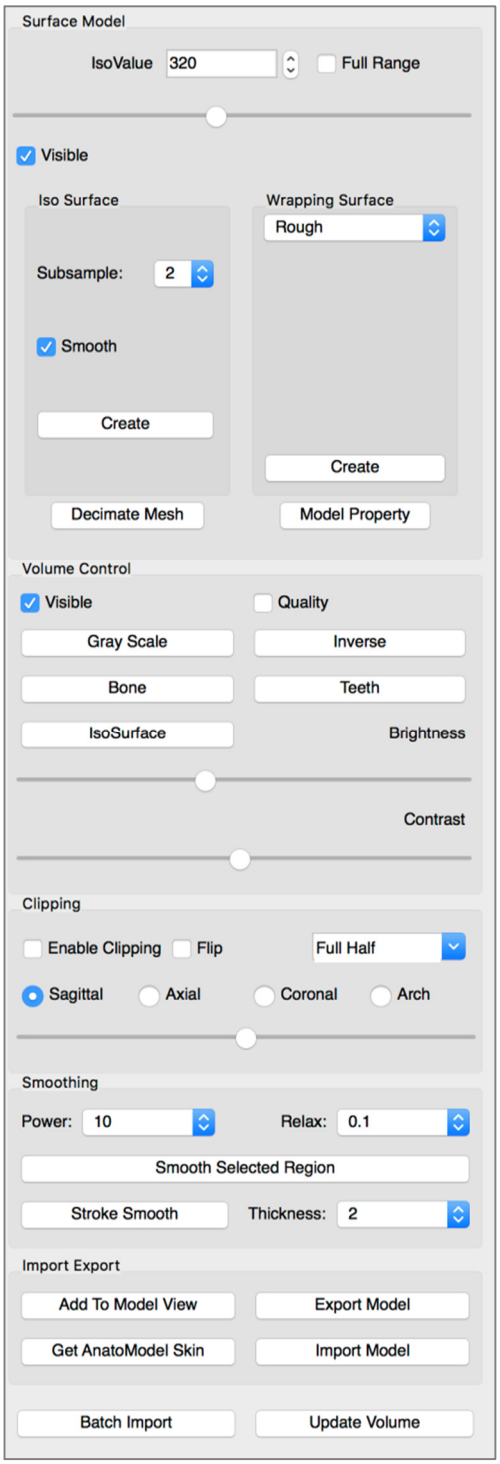
Information Display: Display or hide case information embedded in the data.

Mesh Model List: Open/Close a list of details of all mesh objects in the current case. This Mesh Models Edit window also allows for toggling visibility and deleting individual mesh objects.

Section Layout: Display or hide three cross-sectional views (axial, sagittal, coronal).

Remove Mesh: Use meshes to remove volume. When "Subtract Selected Meshes" is selected, the volume corresponding to the space covered by the selected meshes is removed.. When "Subtract Everything Else" is selected, all of the volume outside the space covered by the selected meshes is removed.

Medical Design Studio: Control Panel



Surface Model

- IsoValue: Set the desired IsoValue for the surface mesh. The value can be set by using the slider bar, clicking the up-down arrows, or typing in the numerical value manually.
- Full Range: When selected, this changes the maximum and minimum IsoValues to match the maximum and minimum values available from the DICOM scan. By default, the "Full Range" selection is off to limit the maximum and minimum values to what the software determines to be the most effective range.
- Visible: Toggles the visibility of the created mesh.
- Isosurface: After manipulating the volume to the desired size/shape with the desired IsoValue, select the Subsample setting value for the IsoSurface (1, 2, 4) and press **Create**. This will create an IsoSurface mesh around the volume. Select Smooth to smooth the created mesh automatically. (See **Medical Design Studio: Mesh Creation**, pg. 218.)
- Wrapping Surface: After manipulating the volume to the desired size/shape with the desired IsoValue, select the wrapping setting (Rough, Normal, Fine) and press **Create**. This will create a wrapping surface around the volume. (See **Medical Design Studio: Mesh Creation**, pg. 218.)
- **Decimate Mesh:** Input the desired number of triangles or reduction ration (0.0 to 1.0) to redefine the number of triangles that compose the surface mesh. The current number of points and triangles can be found in the bottom left corner of the Rendering Window. (See **Medical Design Studio: Mesh Creation**, pg. 218.)
- **Model Property:** Set the various visual properties of the surface mesh, including the opacity, visibility, rendering type (points, wireframe, surface), and shading options (flat, smooth). Material colors and coefficients are also adjustable. For facewrap models, additional texture options are available. Changes in the surface mesh properties are shown immediately in the Rendering Window. (See **Medical Design Studio: Mesh Creation**, pg. 218.)

Volume Control

- Visible: Allows the 3D volume rendering to be turned on or off from view.
- Quality: Box can be clicked on or off to further enhance the quality of the image.
- **View Presets:** Different settings allow for better visualization of certain anatomic structures, soft tissue profiles, hard tissue, etc. This is achieved by displaying specific densities with specific colors and transparencies. IsoSurface image preset provides a preview of the surface mesh based on the current IsoValue setting. Note that the IsoSurface preset does not exactly replicate the mesh that will result when the IsoSurface model is created and is not linked to the brightness and contrast slider bar.
- Brightness & Contrast: Can be adjusted for each of the presets to enhance the image.

Clipping

- Click the "Enable Clipping" box to slice the image along the predefined anatomical planes (sagittal, axial, coronal, and arch).
- Select the size of the clipping amount, from a 5mm slab to a full half.
- Scrolling the mouse wheel or slider bar will move the clipping plane.
- To switch a view to the opposite side, click "Flip."

Smoothing

- Power: Determine the degree of smoothing.
- Relax: Determine the distribution of triangles which can increase the smoothness at the risk of omitting key surface features.
- **Smooth Selected Region:** If an area is selected with the **Select Mesh Area** tool, the smoothing operation will be applied to the selection. If no area is selected, the software will provide the option of smoothing the entire surface mesh.
- **Stroke Smooth:** Manually smooth the surface mesh by clicking and dragging the mouse across the desired regions. The radius of effect is determined by the Thickness.
- See **Medical Design Studio: Mesh Manipulation**, pg. 225.

Import Export

- **Add to Model View:** Add the IsoSurface or wrapping surface model to the Model Tab. The software will prompt for a name for the model and definition of the object hierarchy. Models added to Model Tab will be saved if the case is saved. Adding to the Model Tab does not make an external copy of the surface mesh.
- **Get AnatoModel Skin:** Imports the facewrap model if available from the Model Tab. This model can be generated by the AnatoModel team or with the 3DAnalysis add-on module.
- **Export Model:** Save the surface model externally as an STL or PLY object file. Exporting models do not also add them to the Model Tab.
- **Import Model:** Load an external STL, PLY, or OBJ file into the Rendering Window. Mesh operations can be performed on the imported mesh, including adding it to Model Tab.
- See **Medical Design Studio: Mesh Manipulation**, pg. 225.

Update Volume:

- Sculpted volume becomes the default volume. This change is permanent if the case is subsequently saved.

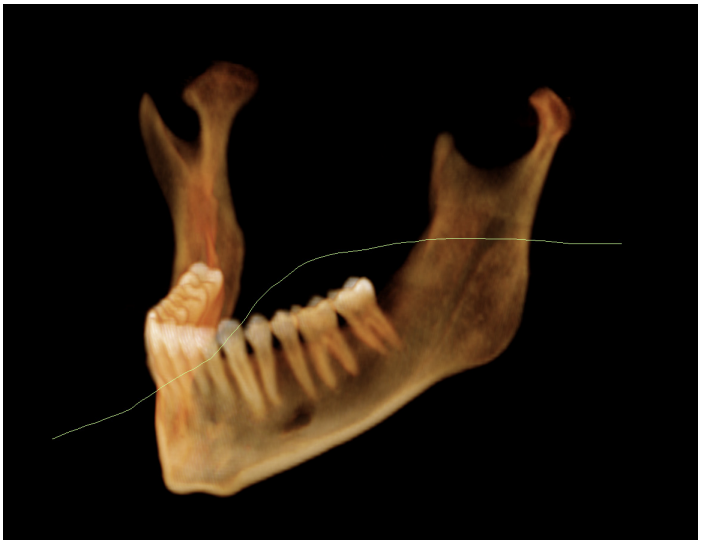
Medical Design Studio: Volume Manipulation

By default, the volume shown in the Rendering Window is generated from the patient's DICOM data and should not be confused with the model/mesh created within the Medical Design Studio Tab. With this rendering, volume can be added or subtracted using the tools in Medical Design Studio shown below:

This section describes how to use the above tools and includes examples to clarify how the tool functions.

Freehand Volume Sculpting Tool 

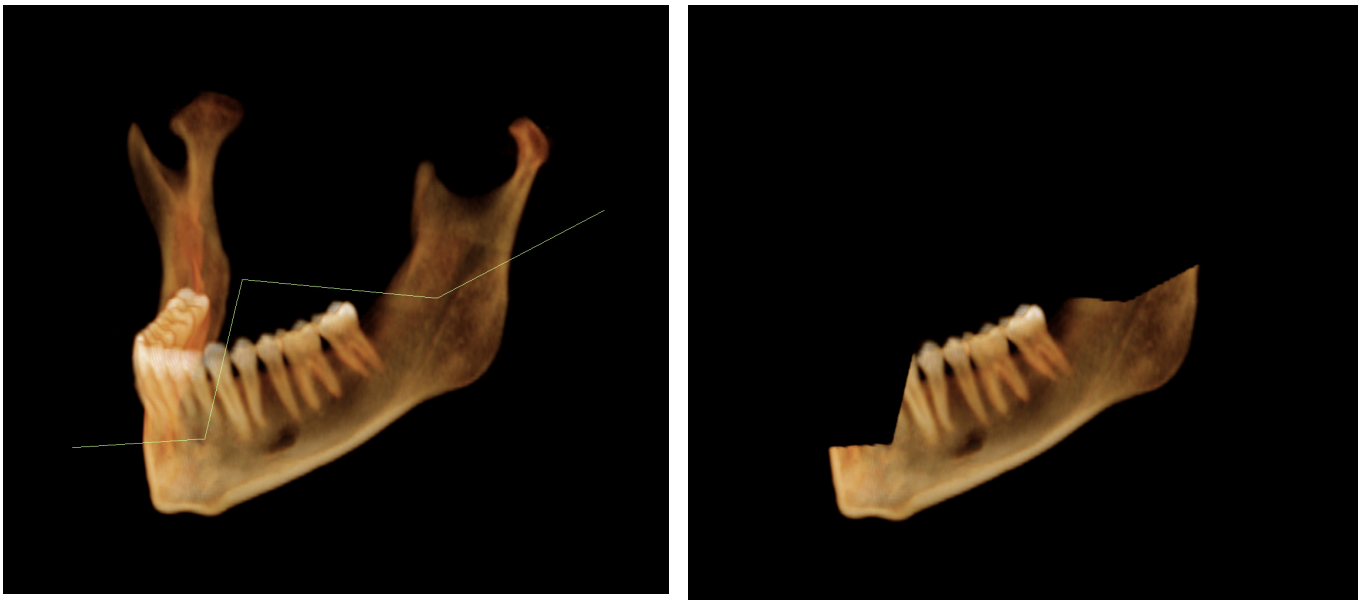
By selecting the Freehand Volume Sculpting Tool, volume can be removed from the rendered image using curves drawn in the Rendering Window.



The cutting line was drawn on the mandible (left) and the top part was removed by clicking on that side of the line. The resulting volume is shown (right).

Freehand Polygon Sculpting Tool 

By selecting the Polygon Volume Sculpting Tool, volume can be removed from the rendered image using point-to-point profiles drawn within the Rendering Window. The image below shows an example of the volume before and after the use of this tool.



The cutting profile was drawn using a series of points (left) and the top part was removed by clicking on that side of the profile line. The resulting volume loss is shown (right).

Inverse Sculpting Tool 

If any sculpting operations have been performed on the volume, the Inverse Sculpt Tool will have one of the following effects:

Volume was removed and Inverse Sculpt Tool is used.

The Inverse Sculpt Tool will reset the rendering to show everything except the volume currently on the Rendering Window.

Ex: Mandible is separated from rest of skull. Inverse Sculpt Tool will show the full volume without the mandible (see image below).

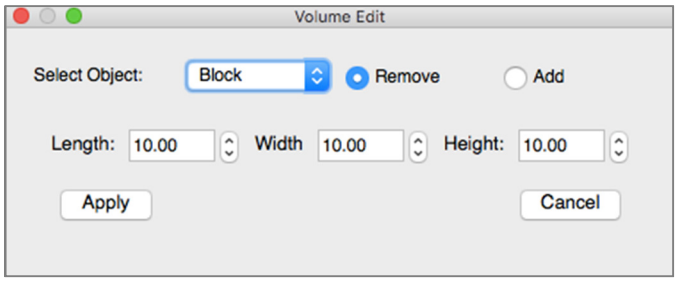
Volume was added and Inverse Sculpt Tool is used

The Inverse Sculpt Tool will perform a Boolean operation and output only the overlapping region of the two volumes.

Ex: Pipe volume is removed from the mandible and nothing else is done to the rendering. Inverse Sculpt Tool will show overlapped volume (see image below).

Volume Objects Tool 

There is a set of predefined shapes that you can use to add (remove) volume to (from) the rendering. The basic shapes are a block, sphere, cylinder, pipe, triangle and voxel. The Volume Objects Tool performs a Boolean add/remove operation with the selected shape.



Sphere:	Define the diameter of the sphere and left-click on an anatomical feature to place the shape. Use the move widget to the desired location and click **Apply** to either add or remove the shape to/from the rendering.
Block:	Define the length, width, and height of the block and left-click on an anatomical feature to place the shape. Use the move widget to the desired location and click **Apply** to either add or remove the shape to/from the rendering.
Cylinder:	Define the diameter and height of the cylinder and left-click on an anatomical feature to place the shape. Use the move widget to the desired location and click **Apply** to either add or remove the shape to/from the rendering.
Pipe:	Define the diameter of your pipe and using the left mouse button, place a series of points to define the pipe profile. Right-click to complete the profile. The pipe should be added to the rendering screen but the profile points can still be moved. Click **Apply** to either add or remove the shape to/from the rendering.
Voxel:	This is a term used to describe a volume element ("volumetric pixel," "volumetric picture element"). Select a size for the voxel and left-click anatomical features in the rendering window. The

	voxel will automatically be added or removed.
Triangle:	Define the height of the triangle and left-click on three anatomical features to define the profile of the triangle. Click **Apply** to either add or remove the shape to/from the rendering.

Reset Volume 

This tool allows to you completely reset the volume in the Rendering Window back to the default settings. Reset Volume will undo any and all operations done to the rendered volume. This does not affect any surface meshes made.

Medical Design Studio: Mesh Creation

Medical Design Studio allows users to create surface meshes/models based on the CBCT scans of patients. This section describes in further detail surface model creation and the different settings available for surface models.

IsoValue

The setting for the IsoValue will determine the density level threshold that Medical Design Studio will use when creating the surface mesh. A higher IsoValue corresponds to a higher density level and a lower IsoValue corresponds to a lower density level.

Use the slider to set the IsoValue or enter the numbers manually.

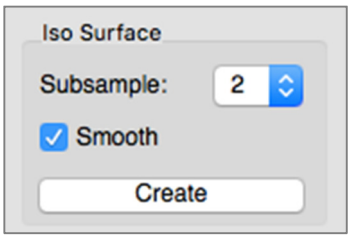
Ex: IsoValue setting "620" includes all densities associated with IsoValue higher than 620. The created surface will include higher density values (ex: cortical bone), some lower density values (ex: soft tissue, gingiva), and densities in between.

By default, Medical Design Studio selects a range of IsoValues that it determines will be the most useful based on the imported data file. However, this can be overridden by selecting "Full Range" which adjusts the slider bar to the full range of possible IsoValues.

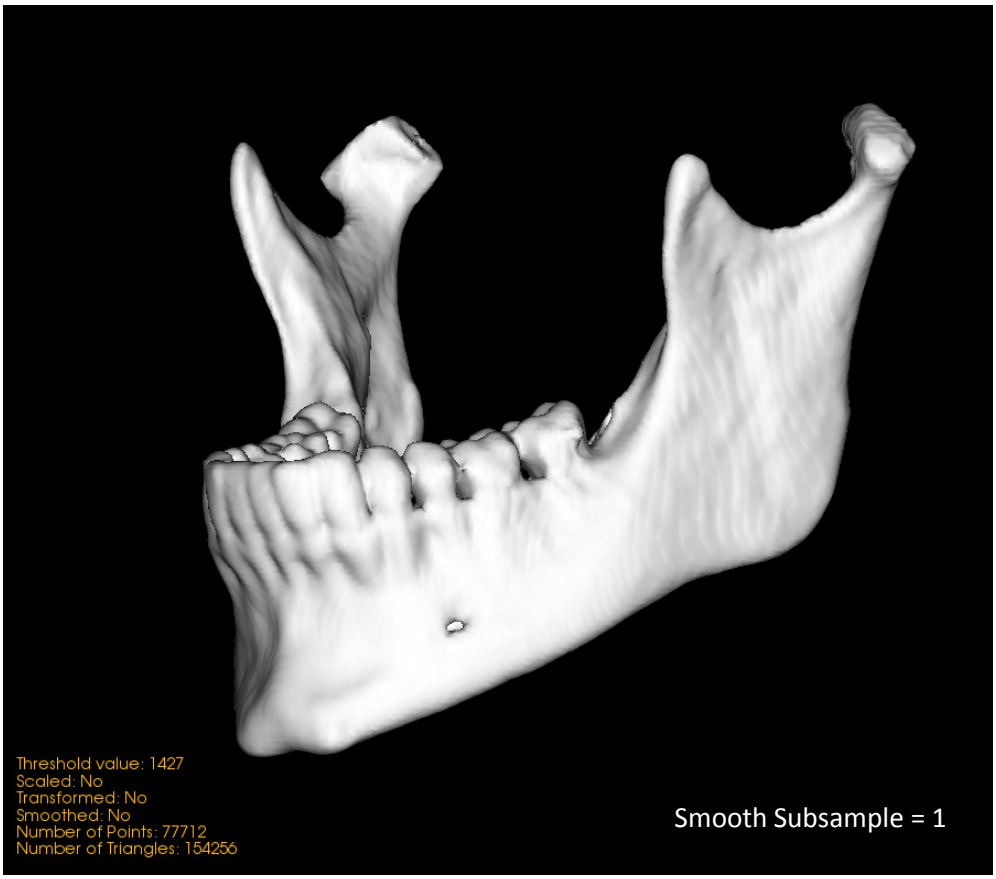
To preview how the IsoSurface will appear, use the preset view named "IsoSurface" under Volume Control. By changing the IsoValue, the rendered volume will actively change within the Rendering Window. The previewed image does not show what the final IsoSurface mesh will look like when created and is a preview tool only.

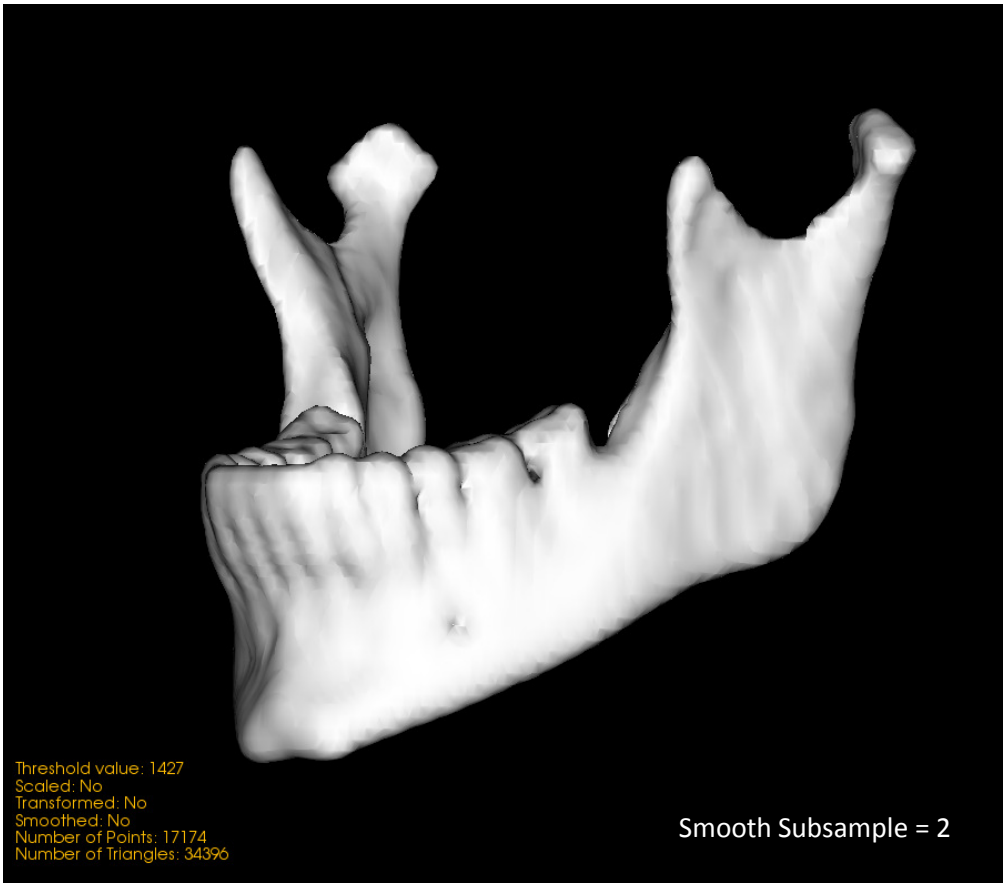
IsoSurface

Select the subsample size to determine the degree of accuracy that the created mesh will represent the surface of the rendered volume. A lower subsample setting corresponds to more points and triangles that will be used to represent the surface resulting in higher accuracy. Press **Create** to make the surface mesh model. Selecting "Smooth" will have Medical Design Studio smooth the surface of the model and ignore some of the noise surrounding the rendered volume surface.

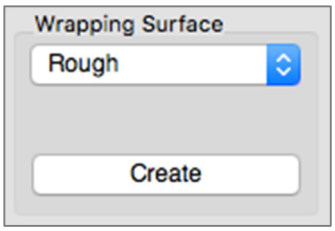


Examples of the different subsample settings are shown on the following page. Notice the difference in the number of points and triangles indicated in the bottom left corner of the images.


Threshold value: 1427
Scaled: No
Transformed: No
Smoothed: No
Number of Points: 77712
Number of Triangles: 154256
Smooth Subsample = 1

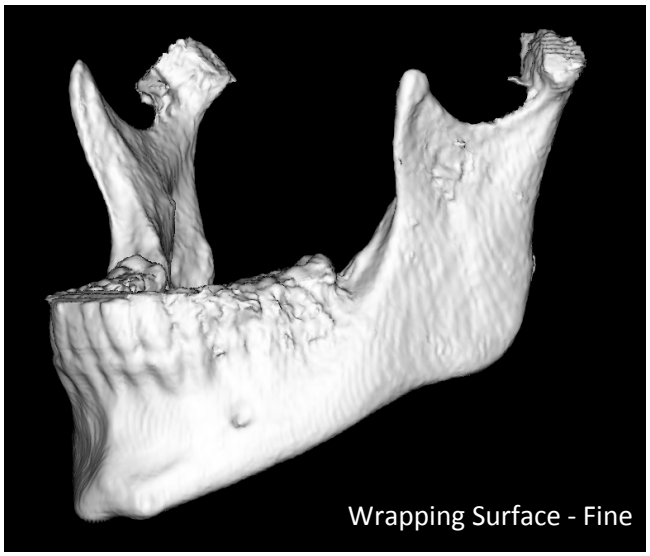

Threshold value: 1427
Scaled: No
Transformed: No
Smoothed: No
Number of Points: 17174
Number of Triangles: 34396
Smooth Subsample = 2

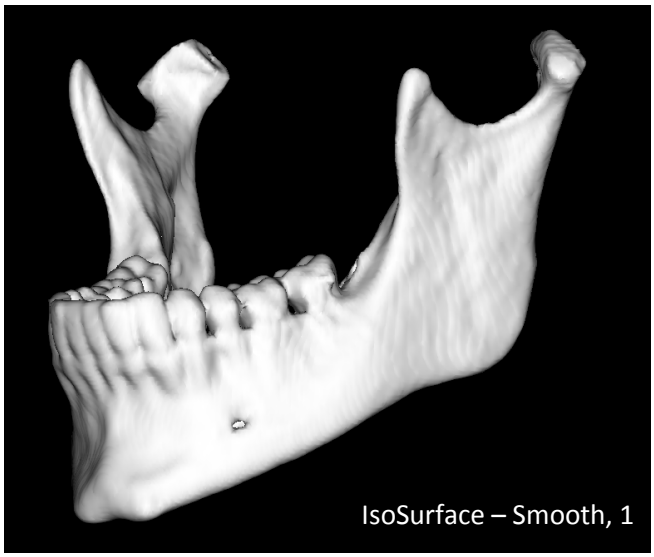
Wrapping Surface



Select the level of accuracy for the Wrapping Surface to exhibit and press **Create** to generate a Wrapping Surface representing the rendered volume surface. Wrapping Surface, unlike IsoSurface attempts to create a uniform surface model (no gaps, holes, inner structures). As a result, it may be more sensitive to noise surrounding the rendered volume surface. However, it can produce more accurate representations for certain renderings. The Rough/Normal/Fine setting will determine how many iterations will be done to create the surface and the allowed deviation.

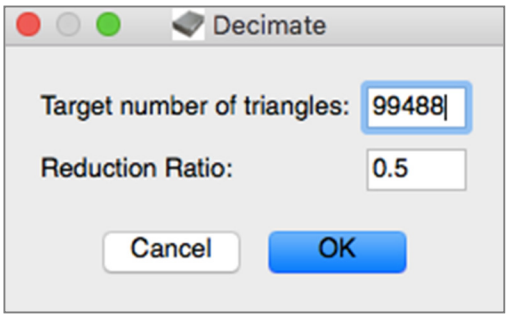
The images below show the same sculpted volume modeled using an IsoSurface (subsample 1) and a Wrapping Surface (Fine setting).





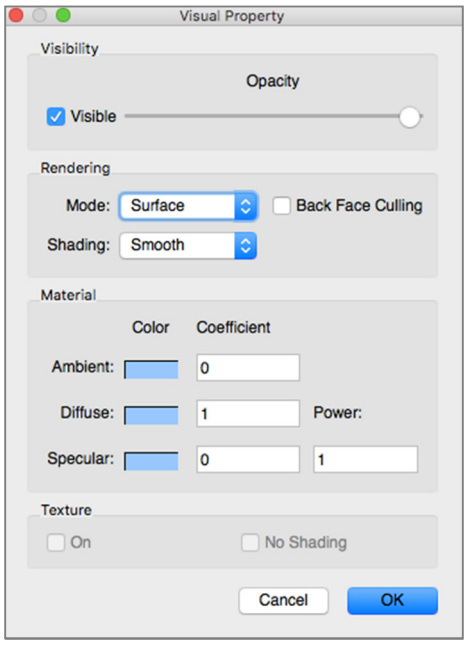
Decimate Mesh

After creating a surface mesh model (either a Wrapping Surface or IsoSurface), the number of triangles used can be reduced. the **Decimate Mesh** to open up the Decimate Window. Enter either the Target Number of Triangles or a Reduction Ratio. Press **OK** to complete the operation.



Model Property

Pressing **Model Property** will open the Visual Property Window where visual preferences can be adjusted.



Visibility

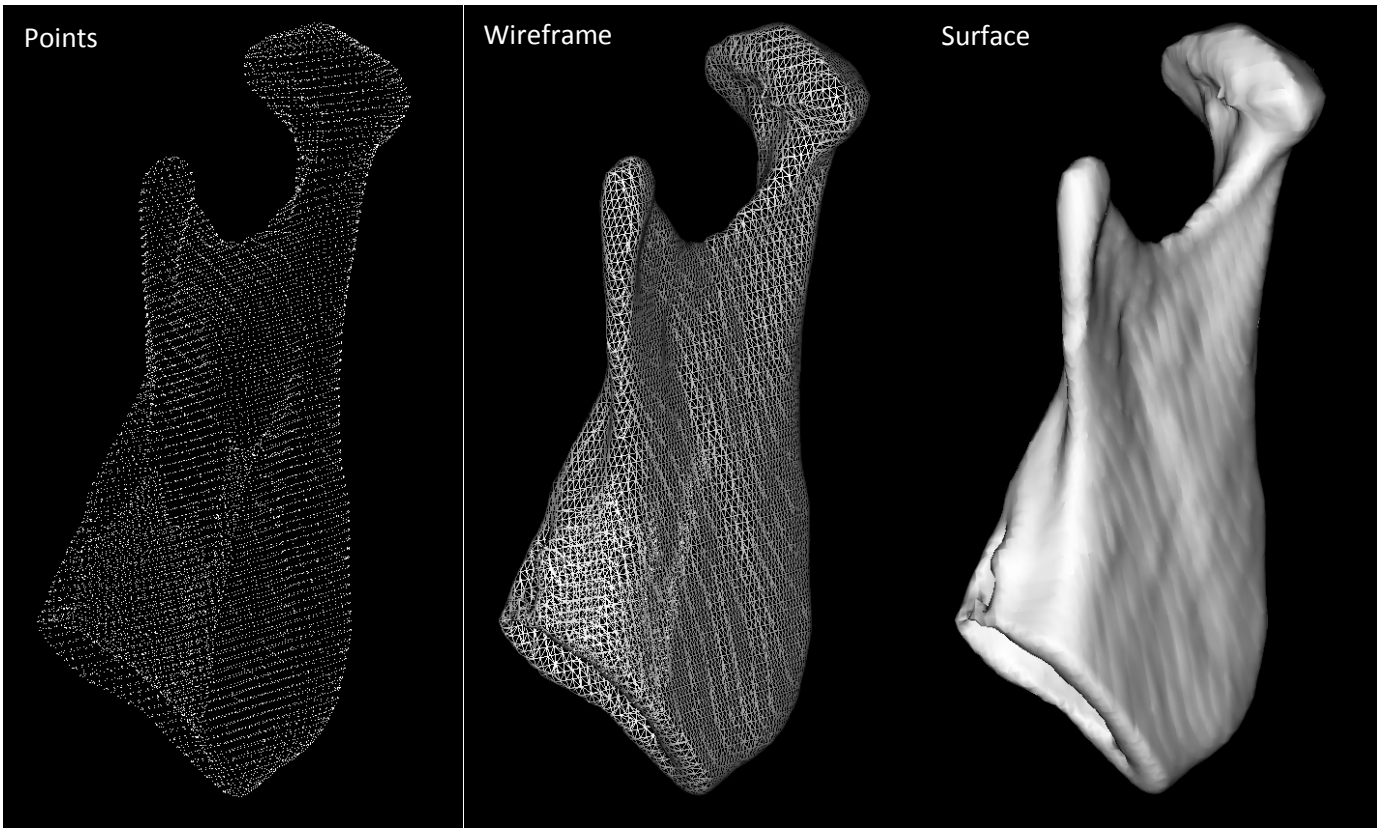
- Use the slider to adjust the opacity of the model in the Rendering Window. Uncheck "Visible" to hide the model entirely.

Rendering

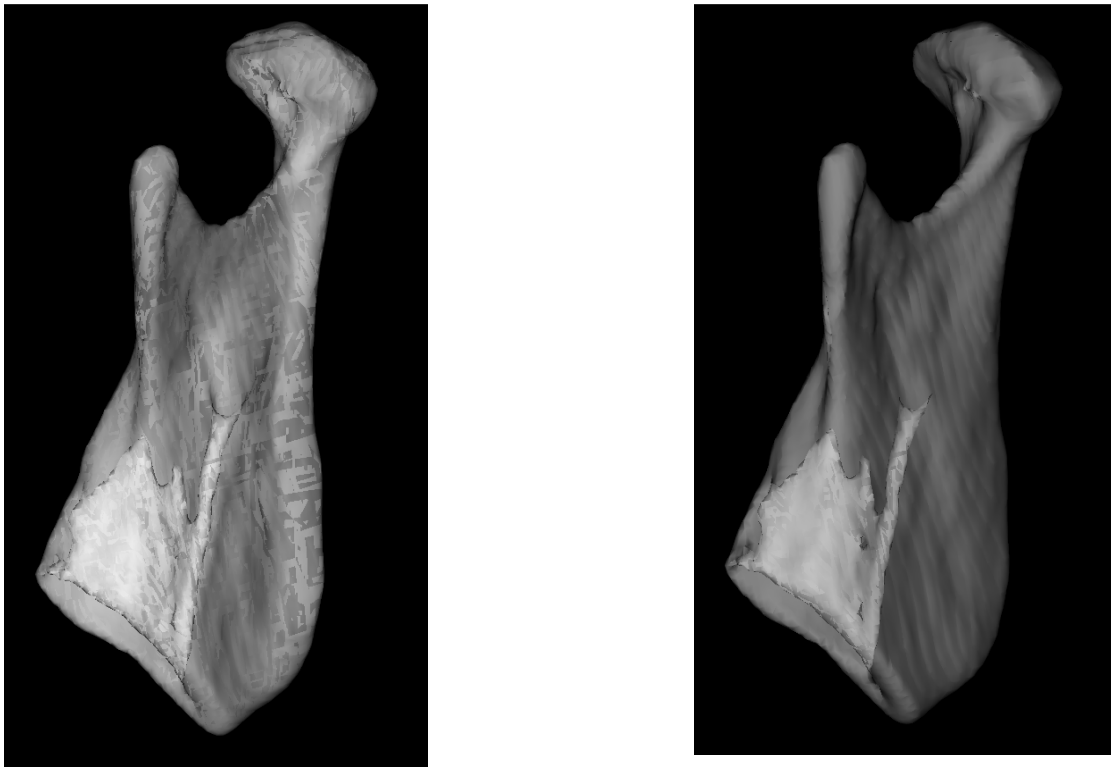
- Mode: Sets how the model will be rendered (surface, wireframe, or points).
- Shading: Affects how lighting reflects off the surface mesh model in the Rendering Window (flat or smooth). The smooth option tends to add shadows to the rendering.
- Back Face Culling: Adjusts which surface normal will reflect light (be seen) in the Rendering Window. If selected, surface faces will be transparent when viewed from behind.

Material

- Set the ambient, diffuse, and specular colors of the model. Adjusting the coefficients affects the intensity of the color on the model.



The above image shows the various rendering modes under Model Property.

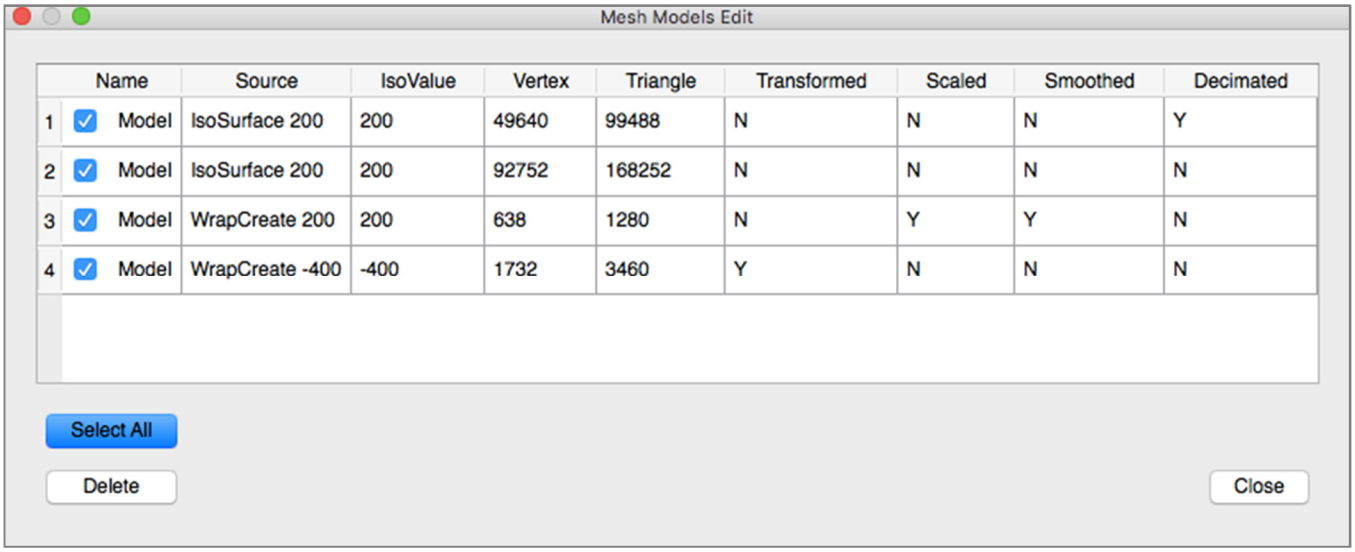


The above image shows the effects of back face culling The image on the right has the back face culling option selected. The image on the left does not. Both images have been set to approximately 60 percent opacity.

Mesh Models Edit

Click on **Mesh Model List** on the toolbar to open the Mesh Models Edit window which lists all mesh objects present within the current case.

From the Mesh Models Edit window, visibility of mesh objects can be toggled by clicking on the checkbox to the left of the model. Selecting a mesh from the list also selects the mesh for editing. Multiple meshes can be selected by clicking on them while holding Cmd. This allows for multiple meshes to be transformed, smoothed, or scaled.

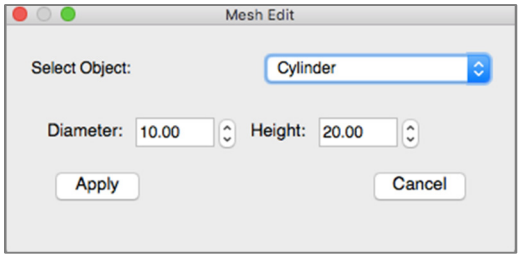


Certain details on the mesh are shown in the Mesh Models Edit window as well.

IsoValue:	The IsoValue selected to create the source mesh.
Vertex:	Vertex count of the mesh. Typically the more vertices in a mesh the larger and/or more detailed the mesh object.
Triangle:	The number of triangles used to form the mesh object.
Transformed:	Whether the mesh object has been transformed. Will display Y if the mesh object has been translated or rotated using Mesh Move.
Scaled:	Whether the mesh object has been scaled. Will display Y if the mesh object has been scaled with Mesh Scale.
Smoothed:	Whether the mesh object has been smoothed. Will display Y if the mesh object has been smoothed with Smooth Selected Region or Stroke Smooth.
Decimated:	Whether the mesh object has been decimated. Will display Y if the mesh object has been decimated with Decimate Mesh.

Create Mesh Primatives Tool

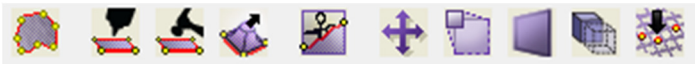
Predefined shapes can be added as new meshes in Medical Design Studio. The basic shapes are block, sphere, cylinder, and path-defined pipe. Meshes placed in with the Create Mesh Primitives tool will be shown in the Mesh Models Edit window.



Sphere:	Define the diameter of the sphere and left-click on an anatomical feature to place the shape. Use the move widget to the desired location and click **Apply** to commit the mesh object placement.
Block:	Define the length, width, and height of the block and left-click on an anatomical feature to place the shape. Use the move widget to the desired location and click **Apply** to commit the mesh object placement.
Cylinder:	Define the diameter and height of the cylinder and left-click on an anatomical feature to place the shape. Use the move widget to the desired location and click **Apply** to commit the mesh object placement.
Pipe:	Define the diameter of the pipe and using the left mouse button, place a series of points to define the pipe profile. Right-click to complete the profile. The pipe should be added to the rendering screen but the profile points can still be moved. Click **Apply** to commit the mesh object placement.

Medical Design Studio: Mesh Manipulation

In addition to creating surface models, Medical Design Studio can edit imported or created models using the basic surface mesh operating tools shown below:



This section discusses in greater detail how to use these mesh manipulation tools and includes photos showing how the tools operate.

Select Area Tool 

Selecting a series of points to define an area on the surface model. Right-click after placing the last point to automatically close the loop and create the area. The image below shows an example of a selected area.

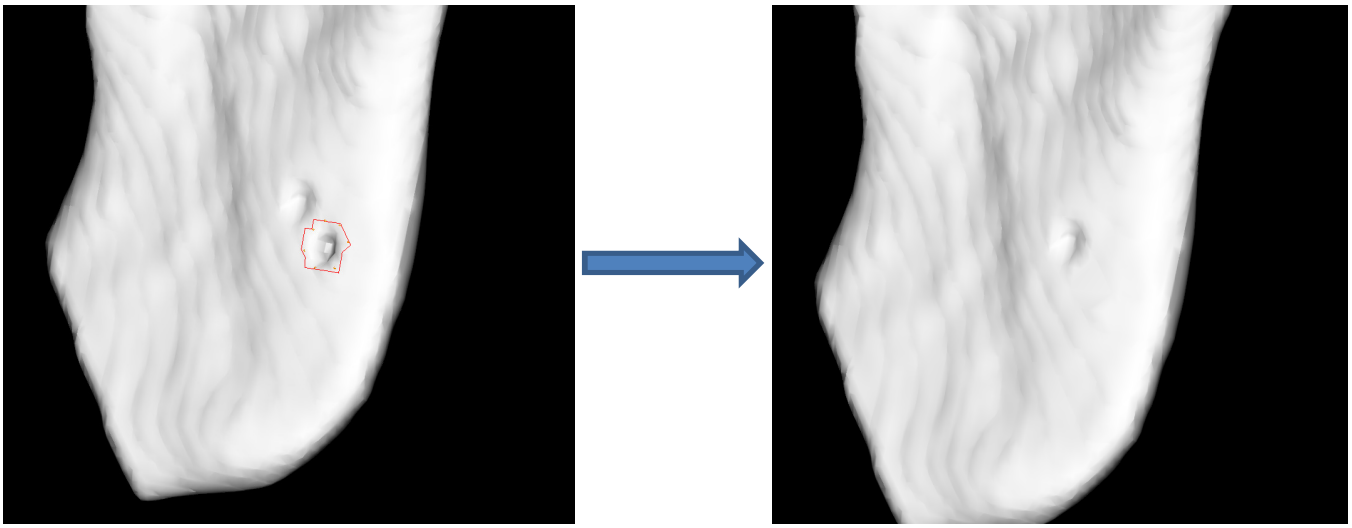
The points defining the profile must be on the surface boundary of the mesh; otherwise, a point will not be placed. When the area has been selected, the placed points can still be moved to better encompass specific features as needed.

It is important to properly define the area as it is the first step in using the following tools:

- Mesh Area Filling
- Mesh Area Flattening
- Mesh Area Pulling
- Mesh Area Cutting
- Smooth Selected Region

Mesh Area Filling 

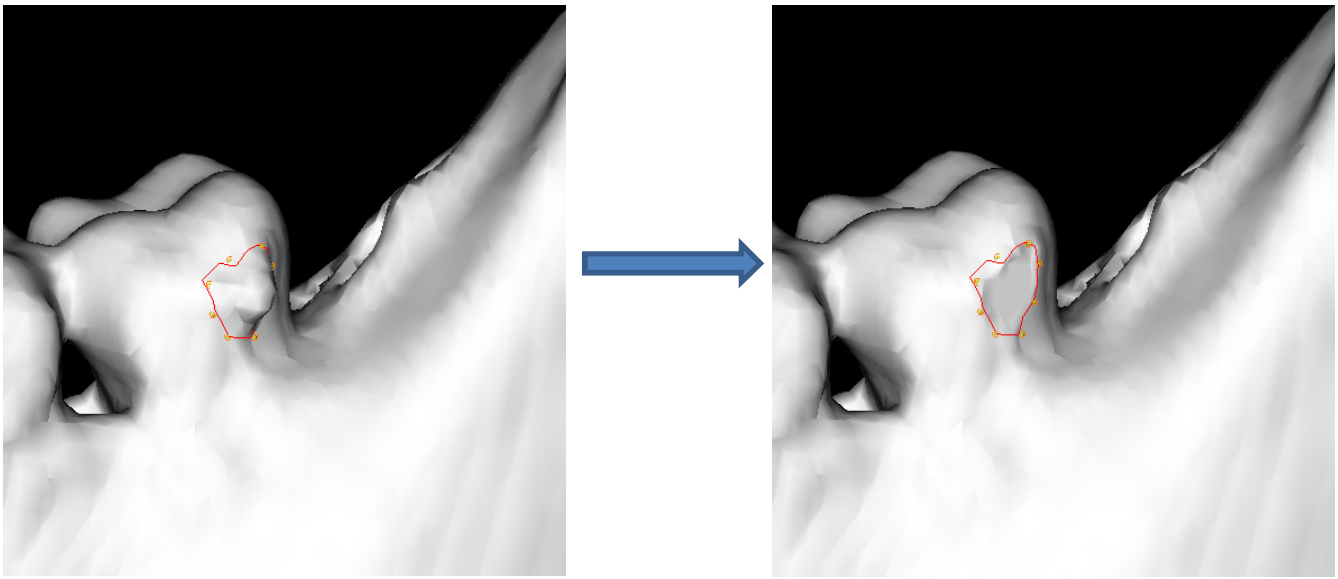
Select an area with the Select Area Tool and fill in gaps for a smoother looking model. Note: Try to adjust the IsoValue first to fix gaps before resorting to the Mesh Area Filling Tool.



The above images show the effect of the Mesh Area Filling Tool.

Mesh Area Flattening 

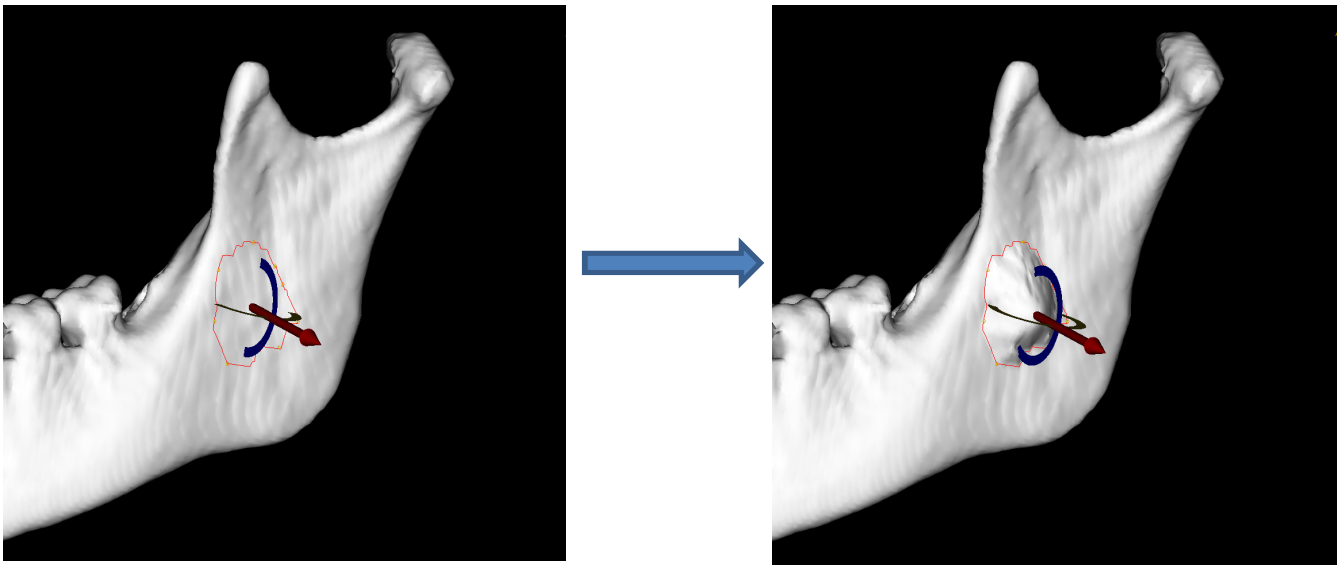
Select an area with the Select Area Tool and flatten features for a smoother looking model. Note: try to adjust the IsoValue first before resorting to the Mesh Area Flattening Tool.



The above images show the effect of the Mesh Area Flattening Tool.

Mesh Area Pulling 

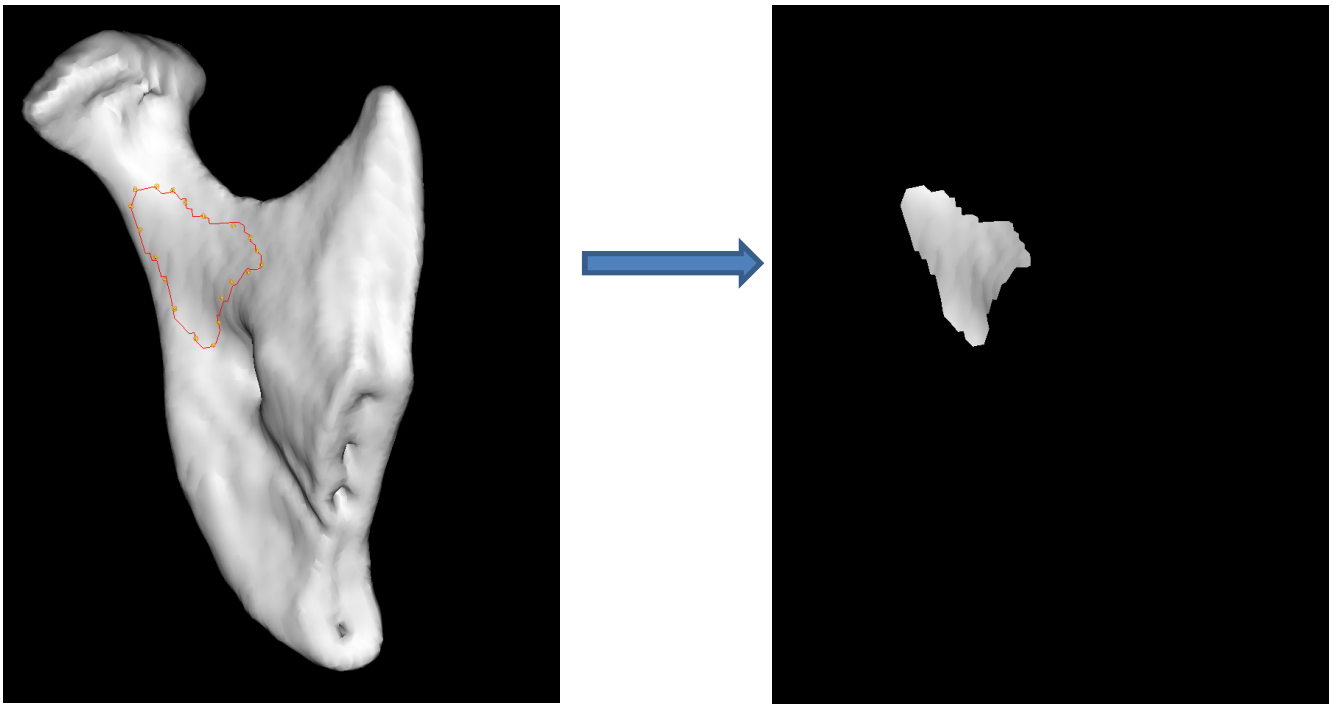
Select an area with the Select Area Tool and pull the area to customize the model. The direction of the pull can be adjusted using the rotation widget that appears. The selected area can also be pushed using the same tool.



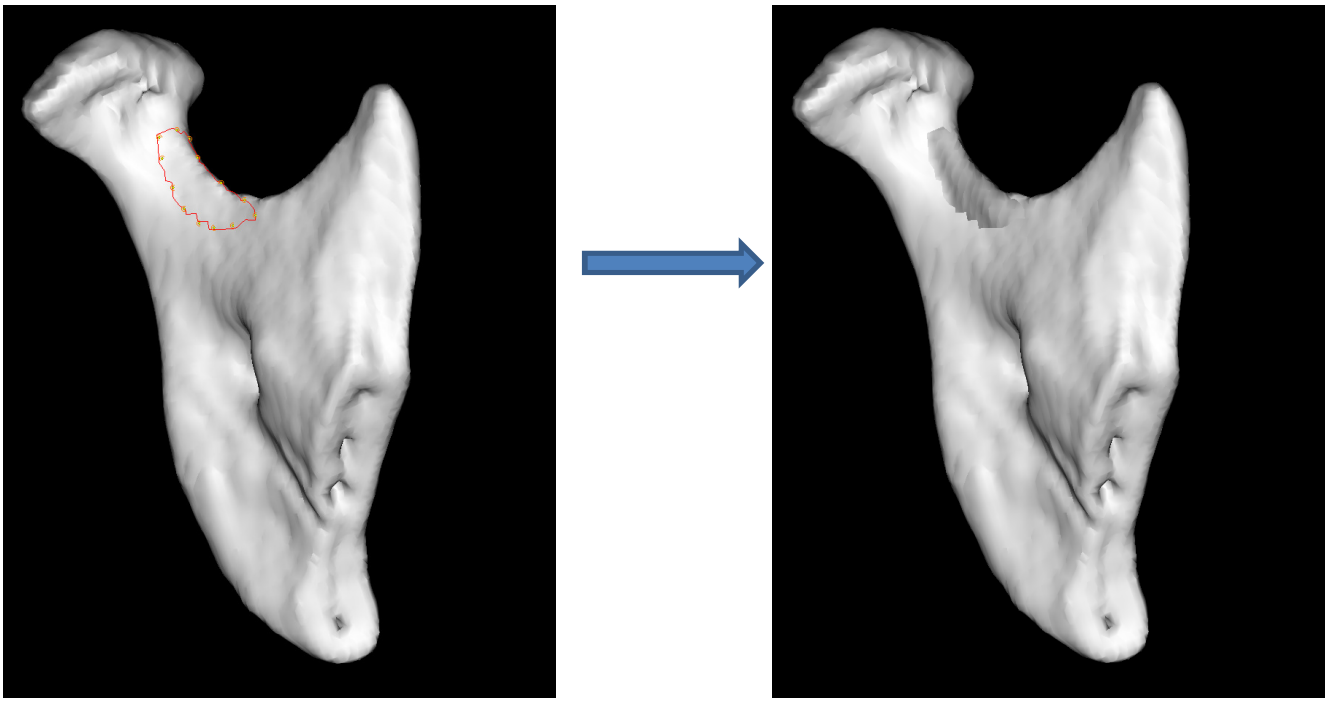
The above images show the effect of the Mesh Area Pulling Tool.

Mesh Area Cut 

Select an area with the Select Area Tool and cut the area with the Mesh Area Cut Tool to edit the model. The software will prompt whether to keep or remove the area within the selected profile.



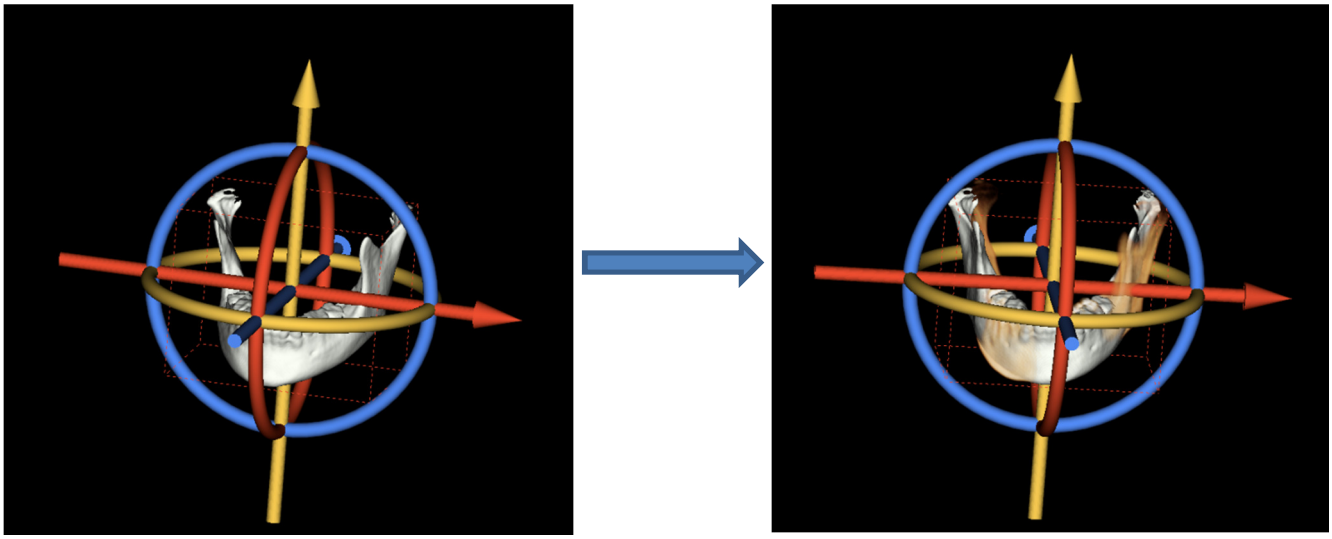
The above images show the effect of the Mesh Area Cut Tool – keeping the inside.



The above images show the effect of the Mesh Area Cut Tool – keeping the outside.

Mesh Move 

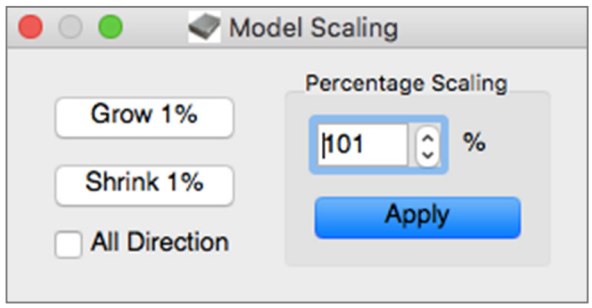
Models can be moved and rotated relative to the original rendered volume. To change the rotation point, hold down the Cmd button to move the rotational axes relative to the surface model. The orientation and location of this surface model will determine its orientation and location in the Model Tab View. (**See Medical Design Studio: Model Import and Export**, pg. 30). This function allows multiple models to be moved together by selecting them first in the Rendering Window by Cmd + left-clicking on multiple models or selecting them in the Mesh Models List.

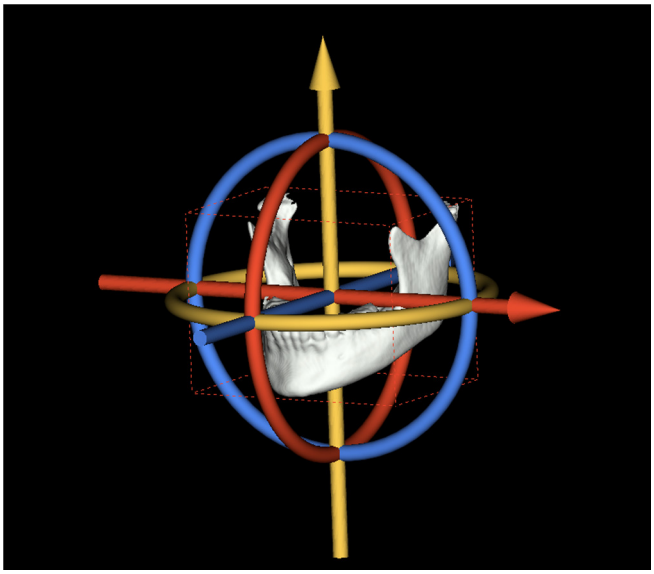


The above images show the effect of the Mesh Move Tool.

Mesh Scale 

Surface mesh size can be scaled using the Model Scaling window. Models can be grown or shrunk by 1 percent increments or by applying a percent scaling. Using the Scaling Widget, select the axis of the model along which axis scaling will be applied. If "All Direction" is selected in the Model Scaling window, Medical Design Studio will apply the scaling transformation along all axes. This function allows multiple models to be scaled together by selecting them first in the rendering window using Cmd + left-click or Mesh Models List.

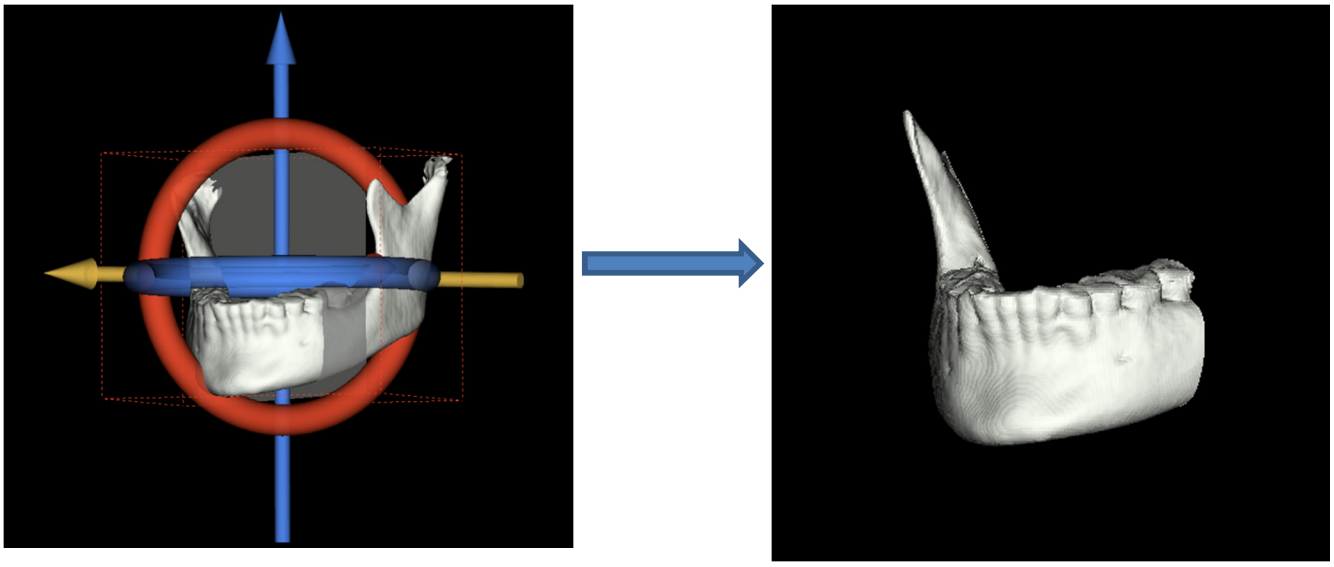




Plane Cutter

Parts of the surface mesh model can be removed using the Plane Cutter Tool. The cutting plane can be moved and rotated using the Plane Cutter move widget. The Plane Cutter will remove any portion of the mesh model behind the yellow arrow.

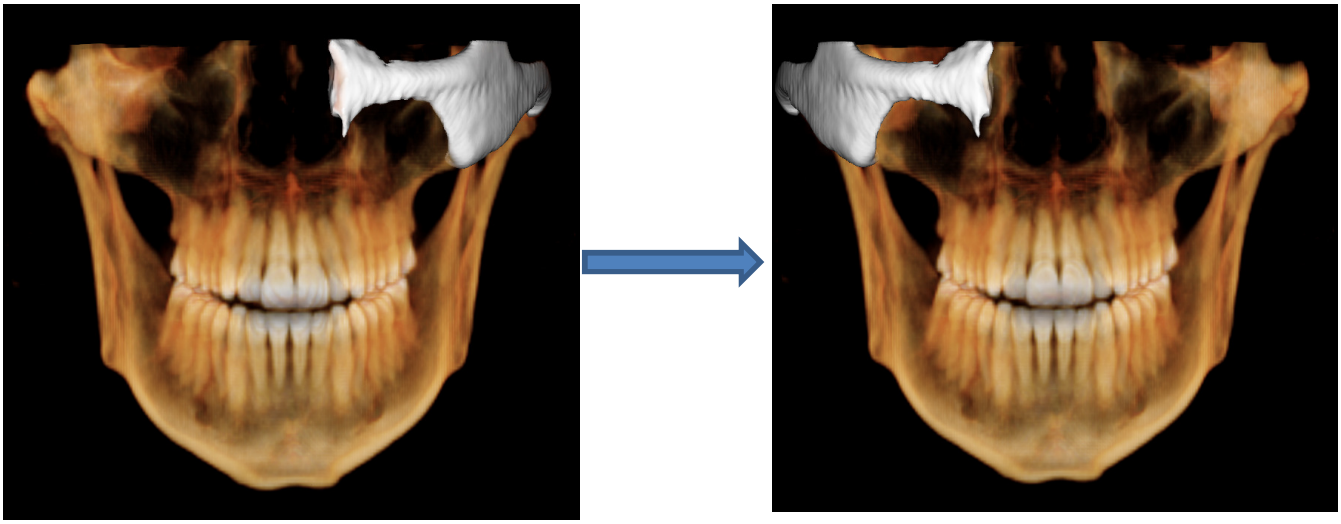
Note: Plane cutting operations will affect the mesh only; the rendered volume will remain the same. Similarly, enabling clipping will not prevent the mesh from being cut as it does for the volume. Even though the volume and mesh may be hidden from view, the Plane Cutter will still remove any portion of the surface mesh model that is behind the yellow arrow.



The above images show the effect of the Plane Cutter Tool.

Mirror Mesh

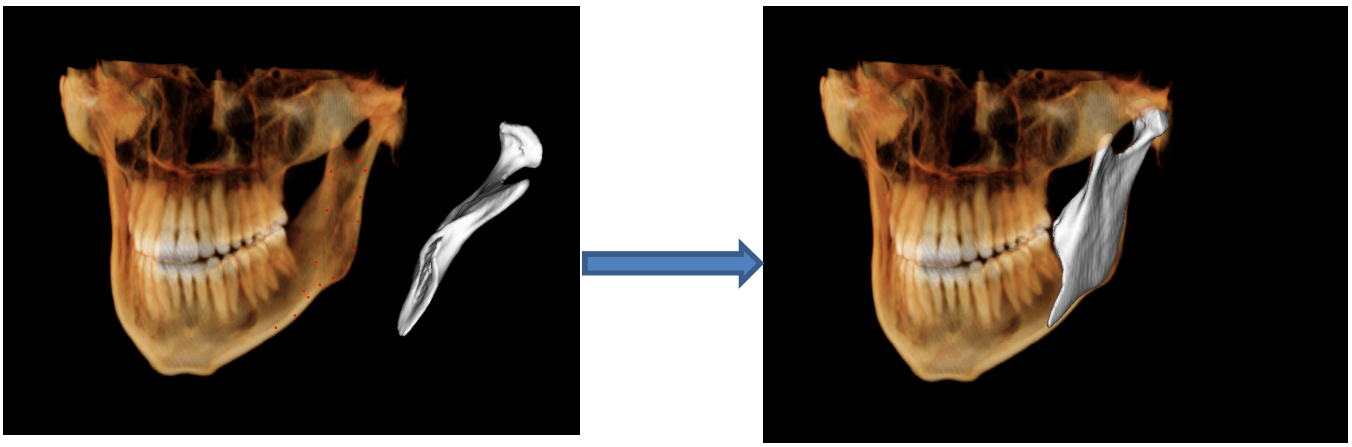
Surface mesh model can be reflected about the volume rendering's mid-sagittal plane. The mirrored mesh will replace the original mesh. All mesh manipulation tools can be operated on the mirrored mesh.



The above images show the effect of the Mirror Mesh Tool. (Note the asymmetry between the zygoma.)

Mesh Registration

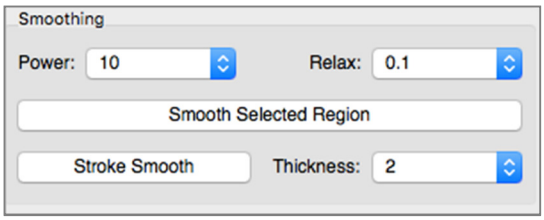
This tool assists in aligning an existing surface mesh model, either created or imported, with the rendered volume. After selecting this tool, select points on the rendered volume. Right-click to finish the process, and Medical Design Studio will register the mesh to these points on the volume. Some final movements or rotations may be necessary to move mesh into an exact location and orientation using the Mesh Move Tool.



The above images show the process of the Mesh Registration Tool. The red dots are the registration points chosen for the mesh.

Smooth Settings

In addition to the manipulation tools in the Toolbar, Medical Design Studio can smooth surface mesh models created or imported) using its own smoothing operation tools. This section covers these smoothing operation tools (Stroke Smooth and Smooth Selected Region) in greater detail.

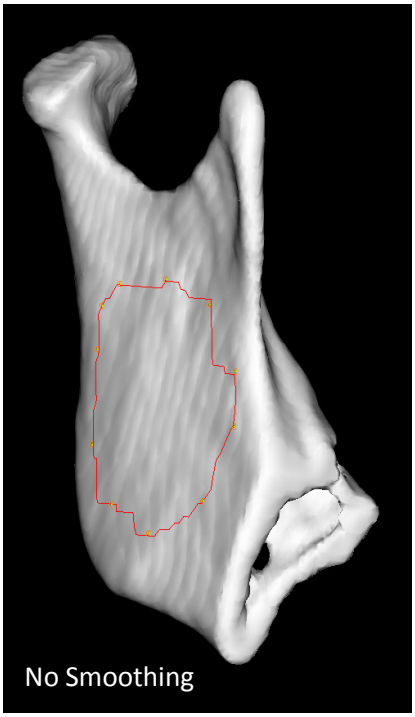


The smoothing operation tools function by selecting an area on the mesh and averaging the positions of the individual points that compose the mesh. The following settings determine the magnitude of smoothing that will be performed on the mesh.

Power: Sets the number of averaging iterations. A larger power setting corresponds to a more noticeable smoothing operation. The images below show the difference between the 10 and 50 settings.

Relax: Sets the distribution of triangles along the surface mesh model. Larger relax settings will result in smoother surfaces but could omit key surface features.

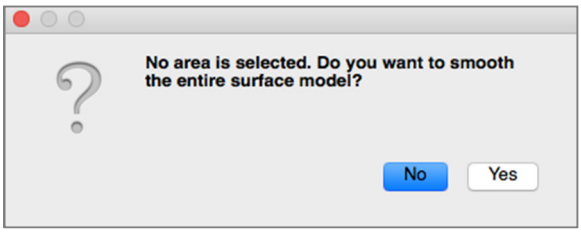
In general, a small relax setting and large power setting is recommended when performing smoothing operations on surface mesh models.



Smooth Selected Region

Use the Select Area Tool to define an area on the created or imported surface mesh model for the smoothing operation. Set the desired Power and Relax settings and press **Smooth Selected Region**. This button can be pressed multiple times for the same selected area to perform the smoothing operation multiple times.

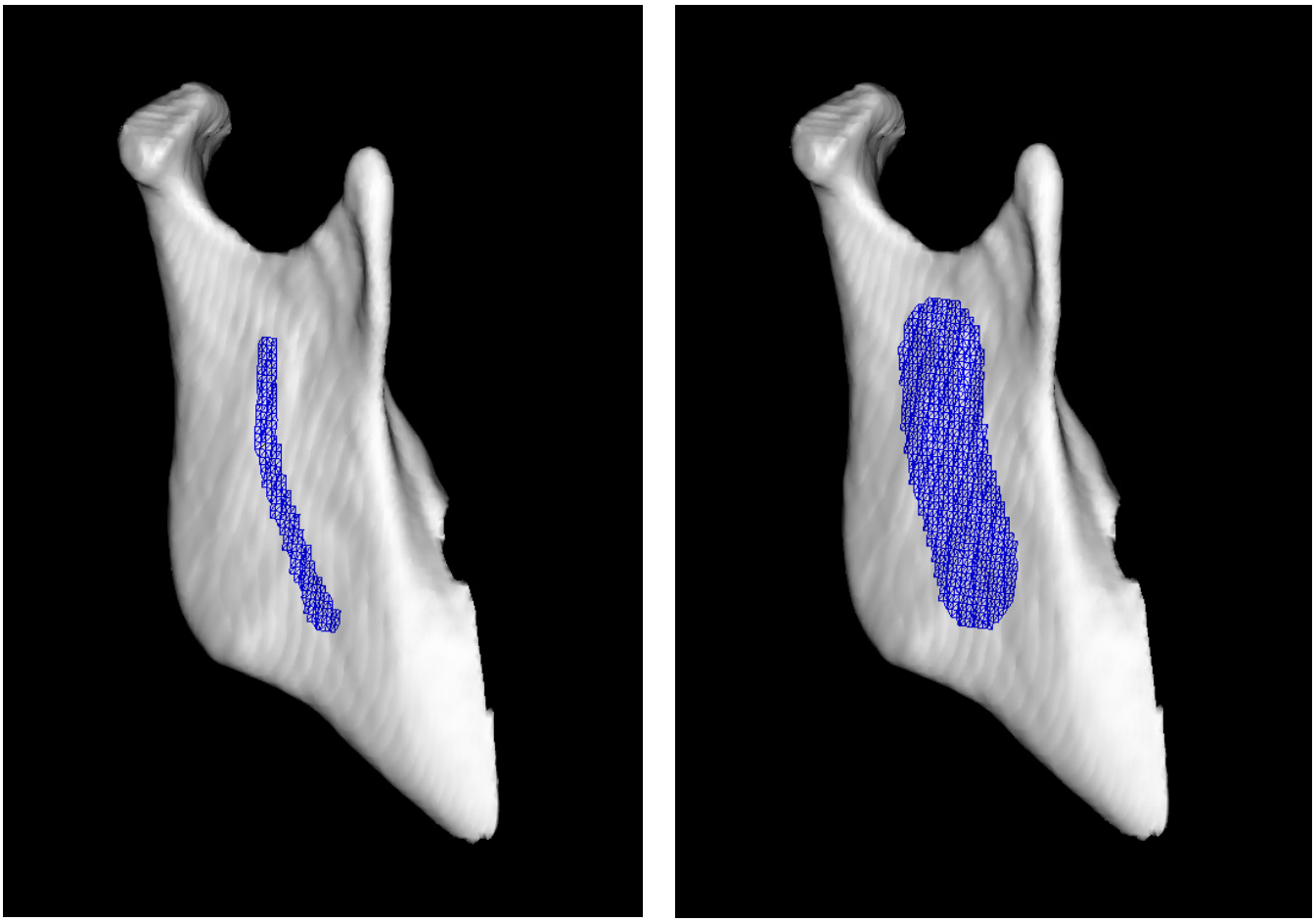
If no area has been selected, Medical Design Studio will ask to smooth the entire model surface at the set Power and Relax settings.



Stroke Smooth

The Stroke Smooth operation tool does not require a selected area on the model to be selected before use. Set the desired Power and Relax settings and press the Stroke Smooth button. Next, highlight an area on the surface to smooth by left-click and dragging on the mouse. When the mouse button is released, the highlighted area will be smoothed at the set Power and Relax settings.

Thickness determines the size of the area around the cursor when highlighting the surface of the model. The image below shows the difference between two Thickness settings.



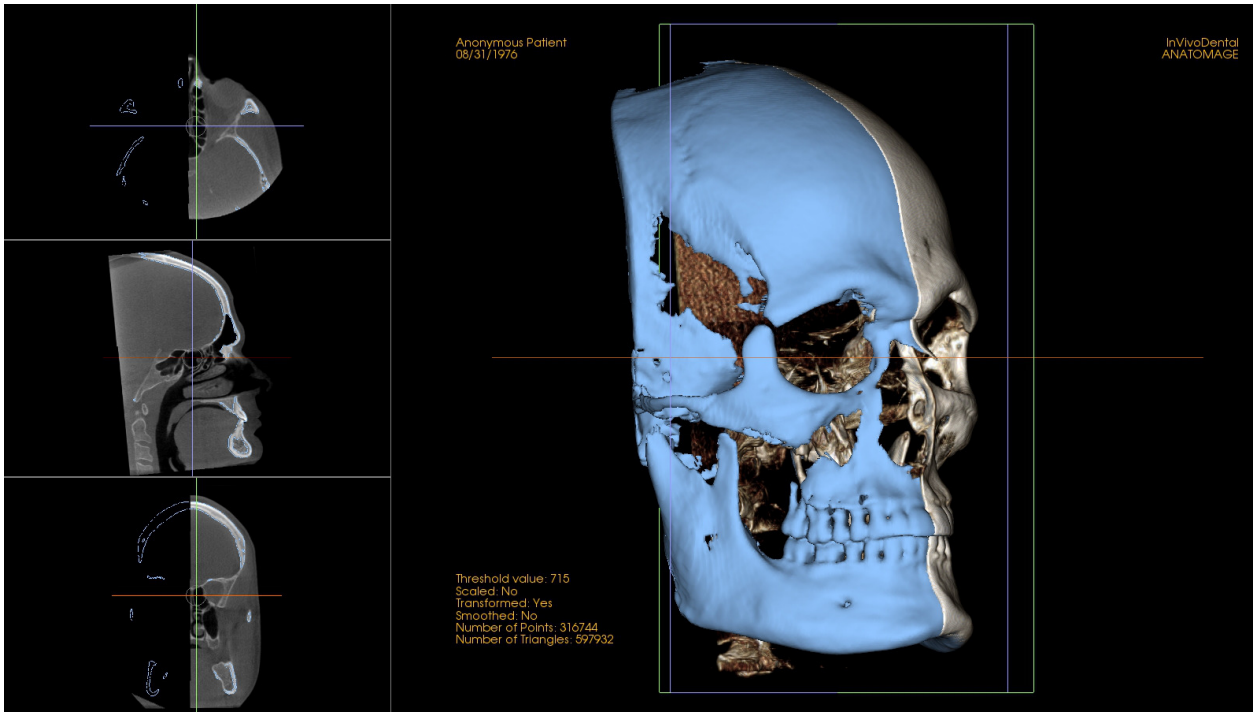
The images above show the difference between two Thickness settings.

Section Layout 

Toggling on the **Section Layout** button on the Toolbar shows or hides three section panels that appear on the left of the Rendering Window. These panels can be navigated similarly to other 2D sections. The top panels

corresponds to the axial slice, the center pane the sagittal slice, and the bottom panel the coronal slice. The mouse wheel can be used to scroll through slices, and the cursors on each slice panel can be dragged to quickly move to a desired point of interest. Orange, green, and blue rectangles will also surround the volume in the Rendering Window. These correspond to the current location of the axial, sagittal, and coronal slice planes respectively.

Mesh objects are also visible on the section panels as well, represented in the same color as it is on the Rendering Window.

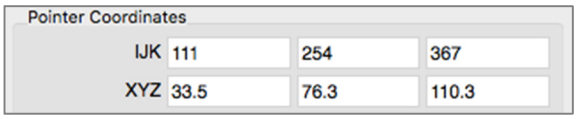


The Section Layout view allows for quick slice cross referencing during mesh and volume editing.

Opening the Section Layout will also activate the Pointer Coordinates section of the Control Panel.

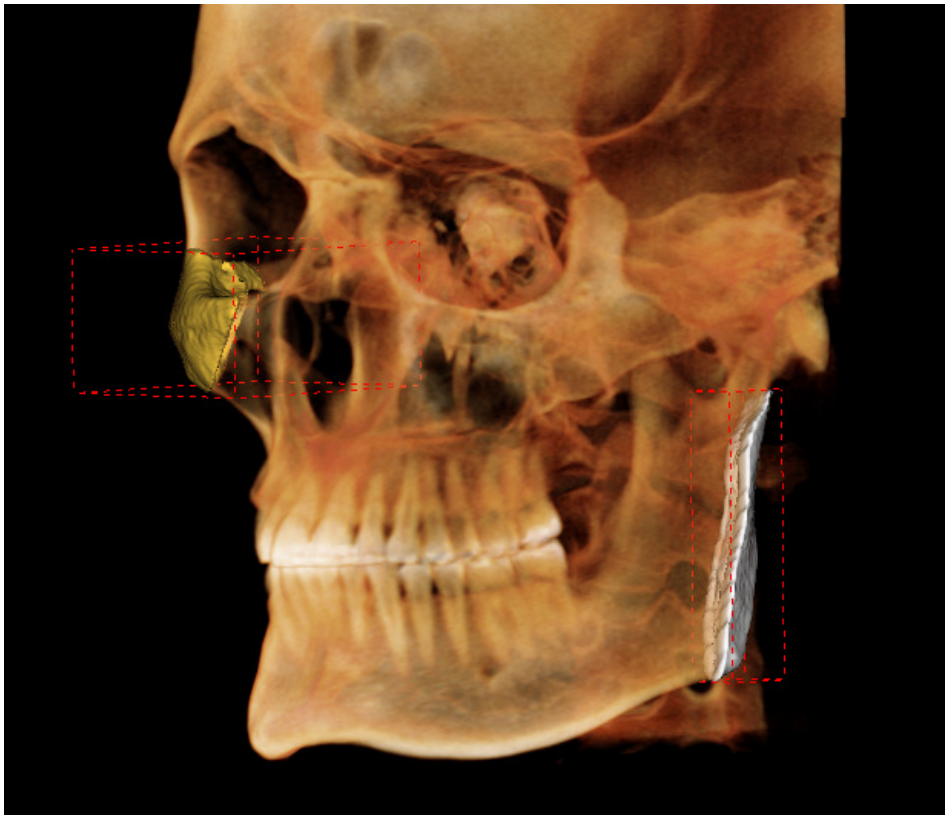
Pointer Coordinates

The pointer coordinates refer to the XYZ and IJK coordinates of the current location of the mouse cursor within the Section Layout. Therefore, it will only reflect the position of the cursor in the grayscale renderers and not in the 3D rendering window.



Mesh Delete 

To delete a mesh or multiple meshes at once, first select the mesh or meshes in the Rendering Window by left-clicking a single model or Cmd + left-clicking multiple models or in the Mesh Model list by left-clicking the names of the models until the dotted red bounding box appears around the desired model or models. Once selected, press the Delete key on the keyboard or the **Delete** button in the Mesh Model List. The program will prompt for confirmation for the model or models to be deleted.

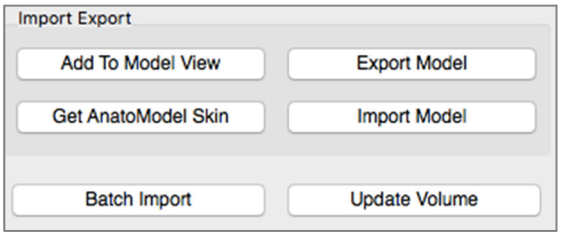


This image shows multiple models selected within the Rendering Window, which allows to simultaneous deletion, scaling, or transformation.

Medical Design Studio: Model Import and Export

Medical Design Studio not only creates and edits models within the Rendering Window, but it can also export them as standard STL and PLY files to use in other design software. Conversely, STL, PLY and OBJ files can be imported from other design software to edit within the Medical Design Studio Tab.

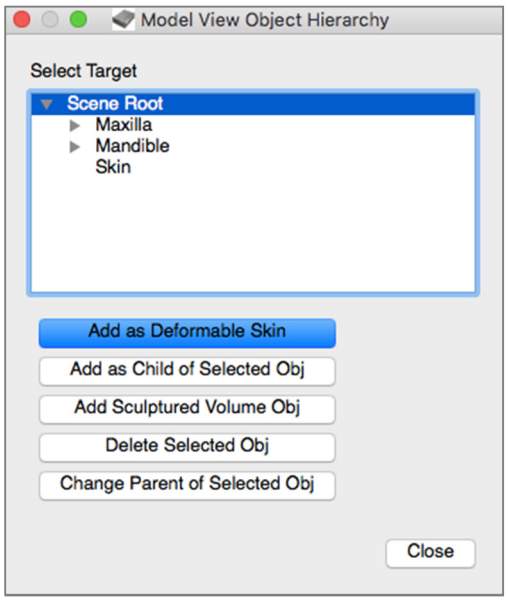
This section discusses the basic steps to export a file from and import a file to Medical Design Studio. It also covers how to add your models to the Model View for simulation and video capture. The models will also be visible in the Superimposition and 3D Analysis Tabs for further clinical analysis.



Add to Model View

After a surface mesh model is either created or imported into Medical Design Studio, the model can be added to the Model Tab. In the Model Tab, multiple surface mesh models can be visualized in the Rendering Window for movement simulations.

When adding a model to the Model Tab, the model hierarchy will need to be defined in the new window (see right). When adding to the Model Tab, the location and orientation of the mesh model relative to the rendered volume will be the same location and orientation in the Model Tab.



Add as Deformable Skin

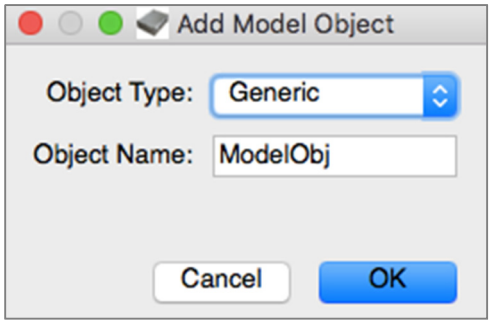
Add the model to the Model Tab as a surface mesh that is deformable. Typically this is done for models that will serve as the facial soft-tissue which can change based on Invivo's Soft-Tissue Prediction algorithms. There can only be up to one Deformable Skin defined.

Add as Child of Selected Obj

- Highlight a model (the "parent model") already added to the Model View. Pressing **Add as Child of Selected Obj** will make the current model (the "child model") dependent upon the motion of the parent model. In the Model Tab, any translation or rotation performed on the parent model will also be performed on the child model. Any translation or rotation performed on the child model will not be performed on the parent model.
- To add a model to the Model Tab without having it dependent upon existing models, select Scene Root

as the parent model.

- Before adding the child model to the Model Tab, give it a unique name and choose under which type the model will be categorized (Generic, Bone, Tooth Segment).
  - Generic: Model is added to Model Tab and will not interact with the soft tissue.
  - Bone: Model is added to Model Tab and will affect soft tissue for predictions.
  - Tooth: Model is added to Model Tab and will affect soft tissue for predictions.
  - Segment: In Model Tab, the mesh will remove volume from the volume rendering when selected. This works well with wrapping surfaces and may not show the ideal responses using IsoSurface mesh models.



Add Sculptured Volume Object

- Current sculpted volume will be added to the Model Tab. Volume render control settings such as Brightness/Contrast, Teeth/Bone renders can be applied individually to sculptured Volume Objects in the Model View. Simulations in the Model Tab can be applied to the sculpted volume object as well.

Delete Selected Object

- Highlight a model already added to the Model Tab. Click the **Delete Selected Obj** and the highlighted model will be removed.

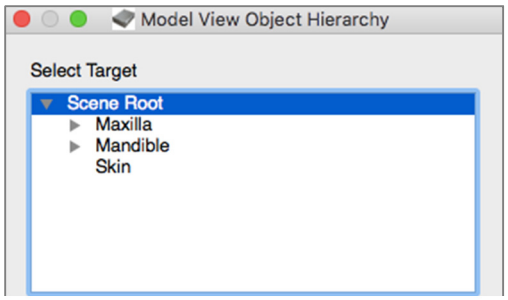
Change Parent of Selected Obj

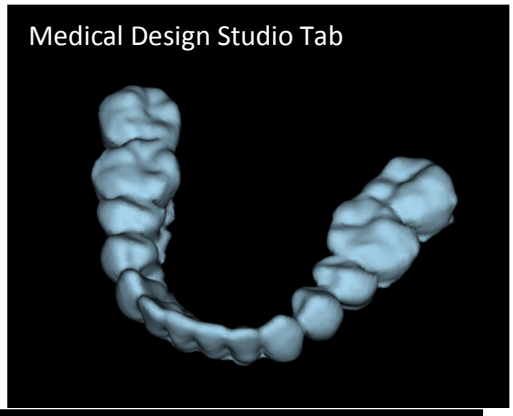
- Highlight a model already added to the Model Tab for making a child model. The model can be either a parent or child model initially. Click **Change Parent of Selected Obj** to open a new window and choose another model to be the parent model.

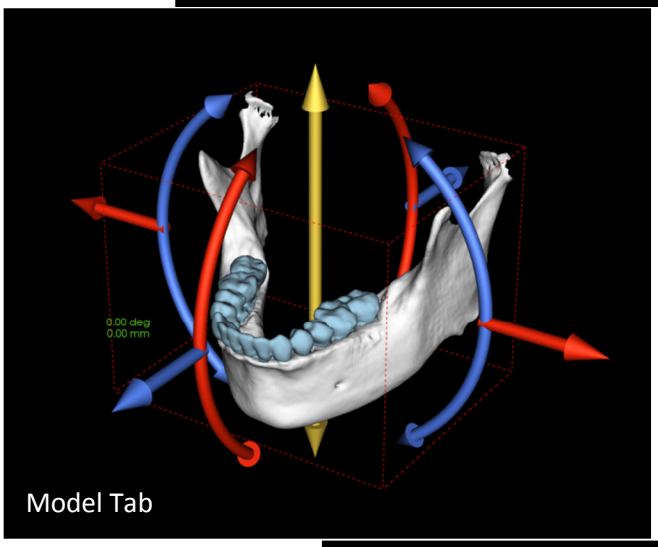
Model Setup Examples

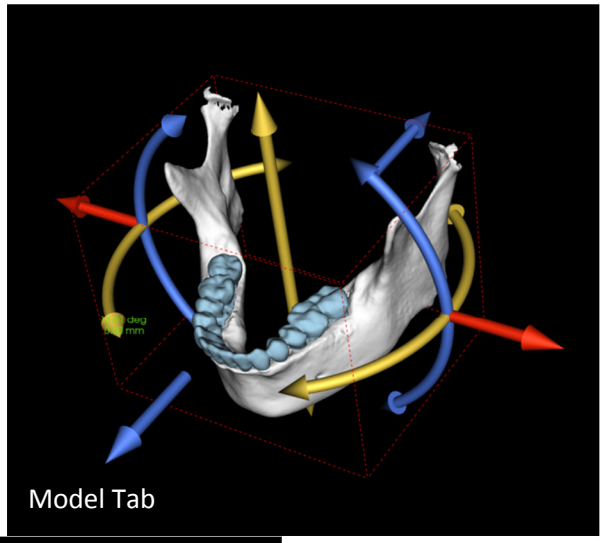
Example 1: Adding a Dependent ("Child") Model

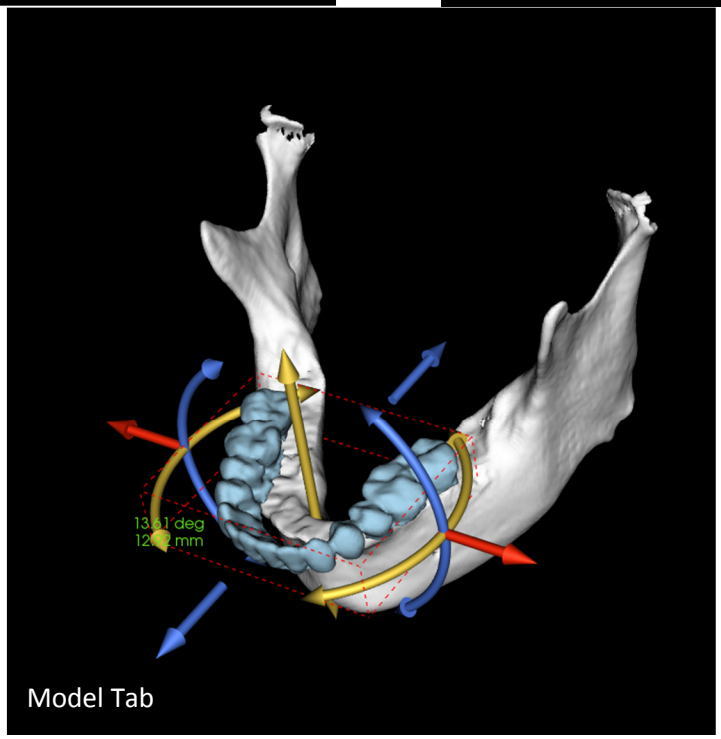
- Create or import a new model (set of teeth).
- Select an existing model (mandible) and click **Add as Child of Selected Obj**.
- Give the model a name and category and click **OK**.
- In the Model Tab the teeth move with mandible movement.
- Teeth can move independently of the mandible if selected.







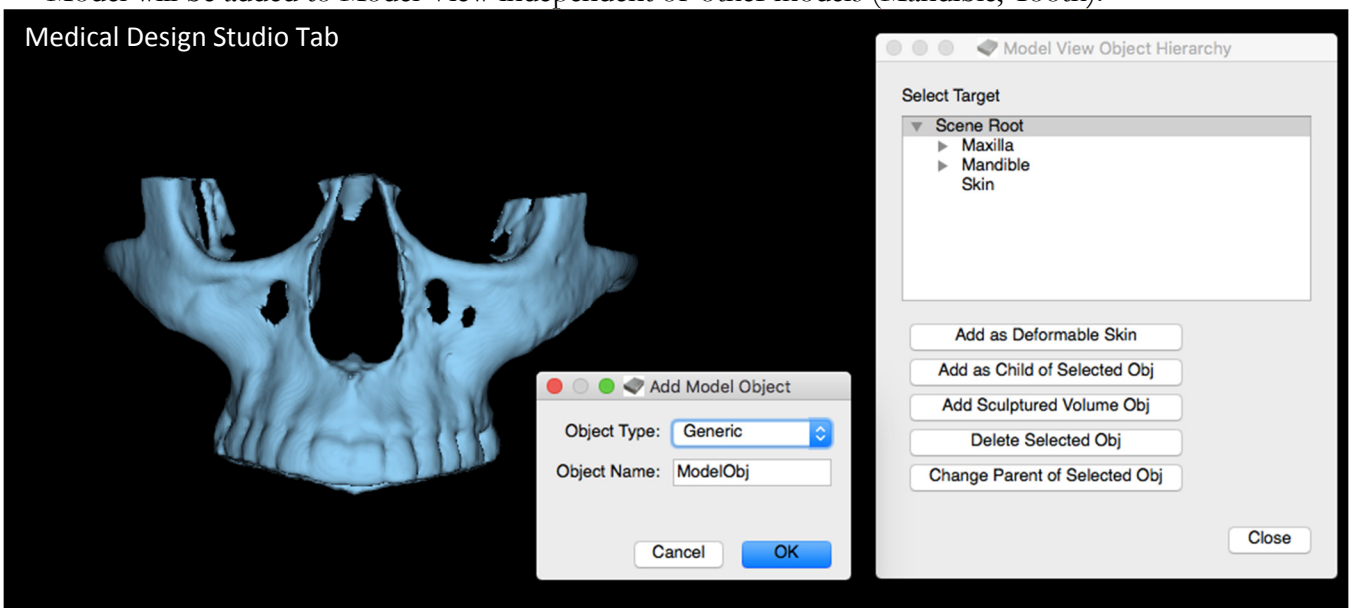


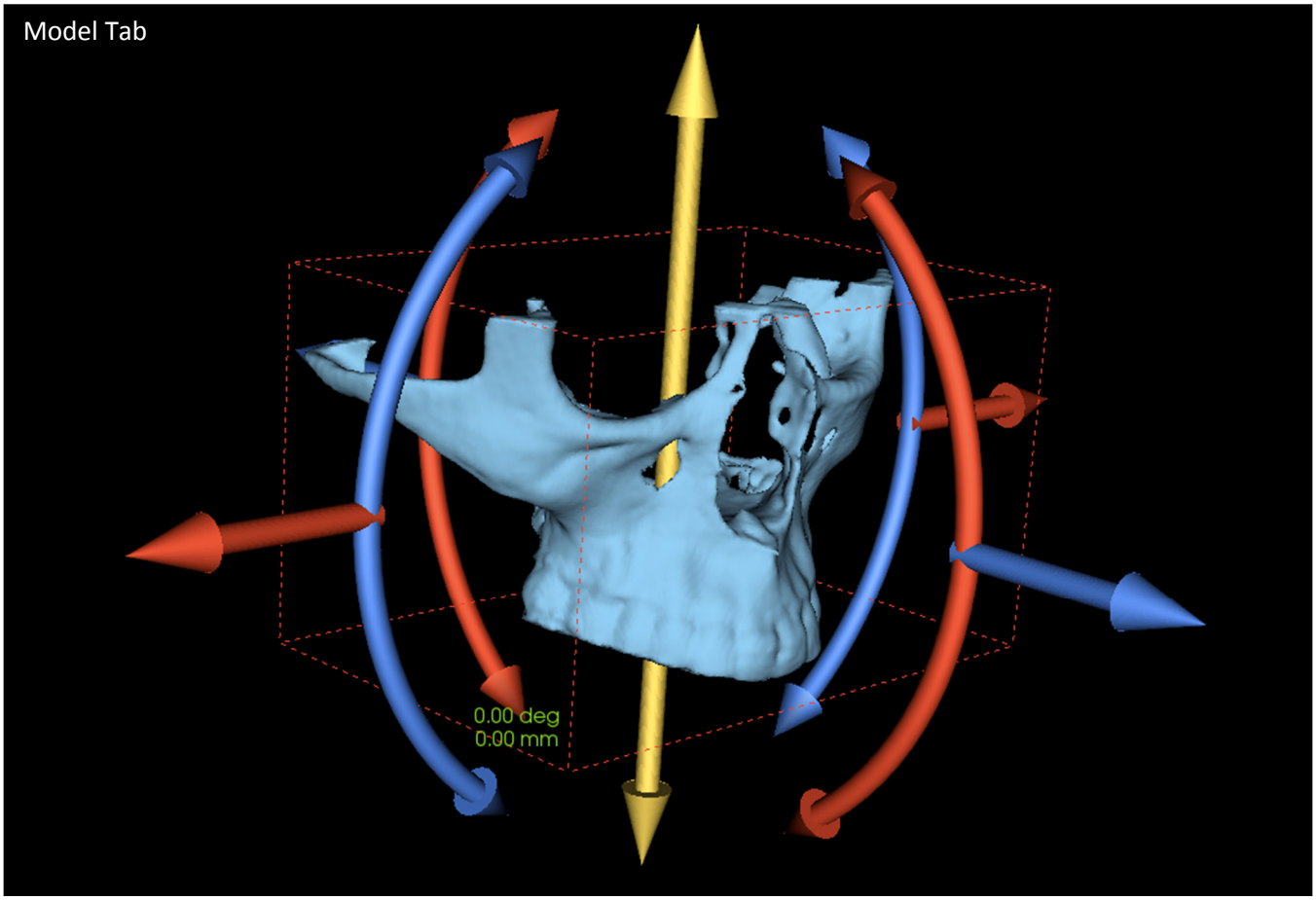


Example 2: Adding an Independent Model

- Create/import a new model (maxilla).
- Select Scene Root and press Add as Child of Selected Obj.

- Model will be added to Model View independent of other models (Mandible, Tooth).

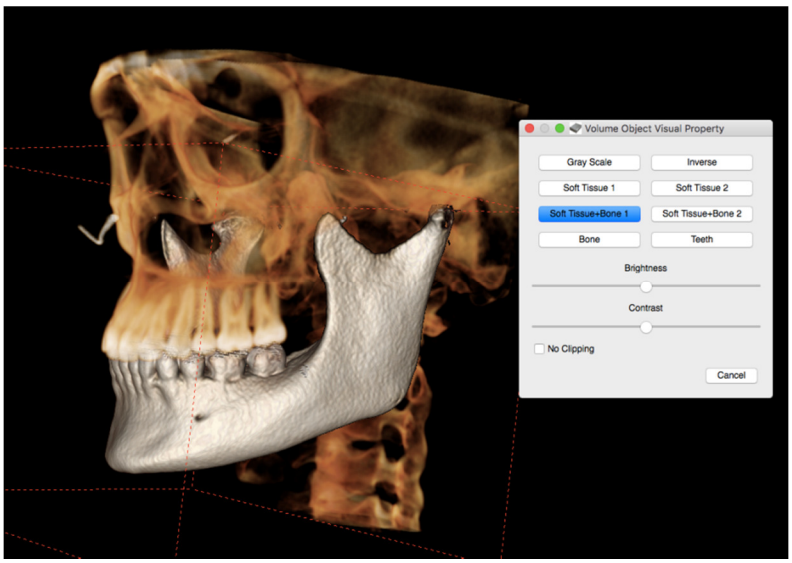




Example 3: Adding a Sculptured Volume Object

- Sculpt a desired volume with the freehand or polygon sculpting tool.
- Click Add to Model View, then select a target (Scene Root).
- Click Add Sculptured Volume Object.
- Model will be added to Model View independent of other models (Mandible, Tooth).

Volume objects differ from models in that volume objects are composed of voxels rather than point clouds and meshes. With accompanying scalar value data, a volume object better preserves the detail of internal structures compared to a mesh model which typically only encapsulates the external surface. Volume objects however will require more system resources to render.



The mandible was segmented away from the rest of the skull in Medical Design Studio and then added as a sculpted volume object.

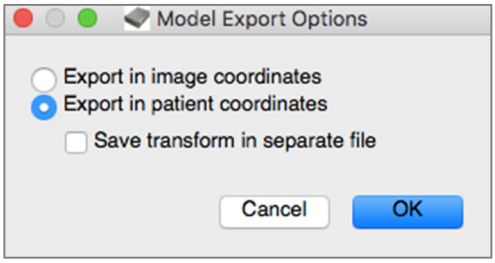
Get AnatoModel Skin

If a skin has been defined and already added to the Model Tab, it can be imported into Medical Design Studio for mesh manipulation. Click **Get AnatoModel Skin**, and Invivo will add the skin to the Rendering Window within Medical Design Studio.

If no Deformable Skin has been defined in Model Tab, nothing will be imported into Medical Design Studio.

Export Model

Click **Export Model** to save the surface mesh model as a PLY or STL file. Model orientation may be exported either with the original scan's image coordinates or with the reorientation coordinates if reorientation was applied. The former should be used if the model will be reimported into Invivo; the latter is recommended for use in third party software where model orientation is important. The transformation data between the reoriented coordinate system and the image coordinate system can also be exported as a .csv file. In the new window, browse to the location to save the file, choose the file type, and name the file.



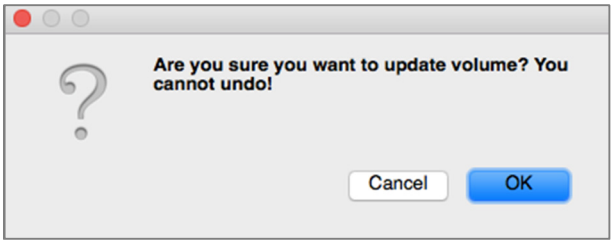
Import Model

Click **Import Model** to import a surface mesh model (PLY, STL or OBJ files). Browse in the new window to find the file that you want added to the Rendering Window within Medical Design Studio. OBJ files can be imported and BMP image files can be associated to give a textured look to the model.

Update Volume

Click **Update Volume** to commit sculpting operations made to the volume in the Medical Design Studio Tab to be reflected throughout all tabs of Invivo. These changes will take effect after the case is saved and reopened and apply to both 2D slice images and 3D volume renderings. Note that saved changes made with the **Update Volume** button are permanent; the undo option in the Volume Render Tab will not replace the data that has been

sculpted away. Likewise, the **Reset Volume** button in the toolbar will not reset the volume to its initial state and will instead reset to the state of the most recent **Update Volume** operation.



Invivo5 Software Troubleshooting

Category	Error	Solution
General	Error Message: *InVivoDental Application has encountered a problem and needs to close. We are sorry for the inconvenience.*	Click the "Don't Send" button. Check if there are old versions of optional plug-ins: remove them or upgrade them to be compatible with InVivoDental. Launch the InVivoDental application again. Warning: Treatment information can only be manually saved. All information added after last saving will be lost.
	Cannot launch InVivoDental	Open Activity Monitor and check if multiple instances of InVivoDental are already running. Close other InVivoDental processes. Launch the InVivoDental application again.
	Computer failure	Launch the InVivoDental application again. Warning: Treatment information can only be manually saved. All information added after last saving will be lost.
Installation	Error Message: *Server is not Responding*	Check Internet connection. If Internet is connected, try again later.
	Error Message: *Please run as administrator to activate software*	Run the installer/application as administrator.
	Error Message: *Failed to verify the license code!*	Check the license code and try again. Check Internet connection and try again.
	Error Message: *Wrong License Code!*	Check the license code and try again.
	Error Message: *Invalid Authorization code*	Check the license code and try again.
	Error Message: *Actual size of the image can't fit to the paper size!*	Change printer setting or create an image with smaller size.
File Operations	Error Message: *Failed to create process. Please close other applications and try again.*	Close all the other applications. Launch the InVivoDental application again.
	Error Message: *Error: Cannot read this file*	Check if this file is supported by InVivoDental.
	Message: *Not enough memory*	Close all the other applications. Launch the InVivoDental application again.
	Error Message: *Can't create temporary save file!*	Check if the remaining disk capacity for the temporary folder is big enough.
	Error Message: *Failed to read DICOM file!*	Check if this file is supported by InVivoDental.
	Error Message: *Can't read Dicom's Image Data!*	Check if this file is supported by InVivoDental.
	Try to open a file but nothing showing up	Check if this file is supported by InVivoDental.
	Error Message: *Cannot save file!*	Check if the file is the correct type. Check if the file path is correct and folder is writable.
Image Rendering	Error Message: *Can't detect hardware acceleration for OpenGL support!*	Check if the graphics card meets system requirements. Check if the latest driver is installed for the graphics card.

	Image is distorted	Switch to another view and switch back.
	Grayscale image shows up for all rendering presets	Check if the graphics card meets system requirements. Check if the latest driver is installed for the graphics card.
	Warning Message: *3D reconstruction may not work!*	Check if the DICOM files are exported correctly.

For all other issues, please contact Anatomage Inc. Customer Support at (408) 885-1474.

Index

This comprehensive list provides a quick and easy way to find the relevant information that you would like to examine.

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