PRINT

Version: 5.0.0

Stand: 01.02.2023

PROMADENT
Quality Dentalware

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2 PRINT incl. Plugin "Implants"

The BISS Dental Software Suite is used for processing scan data in the field of dentistry and orthodontics, with the aim of enabling the scanned data to be mapped onto a workpiece (e.g., by 3D printing or CNC milling). PRINT uses the surface information of a common dental scan to create a 3D model for further processing by e.g., additive manufacturing processes (3D printing). BiSS also supports the processing of the generated model in a variety of ways. A "repair" of the scan data can be performed and is suitable for smoothing and trimming artifacts in the surface information.

> **Note:** *Using the repair function may distort the actual surface. This may result in inaccuracies of fit. Therefore, it is recommended to repeat scans with errors or scans with artifacts.*

The scan data can be spatially aligned by defining the occlusal plane automatically or manually and will be cleaned from unwanted marginal elements by defining a spline-based margin curve. BiSS also allows the addition of removable stumps, various base geometries, supports for encoding the maxillary and mandibular situation, editable frameworks for attaching further attachments, attachments and labels in text or image form. For resource-saving further processing, the model can be "hollowed out" to a user-defined wall thickness. In addition, escape holes can be defined. The finished model can be saved as a project file .GBS, as well as exported as a printable file in .OBJ, .STL or .PLY format for further processing.

In 3 minutes to a printable dental model

FAST · EASY-TO-USE · INTUITIVE

PRINT can be optionally upgraded with *additional plugins* or as a *network multi-user license*.

Face fun with PRINT! :)

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3 Installation

3.1 System Requirements

The system requirements listed below must be fulfilled:

- ✓ Windows 64 Bit
- ✓ At least 500 MB free file system memory, recommended 2 GB
- ✓ Processor with at least 2 cores at 2 GHz, recommended 4 cores at 2,5 GHz
- ✓ Free working memory at least 8 GB, recommended 16 GB working memory
- ✓ Free USB-2.0 connection
- ✓ Minimum display resolution 1200 x 900 Pixel
- ✓ Graphic card: e.g., HD Graphics 3000 DX10.1 (we recommend not to use AMD/ATI RADEON graphics cards)

3.2 Installation Notes

The installation of the program BISS is done with the provided installation file *BISS-5.0.X-setup.exe*. Run the file and follow the installation instructions.

To start BiSS you need a *dongle license*. Make sure that your license dongle, with a valid BiSS license, is connected to your computer before you start the program.

If you have a *BiSS multi-user network license*, please refer to the following section:

3.2.1 BiSS multi-user network license

In order for the network dongle to be recognized within your network, the following settings must be set before BiSS can be started the first time:

- ✓ Install BiSS
- ✓ Insert the network dongle into the device
- ✓ Open the installation directory of BiSS (on the same device)
- ✓ Run *DinkeyServer.exe* as Administrator
- ✓ Under *Startup Modes* on the left, select *Windows Service*
- ✓ Under *Network Configuration* on the right, select *Automatic*
- ✓ Click Start

Your firewall must recognize and allow Dinkey Server. Therefore, select *Automatically Configure Windows Firewall* when prompted to do so.

Dinkey Server now runs as a background service and doesn't need to be restarted manually after rebooting the device.

> **Note:** *If you remove the dongle or add another dongle, a restart of Dinkey Server may be required.*

BiSS can now be started from all devices of your network, according to the number of purchased licenses.

3.3 Control

The software can be controlled with a commercially available mouse as a selection tool in the menu navigation and for rotating, moving, and zooming the model. Input via the keyboard is required for individual functions. The basic options for controlling the software are described in table 1. Below you will find a complete summary of the possibilities for navigation with an explanation of the function.

	Selection Tool	Move the cursor to the desired position and click the left mouse button.
	Rotate Model	Hold down the right mouse button and move the mouse.
	Move Model	Hold down the mouse wheel and move the mouse.
+ Shift	Move Model	Hold down the right mouse button and shift key and move the mouse.
	Zoom Model	Rotate the mouse wheel to zoom in or out of the model's representation on your working surface.
	Set Rotation Center	With a center click on any point you can set the center of rotation.

table 1: Short overview: Control of the program - overview mouse functions.

3.3.1 Overview of General BiSS Short Cuts

Shortcut	Description
Ctrl + F	Reset view to frontal view.
Ctrl + S	Save (Attention: The step "align" must first be exited, otherwise the position change will not be saved").
F10	Clean memory.
Drag mouse with right mouse button	Rotate view.
Drag mouse with middle mouse button	Move view.
Rotate mouse wheel in 3D area	Zoom in / zoom out view (direction can be selected in the settings).
Mouse wheel rotates over a spinner	Change value (a spinner is a field for setting numbers with two small buttons on the side).
Middle click on a part of the model	Focus view on the clicked point.
Right click on a part of the model	Open context menu.
Right-click in 3D area	Open context menu.
Right-click in a list of elements	Open context menu.
Restart User-Interface	Change the language in the settings (or select the selected language again).

table 2: General BiSS shortcuts.

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3.3.2 The Cube

Left clicking on the cube rotates the view as indicated by the black arrow. Depending on where you click:

Left click on cube	Description
On the side that does not face forward	This side is rotated to the front.
One edge while one side faces forward	This edge is rotated upwards while the side continues to face forward.
The center of the side facing forward	The back side is rotated to the front. The direction of rotation depends on whether you click above, below, left, or right of center.
A corner pointing upwards	The corner is rotated forward.
Edge that belongs to a corner that faces forward	The edge is rotated forward.
Corner that belongs to an edge that points forward	The corner is rotated forward.
Edge pointing forward	The edge is rotated 90° to the left or right, depending on which half of the edge you click on.
Double click on the cube, one side facing forward	The side is rotated to the front and aligned that the label is right side up.
Triple click on the cube	Reset the view to frontal view.

table 3: The navigation cube.

3.3.3 Repair-Tool

Navigation	Description
← during manual repair	Reverse.
→ during manual repair	Restore.
+ during manual repair	Enlarge tool radius.
- during manual repair	Reduce tool radius.
Spacebar during manual repair	Initiate repair of the marked area.
Ctrl + left mouse button during manual repair	The previous selection is not deleted but extended.

Shift + left mouse button in Repair mode	A polygon can be drawn.

table 4: Navigation in the repair tool.

3.3.4   Attachments, Implants, Alignment

Navigation	Description
Ctrl + drag left mouse button	Rotate selected object.
Shift + drag left mouse button	Move selected object.
Double click on a curved arrow	Rotate 90° (in the Alignment tool).
Ctrl + left click when aligning	Select first point for aligning or connecting two components (some modes only).

table 5: Navigation for attachments, implants, alignment.

3.3.5   Editing Curve Points

Navigation	Description
Del	Delete selected curve point.
Double click on curve point	Delete clicked curve point.
Space bar during editing curve points	Focus view on the selected curve point.

table 6: Navigation for editing curve points.

3.4 Launch the Program

When you have started BiSS, the window shown in image 1 appears. Here you get an overview of the available modules for BiSS Dental Software Suite. These are PRINT, MILLING, TRAYS and LOCATE. In addition, there is a single application PUZZLE.

You can see from the green checkmarks, which modules are enabled according to your license. You can now select which application you want to launch. To start PRINT, click on the blue button *start software.*

Furthermore, you have the possibility to be forwarded directly to your retailer via the button *visit shop*, but also to purchase further BiSS modules. This button only appears if there is an existing internet connection.
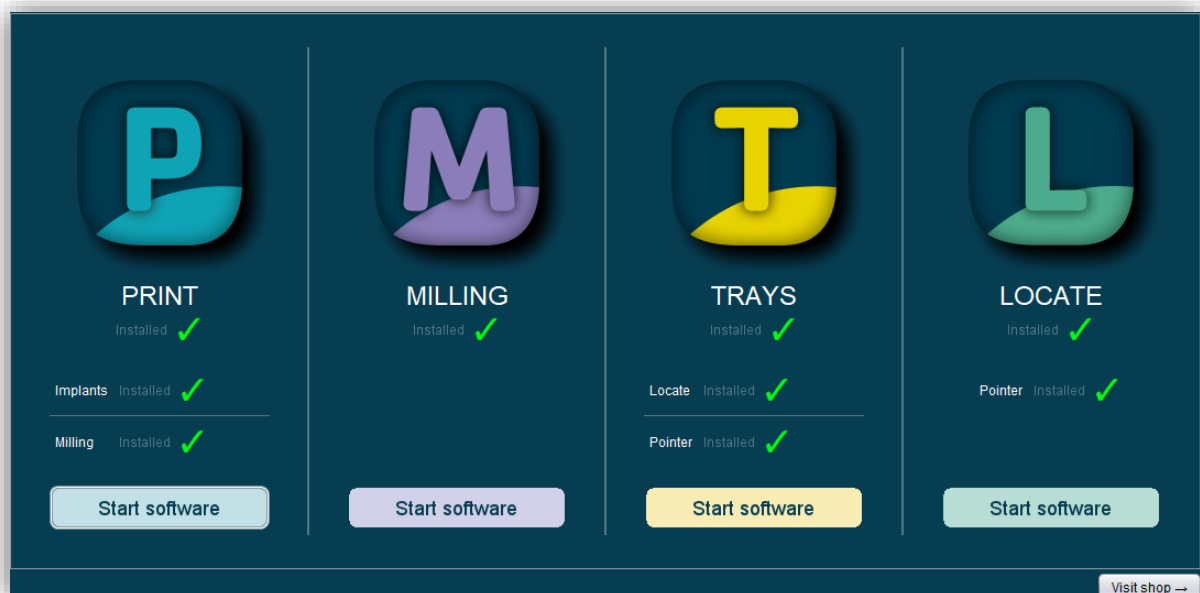
image 1: Welcome window after program launch.

4 The Workstation

4.1 Overview

Familiarize yourself with your BiSS workstation. The user interface is divided into the three main areas: navigation - action - model view

✓ You can access the *menu (burger)* via the navigation bar at the top. The **<** and **>** buttons navigate you step by step to the finished model. The individual processing steps of your workflow are displayed in the center. You can use the status bars to track the progress of

your work. You can also select the buttons individually and go directly to the desired design step. You can recognize the currently selected design step by the darker coloring.

✓ On the left you will find the action window. Here you adjust the settings specific to each design step.

✓ The 3D model you are working on is displayed on the right. Via the text window you will receive messages and notes that support you in your work.
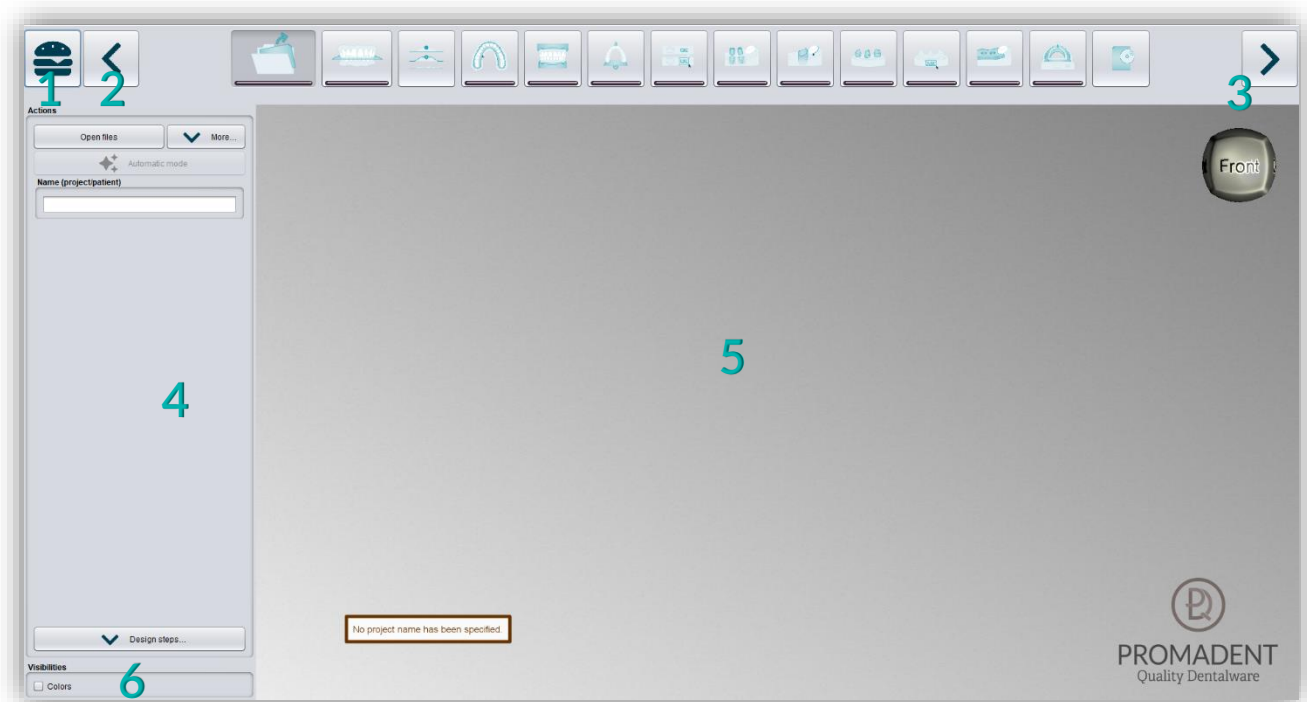
image 2: The BiSS program after launch 1) Menu: Contains settings, about us, other applications, new project. 2) Back: get back to the step before. 3) Next step: Complete the current processing step and proceed to the next step .4) Action window: Individual for the respective work step. Here: Load file and define the work steps. 5) Work surface. 6) Visibility switch: Visible after loading the model.

4.2 Closing the Program

To close the program, select the *X icon* at the upper right corner of the program window and choose *close* under the *menu* button.

There is a query whether to close despite unsaved changes. Changes are both changes made by the user and calculation progress.

4.3 Settings

Under the *menu* button you will find the *settings tab*, see image 3. If you select settings, a new window opens with four tabs: appearance, load & save, control, updates and advanced.
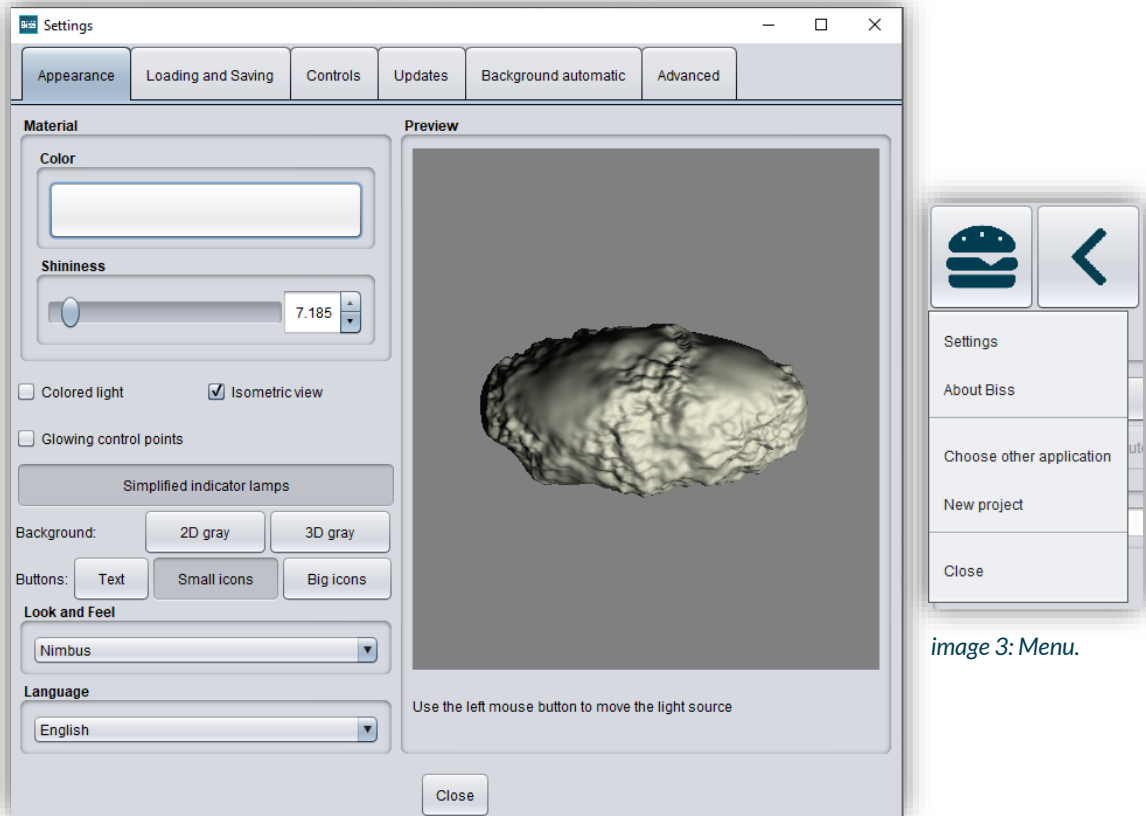
image 3: Menu.

image 4: Changing the appearance of the model and the working environment.

The settings window can be closed by clicking the *close* button int the middle below of the window or the *X* in the top right corner. Your settings will be applied and saved.

Appearance

Under the *appearance tab*, shown in image 4, you can adjust the appearance of the loaded model to your needs by selecting a color and intensity of gloss. Further setting options are summarized in table 7.

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FEATURE	DISCRIPTION	DEFAULT-VALUE
Colored light	Active: Multiple colored light sources from slightly different directions. Inactive: White light source.	inactive
Isometric view	Active: Isometric view Inactive: Perspective view.	active
Glowing control points	In the "trim edge" step, the currently set curve points are displayed as a light source. Attention: Requires a lot of computing power.	inactive
Simplified indicator lights/ Detailed indicator lamps	Changes the appearance of the status bars that indicate progress within the workflow.	simplified indicator lights (active)
Background - 2D gray/ 2D colored	Selects the background of the windows - gray or colored.	2D colored
Background - 3D gray/ 3D colored	Selects the background of the 3D model - gray or colored.	3D grey
Look and feel	Selects the design of the windows.	Nimbus
Language	You can choose between German and English language.	English, with English system language

table 7: Appearance settings.

4.3.1   Loading and Saving

Behind the *loading & saving tab* (image 5) you can set in which format your model should be exported. The file formats .STL, .OBJ and .PLY are available for selection. You can also activate automatic saving of your project and set a time interval for automatic saving.

Note: *When you save automatically, your project file is saved in .GBS format. There is no file export.*

This function is used exclusively to restore the project after an irregular termination of the program. The folder for automatic saving should only be used for this purpose. In addition, if the PUZZLE application has been unlocked, you can decide here in which folder the data for PUZZLE should be exported. This folder must be the same as the monitoring folder of PUZZLE. If you check the box *Ask for additional location to save to*, you can select a new location each time. This must also be the same as the monitoring path of PUZZLE. If you want the data to be sent to PUZZLE automatically with every export, then you must check the box *Send to PUZZLE when exporting*.

Furthermore, you have the option to determine whether color data is loaded and exported.
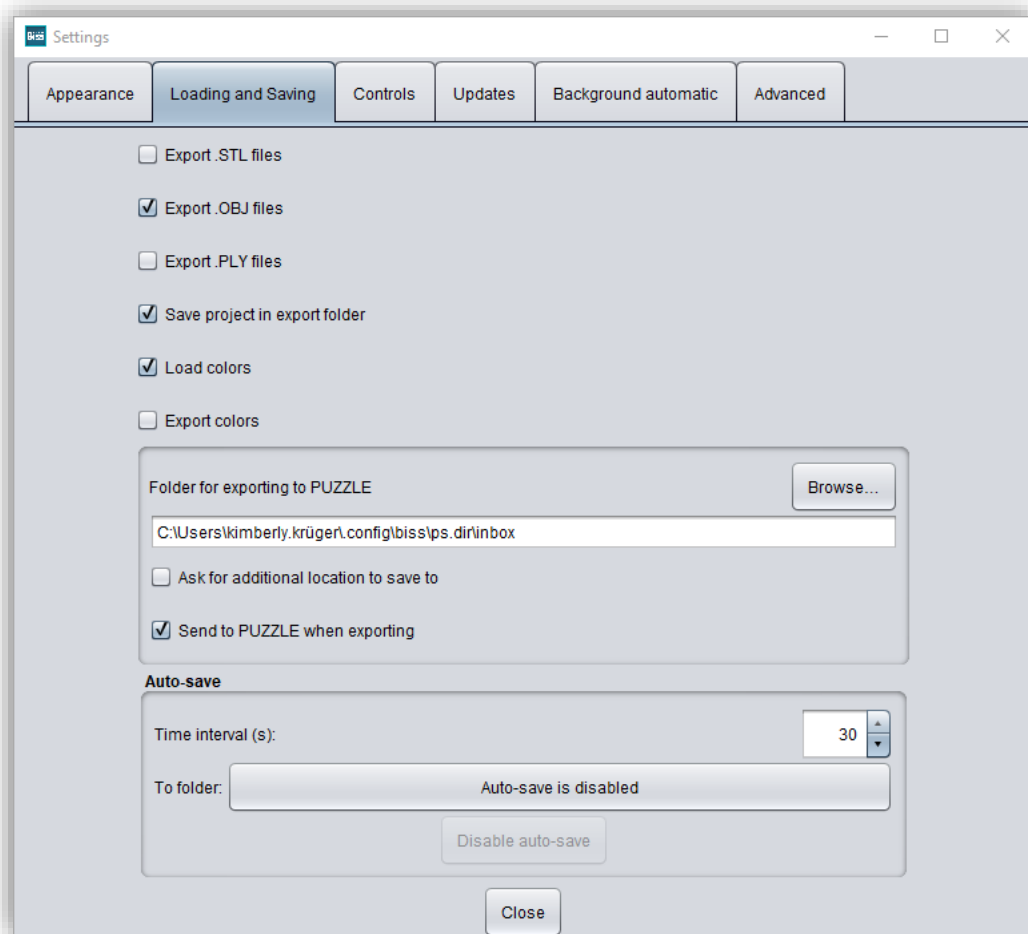
image 5: Loading and saving settings.

4.3.2 Control

In the ***control tab***, see image 6, you can adjust the mouse behavior and the message size.

Mouse behavior	Select whether your model is enlarged or reduced when scrolling up.
Message size	Determine the size of the displayed messages on your workstation by entering a factor.
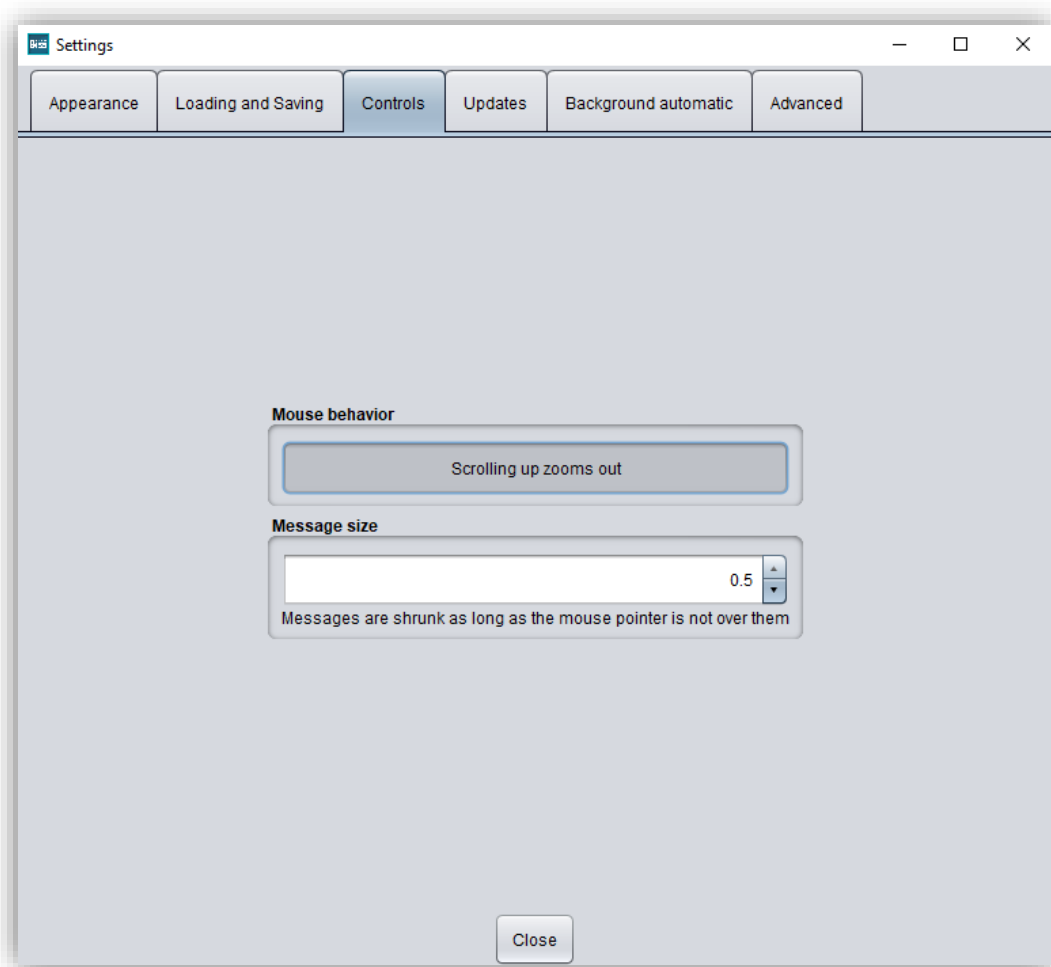
image 6: Custom setting of mouse behavior and message size.

4.3.3 Updates

In the *updates tab* in image 7, you can check if new updates are available for BiSS. To do this, click the button *check for updates*.
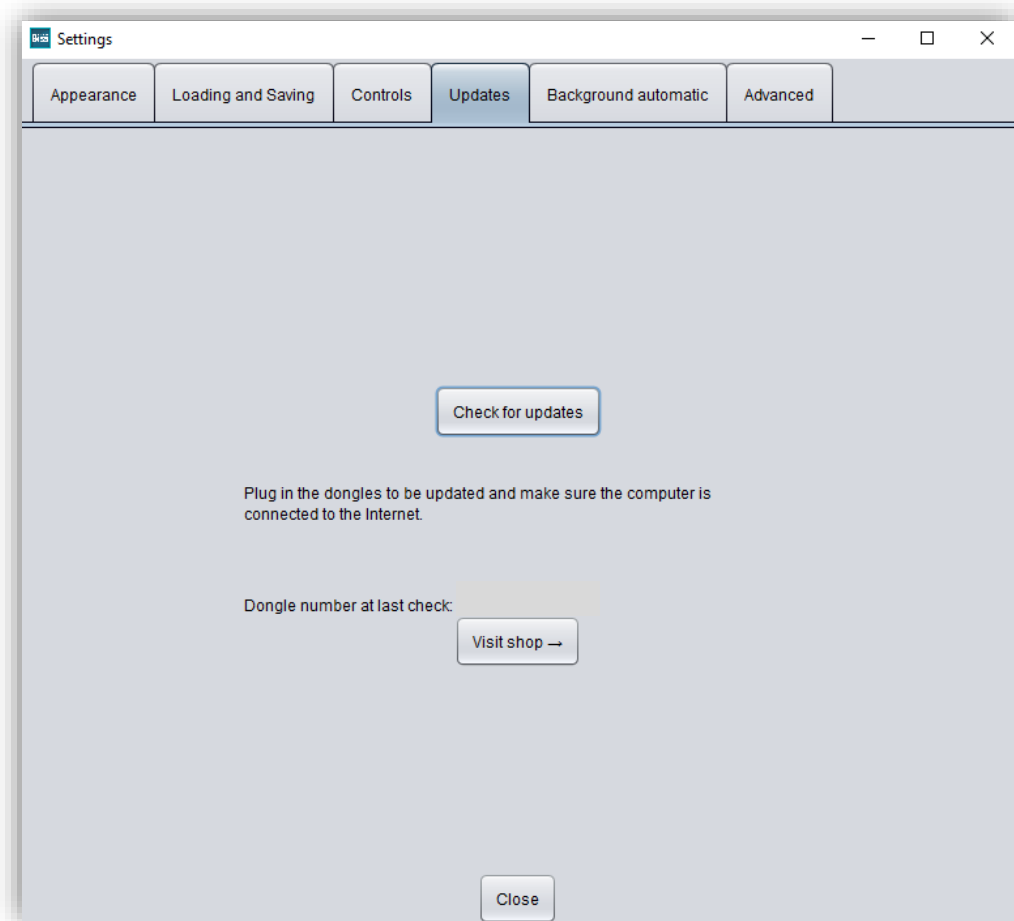
image 7: Update-settings.

Afterwards, a window like the one shown in image 8 opens and informs you about available updates. This can be for example a new software version that is ready for download or a license update for your dongle. You need this function e.g. when purchasing additional modules or extending a license.
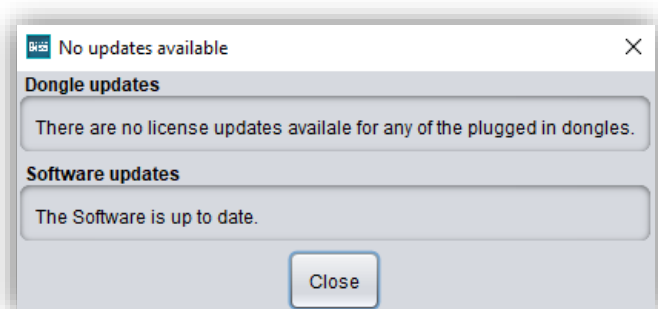
image 8: No updates available.

4.3.4   Background automatic

Under this tab you can make a few settings for the coupling with the *PUZZLE* application.

Select *Make attachments* if you always want to generate a 3-point support in full automation with PUZZLE. The same applies to *Label*. If this check mark is set, a label with today's date and time is created in the OK and UK in the background automation. For this you can decide under embossing height of the label whether the font should be embossed in (minus) or protrude (plus). If the check mark is set for *Hollow*, the model is always hollowed out and provided with drainage holes in the background automatic by default.

Under the area *These directories are being watched*, a folder must be created in which the data, sets to be processed by PRINT, will be located. You can create any number of folders by *adding a path*. If you want *to edit or delete a path*, then the path must be marked first. You can determine in which interwall PRINT will scan the folder created above for new data. To do this, select a value under *Wait for more files (s).* Then you can select in which file format the finished generated model should be exported. Possibilities are under *into folder* as .GBS project file, .PLY files, .STL files and .OBJ files.

Tip: To guarantee fast work with the PUZZLE connection, you should always select Project file.

Then select a folder where the finished models will be exported automatically. By default, the folder C:\Users\[your username]\.config\biss\ps.dir is selected. You can also select a different file path on Browse.

Attention! If you change the file path, the overgrowth file path in PUZZLE must be the same. Otherwise, PUZZLE will not be able to import data from the newly created folder into the software.

---
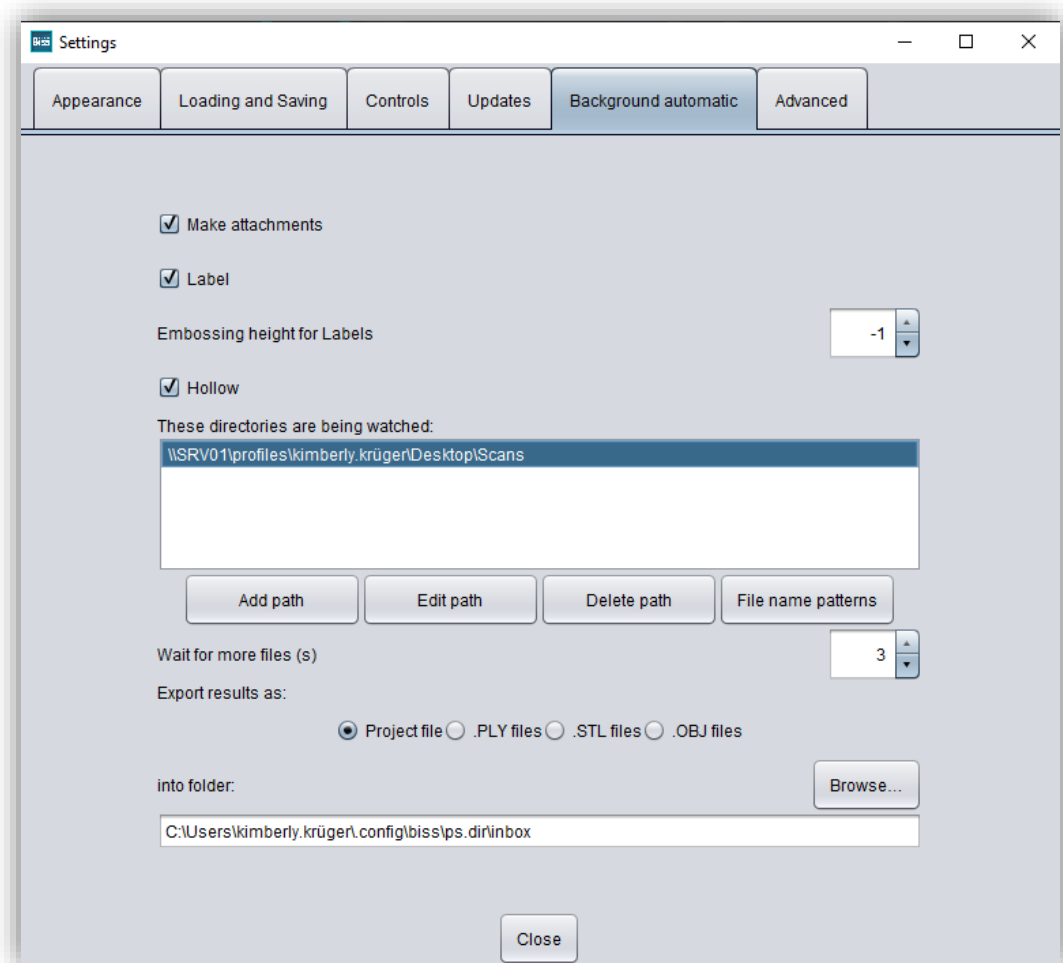
image 9: Background Automatic

4.3.5   Advanced

Under the *advanced tab* you will find advanced settings.

Select *auto-trim by default* if you want your model to always be trimmed automatically.

Select *make attachments in automatic mode* if you want frameworks to be added to models automatically in automatic mode.

Select *rotatable stumps in milling model*, if you want to allow rotation of the stumps on the milling model. By default, this setting is disabled.

Select *edit protected attachments* if you still want to edit protected attachments (e.g., change rotatability and position).

Note: *Only activate this function if, you are absolutely sure. Careless editing and subsequent saving of protected attachments can result in a corrupted file and render the attachment unusable. Contact your supplier at any time if you need assistance.*
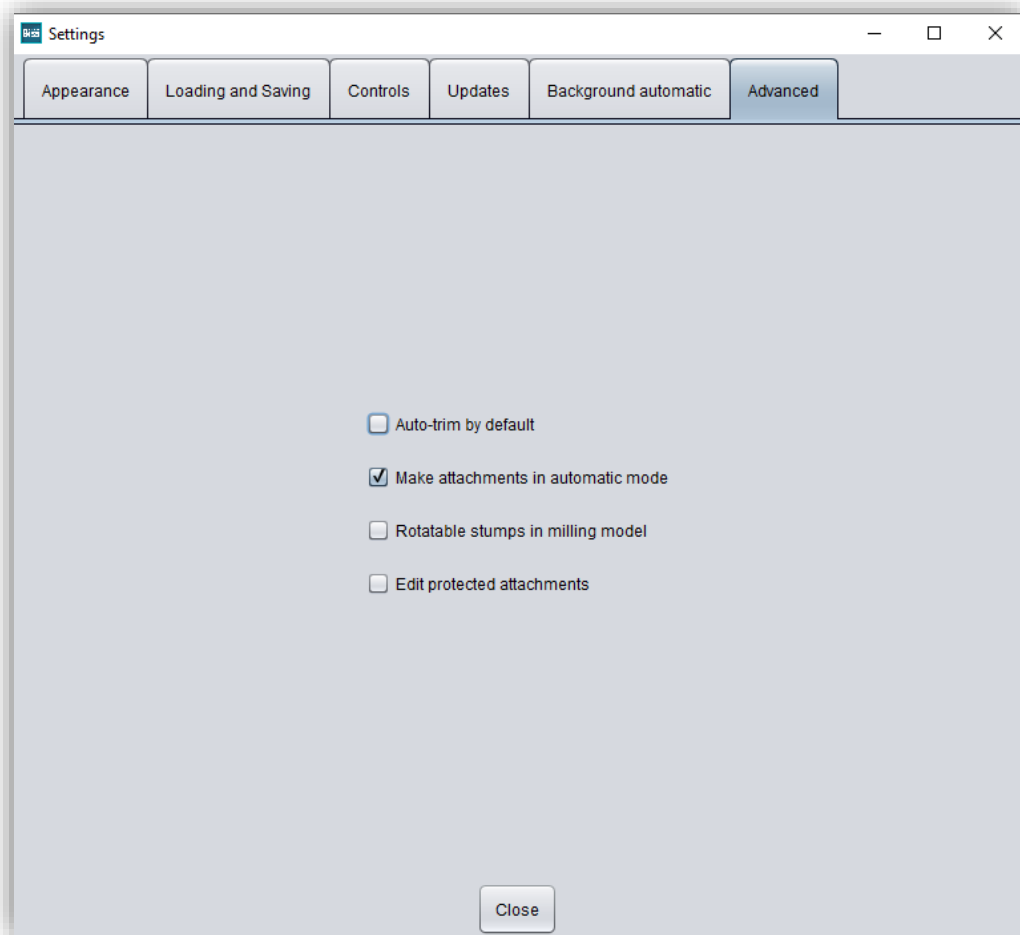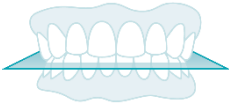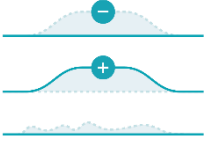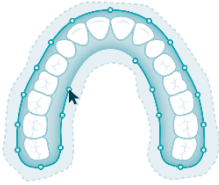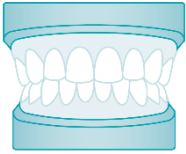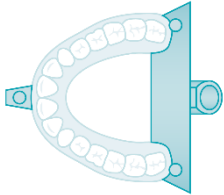
image 10: Advanced settings.

5 From the Scan to a Printable Dental Model

5.1 The Workflow

	Load	Import data in .STL, .OBJ or .PLY formats.
	Align	Automatic or manual alignment of upper and lower jaws and modification of components.
	Repair	Add material, remove material, and smoothen.
	Cut off fringe	Automatic or manual trimming of the edge.
	Make base	Automatic generation of a standard or orthodontic base.
	Attachments	Free loading of attachments, e.g., supports for bite transfer.

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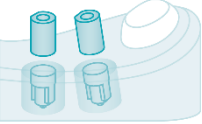
| | **Labels** | Attachment of e.g., patient name or company logo. |

| | **Implants** | Register scanbodies for implant models. |

| | **Stumps** | Defining removable stumps according to freely selectable parameters. |

| | **Milling model** | Generate milling model. |

| | **Gingiva masks** | Setting the start and end point of removable gingival masks. |

| | **Hollow out** | Automatic hollowing and providing with drain holes. |

| | **Save** | Export all components to .STL, .OBJ or .PLY formats. |

table 8: The workflow.

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5.2 Open File

On the left side of the program window, you will find the action menu. Using the *open file* button, you can load your scan data into the program or open an already existing .GBS project file (image 10). After selecting the button, a window will open where you can choose the desired file in the .OBJ, .STL or .PLY format.
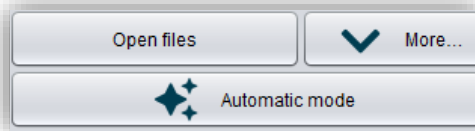
image 11: Open the scan data.

Hint: *You can load multiple scans at once if you hold down Ctrl, select all the files you want, and then click open. If you click on "More...", you can load and unload individual scans.*

If BiSS cannot recognize what type of scan it is from the file name, a *„could not determine purpose of data"* windows open. Select which type of scan is displayed in the preview (image 11).
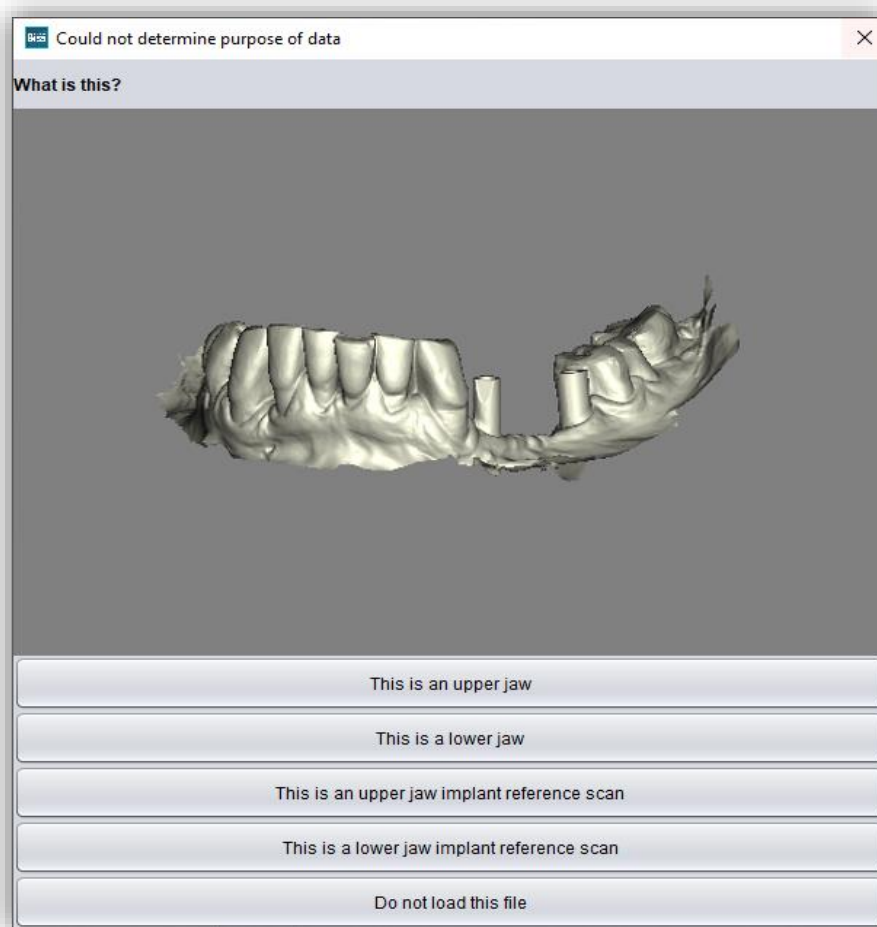
image 12: Assignment of the loaded jaw models.

Hint: BiSS can automatically detect which type of scan it is. BiSS distinguishes between upper jaw, lower jaw, implant reference scan and no implant reference scan. For this to work, there are certain requirements for the file names (see table 9).

File Type	Condition
File is upper jaw	✓ contains *mandibel, mandubul, mandible* or ✓ contains *lowerjaw, lower-jaw, lower.jaw, lower_jaw* or ✓ ends with *occlusion_l* or ✓ is *uk*
File is lower jaw	✓ contains *maxill* or ✓ contains *upper-jaw, upper.jaw, upper_jaw* or ✓ ends with *occlusion_u* or ✓ is *ok*
File is implant reference scan	✓ contains *impla*
File is no implant reference scan	✓ contains *anatom*

table 9: File name components for automatic detection of the scan type.

Tip: You now have the option of loading a .scaninfo file from Exocad in which the stumps already have been defined. This way, BISS automatically recognizes the spline for cutting out stumps.

After you load your scans, the model is automatically aligned. Note this later when exporting your work, see section ***Save the Job***.

5.2.1 iAD – Integrated Auto-Design

Via the button ***automatic mode***, you can sit back, enjoy a little break, and watch BiSS working. A model with base will be created and you can save it directly.

image 13: Automatic mode.

25
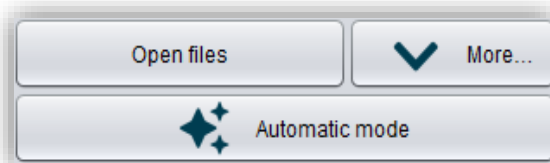
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Note: *Frameworks are only added automatically if a check mark has been set in the menu under "advanced settings" (see above image 9). Implants and a milling models will not be created automatically.*

5.2.2   Colored Representation of an Intraoral Scan

It is possible to display intraoral scans in color in PRINT. To do this, simply load your color scan. BiSS recognizes .PLY files with textures as well as .OBJ or .PLY files with vertex colors. You can also disable the loading of colors under *menu / settings / load and save.*
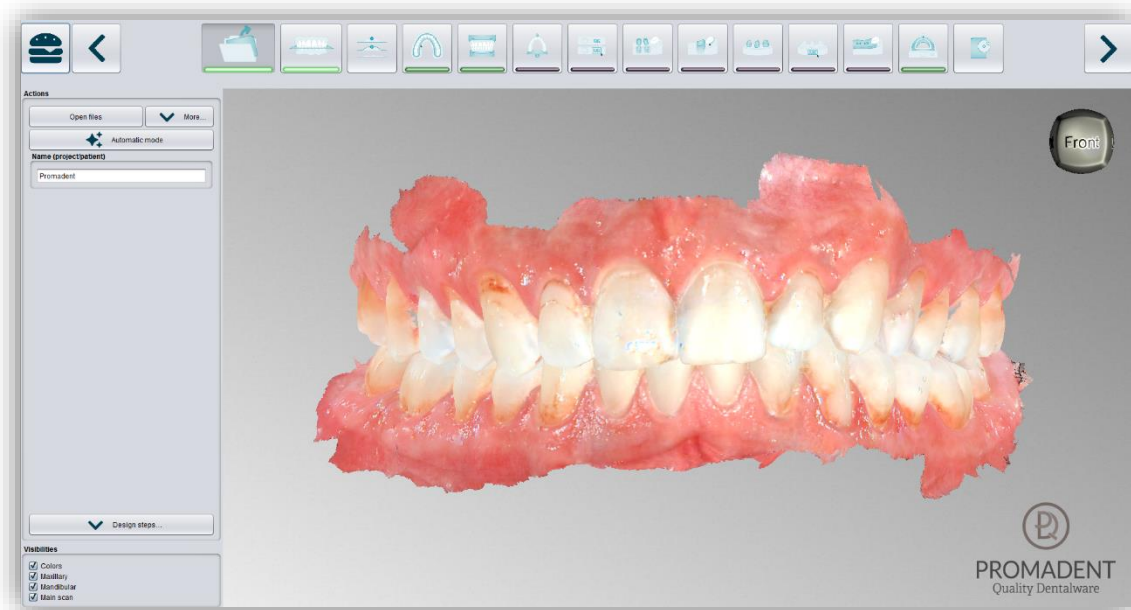
image 14: Color scan with textures.

5.2.3   Unload Model

Of course, you can also unload the loaded models again. To do this, use the *unload upper jaw*, *unload lower jaw* or *unload implants scan* button shown on the action window on the left, see image 14.

image 15: Unload models.

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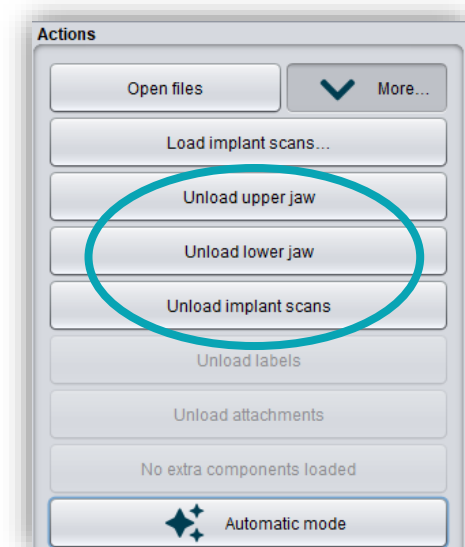
5.2.4 Assign a Project Name

After loading the scan data, it is possible to assign a user-defined name (e.g., project/patient) to the project (image 15). To do this, enter the desired project name in the *name (project/patient)* field. This name also appears in the top line of the BiSS window. If the project remains

image 16: Enter project name.

unnamed, you will see a corresponding message "No project name was entered". However, it is possible to continue without naming.

Hint: BiSS remembers the project name. If you add a label to your model (see chapter Labels) or if you want to save your project, BiSS uses the project name you specified by default - for a faster work.

5.2.5 Your Personal Workflow

If you don't need one or more of the possible designing steps of BiSS in your machining process, you have the option to deselect individual functions. To do this, simply remove the check mark from the relevant function. These functions will then no longer be displayed in the navigation bar. You will find the function palette shown in image 16 on the left side of the action window when you are in the *load step*. BiSS remembers your setting until the next time you open it, so you don't have to make this selection every session.
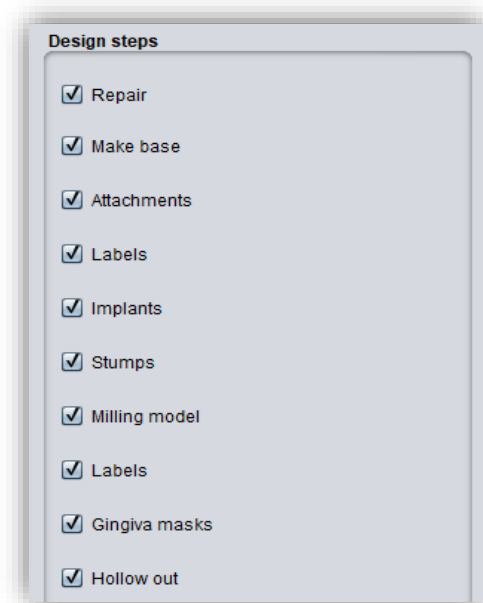
image 17: Design step selection.

Once you have made all the necessary settings, click **>,** to set the occlusal plane for your model.

✓ Click on "Open file
✓ Select the file to load
✓ Determine the upper and lower jaw or reference scans
✓ Give your project a meaningful name

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5.3 Align Object

In this processing step, you can align all loaded components. On the one hand, these are the main scans for the upper and lower jaw, but also implant reference scans or free components, if applicable.

image 18: Action menu – align object.

You will see the *adjust implant scan, adjust jaws individually*, *edit components,* and *join pinned components and main scan* (here you can pin single components, such as scan bodies, which were not connected to the scan, to the scan now). If none of these are selected, then the *align occlusal plane* function is active, see image 17.

5.3.1   Align Occlusal Plane
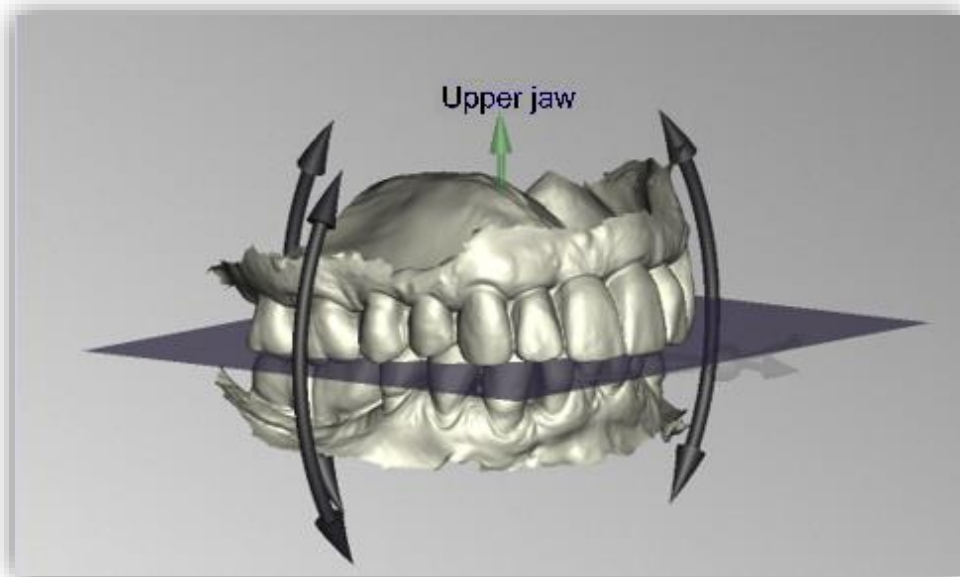
image 19: Automatically aligned occlusal plane. The position of the plane can be adjusted manually.

You can align the occlusal plane automatically or manually on the loaded model. The simplest method is to first align the model automatically. This is already done automatically in the background or by clicking the *automatic* button in the action window (image 17). The plane is now automatically aligned.

Now you can check the position on the model by moving, rotating, or zooming in/out with the mouse as described in the *Control* section.

If you would like to readjust the position of the occlusal plane, click on the appropriate direction arrow that shows you the possible change in position of the occlusal plane and thus move the plane

while holding down the left mouse button. Double-clicking on the rotation arrows rotates the occlusal plane by 90°. Alternatively, click directly on the semitransparent plane. If you are content with your work, click *apply*. If necessary, you can automatically align your model again.

Clicking the *restore original* button will undo any alignment.

Click **>** to move to the next editing step.

> **Hint:** *If you've made changes to the alignment but have not yet clicked "apply", the button will not say ">" but "apply and continue".*

- ✓ Click on "automatic"
- ✓ Check the position of the plane on the model
- ✓ Make a manual readjustment
- ✓ Click on "apply"

5.3.2 Adjusting the Implant Reference Scan

If you have loaded an implant reference scan, then you must also align it to the main scan if this hasn't already been done by the scanner. The alignment process follows a two-step procedure. First, a rough alignment to the main scan takes place, followed by the fine adjustment.

Click on *adjust implant scan*. Now a new menu opens. It is often necessary to roughly align the implant reference scan with the main scan in
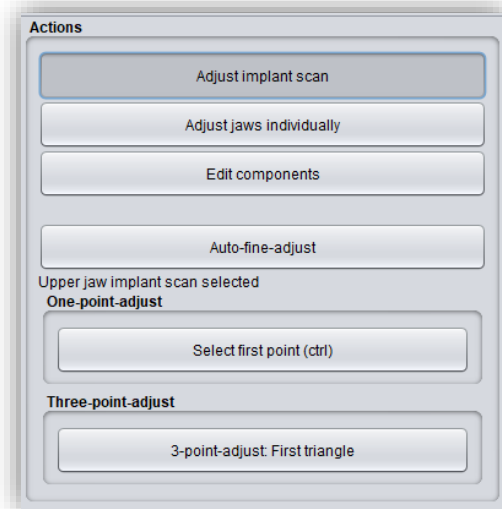
image 20: A new menu opens.

advance because it is in a different spatial position. You have three options: You can "do it yourself" and "move" the implant scan to the main scan with the mouse. To *move* it, grab the arrow cross with the left mouse button pressed. And for *rotation* click on the model with the left
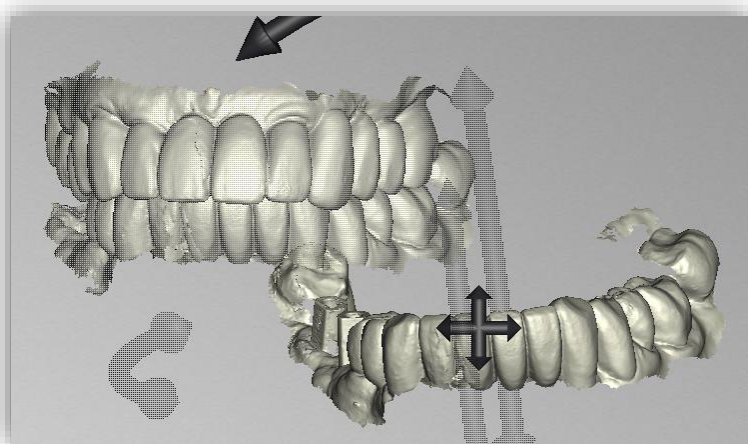
image 21: Implant reference scan has a different spatial position than the main scan.

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mouse button and move the mouse while keeping the mouse button pressed. The implant scan model now rotates around this point.

Move implant scan	Grab the arrow cross with the left mouse button pressed and move the scan.
Rotate implant scan around point	Click on the implant scan. Move the mouse while holding down the left mouse button so that the scan rotates around this point.
Rotate implant scan around center	Grab the curved arrows with the left mouse button pressed and rotate the scan.

Alternatively, you can perform the pre-alignment using *one-point alignment or three-point alignment*. Therefore, click the button *select first point (ctrl)*. Then select a point on the implant reference scan and the corresponding point on the main scan. On the left side of the action window, you will see a preview of your selection, see image 21. After selecting the second point, BISS roughly aligns the implant scan to the main scan. You can also hold down the *ctrl key* instead of clicking on the button and select the corresponding points for one-point alignment.

This is also where the third alternative comes in. What is described above also works with the *3-point* alignment. First select three points on the main scan and then the same three points on the implant reference scan. Here, too, you have the same preview, but on three images following each other.
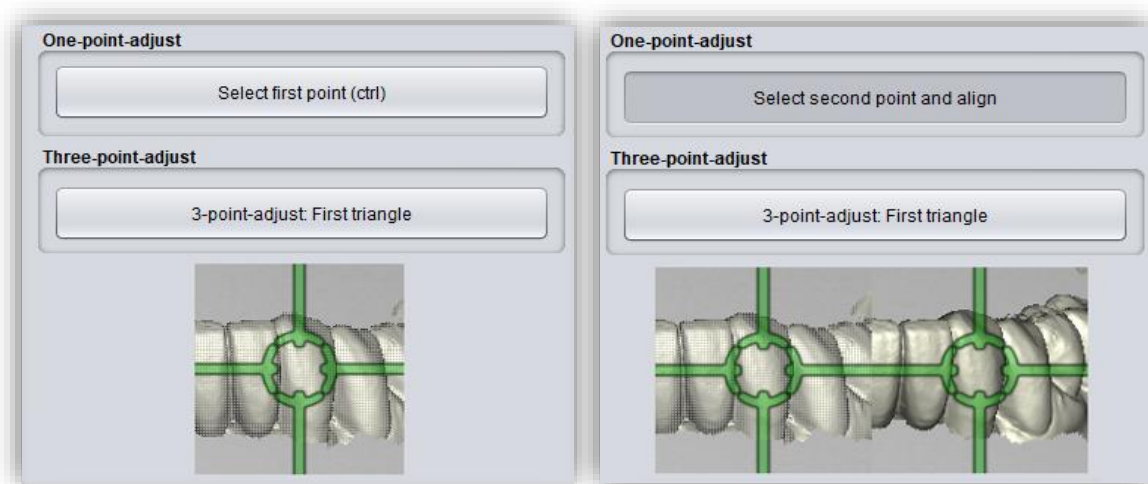
image 22: One-point alignment. LEFT - Select first point. RIGHT - Select second point.

> **Note:** *If you set the first point, this component will not move during alignment. For example, if the upper jaw is to remain in its current position but the implant reference scan is to be aligned with it, you must set the first point on the upper jaw and the following point on the implant reference scan.*

After selecting the two points, the ***automatic fine adjustment*** is started automatically.

If you have aligned manually, you then need to perform the ***automatic fine adjustment***. BiSS now aligns the two scans exactly, see image 22.

When you are done with the ***align step***, click ***> apply and continue***.

image 23: After the preliminary and fine adjustment. The implant reference scan is precisely aligned with the main scan.

✓ Click on "adjust implant scan".

✓ Hold down ctrl and make the one-point alignment or 3-point alignment

✓ Press "automatic fine adjustment"

5.3.3   Single Align

Click the ***align individually*** button, if you want to align the loaded jaw models to each other individually.

Select the respective individual component with a mouse click. You can now rotate and move these components as you wish.

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5.3.3.1 Load Bite Scan…

Via the **load bite scan…** button, you can self-explanatorily load an additional bite scan and align the jaws to the bite scan.

You can choose between automatic **one-point alignment**, **3-point alignment** or **manual alignment** and subsequent fine adjustment via the **automatic fine adjustment** button.

5.3.4 Edit Components

You can load additional components into BiSS as **free components** and edit them in a variety of ways:

- ✓ Delete small components below a selected value limit
- ✓ Load any number of free components
- ✓ Align manually, with one-point alignment or with 3-point-alignment
- ✓ Connect to the model in a variety of ways
- ✓ Load bite scans to align the main scans to each other

5.3.5 Align – Overview of all Functions

ALIGN OCCLUSAL PLANE	
Automatic	The occlusal plane is automatically aligned. This is the initial state after loading the main scans.
Apply	Accepts the occlusal plane after it has been aligned manually.
Restore original	Restores the original orientation of the scan data in space.
ADJUST IMPLANT SCAN	
Automatic fine adjustment	Performs an automatic fine adjustment of the implant scan.
Select first point (ctrl)	One-point alignment as a method of pre-alignment.
3-point alignment: first triangle	3-point alignment as a method of pre-alignment.
SINGLE ALIGN	
Load bite scans…	Another scan can be loaded into the project.

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Automatic fine adjustment	Performs an automatic fine adjustment of the loaded scan.
Select first point (ctrl)	One-point alignment for pre-adjustment of the loaded scan.
3-point alignment: first triangle	3-point alignment for pre-alignment of the loaded scan.

EDIT COMPONENTS	
Load free components	Free components can be loaded into the project, such as (...).
Anchor in upper jaw	The free component is firmly connected to the upper jaw.
Anchor in lower jaw	The free component is firmly connected to the lower jaw.
Delete	The selected component will be deleted.
Delete all free components	All free components are deleted.
Delete small free components	Free components that are smaller than a selected limit, are deleted.
Reset transformation	Transformation steps are reversed.
Select first point (ctrl)	Select first and second point for one-point alignment.
3-point alignment: first triangle	Select the first and second points for the 3-point alignment.
Don't align, just select	Activate the checkbox if the free component should not be aligned.
Connect: affix	Scan and component, which approximately touch each other, are glued, i.e. a gap between them is calculated away and they are joined together.
Connect: interspace	The scan and the component are superimposed in at least one place. All surfaces/volumes that are duplicated are now reduced to one surface/volume. All surfaces/volumes that are new are added.

Connect: sew up		The scan and the component touch and are connected.
Connect: union		The scan and the component are joined together. All internal overlaps are calculated away from the component.
Connect: intersection volume		By means of a Boolean operation, all parts of 2 data sets that do not overlap are calculated away.
Connect: difference		The penetrated volume of the free component is subtracted from the scan.

table 10: Align – overview of all functions.

Once you have loaded a component, you can right-click on it and make some settings:

✓ you can **delete** the free component

✓ you can **pin** the free component to the upper or lower jaw

✓ the free component can be **exported** individually

✓ with **resize** the file can be enlarged in the whole with + or reduced with -.

✓ make a free component **watertight**, i.e., you have a crown, e.g., where the preparation margin is not closed. You can therefore look inside. This can now be closed with a click.

✓ you can **reset the transformation or undo the last move**
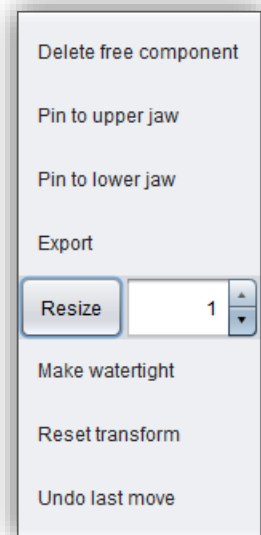
image 24: Extra settings for free components.

5.4 Repair

The repair of data is possible. This may be necessary if there are artifacts in the surface information. The repair trims and smoothes the artifacts and closes holes. In addition, material can be added or removed manually.

> **Note:** *It should be noted that this distorts the surface and can lead to inaccuracies. Therefore, it is recommended to regenerate scans with artifacts and other irregularities.*

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Furthermore, you can apply material to the surface, remove material or smooth the surface. To do this, select the corresponding option in the action window. You can also select the *tool radius* in millimeters (image 23).

5.4.1   Repair

Activate the *repair button* in case it's not activated yet. For repairing, select the areas of the model you want to edit, with the left mouse button. The repair will be executed when you confirm your selection by pressing the space bar afterwards. If you hold down the ctrl key, you can select several areas at once. Otherwise, the previously selected area disappears when you release the mouse button and restart. If you hold down the shift key, you can draw a *polygon* that indicates the area to be

image 25: Action menu – repair.

repaired. We can distinguish two cases here. If the marker touches the boundary area of the model, the marked area will be removed. Here we can *smoothly close* the area through holes downright cut with a smooth edge. If the boundary area remains untouched, the data in the area will be removed and the hole will be closed again using extrapolated data.

> **Hint:** *For example, you can remove entire scan bodies using this method if no corresponding scan is currently available to you.*

5.4.2   Application, Removal and Smoothing

The tools *remove, apply* and *smooth* are executed immediately, i.e., you do not have to confirm the input with the space bar. The intensity of this processing can be adjusted using the *intensity slider*. You can use the left arrow to undo individual editing steps and continue working on an earlier editing status or *restore original*.

5.4.3   Fill Up

The *fill up* function is particularly suitable for filling holes. This tool works in the same way as *apply*, but is even more fun, see image 24.
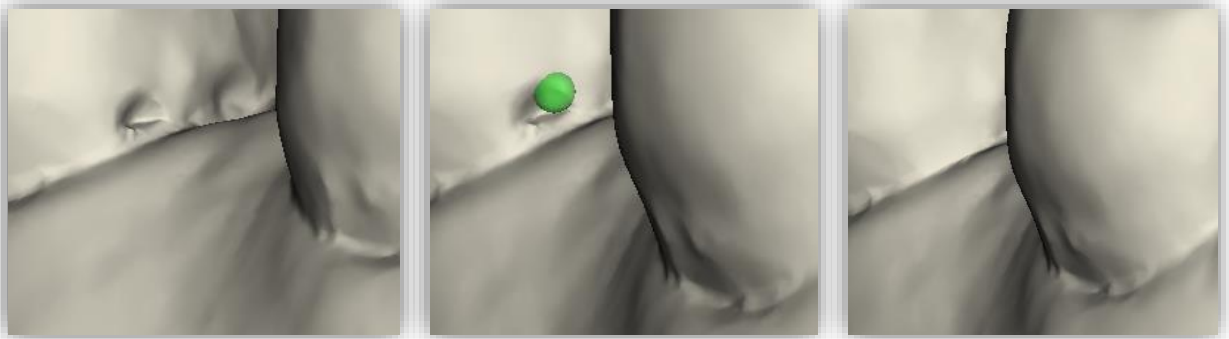
image 26: The fil up tool now makes it even easier to close holes and depressions.

5.4.4   Process Main Scans / Process Extra Components

The *edit main scans/edit extra components* button allows you to choose which scan you want to edit.

5.4.5   Automatic Close and Repair

This function automatically closes possible holes in the scan and repairs scan artifacts by deleting "defective" parts of the mesh (e.g., self-intersections) and then closes the holes.

Click **>** to move to the next editing step.

> *Tip*: When you are done repairing, you can also have the entire model generated automatically from here on.

✓   Select the repair tool
✓   Select the radius of your tool and, if necessary, the intensity
✓   Select the areas to be edited

5.5 Cut off Margin

In this step, the edge of your scan data will be trimmed automatically or manually. Click the
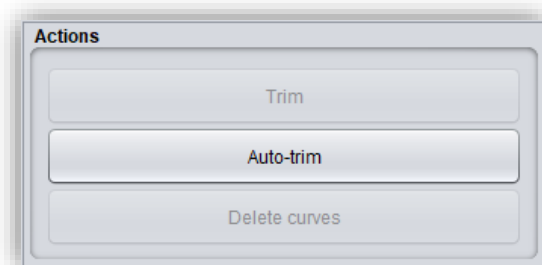
image 27: Automatic trimming.

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automatic-trim button to trim the margin automatically.

You can also set the edge curve (spline) for both jaws manually.

Hint: *To manually trim your model, simply click on the model to set the first point.*

Click on your jaw model with the left mouse button and set the starting point (image 26) and all other points through which the boundary curve should pass. You can also hold down the left mouse button and drag the point to the desired position. The set points are displayed to you in blue and relate to a red curve. The two end points are highlighted in yellow, and the currently selected point is lit, see image 26. You can move an already set point of your spline by selecting a point, holding down the left mouse button and dragging it to the desired position. Continue setting further points until you have defined a closed boundary curve.
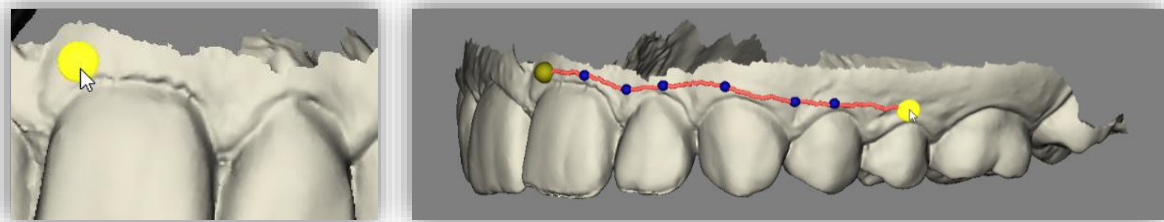
image 28: LEFT - Select the starting point of the boundary curve. RIGHT - Definition of the boundary curve by setting several points.

The curve is closed when one end point is clicked while the other end point is selected. Individual points can be deleted individually by double-clicking or pressing the remove key.

You can also set new points in the middle of the curve if you click close enough to the curve.

Hint: *Rotate the view of your jaw model by centering the view on the selected control point by pressing the space bar.*

After closing, the defined boundary curve is displayed in (image 27), if it is free of self-intersections.

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If the curve contains a problematic point, then a red arrow will appear pointing to that point. You now could make corrections by moving individual points or defining additional points along the curve as needed. When you are finished, click *trim* in the action window (image 27).
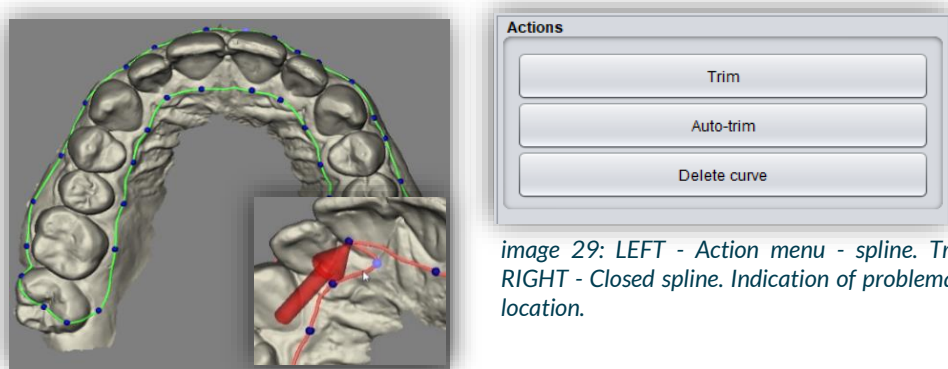
image 29: LEFT - Action menu - spline. Trim. RIGHT - Closed spline. Indication of problematic location.

Even now you still can make corrections. Simply confirm your correction with **> trim**. Proceed in the same way with the second jaw. Your model now looks like the one in image 28.

Note: You can still correct your selection at any time after trimming by dragging the defined points on the model surface while holding down the left mouse button.
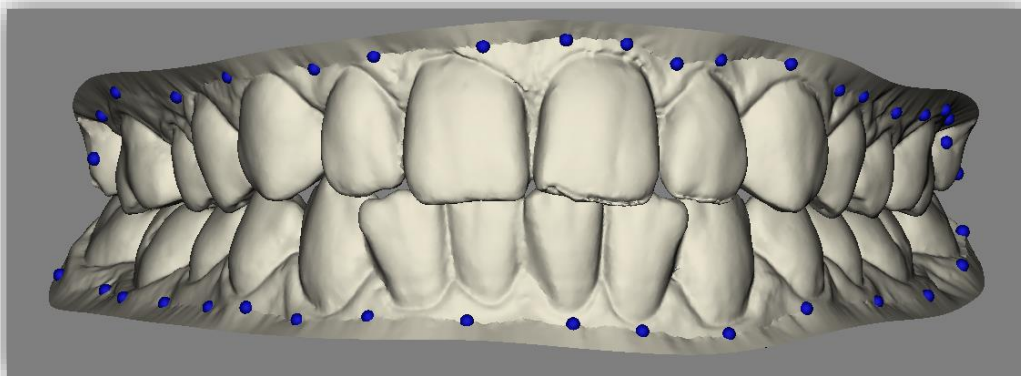
image 30: Model after trimming both curves. The edge areas are completely smoothed.

This margin curve now defines the new outer edges of the upper and lower jaw models, and the overhang is removed. If you are finished with your work, click **>**, to continue.

- ✓ Define the course of the boundary curve on your model
- ✓ Close the curve
- ✓ If necessary, correct the course by moving the points
- ✓ Click on "> trim" in the action window

5.6 Create Base

Add a base geometry in this step. You can choose between a *simple base*, an *orthodontic study model base* or a *base plate adapter in the versions tight, standard, loose* (image 29). If the scans were automatically aligned after loading, the base is also automatically aligned to the occlusal plane. If this is not the case, first align the base with the occlusal plane of the model by clicking on the button *align with occlusal plane* (image 29). Then the selected base is added to the model.

A 45° chamfer can now be added to the base of both base types. The edge length of the chamfer can be set via the bottom *button chamfer (mm)*.
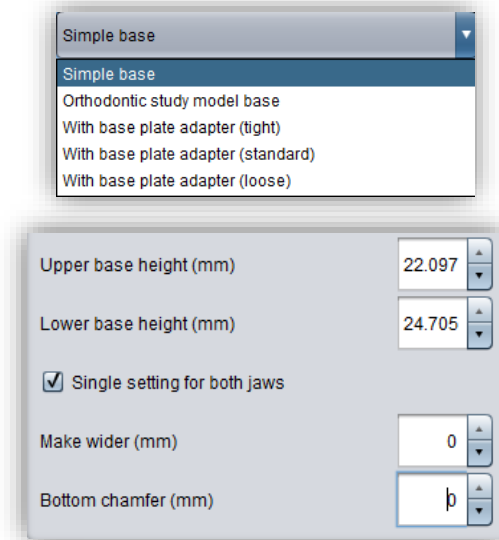
image 31: ABOVE - Action menu - properties of the plain socket. BELOW - Socket type selection.

5.6.1 Simple Base

The *simple base* can now be adjusted in thickness and width by changing the numerical values in the action window. The thickness is determined by the values *base height top/bottom (mm)*. What is meant here is the height of the base starting from the occlusal plane. This height therefore does not generally correspond to the actual base height.

Alternatively, you can edit the orientation and height of the base by dragging the arrows in the model view. In addition, you can also adjust the inclination of the base by moving the planes displayed in the 3D model. Then the middle plane no longer corresponds to the previously defined occlusal plane. You can make these settings for *both jaws* at the same time if the box is checked.

Hint: Widen the base to allow extra small models to fit on your attachments, see image 30.

---
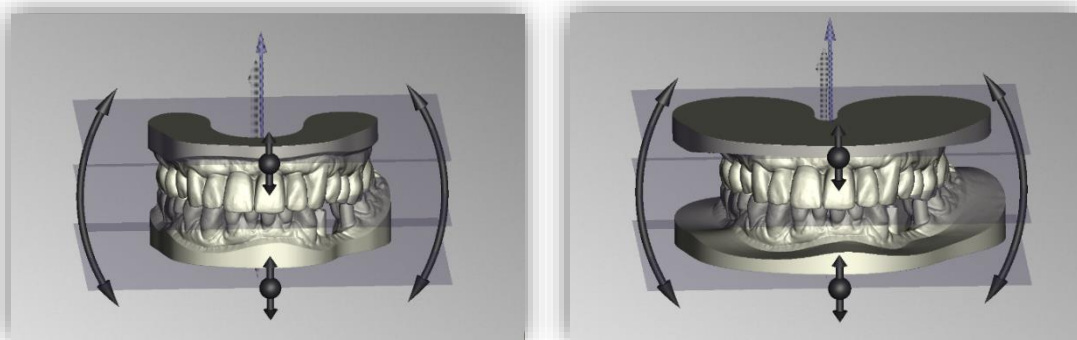
image 32: LEFT - No widening of the plain base. RIGHT - Widening of the plain base by 10mm.

5.6.2 Orthodontic Base

You can make advanced settings for the orthodontic base, as shown in image 31. You can scale the size of the base, move it laterally and raise the back. As for the simple base, you can also set the height of the base and adjust the angle.

The program checks the model for self-intersections and warns if self-intersections are present. Eliminate them if necessary.

Your base model is now already printable.

When you are done with this step, click **>**, to continue.
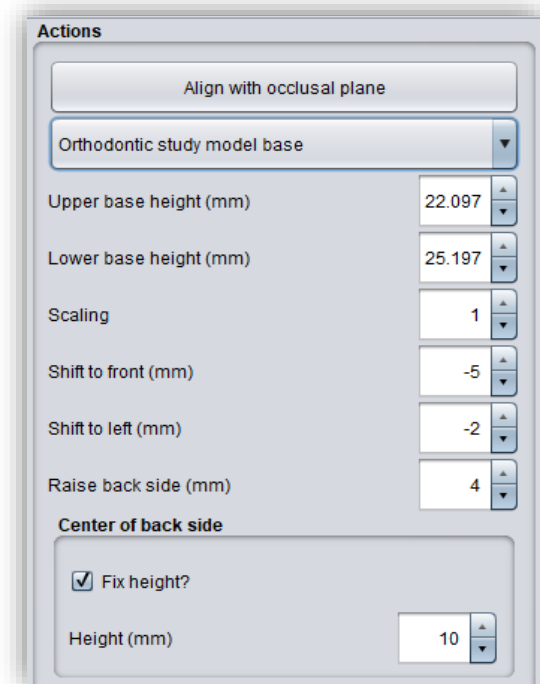
image 33: Action menu - properties of the orthodontic base.

5.6.3 Base Plate Adapter

You have the selection options tight, standard and loose for the mounting of a base plate. These refer to the fit of the pins. This base is not added but removed (see image 34). You can still make the other settings, such as height, widening and chamfer. The socket is moved automatically accordingly. The position of the models on the base plate can be changed in the Attachments step.
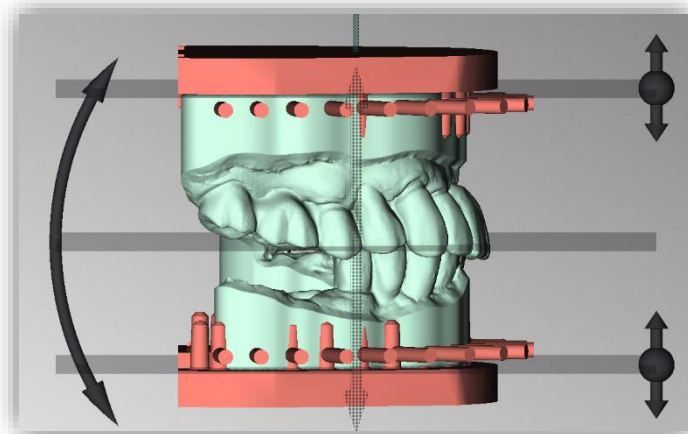
image 34: Base Plate Adapter.

✓ Select "simple base" or "orthodontic study model base"
✓ Select "align to occlusal plane"
✓ Adjust the dimensions

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5.7 Attachments

This function allows you to load attachments, for example, to support or bite.

You can now add attachments to your model. If you right-click on the model, you can choose between several frameworks, see image 32, and add the respective attachment immediately. If you add an attachment automatically, you still have the option to edit, move or remove the attachment afterwards.

If you want to add your own attachments, click **add attachment...** . A new window will open, which will be explained in more detail in a later section.
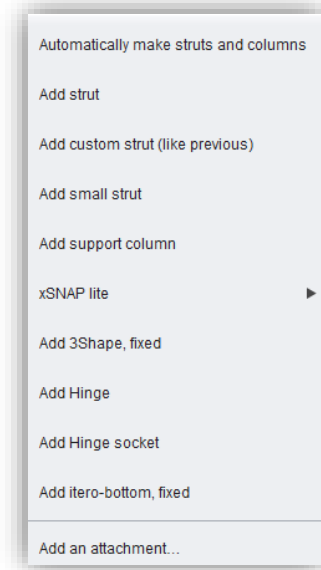
image 35: Selection menu - attachments.

5.7.1   Automatically Make Struts and Columns

If you choose this step, you will get a perfectly aligned 3-point support in a few seconds.

5.7.2   Add Strut

Select **add strut** to add one to the model. The strut is inserted at the position you selected by right-clicking or, if you clicked next to the model, in the center of the scene. However, you can move and rotate the strut parallel to the occlusal plane by dragging it with the left mouse button pressed, see image 33.

Make changes to the framework geometry under **element settings** (see image 33), if necessary. For a preview you can click on **show results**.
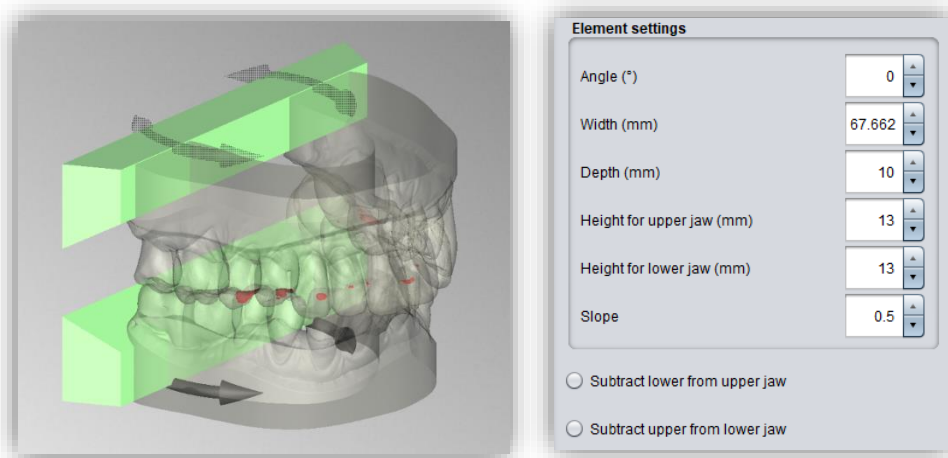
image 36: LEFT - Adjusting a strut. RIGHT - Adjustment options framework geometry.

5.7.3 Add Costum Strut

If you have changed the individual settings of your framework in a previous project, BiSS remembers this. If you now add an adjusted framework, you will get exactly the same as in your previous project.

5.7.4 Add Small Strut

Right-click on your model and select **add small strut**. You can edit the small strut in the same way as the strut in the previous section. The setting parameters are identical.
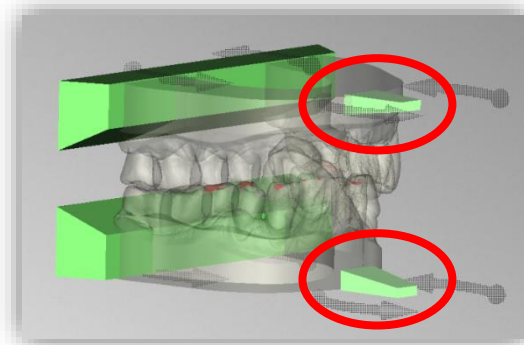
image 37: Add small strut.

5.7.5 Add Support Column

Right-click on your model and select **add support column**. You can add as many support columns as you like and move them freely in the model plane. In addition, you can change the diameter in the element settings.

The support columns shown in image 35 are interrupted in the center and serve
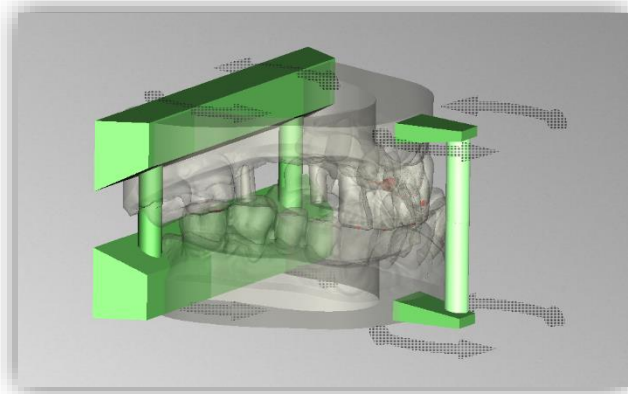
image 38: Add support column.

as articulation aids, i.e., the upper and lower jaws remain separate even after assembly. Support columns added by clicking on a strut are moved and rotated together with the strut.

5.7.6 Add xSnap lite, 3Shape-Connection, hinge, hinge socket and iTero-Connection

All the attachments listed are pre-installed attachment files. Right-click on the face of your model where you want to attach one of these attachments. You can move them afterwards.

Proceed in the same way with the other attachments that you may have created. You can also delete an attachment by right-clicking on it and selecting **delete**. Alternatively, you can also right-click on the attachment in the action window on the left and then select delete.
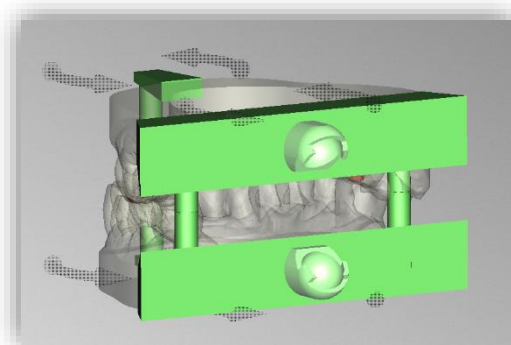
image 39: E.g., add hinge socket.

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5.7.7 Show Results

You can display a preview of your model including all attached files (image 37). To do this, click the *show results* button. If you want to end the preview, click the button again.
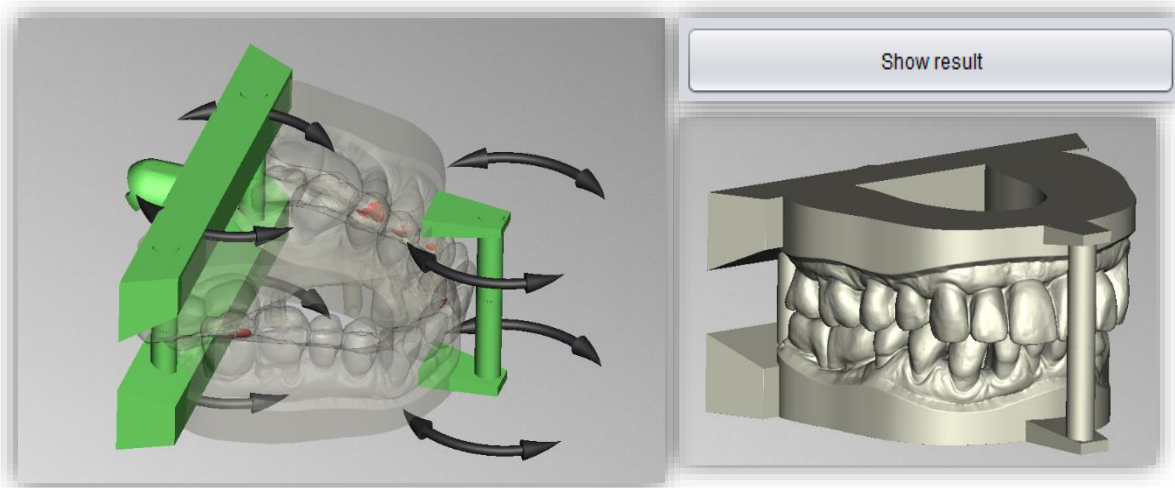
image 40: LEFT - All added attachments before. RIGHT ABOVE - Show result. RIGHT BELOW - After assembling.

5.7.8 Overlap

The scan data of many models have overlaps, which can vary in degree. As a result, your maxillary and mandibular models do not fit together reasonably after socketing.

BiSS shows you these overlaps and marks the affected areas in red, see image 38.

You can now decide how you want to proceed. If you don't have or don't want a new scan data set, then BiSS offers you a tool to make the socketed model fit together: You can either subtract the upper jaw from the lower jaw or subtract the lower jaw from the upper jaw.

image 41: Overlaps are marked in red.
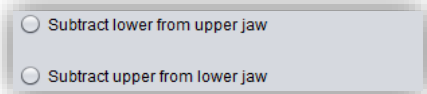
image 42: Pull pine from each other.

If you want to perform this correction, make the corresponding selection in the action window, see image 39.

Attention: *There is no correction of the scan data to clean up the overlaps. This tool is only intended to help to be able to continue working with the data set depending on the type and severity of the overlaps. The user of BiSS is responsible for deciding how to use it. We expressly recommend that you consult with the dentist and, if necessary, continue working with a new data set.*

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Click **>** when you have completed this editing step. The model is automatically assembled in the background.

✓ Right-click on the model and select, for example, "add strut"

✓ Move the object to the desired position

✓ Change the geometry

✓ Proceed in the same way with other attachments

5.7.9 Add your own Attachments

You can add your own attachments with BISS. Make a right click and select *add attachment...* . A new window opens as shown in image 40.

On the right you can see the library with your attachments that you've added. Joint 1 is included by default. With the button *load attachment from file*, you can load attachments that are already in your library into the quick selection/preview. The attachment part is then displayed in the same way as the attachment shown in image 40.
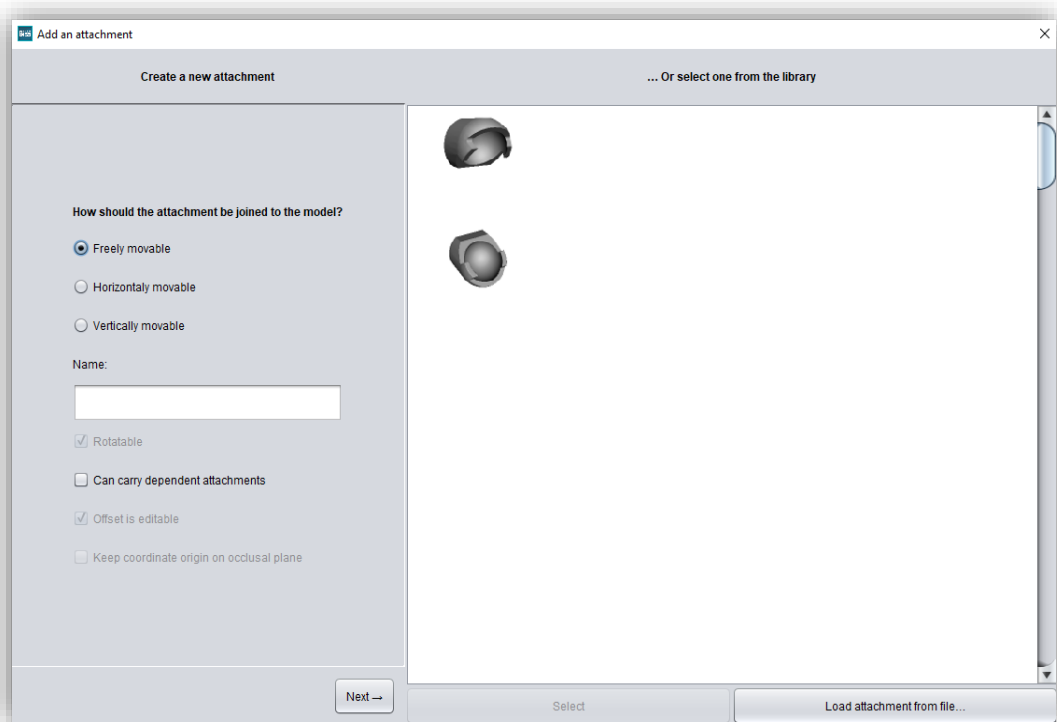
image 43: Add attachment.

5.7.10 Attachment Loader – Create new Attachment

With the already integrated attachment loader you can create a new attachment on the left side (image 40). All 3D models in the formats .STL, .PLY and .OBJ are allowed.

First you need to define the behavior or degrees of freedom of the attachment and assign a unique name. The following options are possible.

- ✓ Freely movable
- ✓ Horizontally movable
- ✓ Vertically movable
- ✓ Rotatable
- ✓ Can carry dependent attachments
- ✓ Adjust distance
- ✓ Keep coordinate origins on occlusal plane

The designations are self-explanatory, so no explanation is given here. When you have made your selection click *next*.

Now choose from the following options (image 41):

- ✓ Add to upper jaw
- ✓ Add to lower jaw
- ✓ Subtract from upper jaw
- ✓ Subtract from lower jaw

A user-defined attachment can specify a "positive" and a "negative" geometry for the upper and lower jaw respectively. The positive geometry is displayed in green and is added to the model when the attachments are assembled. The negative geometry is shown in red and is subtracted from the model after the positive ones are added.

When you have made your selection in image 41 a window opens, and you can select the corresponding 3D model file. It will now be displayed as a preview on the right side, image 42. If your attachment consists of several parts (e.g., for upper and lower jaw), repeat these steps.
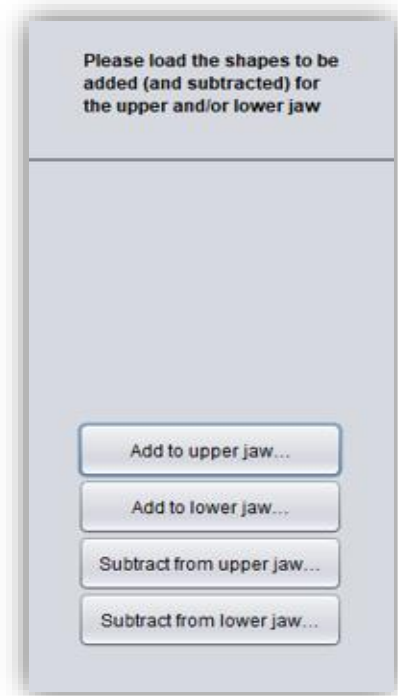
image 44: Load attachment.

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When you have loaded all the models, click the *next button*.
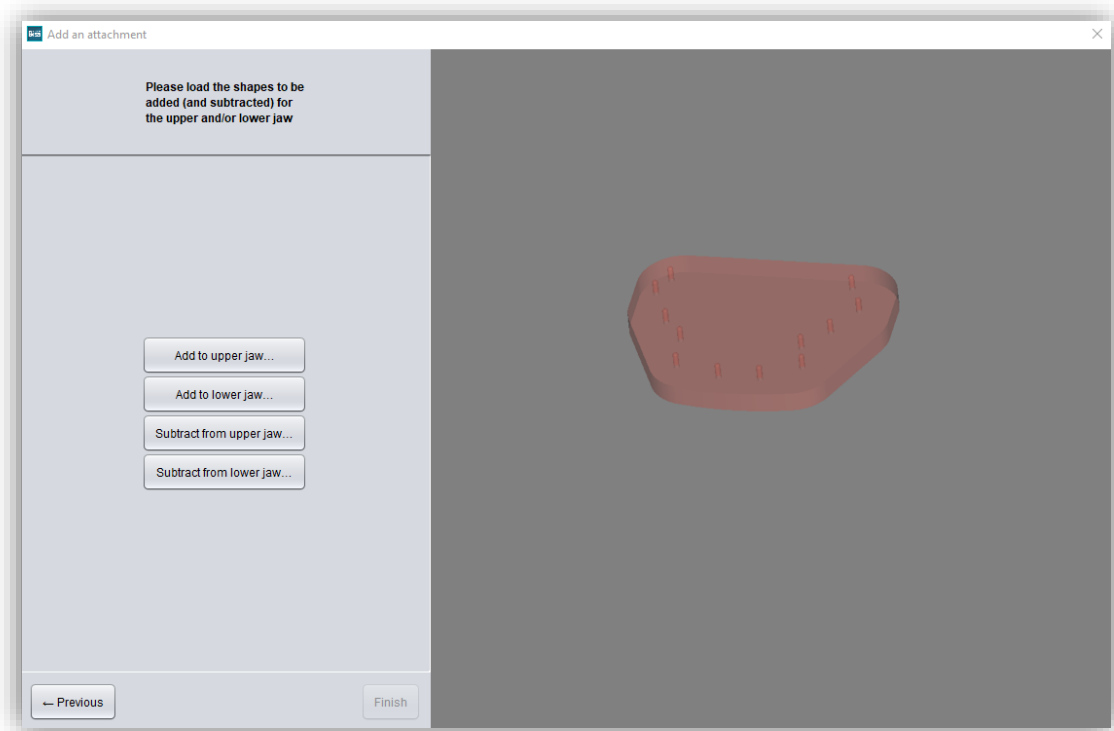
image 45: Preview.

Now you must select an anchor point for each loaded model and align the coordinate system correctly (image 43).

Set the anchoring point by clicking on the model. This will be displayed as a blue point with two black arrows in the preview. The arrow pointing upwards visualizes the surface normal, i.e., it is perpendicular to the surface to which the attachment is aligned in this example. The other arrow represents the forward direction. You can invert the direction of the surface normal by checking the *flip normal box*. You will then rotate the attachment upside down (or back) once. For rotatable attachments, as in this example, you can set the *angel of the front direction*. This will rotate the attachment.

Here's how to do it: Select an anchor point on your attachment. To do this, click on the model preview. The anchoring point is now displayed with a coordinate system. The arrow pointing up (or down) represents the surface normal, i.e., it is perpendicular to the surface. Reverse the direction, if necessary, by checking the *flip normal box*. The other arrow shows the direction to the front. You can adjust this direction using the angle settings *angel of front direction.* You can use the *+90°/-90°* buttons for quick alignment in space.

Accordingly, the setting for vertical attachments is called the *angle of the top direction*. Alignment is not necessary for attachments that can be positioned freely.
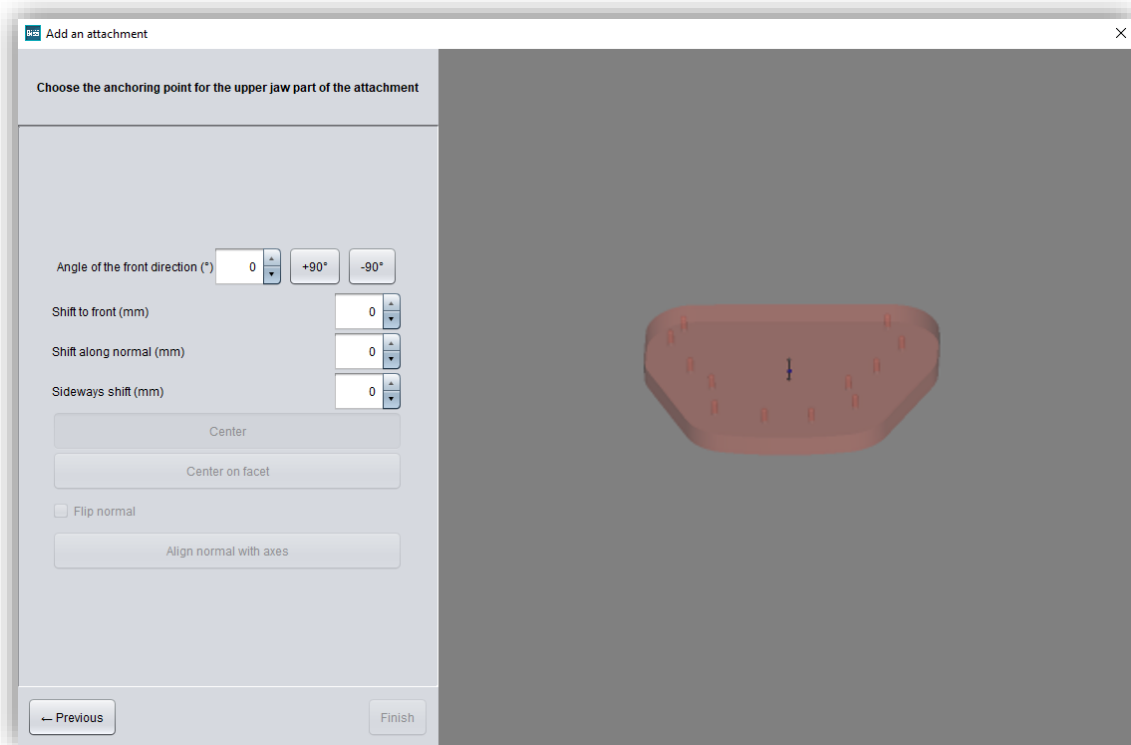
image 46: Select anchorage point.

Click **next** to assign a 3D model to the other jaw, for example, or click **finish**.

> **Note:** *For vertically attached attachments, align the attachment until the set normal is pointing vertically into the model. In the case of horizontally attached attachments, align the attachment until the set normal is pointing out of the base of the pedestal.*

> **Tip:** *If you want to try out the correct setting of the normals, then you don't have to add a new attachment every time, but you can call up the already created one again with "edit attachments..." in the context menu of the editor.*

Your attachment has now been loaded. You can position it on the model according to the degrees of freedom you specified earlier.

> **Tip:** *If you save the attachment, you just configured and add this to your library, then you can use the attachment directly the next time.*

The individually configured add-on part has now been inserted in the model view. You can now align it on the model according to the previously defined degrees of freedom, e.g., move it in the plane or rotate it.

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Click **>** when you have completed this editing step. The model is automatically assembled in the background.

✓ Right-click on the model and select "add attachment"

✓ Determine the degrees of freedom and assign a name

✓ Select remove/add upper/lower jaw

✓ Align the coordinate system

✓ Position the attachment on the model and join it together

5.7.11 Save Attachment to File

You can save added attachments for a later use and load those saved attachments e.g., directly from your library. This is how you save the attachment you just created:

Right-click on the attachment and select *save attachment to file*, image 44.

If you save the attachment in the *attachmentLib* folder, then it is added to the library. If you save it in the *attachments* folder, then it is

image 47: Right-click on the attachment to edit or save.

available via the quick right-click selection. The attachment should be saved in only one of the two folders, otherwise it will be displayed twice.

You can reach these folders via the following paths:

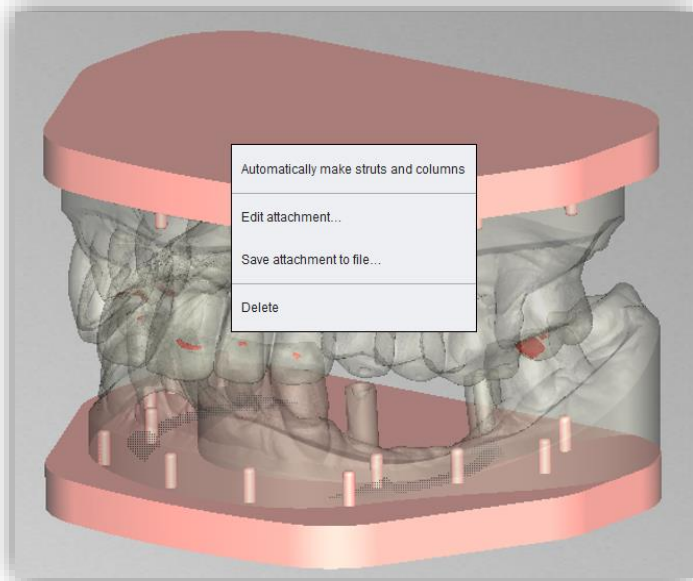✓ <Users>\.config\BISS\attachments
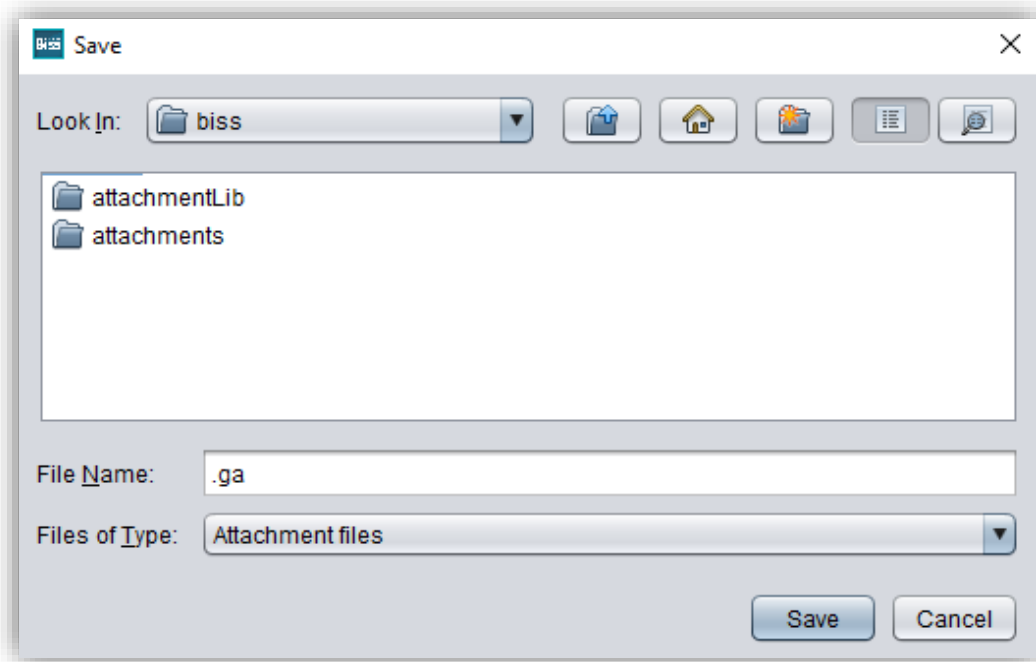
✓ <Users>\.config\BISS\attachmentLib

image 48: Save attachment to library.

5.8 Labels

You can add a label to your model to clearly identify it after printing. This can be a simple text or an image file in .BMP, .JPG, .PNG or .GIF format.

image 49: Selection label.

Right-click on the part of your model where you want to add the label and select either *new text label* or *new image label* (image 46). Note that the horizontal surfaces are no longer fully present after the model has been hollowed out and are therefore not suitable for labeling.

If you have selected new text label, then enter your text in the input line provided in the action window. If you have assigned a project name, this will be used by default. Of course, you can change the text. If you want to add an image label, then click on the image icon and select your image file (image 47).

The selected labels are displayed on the model in design mode (image 47). You can change the *properties* of the labels, such as size, angle, and depth of the sweep in the action window.

In the upper display field, there is a list of your added labels. You can select a label from this list and add it again by clicking on the other jaw of the model in the appropriate place or edit only its properties.

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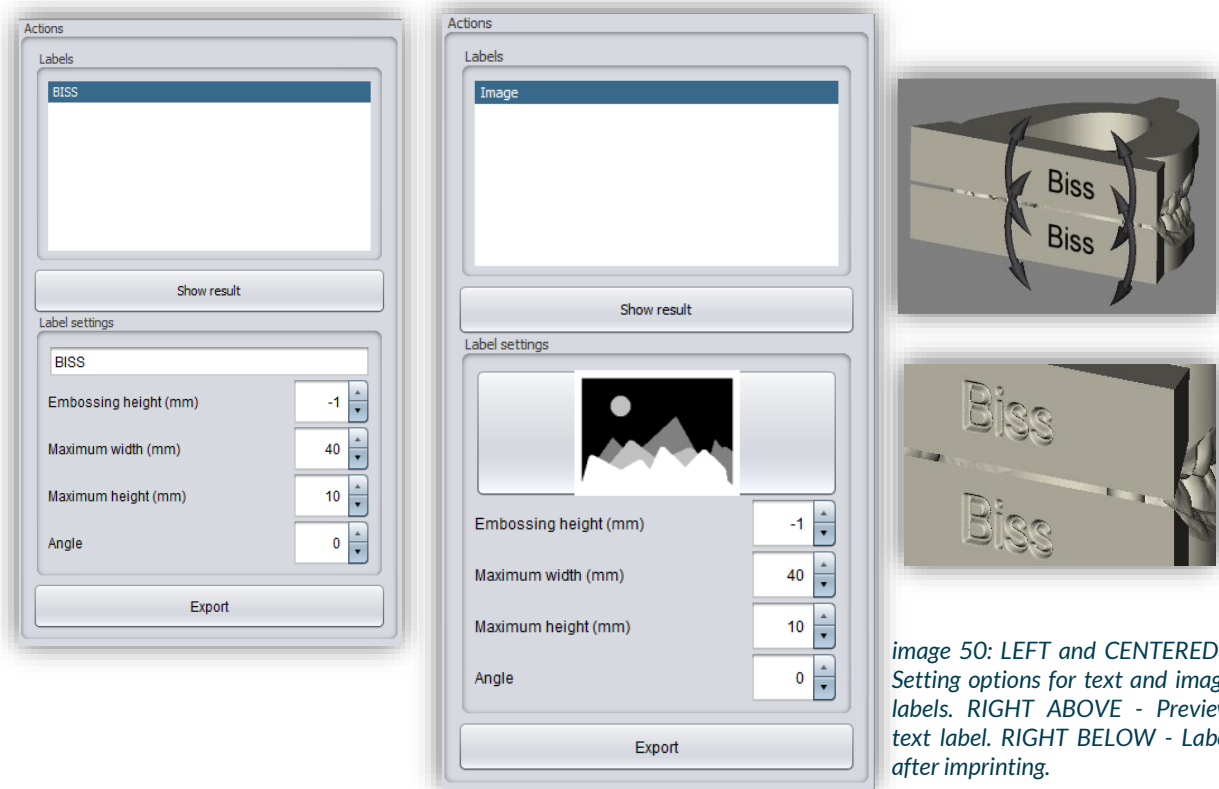
image 50: LEFT and CENTERED - Setting options for text and image labels. RIGHT ABOVE - Preview text label. RIGHT BELOW - Label after imprinting.

Click **show results** if you want your labels to be added to the 3D model. You can edit the labels at any time afterwards. Reactivate the editing mode by clicking on your model. In addition, the imprints are added automatically when you exit the work step.

If you have added one or more labels to your model and don't want to make any further changes, click **next step.**

✓ Make a right click on the model

✓ Select e.g. new text label

✓ Enter your text or select an image file

✓ Change the geometry

✓ Move the label to the right place

✓ Set more labels

5.9 Plugin "Implants": Add Implants

5.9.1 Adding a File to the Implant Library

To work with the Implant module, you need to add the required models for scanbodies and analogs to your implant library.

Variant 1:

Go to the BiSS installation directory and open the *implants* folder. There you can create subfolders as you like, e.g., sorted by manufacturers and diameters, and thus create your personal implant library. Each implant geometry should have its own folder. Your personal implant library appears on the left side of the action window under the folder *"system-wide"*.

Variant 2:

Open the folder *.config* in your user directory and create a folder *implants*. Here you can also create your personal implant library, as in variant 1. It appears in the BiSS action window under *"user-specific"*.

Add your required files for analogs and scanbodies to the desired location within the *implants* folder. Please create a separate folder for each implant geometry. This folder contains the file for the *scanbody*, the file for the *model analog* and, if necessary, a *symmetry.txt* file that describes the rotational symmetry of the analog.

When creating their library, also note that the software works with the file names. Make sure that the file names contain the terms *(...)_analog* and *(...)_scanbody*. Then the files will be recognized correctly.
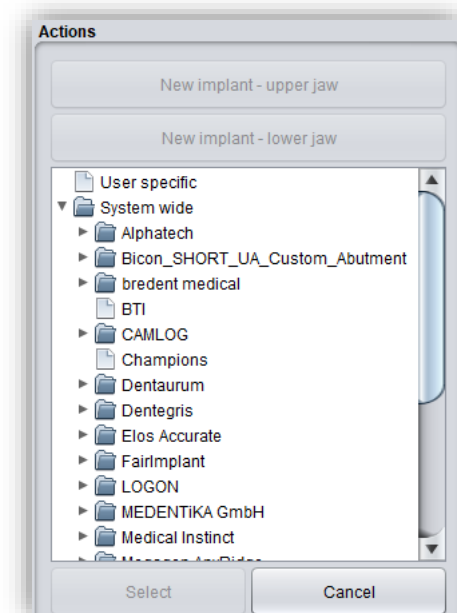
image 51: Implant library.

Note: Please note that these implant models in .BOB format can only be opened with BiSS. Any other use is not intended.

Once you have added the required files to your implant library, these implant models will be displayed in the implants editing step *after the next restart of BiSS*, see image 48.

5.9.2   Load Implant Scan

Load the implant reference scan at the same time as the two main scans at the very beginning of your project, see section *Open File* on page 24. BiSS automatically recognizes the implant scan by the file name as described in table 9.

If BiSS cannot retrieve this information in the file name, then the scan is loaded and assigned by a query.

> **Tip:** *If you do not have a reference scan at hand, you can load the normal implant scan as a reference scan and use the repair function to cut out the scan bodies.*

5.9.3 Align

The implant reference scan is aligned directly after loading in the *align* processing step, see chapter *Align Object*.

Often the loaded implant reference scans are located somewhere else in space than the corresponding main scan. A *pre-adjustmen*t is then required. You have three options for pre-adjustment:

With the mouse	Click the arrow cross to move, or the arrows to rotate. Click the model to rotate around the point.
One-Point-Alignment	Hold down CTRL and select two corresponding items on implant scan and main scan.
3-Point-Aligment	Hold down CTRL and select corresponding points on implant scan and main scan.

When you have made the rough pre-alignment with the mouse, you still must make the fine adjustment. To do this, click *automatic fine adjustment*.

The program automatically matches the scans to each other. When the scans are fine-adjusted, a control is automatically performed, i.e., the program controls itself (best-fit adjustment), for a perfect match. The loading bar shows you the progress.

5.9.4 Creating New Implants

When you arrive at the implants step, you will see a view with transparent main scans and the implant scan in the foreground, see image 49.

Now create new implants for the upper jaw or lower jaw, depending on the scans you have loaded.
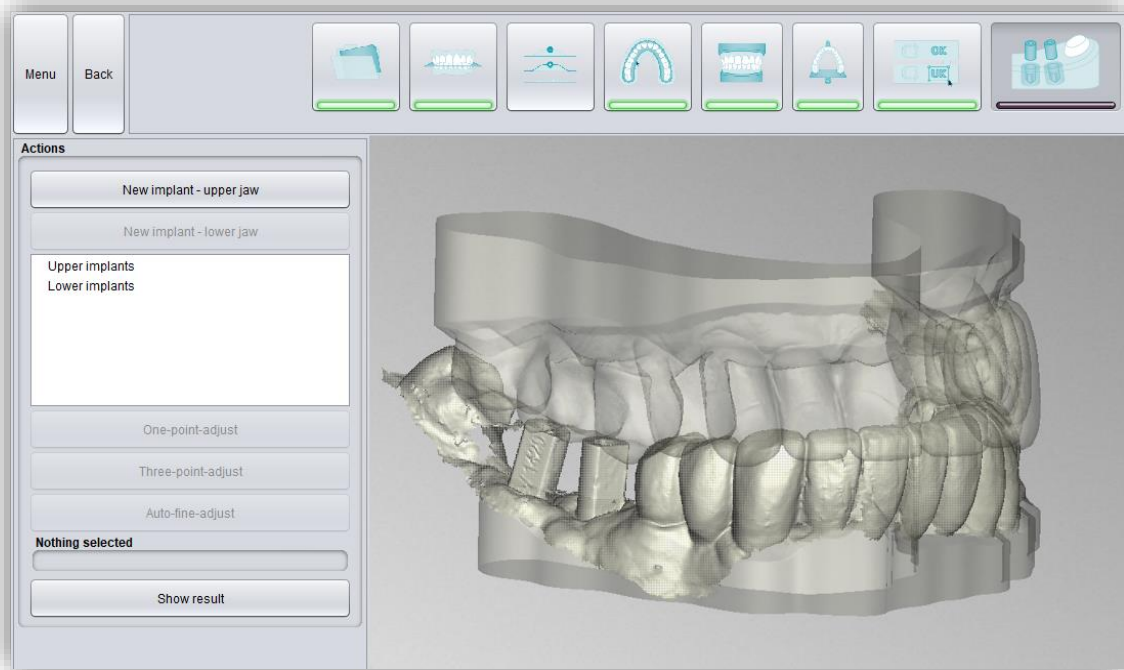
image 53: Insert implants machining step. The main scan is displayed transparently in the background. The implant reference scan appears in the foreground.

For example, click **new implant - lower jaw** if you have loaded a mandibular implant reference scan. Similarly, click **new implant - upper jaw** if you have loaded a maxillary implant scan. Alternatively, right-click the respective reference scan and select new implant from the context menu.
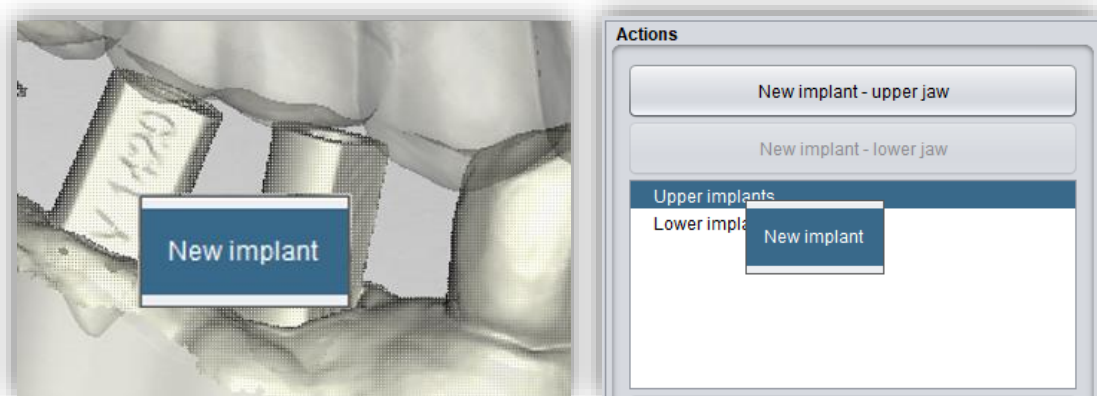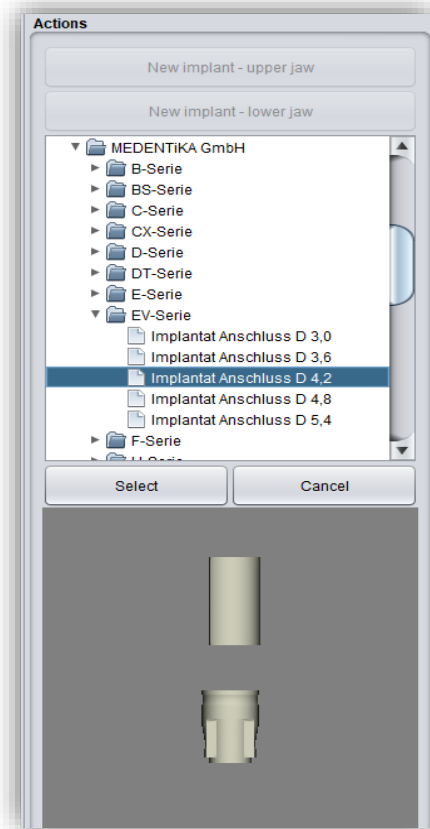

image 52: Add new implant from the context menu. LEFT - Right-click on the implant scan. RIGHT - Right-click on "implants below".

On the left-hand side in the action menu your previously loaded implant library will now open, see image 54. Select the desired implant model and confirm with **select**. The **cancel** button discards your selection.

image 54: Select the appropriate implant from your implant library. A preview is displayed at the bottom.

If you have selected an implant model, then you will see a preview of the scanbody. You will be prompted to select a point for **one-point alignment** on the preview and correspondingly on the reference scan. Follow the instruction and select the points. The one-point alignment will now take place automatically. It starts at that moment you select the second point.

The one-point alignment is usually sufficient. If desired, you can also perform a 3-point-alignment. Select the **3-point-alignment** button for this. You will now be prompted to select three points on the preview and correspondingly on the model.

For another implant, repeat the steps again: select new implant, select the appropriate implant from your library and perform the one/three-point alignment.

image 52 shows the result after inserting and adjusting an implant. As you can see, the analogs are protruding from the based model. When you exit the working step, the base height is automatically adjusted so the analogs no longer protrude from the model.

You can still make implant adjustments after the alignment by enlarging or wrapping the analog. You can also insert a hole towards the bottom.
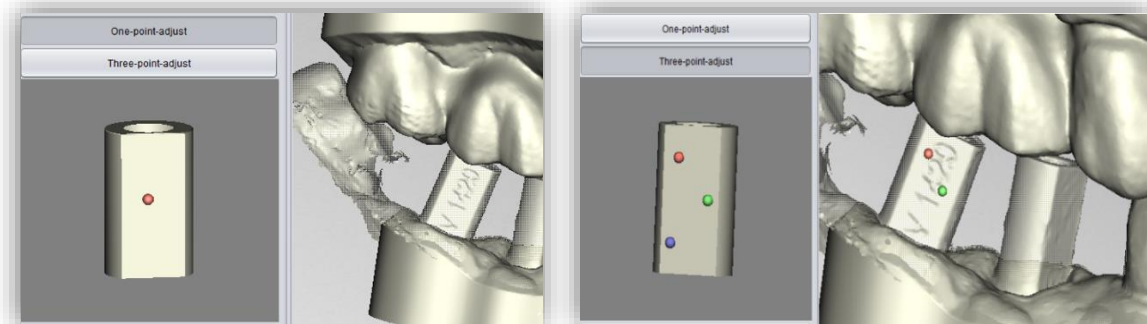
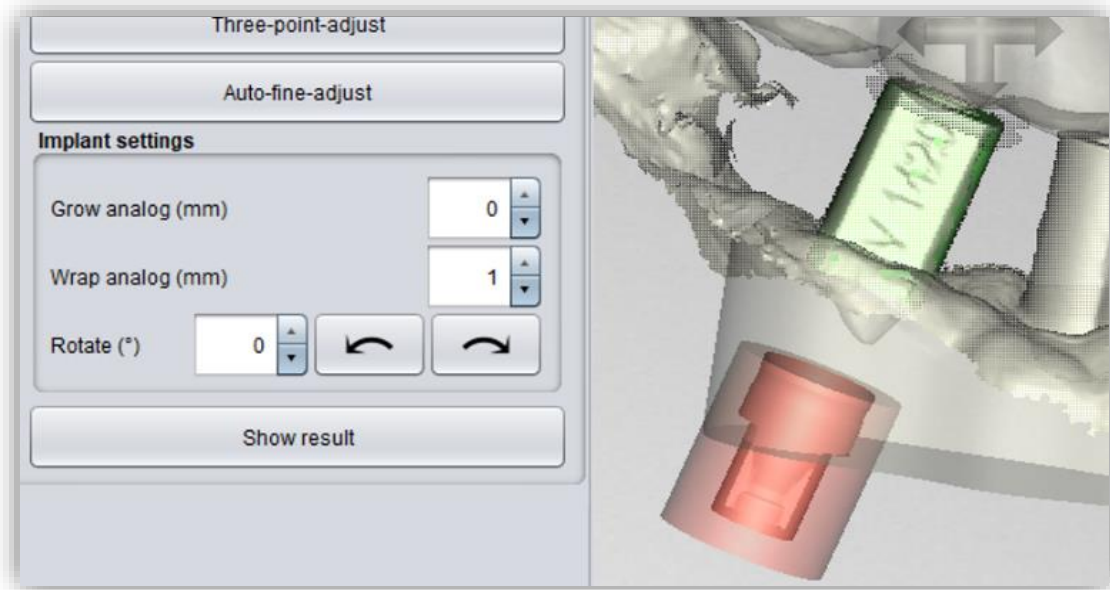image 55: LEFT - One-point-alignment. RIGHT - Three-point-alignment.

image 56: Display after one/three-point alignment and fine adjustment. The scanbody is shown in green. The analog is shown in red.

IMPLANT SETTING	DESCRIPTION
Grow analog (mm)	Increases the diameter of the analog. Values < 0 reduce the diameter. This value represents a correction value for 3D printing and must be tried out. (For the Anycubic Photon, this value is 0.05mm).
Wrap analog (mm)	Adjusts the distance of the wrap around the analog. By default, it is set to 1 mm. It represents a protective area that wraps around the analog. This means that no guides are cut off when adding gingival masks, for example.
Hole to bottom Ø (mm)	The hole down can be inserted to verify a properly analog seat and to allow air displacement during 3D printing.
Rotate (°)	This function rotates the analog. If we have an analog with a certain symmetry, then clicking on the arrows will rotate it according to the symmetry.

table 11: Description of the implant settings.

Clicking **show result** displays the result including base extension and analog punch-out.
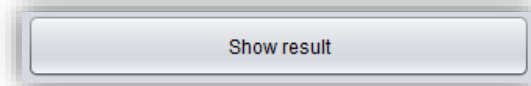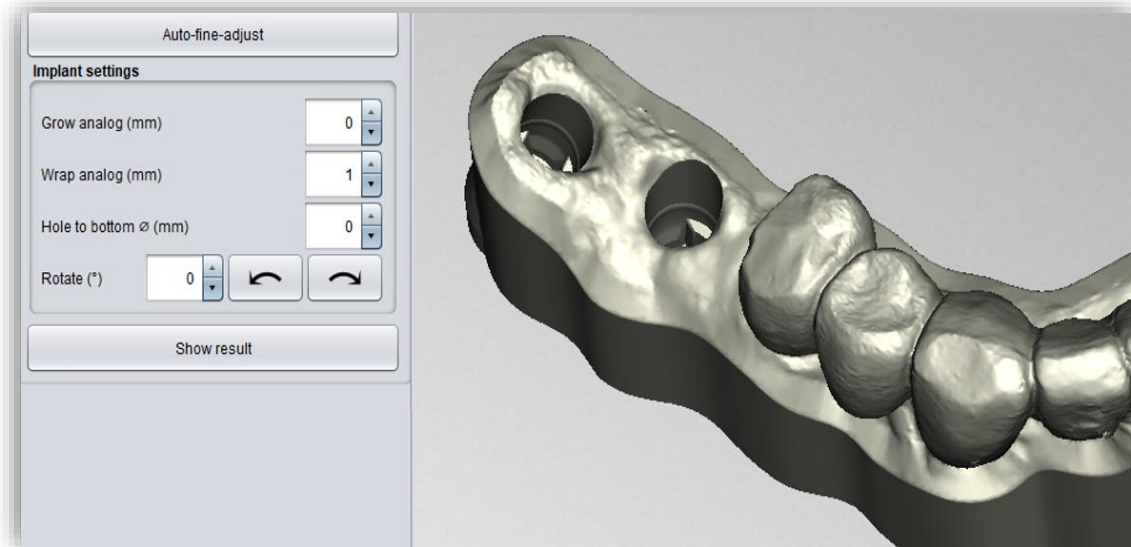

image 58: Show results.

image 57: Insert implants – show results.

By clicking **>**, the base height is automatically adjusted, and the implants are "punched out". **Removable stumps** and **gingival masks** can be defined afterwards, if desired.

Implant hole drillings and analog punch-outs are not yet immediately visible. They will be displayed when the loading of the implants is completed.

✓ Load the implant reference scan

✓ Match the implant reference scan with the main scan

✓ Create a new implant

✓ Perform the one-point alignment or the 3-point-aligment

✓ Perform the automatic fine adjustment

5.9.5   Note on the Reference Surface

Intraoral exposures are usually enlarged slightly. Although the implant models are aligned according to the reference surface, they are subsequently centered. This prevents inaccuracies due to scan expansion.

5.10 Define Stumps

In this machining step, you can define the stumps.

5.10.1 Automatic Import of Stumps

In BiSS there is the possibility to import stumps automatically if they have already been defined in a previous processing step, e.g., in the scan software.

BiSS checks whether there is a narrow, ring-shaped gap between two parts of a loaded scan and interprets this geometry as a stump. The gap will be closed and a stump with a matching edge curve will be created.

If the scan was dragged down the margins of the gap in a unified direction, creating a trench around the stump, then there will be an option later to use the exact shape of the trench as the stump boundary curve, rather than a control point-based spline as normal.

However, this only works if the mesh has not been changed too much in the trench after loading, which could happen, for example, by anatomical repair or addition of attachments.

5.10.2 Select Stumps Manually

First, individually select the stumps you want to create. Place your selection point approximately in the center of the corresponding stump (image 57), to define the center. When you are finished with your selection for the upper jaw, then click *proceed to lower jaw*. Make your selection here as well, if necessary. Even if you don't select any stumps for any of the jaws, you still can continue as normal. Now click on *edit stumps* (image 57).
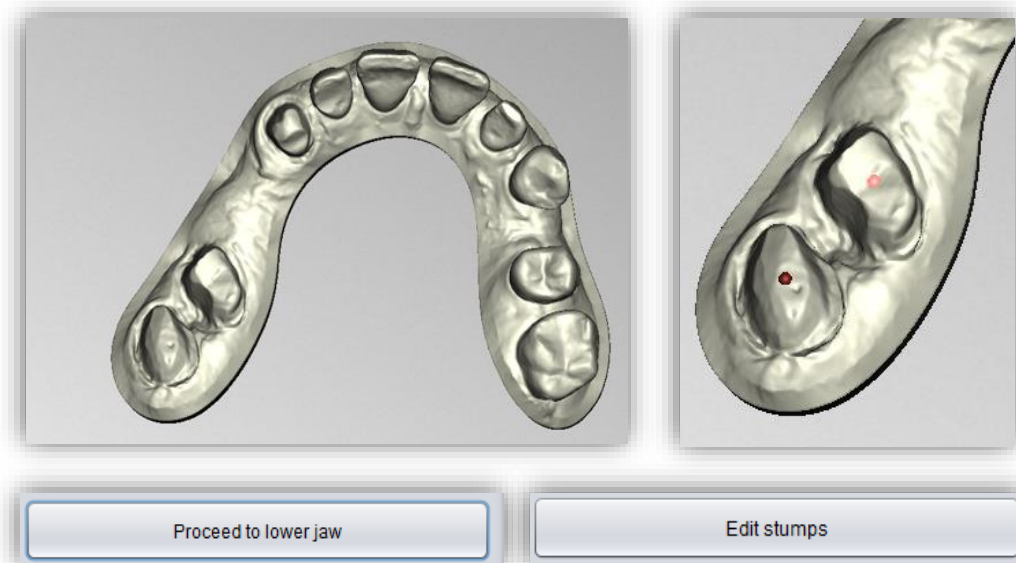

image 59: ABOVE - Selection of stumps. BELOW - ,Proceed to lower jaw' and 'edit stumps' after selecting the stumps.

5.10.3 Setting Stump Parameters

In the following step, the stumps are processed individually. In the **action window** (see image 58) you can view at the top a list of the selected stumps, divided into upper and lower jaws. Behind the magnifying glass icon is a preview function with which you can view a detailed preview for a single stump. It is suitable for fixing problems with this single stump without cutting out the other stumps as well. Below that, you can make individual

image 60: Action menu above.

settings for your system (depending on your printer (see image 59). You can save your individual presetting's.
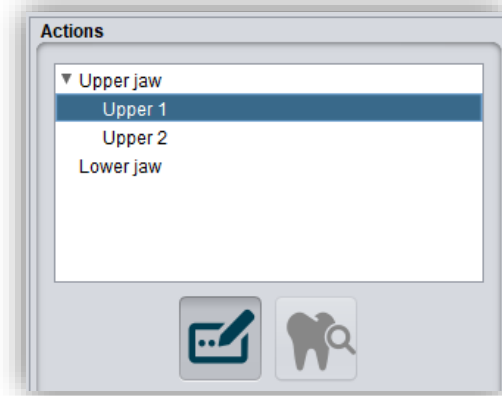
You can set the following values in the stump settings (image 59):

- ✓ Free stump
- ✓ Bars in hole
- ✓ Gap (mm)
- ✓ Bar height (mm)
- ✓ Bar width at base (mm)
- ✓ Bar width at top (mm)
- ✓ Bar count
- ✓ Minimum bar distance (mm)
- ✓ Horizontal resolution(mm)
- ✓ Vertical resolution (mm)
- ✓ Bottom hole diameter (mm)
- ✓ Minimum taper (mm)
- ✓ Groove Ø (mm)
- ✓ Groove-to-edge distance (mm)
- ✓ Bottom step height (mm)
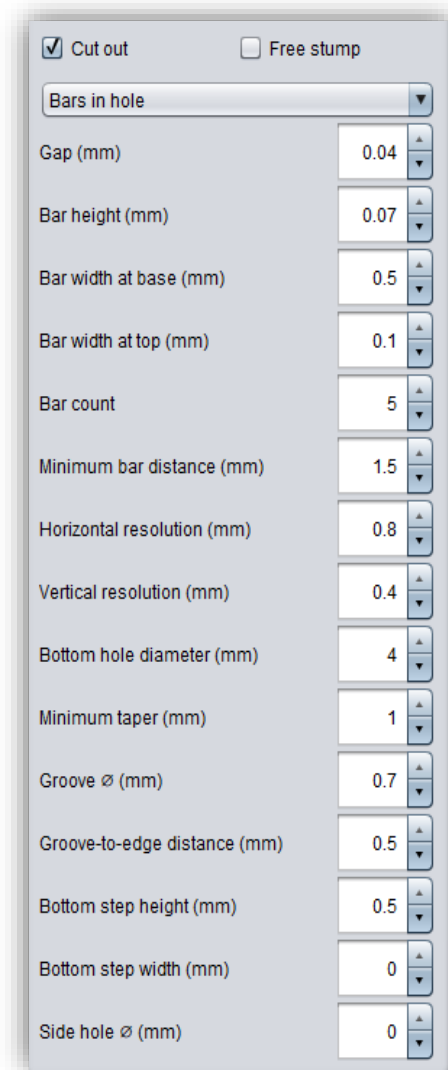- ✓ Bottom step width (mm)
- ✓ Side hole Ø (mm)

image 61: Settings for the removable stumps.

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First, you can select whether the friction bars are located on *the stump* or *in the hole* (image 60). Under *gap (mm)* you define the gap between the stump and the hole. This is necessary to compensate for the effects of light scattering in the edge areas and to maintain the accuracy of fit. The *bar*

image 62: bars on stump, bars in holes or erase tooth.

height, *bar width*, *bar counts*, and *minimum bar distance* can be defined. The specified bar minimum distance must of course match the number of bars and the stump diameter. Furthermore, you can specify a *horizontal* and *vertical resolution* of the model. This allows you to determine the resolution of the stump/hole wall. Small values i.e., a high resolution, are usually not necessary and lead to an increased memory consumption with longer calculation time. The *bottom hole diameter* can be specified and adapted to the conditions of the model. In addition, you can specify the *minimum taper* of the stump. The bottom hole has at least the specified diameter, unless this would make it larger than specified by the taper. Consequently, the angle of the stump is defined by these values. We recommend choosing a rather small angle for a good hold. You can also extend the taper into the negative range, so that the lower part of the stump becomes significantly wider than the upper i.e., an inverted conical stump. This offers the possibility of inserting a stump into the model from below as well. For better visualization of the stump margin, the tooth stump has a *groove* whose diameter and distance from the edge can also be defined at this point. The *bottom steps* compensate the technically induced widening of the first pressure layers. Set the height and width as your system requires. You can also define a *side hole* to check position and fit accuracy.
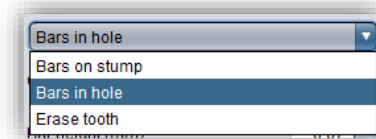
The *free* option allows you to expose the area around the die instead of a removable stump. There are a few special settings for this (Bild 66). With *Freeing radius (mm)* you define the radius with which the area around the spline is to be exposed. You can adjust the area to be freed with *downward or outward displacement (mm).*
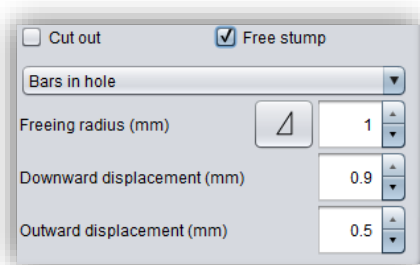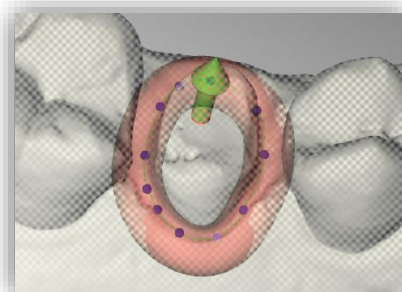

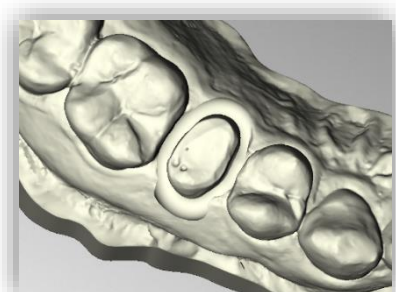*image 65: Action free stump*

Bild 65: freeing area.

Bild 65: freed area.

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5.10.4 Set Stump Margin

Start defining the first of your previously selected stumps. The view is already automatically zoomed into the area in concern. Place a *spline* around the stump by selecting the individual spline points. Close the spline. If there are no self-intersections after closing the margin, the curve turns green (image 61).
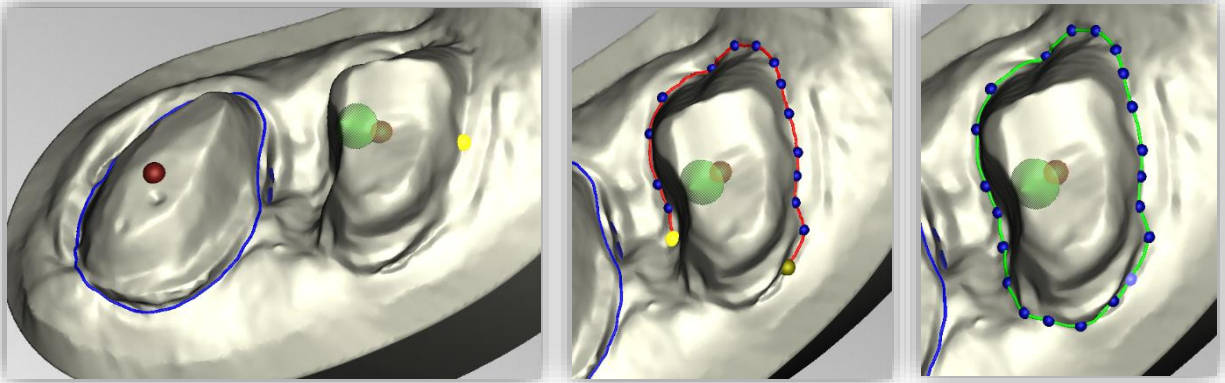

image 66: Definition of the spline around a removable stump. The line of the closed spline is displayed in green. The arrow visualizes the insertion direction. Click on "Next stump" to edit the next stump.

Hint: *In some cases, it may be helpful to rotate the model and view the back side for a better view of the stump margin. The curve points can also be set from this perspective.*

You can now continue with the other stumps by clicking **> next step**. Proceed just as described until you have defined all the stumps.

If you are not currently editing the spline but are instead rotating or moving the view or changing stump settings, the jaw is displayed transparently allowing you to see a rough preview of the stumps in blue (image 62). If you move the direction of the arrow shown in green with your mouse, the orientation of the stump changes accordingly. For a vertical orientation, simply right click on the stump and select *reset insertion direction*. The stump can also be *deleted* at this point (image 62).
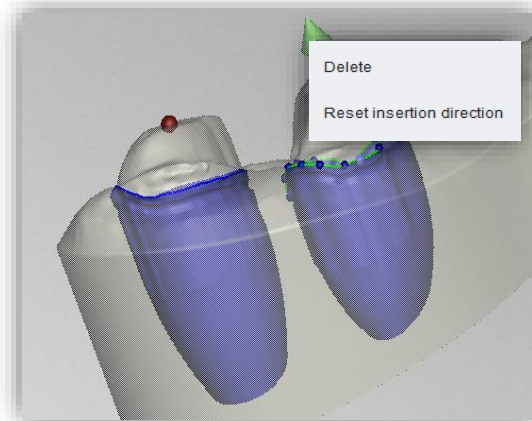

image 67: Reset the insertion direction of the stump or delete the stump. Preview of the removable stump.

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When you are done defining all the stumps, click **> cut out all stumps** (image 64) at the top right of the program panel This process may take a short moment. If you receive an error message, correct the corresponding values or points in the respective spline and cut out the stumps again.
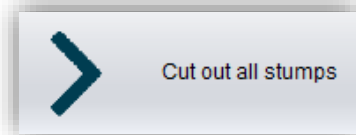
image 68: Cut out all stumps.

The finished model with stumps is now displayed (image 65). In this view, you can hide the individual jaw matrices and the stumps separately or together to check your result (image 63).
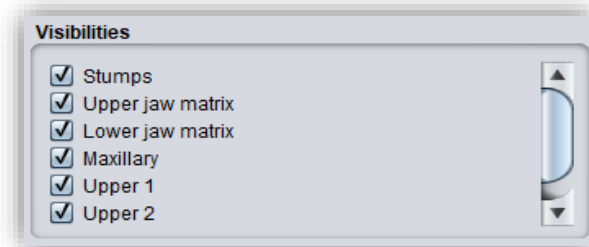

image 69: Selection of visibilities after generation of removable stumps.

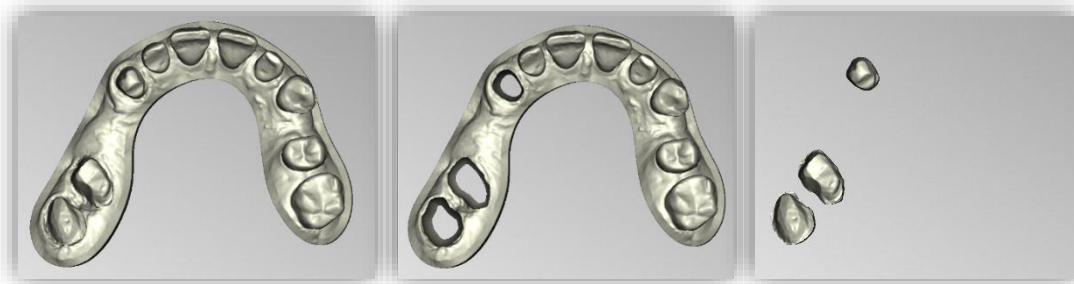When you are done, click **>** or add segments. You can add more stumps at a later stage.

image 70: Upper jaw with stumps, upper jaw without stumps, stumps single.

- ✓ Select stumps
- ✓ Enter stump parameters or select profile
- ✓ Place the spline around each die individually
- ✓ Correct the insertion direction if necessary
- ✓ Click „> cut out all stumps"

5.10.5 Define Segments

You can also define segments in the " stumps" editing step. If you want to define segments, click on the **define segments...** button in the action window (image 66). A new window opens, see image 68.
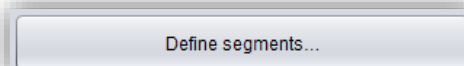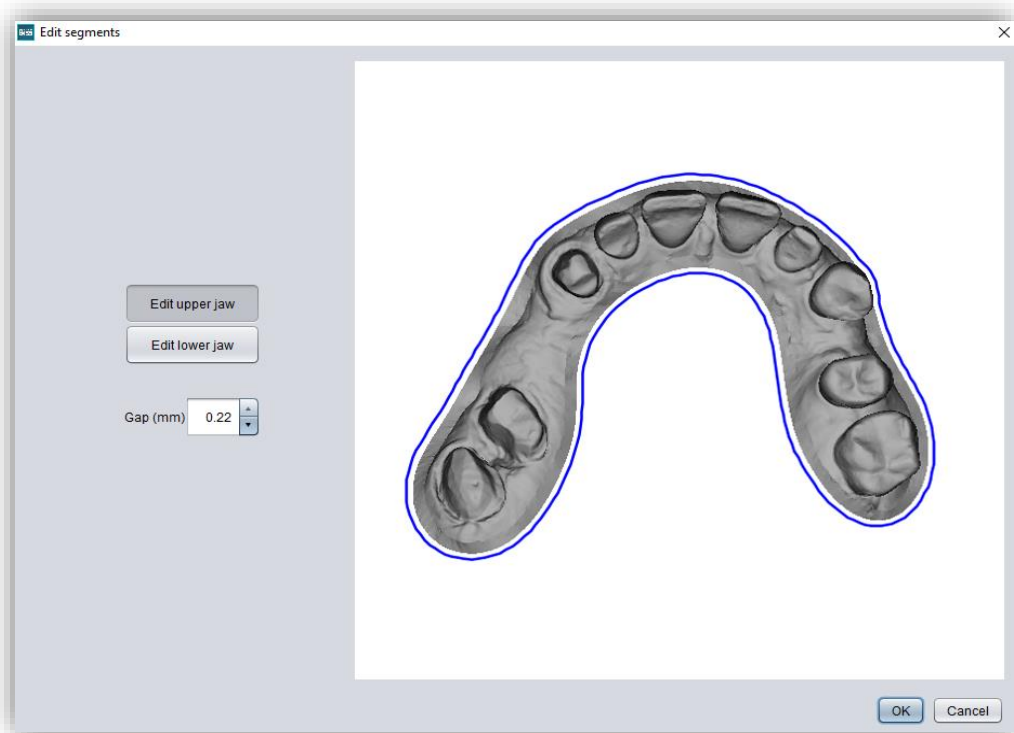

image 71: Define segments.

image 72: Window edit segments.

You can define upper jaw segments and lower jaw segments separately. In this case, we define segments for the lower jaw. You can set the gap between the segments. To define a segment, click on the blue border and set the starting point for the section. Click on the blue border a second time to set the end point, see image 69. With a right click on the created line, you can insert additional points to create an arc section. Proceed in the same way for further cuts. Confirm the selection with "OK".

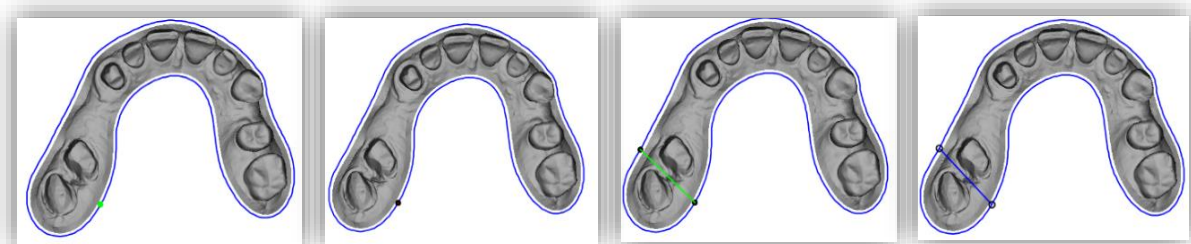It doesn't matter whether you make the cut lines before or after the stump definition.

*image 73: Defining the segments with several cut lines.*

> **Note:** *The segments are not displayed in the preview of this editing step. However, they are still present.*

When you are done defining the segments, then click **>** or define your stumps.
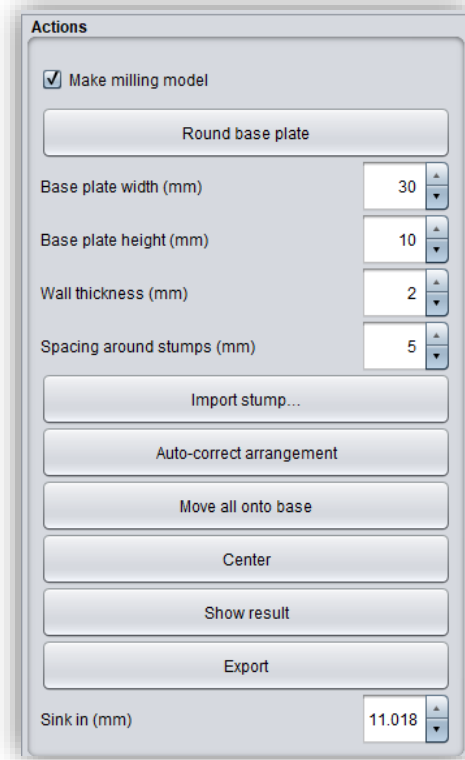
5.11 Module MILLING: Design a Milling Model

If you already have the stumps and implants defined in your model, then generating the milling model is a breeze. The base plate is automatically generated, and the previously defined stumps and implants are automatically placed, see image 70.
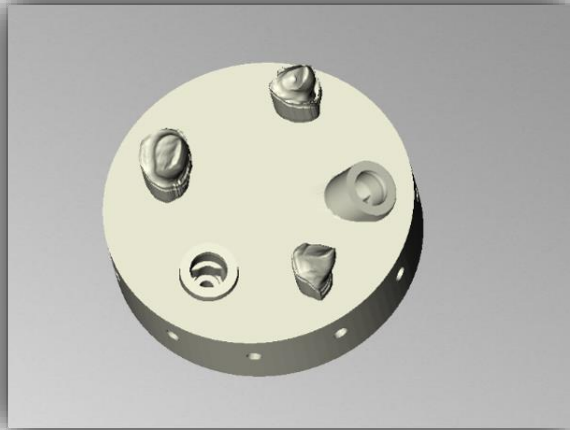
image 75: The milling model is generated automatically. The geometry of the base plate and the position and alignment of the stumps and implants can be corrected.

image 74: Setting milling model.

Various settings can be made in the action panel. You first must select whether a milling model should be generated. Now you are welcome to *import stumps*, which will be placed on the milling model with the orientation in which they were previously saved.

You can choose between a *round base plate and a square base plate*. The *width* (i.e., the diameter or edge length) and the *base plate height* can be set. The base plate is automatically hollowed out. Use *wall thickness (mm)* to set its thickness according to your preferences.

In addition, an initial presetting of the distance around the stumps is possible for the function *auto-correct arrangement*. Further automatic corrections are possible via the *move all onto base* and *center buttons*. You can also move the stumps manually, even all stumps together as a group by holding down the CTRL key. The rotatability of the stumps is disabled by default, but this function can be activated in the menu.

You use the parameter *sink in (mm)* to determine how deep the stumps are sunk into the base plate. The sinking can also be done comfortably with the mouse when the milling model is viewed from the side. This point only becomes visible when you have selected a stump.

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You can now also label the base of the milling model in the next step. You can proceed in the same way as in the other labeling tools.

Once you have designed the milling model according to your requirements and preferences, you can export it directly from this step. For this purpose, first click *show results*. The individual components of the milling model are now combined into a single model. To export them for 3D printing, click the *export button*. You can now select a suitable storage location for your model.

When you are finished with the milling model, click *next step*.

✓ Correct arrangement automatically or manually
✓ Display results
✓ Export milling model

5.12 Creating Gingival Masks

In this processing step, you can define removable gingiva masks. image 72 shows the action window with the possible actions and settings. You can create new gingiva masks, set gap parameters, and display results. Gingiva masks are suitable for both implant models and models with removable stumps.

5.12.1 Edit New Gingiva Mask

To add a gingiva mask, click the *new gingiva mask - upper jaw* or *new gingiva mask - lower jaw* button.

Alternatively, you can go via the *context menu*: right-click on the model and select *new gingival mask*. Or right-click on *gingiva masks* at the top/bottom of the actions window and select *new gingiva mask* as well.
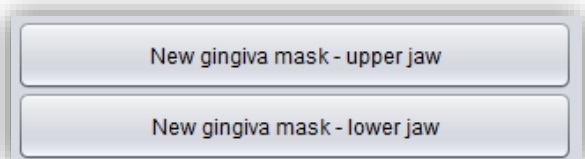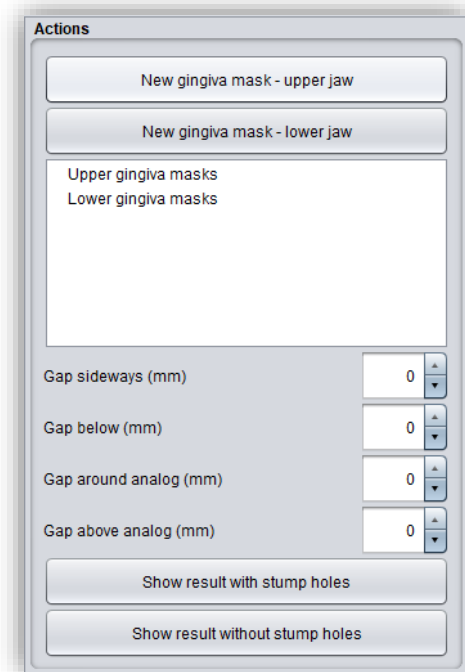

image 76: Action window - create gingival masks.

Then select the start and end points by clicking on the 3D model, see image 75. A preview is generated which shows you a masked area. A gingiva mask will be created for this area.

image 77: Select "new gingiva mask - lower jaw" or "new gingiva mask – upper jaw".

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image 79: Create a new gingival mask via the context menu.

You can edit this area by using the displayed arrows. You can also move the start and end points laterally and enlarge the cutout for the gingival mask. However, you can move the end points up and down to make the gingival mask flatter or deeper.
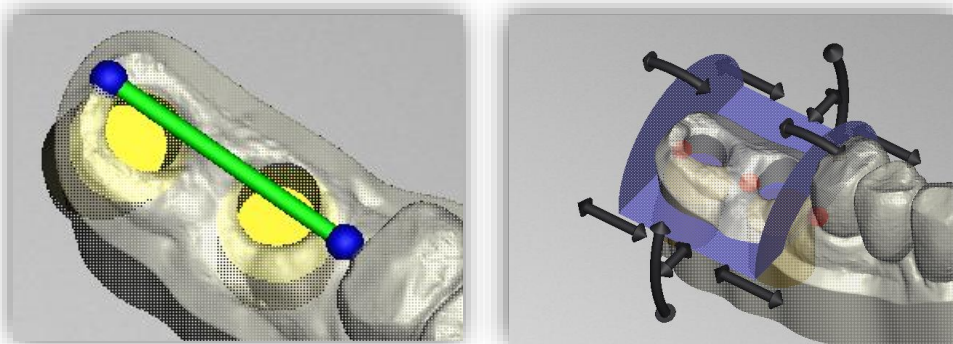

image 78: LEFT - Select the start and end points. RIGHT - Preview - The masked area can be edited with the arrows.

Note: *If you drag the gingival mask into the area of the analog on implant models, a small protective area is automatically created which will not be cut away, allowing the analog to be inserted sensibly.*

If you want a preview of the result as in image 76, click ***show result with/without stump holes***. Even if, as in the example, you don't have any stump holes.
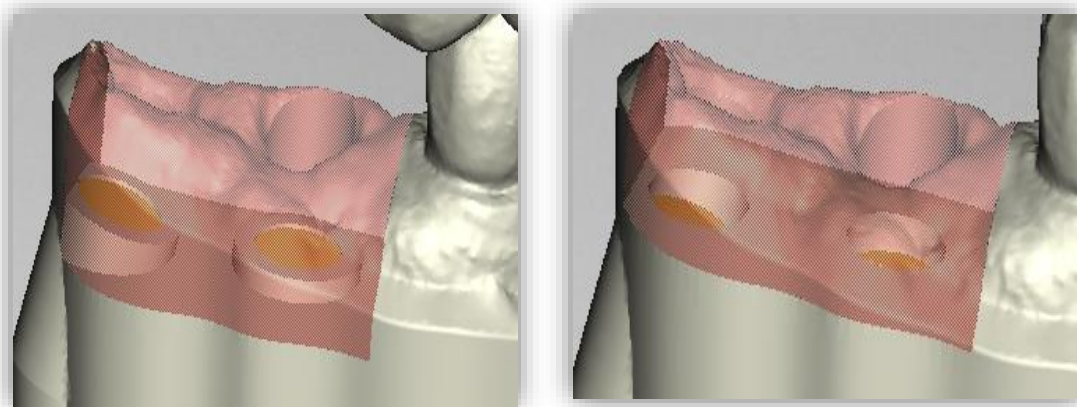

image 80: Deep gingival mask with protective area around the analog. Right: Flat gingival mask. Does not touch the area of the analog.

5.12.2 Show Result

If you have created removable stumps for your model, you can display the result preview with and without stumps. If you click on *show result with stumps*, the gingival mask is created and the result is displayed, see image 77. If you click on *show result without stumps*, the gingival mask is created, and the result is displayed as shown in image 77.
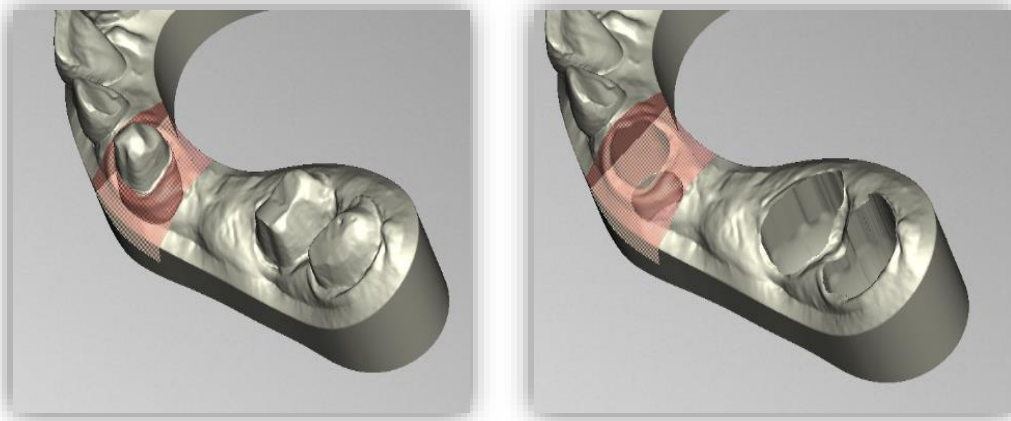

image 81: LEFT - Show results without stump holes. RIGHT - Show results with stump holes.

5.12.3 Setting Gap Parameters

Often, the 3D printed gingival mask is slightly larger than your model, because of technical reasons. To compensate this feature and still maintain accuracy of fit, you can set parameters for different *gaps*:

FEATURE	DISCRIPTION
Gap sideways (mm)	Creates a gap at the side of the gingival mask. The mask is usually slightly larger when printed. This can be compensated by a lateral gap.
Gap below (mm)	Creates a gap towards the bottom.
Gap around analog (mm)	Creates a gap around an analog.
Gap above analog (mm)	Creates a gap above the analog. The mask is usually slightly larger when printed. This can be compensated by a gap above the analog.

table 12: Description – Gap for gingival masks.

5.12.4 Multiple Gingival Masks

You can create several gingival masks for one jaw. This works analog to the description above. If two gingiva masks overlap, only one part is created at the end, which is also printed as a whole part later.

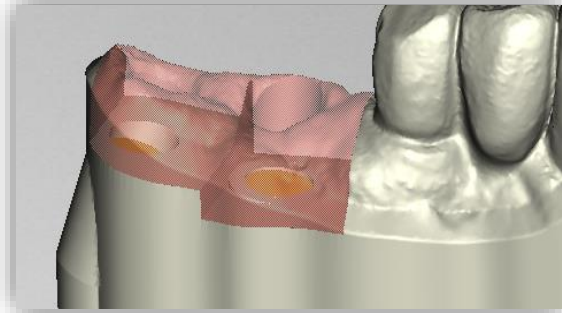When you have finished creating the gingival masks, click **>**.

image 82: Two gingival masks are joined together to form one part.

✓ Click, for example, on "new gingival mask - mandible"

✓ Set the start and end points

✓ Enlarge, move and rotate the walls in the preview

✓ Display the result

✓ Add further gingival masks if necessary

5.13 Hollow Out

Hollowing out completely generated objects enables material-saving further processing in 3D printing. *Escape holes* allow excess material to flow off in 3D printing and avoid production-related deviations from the model. You can subsequently *cut off the bottom from the upper and lower jaw.*

In the default setting, the model is automatically hollowed out and escape holes are created. You can define the *wall thickness* of the model after hollowing. You can also set the *diameter* of the escape
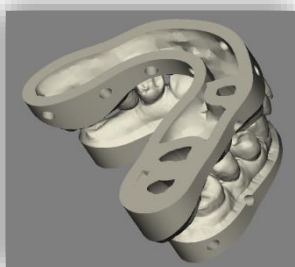

image 83: Action menu – hollowing.

holes, the *distance* between the escape holes and the *height* i.e., the position on the model base. If these two options are not desired, you can *skip hollowing* and also skip creating escape holes (image 79).
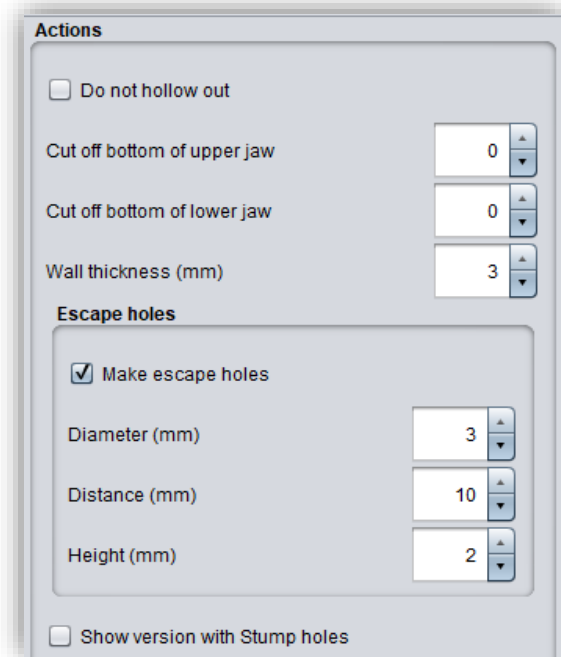

image 84: Preview after hollowing.

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You can also select whether the version is to be displayed with or without stump holes. If it is displayed without stump holes, you still have the option here to *define segments* subsequently.

Once you have made all the settings you want, click **>**.

✓ The model is automatically hollowed out and provided with drain holes

✓ If desired, select "skip hollowing" or deselect "create escape holes"

✓ Change the diameter, spacing and height

5.14 Save the Job

Now you have the possibility to *save* the whole project in a project file .GBS or to *export 3D models* and all components as .STL, .OBJ or .PLY for further processing. In addition, you can also export individual intermediate states, *export the model aligned*, start directly with a *new project,* or return to the start screen and *choose another application* (image 81).

5.14.1 Save BiSS-Project

Select *save* to save the project file .GBS. If you have already saved the project or no project name is set, select *save as*.

5.14.2 Send BiSS-Data to PUZZLE

If you have purchased the PUZZLE application, then you can send the data directly to PUZZLE so that they are placed fully automatically. To do this, it is necessary to set the storage path beforehand (see Background automatic).

5.14.3 Export 3D-Models

Use the *export 3D models button* to save your models in printable .STL, .OBJ or PLY format. Each component of the model is saved as a separate file. These are usually the lower jaw, upper jaw, gingival masks, and removable stumps.

5.14.4 Export Aligned

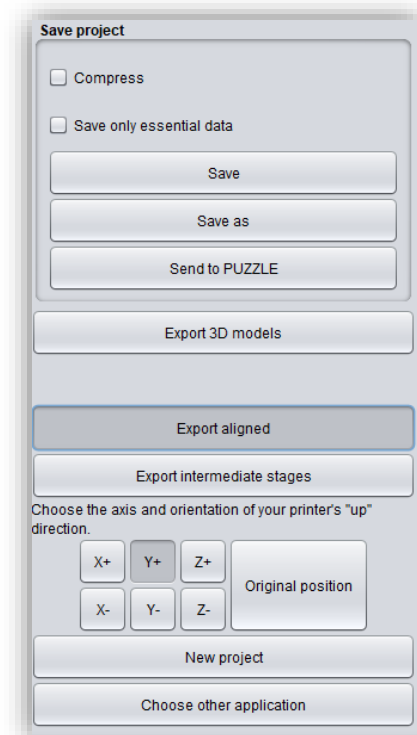You can export the data in *original position*, or already aligned for 3D printing.

image 85: Selection for saving and exporting.

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Therefore, activate the *export aligned button* and select the axis and orientation that points upwards for your printer. If *export aligned* is not activated, the default is to export in the coordinate system used by BiSS, i.e., the set occlusal plane is the x-z plane. Export in *original position* means that the data is exported in the same coordinate system in which the main scans were originally loaded.

5.14.5 Export Intermediate Stages

To export an intermediate status, select the processing statuses that you want to export and then click *export* (image 82).

Stage	Upper jaw	Lower jaw
Original	☐	☐
Extra components	☐	☐
Implant scan	☐	☐
Manually repaired	☐	☐
Fringe cut off	☐	☐
Holes closed	☐	☐
Base added	☐	☐
Attachments assembled	☐	☐
Labeled	☐	☐
With implantats	☐	☐
Gingiva masks subtracted	☐	☐
Segmented	☐	☐
Hollowed out	☐	☐
With escape holes	☐	☐
Simplified	☐	☐
Stumps removed	☐	☐
Gingiva masks subtracted (Stumps)	☐	☐
Segmented (stumps)	☐	☐
Hollowed out (Stumps)	☐	☐
With escape holes (Stumps)	☐	☐
Simplified (Stumps)	☐	☐

Export

image 86: Export intermediate state. Select the desired intermediate levels and click "export".

The processing statuses and their sequence correspond to the BiSS workflow and are self-explanatory in terms of terminology. Therefore, a description of the individual stages is unnecessary at this point.

5.14.6 New Project

Clicking on *new project* opens a new project. The old project is closed if it was saved before. If it has not been saved yet, then there is a hint about it.

5.14.7 Choose Other Application

Return to the start screen and select another BiSS application.

5.14.8 Short Excursion to the Coordinate System in BiSS

If you look at your denture from the front, the positive y-axis points upwards, the positive x-axis points to the right and the positive z-axis points to the front, see image 83.
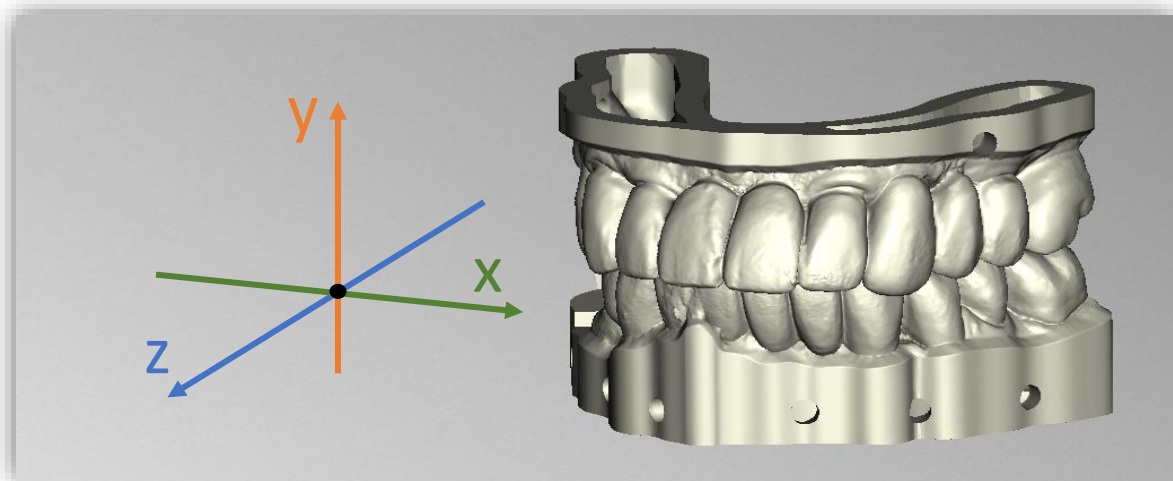

image 87: The orientation of the coordinate system used in BiSS.

6 Software-Updates

6.1.1 Update-Availability

You will automatically receive a message when a new update is available for your software.

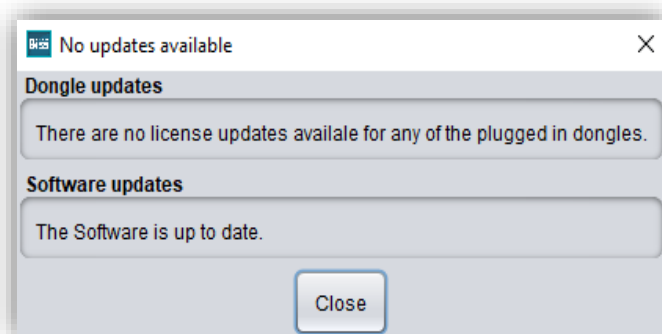Alternatively, you can click the *check for updates* button via Menu - Settings - Updates.

image 88: No software-update available.

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If no update is available, the message shown in image 84 appears.

6.1.2   Install Update

Click on the provided link and download the new software version. Install the software in the desired directory. Manually added implant libraries should be preserved.

7   Dongle-Updates

In some cases, a dongle update is required:

- ✓   Your monthly license has expired, and you would like to extend it
- ✓   You have purchased another BiSS module, e.g., Premium Business
- ✓   You have purchased another workstation for your multi-user network license
- ✓   For more extensive updates, a dongle update may also be required so that you can benefit fully from the BiSS updates.

7.1   How to know that a dongle update is required?

You will be notified when a dongle update is ready for you:

7.1.1   At Startup

You will automatically receive a message when you start BiSS if there is a new update available for your dongle. The prerequisite is that your dongle has not yet expired.

7.1.2   Via the Menu

Go to the menu and then via settings to the updates tab. Click on the *check for updates button*. If there is an existing license update for your dongle, you will see it.

7.1.3   Execute the UpdateClient.exe

In the installation directory of BiSS is the *UpdateClient.exe*. If BiSS does not start anymore, because your license has expired, you can start the update client this way, for updating your dongle or the software.

7.2   Execute Dongle-Update

Make sure that your BiSS dongle is plugged into the PC from which you will perform the dongle update.

Start the update client and follow the instructions.

8 Warning and Notes - Disclaimer

The software does not create dental prostheses and is only suitable for the further processing of digitally produced components in dentistry and orthodontics. Further use outside dentistry and orthodontics is not suitable.

The software leaves behind temporary files if it has not been terminated properly, e.g., in the event of a system crash. The user must then manually delete these files from his temporary files folder to free up disk space.