Ortho Simulation

Version 1.4.0
June 2024

Medit Ortho Simulation

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Overview and General Information

Overview

Medit Ortho Simulation is an app for simulating the trajectory of teeth movement in an orthodontic treatment. It generates animated treatment simulations based on the details provided in the treatment scenario (missing teeth, planned prosthesis, or extraction). Additionally, the app offers a step for advanced adjustments, where each tooth can be individually repositioned if needed. User-created simulations can be used as visual aids during patient consultations, facilitating more comprehensive discussions, or for detailed examination of the proposed treatment.

Intended Use and Disclaimer

Medit Ortho Simulation was not developed for medical or clinical use. As such, it cannot be used for the following purposes:

- diagnosing, treating, mitigating, or preventing diseases/injuries/disorders.
- inspecting, replacing, or transforming a structure or function.

The software is meant to be used as a visual aid during patient consultations or as a tool for analysis tasks. The generated simulation and analysis results should not be used as the sole source of healthcare guidance.

Medit does not take responsibility for any miscommunication or improper use of the software and is not liable to either the user or the patient for any decisions or actions taken in reliance on the information given by the software. The user assumes full responsibility for the following:

- generated results and their further interpretation and communication to the patient
- informing the patients that the results produced by the software may not be precise or reliable
- actions and treatment decisions based on the generated results

System Requirements

Windows

CPU	Intel Core i5 2.6 GHz or higher
RAM	16 GB or higher
Graphics	NVIDIA GeForce GTX 1060 (2 GB) or higher
OS	Windows 10 64-bit, Windows 11 64-bit

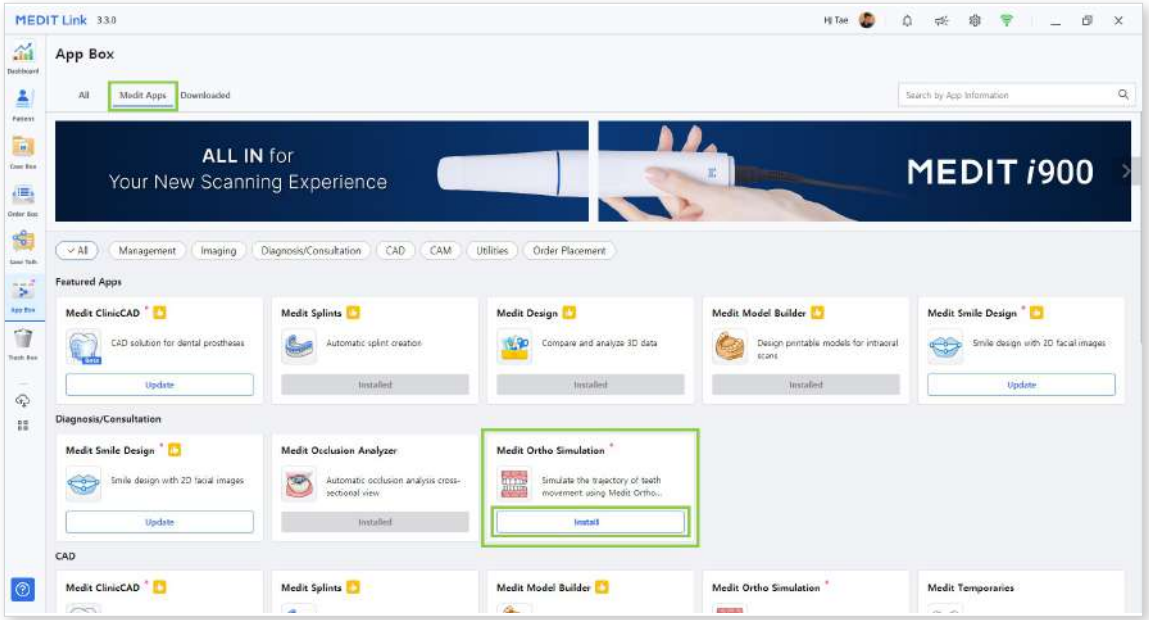
macOS

CPU	8-core or higher
RAM	16 GB or higher
Chip	M1/M2 or higher
OS	Monterey 12

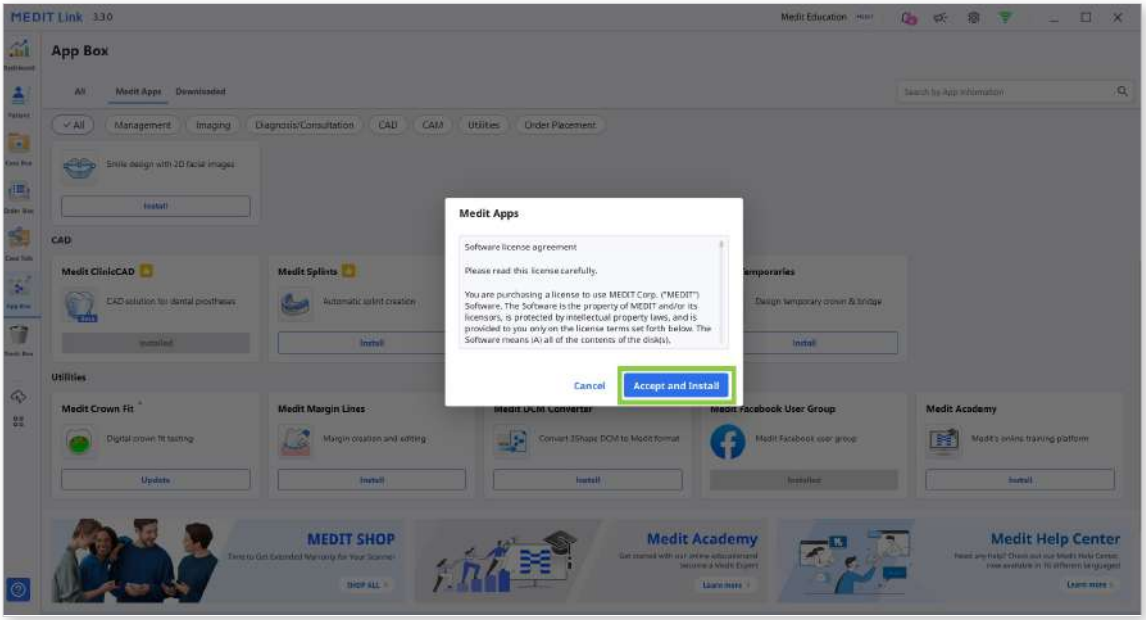
Installation Guide

① Log into your Medit Link account and go to the App Box on the left-hand menu.

② In the Medit Apps tab, find the Medit Ortho Simulation app and click "Install."



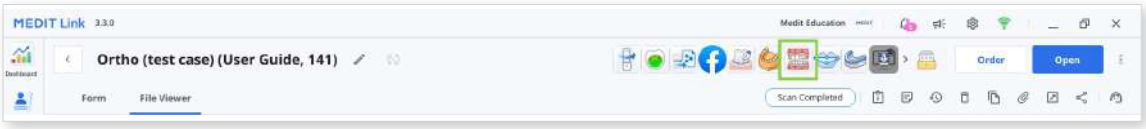
③ Read the Software License Agreement and confirm app installation by clicking "Accept and Install."



④ The app will be downloaded and installed automatically. It may take several minutes to finish the installation process.

> ⚠ Do not turn off the PC or close Medit Link during the installation process.

⑤ Once the app is installed, you can run it from any case in Medit Link by clicking the app icon in the top right corner of the Case Detail window.



Data Management

Preparing 3D Data

There are several ways to gather 3D data that will be used for the project in Medit Ortho Simulation.

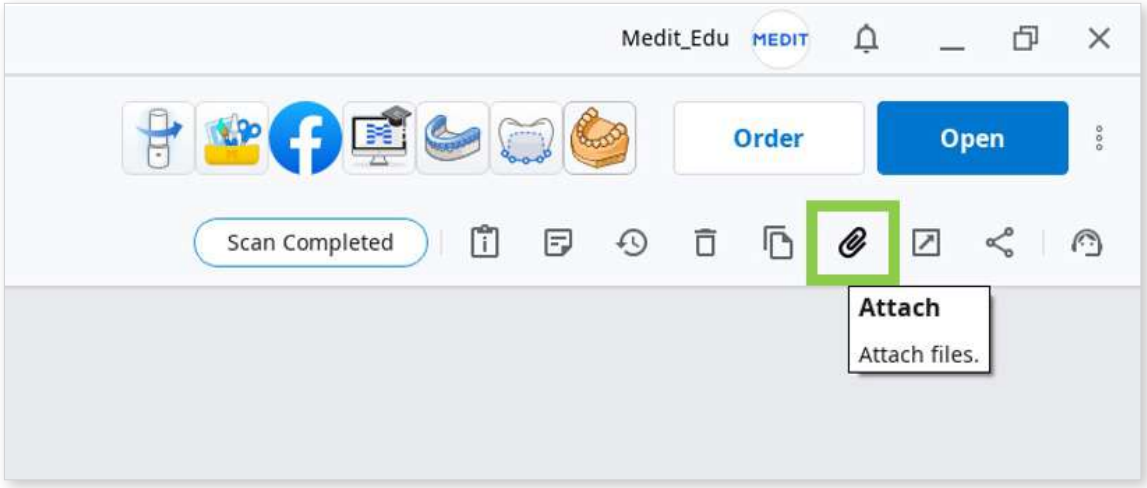
① Complete scanning in the Medit scanning programs

Upon scanning, all acquired data is saved to the corresponding Medit Link case. The app will automatically import data that is available in the case.

> To run the app, you must use maxilla and mandible scans for which the occlusal scanning was completed.

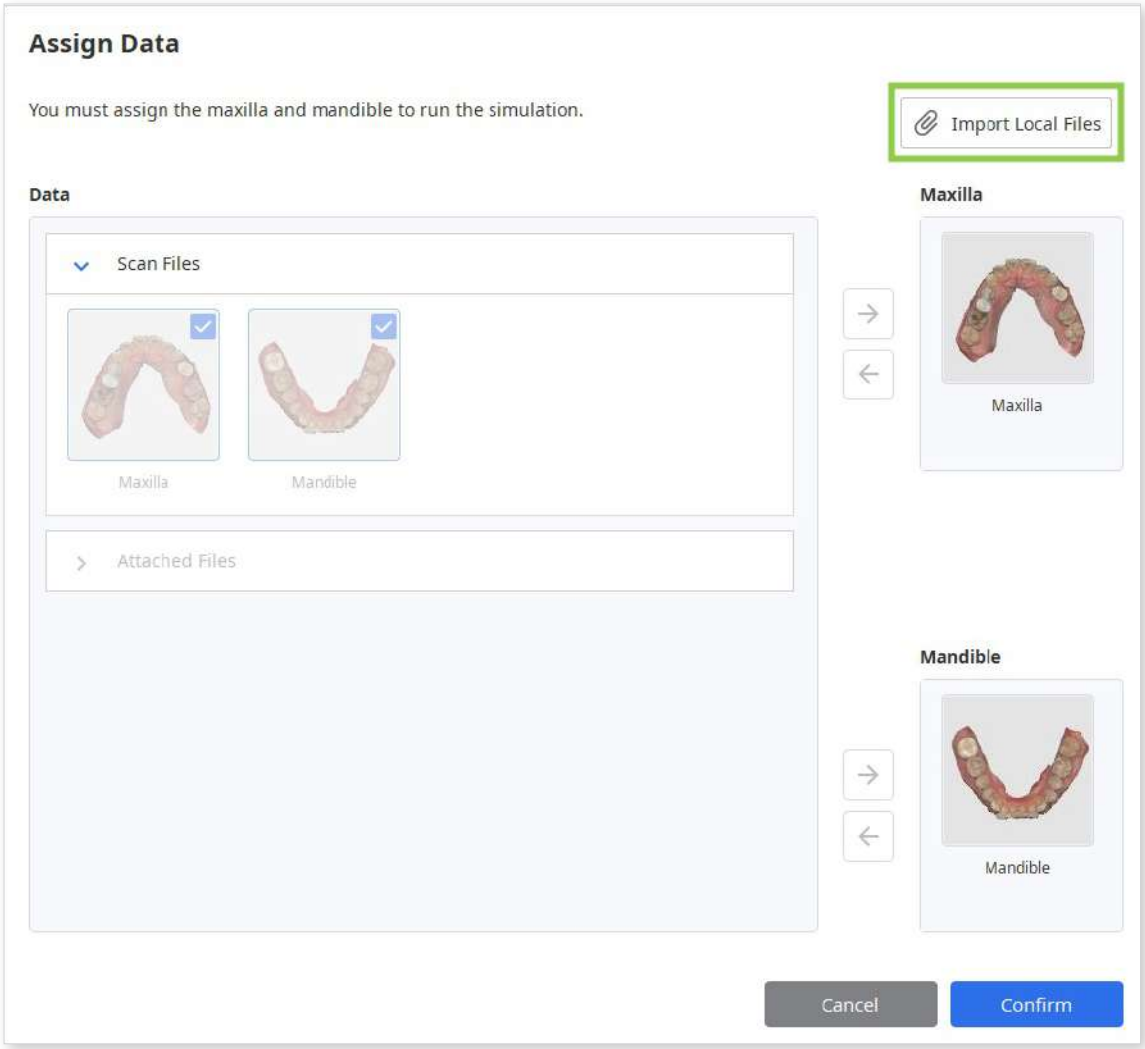
② Attaching files to the Medit Link case

Users can add locally stored scan data to the Medit Link case via the "Attach" feature in the Case Detail window.



③ Importing files after running the app

Users can import locally stored scan data after running the app in the Assign Data window.



3D Data Control

Users can control the 3D data using a mouse alone or both mouse and keyboard.

3D data control using a mouse

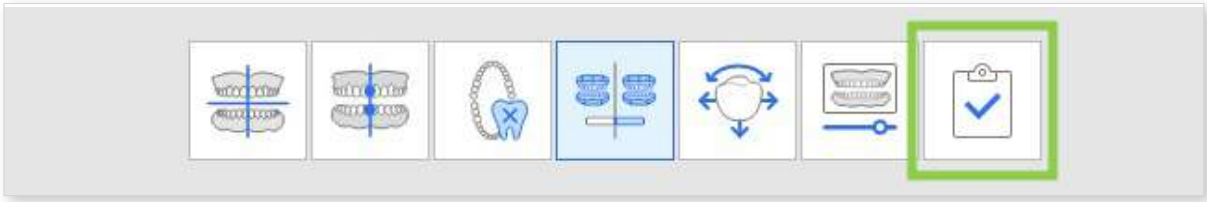
Use	Action	Image
Zoom	Scroll the mouse wheel.	
Zoom Focus	Double-click on the data.	
Zoom Fit	Double-click on the background.	
Rotate	Right-click and drag.	
Pan	Hold both buttons (or wheel) and drag.	

3D data control using a mouse and keyboard

Use	Windows	macOS
Zoom		
Rotate		
Pan		

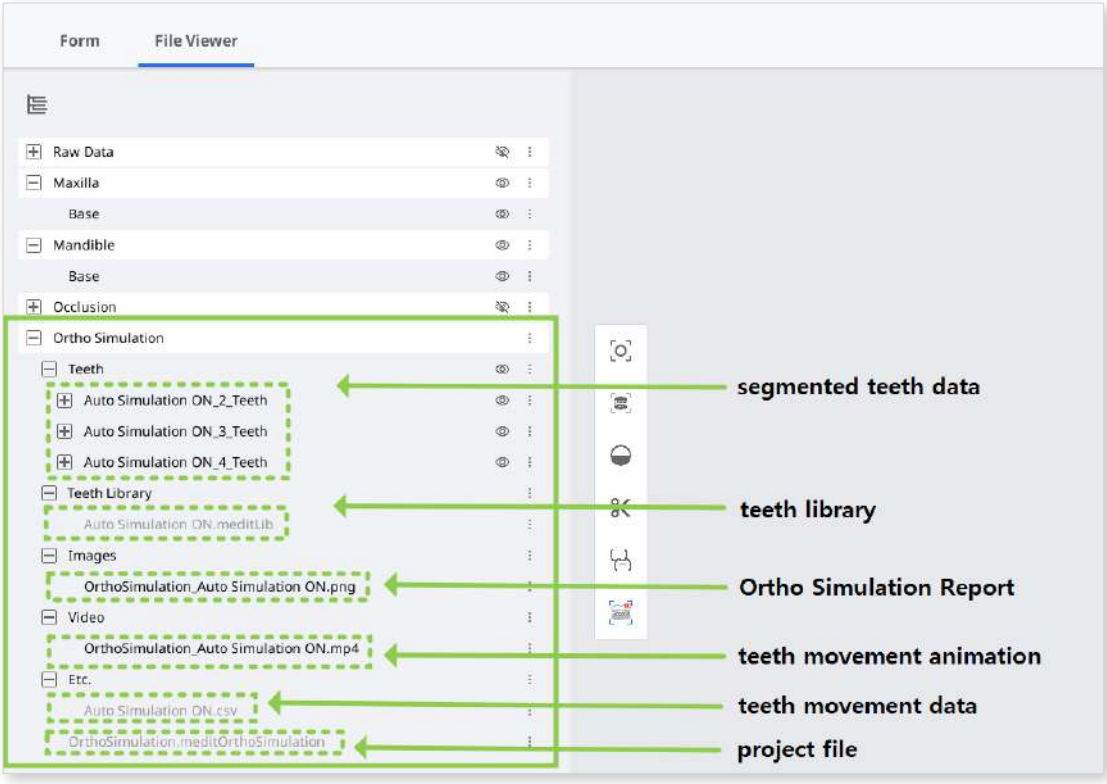
Saving Completed Project

Users can save the results of their work on a simulation project by clicking the "Complete" icon at the top, which represents the final step of the work process.

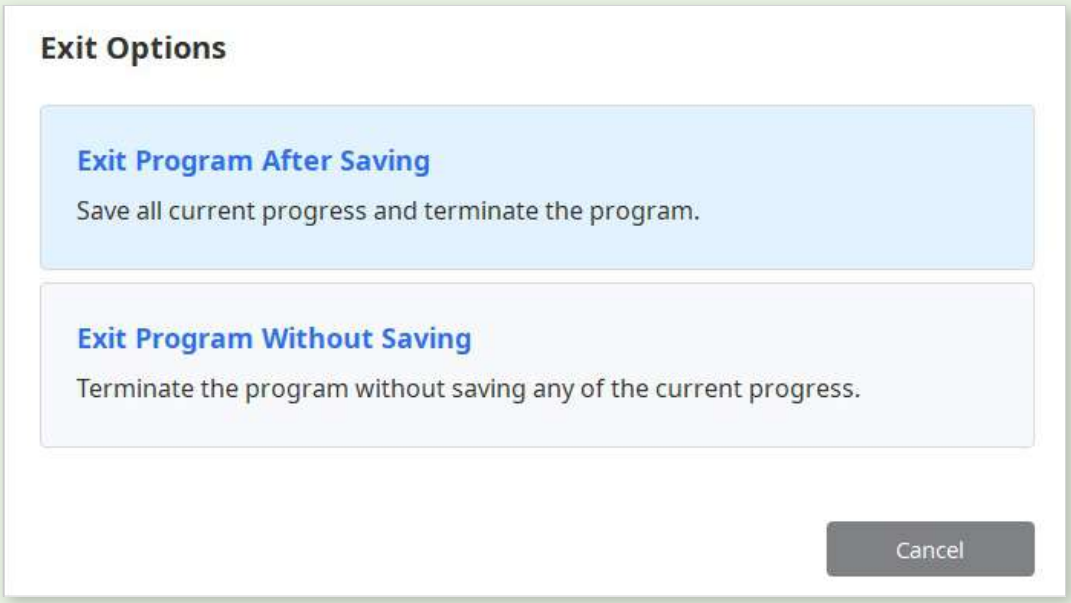


After project completion, the program will save several result files to the Medit Link case. They can include:

- segmented teeth data (if exported)
- teeth library for Medit ClinicCAD (if exported)
- capture images of the simulation with basic project information (also referred to as Ortho Simulation Report)
- a CSV file with teeth movement data (optional)
- video of the animated simulation
- project file*
  *Only one project file is allowed per case, meaning that it will be overwritten every time you reopen the app from this case.

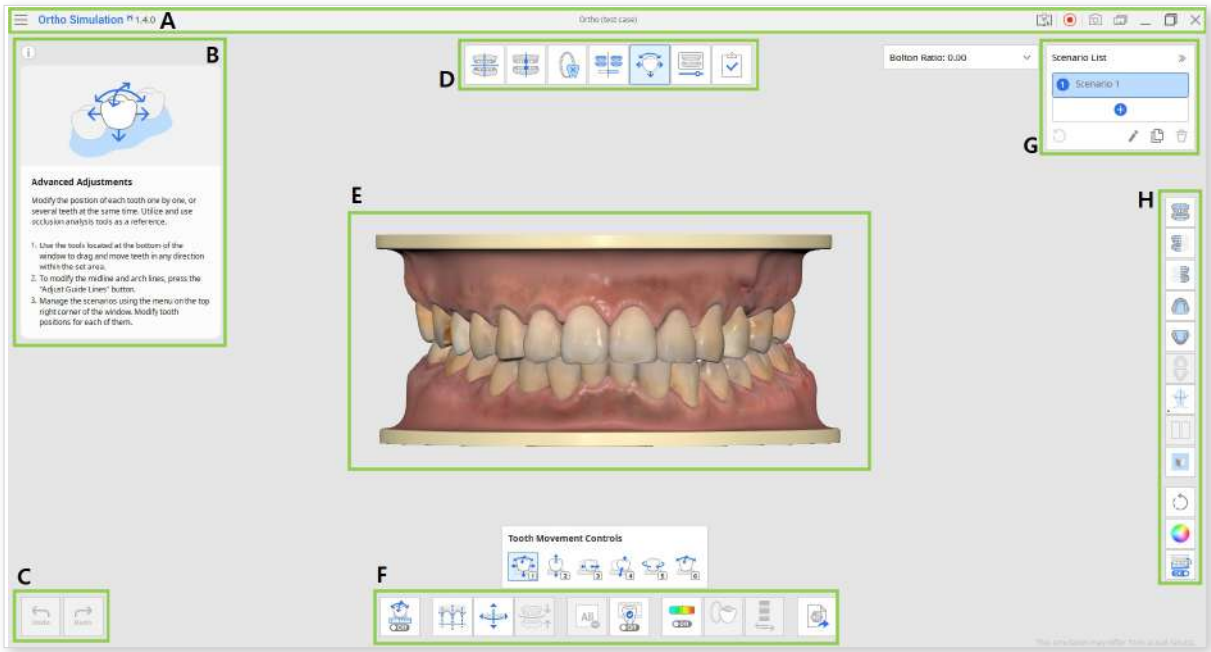


Users can save their work progress for an unfinished project even if they terminate the program before reaching the final workflow step.



User Interface

User Interface at a Glance



A. Title Bar

B. Info Box

C. Action Control Buttons

D. Workflow

E. 3D Data

F. Toolbox

G. Scenario List

H. Side Toolbar

Title Bar

The Title Bar is the ribbon at the top of the application window that contains basic controls on the right and the program menu on the left. It also shows the app name.

	Menu	Access the available settings and assistance resources (user guide, tutorial page, help center), and check the details about the app.
	Help Center	Go to the Medit Help Center page dedicated to this app.
	Start/Stop Video Recording	Start and stop the video recording of the screen.
	Screenshot	Take a screenshot. Capture the app with or without the title bar using automatic selection, or click and drag to capture only the desired area.
	Screenshot Manager	View, export, or delete the screenshots. Upon completion, all captured images will be saved to the case automatically.
	Minimize	Minimize the application window.
	Restore	Maximize or restore the application window.
	Exit	Close the application.

Action Control Buttons

There are two buttons for action control in the bottom left corner of the application window.

	Undo	Undo the previous action.
	Redo	Redo the previous action.

Side Toolbar

The Side Toolbar provides data visualization and control tools that can be used across the entire process of working on simulations.

	Frontal View	Show the front side of the data.
	Right Lateral View	Show the right lateral side of the data.
	Left Lateral View	Show the left lateral side of the data.
	Maxilla View	Show the occlusal surface of the maxilla.
	Mandible View	Show the occlusal surface of the mandible.
	Occlusal Surface View	Show occlusal surfaces of the maxilla and mandible.
	Show/Hide Reference Data	Show or hide such reference data as midline, arch line, and face data.
	Scenario Comparison Mode	See the selected scenario or all scenarios in comparison to the original model.
	Grid Settings	Show or hide the grid, and control its position in relation to the model (overlay on/off).
	Rotate	Rotate data by click-and-drag.
	Model Display Mode	Change the model display mode between the original color display mode and the study model display mode.
	Lower Jaw Movement On/Off	When on, this shows the lower jaw movement together with teeth.

Toolboxes

Toolboxes provide features necessary for working in the corresponding stage. Below are the explanations for the features provided in each Toolbox across the entire app.

Data Alignment

	Align by 3 Points	Set three points on the arch to align it with the occlusal plane.
	Align by 4 Points	Set four points on the arch to align it with the occlusal plane.
	Delete Point	Delete the last added point.
	Detach Data	Reset alignment and move data to the initial position. Select points on the data to align it manually.
	Multi-View	When on, this function shows data from four different angles.

Simulation Preview

	Teeth Movements Data	Check the values of the teeth movements after simulation.
	Sculpting	Sculpt data using tools to add, remove, morph, or smooth its parts.

Advanced Adjustments

	Teeth Movements Data	Check the values of the teeth movements after simulation.
	Preview IPR	Set the tooth removal amount (mm) and preview the results.
	Adjust Guide Lines	Modify the existing guide lines on the model.
	Align to Guide Lines	Update the model according to the adjusted guide lines.
	Deselect All	Remove all selections.
	Selected Simulation	See the animated movement for the selected teeth.
	Show/Hide Occlusal Intersection	Turn on to examine the occlusal contact between arches.
	Occlusion Multi-View	Adjust the position of each tooth while referencing the changes in the occlusion intersection on the right.
	Switch Deviation Display Area	Switch deviation display scale between all data and contact area only.
	Export to Medit Link	Export the current scenario at this stage of progress.

Animation View

	Delete All Pins	Delete all pins.
	Split Animation into Steps	Split the animation into a number of even steps.
	Export to Medit Link	Export the current scenario at this stage of progress.

Workflow

The workflow in Medit Ortho Simulation consists of 7 stages, which must be followed in a specific sequence. However, after completing the "Advanced Adjustments" stage, users can return to the "Simulation Preview" stage to compare the modified scenarios with the original model.

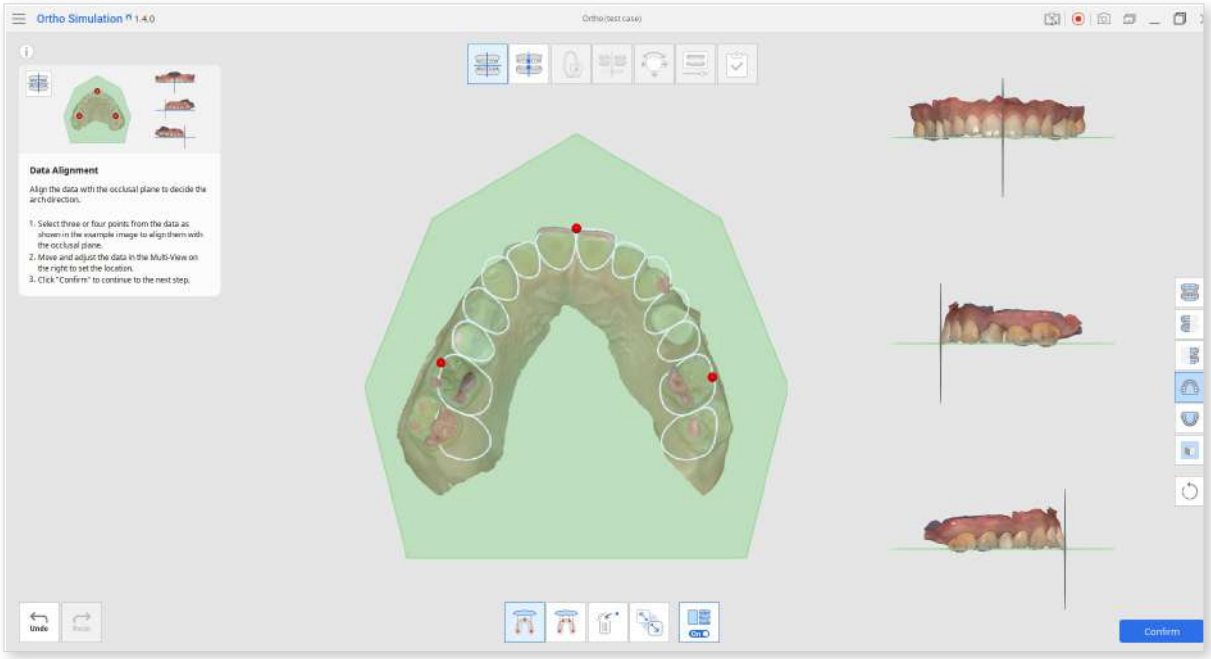
The first stage is skipped if the scan data was acquired using Medit software. Data acquired by third-party software must first be aligned to the occlusal table.

	Data Alignment	Align scan data to the occlusal table.
	Model Settings	Set the model midline and clean the data.
	Simulation Settings	Adjust settings for the simulation by defining missing teeth, planned extractions, and prostheses.
	Simulation Preview	Preview simulation results alongside the original model to compare the before and after.
	Advanced Adjustments	Adjust the position of each tooth manually.
	Animation View	View the animated tooth movement for each simulation.
	Complete	Finish work on the project and save results to the Medit Link case.

Data Alignment

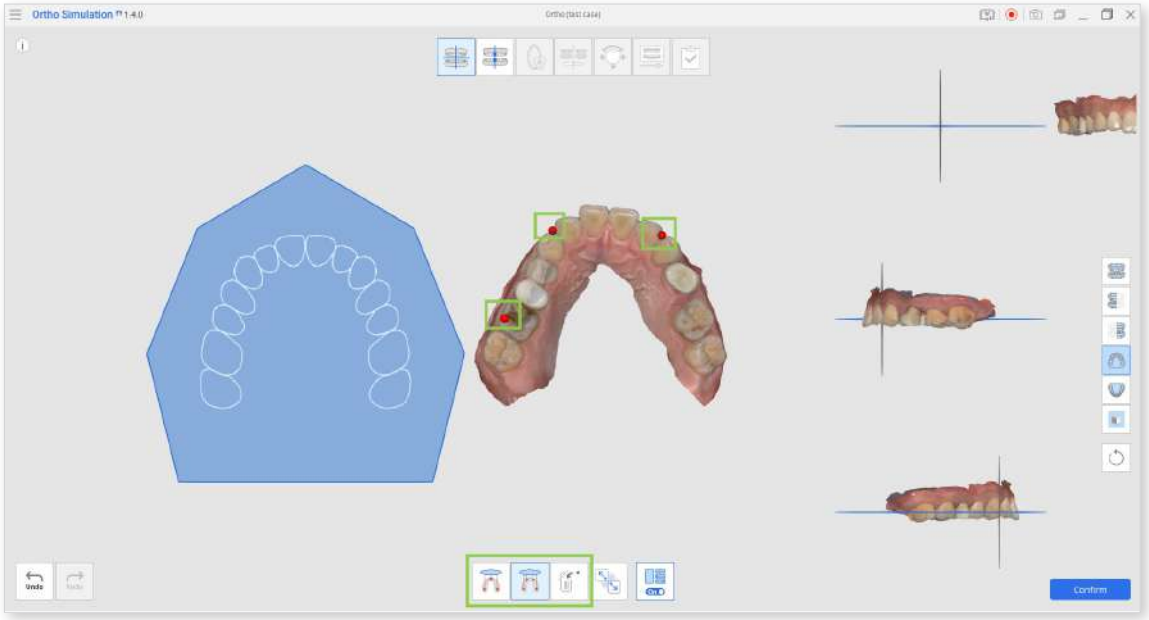
The primary task of the first stage is to align the scan data to the occlusal plane. This step is mandatory for users who imported scan data acquired with third-party software. However, if the scan data comes from Medit Scan for Clinics or Medit Scan for Labs, this stage will be automatically skipped.

If needed, users with data from Medit scanning programs can return to this step and realign data after simulations are generated, but doing so will reset the work progress.

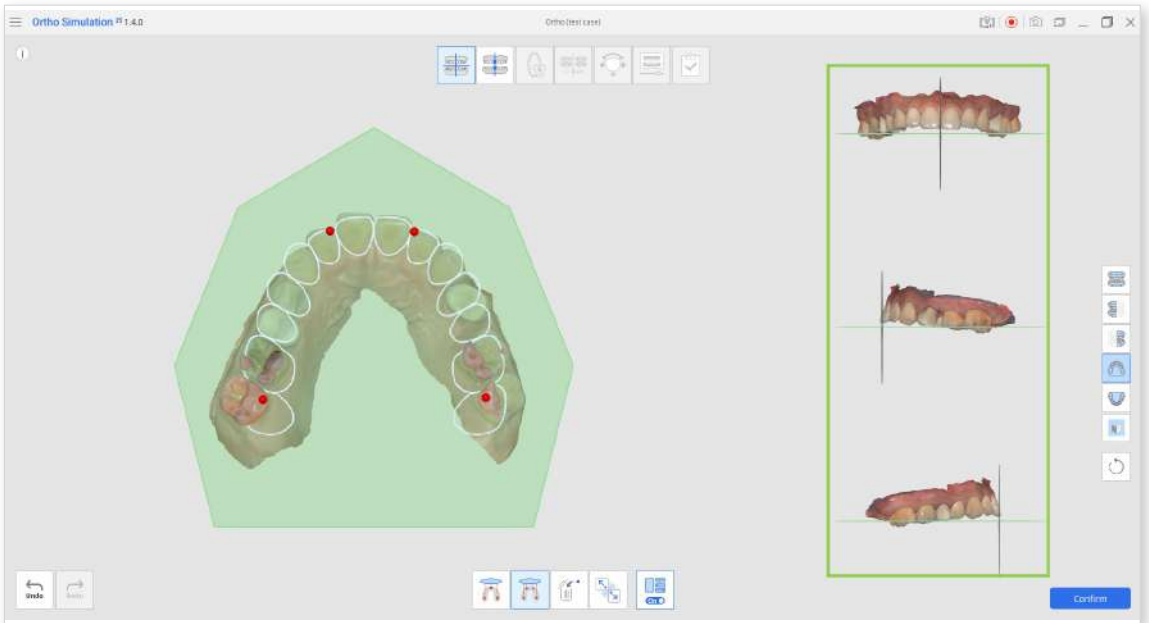


① You can align data to the plane by three or four points. Choose the corresponding tool below and then select points on the data. The scan data will be aligned to the occlusal plane automatically.

Use the "Delete Point" feature if the point was placed incorrectly.



② Once the data is aligned, use the Multi-View on the right to check data positioning and make more precise adjustments.



③ If realignment is necessary, click "Detach Data" at the bottom to start over.

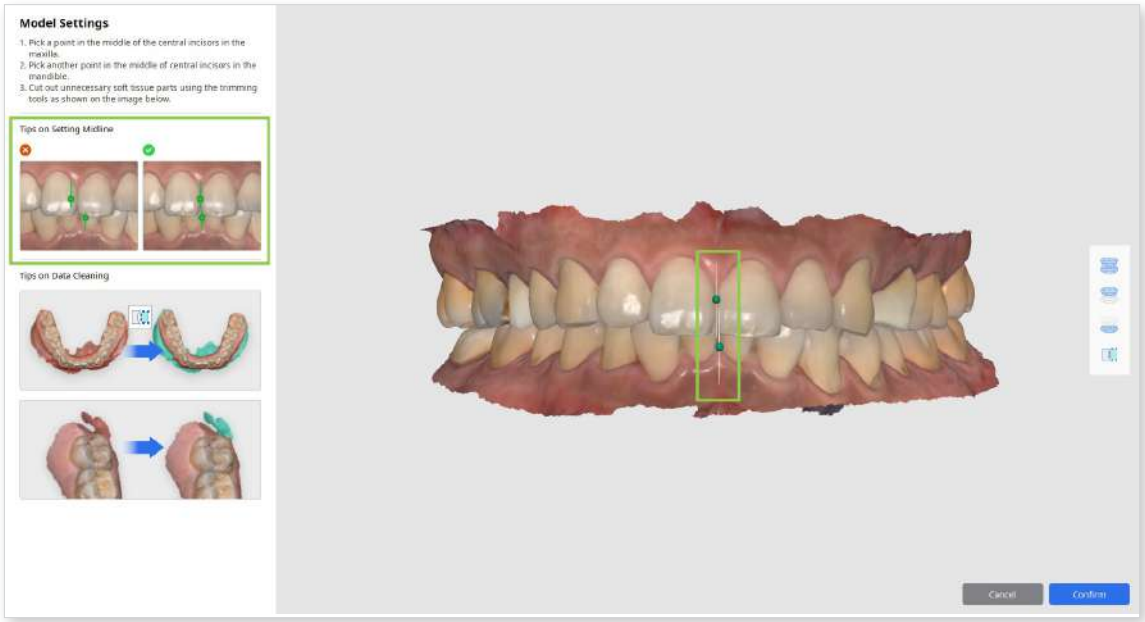
④ When done, click "Confirm" in the bottom right corner or click the icon of the next stage at the top of the screen.

Model Settings

In this stage, users must adjust the orientation of the arches by defining midline points on both the maxilla and mandible.

> ⚠ Returning to this stage to make changes after generating simulations will reset your work progress.

① Set the midline on both arches by dragging the green points; place them between the two central incisors.



② Before proceeding to the next stage, check your scans for any excessive gum data (anything past the mucogingival junction). This will ensure smoother work of the program in the following stages.

If any is present, the unnecessary soft tissue data can be removed using the "Polyline Trimming" tool provided on the right. Click and drag (or click in several spots) to select the area, then right-click to delete it. Click the tool icon again to exit the tool.

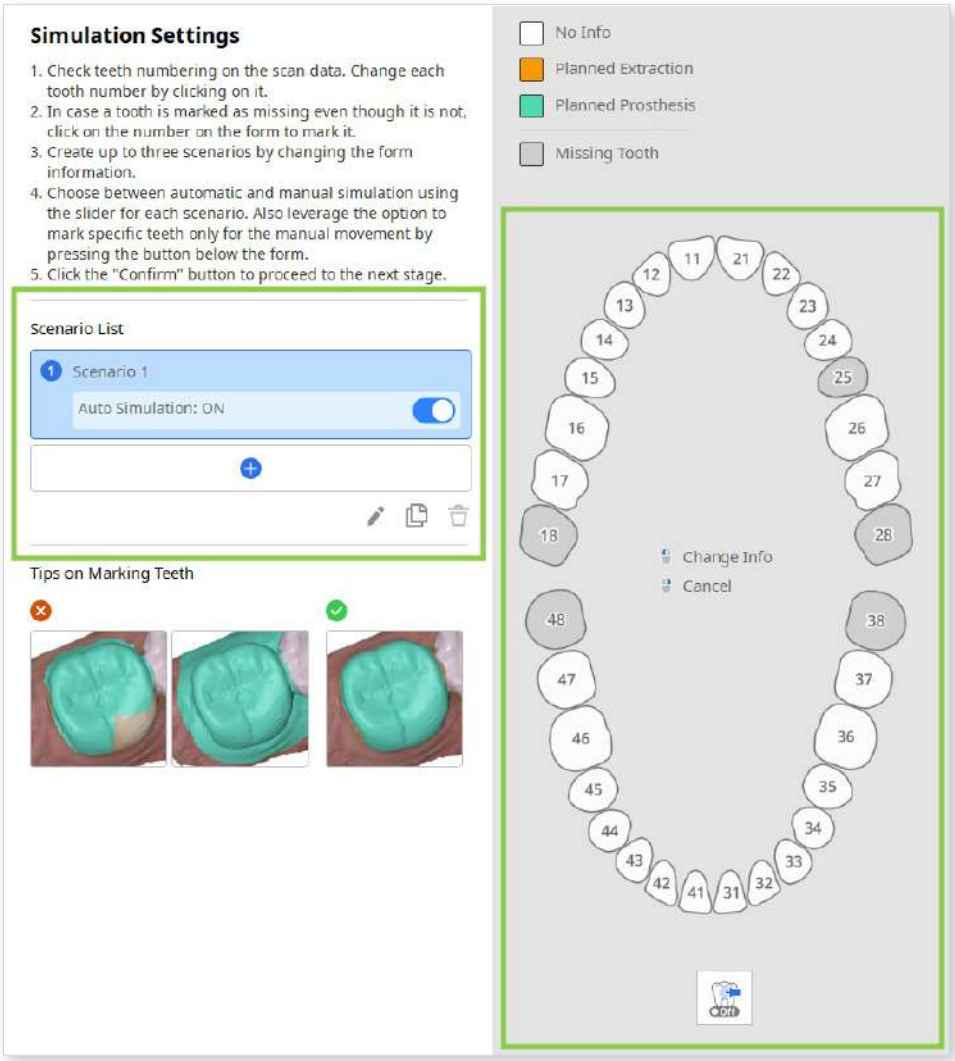
③ When done, click "Confirm" in the bottom right corner.

Simulation Settings

This is the most important stage in the simulation generation process. The user must complete two tasks here: create and set up simulation scenarios and segment the teeth data. The simulation will be generated in the next stage based on the input of provided here.

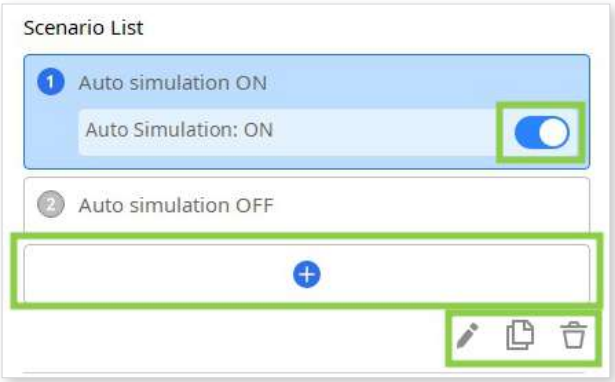
Creating Simulation Scenarios

To create a simulation, the user must set up a scenario for the teeth movement by providing details on the patient's dentition and planned treatment. This is done on the left side of the screen.



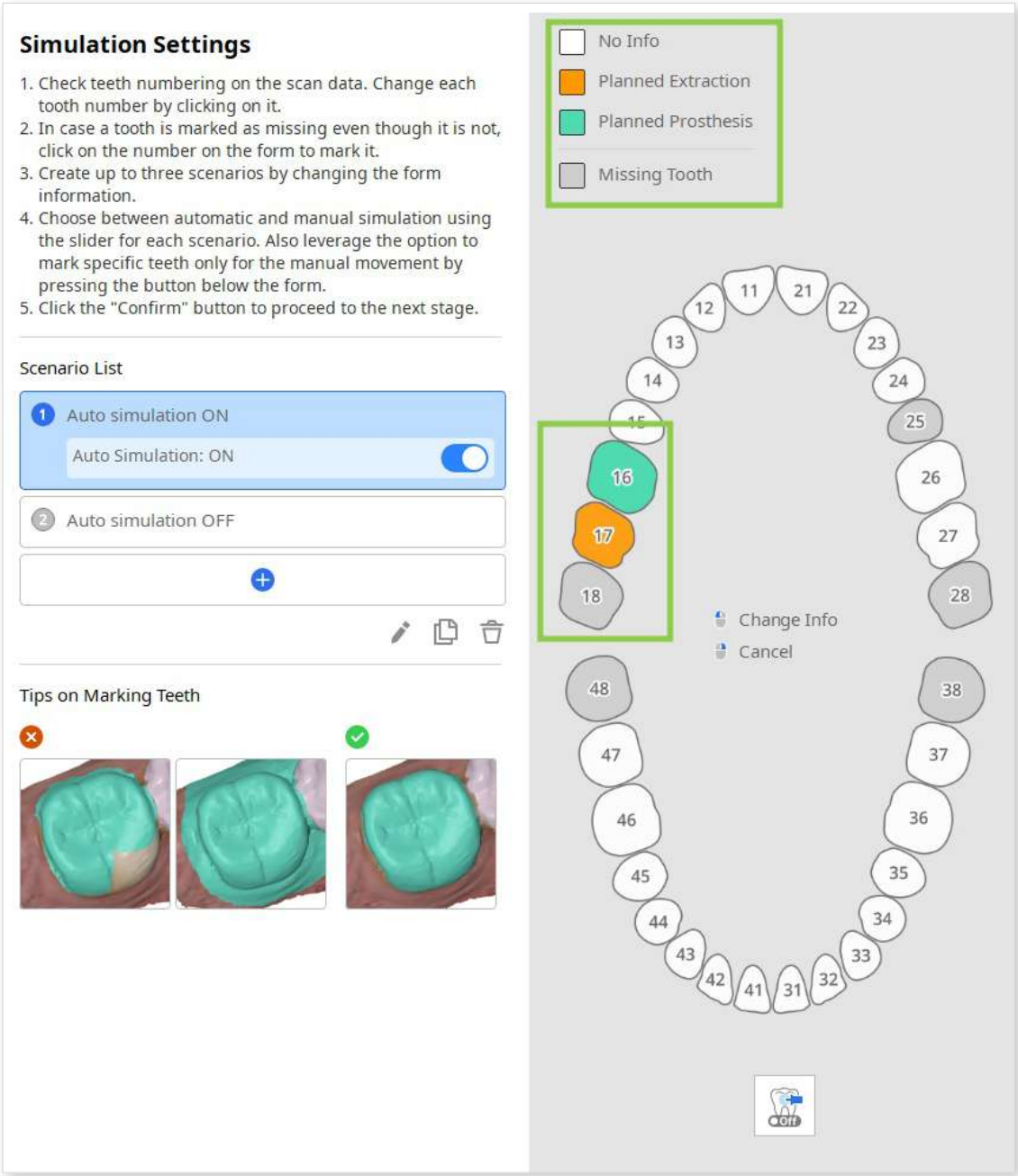
① Start by checking your scenario list in the guide panel on the left. You can create up to 3 scenarios by either adding one with an empty form or cloning an existing one. Here, scenarios can also be renamed or deleted.

The "Auto Simulation" toggle is on by default for each scenario. If you toggle it off, the teeth positions in the original and simulation data will remain the same, requiring you to move each tooth manually in the following stages.

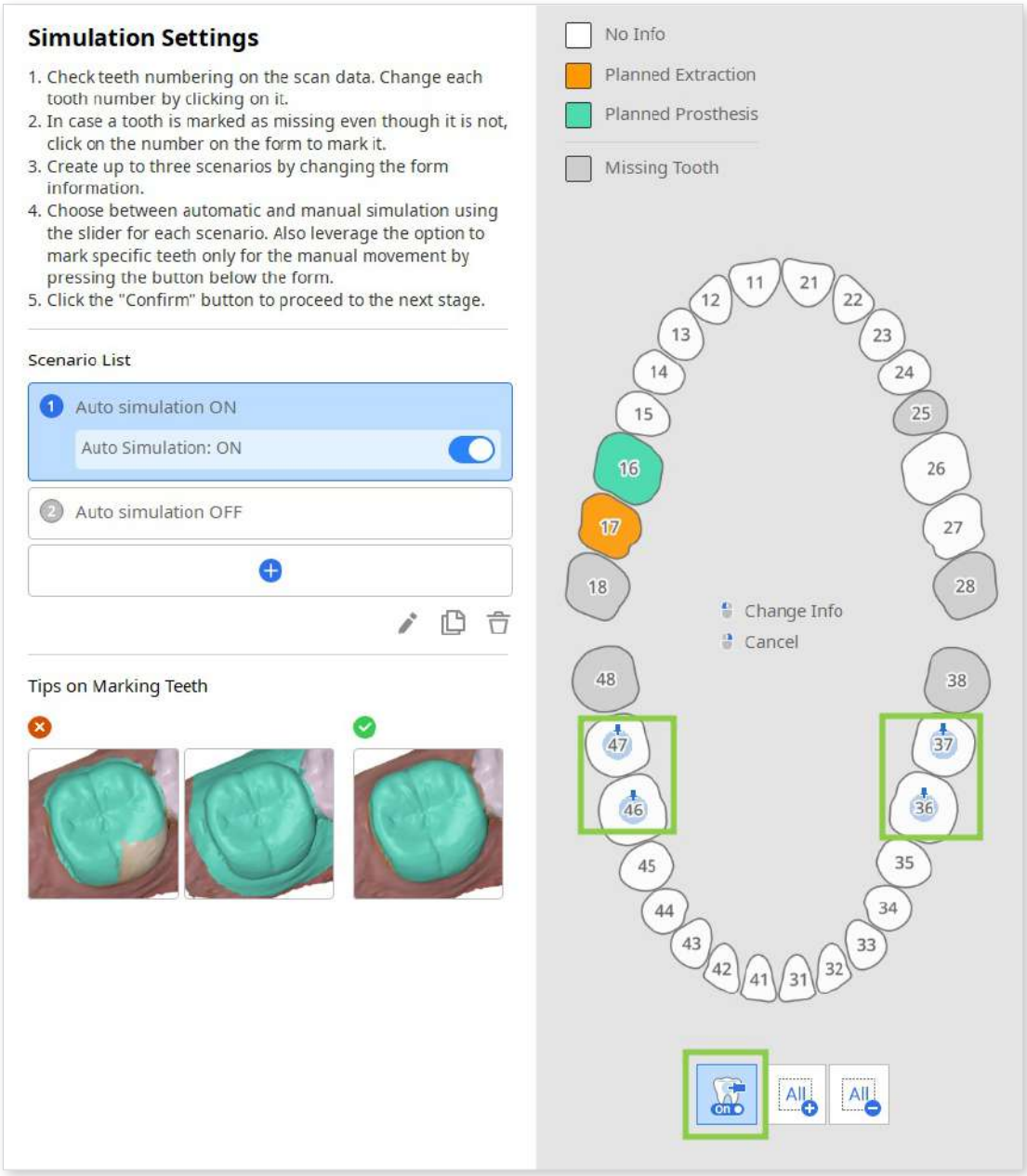


② Next, check the form information on the right and edit it for each scenario according to the planned treatment.

The first click on a tooth number will set it as 'Planned Extraction,' and the second will change it to 'Planned Prosthesis.' Information on missing teeth is updated automatically based on the teeth numbering and data selection on the right side of the screen.

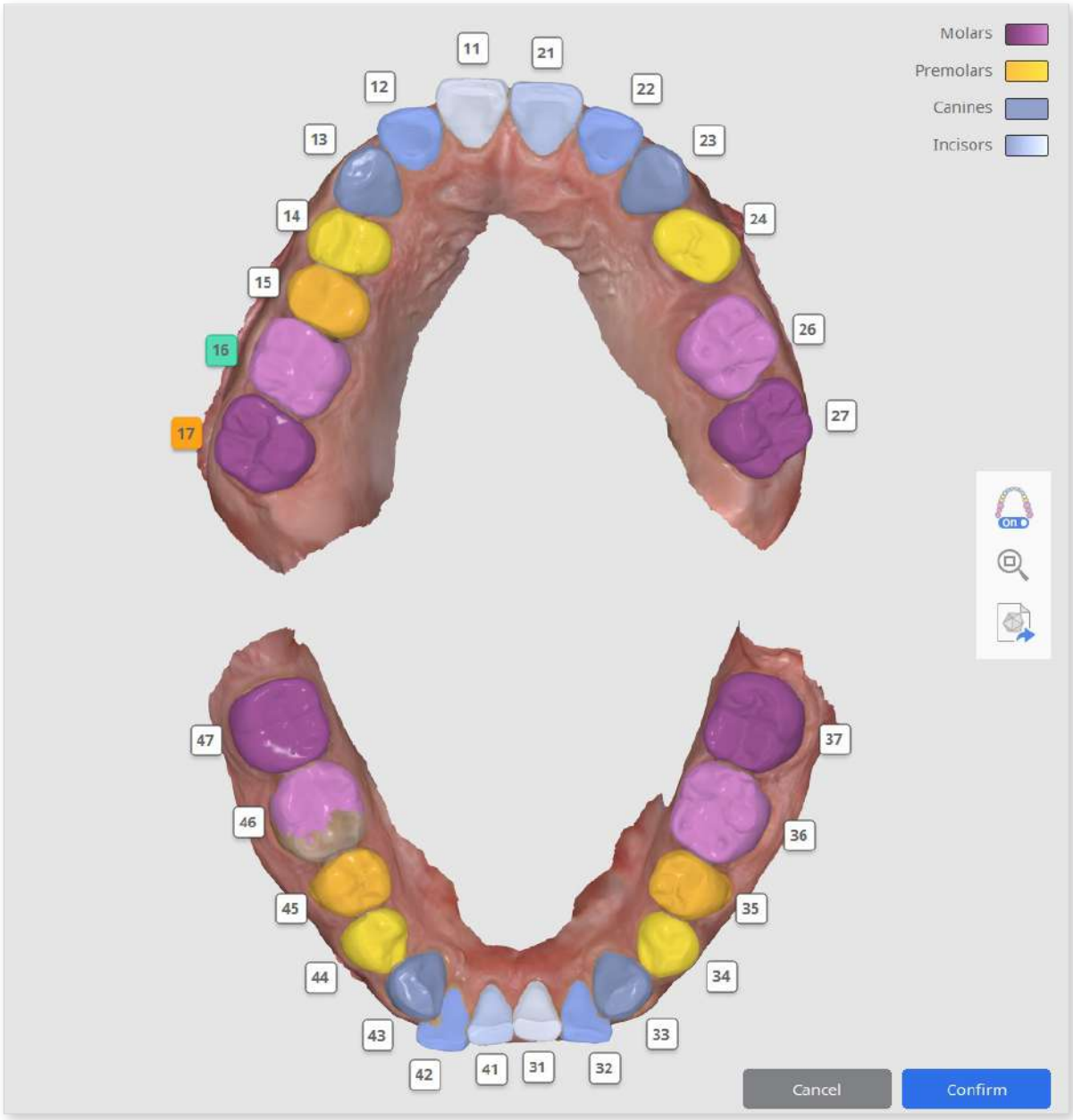


- When "Auto Simulation" is enabled, you can use the "Manual Movement Only" feature to pin specific teeth in the form. The pinned teeth will remain in their original position after generating the simulation.

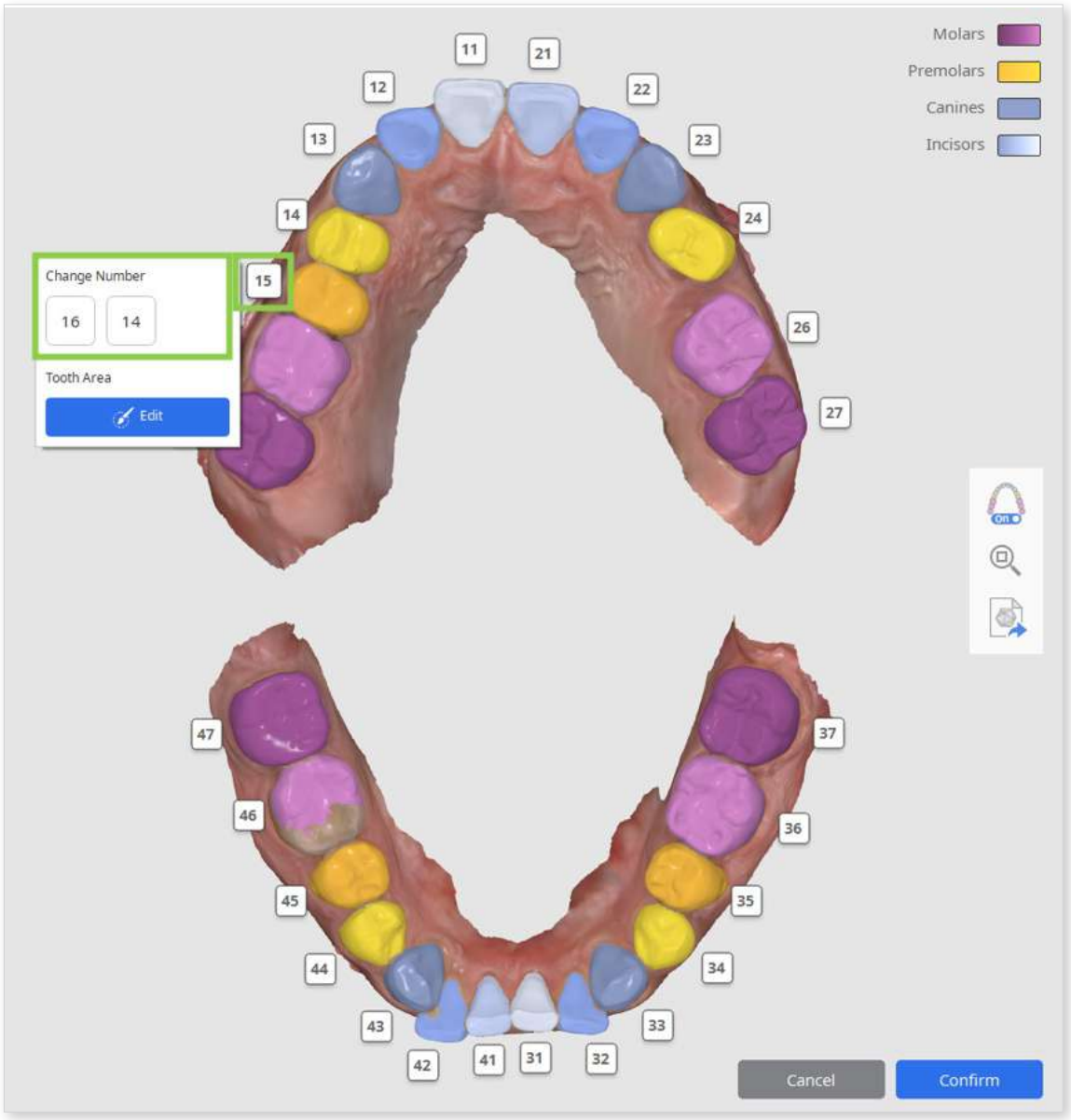


Segmenting Teeth Data

The teeth data is automatically segmented, and the results are displayed on the right side of the screen. Users must review the teeth numbering and data selection for accuracy.

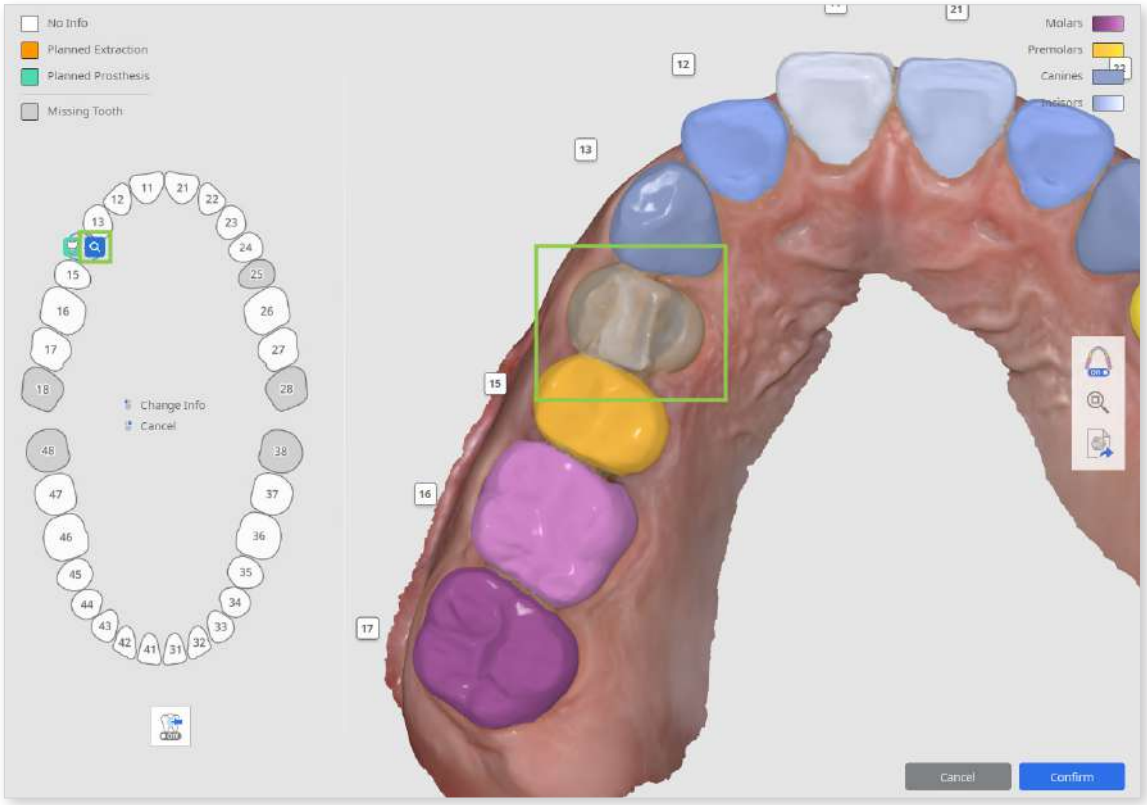


① First, check the teeth numbering. If a tooth was incorrectly identified, click its number to reassign it.



② Next, review the data selection to ensure each tooth is accurately selected. The entire surface of the tooth must be selected, excluding any gum data. If the data selection needs editing, click the tooth number and choose "Edit" to manually reselect tooth data on the scan.

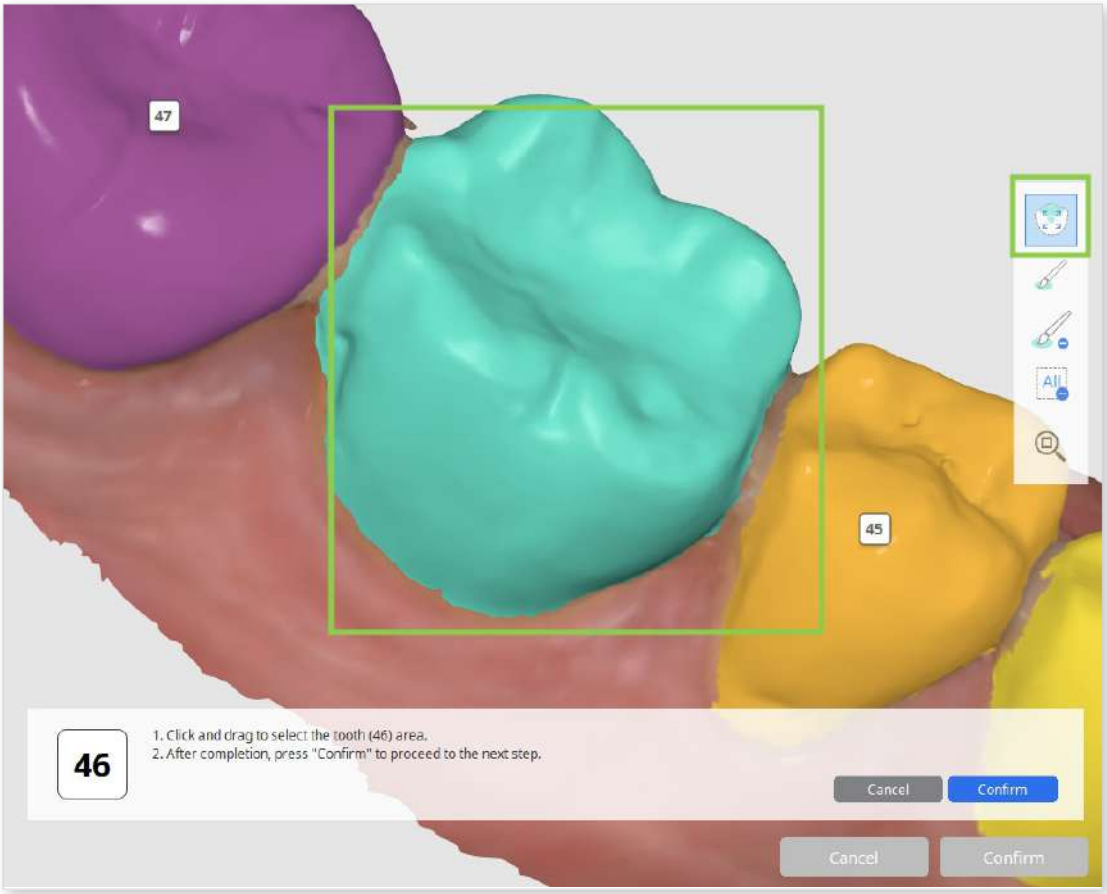
③ Teeth numbers with no corresponding data will be automatically marked as missing in the form on the left. If that needs correction, hover over the missing tooth and choose "Tooth Area Selection" to manually select the data of that tooth on the scan.



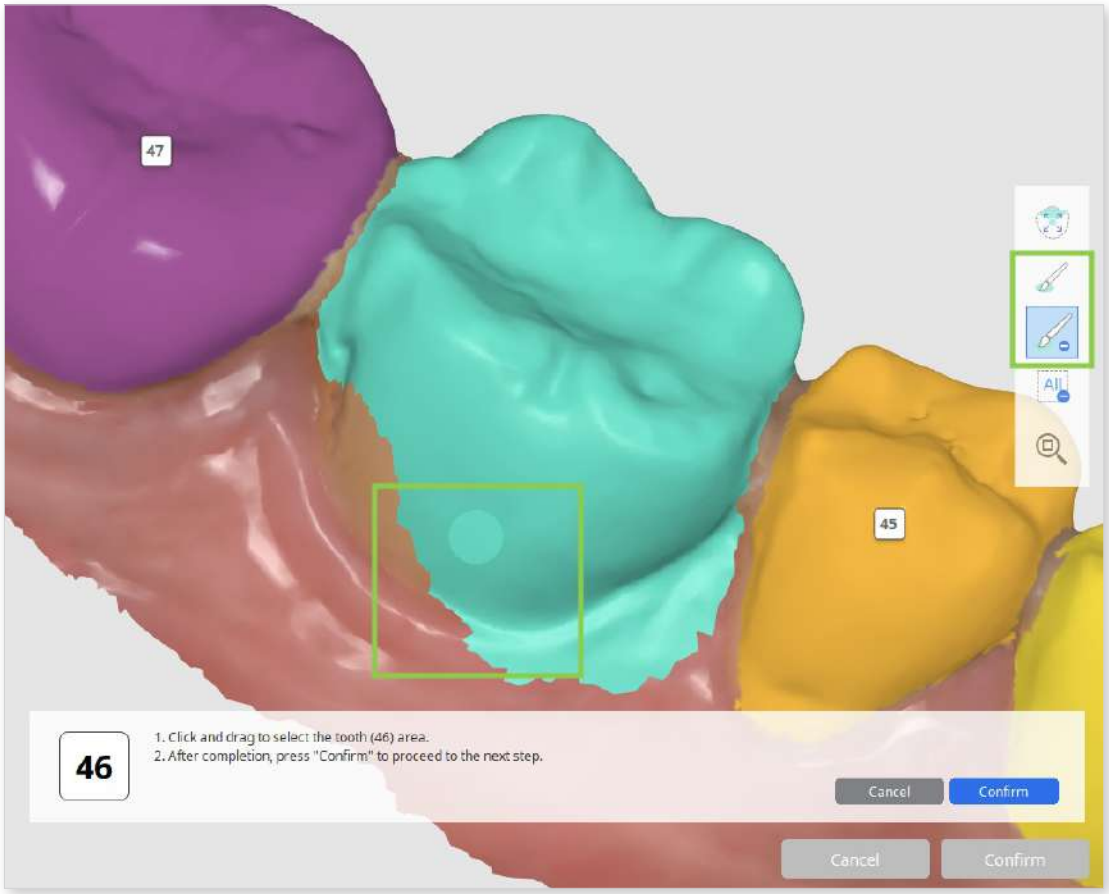
How to select tooth data

Selection editing mode is prompted if users need to manually select data for a non-identified tooth or correct the existing data selection.

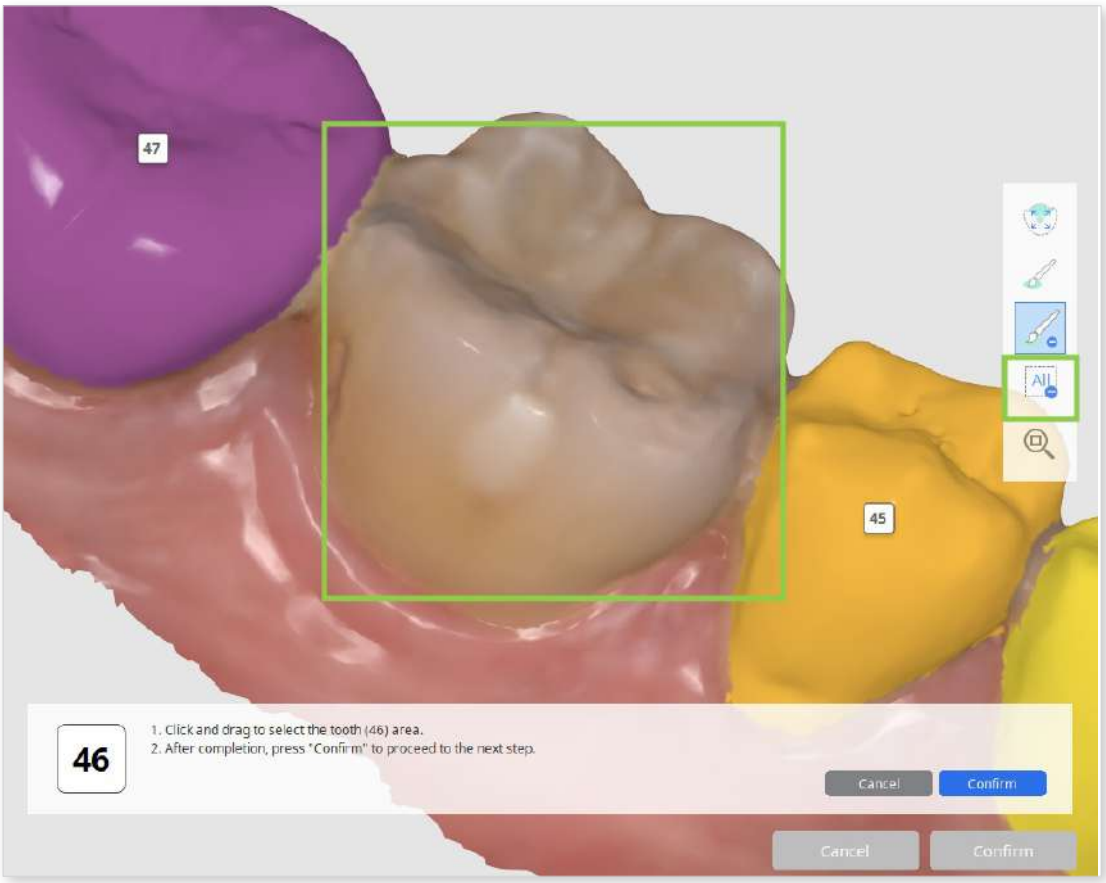
- Use the “Smart Tooth Selection” tool to automatically select an area of an entire tooth with a click and drag.



- To make the data selection more precise, adjust it using “Brush Selection” or “Brush Deselection.”



- To clear all selection and start over, use “Clear Selection.”

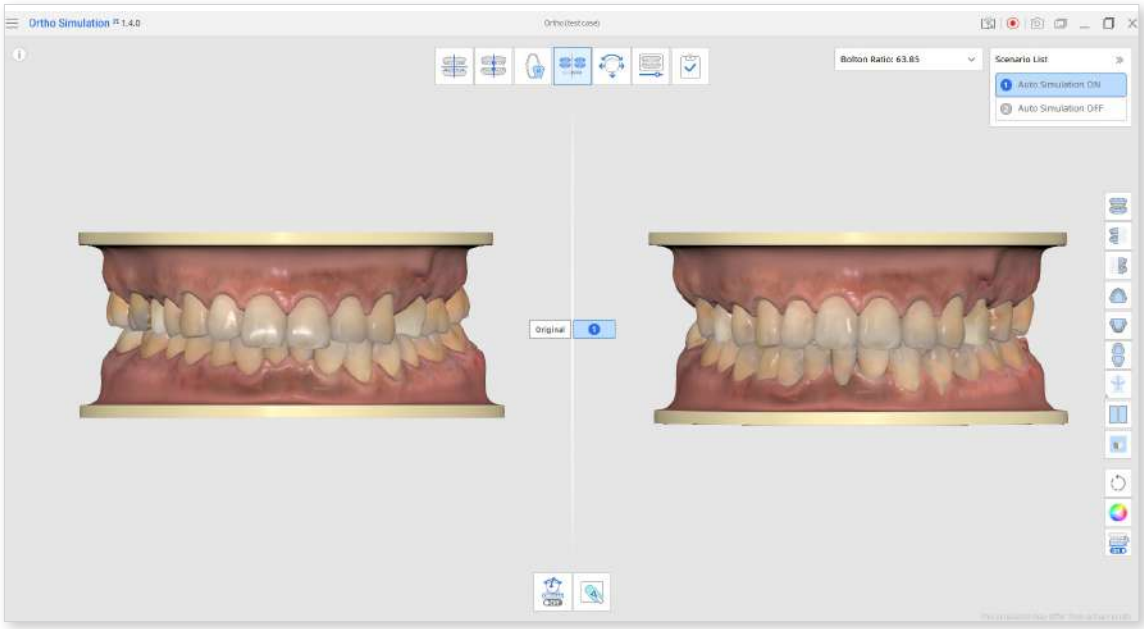


- Click “Confirm” in the bottom right corner when done to save changes.

When all work in this stage is done, click "Confirm" in the bottom right corner.

Simulation Preview

In this stage, users can preview automatically generated simulations alongside the original data model. The "Simulation Preview" stage serves two main purposes: facilitating patient consultations and conducting simulation analysis.



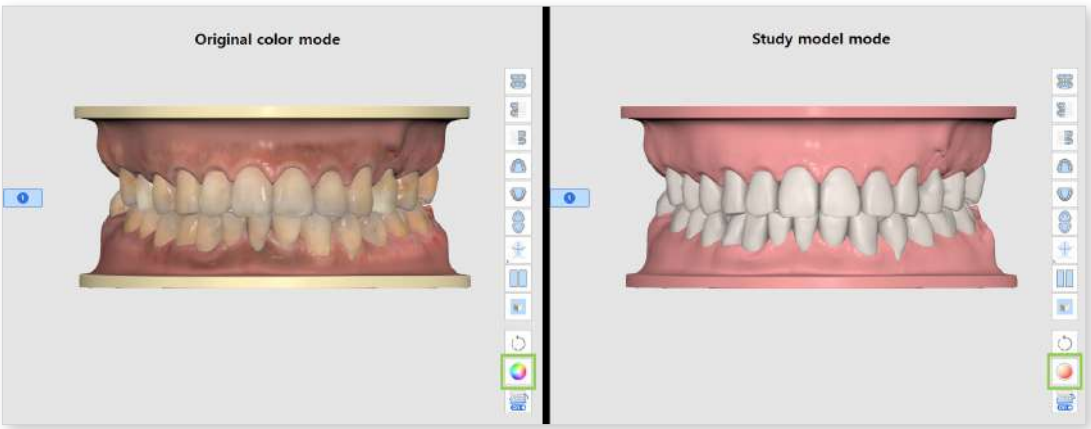
Patient Consultation

This stage allows users to preview dental models showing both the pre-treatment and expected post-treatment dentition. These visual aids can be beneficial during patient consultations.

Here are some helpful features available in the Side Toolbar on the right that can be used.

① Model Display Mode

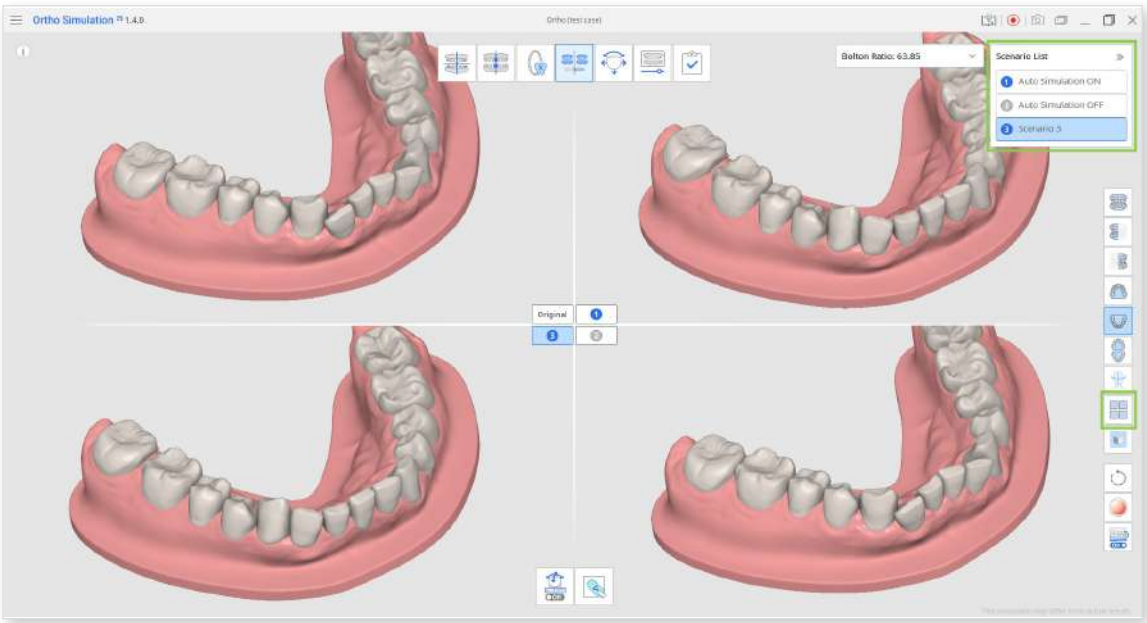
If the realistic model display makes your patient uncomfortable, you can change to a simplified two-color study display mode.



② Scenario Comparison Mode

You can compare each scenario's simulation individually with the original model by switching between them in the top right corner. Alternatively, you can use "Scenario Comparison Mode" to simultaneously view all scenarios alongside the original model.

Try using the view control features in the Side Toolbar to review the simulation from various angles.

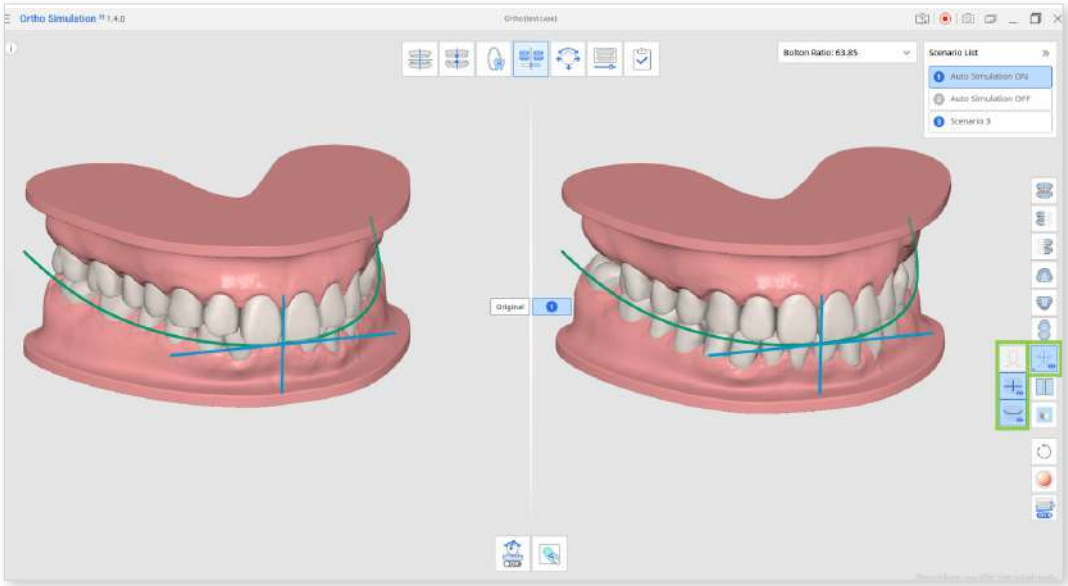


③ Show/Hide Reference Data

You can preview simulations with the reference data: midline, arch line, and face scan data. Click the feature icon in the Side Toolbar and choose what data you want to see.

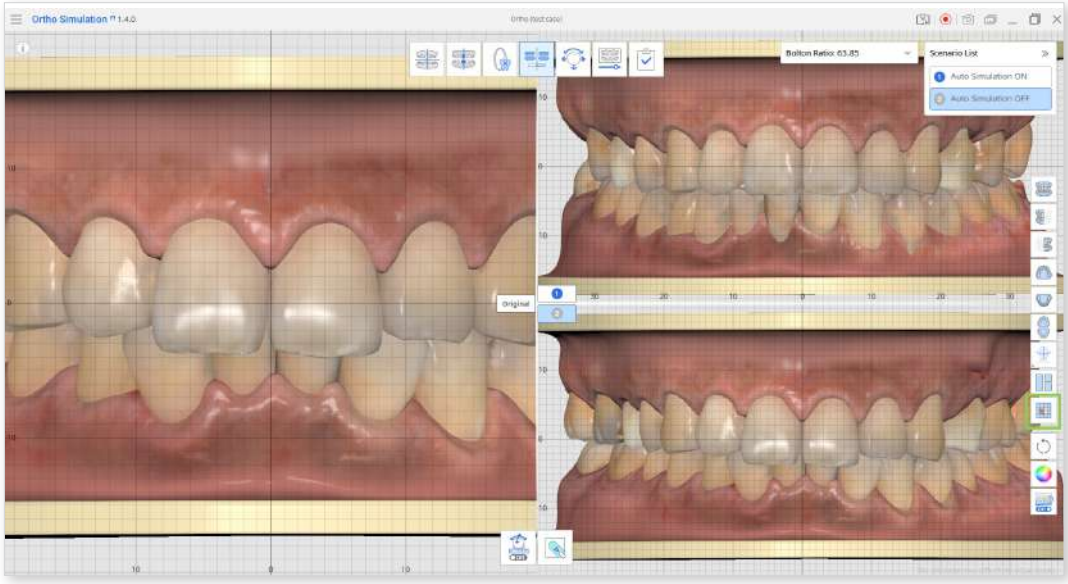
If needed, the midline and arch line can be adjusted in the next stage.

> To reference the face scan data, it must be acquired and aligned in Medit Scan for Clinics. If any is available in the Medit Link case, it will be automatically imported into the app.



③ Grid Settings

Click this feature in the Side Toolbar multiple times to show, overlay, and hide the grid. The grid utilizes millimeters as a measurement unit.



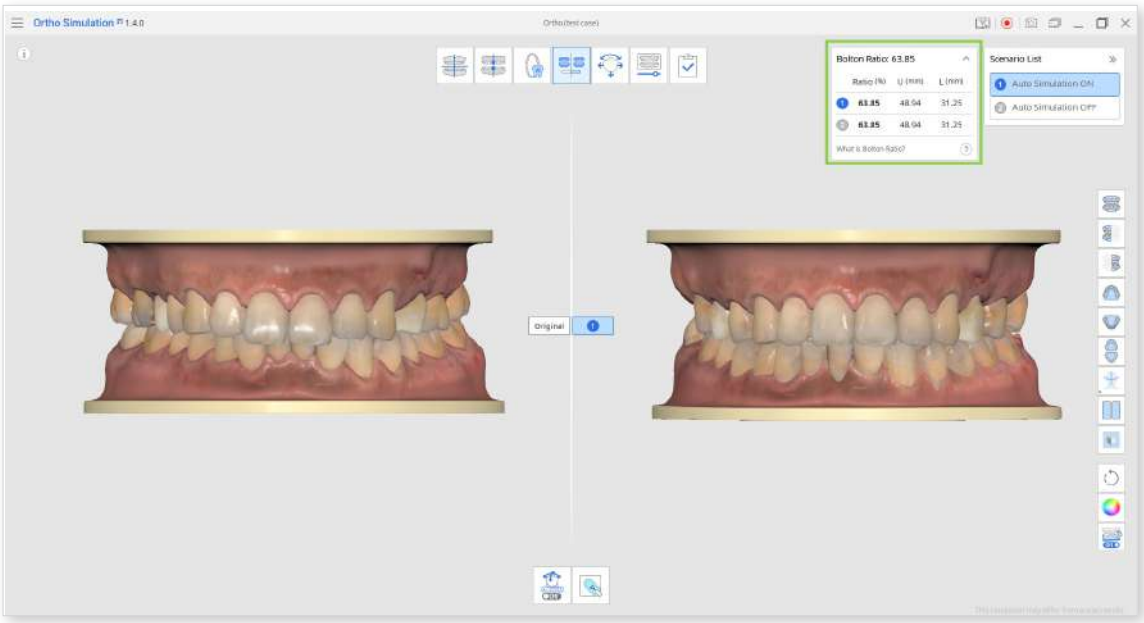
Simulation Analysis

This stage offers three features for analyzing and examining the simulation: Bolton Ratio, Teeth Movements Data, and Sculpting.

① Bolton Ratio

The Bolton Ratio is calculated automatically, and the results for the currently selected scenario are displayed in the top right corner. You can expand the widget to see the results for all scenarios.

> You can hide the Bolton Ratio widget in the program settings (Menu > Settings).

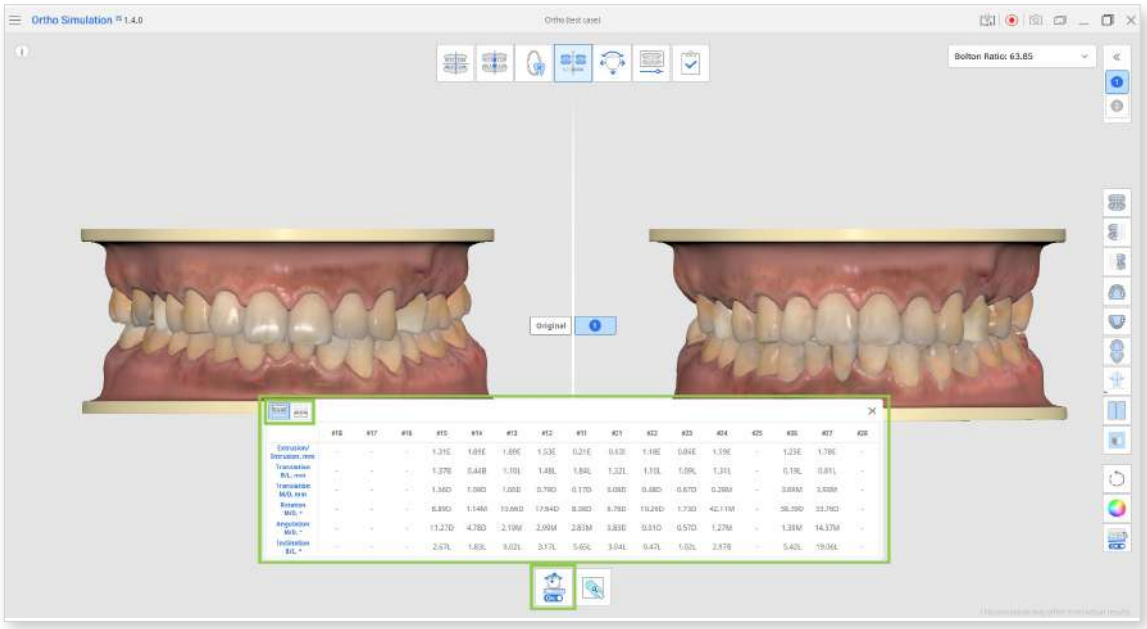


② Teeth Movements Data

This feature is located in the Toolbox at the bottom of the screen. It shows the calculations for teeth movements in the simulation, allowing you to check the feasibility of the proposed treatment scenario. This data is also helpful when reviewing the expected teeth movement for a patient with planned extraction or consulting patients on orthodontic treatment.

You can copy data from the table. Click and drag to select the cells you need, then press Ctrl+C/Cmd+C.

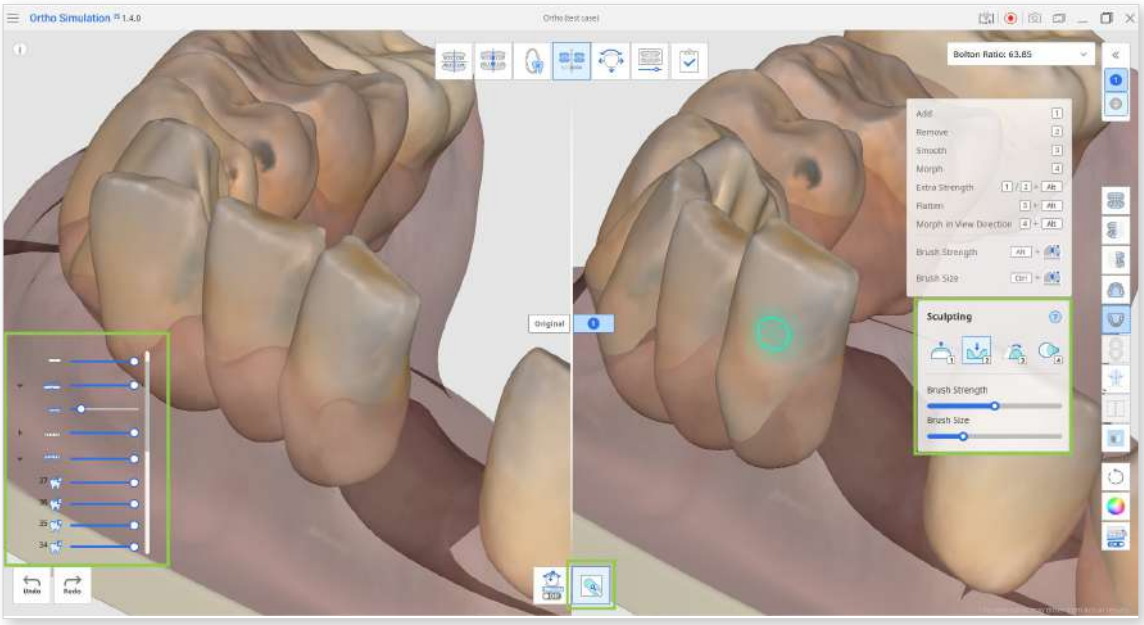
This data can also be included in an exported Ortho Report.



③ Sculpting

The "Sculpting" tool in the Toolbox at the bottom lets you modify gum and teeth data. Changes made to either the original or simulation data are automatically mirrored on the other. Note that sculpting does not affect the results for the Bolton Ratio.

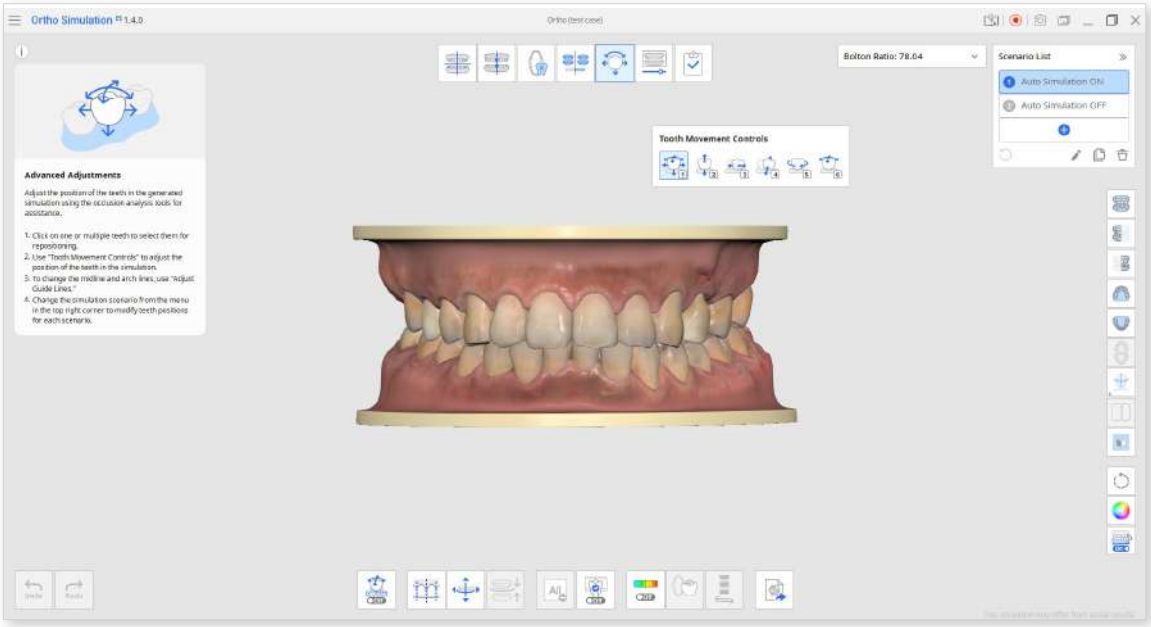
With this tool, you can add, remove, morph, and smooth data. Adjust the brush size and strength for more control, and use the Data Tree to hide data from the view for greater comfort.



When you're done, click the next stage icon at the top of the screen.

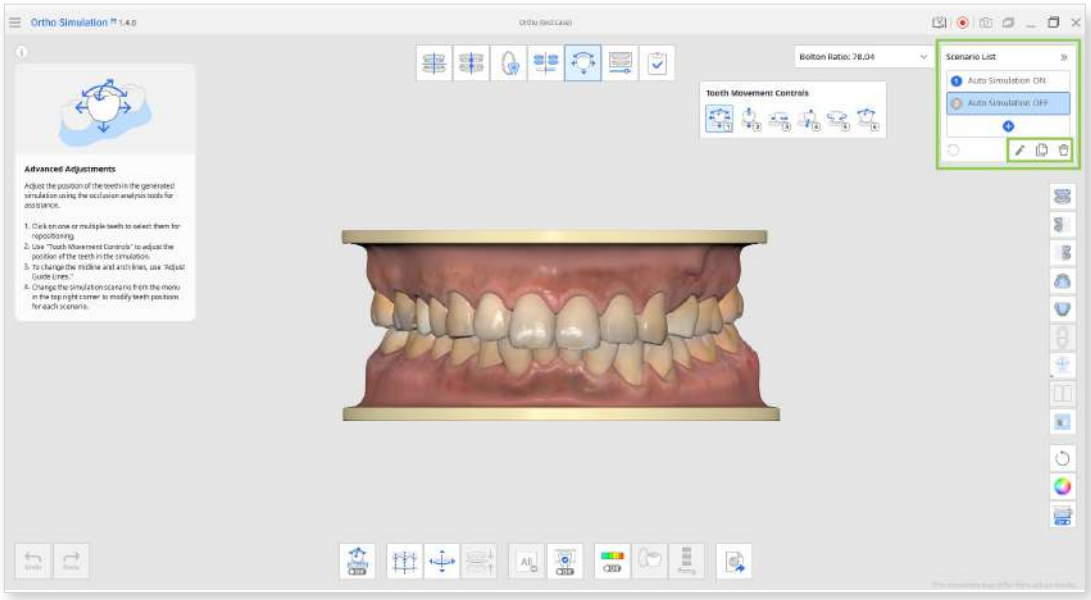
Advanced Adjustments

"Advanced Adjustments" is the stage where users can manually readjust the generated teeth movements. This stage allows users to edit simulations created with the "Auto Simulation" option enabled or move teeth in scenarios where the option was disabled. Additionally, users can export generated data from this stage after adjusting teeth movement in the simulations.

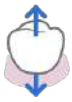


① Choose a scenario in the top right corner. Here, you can also manage your scenario list without returning to the "Simulation Settings" stage.

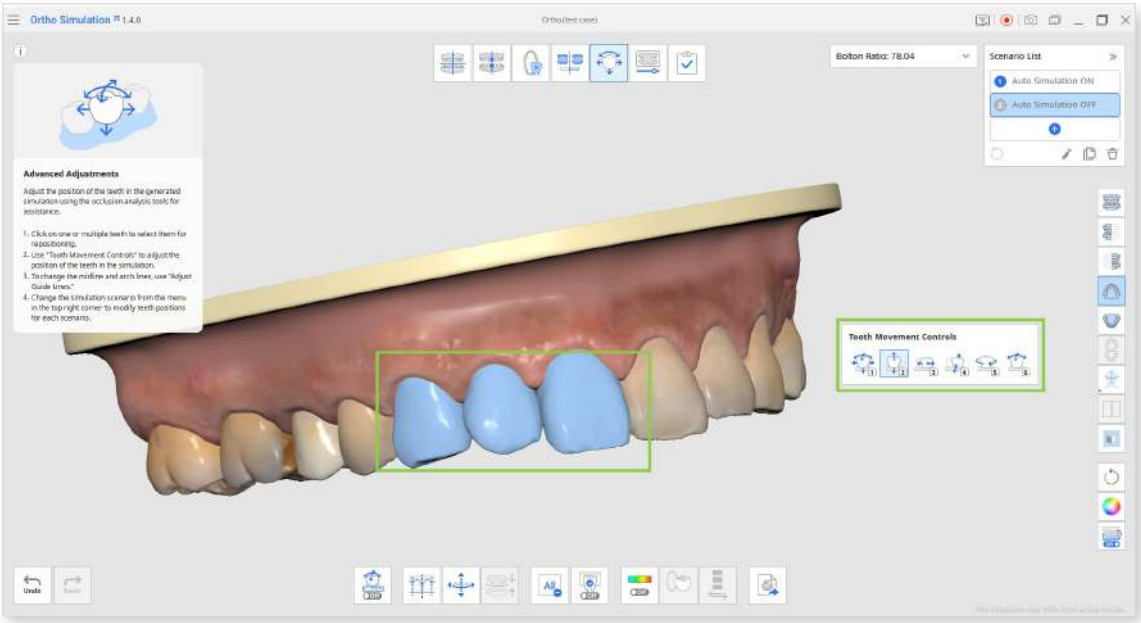
> The "Reset" feature in the scenario list widget will undo only the changes made in this stage.



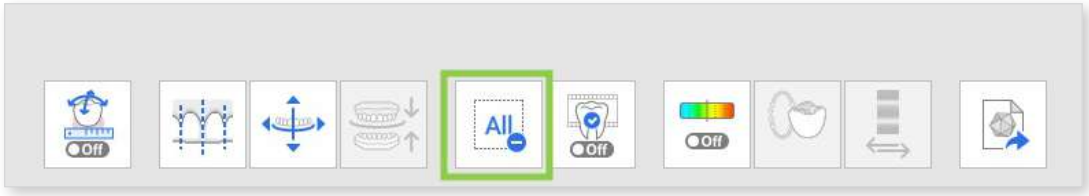
② Using the "Tooth Movement Controls," you can adjust each tooth individually or select multiple teeth to move them simultaneously. The "Move Freely" option is selected by default, but you can choose other options that allow movement along only one set direction. Note that the gum data will adjust automatically once the teeth are moved.

					
Move Freely (* use Ctrl to rotate)	Move along the Occlusal Direction	Move along Mesial/Distal Direction	Move along Lingual/Buccal Direction	Rotate around Occlusal Direction	Rotate around Lingual/Buccal or Mesial/Distal Direction

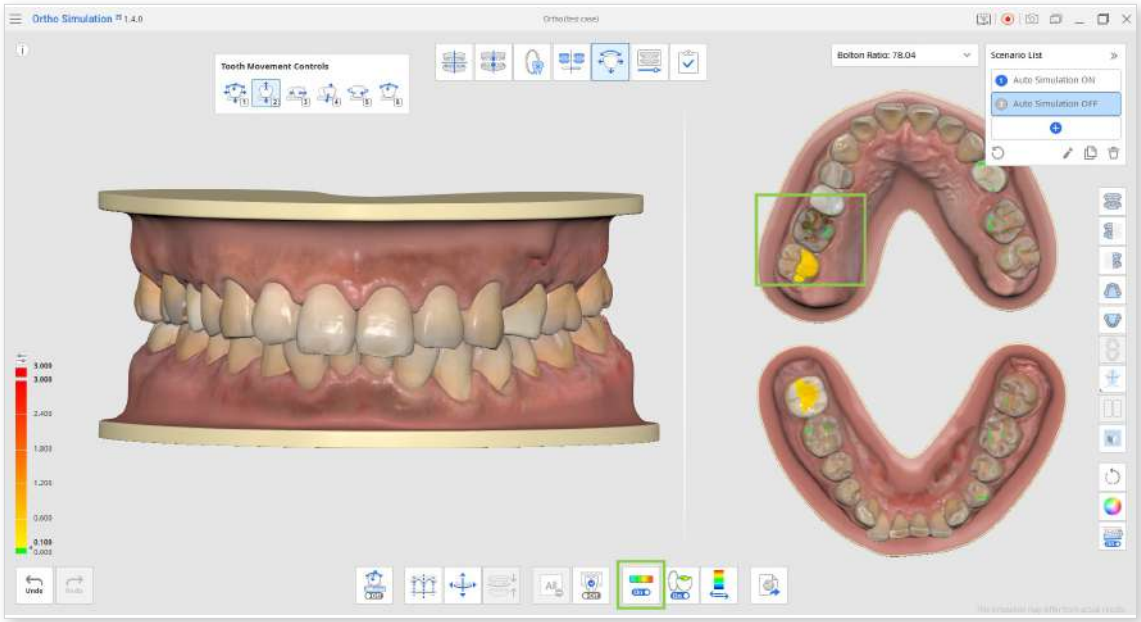
Use the keys 1 to 6 for quick change between options in the "Tooth Movement Controls."



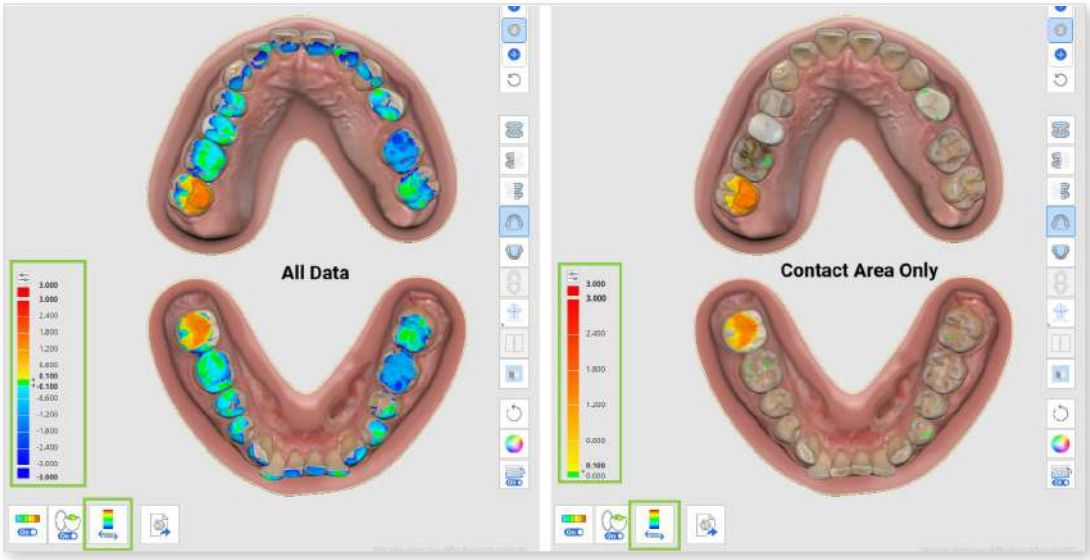
- Use "Deselect All" to remove selection from all teeth and return to moving them individually.



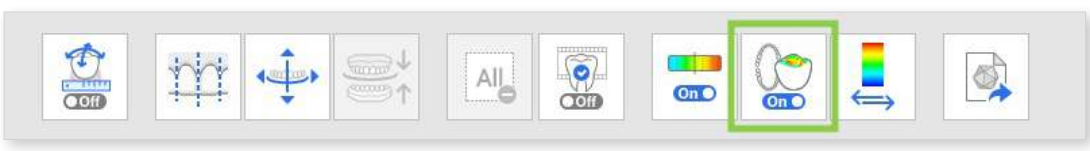
③ Turn on "Show/Hide Occlusal Intersection" if you want to reference the changes in occlusal relationship while moving teeth.



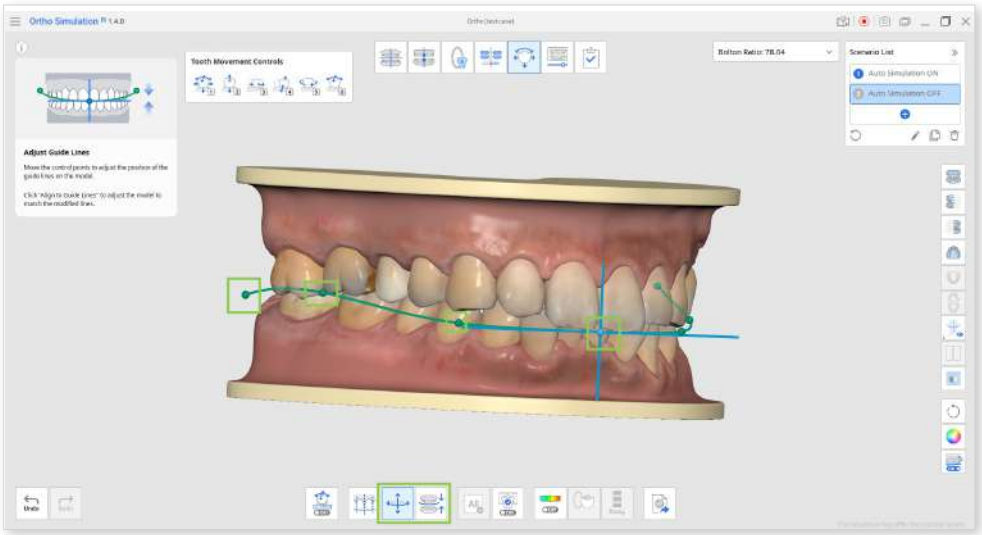
- You can change the scale of the deviation display between all data and the contact area only by clicking "Switch Deviation Display Area." The scale resolution can be adjusted using the small icon at the top of the color bar on the left or by entering different values for the bold numbers.



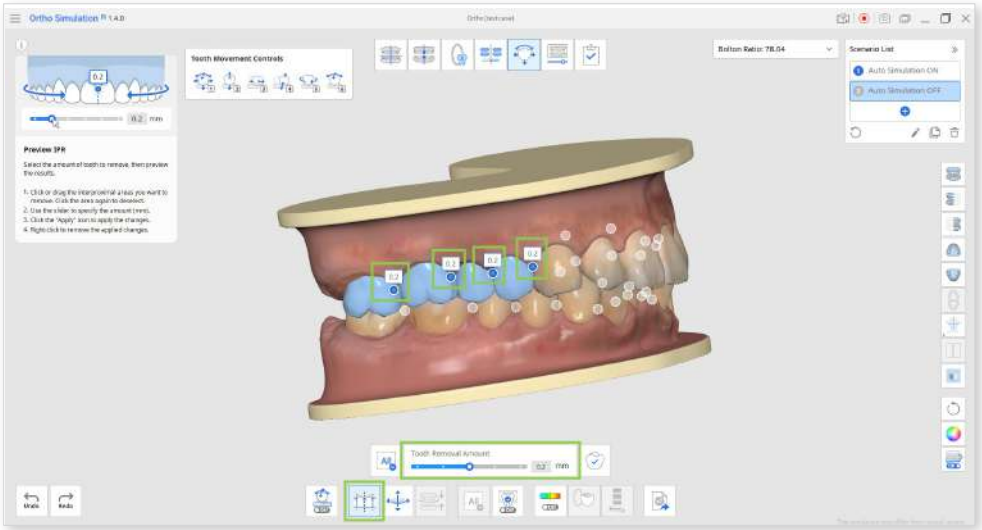
- The split screen with the occlusal view of the data on the left can be turned off if you click "Occlusion Multi-View."



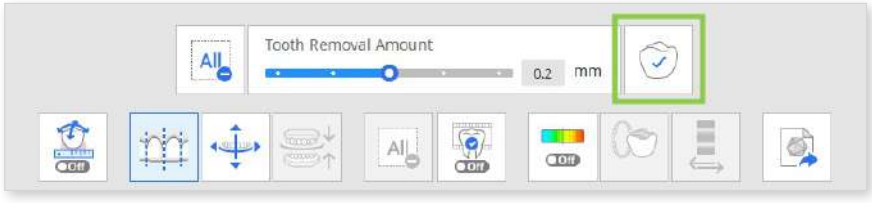
④ Teeth can also be moved by adjusting the midline and arch line. To do this, choose the "Adjust Guide Lines" tool at the bottom, then modify the guide lines on the model by dragging their control points. Once the guide lines are adjusted, click "Align to Guide Lines" to update the model according to changes.



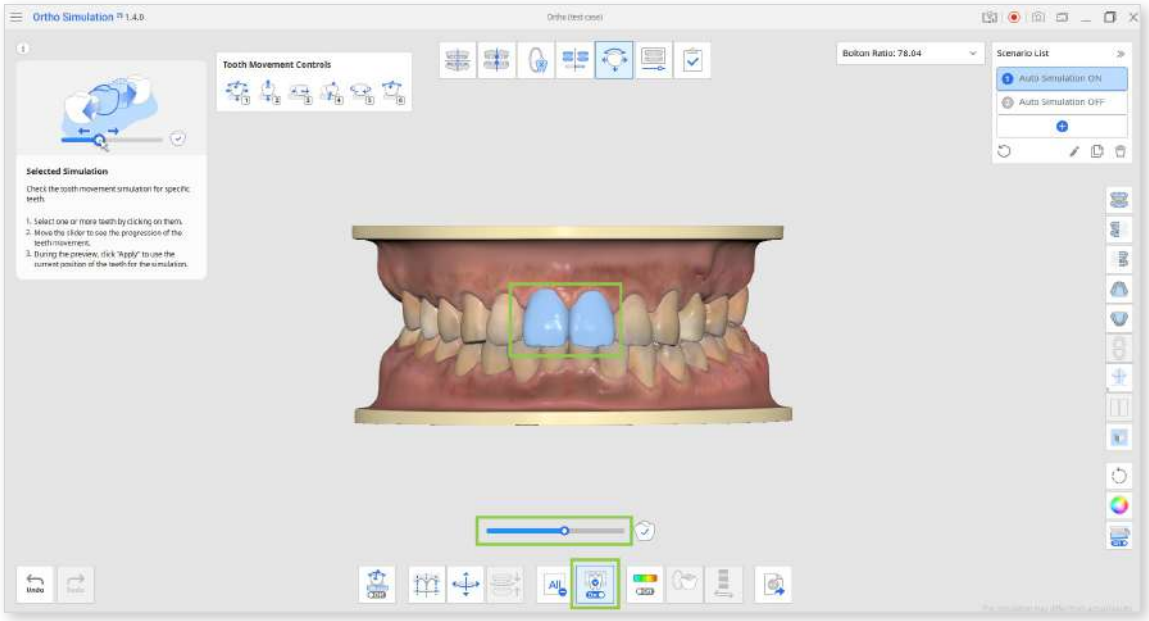
⑤ The "Preview IPR" feature lets you see the expected results of the interproximal reduction on your current simulation model. First, set the amount of tooth removal by moving the slider below. Then, select the circles representing the interproximal areas where reduction is expected. The preview will be available immediately.



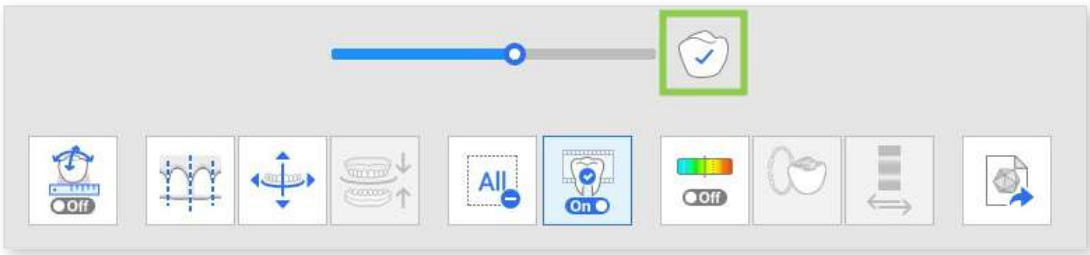
- If you want to apply the previewed IPR to the final simulation model, click "Apply" before deactivating the "Preview IPR" feature.



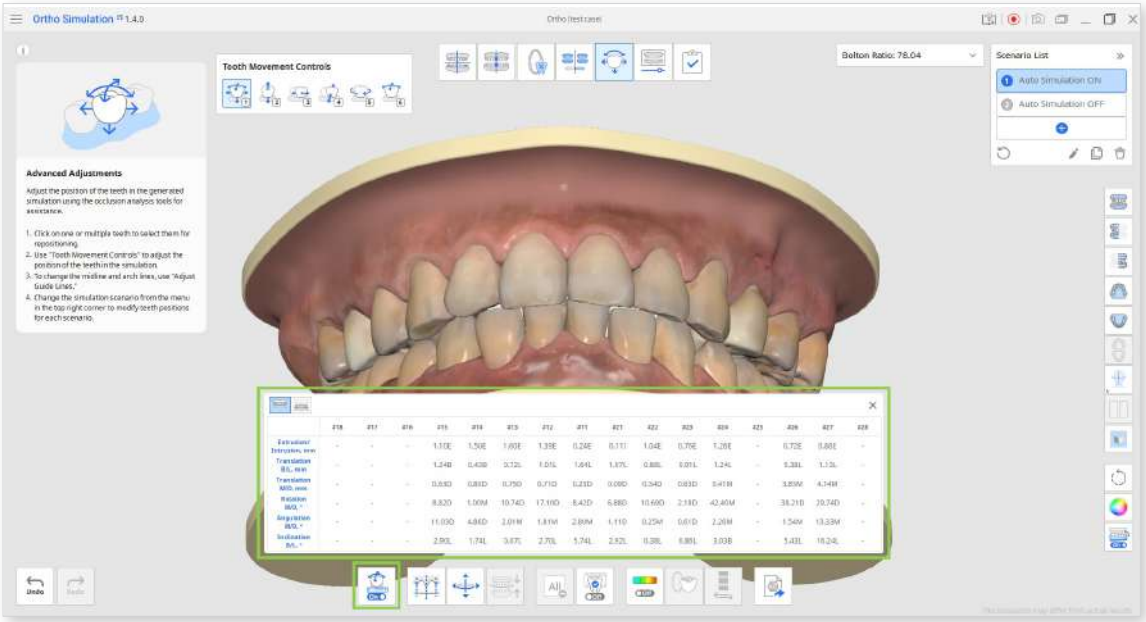
⑥ The "Selected Simulation" feature lets you check the animated tooth movement for specific teeth. Click on the teeth you're interested in, then drag the slider below to see the progression of their movement.



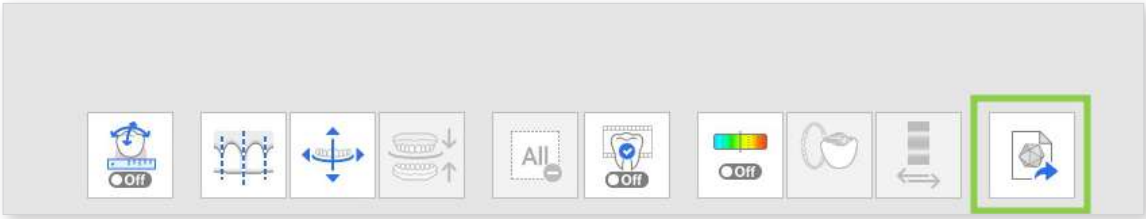
- If you want to apply the current position of the teeth from the replay to the final simulation, click "Apply" before deactivating the "Selected Simulation" feature.



⑦ Similar to the previous stage, you can review the details of teeth movements calculated and organized in a table for each arch using the "Teeth Movements Data" feature.

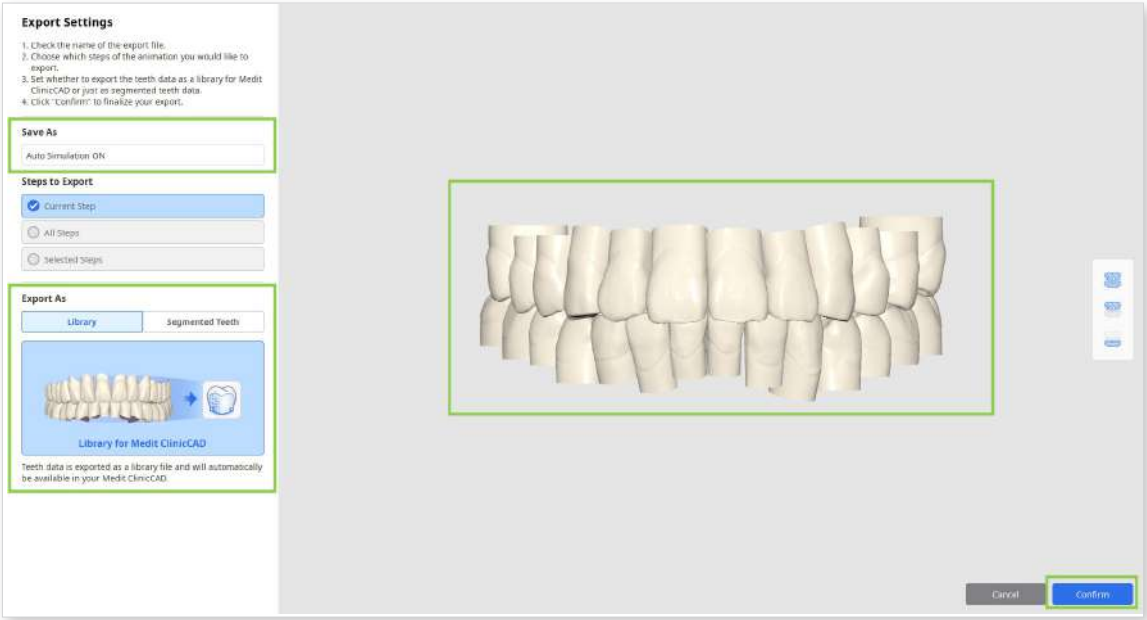


⑧ This stage also provides a feature for exporting your simulation data. Select a simulation scenario in the top right corner and click "Export to Medit Link" to customize your data export.



You can export data as a library file for further use in Medit ClinicCAD or just as segmented teeth data (open or closed). If you export data as a library, it will be automatically added to your Medit ClinicCAD upon the next app launch. Enter the name for the export file, review the data, and click "Confirm." All exported files will be added to your current Medit Link case.

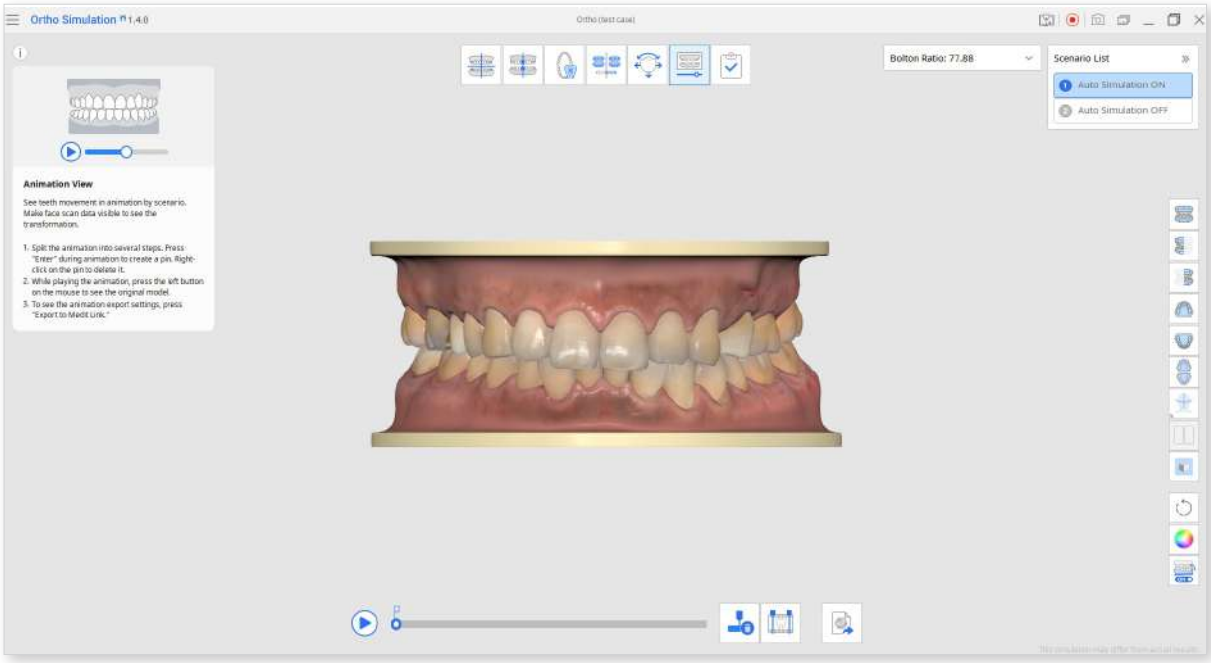
The "Steps to Export" options will be available in the next stage, where the animated simulation is divided.



⑨ When all work in this stage is completed, click the next stage icon at the top of the screen.

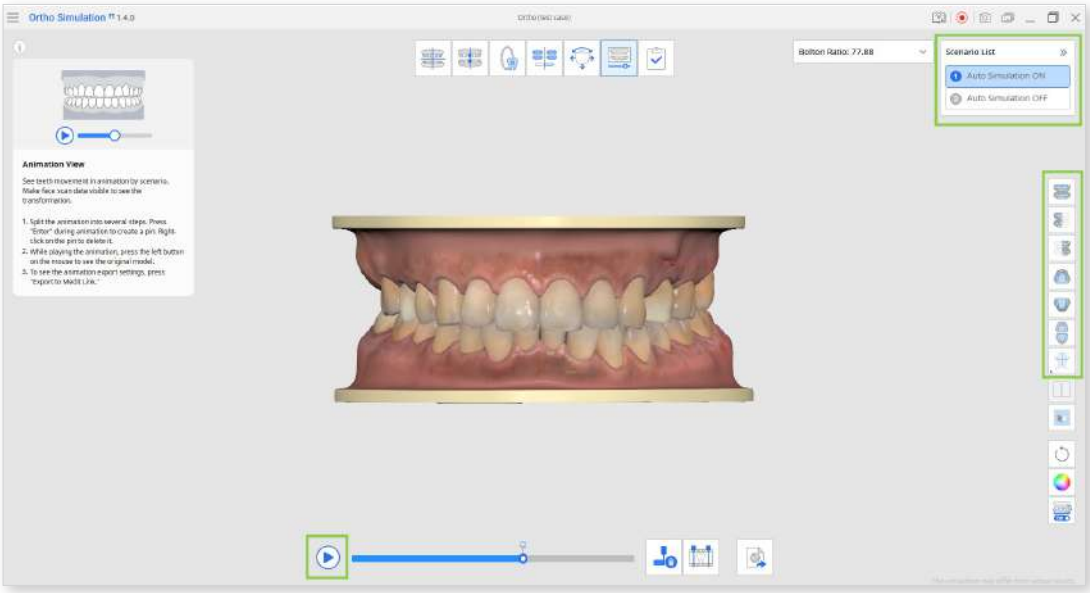
Animation View

This stage provides animated simulations for each scenario, serving as an additional visual aid for consultation or simulation analysis. Users can also export teeth data from a specific step of the animation if required.

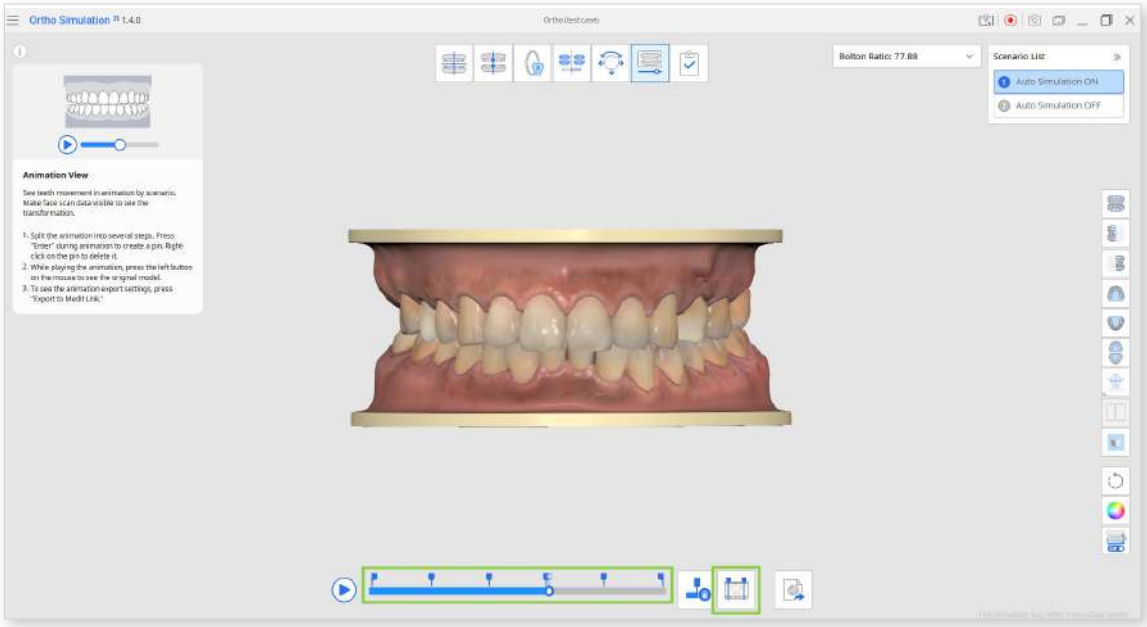


① Start by choosing a scenario in the top right corner for which you want to view the animated teeth movement. Then, click play (or hit the space key) to start the animation. Click on the model at any moment of the animation replay to pause it. If you click and hold, you can compare the current state of the teeth with the original model.

Use the view control buttons or "Show/Hide Reference Data" in the Side Toolbar for assistance.

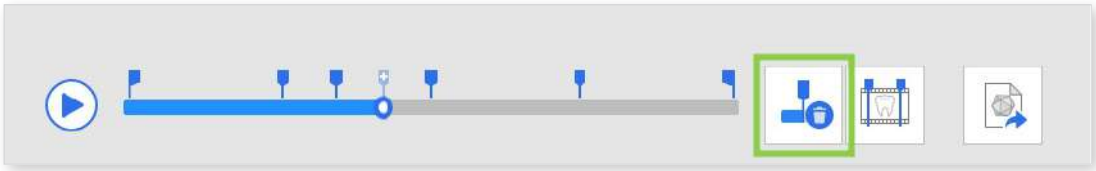


② Click "Splint Animation into Steps" in the Toolbox at the bottom to automatically divide the animation into even steps. You can set the number of steps, up to 20. Each step will then be marked with a pin.



- Steps can also be manually created by clicking the little pin icon above the seek bar.

- Right-click a pin to delete it, or use "Delete All Pins" to remove them all at once.



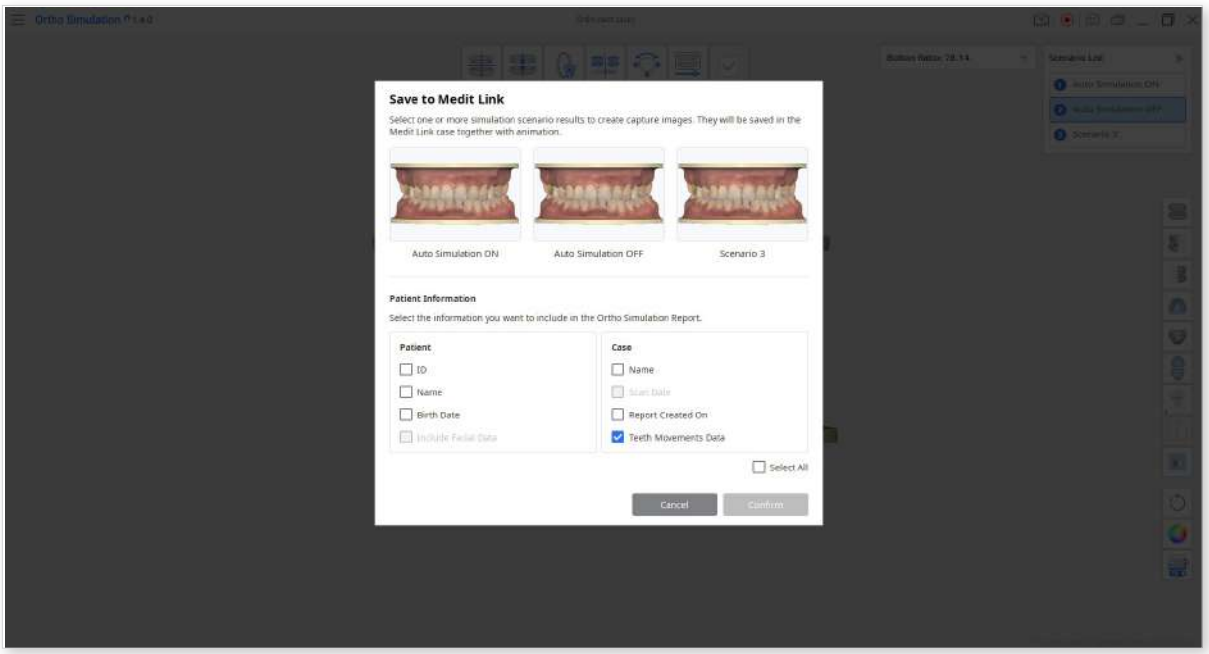
③ If needed, you can export teeth data from a specific step by customizing the export options in the "Export to Medit Link" feature at the bottom. You can export the current step only, all steps, or select specific steps.

> Exporting teeth data from a step in an animation is only possible if you export data as segmented teeth, not library data.

④ When all work in this stage is completed, click the final stage icon at the top of the screen.

Complete

Use "Complete" when you have finished working on the simulation project. This stage allows users to save the result files for the current project to the Medit Link case.



Choose which scenarios you want to save; you can select multiple scenarios. By default, the program will save the following results from your project:

- project file

> The app can create only one project file under a single case, meaning that it will be overwritten every time you reopen the app from the same case.

- capture images of the simulation with project information (also referred to as Ortho Simulation Report)
- video of the animated simulation
- a CSV file with teeth movement data (optional)

For the Ortho Simulation Report, check what patient and case information you want to add to the capture images of the simulation. The report will be available for review in Medit Link.