User's guide
H-5489-8405-01-A

RENISHAW
apply innovation™

Getting started with incise™

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incise™

incise™

Overview

This document will guide you through the process of installing an incise™ system. Use it in conjunction with the application help files.

Prior to installing the incise™ system, you should read the Laboratory guidelines located on the Renishaw web site www.renishaw.com.

The incise™ software must be loaded on to a PC with the following minimum specification:

PC hardware

Processor:	Intel Pentium 4, 3.0 GHz (or equivalent)
Hard drive:	100 MB minimum free space is required for installation. Additional hard disk space is required to store frameworks as they are created. If only limited free space is available, regular archiving of the framework files will be necessary.
Memory:	1 GB RAM (for Windows XP SP3) 2 GB RAM (for Windows Vista SP1 and Windows 7)
Graphics adaptor:	Fully DirectX 9 compatible graphics adaptor 256 MB (minimum) video RAM
Colour display resolution:	1024 × 768 capable
Mouse:	3-button mouse or pointing device
CD-ROM drive:	Required for software installation
USB ports	One spare USB port is required.

PC operating system

The computer must be running one of the following:

- Microsoft Windows XP SP3
- Windows Vista SP1 (x32 Edition)
- Windows 7 (x32 Edition)

NOTE: Microsoft Windows XP Professional x64 Edition, Windows Vista x64 Edition and Windows 7 x64 are not supported.

Broadband internet must be loaded and operational.

Hardware installation

There are two models of incise™ scanner, the only difference being in the appearance of the machine – the functionality is identical.

incise™ scanner model 1

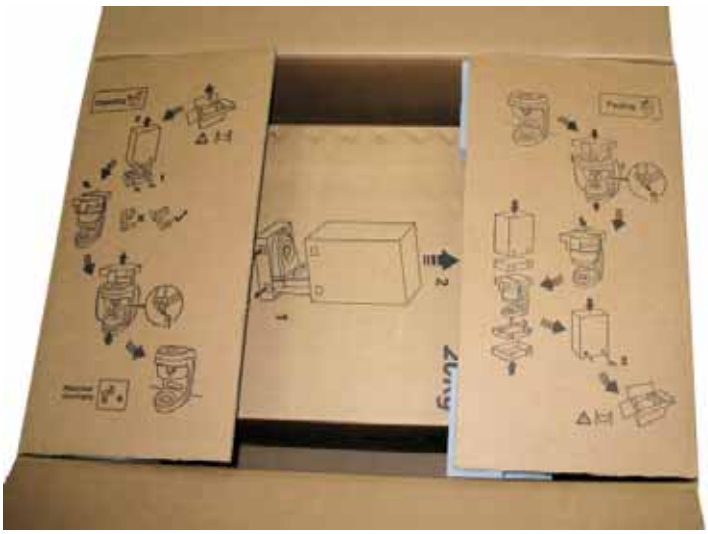
incise™ scanner model 2

The illustrations contained in this document show a model 1 scanner. The procedures described are identical for a model 2 machine.

Unpacking the machine

The incise™ system as delivered.

Undo the main box and observe the unpacking instructions.



Remove the incise™ box from the main delivery box.

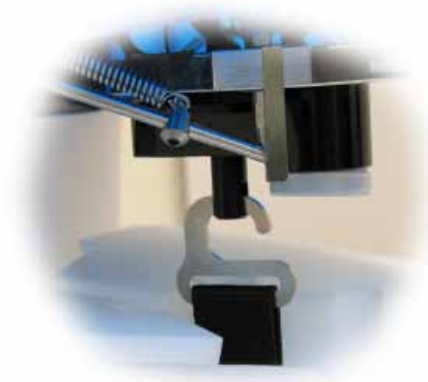
Remove the four retaining clips.

Remove the outer cover by sliding it in an upwards direction.

Undo the top strap to remove the top packing.

Gently slide the transit packing down.

Remove the transit packing by unhooking it from the probe body.



Finally, lift the machine from the remaining packaging and place it on a solid work surface.

Take care when lifting, as the machine weighs 16 kg.

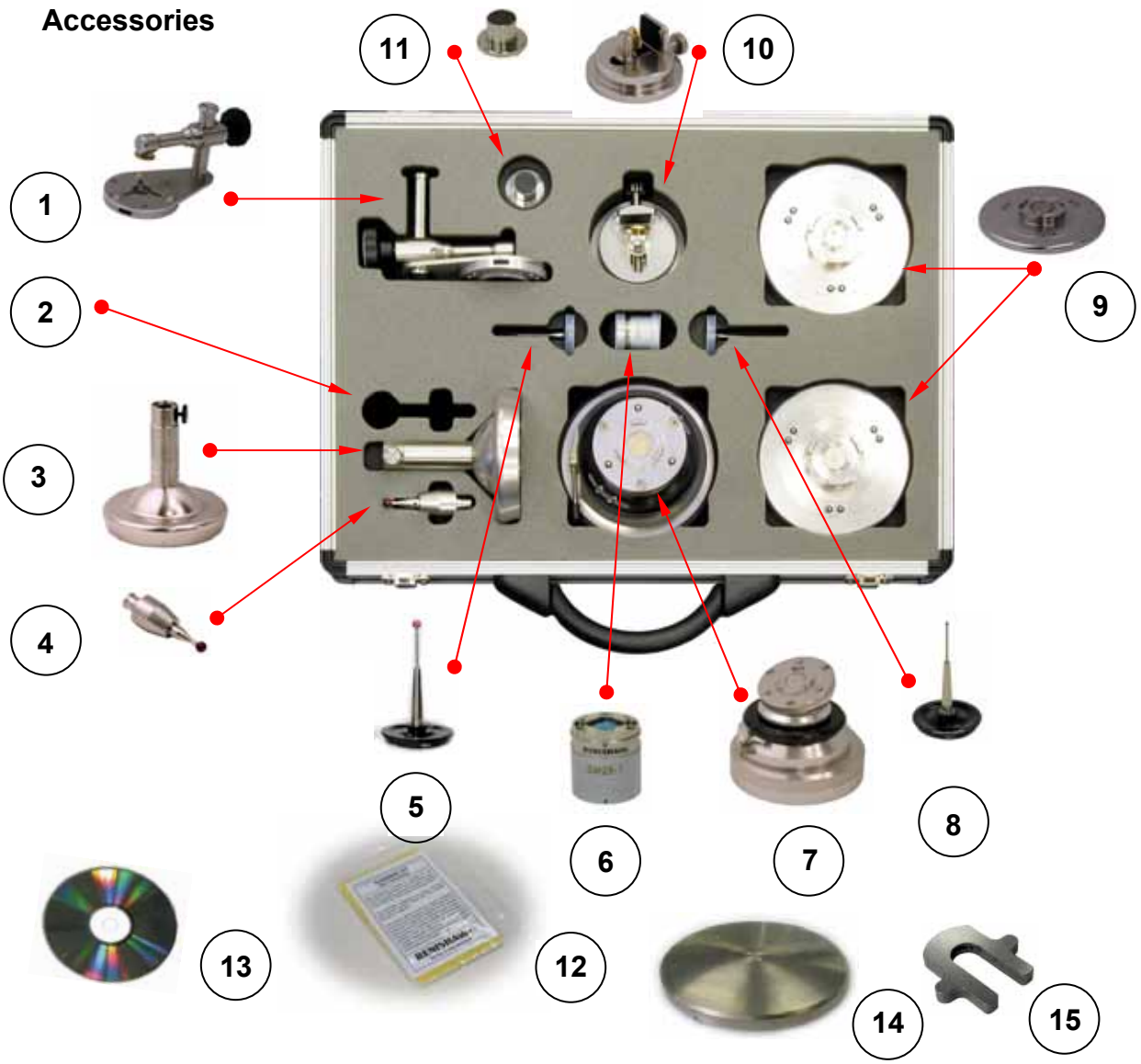
Power supply cables

P-CA38-0036	US (USA, Mexico, Taiwan, Canada)
P-CA38-0011	EU (Europe, Korea)
P-CA38-0006	UK (UK, Kuwait)
P-CA38-0037	AU (Australia)
P-CA38-0038	ZA (South Africa, India)
P-CA38-0039	CN (China)
P-CA38-0040	IL (Israel)

P-EA02-0020
PSU 30 W +18 V

P-CA33-0001
USB cable

Accessories



Ref.	Part no.	Description
1	A-5351-1050	Jaw holder
2	A-5351-1030	Empty (not used)
3	A-5351-1090	Artefact base adaptor
4	A-5351-1020	6 mm diameter calibration ball assembly
5	A-5003-7784	SP25 stylus assembly, 3 mm diameter x 30 mm long, effective working length 22.5 mm (stylus B)
6	A-2237-0350	SM25-1 module assembly
7	A-5351-1040	Gimbal
8	A-5003-7785	SP25 stylus assembly, 1 mm diameter x 30 mm long, effective working length 22.5 mm (stylus A)
9	A-5351-1070	10 mm spacer assembly (2 off)
10	A-5351-1080	Die holder
11	A-5351-1055	Jaw holder platform
12	A-5351-0060	Cleaning kit
13	A-5351-0025	incise™ CD assembly
14	M-5351-0210	Kinematic jaw plate
15	M-5351-0159	Die holder jaw retainer

Loading the probe module

The probe module needs to be connected to the probe body to enable the measuring system to operate.

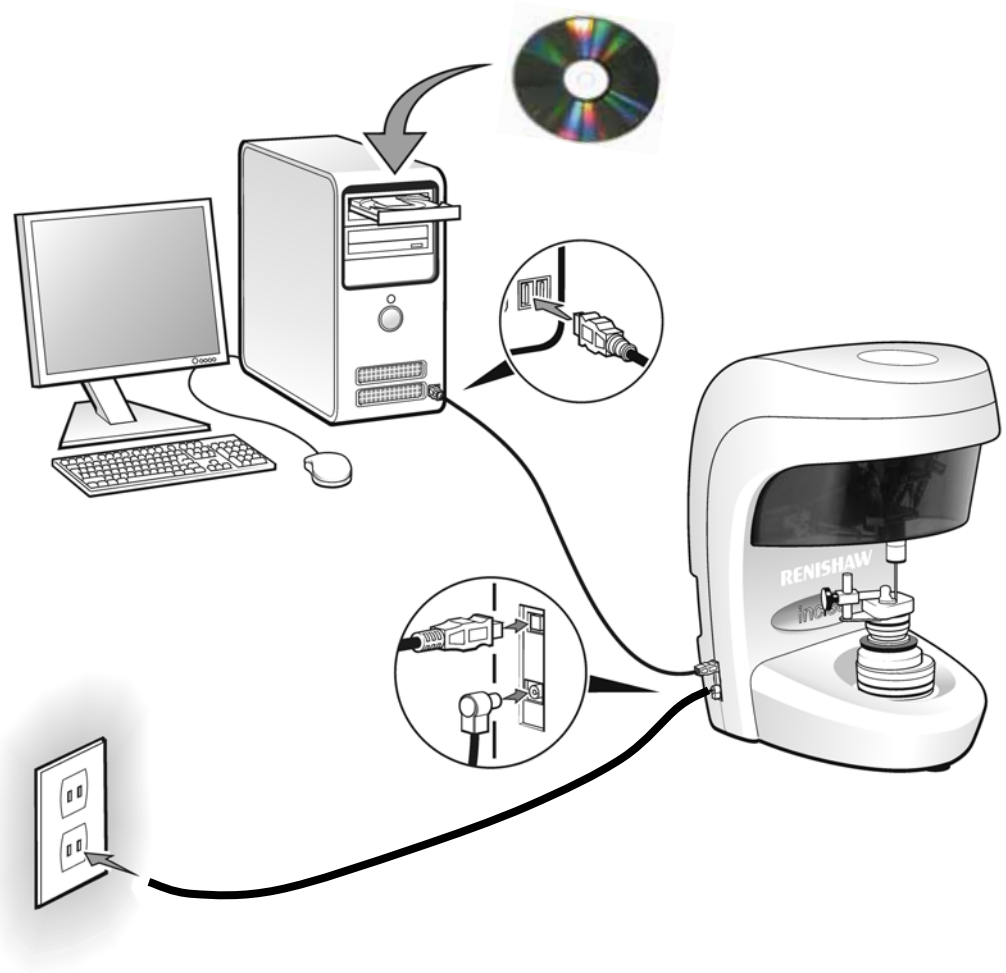
Remove the probe module from the accessory case and remove the protective end caps.

Take care not to touch the glass window, as fingerprints or dirt can cause the system to give poor results.

Remove the end cap from the probe body.

Attach the probe module to the probe body as shown. A magnetic location system retains the module.

Connecting the machine



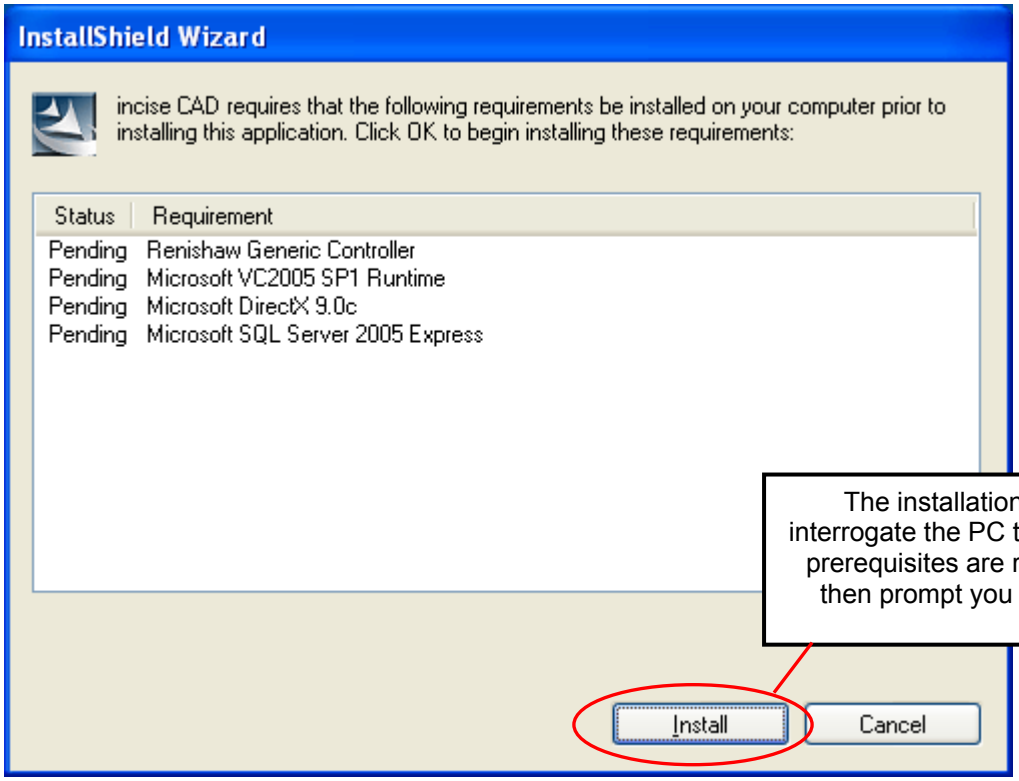
Connect the incise™ machine as shown above. After it is connected, it must remain switched off until the software has been installed.

NOTE: On a series 2 scanner the connections are on the back of the machine.

Installing the software

1 Ensure the incise™ scanning machine is switched off.

2 Load the installation CD into the PC. The installation process will automatically execute.



The installation process will interrogate the PC to establish which prerequisites are required and will then prompt you to install them.

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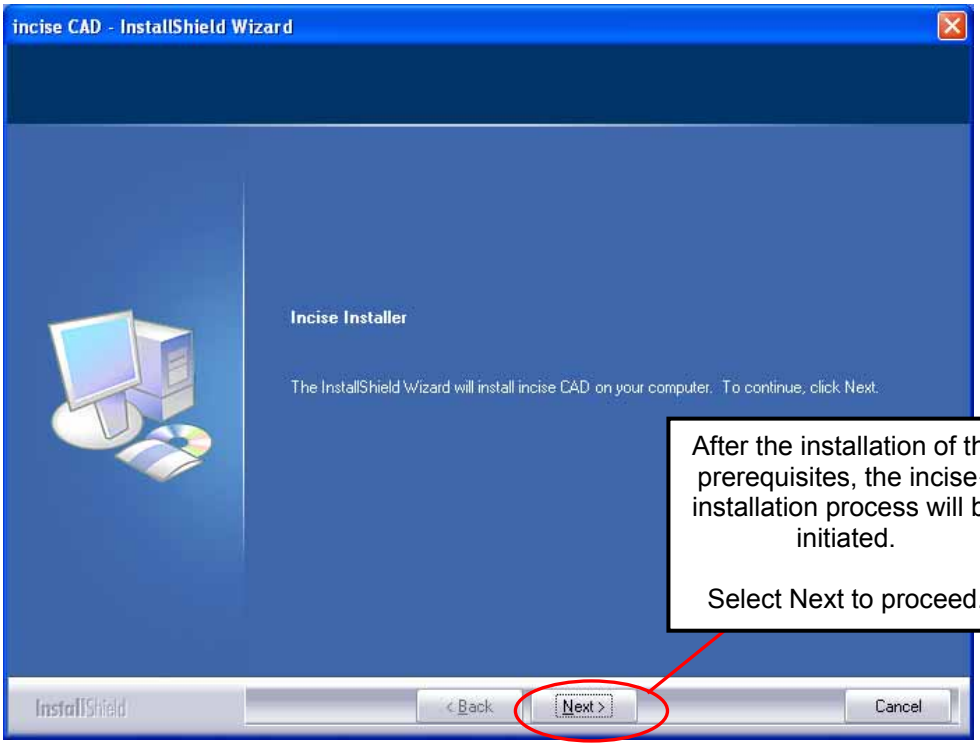
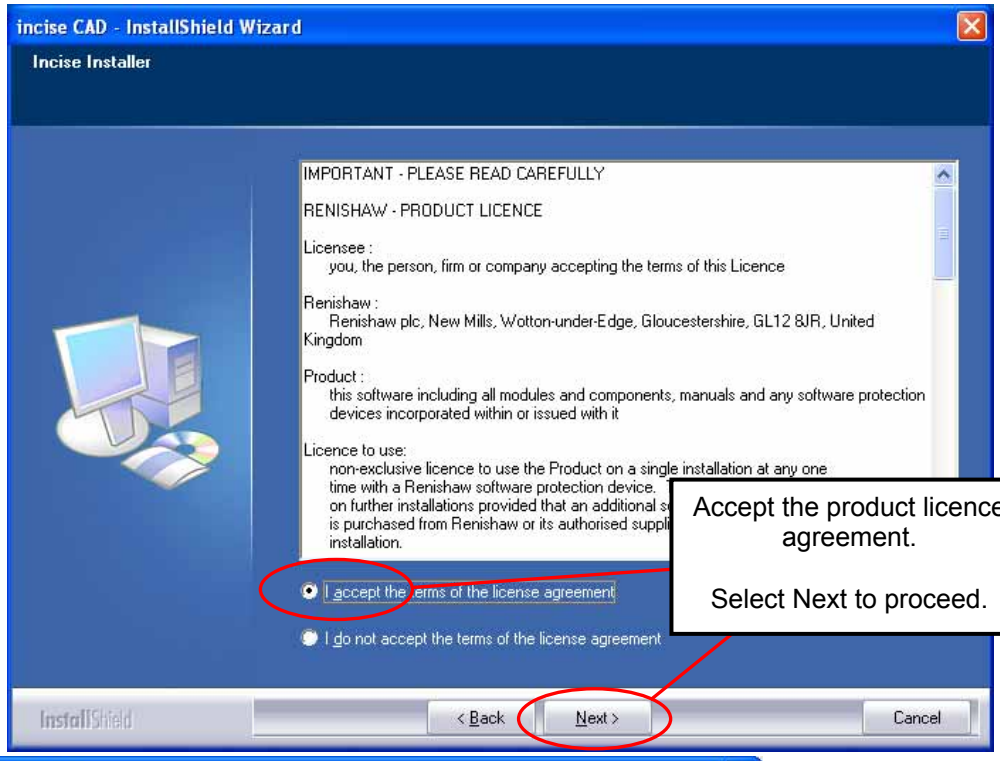


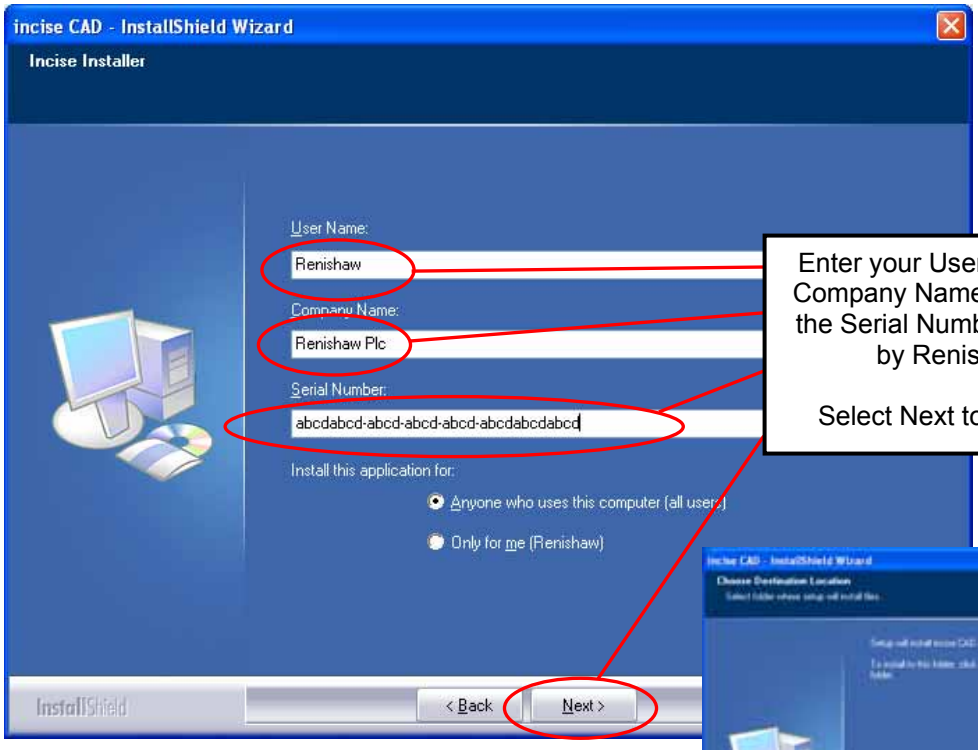
After the installation of the prerequisites, the incise™ installation process will be initiated.

Select Next to proceed.



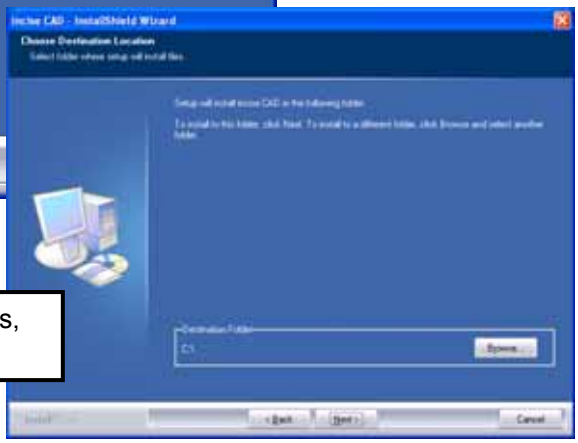
Accept the product licence agreement.

Select Next to proceed.



Enter your User Name and Company Name. Also enter the Serial Number supplied by Renishaw.

Select Next to proceed.



In all the remaining dialogs, select Next to proceed.

Calibration

When the software installation is complete, switch on the incise™ scanning machine. The PC will detect the device and the system will be ready for use.

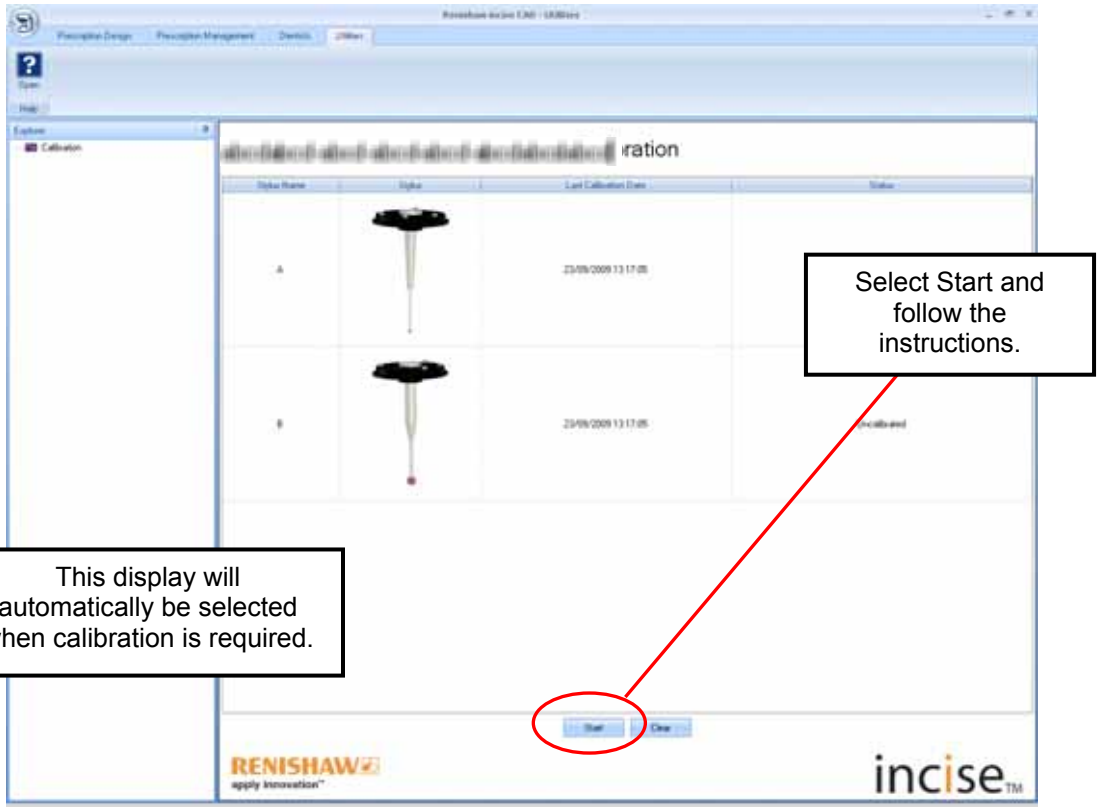
System switch-on and connection

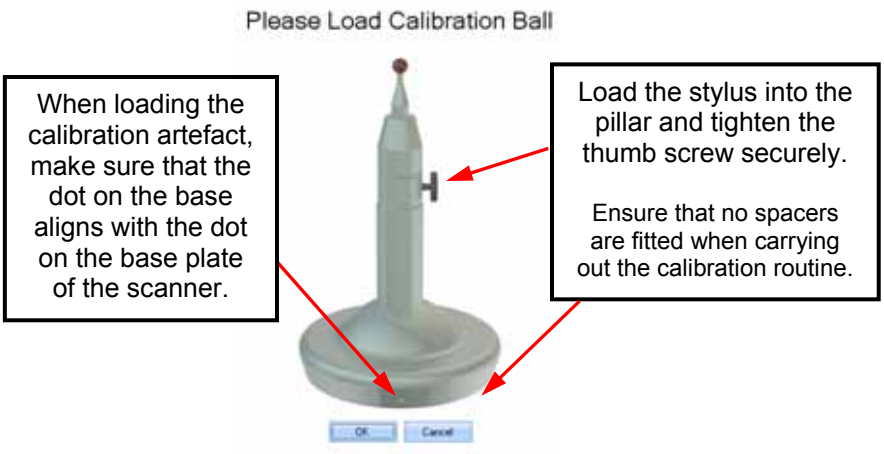
1 Check to make sure that all cables are plugged in and secure.

2 Switch on the scanner (the button is located on the left hand side).

3 Open the incise™ application.

4 Select **Start** to initiate calibration.



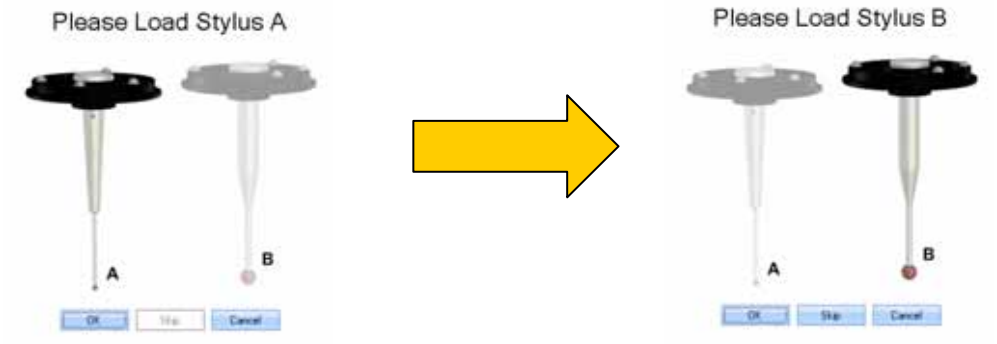


When fitting stylus A or B:

1 Orientate the stylus so that the three small balls are facing up and to the front of the scanner (a little marker can be seen below the ball).

2 Offer the stylus up to the probe – the front centre ball should align with the hole in the front of the probe body. The magnetic pull should locate the stylus correctly.

3 To remove the stylus, hold on to the stem base and pull it towards the front of the machine, bending it slightly to the side and upwards to release the rear ball location. When removing the 1 mm ball stylus, be careful not to bend the stem.

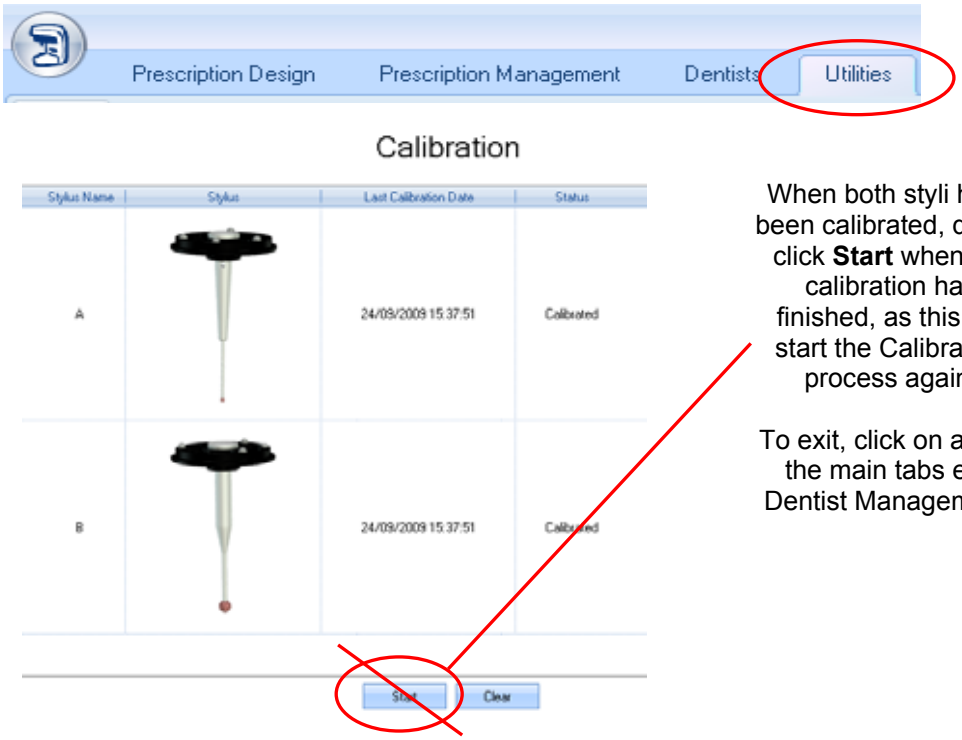


The first time you run the calibration process, the system will automatically find the calibration sphere and store its values. You will need to run it a second time to calibrate the system.

The **Clear** option deletes all calibration data; the system reverts to a 'new machine' state and the calibration sphere will be reset from the software.

Calibration will be requested one week after the system was last calibrated.

Calibration can be carried out at any time by selecting it from the **Utilities** tab. It is essential you recalibrate if you replace a stylus, and recalibration is recommended if you move the machine.

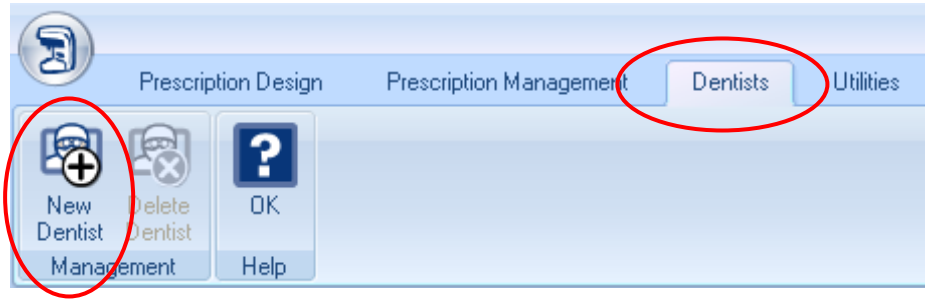


When both styli have been calibrated, do not click **Start** when the calibration has finished, as this will start the Calibration process again.

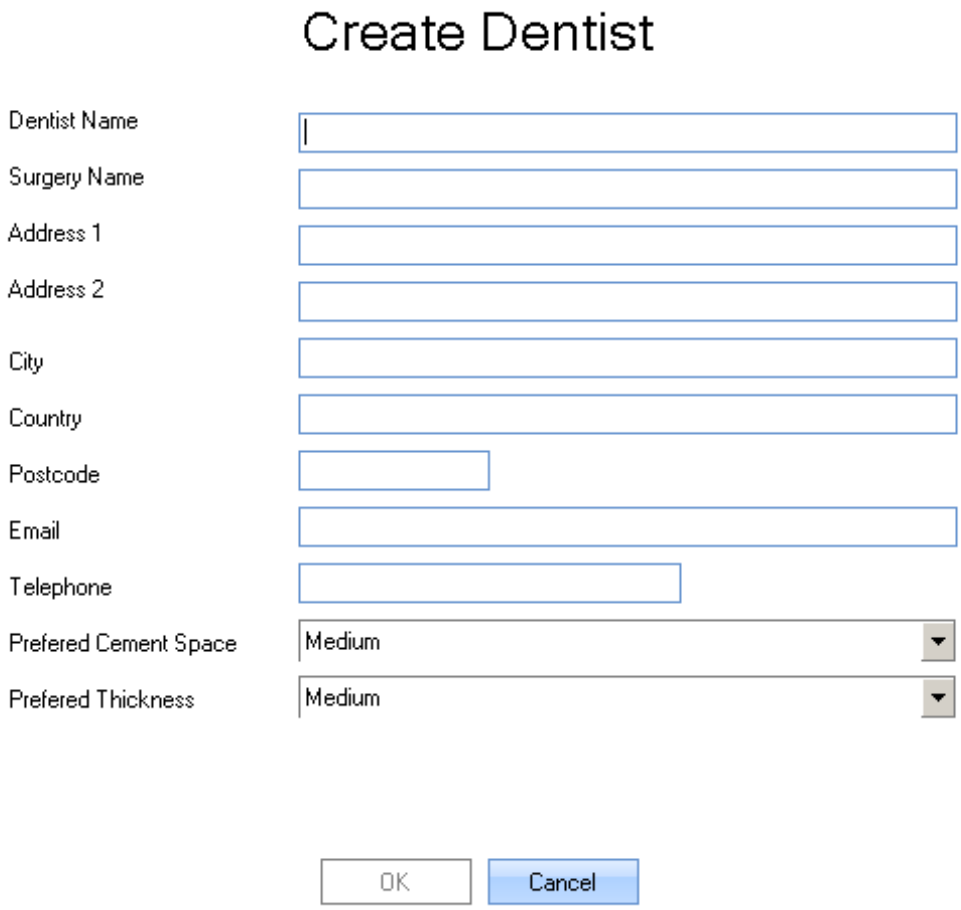
To exit, click on any of the main tabs e.g. Dentist Management.

Dentist Management

The **Dentist Management** tool is used to create all your contacts in the dentist database and keep a record of them on your system. This will be used when creating prescriptions.



Clicking on the **New Dentist** button opens the “Create Dentist” menu. This allows you to enter the following details for the dentist contact. These details will be saved automatically when you click OK.



The **Delete Dentist** button removes the dentist from the folder.

Starting a new prescription

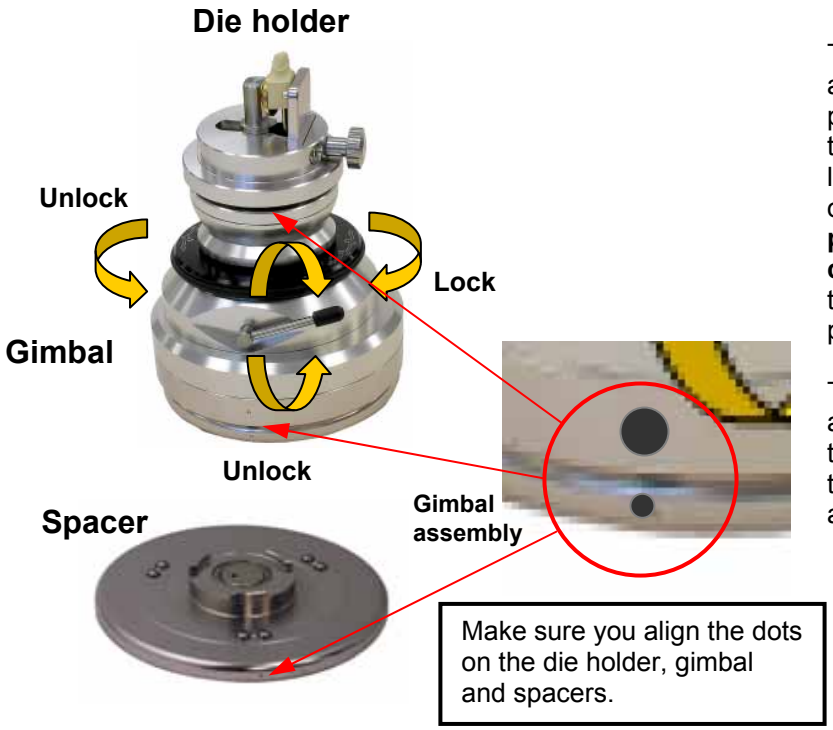
Select the **Prescription Design** tab and check that the Scanner Status shows three green lights; the calibration light will only show if the machine has been calibrated.

Before any scanning can be started, the preparation needs to be held in the die holder, which in turn is located on the gimbal.

Orientate the preparation so that the margin line is visible when viewed from above. This is achieved by using the die holder and gimbal together until the desired position is established. For a single preparation, the model should be orientated so that the buccal face is at the front of the scanner.

There are two ways to adjust the position of the model on the gimbal:

The orientation is adjusted using the top plate. Release it by rotating the locking ring anti-clockwise. The top plate can then be positioned before being locked by rotating the locking ring clockwise.



The horizontal position is adjusted using the lower plate. This is unlocked using the locking lever, allowing the lower plate to move freely over the base. **Try to position the model in the centre of the gimbal.** Move the handle back to its original position to lock it.

Two spacers are provided to adjust the overall height of the gimbal. It is suggested that one spacer is used for an average size preparation.

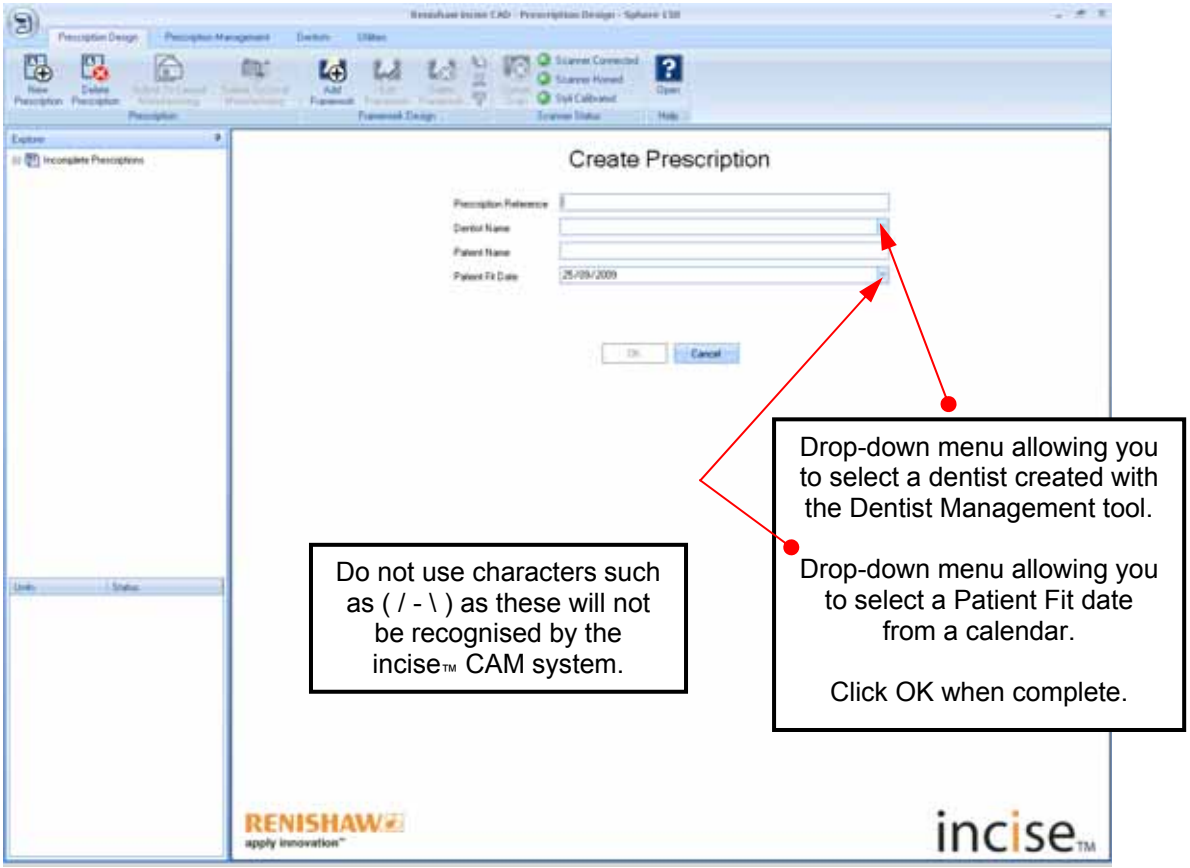
Make sure you align the dots on the die holder, gimbal and spacers.

Prescription Design (single preparation scan)

This tab is used when you want to create a job for scanning. Click on **New Prescription** to proceed.

Create Prescription

Enter the details for the job to be scanned. This information will be saved and can be viewed from the **Prescription Management** tab when required.

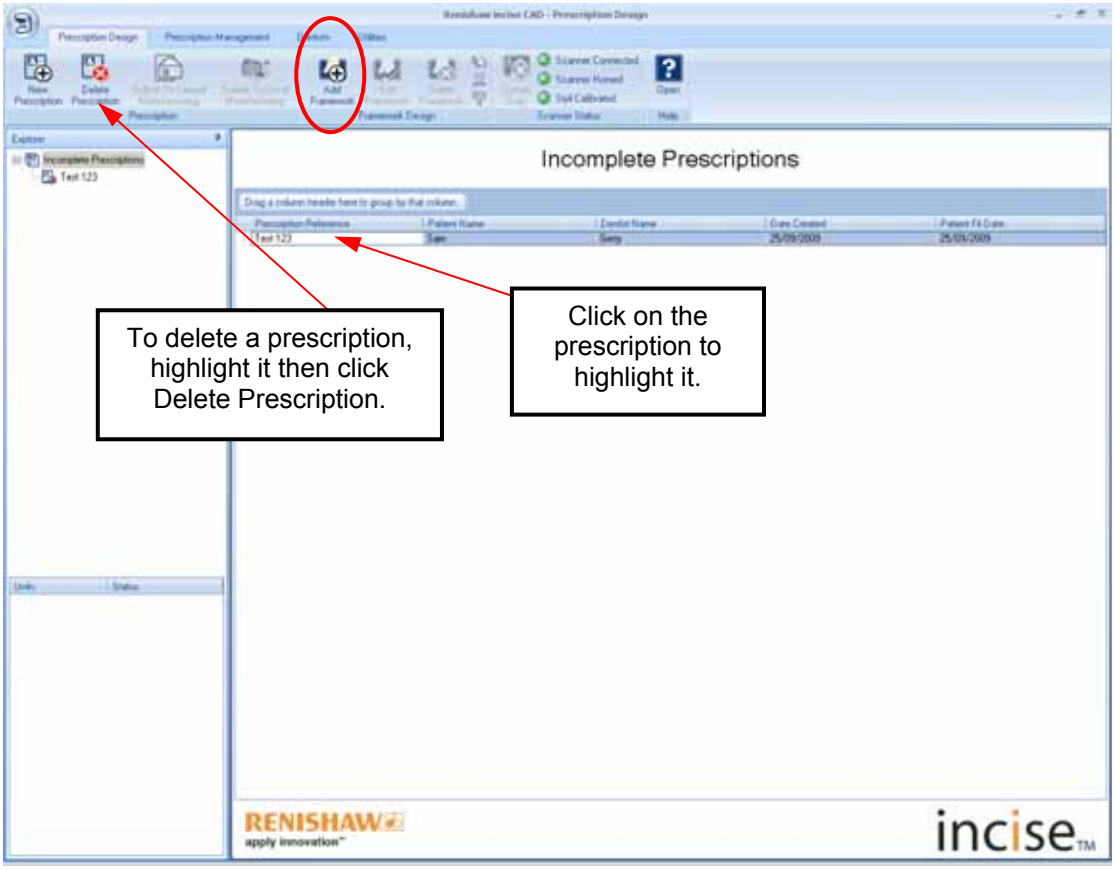


Add Framework

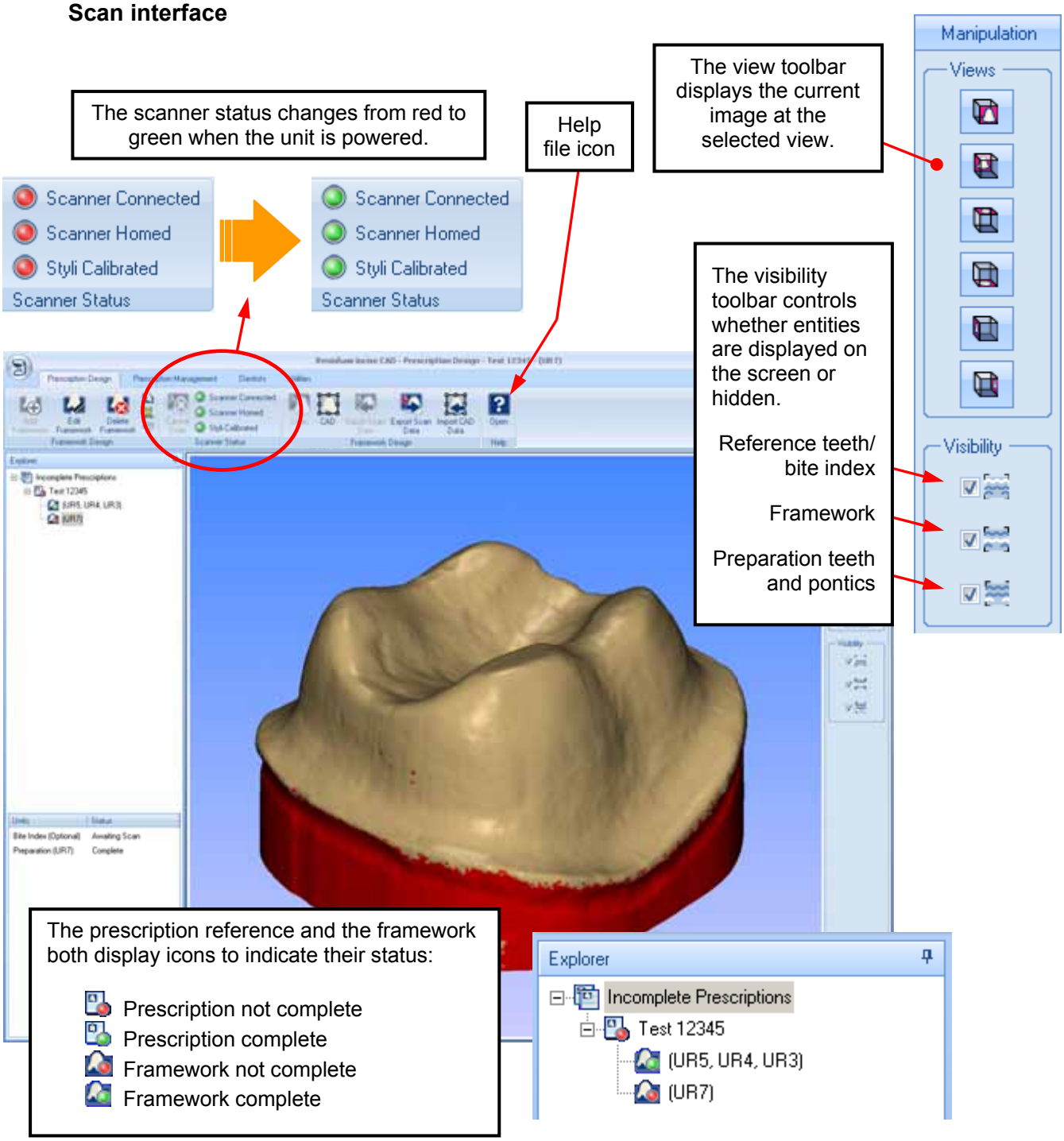
Once you have created the prescription and clicked **OK,** the screen menu will change.

Highlight the newly created prescription and then click on **Add Framework**.

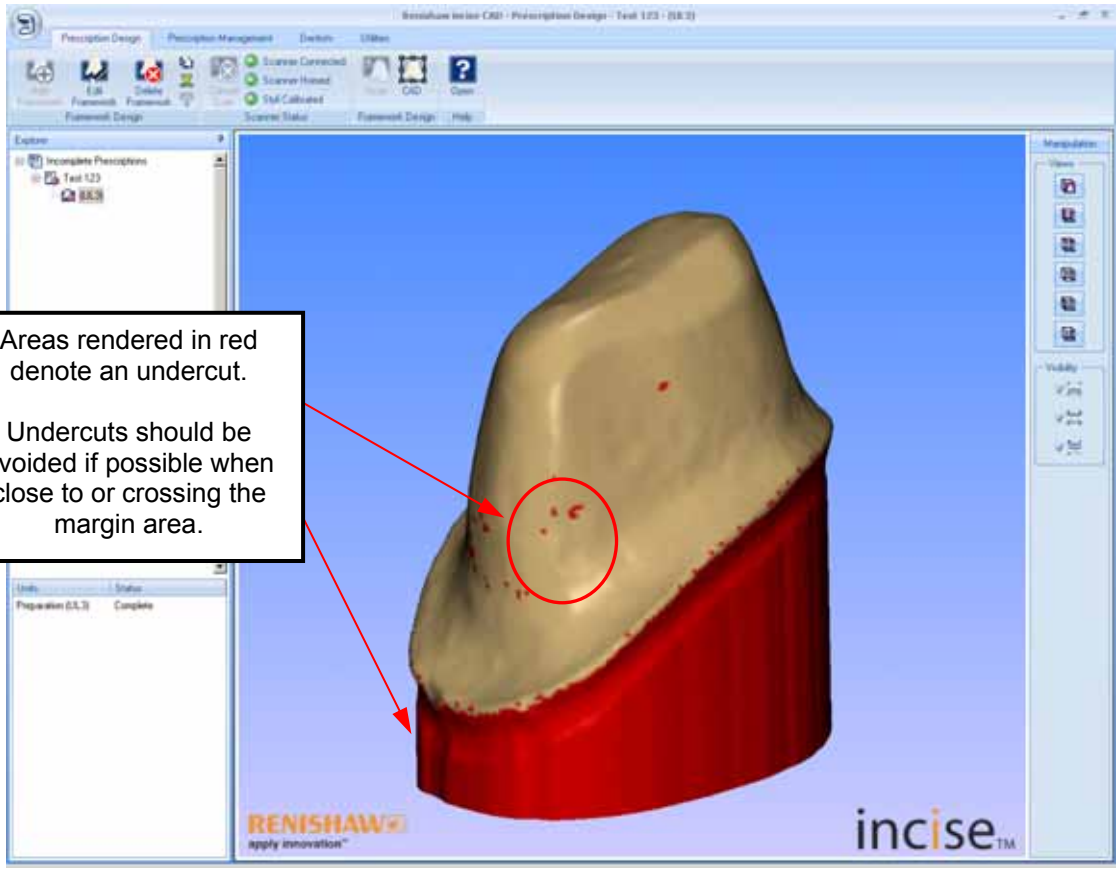
If you have made a mistake, you can **delete** the prescription and start again.



Scan interface



When all frameworks within a prescription are green, the prescription icon turns green and the prescription can be submitted.



When scanning is complete, the image can be manipulated using the mouse as described below.

Left mouse button

Moving the mouse with the left key depressed re-orientates the model.
Moving the mouse left to right (or right to left) rotates the model as the mouse is moved.
Moving the mouse top to bottom (or bottom to top) tips the model towards you (or away from you).
Other mouse movements move the model in a combination of these directions.

Right mouse button

Moving the mouse with the right key depressed zooms the view of the model.
Moving the mouse bottom to top zooms in (enlarges the model), and moving it top to bottom zooms out (reduces the model).

Centre mouse button

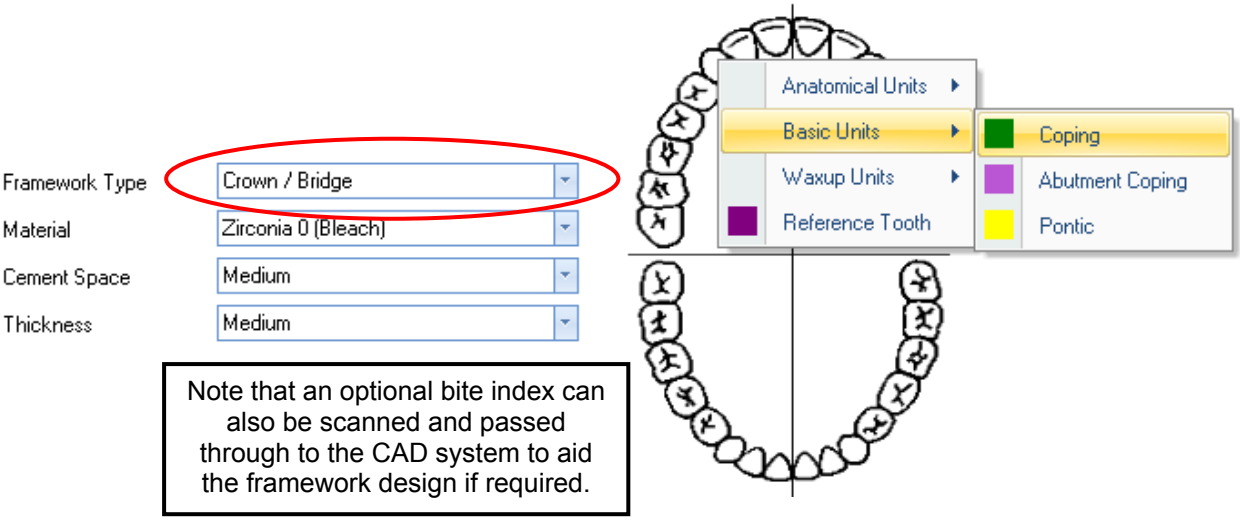
Moving the mouse with the centre key depressed "pans" the view of the model.
The model moves around the screen as the mouse is moved.

Mouse wheel

Rotating the mouse wheel is another way of zooming the model. Rotating the wheel away from you zooms in (enlarges the model), and rotating it towards you zooms out (reduces the model).

Framework type

When defining a framework, the elements highlighted can be of differing types as described below. Each framework type has a sub-type; these sub-types are selected by clicking on the unit and selecting from the drop-down lists.



Note that an optional bite index can also be scanned and passed through to the CAD system to aid the framework design if required.

Crown/Bridge A standard tooth or abutment-supported framework.

Basic units This scans standard preparations or ridges depending on the sub-type. The scan data is passed through to the CAD system where the framework can be designed.

Sub-types
Coping
Abutment coping
Pontic

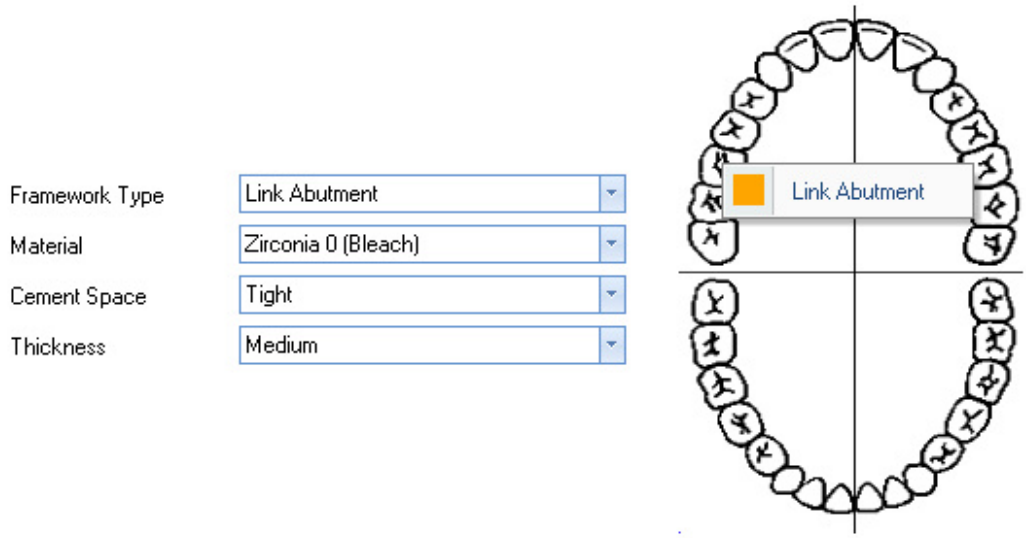
Anatomical units This scans standard preparations or ridges depending on the sub-type in the same way as Basic units. However, when this scan data is processed in the CAD software, the outside "anatomical" form will be automatically added to the design to define the outside surface of the framework.

Sub-types
Anatomical coping
Anatomical abutment coping
Anatomical pontic

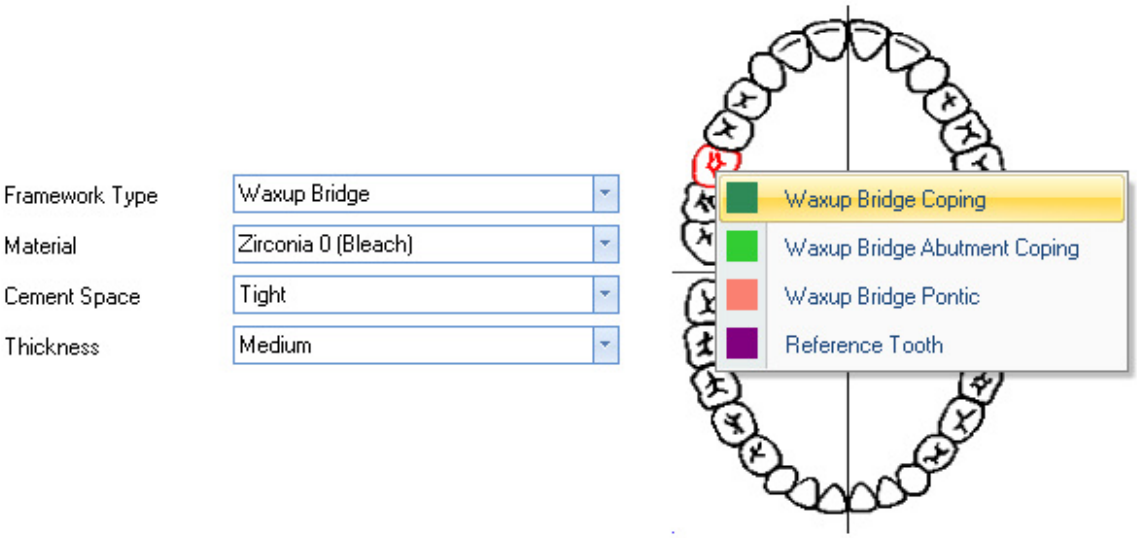
Wax-up units This performs two scans – one for the base preparation or ridge (depending on the sub-type) and one for the waxed up outer surface. Scans can be performed in either order. The wax-up scan will be used by the CAD software to define the outside surface of the framework.

Sub-types
Wax-up coping
Abutment wax-up coping
Wax-up pontic

Reference tooth This scans a tooth that is adjacent to the framework. The scan can then be displayed and used to aid design of the framework.



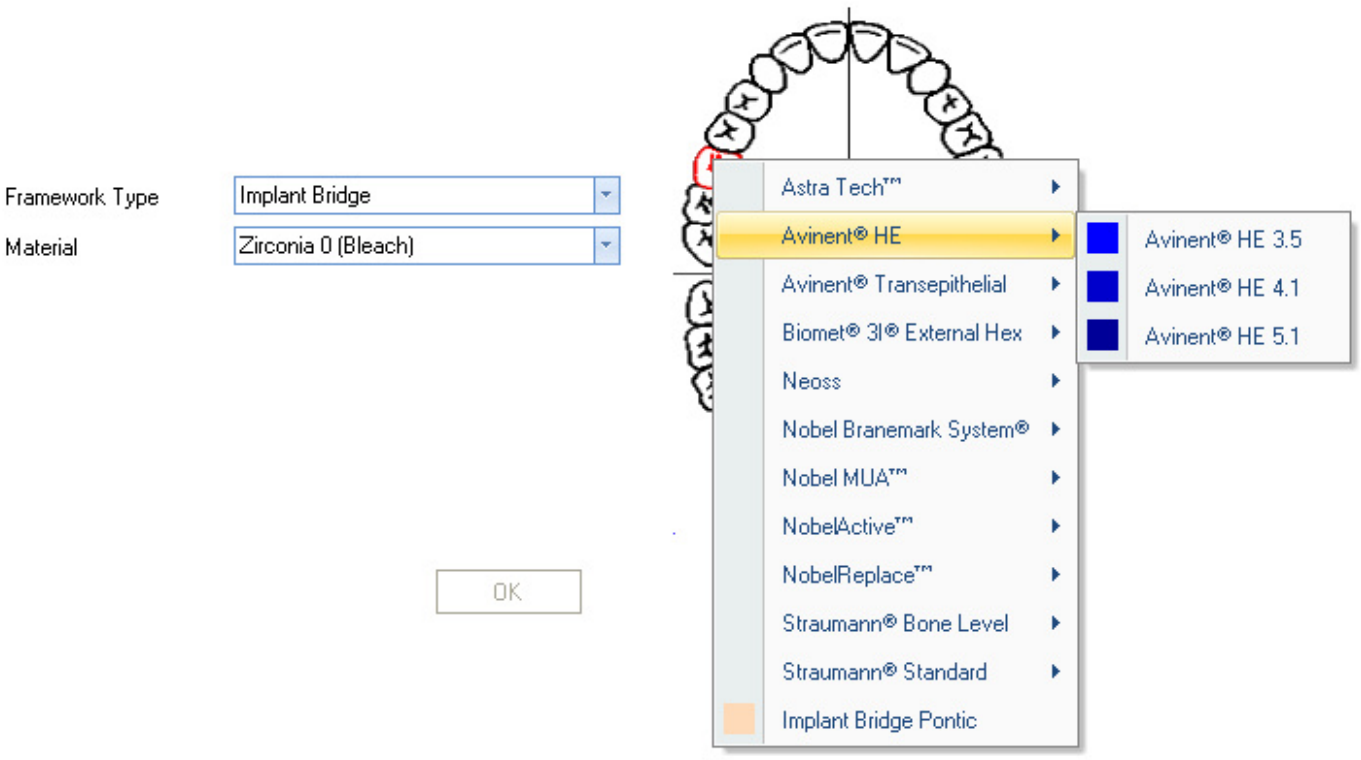
Link abutment A single tooth framework to fit on top of a link abutment.



Wax-up bridge Similar to a standard bridge, but the bridge form is supplied as a single wax-up for the complete bridge.

Wax-up bridge coping	This scans a tooth preparation. The coping that is produced will have a standard cement space.
Wax-up bridge abutment coping	This scans an abutment. The coping that is produced will have a reduced cement space.
Wax-up bridge pontic	This scans a ridge.
Reference tooth	This scans a tooth that is adjacent to the framework. The scan can then be displayed and used to aid design of the bridge.

An additional scan of the complete outside form of the bridge will also be required. This will be segmented in the CAD system to define the outside form of all the units.



Implant bridge framework types An implant supported bridge.

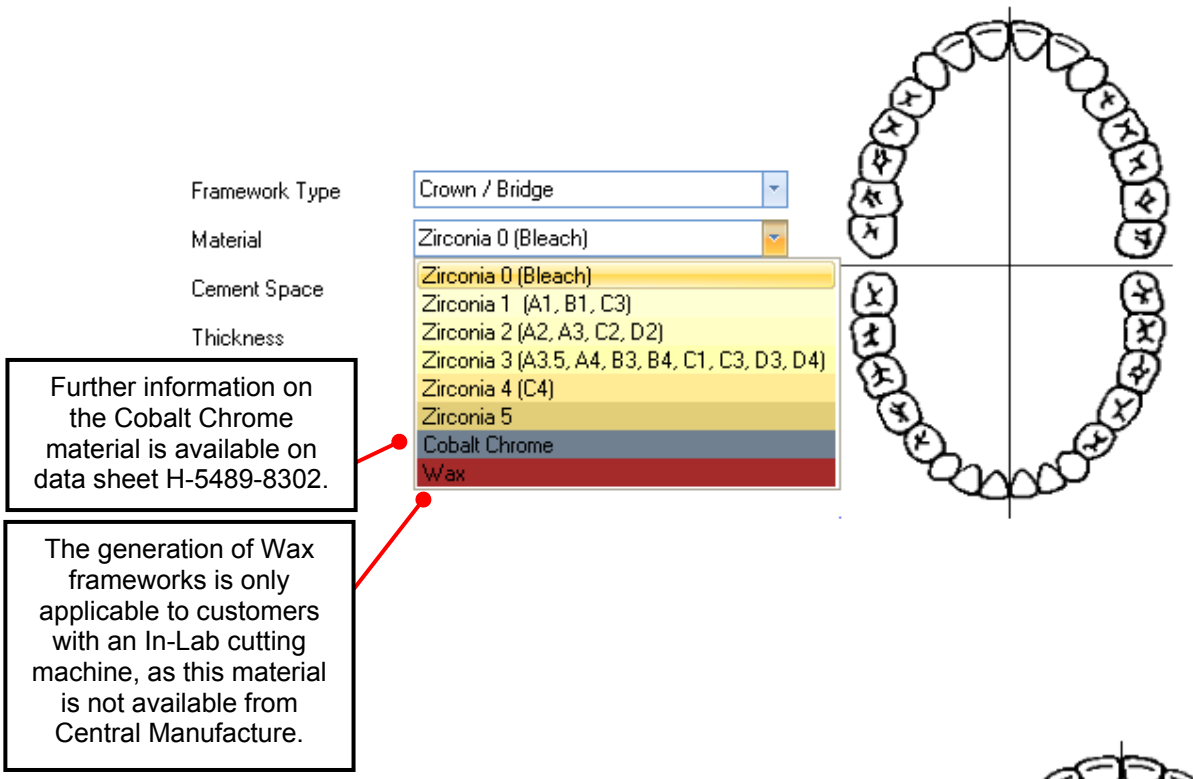
Implant supported units need to have the implant system and platform size selected from the available Manufacturer and Type list.

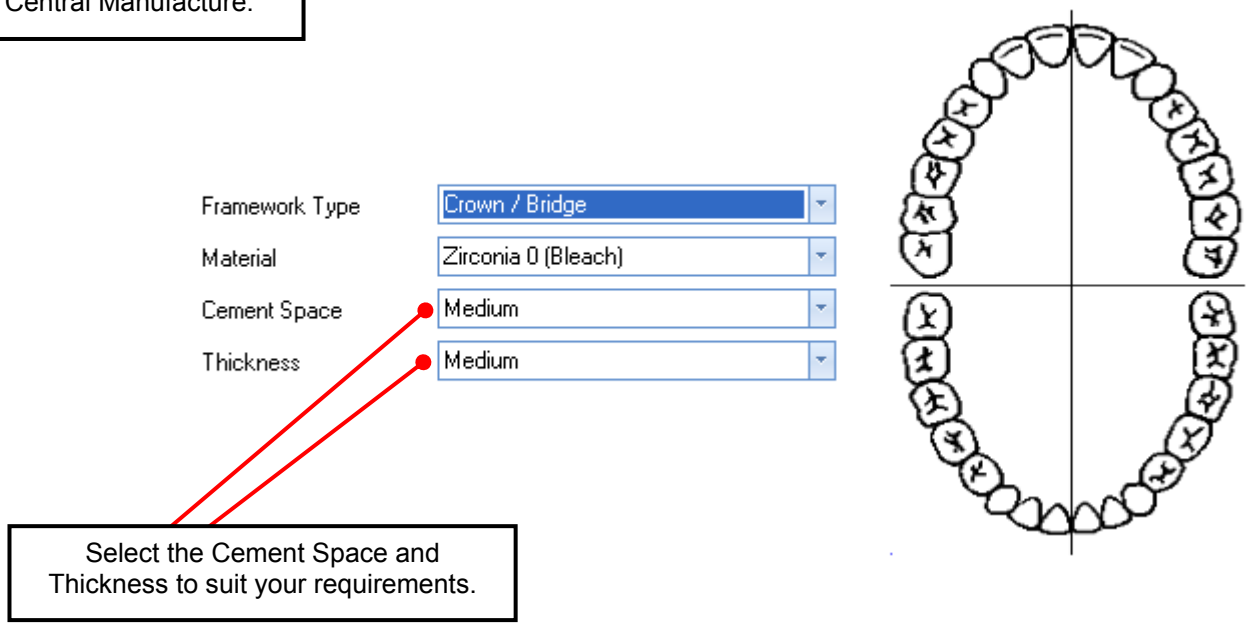
- Astra Tech — Small 3.0, 3.9
- Avinent — HE 3.5, 4.1, 5.1
  Transepithelial
- Biomet 3I — External Hex 4.1, 5.1
- Neoss — 4.1
- Nobel — Brånemark NP, RP, WP
  MUA
  Replace NP, RP, WP, 6.0
- Straumann — Bone Level NC, RC
  Standard RN
- Implant Bridge Pontic — Unsupported unit

An additional scan of the complete implant bridge replica will also be required.

Material

Select Material type and Shade from the drop-down list. The available material will vary according to the Framework Type selected.



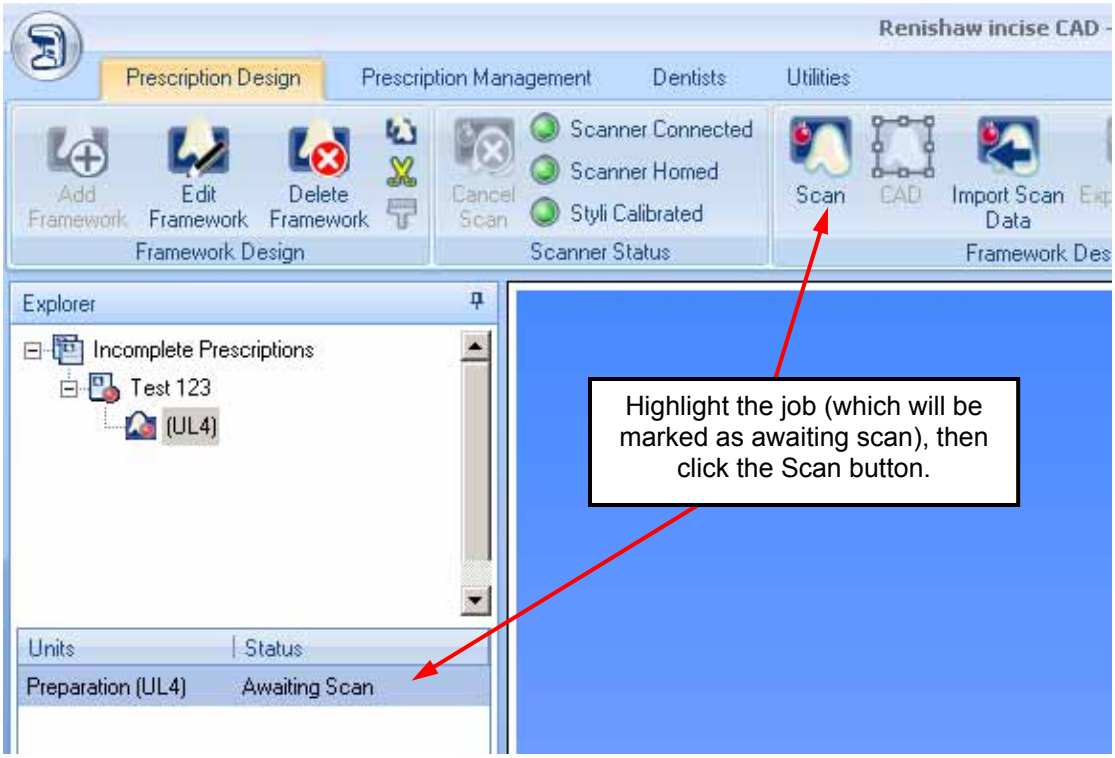


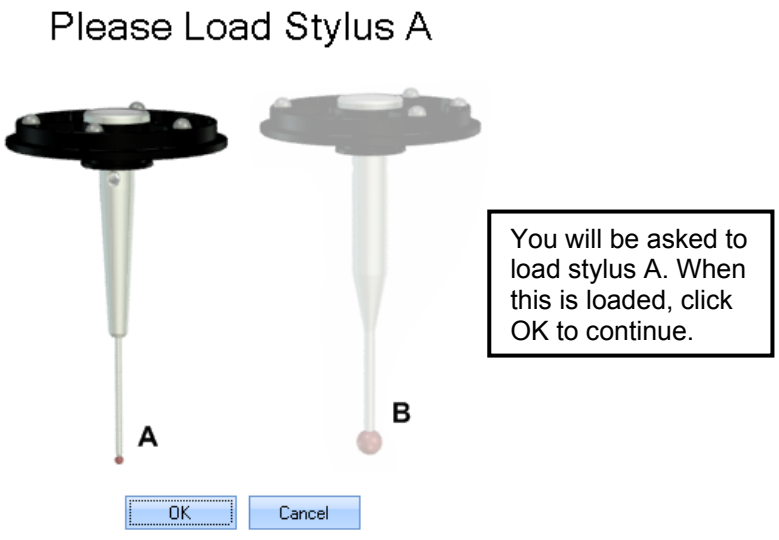
Scanning a single basic framework

When you have selected the framework you wish to scan, make sure that the model has been set up correctly in the die holder and aligned using the gimbal. Make sure you can see the margin line from the top view.

After you have created the framework you will see the following screen.

Click the left hand mouse button to select the preparation you wish to scan. This will be marked as awaiting scan. Then click the Scan button.





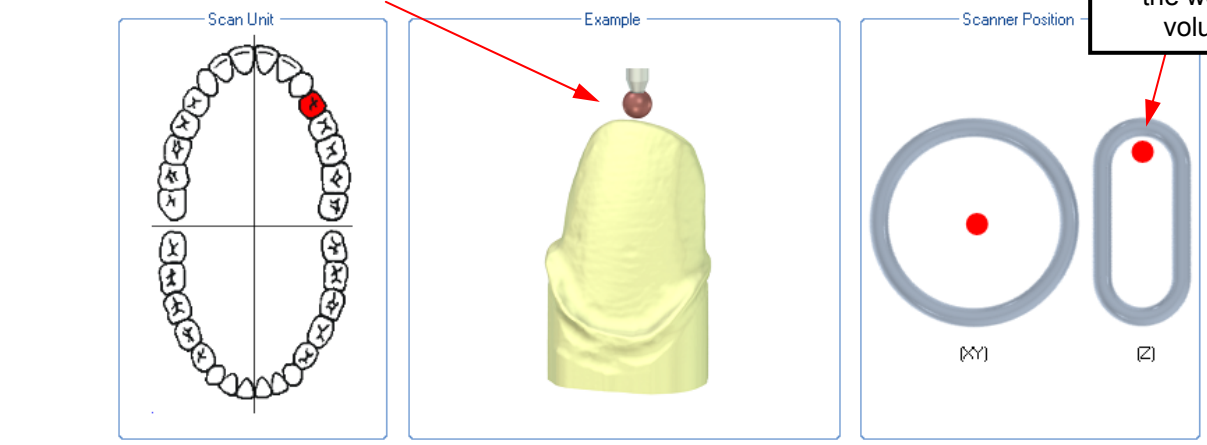
When setting the top and lower limits of the scan, make sure you work within the working volume. If the height needs adjusting, use the spacers in the accessory kit.

Next you must select the top centre and the lowest part of the margin line. Do this as follows.

Take hold of the stem of the stylus and move the stylus above the centre of the preparation. Click OK to continue.

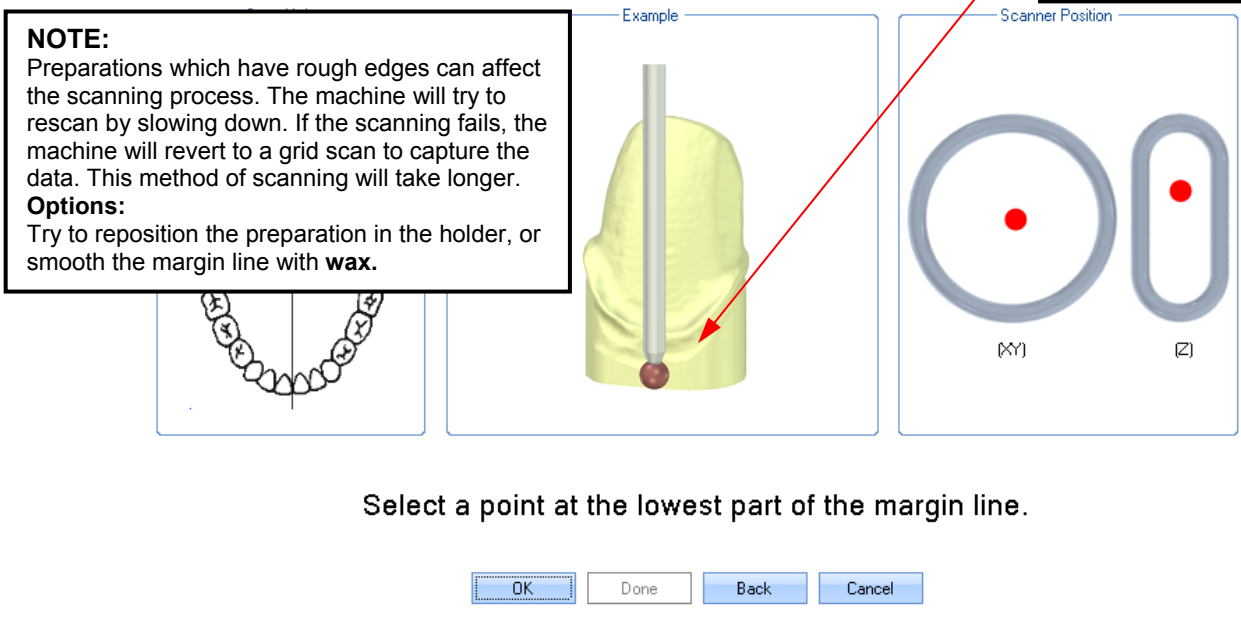
Working Volume

Red dots show the probe inside the working volume.



Select the lowest point; making sure you are low enough to scan all the margin line. Check you are within the working volume. Click OK to continue.

NOTE:
Preparations which have rough edges can affect the scanning process. The machine will try to rescan by slowing down. If the scanning fails, the machine will revert to a grid scan to capture the data. This method of scanning will take longer.
Options:
Try to reposition the preparation in the holder, or smooth the margin line with **wax.**



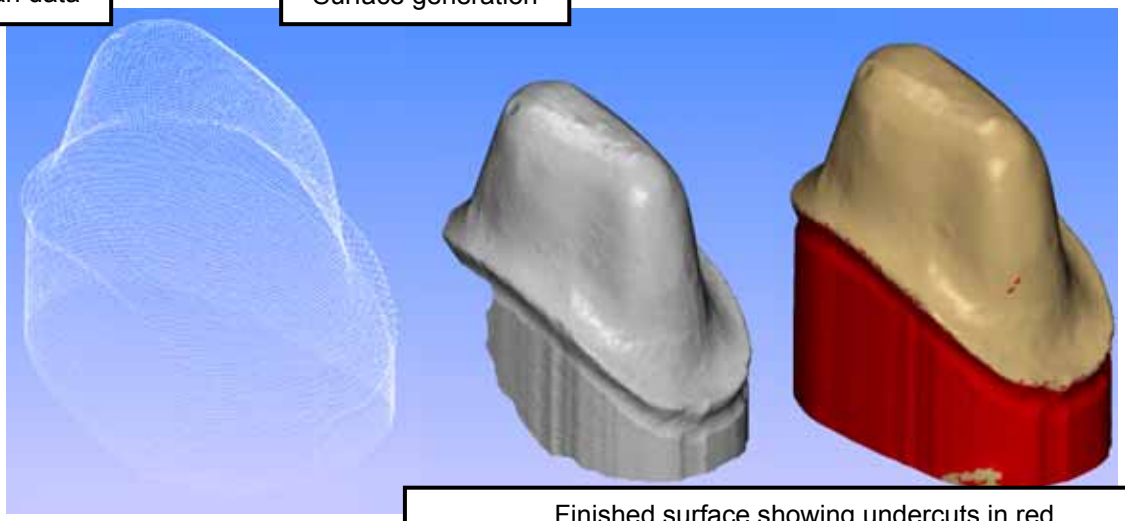
When all the limits have been defined and the start points established, click OK. Scanning will start automatically.

Capturing data (single preparation)

Scanning starts automatically. The model data is collected and built on screen as shown below. The scanning should be in a circular capture method. If the machine has difficulty with the surface, the scanning method will change to a grid scan. A grid scan will take longer to complete.

Scan data

Surface generation



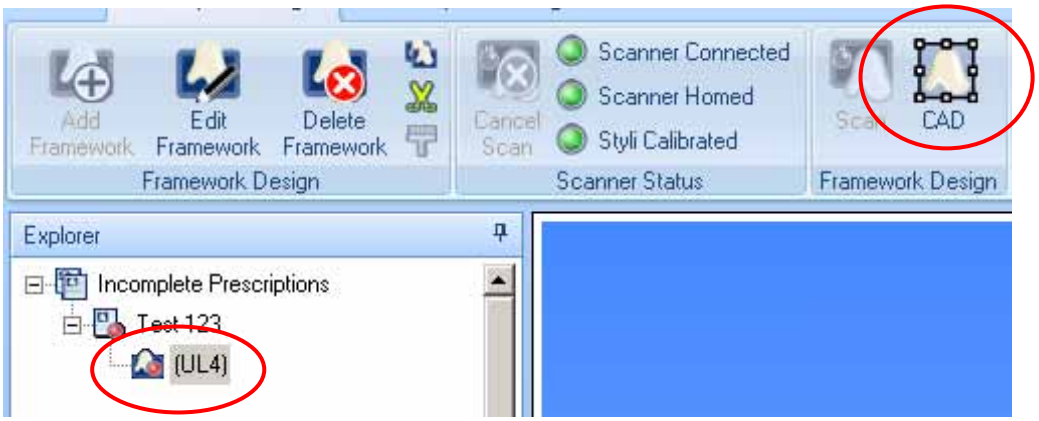
Finished surface showing undercuts in red.

Data in red above the margin line must be closely checked, as this is re-entrant data. This can cause problems for the fit if it is not corrected.

Data in red below the margin line is acceptable.

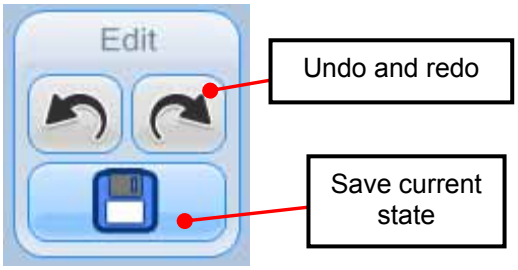
Submitting the data to CAD

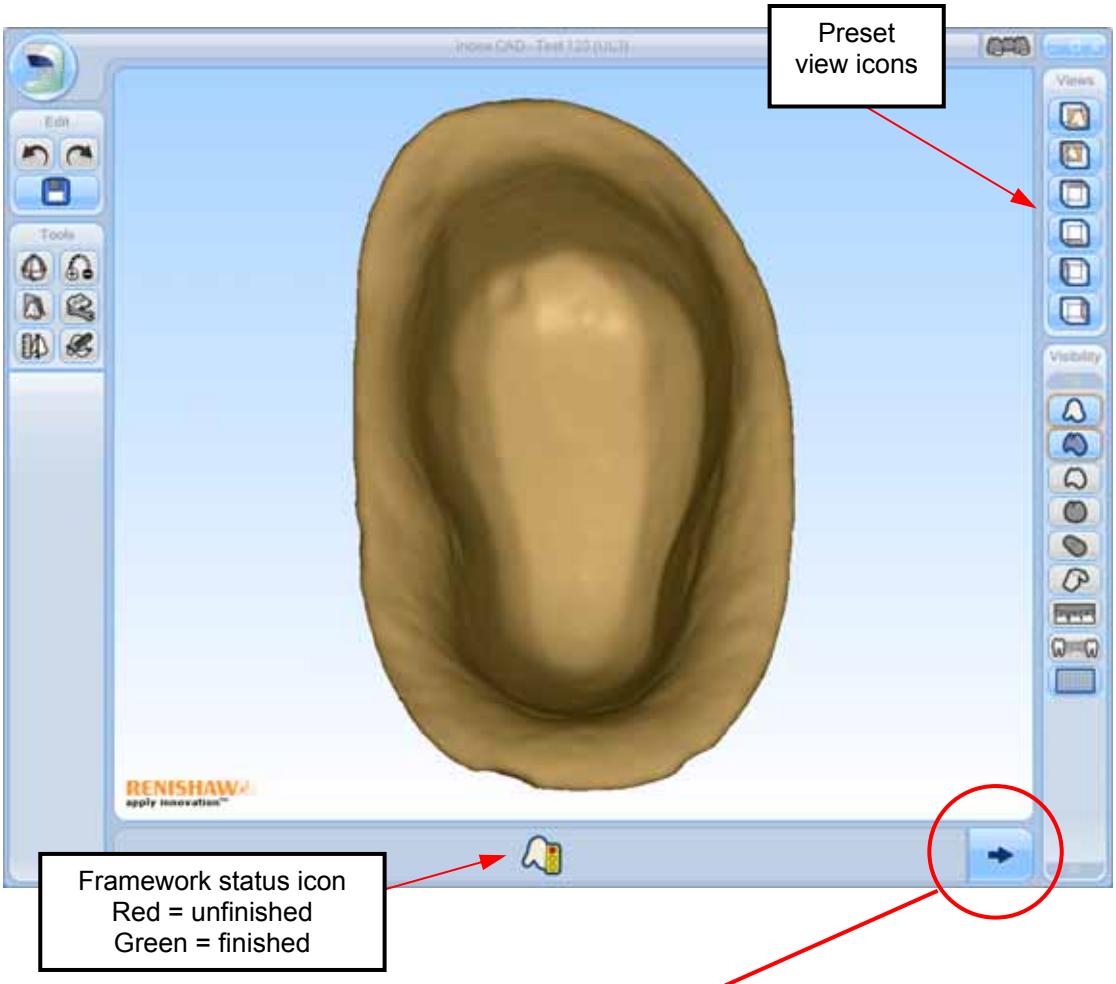
When the scanning has finished, the data is ready for the CAD process. Click on the job name with the left hand mouse button to select it, then click the framework shown under the job name to display the data on screen. Click the CAD button to submit.



incise™ CAD

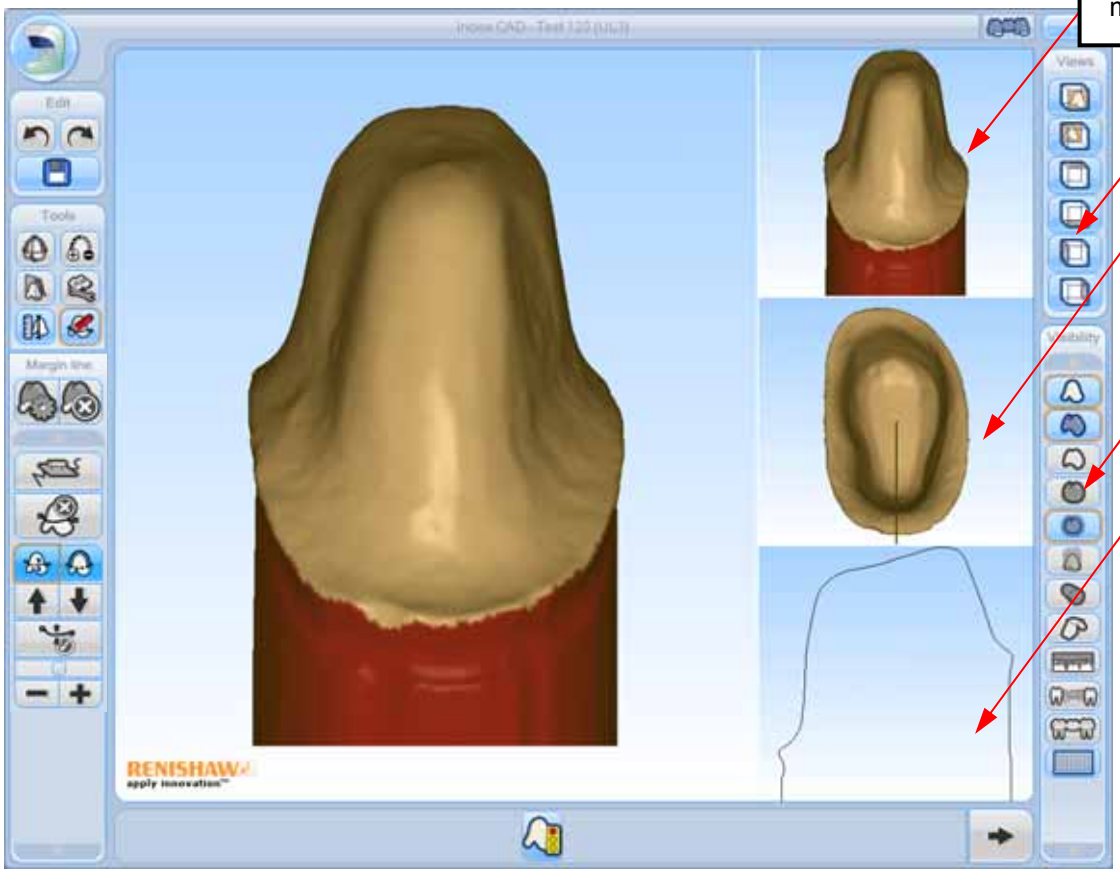
The image below shows the initial view of the transferred model data; this screen allows you to view the data from different angles.





To generate a margin line, click the Continue button.

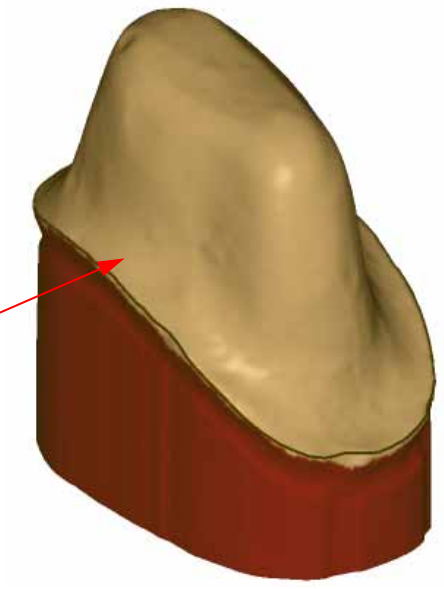
To create the margin line, guide the mouse arrow over to the margin edge of the model. Hold down the Ctrl key and click the selected point with the left hand mouse button to automatically generate the margin line. The on-screen view will show the created margin line. You can now use the margin line tools to manipulate the line to the required size and position.



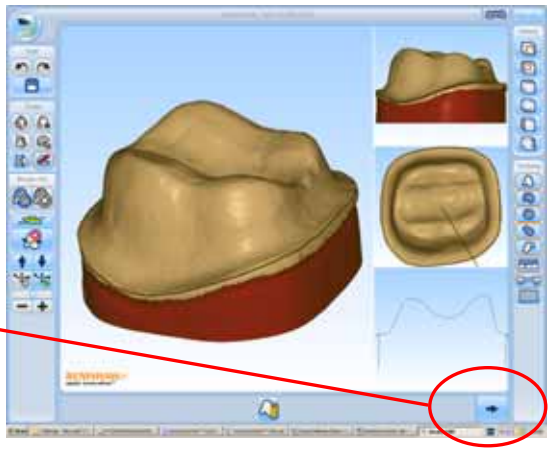
Rotate the model around on the screen (see page 19) to check the fit and position of the margin line. If any editing is required (see the following pages), it must be done before clicking the Continue button.

Ctrl + left mouse button will auto-generate the best margin the system can identify.

Any additional Ctrl + left mouse button actions allow you to guide the arrow slowly to draw or reposition the margin line on the model.



Generate the coping



Once you are happy with the form and position of the created margin line, click ‘Generate’ to see the final coping and exit the margin line tool. This can also be achieved using the “Next” wizard icon.

Delete the coping

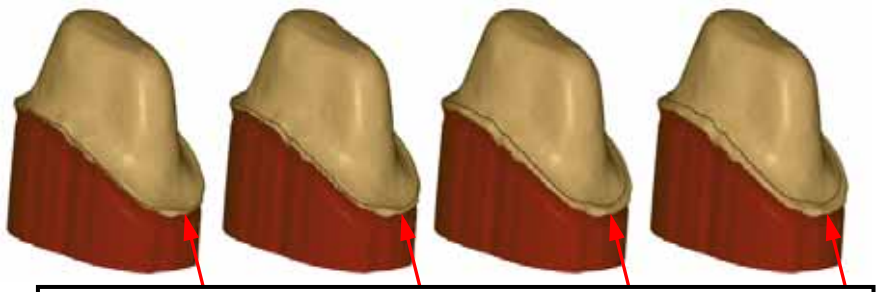
If the coping has already been generated, this button deletes it and allows further margin line modification.

Delete the margin line

This removes the on-screen margin line, allowing you to start the process again.

Nudge up / Nudge down

This moves the whole margin line (or the partial area, if partial nudge is selected) up or down the model.

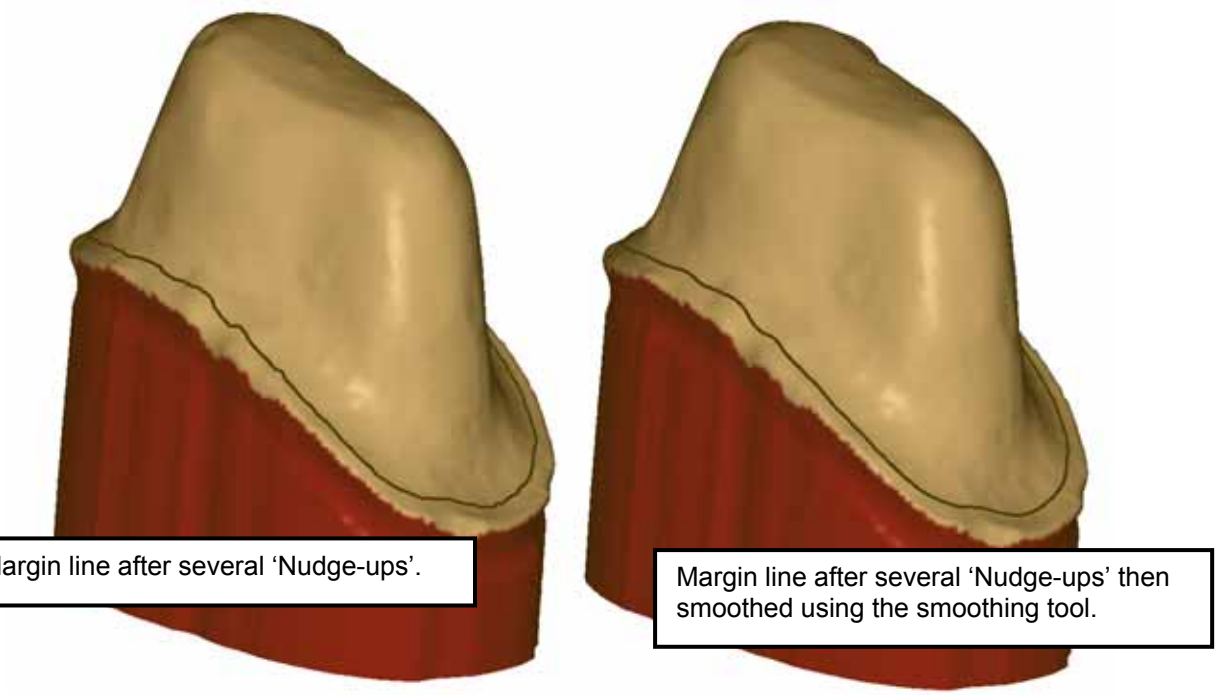


The example above shows the nudge tool results when the Nudge up button is used several times.
The margin line is being moved ‘up the surface’.

Smooth the margin line

This allows the final margin line to be smoothed to the form of the model.

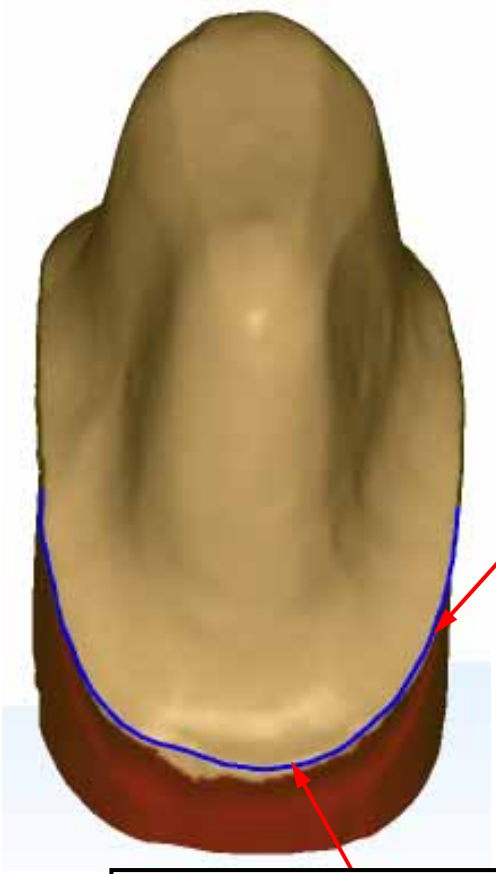
NOTE: If you use the smooth function too many times, you will change the form of the margin line.



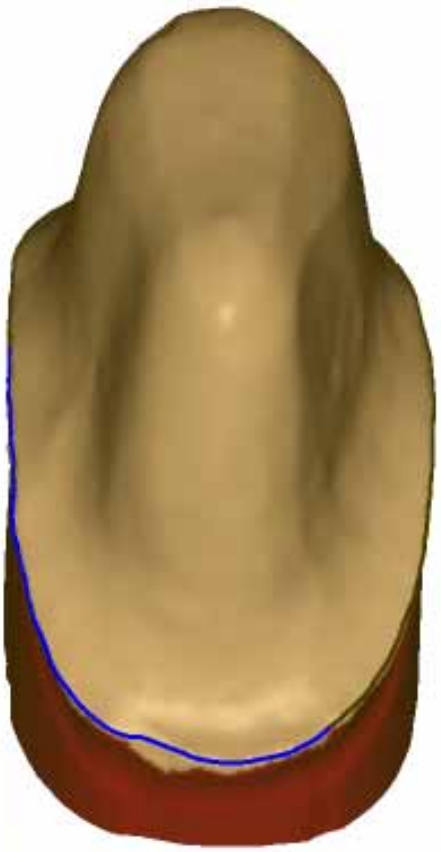
Partial nudge tools

The partial nudge tools are useful if you want to apply a cutback to a portion of the coping. They allow a section of the margin line to be nudged up or down, with a smooth transition area automatically generated at either end.

After the margin has been generated, select the nudge icon, then select the partial nudge start icon.



The partial section is highlighted in blue.
This is centred about the selection position.



Ctrl + left mouse click on the defined margin

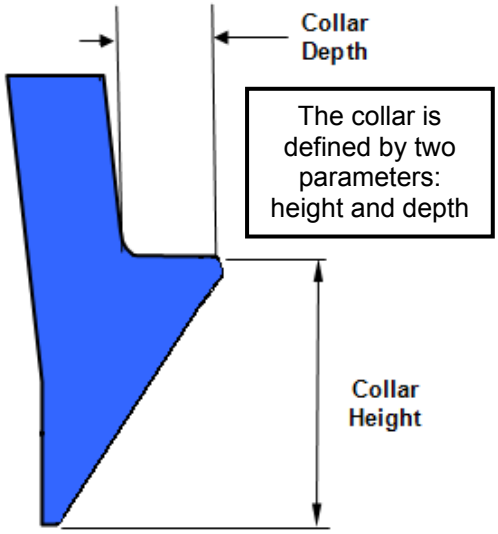
The position icon can be moved left or right.
This will move the partial section in the same direction as the icon.

The + and – buttons control the size of the cutback section.

Exit partial nudge

All subsequent nudge up and nudge down operations will operate on the complete margin.

Collar tools

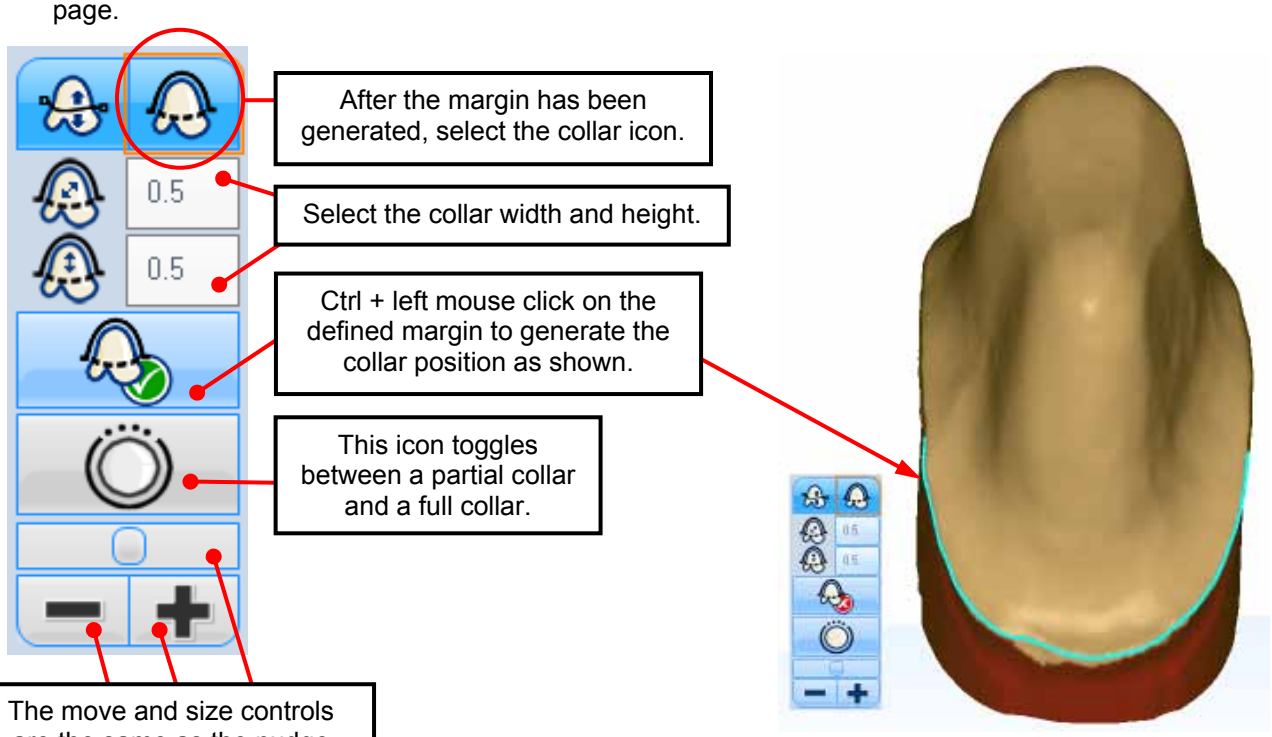


These are used to apply a collar to the complete margin line, or a portion of it. They allow a section of the margin line to be marked as containing a collar. The coping will then have a collar automatically added in this region.

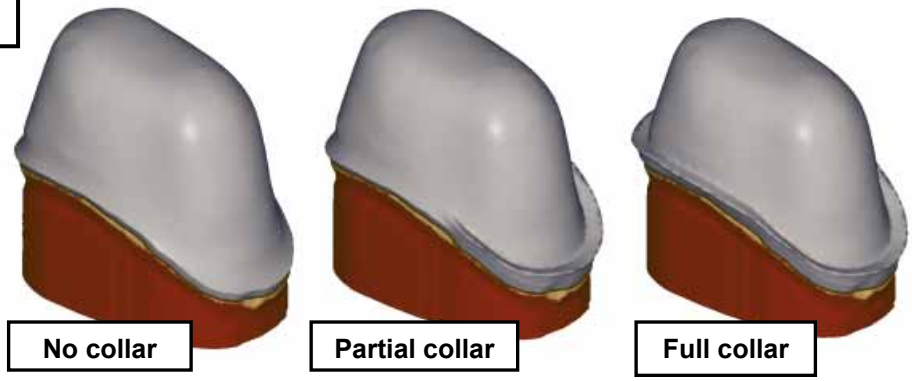
Note that the way that a collar is generated varies according to the unit type:

- Basic copings will have the collar generated when the coping is generated.
- Anatomical and wax-up copings will have the collar generated when reduction is applied to the coping. In this case, the collar depth will be set to the reduction amount, subject to maintaining the minimum coping thickness.

Collar tools operate in a similar manner to the partial nudge tools described on the previous page.



The collar will be displayed when the framework is generated.



Measurement tools

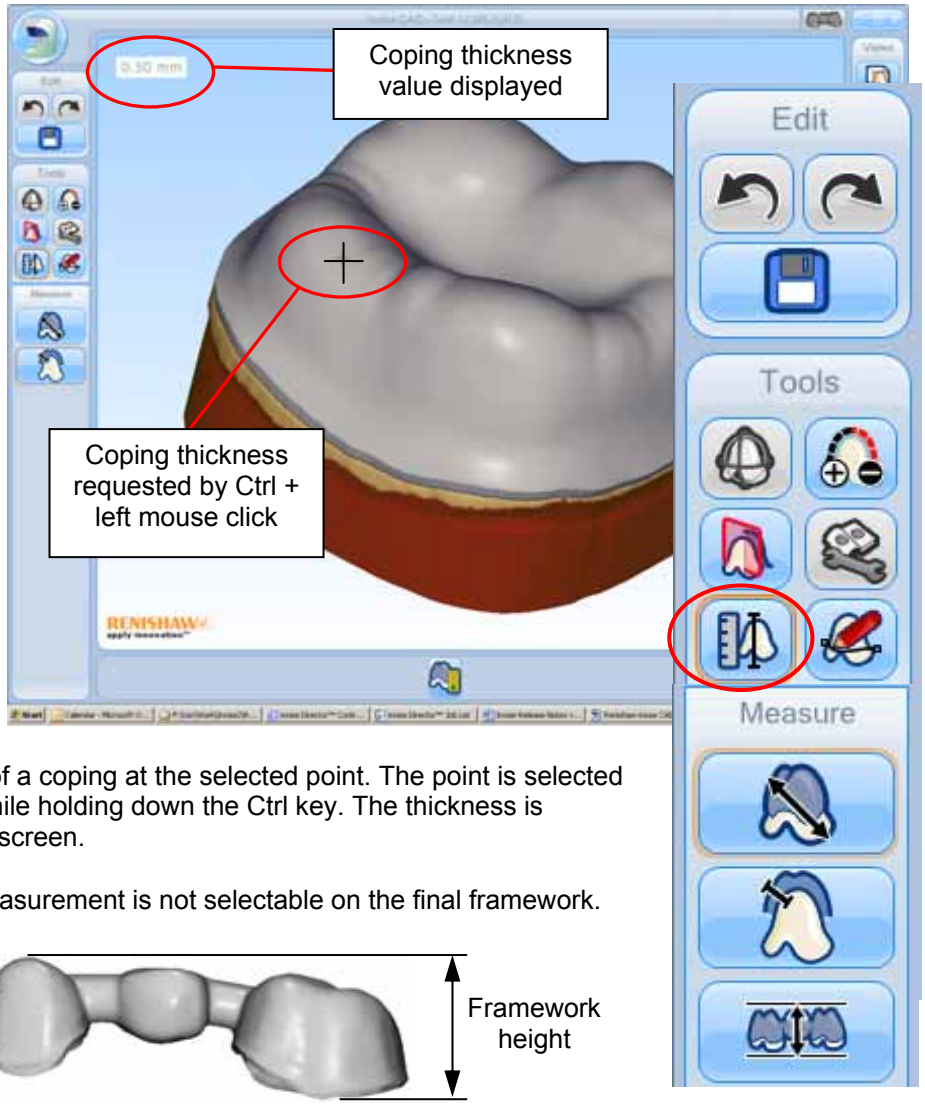
Three measurement tools are available for different measurement tasks:

- Coping thickness measurement for measuring coping thickness.
- Measurement grid option to display a measurement grid behind any view.
- Two-point select measurement to measure the distance between two points.

Point to point measurement

This measures the distance between two selected points. Each point is selected using the left mouse button while holding down the Ctrl key. The distance is displayed at the top left of the screen.

Coping thickness measurement



This measures the thickness of a coping at the selected point. The point is selected using the left mouse button while holding down the Ctrl key. The thickness is displayed at the top left of the screen.

Note that coping thickness measurement is not selectable on the final framework.

Framework height

This displays the overall height of the framework in its “unsintered” state. This can be used to check if a framework will fit into a billet.

It is also possible to use the “show measurement grid” option  from the visibility toolbar to show a 1 mm grid which can be useful to give a rough idea of size.

Add / Remove material tools

The Add / Remove material tool allows local thickening to be applied to a framework.

Ctrl + left mouse click

This will add material and the 'tool' will be shown in blue.

Ctrl + right mouse click

This will remove material and the 'tool' will be shown in red.

The system will not allow the framework to become thinner than the minimum coping thickness.

Shift + left mouse click

This will smooth the surface and the 'tool' will be shown in yellow.

This slider controls the amount of material added or removed each time the tool is used.

This slider controls the size of the tool to be used.

Outer surface reduction

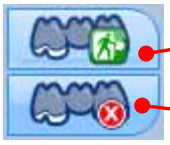
A uniform reduction can be applied to the outer surface of copings and pontics, subject to maintaining the minimum coping thickness.

- The reduction amount is absolute from the outside surface, e.g. a reduction of 0.5 mm followed by a reduction of 1.0 mm will reduce by 1.0 mm in total, NOT 1.5 mm.
- The reduction is only applied to the currently selected unit. This allows different reductions for different units, but does mean that you need to reduce each unit of a bridge separately if required.
- Reduction cannot be applied to connectors.
- The visibility  icon can be used to toggle the display of the original surface after reduction.
- Reduction is not allowed on the final framework.

Saving a framework

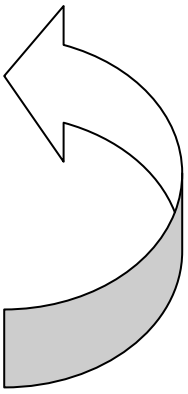
When the CAD design is complete, select the **Generate** icon  to generate the final framework.

On successful completion of framework generation, the following two options are available:



Return to incise™ to continue another design or submit the framework for manufacture.

Delete the framework to allow further design changes.



Loading a bridge for scanning

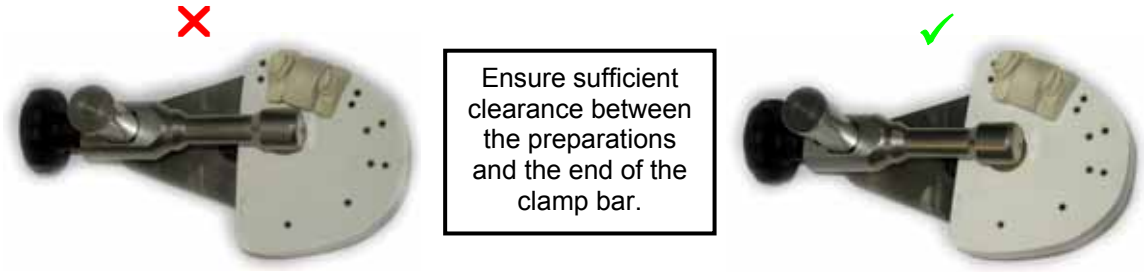
Before any scanning can be started, the bridge will need to be held in the jaw holder, which in turn will be located on to the gimbal.

Orientate the bridge in such a way that all margin lines are visible when viewed from above. This is achieved by using the gimbal axes until the desired position is established.

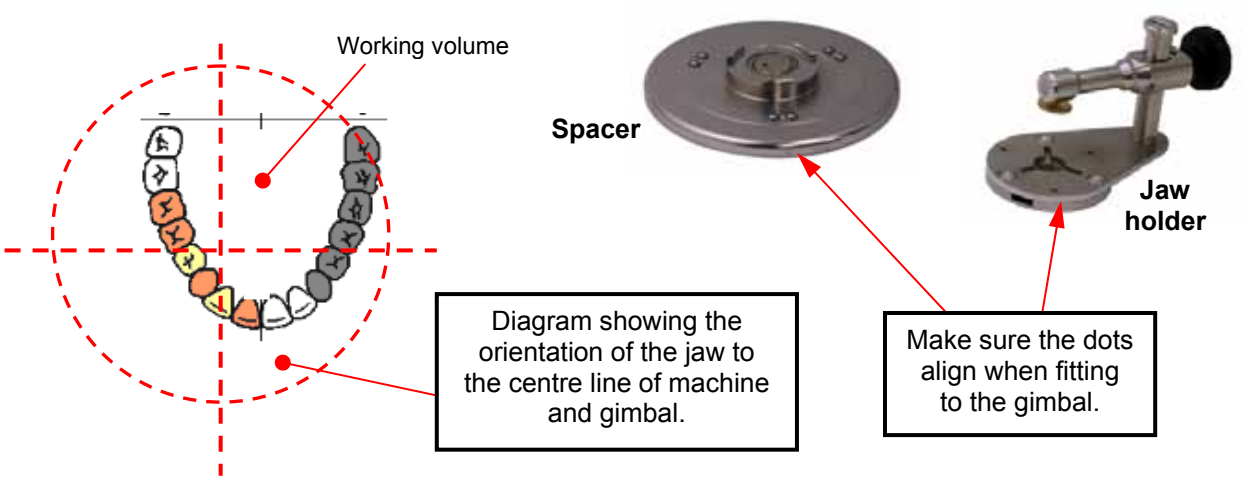
There are two ways to adjust the position of the model on the gimbal:

- Adjust the orientation using the top plate. Release it by rotating the locking ring anti-clockwise. The top plate can then be positioned before being locked by rotating the locking ring clockwise.
- Adjust the horizontal position using the lower plate. This is unlocked using the locking lever, allowing the lower plate to move freely over the base. Try to position the model in the centre of the working volume. Move the handle back to its original position to lock it.

Mount the model in the jaw holder with only the required elements present.



Two spacers are provided to adjust the overall height of the gimbal. It is suggested that one spacer is used for an average size bridge.



Use good model bases (plastic ones work well). If the preparation wobbles in the base, fix it with some wax, as movement during scanning will generate undersize data.

Plastic bases can distort when clamped in a jaw holder if not correctly supported. To prevent this happening, use a die-stone pad or a support plate.

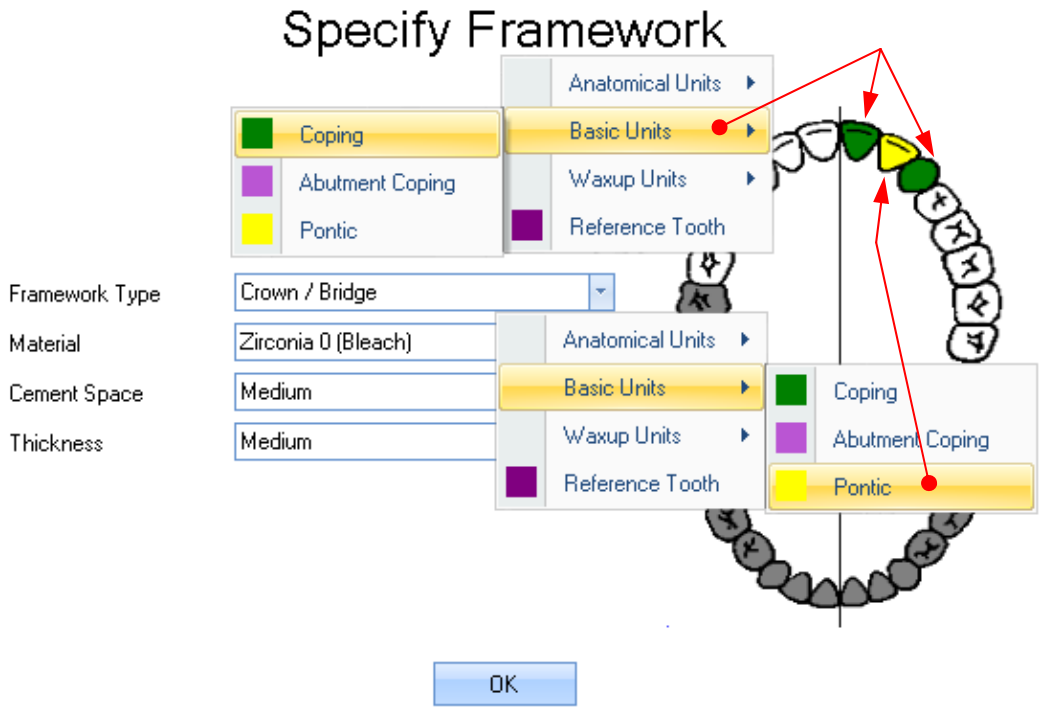
Prescription design

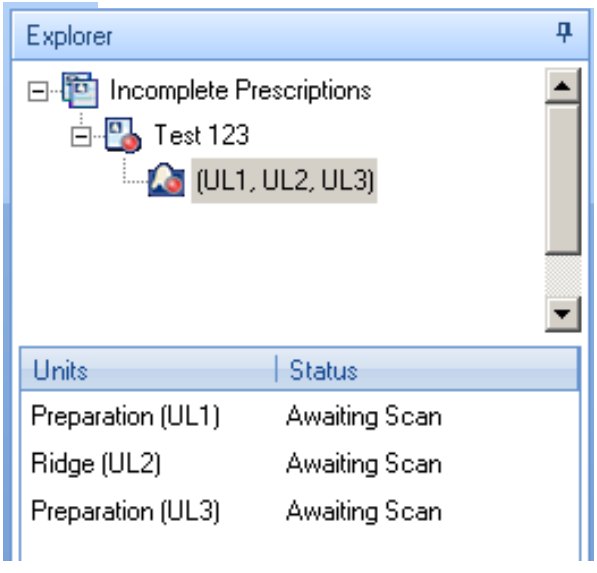
Use this tab when you want to create a job for scanning, Click on **New Prescription** to proceed.

Specify framework

To scan a bridge, click on the required tooth then select **Basic Coping** as a “Unit type” for all the retainers. Then repeat the process for the pontics, clicking on **Basic Pontic** in “Unit types”. Click OK to continue.

NOTE: When selecting a retainer, any of the valid types can be selected.





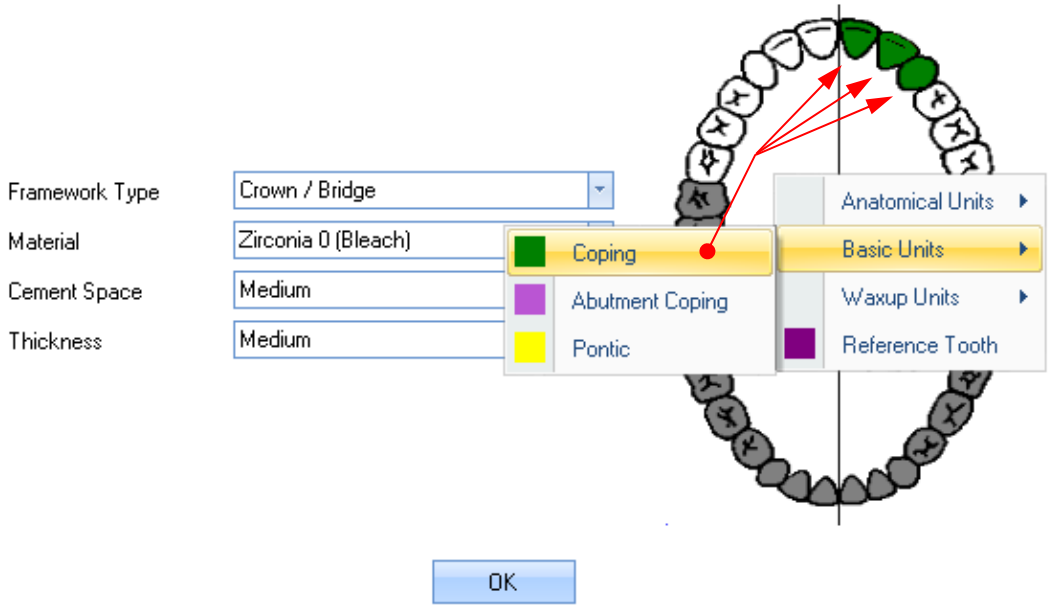
This example shows a three-unit framework:

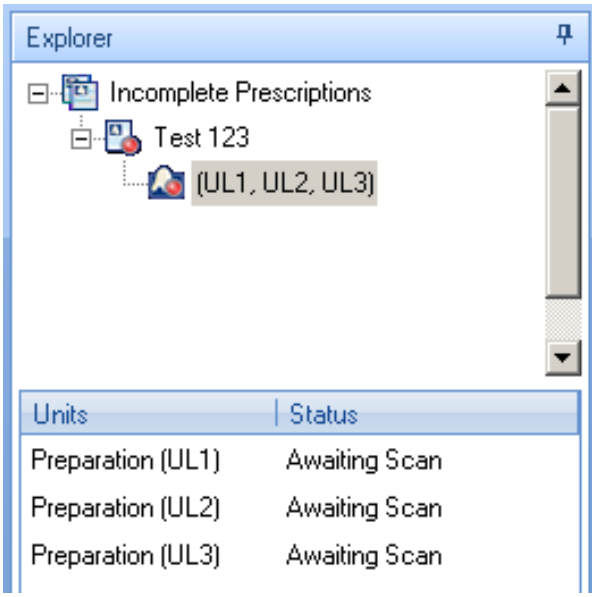
- UL1 Coping
- UL2 Pontic
- UL3 Coping

Scan as follows:

- Remove the ridge element UL2
- Scan UL1 and UL3
- Remove UL1 and UL3 replace UL2
- Scan UL2 (a stylus change will be requested)

Specify Framework



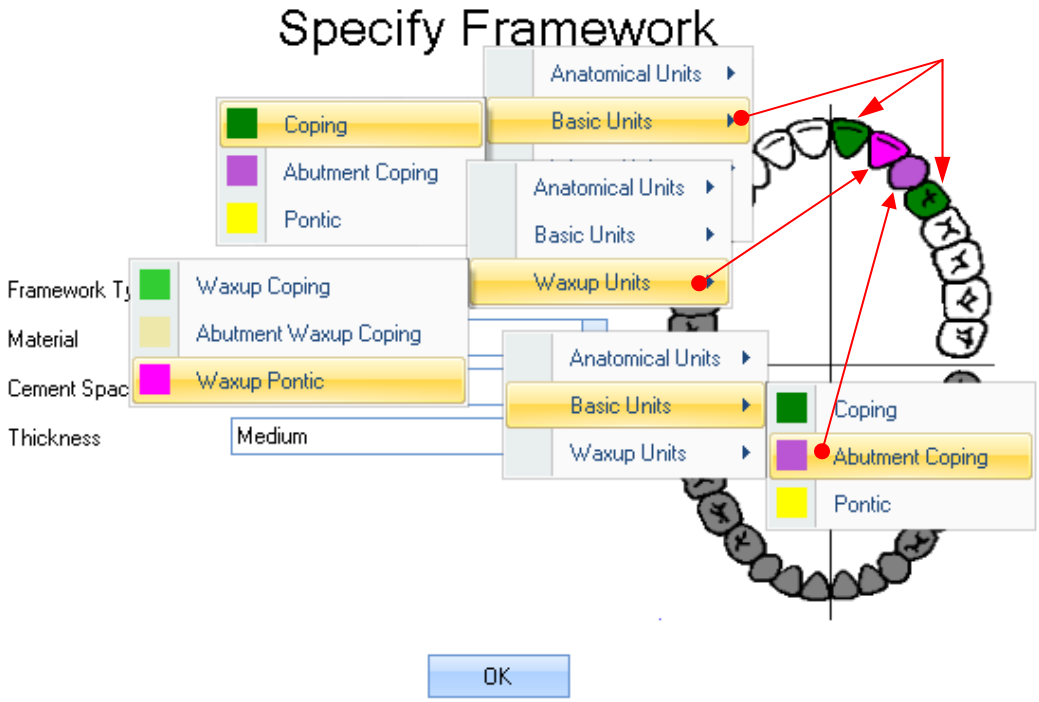


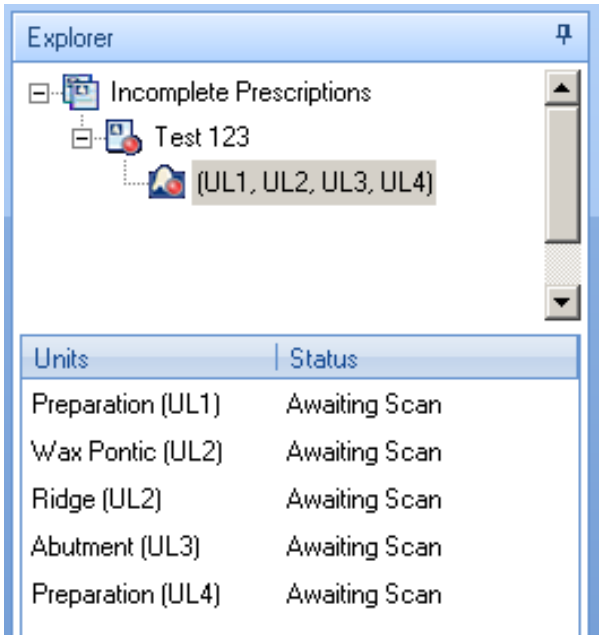
This example shows a three-unit splinted framework:

- UL1 Coping
- UL2 Coping
- UL3 Coping

Scan as follows:

- Remove UL2
- Scan the UL1 and UL3
- Remove UL1 and UL3 replace UL2
- Scan UL2





This example shows a four-unit framework:

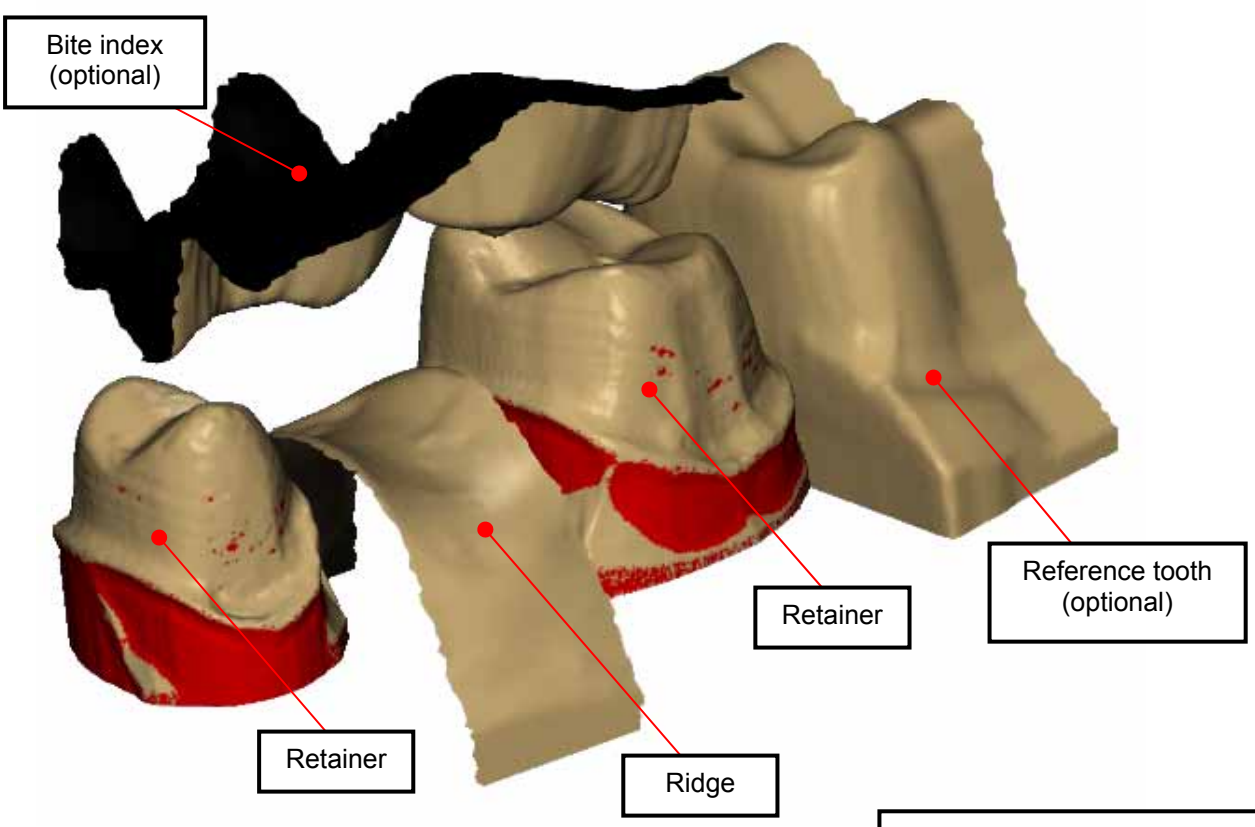
- UL1 Coping
- UL2 Wax pontic
- UL3 Abutment coping
- UL4 Coping

Scan as follows:

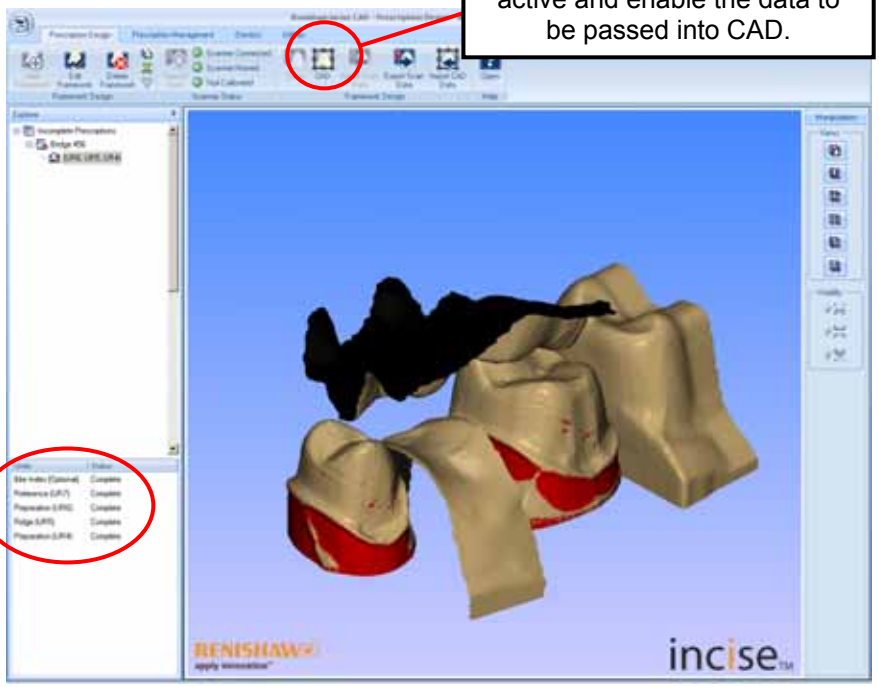
- Remove UL2 and UL3 from the model
- Scan UL1 and UL4
- Remove UL1 and UL4 replace UL3
- Scan UL3
- Remove UL3 and replace UL2
- Scan UL2 (a stylus change will be requested)
- Wax up the pontic then scan

Multi-unit frameworks

To generate a bridge (UR6, UR5, UR4) the following elements need to be scanned. Additional elements can optionally be captured to assist in the CAD process.

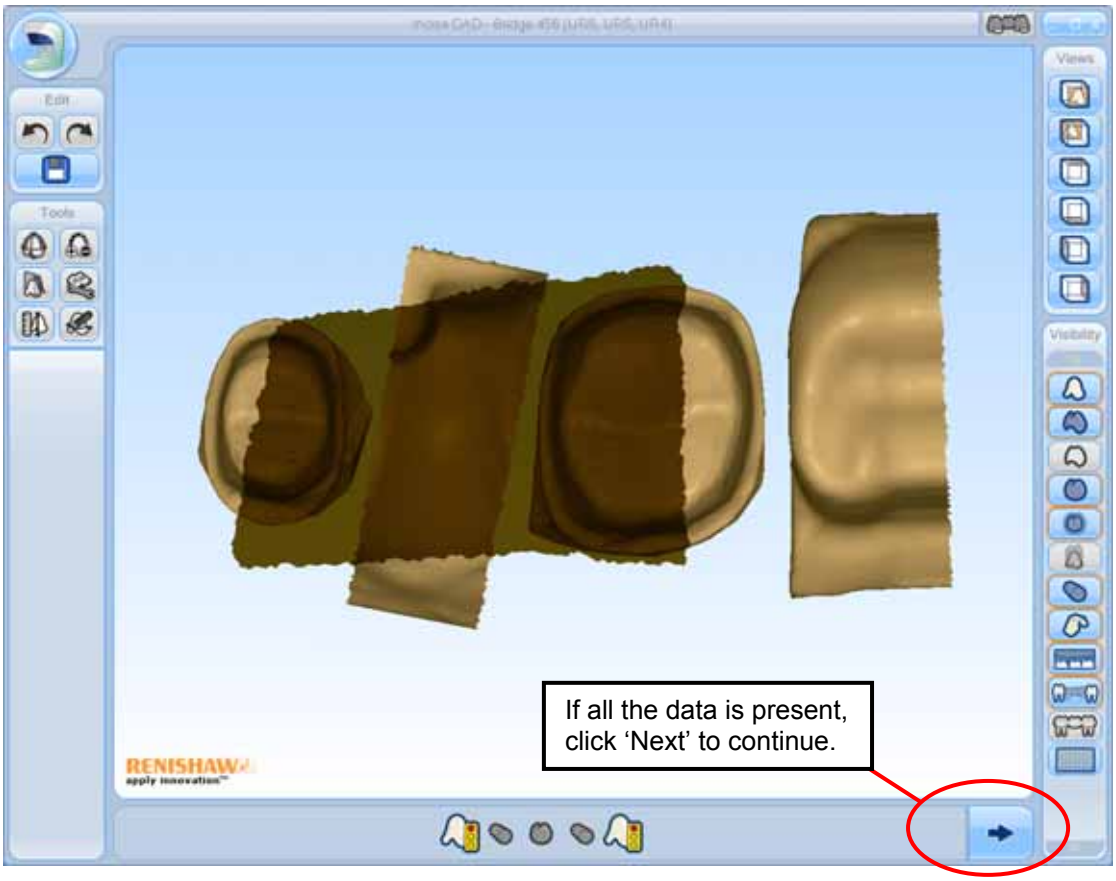


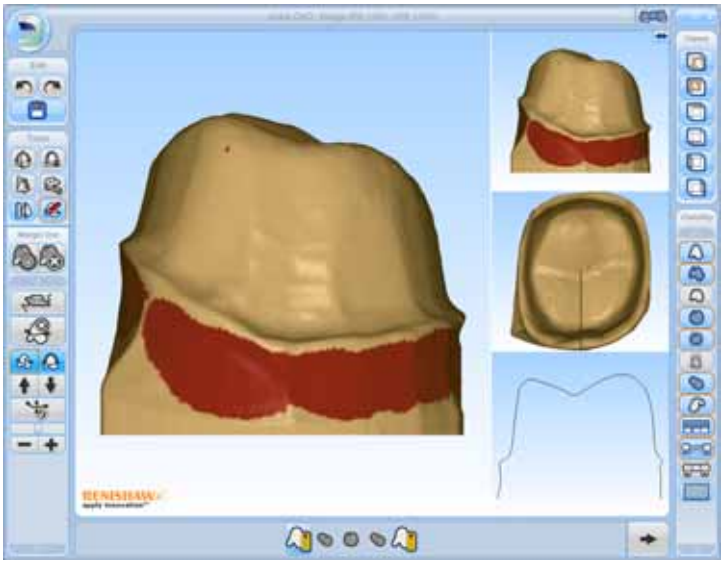
The CAD icon will become active and enable the data to be passed into CAD.



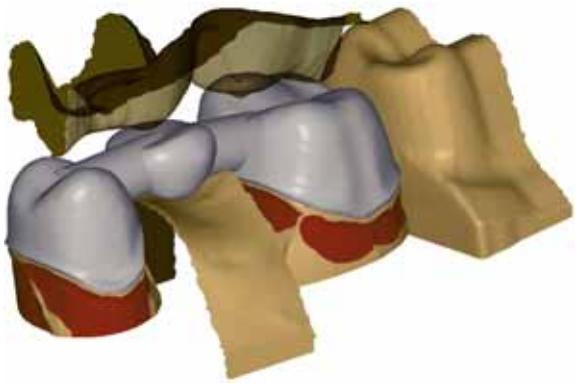
When all the defined elements have been scanned, they will be marked as complete in the status area.

The first operation in the CAD module is to display the captured data as show below.

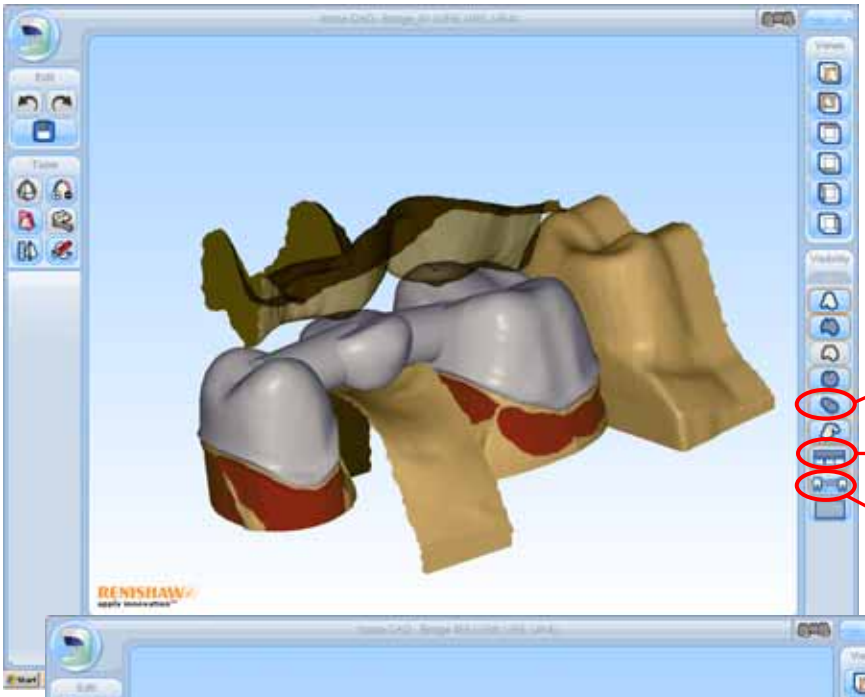




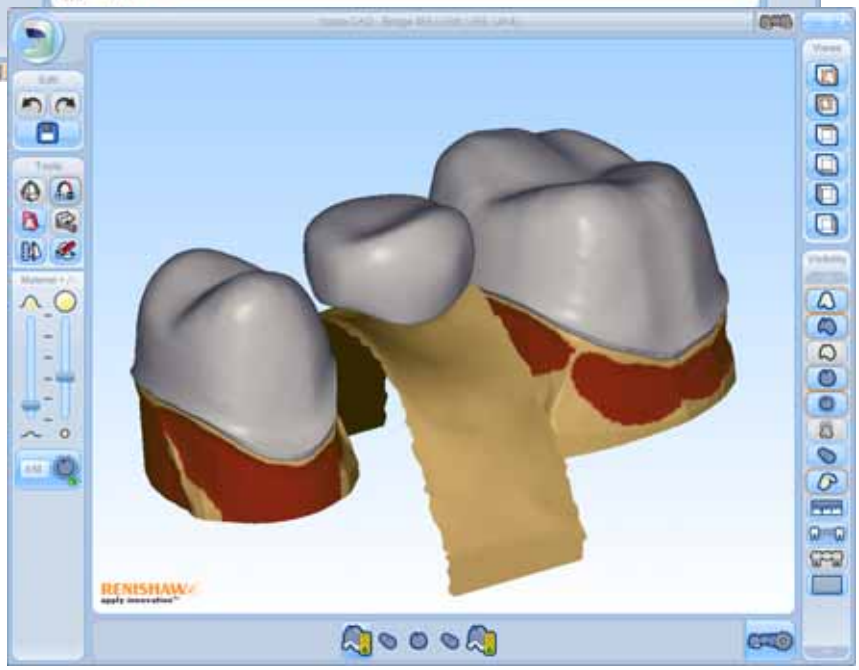
The margin then needs to be added as described on page 29 for all the retainers captured. After the last margin is defined, the CAD module will place a pontic and connectors in the approximately final position.



When the default bridge is generated, the pontic and connectors will need to be modified prior to the final design of the bridge.



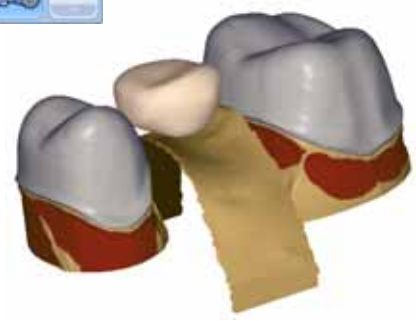
The first step in the design process is to 'switch off' some of the scanned elements to improve the clarity of the display.



By switching off the above items the pontic can be seen more clearly.

The next operation is to reposition, scale and re-orientate the pontic.

To start the modification, double-click the pontic to select the element, which will change colour as shown.



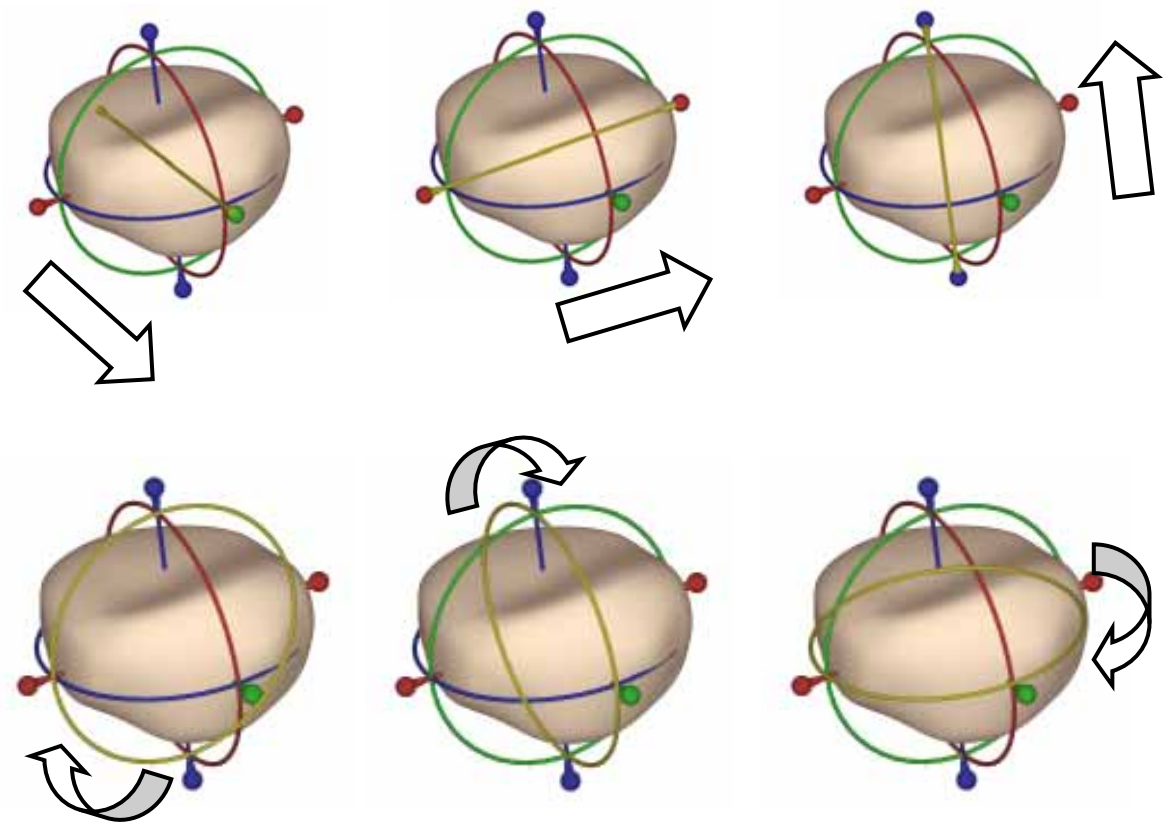
Once an element has been highlighted, additional tools become available. The first tool to select is the Entity Manipulator.

There are three modifications which can be made – rotation, translation and scaling. These operations can be undertaken in any of the displayed directions.

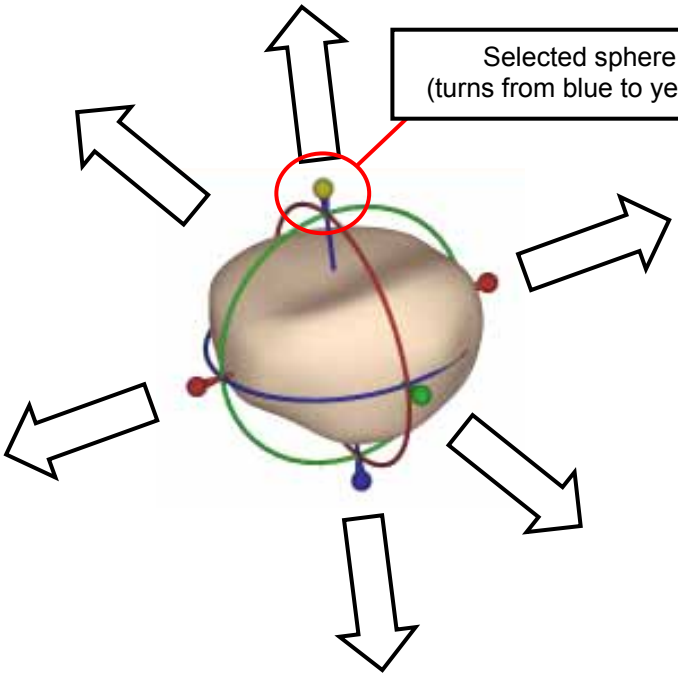
If the cursor is positioned over one of the control elements, that element will change colour to yellow. When this happens, use the left hand mouse button to move the element in the direction of the control element.

The following rules apply:

- Selecting a line will translate
- Selection a circle will rotate
- Selecting a ball will scale



The element will translate / rotate in the direction of the arrow.



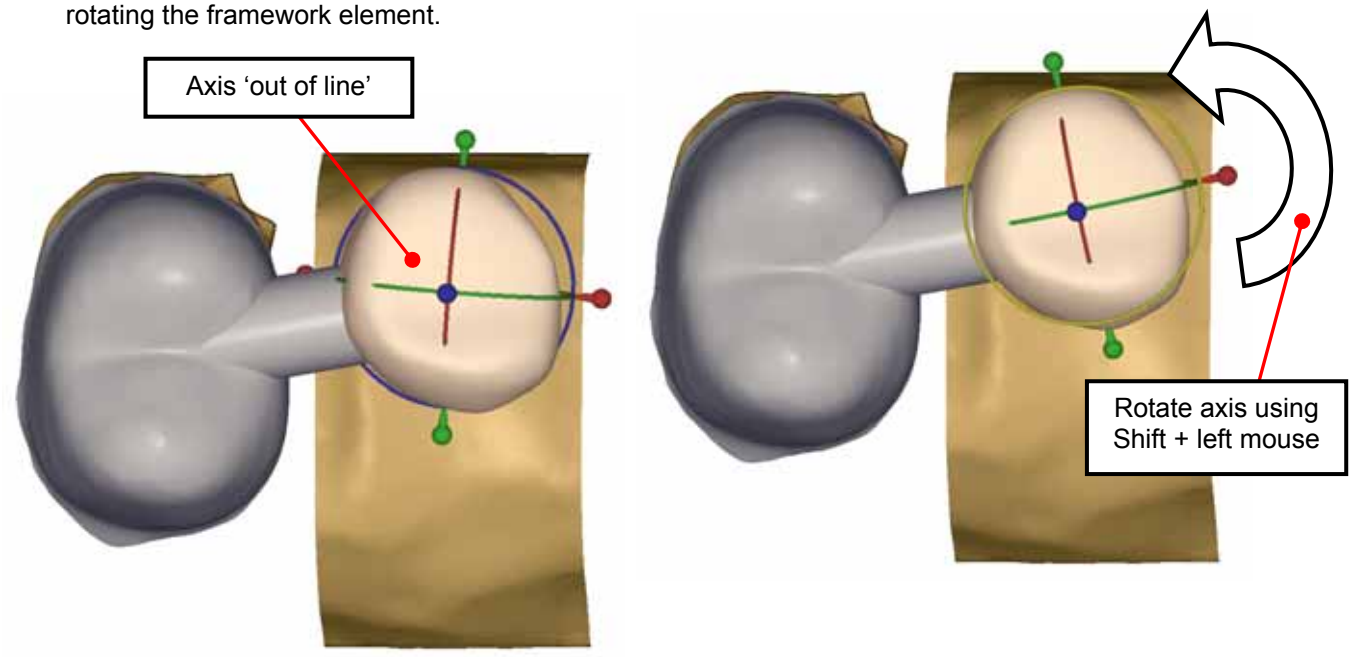
When scaling is required, select the relevant sphere and use the left hand mouse button to move it in/out or up/down to scale up or down.

The scaling will be about the centre of the Entity Manipulator in all directions with one exception:

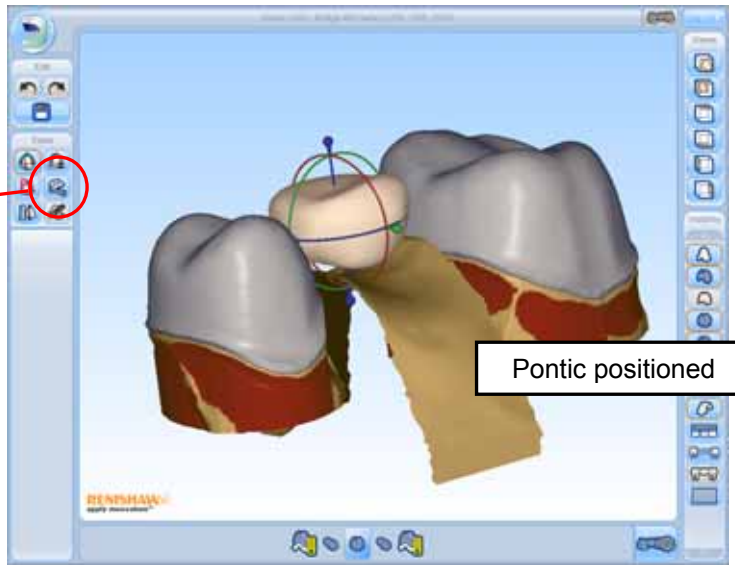
If you select a sphere using Ctrl + left mouse click, it will scale about the opposite sphere, i.e. Ctrl + left mouse click and move the top, the bottom remains in the same position and vice versa.

When the pontic has been scaled and repositioned, the elements which have been switched off should be reselected to check for any problems with the bite or ridge. This may result in further modifications to the pontic being required.

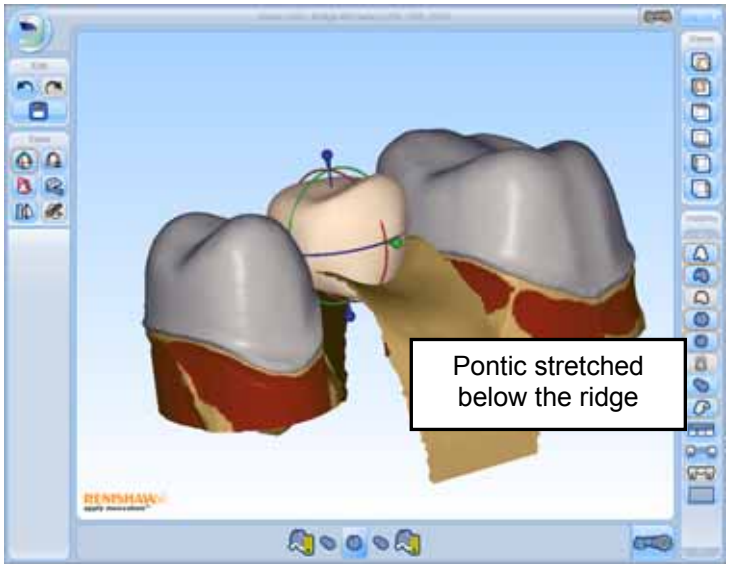
If the Entity Manipulator has an axis not aligned to the framework, this can be corrected by rotating the Entity Manipulator. To do this, highlight the blue circle, hold down the Shift key and the left hand mouse button and rotate. This will rotate the Entity Manipulator without rotating the framework element.



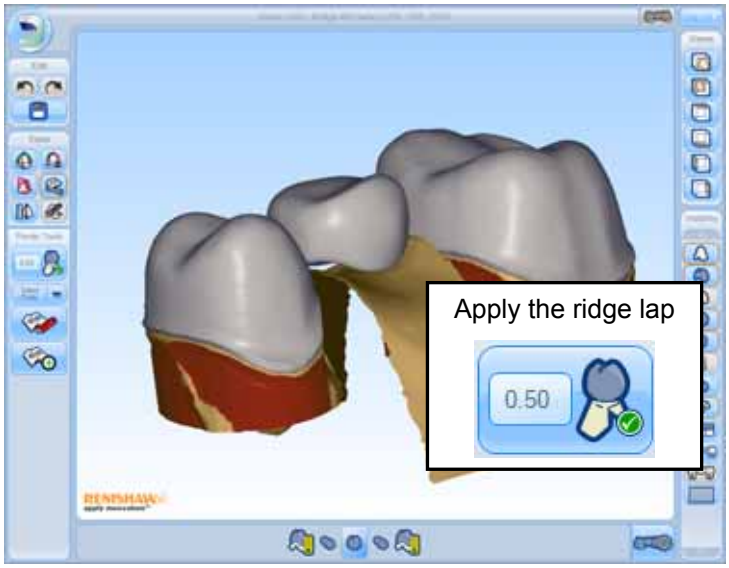
A pontic base can be automatically trimmed to the ridge using the ridge lap tool from the pontic tool box.



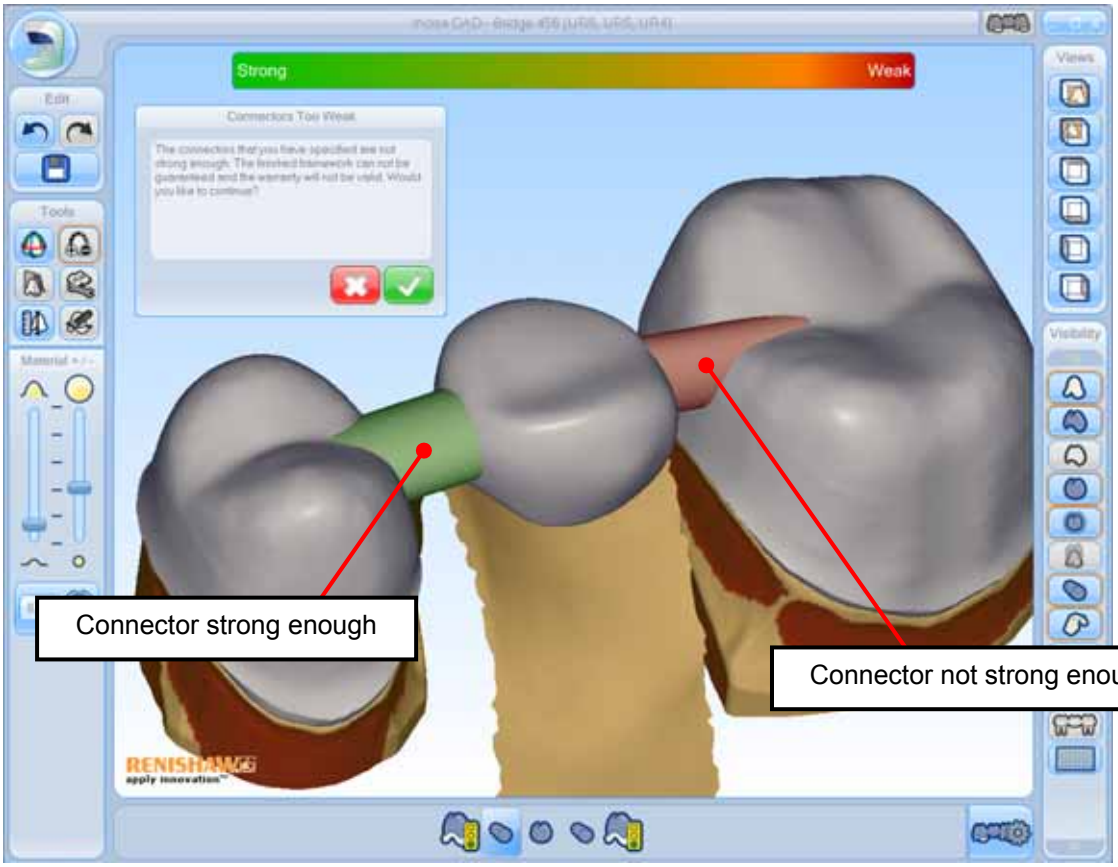
The ridge lap process will only remove material from the pontic, so the pontic form must first be stretched below the ridge using the standard entity manipulation tools. Note that the base of the pontic can be stretched without moving the top of the pontic by holding down the Ctrl key during the stretch process.



Set the ridge lap offset. Note that this can be a positive or negative value. A positive value will offset above the ridge, while a negative value will offset below the ridge, allowing an interference with the ridge. Apply the ridge lap.



The framework generation process will first test the connector strength to ensure the connectors are strong enough.

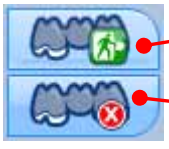


If a connector is shown as being not strong enough, click the  icon. This will return to a pre-generated state to allow modification. The process is then repeated.

Saving a framework

When the CAD design is complete, click the **Generate** icon  to generate the final framework.

On successful completion of the framework generation, the following two options are available:



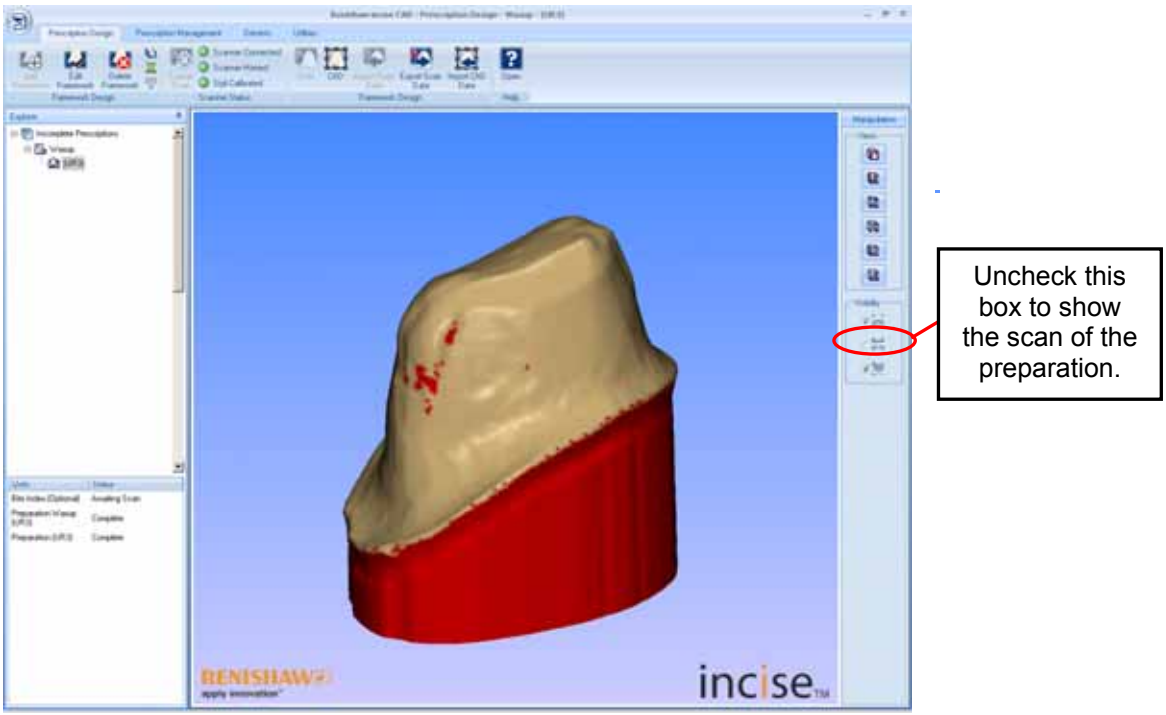
Return to incise™ to continue another design or submit the framework for manufacture.

Delete the framework to allow further design changes.

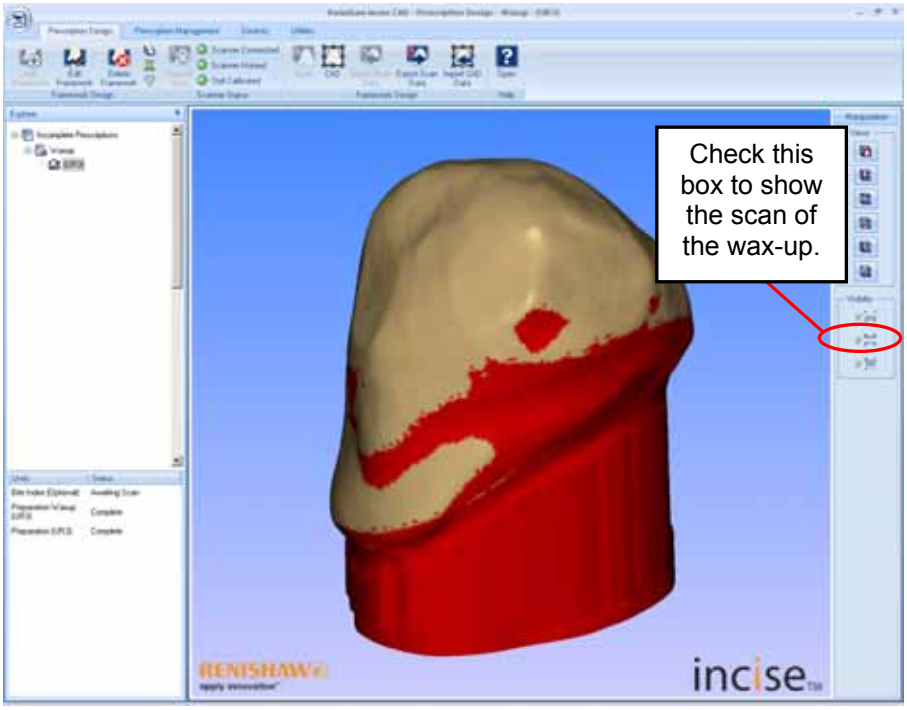
Wax-up coping

If a wax-up option is selected, the system will request the framework element to be scanned twice, once for the preparation, then again using a larger stylus for the wax-up. The order in which the scans are taken is not important – the unit(s) can be waxed up and checked in an articulator prior to any scanning, thus scanning the wax-up first. Alternatively the units can be set to the correct insertion axis, scanned and then waxed up.

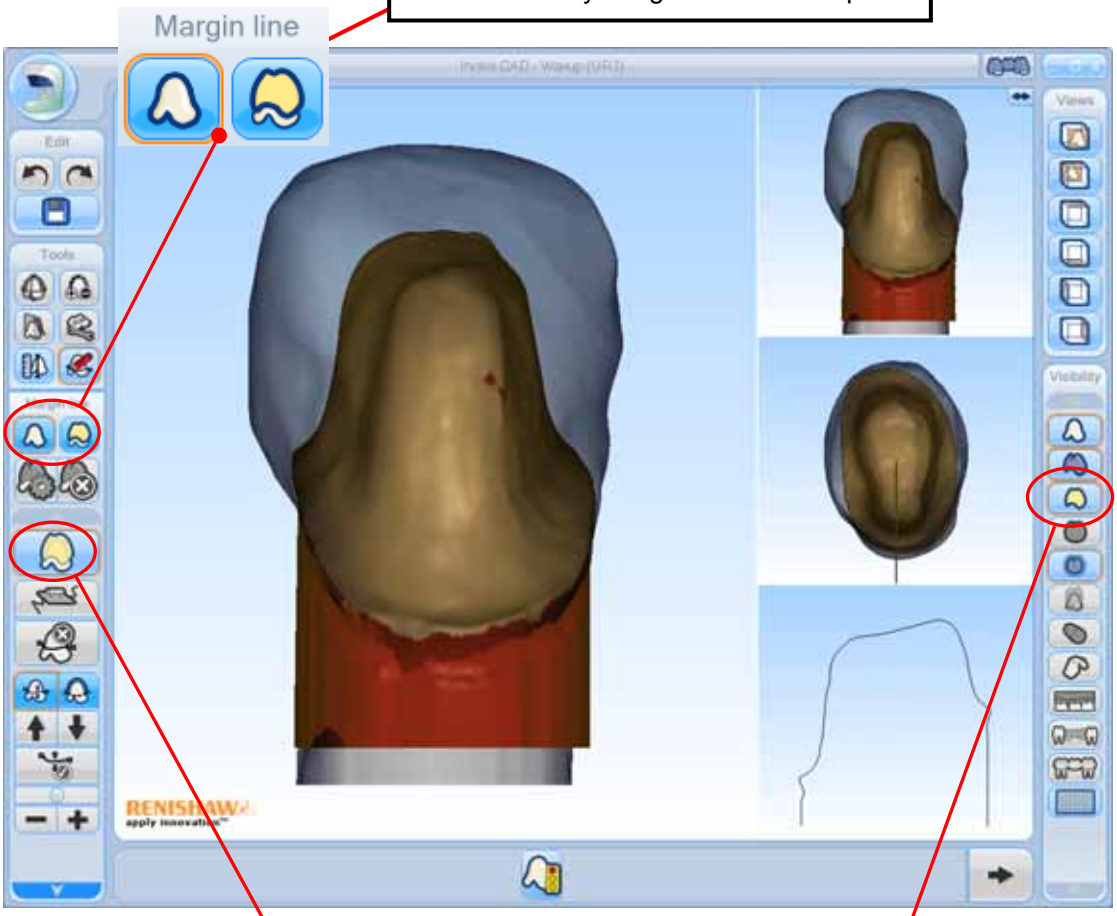
After both scans have been completed, you can toggle between the scans using the check box shown below.

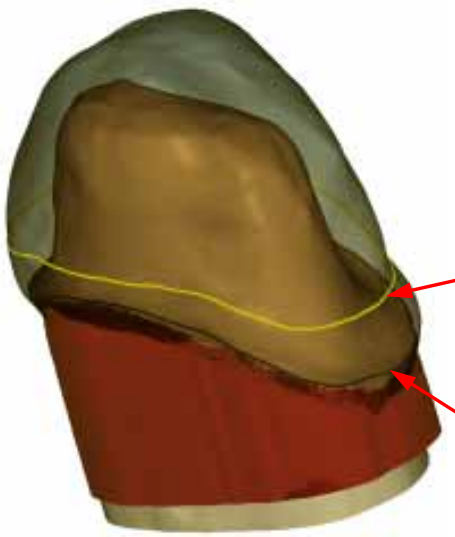


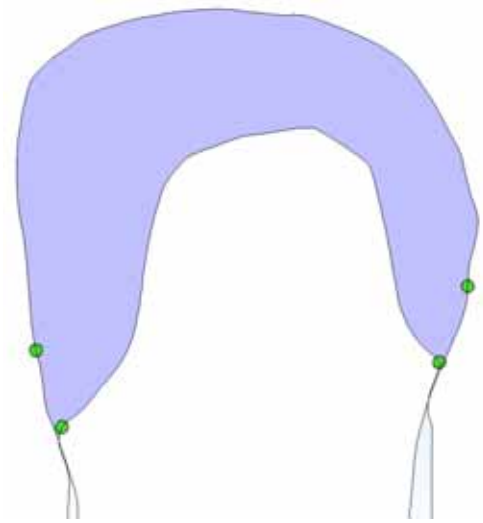
When both scans have been completed, click the CAD icon.



The CAD module will display the preparation as a solid and the waxed scan as translucent.







The section view will show both the margin lines that have been generated.

The resulting coping will generate a ‘ruled surface’ between the two margins.

All the existing tools can then be used on the generated coping.

The Add/remove material tool will allow the removal of material from the wax-up coping, provided it does not violate the standard coping thickness rules.

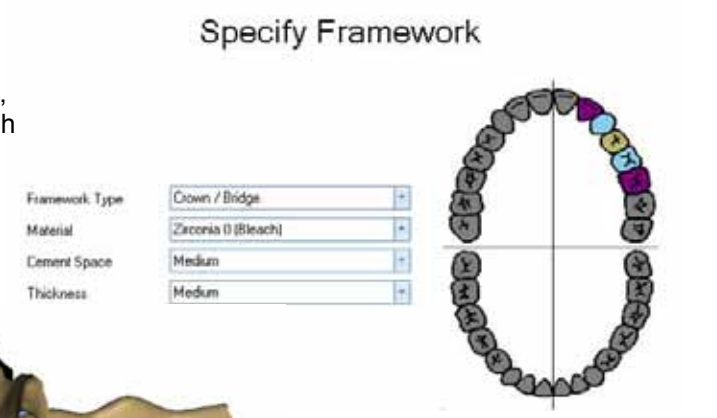
Wax-up pontics

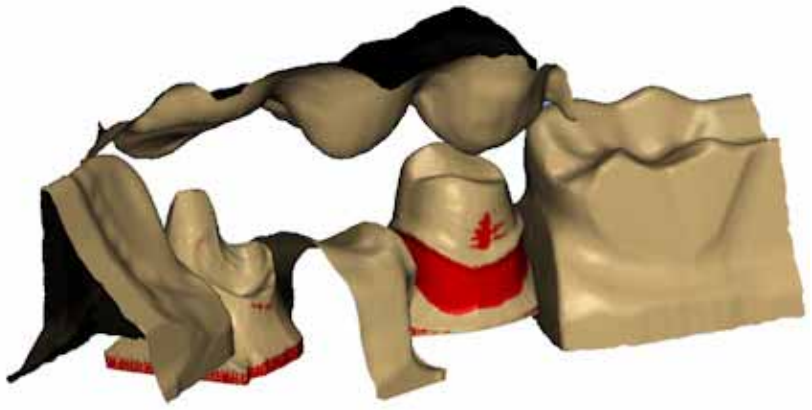
If a wax-up pontic is selected, the process will follow the bridge process with one additional scan. This scan will be of the waxed up pontic. The waxed up pontic needs to be waxed on to the ridge with no connectors present.

The scan will capture the ‘top half’ of the wax-up and the bottom will be generated taking into account the data from the ridge scan.

Anatomical frameworks

If a framework is defined as anatomical, the following process is followed through the design process:

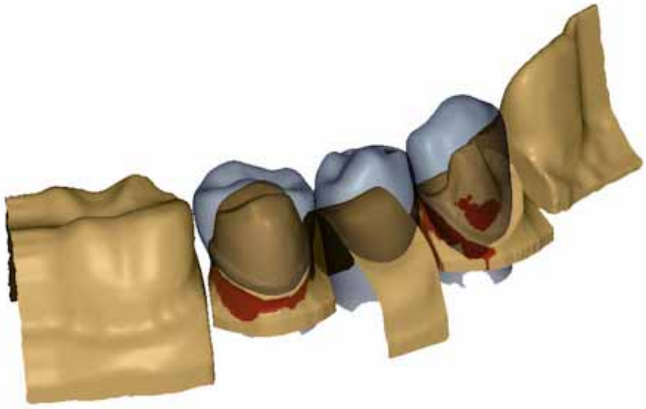




The scanned units are displayed, and reference teeth and a bite index are scanned to enable anatomical placement.

- When the scanning is complete, click the CAD icon 

to display the scanned data.
- Click the  icon to move to the initial margin line definition stage.
- Define the preparation margin line for each anatomical unit. See pages 29 to 33.
- Once the final margin line has been placed and accepted, the anatomical forms are displayed in their default positions.

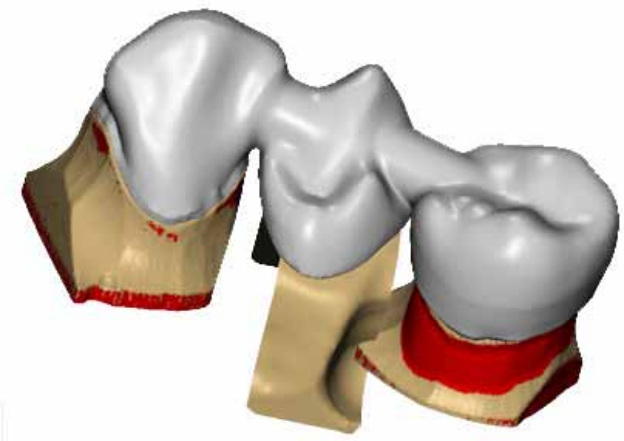


- Use the standard “Entity Manipulation Tool” to resize and position each of the anatomical forms to their correct size and position.
- Use the  icon to move to the secondary margin line definition stage.

- Define the secondary margin line for the first anatomical unit.
- Once the secondary margin line is in the correct position, use the  icon to generate the coping.
- Use the  icon to display the current anatomical view.
- Repeat the previous four stages for each anatomical preparation in the framework.
- Once all the copings have been generated, use the  icon to generate the pontics and show the standard “Segmented model” view.
- Subsequent framework design is then completed in the standard way. Note that the reduction tool can be used to reduce the coping and pontic thickness to allow for the porcelain.

NOTES:

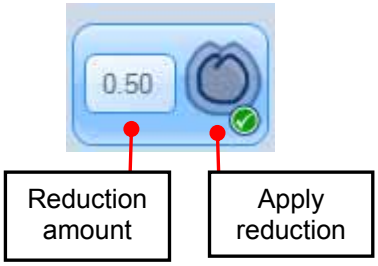
- A single anatomical framework assumes that the tooth preparation was scanned with the front of the tooth to the front of the scanner when setting the default position of the anatomical form.
- The bite index and reference teeth are optional and are used as visual aids only. They are not used for anatomical placement, scaling or morphing (to the bite index).
- Anatomical teeth are not automatically scaled to fit any adjacent anatomical teeth in the framework.
- Anatomical pontics are generated using standard pontic rules. Ridge lap pontics may be generated by stretching the base of the pontic down and using the ridge lap tool.
- Anatomical copings will conform to minimum coping thickness rules.
- It is possible to remove material from an anatomical framework, subject to the minimum coping thickness rules.



Outer surface reduction

A uniform reduction can be applied to the outer surface of copings and pontics, subject to maintaining the minimum coping thickness. This is particularly useful for anatomical and full wax-up units, as the outside form can be designed and then reduced to allow for the porcelain.

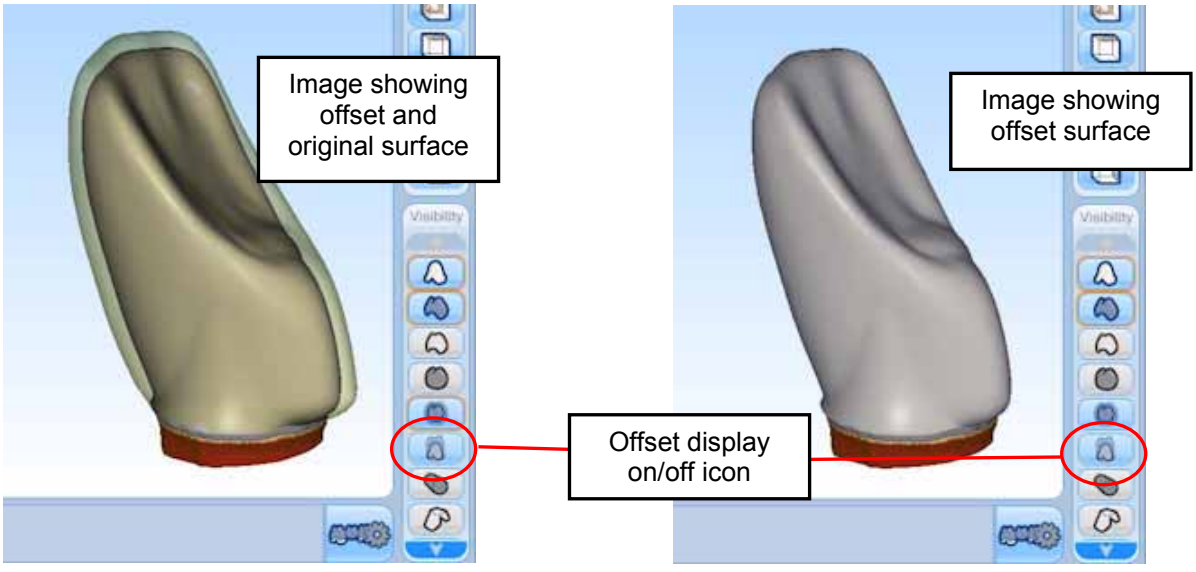
Use the following tool on the **Add/Remove Material** menu:



When the **Apply reduction** icon is selected, the currently selected unit will be reduced by the current value of the reduction amount. The reduction amount can be changed by clicking the displayed value and typing in a new value.

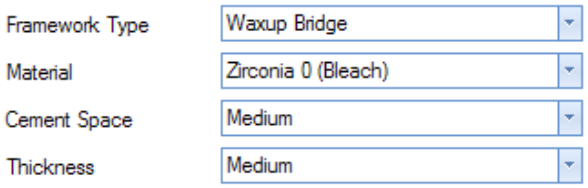
NOTES:

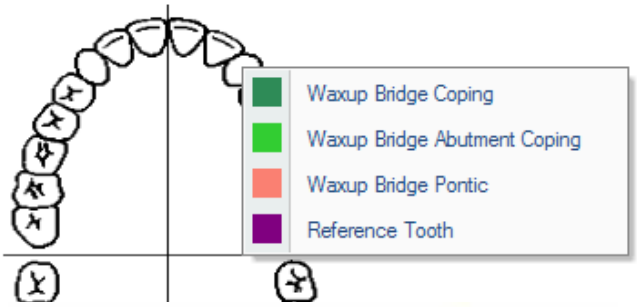
- The reduction amount is absolute from the outside surface, e.g. a reduction of 0.5 mm followed by a reduction of 1.0 mm will reduce by 1.0 mm in total, NOT 1.5 mm.
- The reduction is only applied to the currently selected unit. This allows different reductions for different units, but does mean that you need to reduce each unit of a bridge separately if required.
- Reduction cannot be applied to connectors.
- The  icon can be used to toggle the display of the original surface after reduction.
- Reduction is not allowed on the final framework.



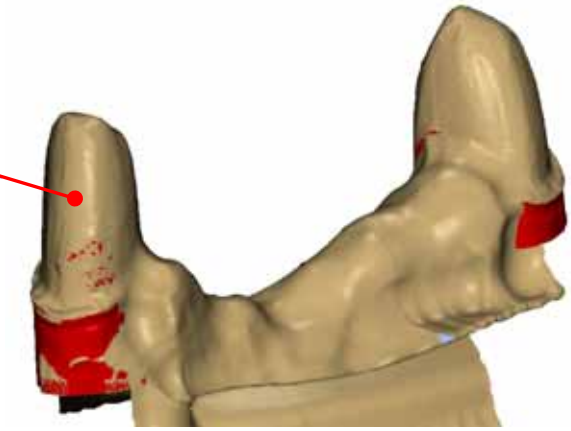
Full wax-up frameworks

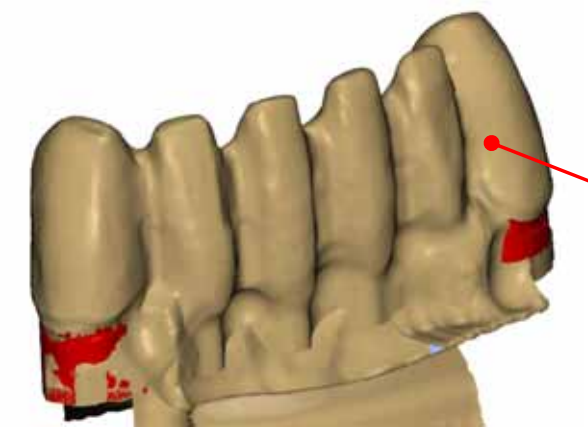
Select “Waxup Bridge” for the **Framework Type**, then define the bridge units as normal.





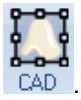
Scan the base units as normal.



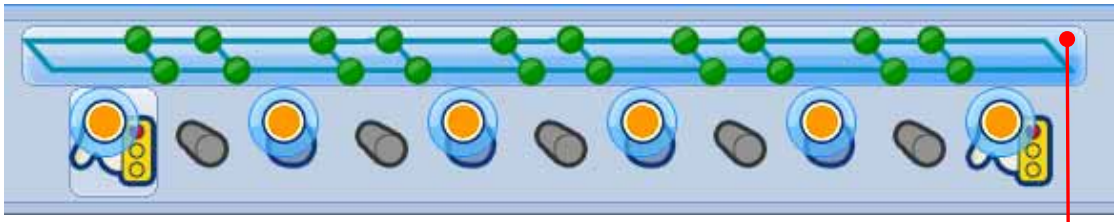


Scan the complete wax-up. This can be done with both the 3 mm and the 1 mm stylus.

The full wax-up scan must cover all the framework units.

Select the CAD icon 

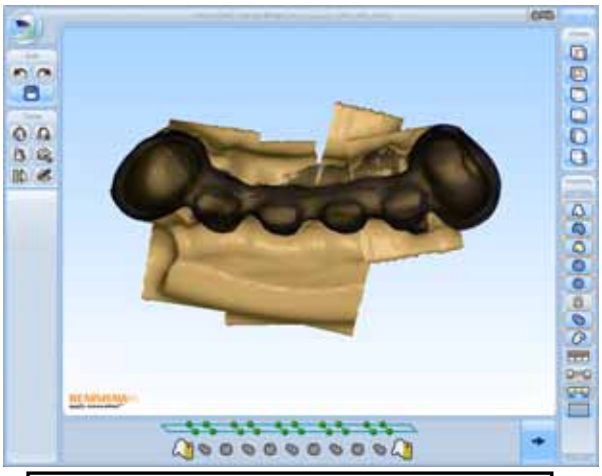
. The wax framework must then be split into individual units.



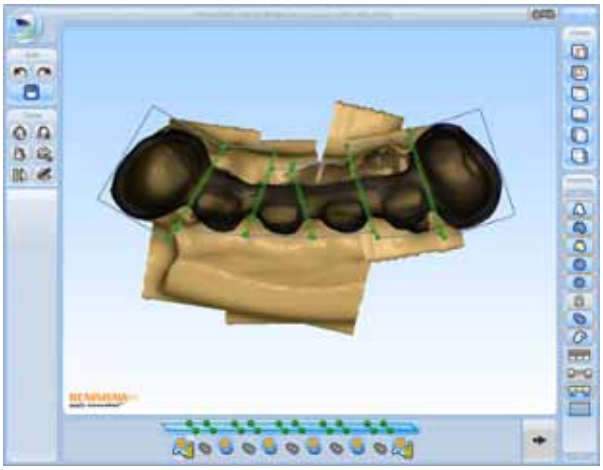
Click the Framework Segmentation icon to turn the segmentation view on or off.

The wax framework needs to be segmented into its constituent units using the bars and balls:

- Ctrl + left mouse click on a bar to move it along the framework.
- Ctrl + left mouse click on a ball to move one end of the bar along the framework.



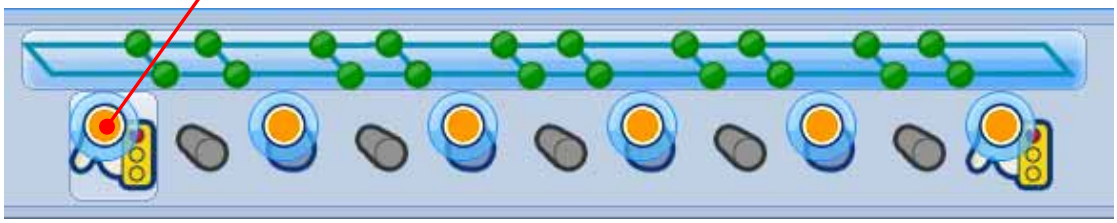
Framework segmentation Off



Framework segmentation On

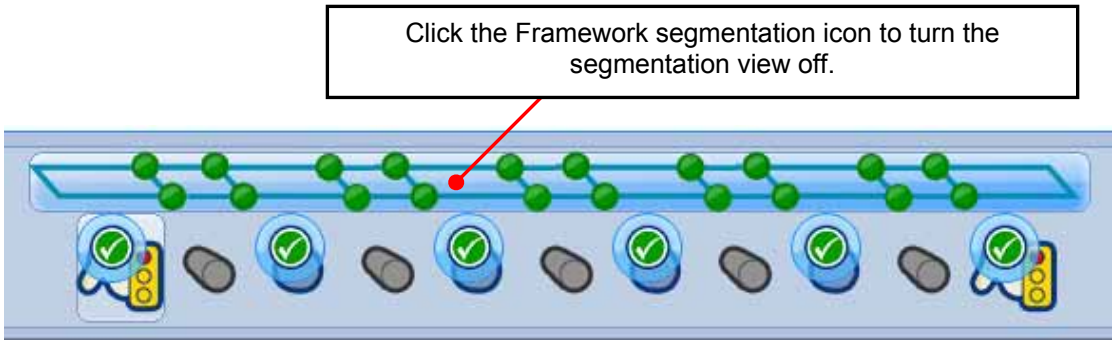
When the segmentation for a unit is correct, lock it in position by clicking on the “Lock” icon for that unit.

If you need to reposition the segmentation, click the “Lock” icon again for that unit to unlock.



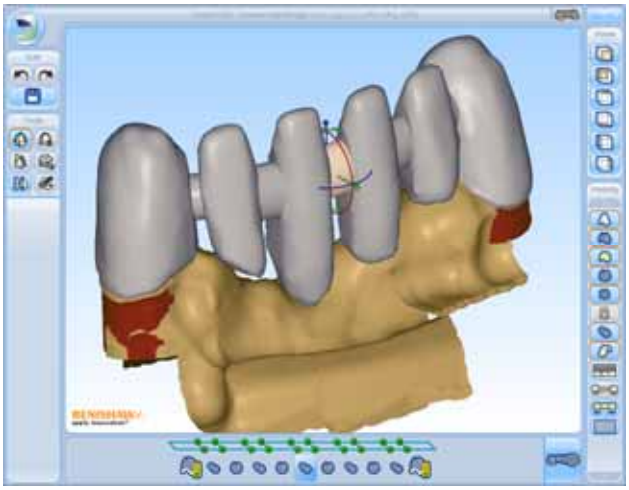
Repeat this process on all elements to be segmented and ensure that all elements have a tick.

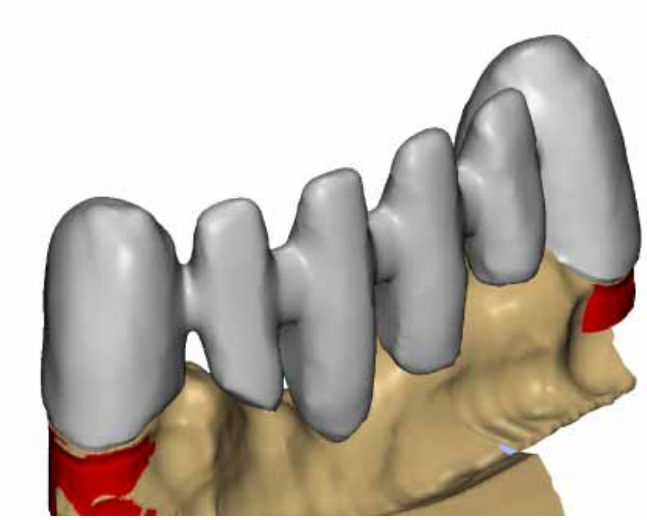
Once all units are locked, exit the segmentation view by clicking the Framework segmentation icon again.



The framework design can now continue as normal as if each unit had its own “wax-up” data associated with it.

Then use the Entity manipulator in the same way on the connectors to re-size and re-orientate.

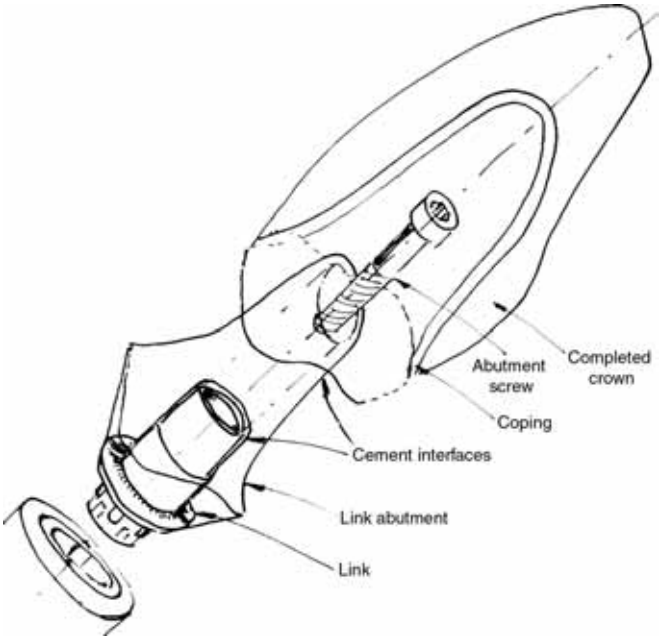




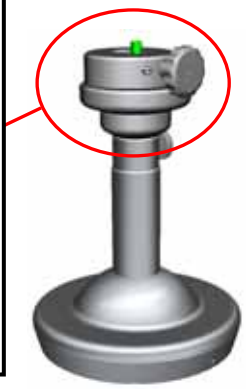
When the bridge is finished and the pontic and connectors modified, click the **Generate** button.

Implant link abutments

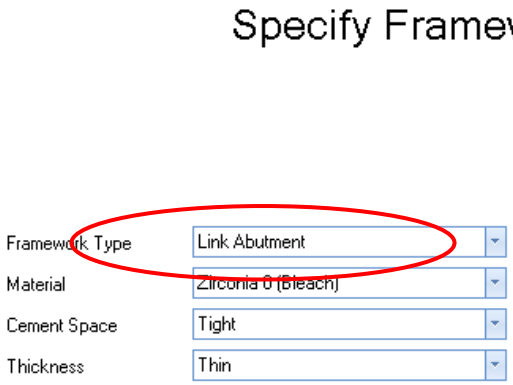
Framework type “Link abutment”: Further information on this framework type is available on data sheet H-5489-8301.

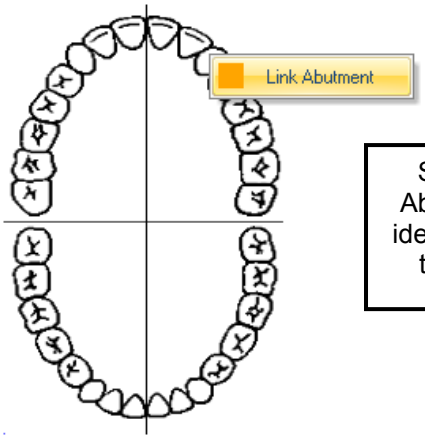


An additional clamping device is supplied which is mounted in the calibration pillar. This is used to hold the implant replica in a vertical position. The link should be mounted on to the replica with an appropriate screw, and the screw hole waxed over. The whole assembly is then placed in the incise™ scanner for scanning.



The link abutment must be designed in wax. The wax is then fitted on to the link and scanned in the same orientation.





Select ‘Link Abutment’ and identify it on the tooth chart.

The link abutment process

- Scan the link (using the Ø1.0 mm stylus).

  NOTE: the hole in the top of the link needs to be filled with wax.

- Scan the link abutment (using the Ø3.0 mm stylus).

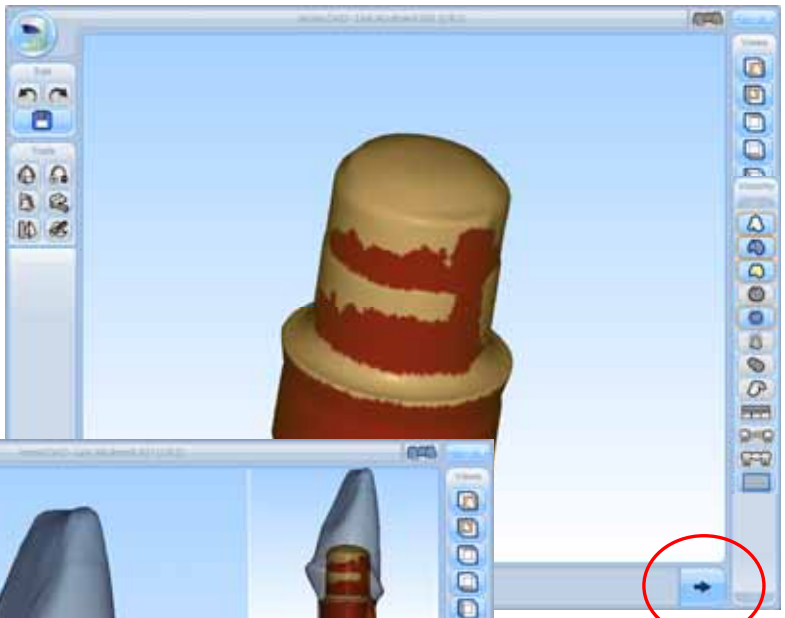
Scan the link and then the wax the link abutment.

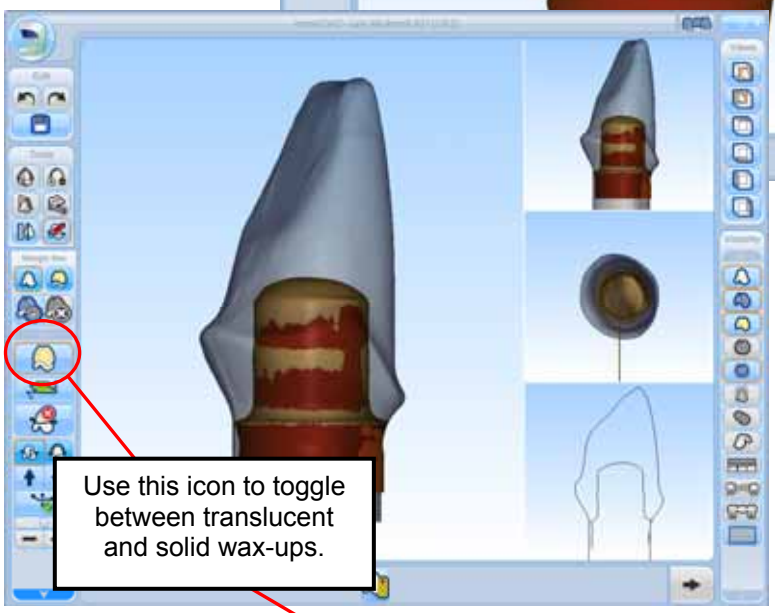
Then select CAD.

Link abutment

When the scanning of the link and link abutment is complete, select the CAD module.

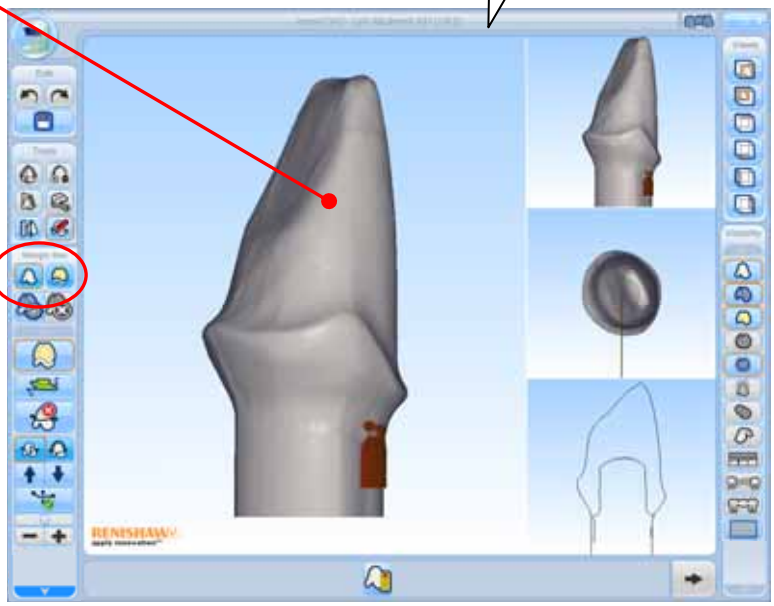
The margin line generation screen will then appear with the link shown and the link abutment displayed as a translucent image.





Select the **Next** icon to start margin line generation.

Use this icon to toggle between translucent and solid wax-ups.



Primary Secondary

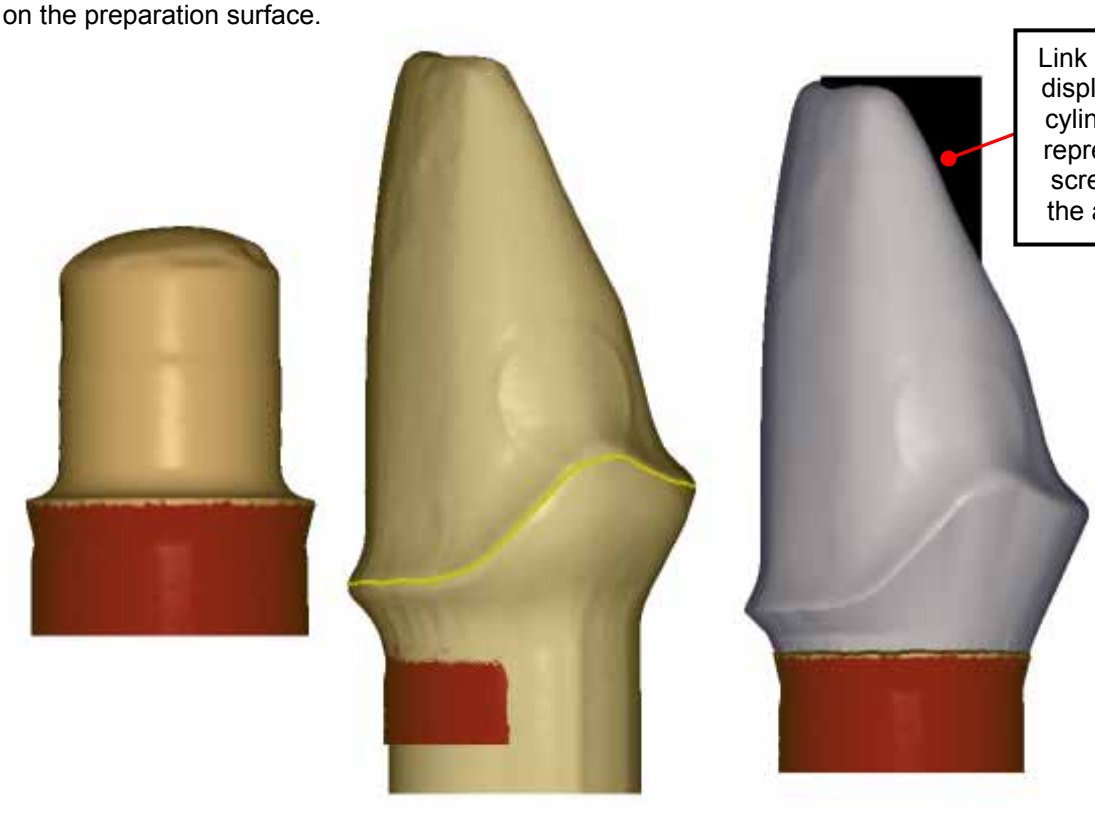
Two margin lines are required:

Primary margin line for the link

Secondary margin line for the link abutment

The selected unit will require two “margin” lines to be defined. The first one is defined on the preparation or link surface, and the second one is defined on the wax-up surface.

NOTE: The line that is defined on the wax-up surface is strictly speaking not a margin line, but it defines the position from which the wax-up surface will reduce down to the margin line on the preparation surface.



Preparation **Wax-up** **Generated coping**

Additional tools to define the two margin lines

Select the preparation surface margin line. Subsequent margin line operations will define the line on the preparation surface.

Select the wax-up surface "margin" line. Subsequent margin line operations will define the line on the wax-up surface. If the wax-up margin is selected below the preparation surface margin, then the wax-up margin will snap to the margin line above.

Toggle between solid and translucent display of the wax-up surface.

Translucent

Solid

Note that the preparation and wax-up surfaces can still be hidden using the normal icons on the **Visibility** toolbar:

Show / Hide the preparation surface

Show / Hide the wax-up surface

Saving a framework

When the CAD design is complete, select the **Generate** icon  to generate the final framework.

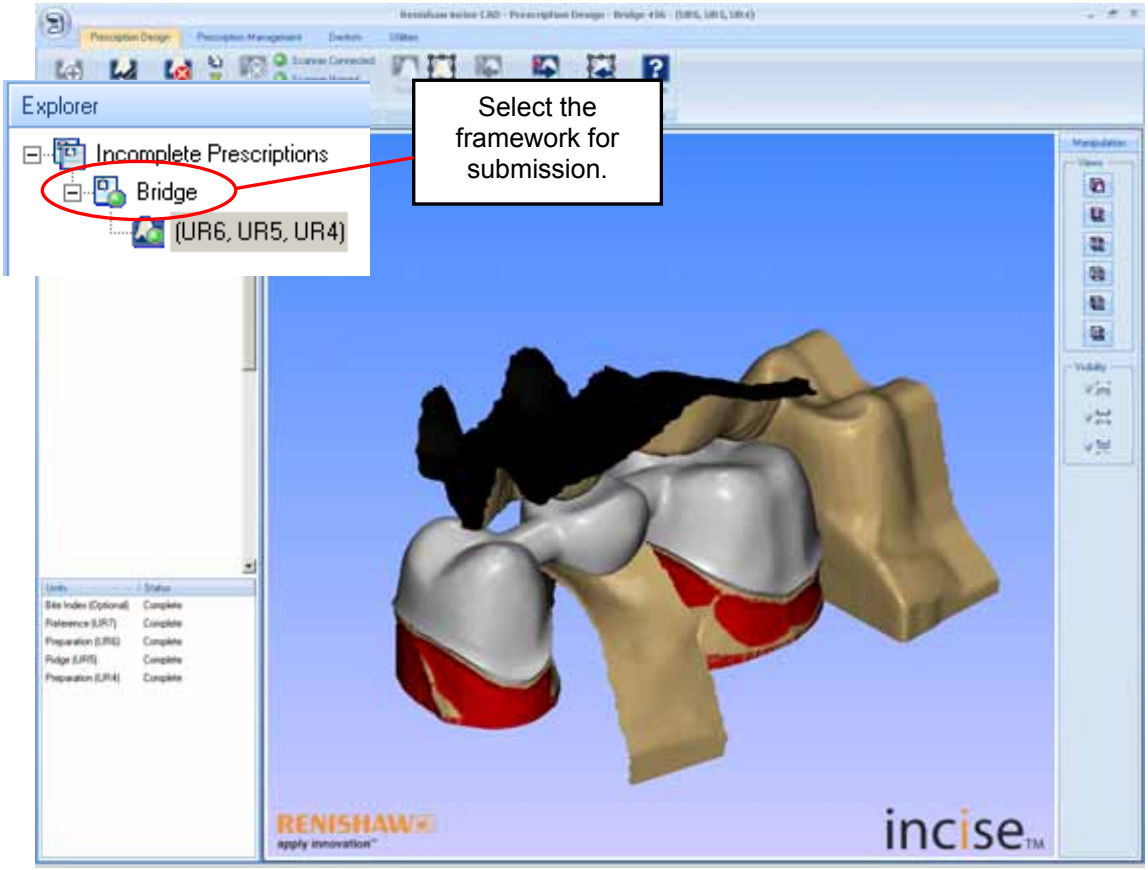
On successful completion of framework generation, the following two options are available:

Return to incise™ to continue another design or submit the framework for manufacture.

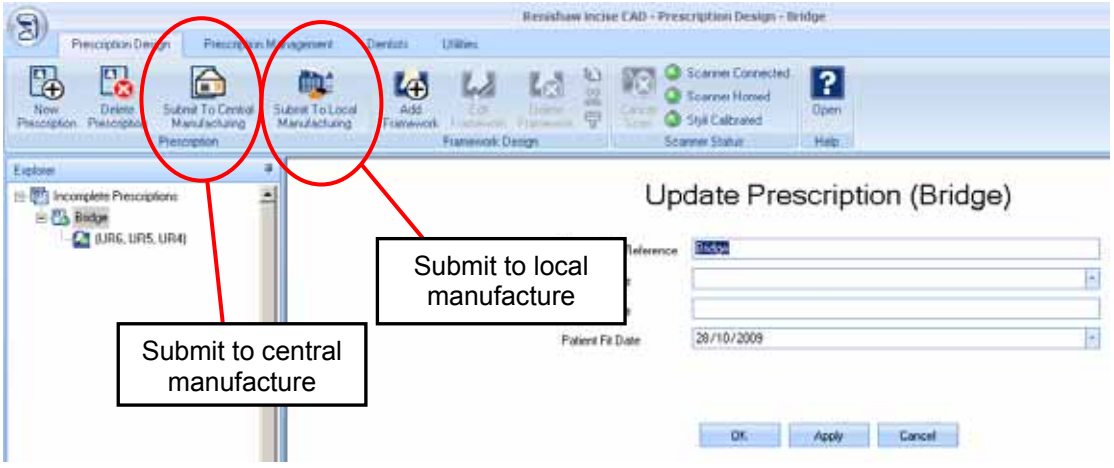
Delete the framework to allow further design changes.

Job submission

After a framework has been saved in the CAD module and returned to incise™, it will be displayed and ready for submission.



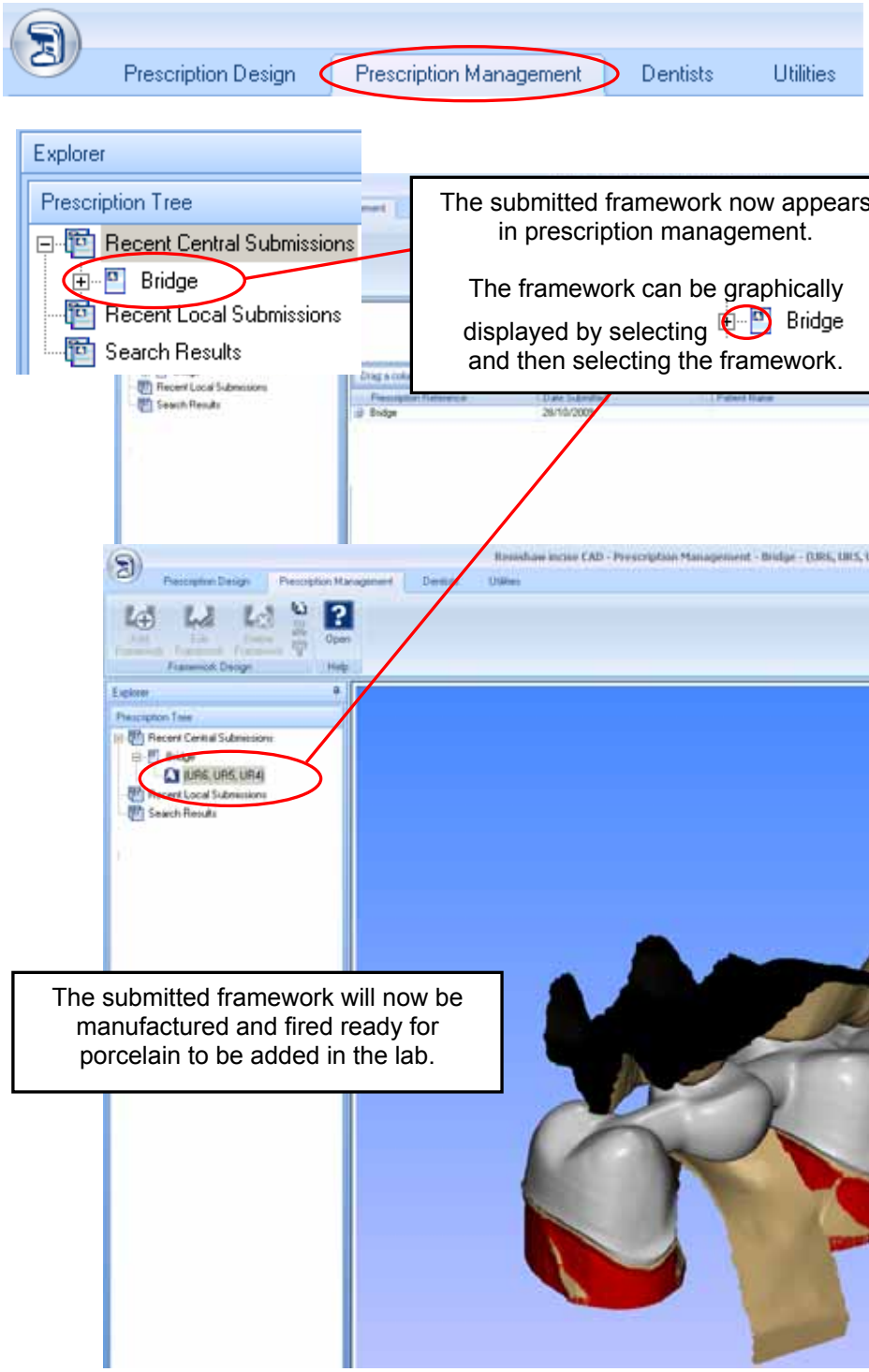
Once the framework has been selected, the display will change to show the prescription detail and enable the submission icons.



Select one of the submission icons to move the prescription from the **Prescription Design** tab to the **Prescription Management** tab.

Prescription management

Select the **Prescription Management** tab. The submitted jobs will be present.



Implant bridges

It is possible to design implant bridges for manufacture in zirconia, titanium or cobalt chrome.

The process requires the following two items:

A plaster master of the implant positions.

A replica of the implant bridge to be produced.

The accurate implant positions are measured on the plaster master and the basic implant bridge form is generated from a scan of the replica implant bridge. These two sets of data are then combined to insert accurate implant interfaces into the implant bridge form prior to machining.

The following Implant systems are supported

Avinent HE	3.5, 4.1, 5.1
Avinent Transepithelial	
Nobel Replace	NP, RP, WP, 6.0
Nobdel Brånemark	NP, RP, WP
Nobel MUA	
Straumann Standard	RN
Straumann Bone Level	NC, RC
Biomet 3I External Hex	4.1, 5.1
Astra Tech Small	3.0, 3.9
Neoss	4.1

Scanning an implant bridge

- Create a new prescription.
- Add a new framework of type “Implant Bridge”.
- Set the unit type for each unit of the framework. Units supported by an implant should have the implant system and size selected from the drop-down lists. Other units should be set to “Implant Bridge Pontic”.

The implant bridge framework is now ready to be scanned. Three types of scan need to be performed. These can be performed in any order.

Implant bridge framework

The framework needs to be mounted on pins and then mounted on to the implant bridge framework holder. This should then be loaded on to the scanner with the gum side of the bridge facing upwards.

Four positions around the bridge then need to be indicated:

1. The position of the first mounting pin. This can be either pin.
2. The position of the second mounting pin. Note that for a partial implant bridge which is only mounted on one pin, this should be a repeat of the first position.
3. The position of the start of the scan.
4. The position of the end of the scan. Note that for a partial implant bridge which is only mounted on one pin, this should be a repeat of the previous position.

The gum side of the bridge will then be scanned.

At the end of the scan, you will be prompted to turn the bridge over and the other side will be scanned.

The complete bridge will then be displayed.

Implant framework positions

The two outside mounting positions need to be measured on the implant framework replica so that the framework can be aligned to the master implant positions.

- Mount the framework pin designed for the implant type / platform size on the model and secure it using the bolt supplied. Both pins may be mounted together if there is sufficient space for the stylus ball between them.
- When requested, indicate the position of the pin by resting the stylus at the centre of the top of the pin. The screw access hole (if present) can be used as a guide to the centre position. The pin will then be measured to give its position and orientation. Note that the units are identified from the top “tooth” side, so when indicating the positions from the gum side, the on-screen indication will be mirrored.

Master implant positions

Each of the master implant positions needs to be measured.

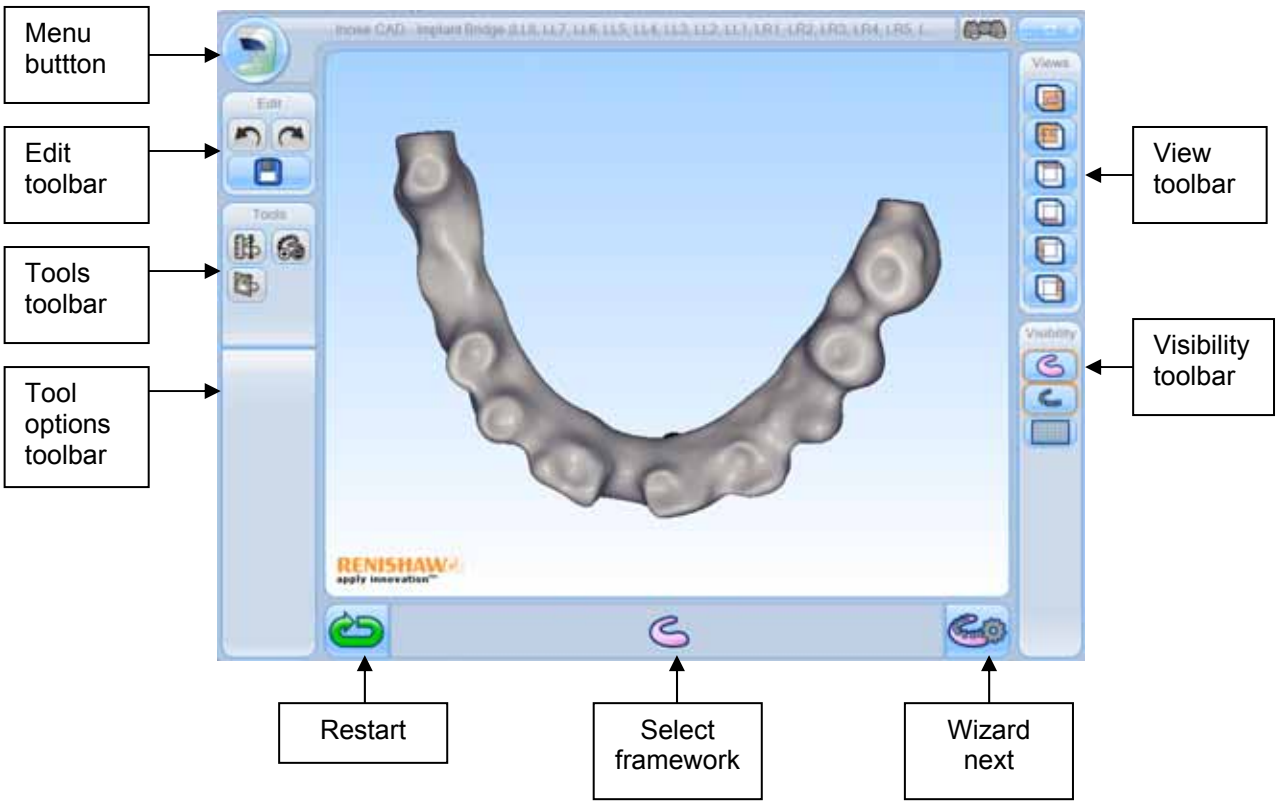
- Mount the master implant pin designed for the implant type / platform size on the model and secure it using the bolt supplied. Several or all of the pins may be mounted together if you have sufficient pins and there is sufficient space for the stylus ball between them. Otherwise, individual pins may be mounted and scanned.

- When requested, indicate the position of the pin by resting the stylus at the centre of the top of the pin. The screw access hole (if present) can be used as a guide to the centre position.

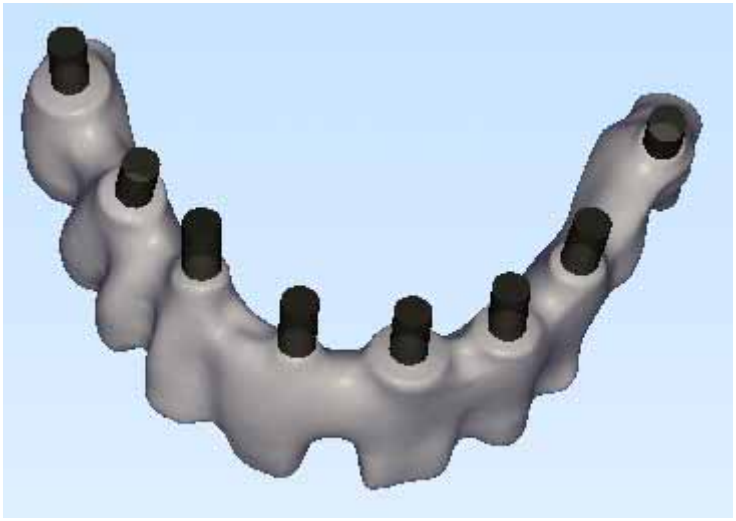
When all the scans and measurements have been completed, the replica bridge will be automatically aligned to the master implant positions prior to passing the data through to the design system.

The implant bridge design process

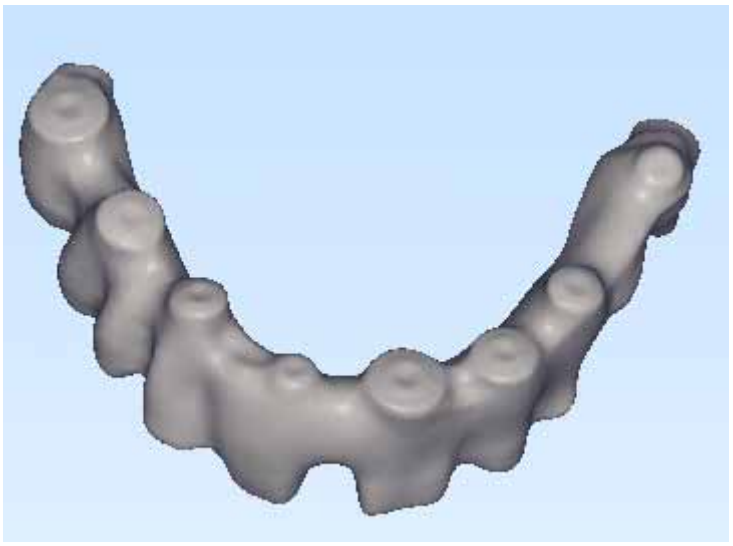
The design process for implant bridges is completely different from the process for other frameworks, so it has its own screen layout.



On entry to the design process, the implant bridge is displayed with the implant positions indicated by cylinders.



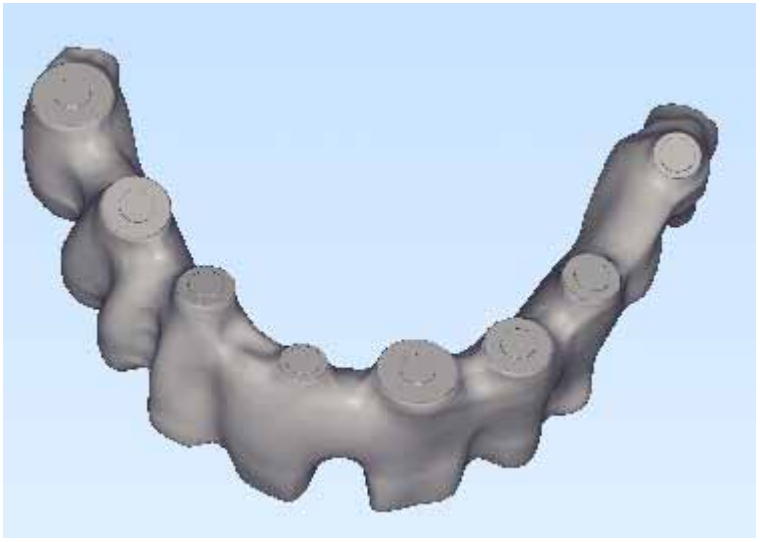
The implant position cylinders may be displayed or hidden using the  button.



If you want to modify the implant bridge framework, select it then use the Add/remove material process as required  .

Generate the final bridge using the **Generate** button  **.**

This will insert the accurate implant interface details into the model, based on the implant type and size.



Save and exit the design process using the  button.

Using other CAD systems

Scanned surfaces can now be exported to external CAD systems using the following icon:

This will generate an STL file for each scanned element as follows:

- exported_Preparation_<unit identifier>
- exported_Ridge_<unit identifier>
- exported_Pontic_<unit identifier>
- exported_Abutment_<unit identifier>
- exported_AbutmentWaxup_<unit identifier>
- exported_BiteIndex_
- exported_LinkAbutment_<unit identifier>
- exported_Link_<unit identifier>
- exported_PreparationWaxup_<unit identifier>
- exported_Reference_<unit identifier>
- exported_WaxPontic_<unit identifier>

The folder containing the files will be opened and the data can be used in another CAD system.

Once the framework is designed, it can be imported back into the incise™ system using the following icon:

NOTES:

- The framework that is returned from the external CAD system will not be checked for compatibility with machining – tool accessibility (ballooning) or thickness at margin line.
- No guarantee will be provided for any frameworks which are designed using an external CAD system.

Using other scanning systems

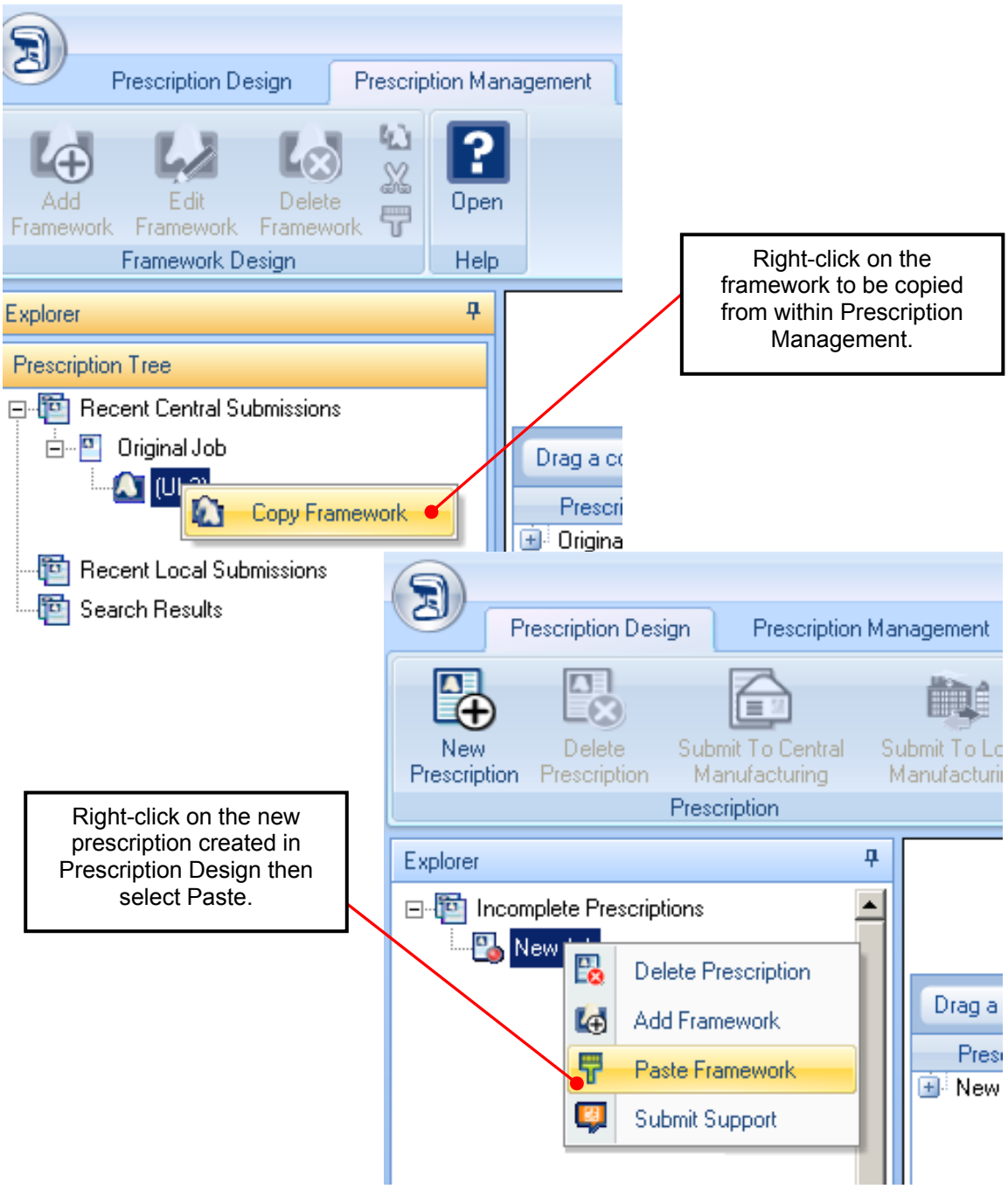
Data from an external scanner can be imported into the incise™ system using the following icon:

Once a framework has been defined, this can be used instead of the Scan command to acquire the scan data.

Copying a framework / Re-makes

After a framework has been submitted, it no longer resides under the **Prescription Design** tab as it has been moved to the **Prescription Management** section. If the framework needs to be re-manufactured, the data needs to be copied back into a new prescription.

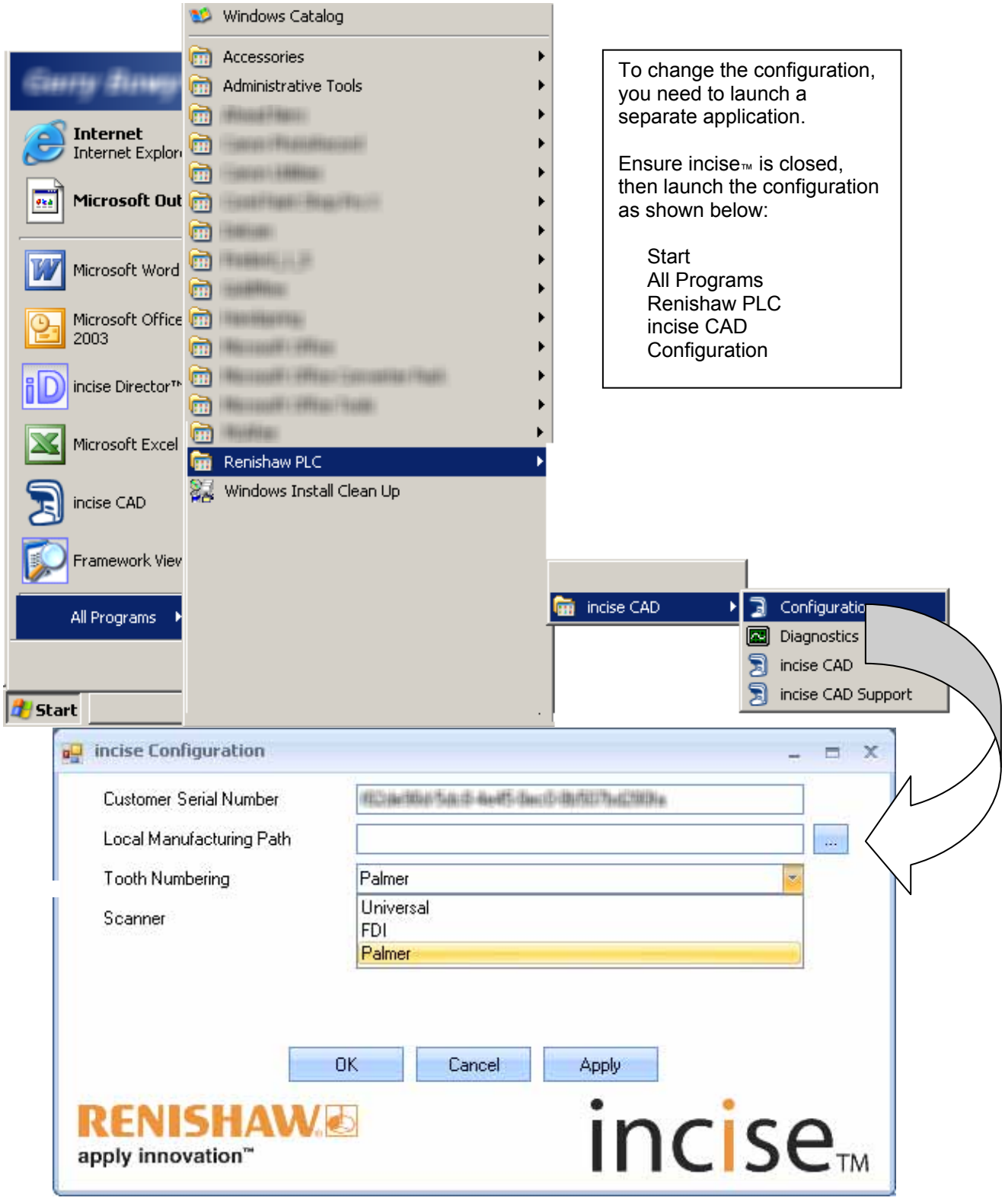
The procedure is as follows.



This will generate a copy which can then be submitted as a normal framework.

CAD configuration

Tooth classification changed with an optional configuration



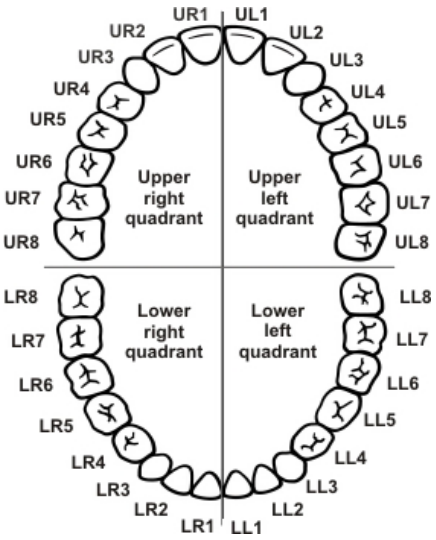
To change the configuration, you need to launch a separate application.

Ensure incise™ is closed, then launch the configuration as shown below:

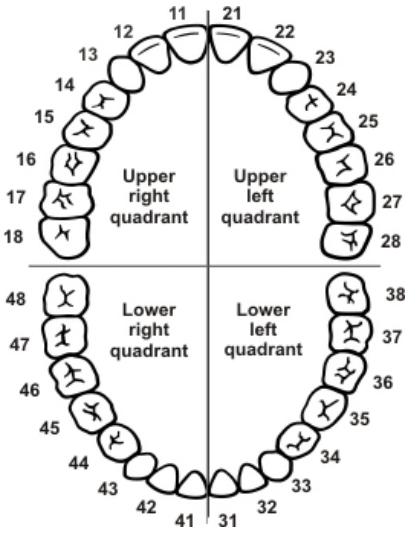
Start
All Programs
Renishaw PLC
incise CAD
Configuration

The tooth-numbering systems supported are shown below. The default is Palmer notation.

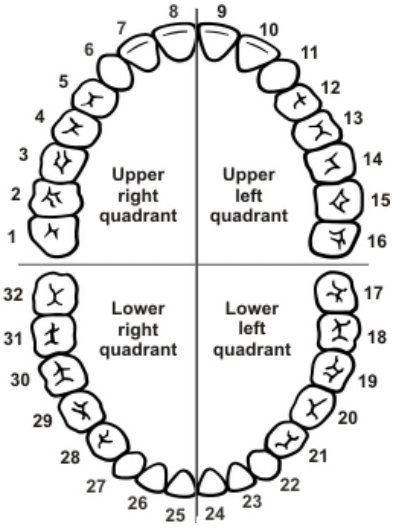
Palmer notation



FDI World Dental Association notation



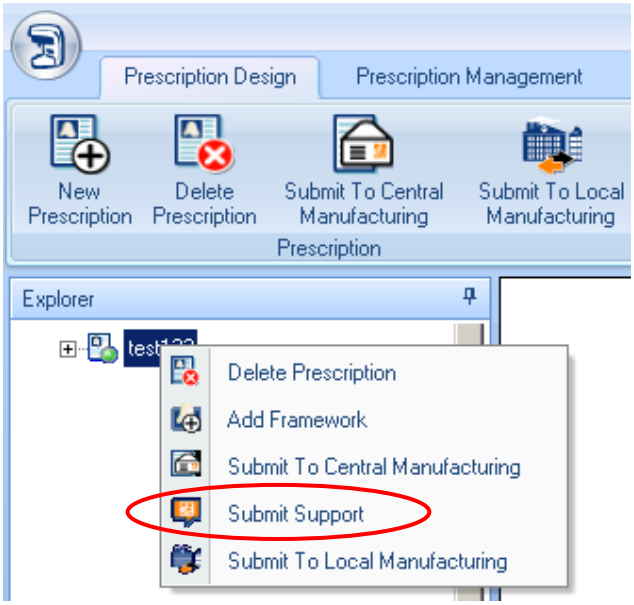
Universal numbering system



Submitting a support job

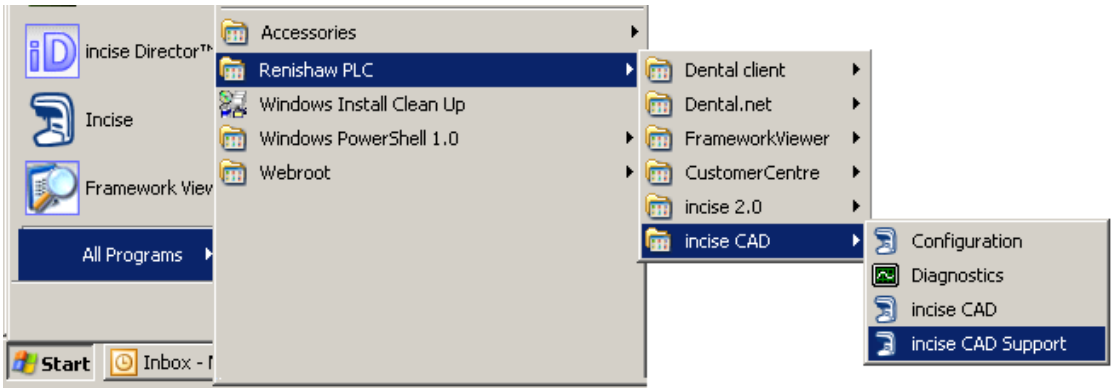
You may be requested to submit a support job in order for the framework to be investigated at Renishaw. Jobs submitted using this option will NOT be manufactured and should only be used when requested by Renishaw.

If the job had already been submitted, you will need to copy it from Prescription Management to Prescription Design. Do this as described on page 72.



Support mode

The incise™ application can be executed in support mode; this may be required when customer support is requested and should only be undertaken when requested by Renishaw.

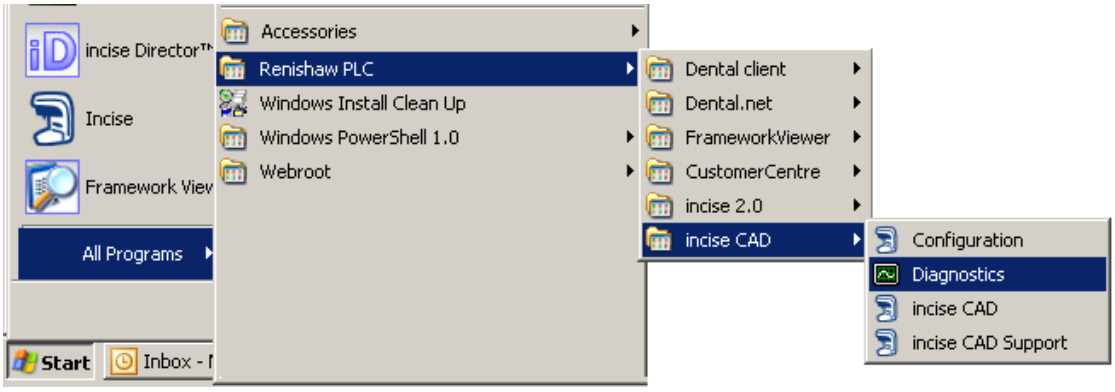


When in support mode, you will be instructed by Renishaw on what operations to undertake.

Scanning machine diagnostics

There is a diagnostic facility which, when executed, will check the scanning machine and send the data back to Renishaw for analysis.

To run this program, you must exit from incise™ and then execute the diagnostics as shown.



When the diagnostics program is executed, you will be given instructions on the actions required.

Appendix

Instructions for obtaining the maximum performance and reliability from incise™ frameworks and the incise™ manufacturing system.

Overview

The flexible nature of the incise™ scanning and CAD software means that it is possible to design a framework which is either clinically unsuitable, or impossible to manufacture – or both. Most technicians are well versed in what works and what doesn't when it comes to framework design, and the strength of zirconia means that most of this knowledge carries over from their metal experience. There are some key points about using the system which need to be explicitly explained. These are outlined here.

Ballooning

What is it?

Ballooning, or machining allowance, or tool clearance, is a way of ensuring that the framework will fit, even if it has designed-in features which are impossible to access with a milling tool. It is an automatic enlarging of the framework around sharp features on a preparation, causing a localised thickening of the cement space around the feature. Importantly, the actual wall thickness of the coping will not be automatically increased or reduced.

Why do we have it?

A dentist does not consider the accessibility of a milling tool into a framework when he is creating the male form of the preparation. There could be sharp external radii on the preparation which the lab will have to fit a coping to. Traditional CAD systems would require these to be waxed over, or absorbed into a generally excessive cement layer.

To create a female form to fit over the preparation, regardless of the sharpness of any external radii, would require the milling tool to be an infinitesimally small spherical point. In practise we use a 1.1 mm diameter ball-end tool (equating to 0.88 mm diameter in the sintered state). Ballooning creates the necessary space around sharp features to give this size of tool sufficient access. This means that any framework that can be designed for a scanned preparation will fit with no modifications. Without ballooning, there is no guarantee that any framework would fit without careful grinding on the internal surfaces, possibly compromising the strength and fit accuracy, and taking up valuable time.

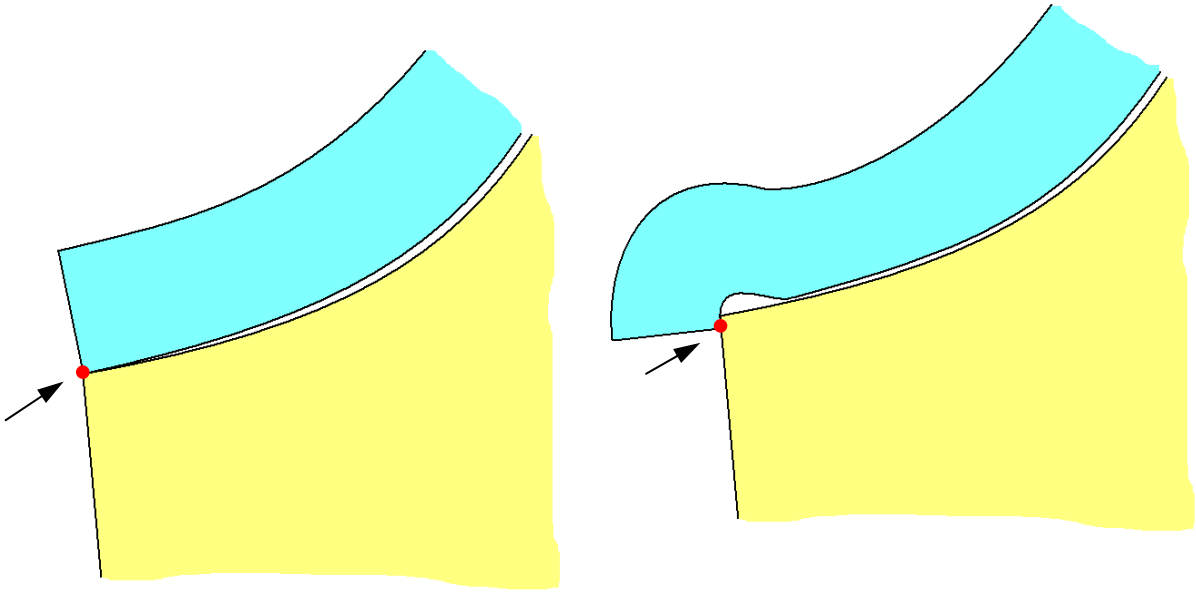
There are CAD systems on the market now which do not have ballooning. With incise™ CAD, the technician does nothing to the preparation to modify it before scanning, and everything is done digitally downstream.

What are the down sides?

Ballooning over sharp features on the occlusal surfaces of the preparation will cause the coping to take up extra vertical space, which can limit the amount of room left for porcelain. In practice, the ballooning radius is small and this effect is not very pronounced. Much more of a problem is when there are sharp features on the margin land area. If the ballooning runs to the margin line itself, then there will be a gap locally at the margin, compromising the seal. Because the margin land is often unsupported and is the thinnest part of a coping, ballooning here can cause the framework to chip during machining. This is caused by the rapid change in tool engagement that occurs, as the ballooned area is by definition the same size as the tool.

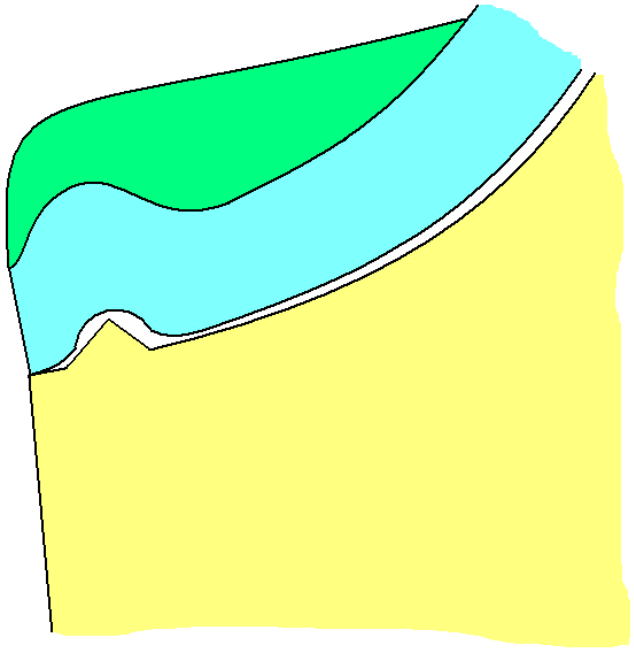
Minimising margin ballooning

Sometimes there are features on the preparation which require ballooning and cannot be avoided. This is why ballooning is performed. However, the amount of ballooning in many cases is a function of the coping design and margin placement, over which the technician has control.



Two slightly different margin placements (shown by arrows) giving very different coping results

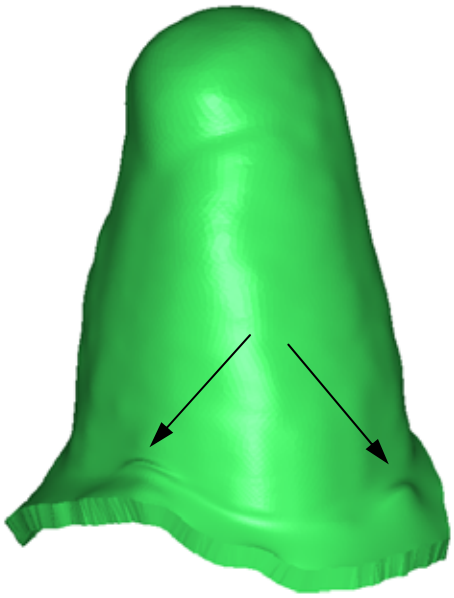
The example above shows the importance of not ‘wrapping’ the margin line over the edge of the preparation. This creates a tight corner into which the tool cannot reach, creating a large amount of ballooning right on the edge of the coping. Frequently a lab may want to cut back a margin and so deliberately over-extend in the design. This is a mistake, because any cut-back will expose a large gap created by the ballooning. All cut-backs should be designed-in at the margin placement stage in CAD.



A case of ballooning that could not be avoided by alternative margin placement. In this case, the edge has been reinforced by placing additional material over the ballooned area in CAD. If required, this can be easily dressed off once the coping has been machined.

Increasing the thickness locally around areas near the margin that have ballooned is a very good way of ensuring the edge does not chip. In a case such as that shown above, doubling or tripling the local coping thickness works well.

Two areas of ballooning near the margin seen from the inside and outside of the coping. This coping has not had added material placed, so shows clearly what ballooning looks like and how to identify it.



Shoulder design

Although there are preparation guidelines for the incise™ system, most dentists do not follow them and so the system has to cope with a very wide range of possible geometries.

Very deep

Very deep shoulders can sometimes be damaged during machining. These should be reinforced by adding material in CAD (also possible in wax if it is a wax-up framework). This can be dressed back after machining, or left on to increase the strength of the restoration in clinical service, depending on the aesthetic requirements of the case.

Very shallow

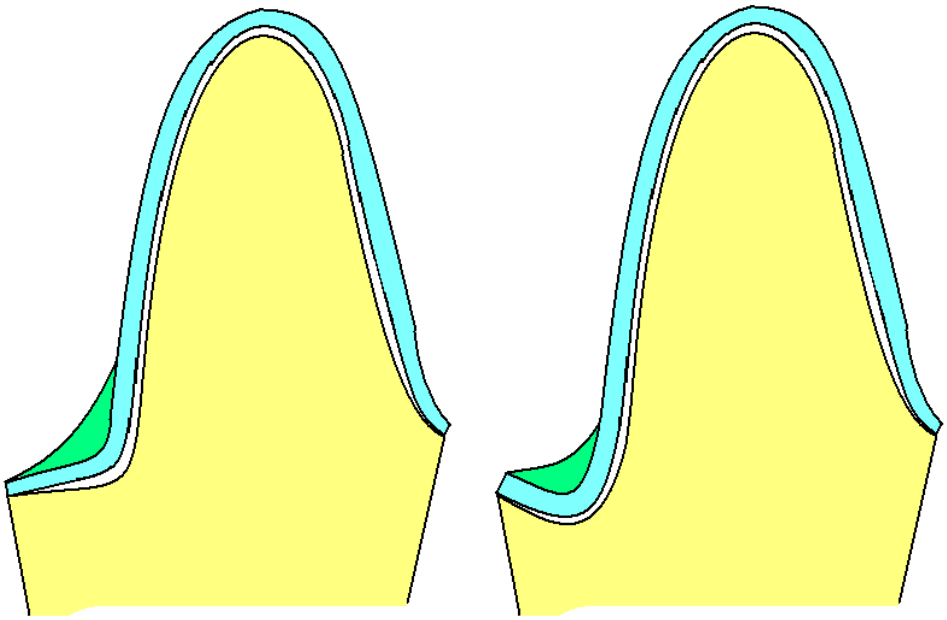
Shallow shoulders often occur because the dentist has not prepared enough material off the tooth surface. This type of preparation is also often very steep-sided. In these cases it is recommended to avoid the tight cement option and use medium or loose. This is because the margin contact area can encroach up on to the side of the preparation when there is such little reduction, causing an overly tight fit or failure to seat. The same is true for any preparation with steep or parallel side walls, regardless of the depth of the shoulder.

The radial contact distance over which the cement space is zero (the margin land length) can cause problems when there is very little preparation reduction. If the reduction is less than this distance, and the preparation is vertical-sided or undercut, then the full extent of the vertical or undercut section will have a zero cement space. This can cause very tight fitting or failure to seat. The abutment coping option has a margin land length of 0.1 mm to avoid this scenario, as abutments are often very steep-sided. In theory this can be used for standard copings if they are for preparations with very little reduction. However, only the loose cement option should be selected. The natural roughness and undulations on the surface of a preparation are generally incompatible with the very thin cement spaces used for the abutment coping option.

Note that bridges do not use the abutment coping parameters, regardless of what was selected on the job specification screen. Any bridge with excessively parallel or undercut faces on the preparation may be tight.

Guttered shoulder

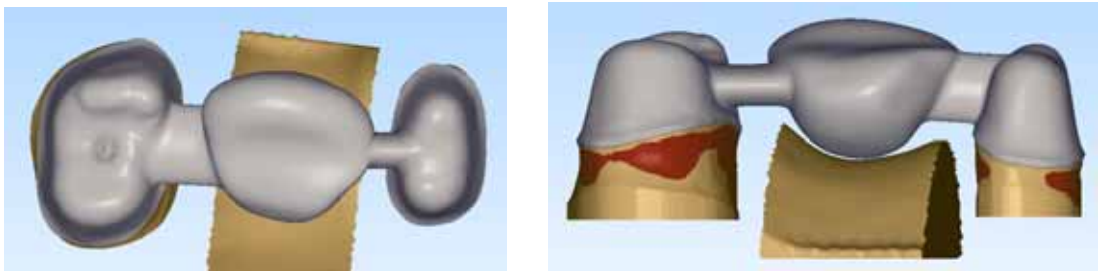
Guttering creates a pocket in the upper surface of the coping near the margin, into which the tool must drop. Both the machined coping and the fired restoration will be considerably stronger with a small amount of reinforcement added.



Deep shoulder and gutter preparations with appropriate reinforcements added in CAD

Bridge connectors

Renishaw's incise™ CAD includes an advanced strength analysis capability. Unlike other CAD systems, there is no minimum connector cross-section specified for the incise™ system. The strength is calculated dynamically taking into account the position of the restoration in the jaw and distance between pontics and retainers. Importantly, the system calculates whether the framework is strong enough to withstand occlusal loads, but not any other loading condition. Side forces and cross-bite are not considered, and the experience of the dental technician must be used to specify the connector geometry to account for this on a case-by-case basis.



Both connectors on this bridge have equal strength in the occlusal direction (two views shown for clarity). The tall, narrow connector will be weaker in resistance to cross-bite and the technician must be aware of this, because the CAD system does not calculate the strength for all loading directions.

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