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CEREC Basic Information 3.8
A Clinical Guide

Authors: Andreas Ender, Albert Mehl



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I. The CEREC system – an overview

CEREC is a dental CAD/CAM system consisting of an acquisition unit (CEREC AC), an intraoral camera (CEREC Bluecam) and a milling unit (CEREC MC XL). With the aid of the CEREC Bluecam the dentist scans the treatment site in the patient's mouth. On the basis of this scanning data the CEREC AC computes a three-dimensional virtual model. The dentist then designs the restoration (CAD process) on the monitor of the CEREC AC and transfers the design data to the CEREC MC XL via a wireless link. The restoration is milled out of a ceramic block (CAM process).

1. The history of CEREC

The CEREC procedure was developed in the 1980s by Prof. Dr. Werner Mörmann and Dr. Marco Brandestini. The underlying idea was to create all-ceramic restorations directly in the dental practice during a single treatment session. This established a completely new concept in dentistry: "Chairside CAD/CAM" (Computer Aided Design/ Computer Aided Manufacturing in the dental practice).

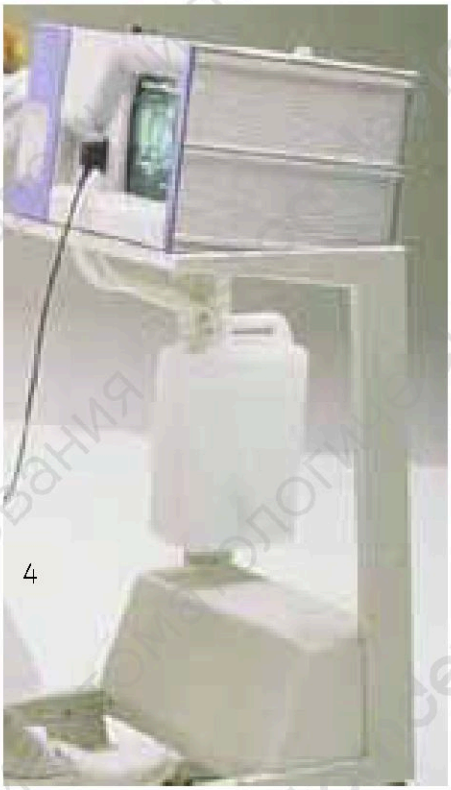






1 *CEREC AC*
2 *CEREC Bluecam*
3 *CEREC MC XL*
4-6 *Development of the CEREC AC*
7 *Prof. Dr. W. Mörmann and Dr. Marco Brandestini, who invented the CEREC technique*
8 *The first optical impression made with the CEREC 1 camera*

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The world's first CEREC overlay was created in Zurich in 1985. Since then more than 22 million CEREC restorations have been fabricated and placed.

The CEREC system has undergone continuous development, culminating in today's CEREC AC milling unit. 2001 saw the launch of the inLab unit, a CAD/CAM system designed specifically for dental laboratories. This allows the dental technician to scan models and then create prosthetic restorations out of high-strength oxide ceramics.


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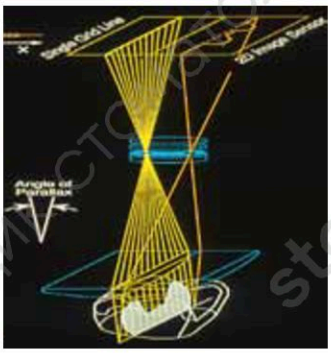

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2. Digital impressions

The core of the CEREC procedure is digital impression scanning. The CEREC Bluecam operates on the principle of stripe-light projection, combined with active triangulation.



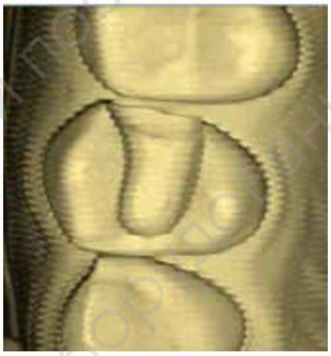
A pattern of parallel lines is projected onto the tooth. These lines are distorted by the tooth contours.



The distortions can be viewed from an angle (triangulation). This delivers precise information about the various elevations of the tooth. If the line pattern is shifted, by moving the grid during the exposure, the measuring points can be clearly assigned.



The accuracy of the optical impression depends on the wavelength of the light source. Short-wavelength blue light ensures greater accuracy than e.g. red or infrared light.





The automatic exposure system eliminates substandard optical impressions. In these examples, the left-hand image is blurred; the right-hand image is correct.

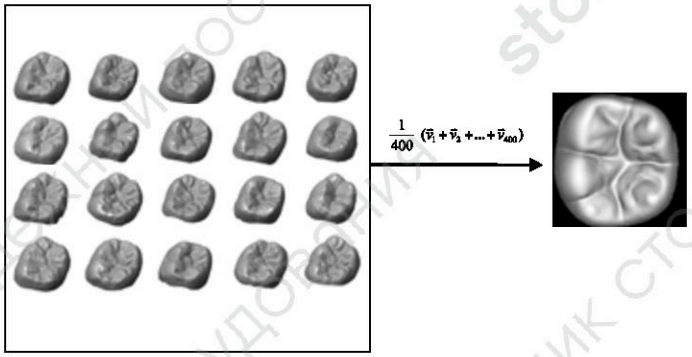
The CEREC impressions achieve very high levels of precision – inlay preparations: 19 µm.

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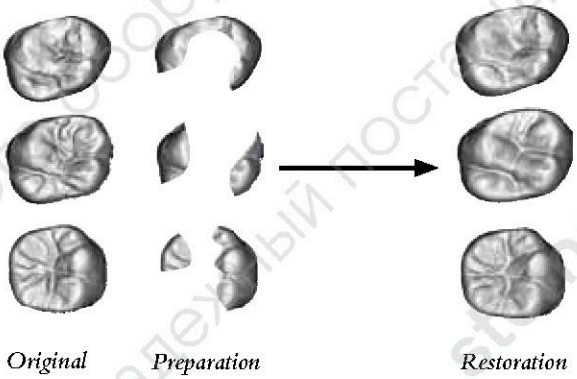
3. CEREC 3D software

A unique feature of the CEREC 3D software is the **biogeneric occlusal surface design function**.

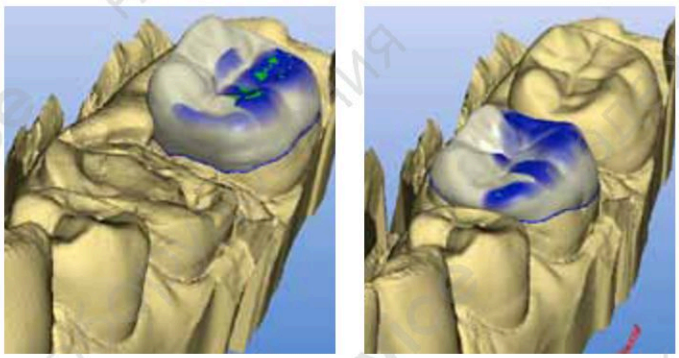
The biogeneric process is based on the scientific finding that a patient's teeth share common morphological characteristics. These characteristics can be analyzed and then expressed as mathematical functions. The "Biogeneric Tooth Model" is the outcome of extensive research carried out by Prof. Dr. Albert Mehl and Prof. Volker Blanz.



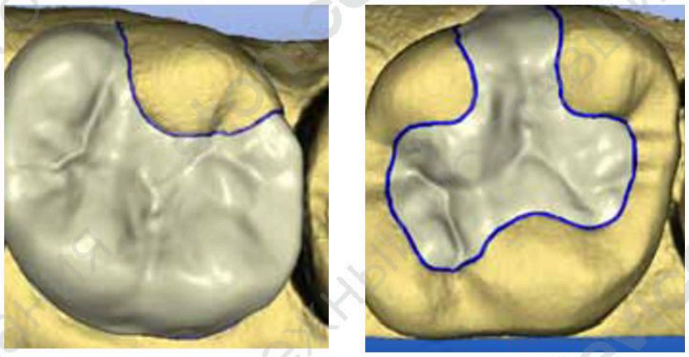
The patient's individual tooth morphology is analyzed. This provides the basis for the automatic computation of the occlusal surfaces.



Patient-specific CEREC restorations can now be created "at the touch of a button". The restoration is adapted automatically to the residual tooth and the neighboring teeth.



The biogeneric tooth model implemented in the CEREC 3D software streamlines and speeds up the computer-aided design process. The resulting restorations are rated very highly by dentists



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4. The advantages of the CEREC system

The advantages of the CEREC system are as follows:

- Treatment of single-tooth defects with high-quality ceramic restorations in a single treatment session
- Broad spectrum of applications, ranging from inlays to full crowns and veneers
- Direct monitoring of the preparation on the computer screen
- No need for temporary restorations
- No need for conventional impression materials
- No post-operative oversensitivity
- Fast, highly automated design process
- Patient-specific restorations
- Integration of X-ray data for implant planning and the production of surgical guides
- Integration into digital workflow – CEREC Connect
- Fabrication of temporary crowns and full-size bridges with up to 4 units as long-term temporaries – e.g. in connection with implant therapy

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5. The possibilities with the CEREC system



The digital impressions generated by the CEREC AC open up a wide range of possibilities – from the creation of all-ceramic restorations to integrated implant planning.



1. Chairside solution – CEREC AC acquisition unit + CEREC MC XL or CEREC 3 milling unit
You work in the "chairside" mode. With the aid of your CEREC milling unit you can create a complete spectrum of all-ceramic single-tooth restorations during a single treatment session. The same applies to crowns and temporary bridges (with up to 4 units) made of polymer materials.



2. Digital impression solution – CEREC Connect
You delegate the fabrication process to a dental laboratory. Your intraoral images are transformed into a 3D data model, which is then transmitted online to the dental lab. The lab fabricates the restoration and sends it back to you together with an industrially produced model.
The laboratory can either use its inLab system or else delegate the fabrication process to infiniDent, Sirona's central production service. The restoration can also be fabricated using conventional lab techniques.



3. Labside solution – inLab
The CEREC system is 100% compatible with the Sirona inLab system. CEREC can be expanded with the inLab system to scan intraorally and from a model. This enlarges your restoration spectrum to include bridge frameworks and crown copings made of oxide ceramics e.g. zirconium oxide, as well as customized implant abutments.



4. Integrated implantology solutions – CEREC meets GALILEOS
You have the option of integrating digital CEREC impressions into Sirona's GALILEOS Implant software. This creates the basis for simultaneous surgical and prosthetic implant planning. This data can be used to create surgical guides.

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6. CEREC glossary

Chairside solution
Complete treatment during a single visit, performed directly in the dental practice.
The dentist prepares the tooth, acquires an optical impression with the aid of the CEREC AC unit, designs the restoration and mills it out of a ceramic block using a CEREC milling unit. The restoration is adhesively bonded and then polished.

Labside solution
Fabrication of the restoration in the dental laboratory using CAD/CAM techniques.

Digital impression solution – CEREC Connect
Acquisition of digital impressions either directly in the patient's mouth using the CEREC AC or indirectly on the basis of the stone model.

The term "digital impression" describes the following process:
The dentist prepares the tooth and takes an optical impression. This impression is then sent via CEREC Connect to the dental laboratory, where the restoration is fabricated. The necessary models can be ordered from infiniDent*, Sirona's central production service. *Not available in all countries.

Central production solution – infiniDent*
The infiniDent production centre fabricates metal and oxide ceramic restorations on the basis of 3D data generated by the CEREC and inLab systems.
The dentist or dental technician sends the design data via the Internet to infiniDent, where the restoration is fabricated. The finished restorations are then sent to the dental practice/dental laboratory. *Not available in all countries.

Integrated implantology solutions – CEREC meets GALILEOS
Integration of the CEREC 3D data into the GALILEOS Implant software as the basis for simultaneous prosthetic and surgical implant planning.

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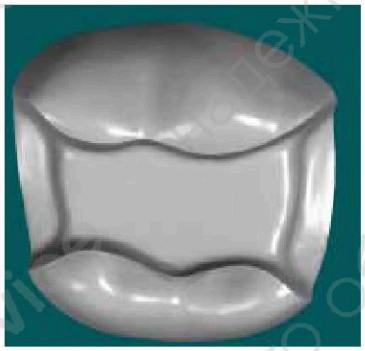
II. Acquiring optical impressions with CEREC Bluecam

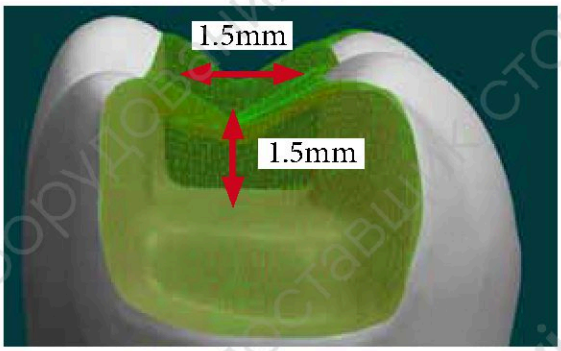
1. Preparation guidelines

General all-ceramic preparation guidelines apply to CEREC. It is important to ensure a sufficient wall thickness and to create carefully rounded inner transitions. The only sharp edge in an all-ceramic restoration is the preparation margin.

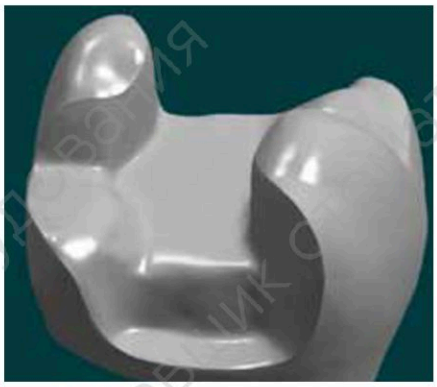
An inlay preparation consists of a flat cavity base and divergent cavity walls towards occlusal ca. 6°. The transition between the cavity wall and the occlusal and proximal box must be rounded. The circumference of the cavity must be prepared without sharp edges and narrow radiuses. It is important to achieve a clearly defined preparation margin. All areas of the preparation margin must be visible from the direction of the occlusal preparation (insertion axis).



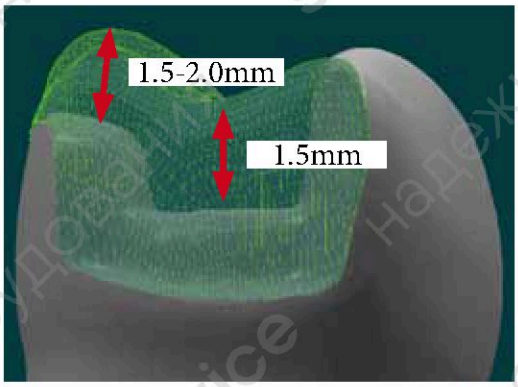




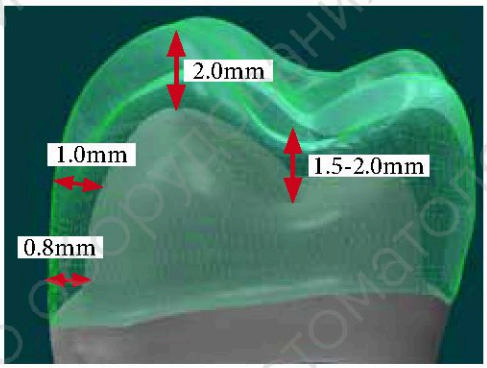
If, for a vital tooth, the minimum wall thickness of 1.5 mm cannot be maintained, the corresponding cusp must be shortened by 1.5 – 2 mm. It is important to achieve a horizontally level preparation margin in the area of the shortened cusp. The transition from the proximal box to the horizontal preparation margin must be rounded. Adhesively bonded partial crowns allow the dentist to adopt a very variable, tissue-conserving preparation technique. In many cases partial crowns eliminate the need for a full-crown preparation.

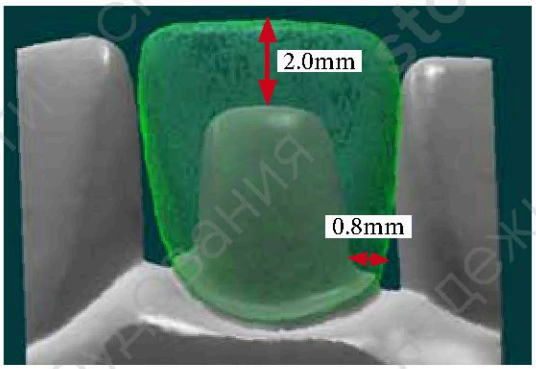






In cases where a full crown is indicated, a circular step should be created with a rounded inner edge (shoulder preparation). The width of the shoulder should be 0.8 mm. The tooth stump is reduced occlusally by 2 mm. A convergence angle of 6 – 10° should be maintained.

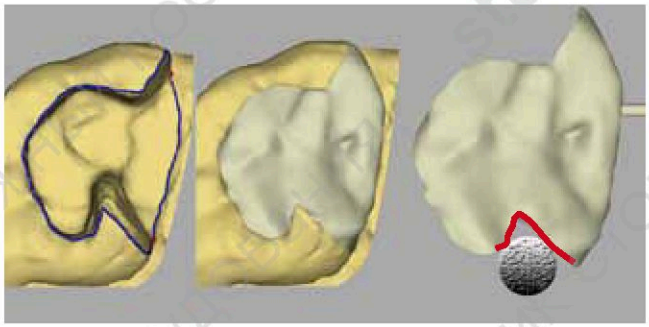




Preparation errors

Incorrect preparations have a negative influence on the fit of a ceramic restoration. The longevity of the restoration can be reduced as stress-induced fractures are possible.

The most common error is the creation of narrow angles in the cavity walls and/or at the transition from the occlusal to the proximal box. In such cases it is not possible to mill the restoration to the required shape due to the constraints of bur geometry. This leads to an excessively tight fit, which in turn weakens the ceramic material.



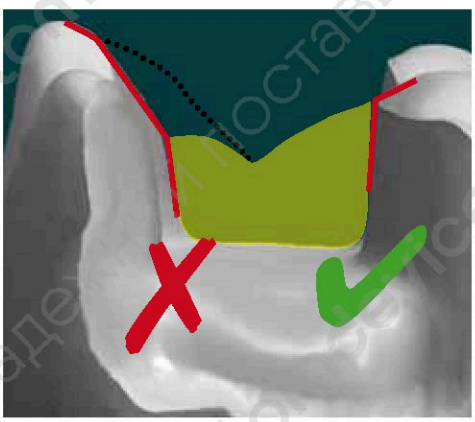
Irregular cavity bases and preparation margins prevent the accurate milling of the restoration.



Undercuts in the proximal box cannot be milled and hence lead to defects in the restoration. In the proximal box it is important to create an occlusally divergent preparation, ideally with an aperture angle of 4 – 10°.



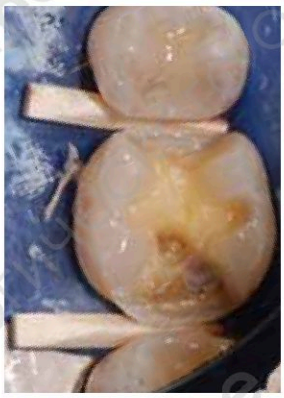
Not well defined preparation margins are difficult to detect on the model and result in inadequately dimensioned restorations. In addition, thin ceramic margins are extremely fracture-prone.



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2. Soft tissue management

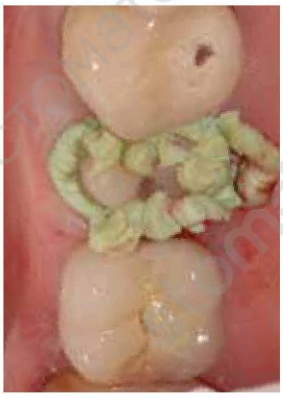
The basic rule for optical impressions is the camera can detect only those areas which are clearly visible. Before the non-reflective powder coating is applied the entire preparation margin must be clearly revealed. Depending on the specific situation, various techniques can be applied.

In the case of supragingival and equigingival preparation margins no additional effort is required. In the case of equigingival proximal boxes the preparation margins can be separated additionally by means of wooden wedges.



An intrasulcular or subgingival preparation margin is often desirable for crowns and bridge restorations. The simplest way to displace the gingival tissue is to deploy a retraction cord.


To achieve additional haemostasis the dentist can apply an iron sulphate gel (e.g. Astringent, Ultradent) or ammonium chloride products (e.g. Expasyl).



In some cases it may be necessary to perform a gingivectomy procedure with the aid of an electrosurgery device or a laser in order to reveal the preparation margin.

3. Powdering

In order to obtain an accurate optical impression an opaque powder coating must be applied evenly to the preparation. Various products are available for this purpose – e.g. CEREC Optispray (Sirona).



Begin by powdering the outer tooth surfaces. Rotate the nozzle in such a way that you can access the buccal surfaces while holding the spray can in a vertical position. Apply the coating in short bursts, from mesial to distal. 1





Rotate the nozzle and powder the oral tooth surfaces. 2





Finally, you should coat the occlusal surfaces and the tooth cavity. An even and thin coating in the cavity is a prerequisite for the optimum fit of the restoration. The optimum thickness is 40 - 60µm (150 µm in the case of excessive application). 3





Powdering an inlay cavity



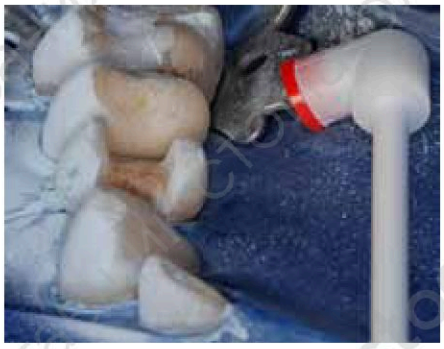
This clinical example describes the application of a powder coating to an inlay cavity. After the preparation has been performed, the cavity and the adjacent teeth should be dried thoroughly..

1 Begin by coating the exterior buccal surfaces. Rotate the nozzle horizontally while keeping the can in a vertical position. Maintain a distance of approximately 1 cm from the tooth surfaces. Apply the powder in intermittent short bursts.



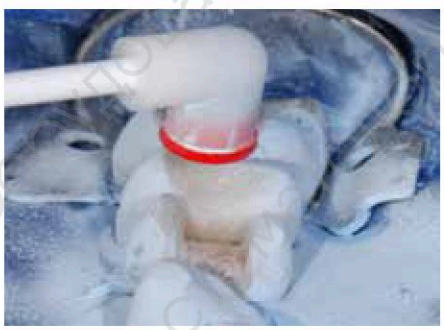


2 Then adjust the nozzle in such a way that you can powder the oral tooth surfaces. To achieve an even coating it is important to keep the spray can in a vertical position and to rotate the nozzle as necessary.





3 Finally, you should powder the interior surfaces of the preparation from an occlusal direction. This ensures a thin and even coating of the cavity. Check to ensure that all surfaces have been properly covered. Defective areas can be powdered subsequently.





4. Operating the camera

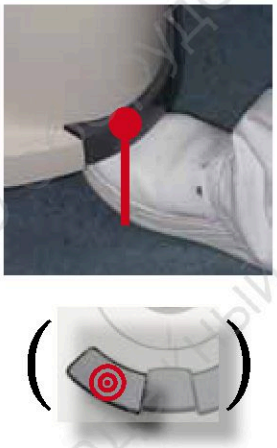
The CEREC Bluecam is equipped with an automatic acquisition control system. In the so-called “continuous measuring mode” the system triggers a series of optical impressions as a soon as the camera is held steadily. Alternatively, the optical impressions can be acquired in the manual mode. In this case, the user determines the moment when the optical impression is captured, irrespective of whether the camera is held steadily or not. The camera is activated either via the left mouse or alternatively the foot control.





Activating the automatic acquisition mode

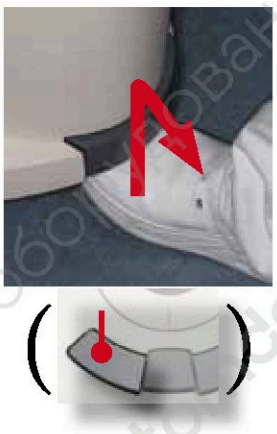
To activate the continuous measuring mode either click the left mouse or touch the foot control briefly. A series of optical impressions is captured as long as the camera is held steady. To deactivate the automatic acquisition mode simply click the left mouse or the foot control again.





Activating the manual acquisition mode

The manual acquisition mode is activated by pressing the foot control upwards or by holding down the left mouse. As soon as you release the foot control or the left mouse a single optical impression is captured. To acquire further optical impressions simply repeat this procedure.



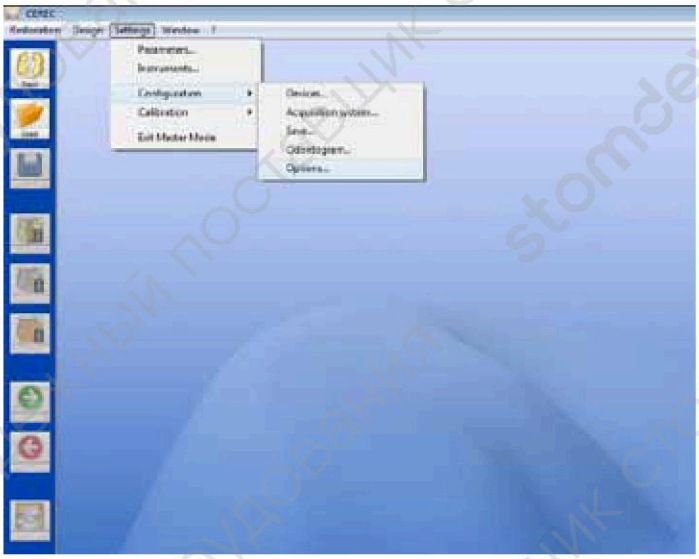


In the automatic as well as the manual acquisition mode the cursor must be positioned over the “Acquire preparation” icon.

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Adjusting the sensitivity of the camera

The shake sensitivity of the camera can be adjusted via the "Settings/Options" menu. Here you can determine how much camera shake is permitted when the optical impressions are triggered automatically. The settings range from "Tolerant" to "Very strict". We recommend that you choose the "Strict" setting on a day-to-day basis. In normal clinical situations the "Very strict" setting is impractical due to the patient's movements. This setting should be used only to acquire optical impressions of stone models or elastomer jaw impressions.



5. Digital impression scans

Position the camera over the preparation. The C-Stat support helps you to position the camera on the occlusal surface without damaging the powder coating. In automatic mode as soon as the camera is steady it will take an image. In manual mode you either have to release the left mouse or touch the foot control. The image is immediately displayed on the monitor.





Optical impression of the preparation

The optical impression of the preparation captures the entire cavity. Position the camera in such a way that the entire preparation margin is visible. The optical impression is then triggered and is displayed immediately as a 3D preview in the image catalogue and as an image (icon) in the docking bar.

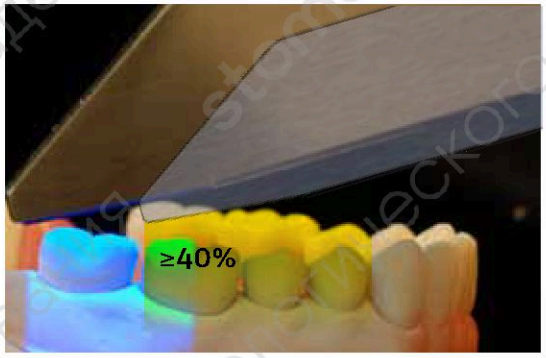


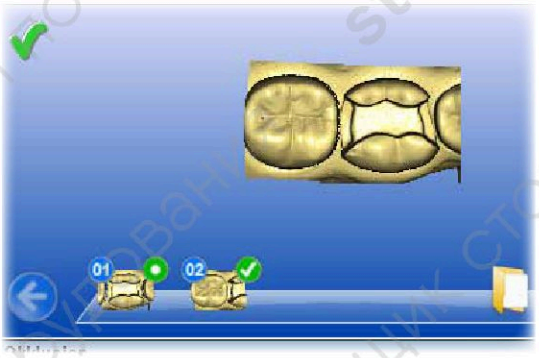




Supplementary impressions

The purpose of the supplementary impressions is to capture the adjacent teeth and expand the 3D model. Simply move the camera along the tooth row and trigger a second impression. In order to achieve optimum processing results the degree of overlap with the first impression should be at least 40%. This is indicated by a green tick next to the second image in the 3D preview. The 3D preview is expanded to include the second image.



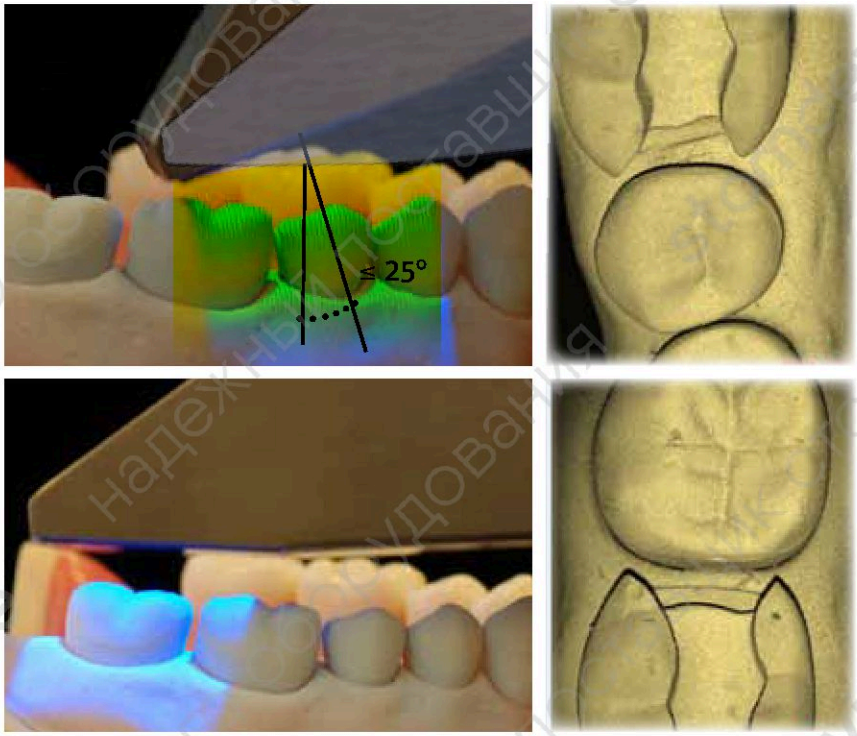
You can then acquire impressions of the adjacent teeth.



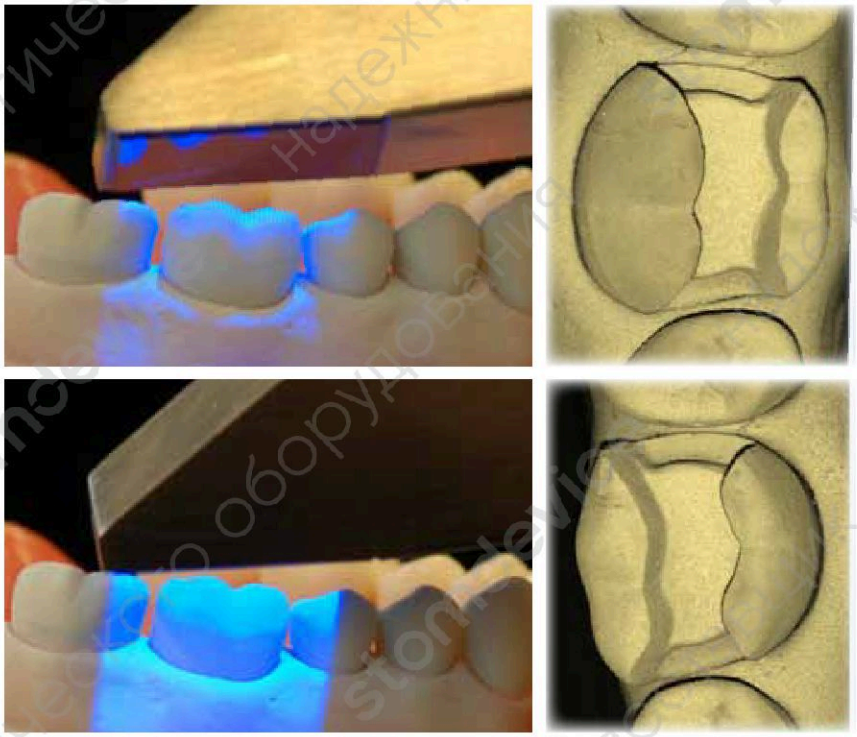


Angled impressions

Angled impressions are necessary for the optimum acquisition of the external tooth contours. They enable you to capture the areas under the tooth equator and hence help you to evaluate and edit the restoration on the monitor. Mesially and distally tilted impressions capture the proximal contours of the neighbouring teeth – important for the adjustment of the proximal contacts. After you have acquired the mesial image you should hold the camera at a steeper angle in order to capture the distal proximal surface of the adjacent mesial tooth. The angle between the two images should not exceed 25°. Following this you can capture the mesial proximal area of the distal neighbouring tooth.

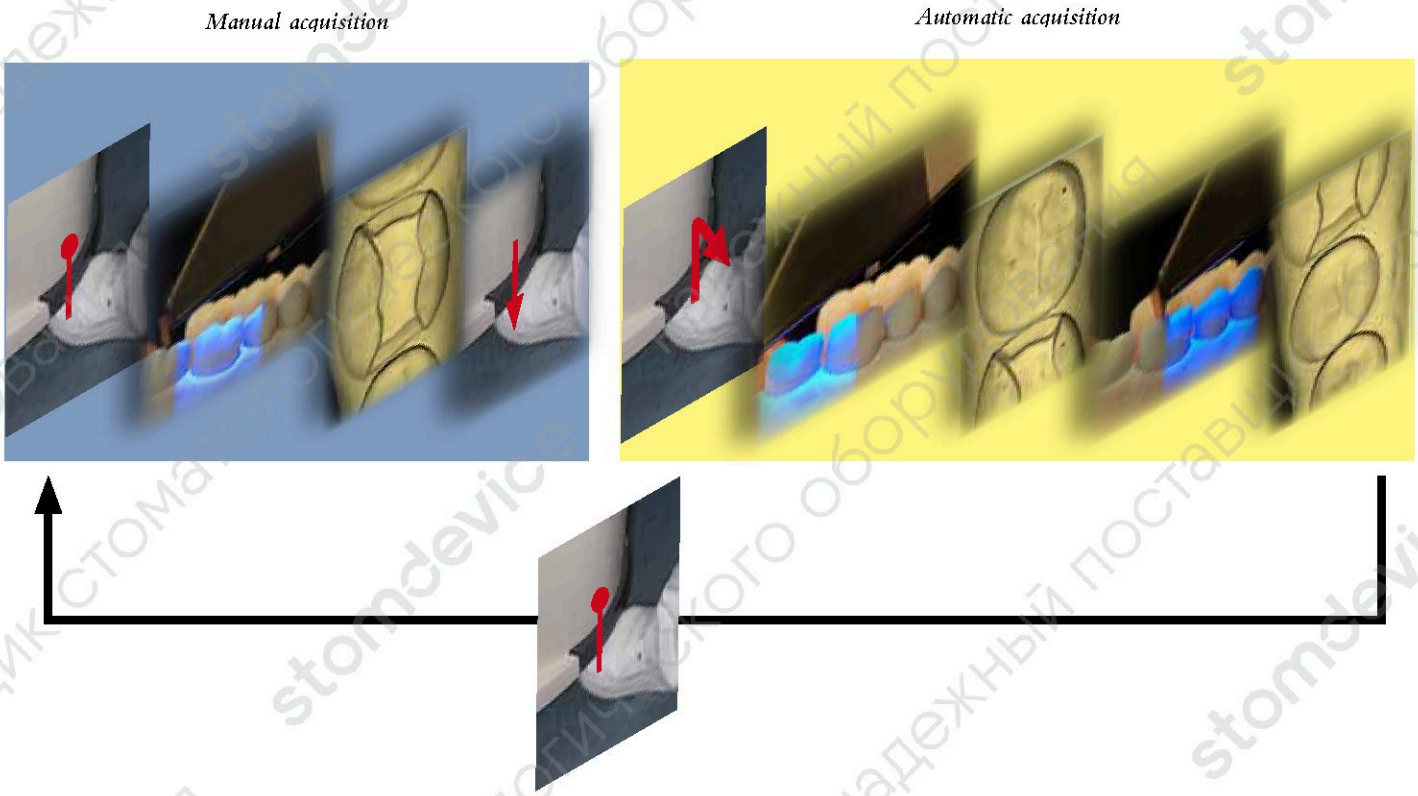


The supplementary buccal and oral impressions capture the outer contours of the prepared tooth and its neighbours. This is particularly helpful in relation to partial and full crowns, as well as anterior restorations. Tilt the camera in a buccal and then in an oral direction. Here as well, the angle between two images should not exceed 25°.



Switching between acquisition modes

Subsequent supplementary impressions are best captured in the automatic mode. To activate this mode touch the foot control briefly. During the imaging sequence it is possible to switch back and forth between the two acquisition modes.



In the manual acquisition mode you have ample time to position the camera over the preparation in order to capture the first optical impression. You can then activate the automatic mode by briefly clicking the left mouse or lowering the foot control. This allows you to capture a series of supplementary optical impressions in quick succession. To switch back to the manual mode simply raise the foot control.

End the imaging sequence by briefly raising the foot control. Return the 3D camera to its holder and fix it in place with the retaining clip.



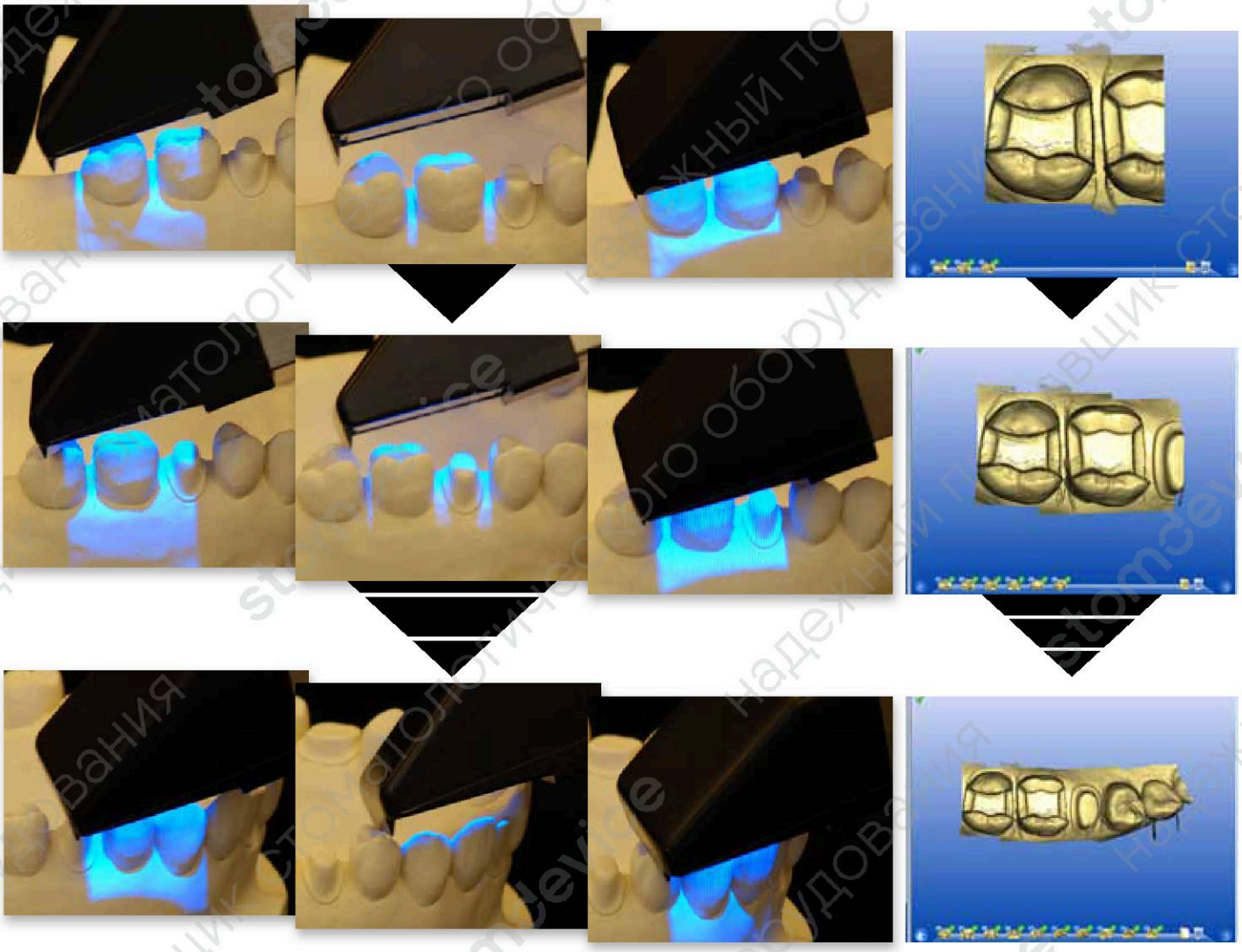


All the saved impressions are displayed as icons in the lower bar of the image catalogue. The preparation can be viewed and assessed in the 3D preview. Here you can see the extent of the virtual model.

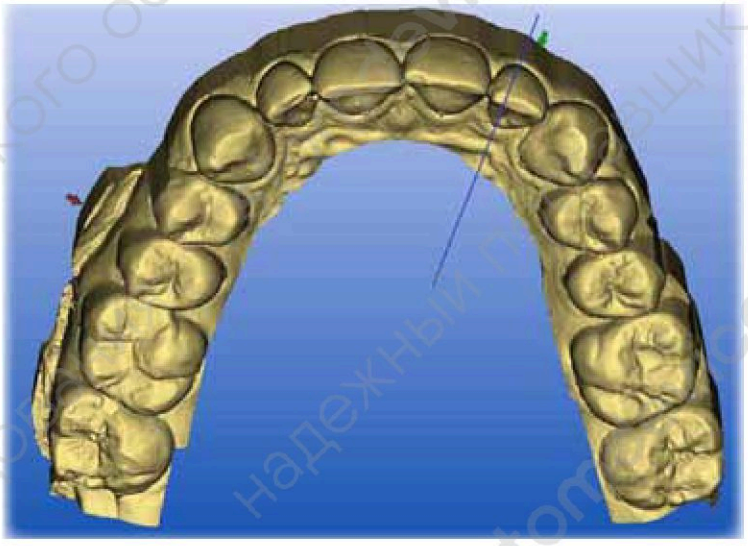


Quadrant impressions

The high precision CEREC Bluecam camera is capable of generating impressions of quadrants and whole jaw arches. To this end the camera is moved successively to different positions. Quadrant impressions ranging from the distal molar to the canines are recommended for the chairside treatment of several adjacent teeth (quadrant redevelopment). 15 to 20 impressions are usually sufficient for this purpose.



Whole-arch impressions can be acquired when you are working simultaneously on several quadrants. However, this imaging technique requires a certain amount of experience with the 3D camera. In addition, it is necessary to deploy extensive retention techniques for the lips, cheek and tongue.



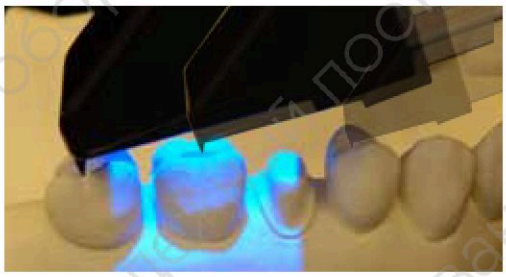
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6. Capturing the bite situation

The CEREC 3D software can automatically adapt the restoration proposal to the antagonist. To this end it is necessary to capture the position and morphology of the opposing teeth. This can be performed in two different ways.

6.1. Buccal registration

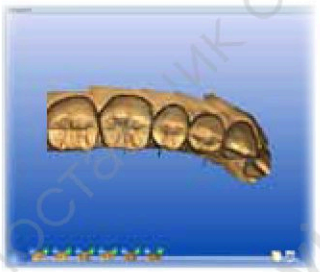
1 Buccal registration entails a series of angled and supplementary impressions acquired from the occlusal, buccal and oral direction. These supplementary impressions should extend as far as the canine.



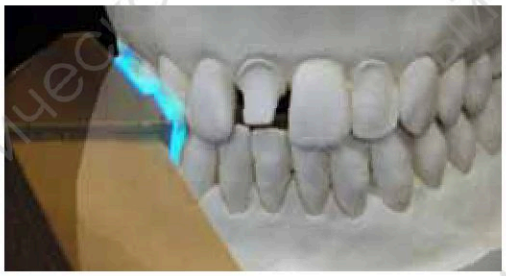


2 This is followed by the application of the powder coating and the acquisition of the antagonist quadrant. In this case supplementary buccal impressions are an absolute must. Here as well, the optical impressions should extend as far as the canine region.





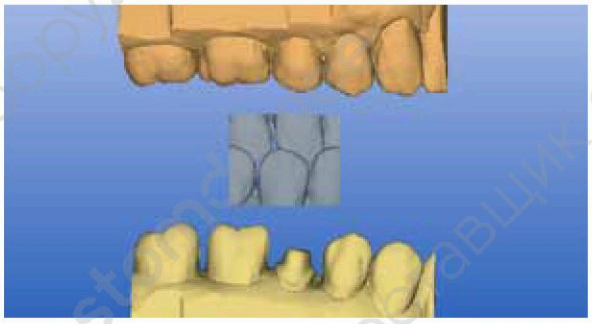
3 The patient then closes his or her jaw in permanent habitual occlusion. The camera is placed horizontally in the vestibule and an impression is acquired in the area of the premolars at the height of the occlusal plane. To continue press the green icon “Next”.



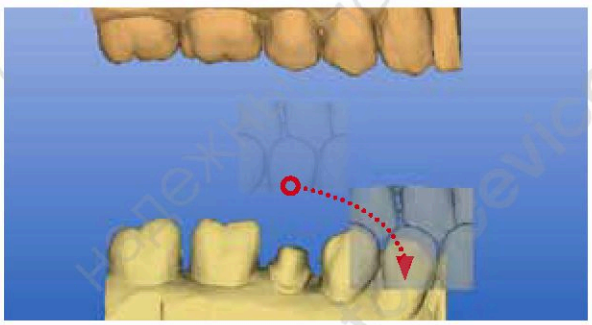


Attention:
The camera must not compromise the patient’s terminal occlusion. For this reason the camera should be placed in the canine-premolar region, where there is sufficient space.

4 The next step is to assign the preparation model, the antagonist model and the buccal impression to each other. The three images are arranged one above the other on the monitor.

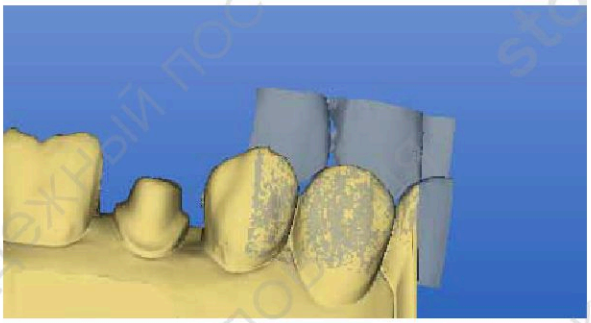


5 Move the cursor onto the buccal impression and click on the cervical area of the upper canine. While keeping the left mouse pressed, drag the buccal impression onto the upper canine of the preparation model and release the left mouse.



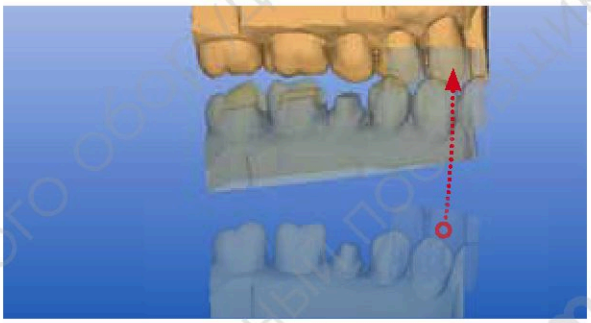
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The bite occlusion image is superimposed on the basis of the buccal surfaces. This is why it is so important to capture the angulated images of the preparation and the antagonist.



6

Click on the cervical margin on the antagonist canine and keep the left mouse pressed. Drag the buccal impression and the preparation model onto the canine of the antagonist model.



7

The outer contour of the model is now superimposed on the buccal impression. The preparation and the antagonist have now been spatially assigned to each other according to the specific clinical situation.

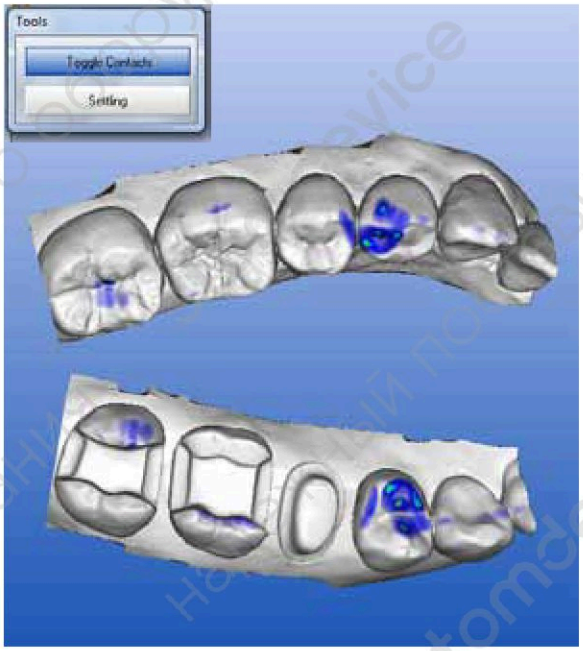


8

To view the occlusal contacts on the 3D model click the "Contact" button.

Via the "Settling" function the CEREC software attempts to achieve an even distribution of contact points across the entire model. This function should be deployed only with great caution due to the fact that the software cannot allow for the real-life contact situation (position relative to the TMJ, resilience of the individual teeth, clinical non-occlusion, etc.). On the basis of our clinical experience the assignment of the models on the basis of the buccal impression is very precise, so that "Settling" is not required.

"Settling" can be used to create evenly distributed contacts on whole-arch stone models. This function should not be used for intraoral impressions.



9

6.2. Bite material registration

Bite material registration offers a further possibility for capturing the antagonist. This method is ideally suited for distal single-tooth restorations, as it reduces the total number of optical impressions which need to be acquired. In addition, it is ideal for those design modes in which buccal registration is not available e.g. Correlation.

1 We recommend that you use an A-type silicone material, which does not require an anti-reflective powder coating. Various products are available – e.g. Metal-Bite Blue (R-dental).



2 Apply only a small quantity of the material to the preparation and request the patient to assume his or her habitual occlusion. The material hardens in approximately one minute.



3 The registration material should cover the entire prepared tooth and at most 50 percent of the two adjacent teeth. Excess material should be removed using a scalpel. The registration must not be removed from the tooth, as this makes exact repositioning impossible.



4 The teeth are powdered and the bite registration captured using CEREC Bluecam. Supplementary optical impressions are then acquired of the uncovered portions of the adjacent teeth. These serve as the basis for superimposing the optical impressions of the preparation and the antagonist.



5 The antagonist model consists of the preparation (completely covered by the bite registration) as well as the two adjacent teeth (distal and mesial).



In addition to the static bite registration, it is also possible to capture a functionally generated path (FGP). This allows the restoration to be customized to the patent's individual functional movements. This technique has been described in the scientific literature: FGP technique with CEREC 3D, Müller, H. Int J Comput Dent 2006, Oct: 9(4):333-8

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III. Design steps in CEREC 3D software 3.8

1. Working with the 3D model

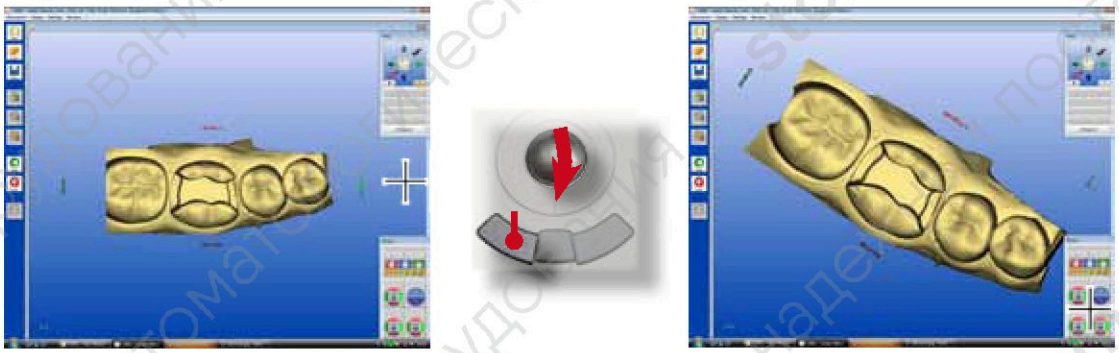
Turn

Position the cursor on the model, press and hold down the left mouse and rotate the trackball. This enables you to view the model/restoration from all angles and carry out adjustments.



Rotate

Position the cursor on the right-hand side of the 3D model. Press the left mouse and move the trackball downwards. The model is then rotated downwards on its mesial side. The rotation function is deployed above all when making corrections to the insertion axis.



Drag

Position the cursor on the model, press and hold down the right mouse and move the trackball. In this way you can position the relevant tooth in large-sized models (quadrant impressions) in the centre of the monitor.



Zoom

To zoom the 3D model press and hold down the central mouse. To enlarge the 3D model move the trackball in an upward direction. To reduce the model move the trackball downwards. The zoom function is also available in the "View" window.



2. The “View” window

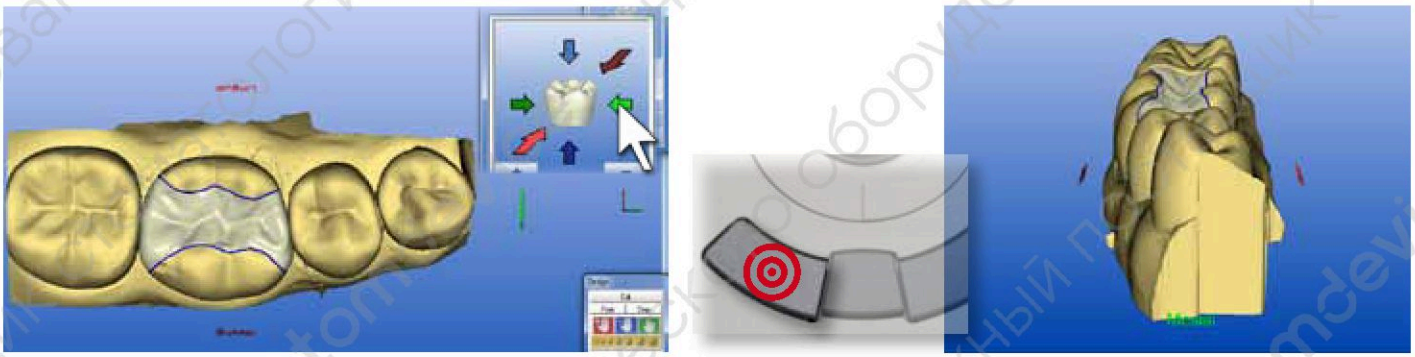


The “View” window enables you to access all the necessary functions for viewing the 3D model and the restoration during the design process.

Standard views

The “View” window contains a tooth symbol. With the aid of the arrows you can select the predefined “Standard views”.

A single click on the arrow displays the 3D model from a raised 15° angle. This ensures a good overview of the 3D model and the restoration.



A double click on the arrow displays the model from a straight 0° angle. This view should be selected in combination with the “Edit” and “Cut” functions (for example).

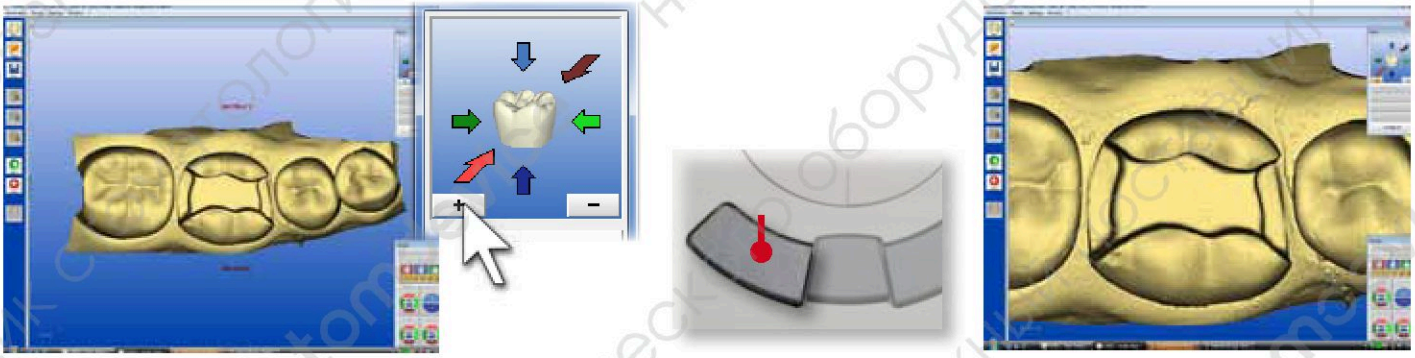


A click on the light blue occlusal arrow restores the standard occlusal view. This is especially useful if an unclear situation has arisen after the model has been freely turned and rotated several times.

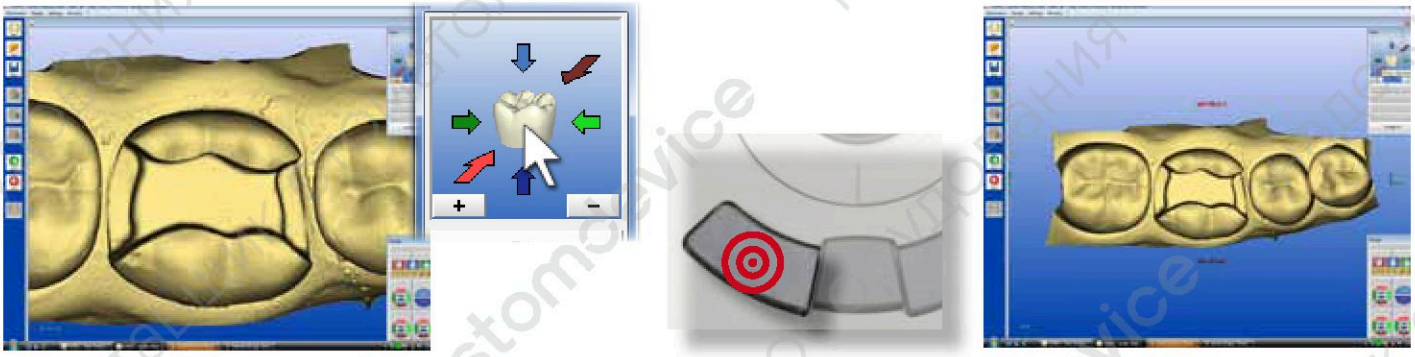


Zoom

To enlarge the model position the cursor on the “+” sign underneath the standard views and hold down the left mouse. To reduce the model size click and hold down the “-” symbol.

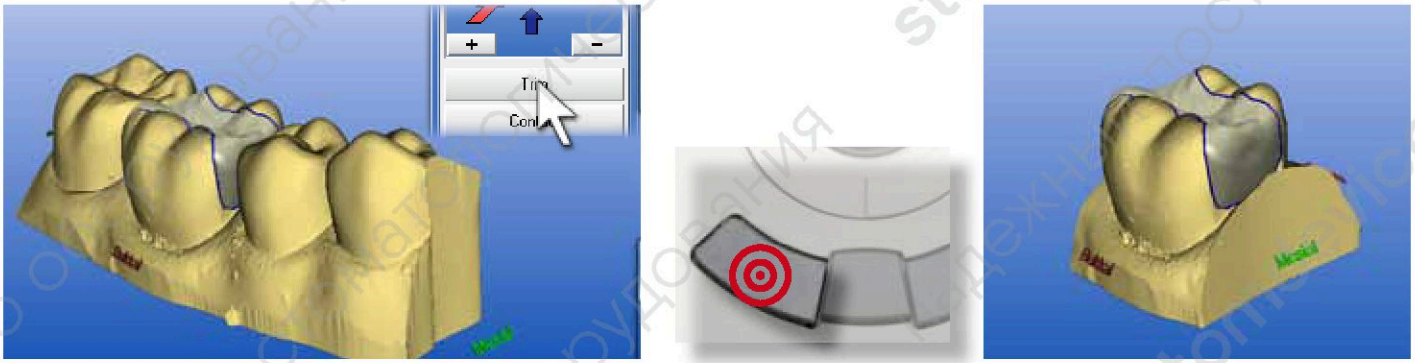


By clicking the tooth symbol in the “View” window you can return to the original zoom level at any time and view the model in its normal size.



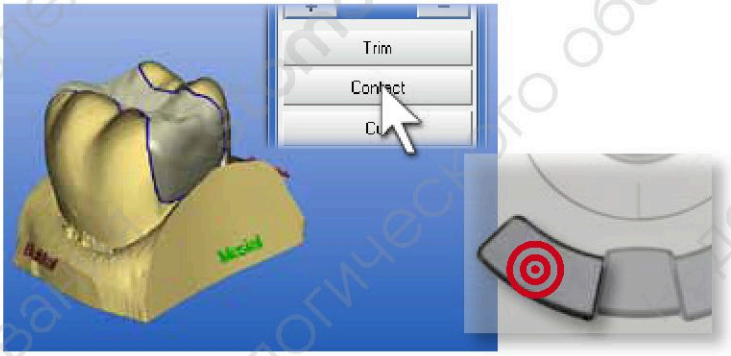
Trim

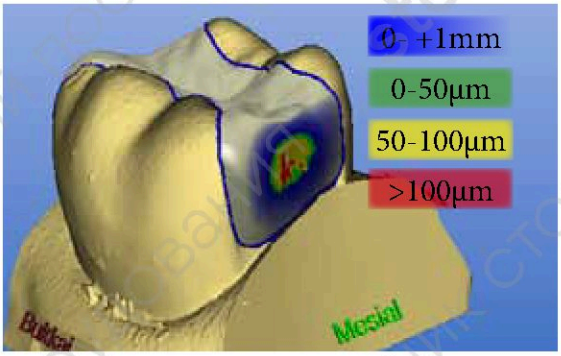
To hide the adjacent teeth click the “Trim” button. To show the adjacent teeth click the “Trim” button once again. The separation of the restoration gives you an optimum view of the external surfaces as a basis for evaluating and adapting the restoration proposal.



Contact

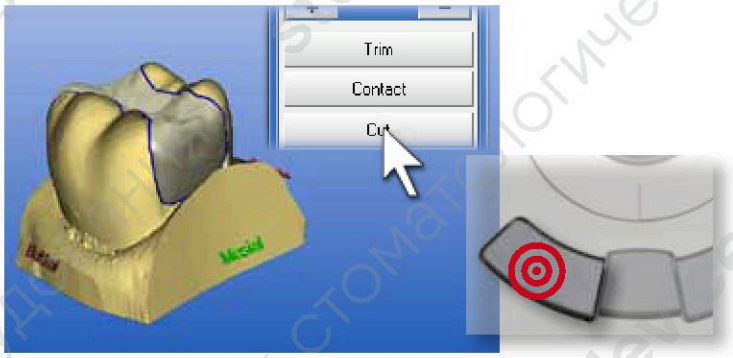
The “Contact” button enables you to view and adjust the proximal contacts in terms of their position, extent and strength. Blue indicates the clearance between the restoration and the adjacent tooth is less than 1 mm. Green indicates a penetration of 0 – 50 µm. Yellow indicates a penetration of 50 – 100 µm. Red indicates a penetration in excess of 100 µm.

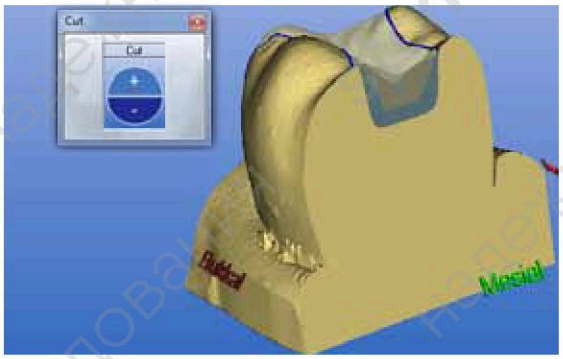




Cut

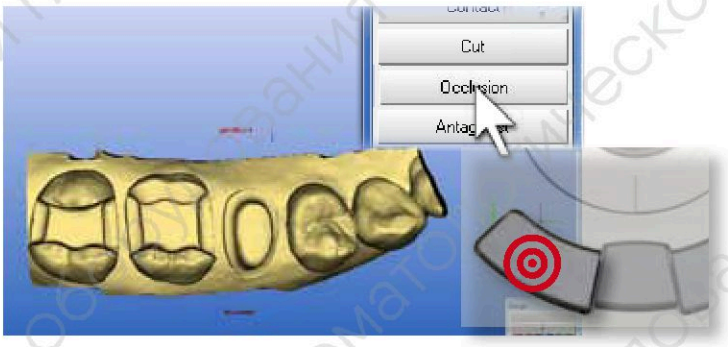
The “Cut” tool enables you to view cross-sections of the model or restoration. In this way you can quickly detect areas with a critical layer thickness and/or evaluate the contact situation in specific areas. You can move the cross-sectional plane by clicking the “+” or “–” buttons.





Occlusion

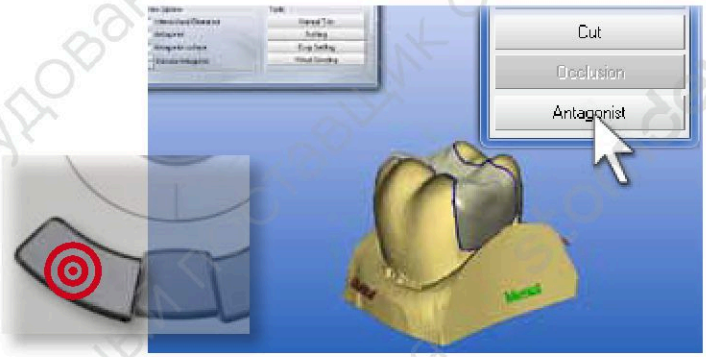
Click the “Occlusion” button to view the initial situation (the unprepared tooth, model tooth, reference tooth) captured in the “Occlusion” image catalogue.



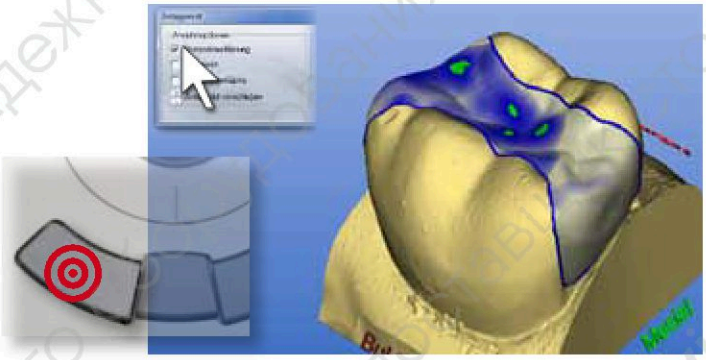


Antagonist

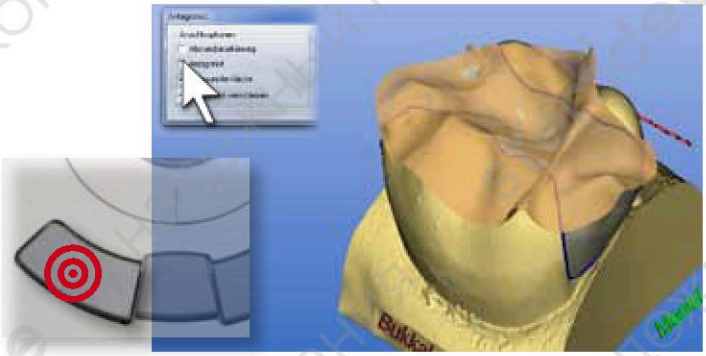
To activate the antagonist menu click the “Antagonist” button. This menu contains various options for visualizing the acquired bite situation, as well as various tools for the automatic occlusal adjustment of the restoration.



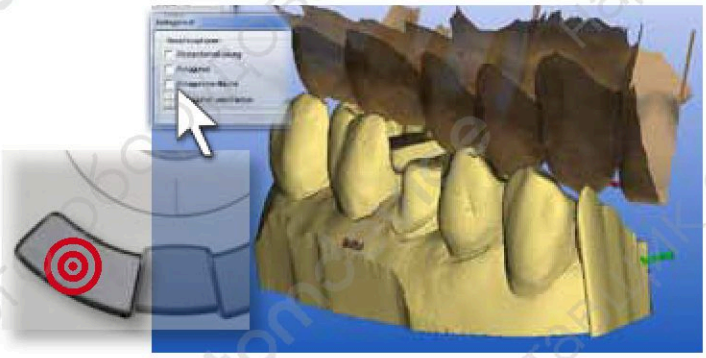
When you click the “Interocclusal clearance” button you can view the colour-coded contact situation analog to the colour-coded proximal contacts. This view is normally selected in order to adjust the occlusal contacts of the restoration.



To view the surface of the antagonist click the “Antagonist surface” button. This enables you to check the position of the contact points relative to the antagonist.



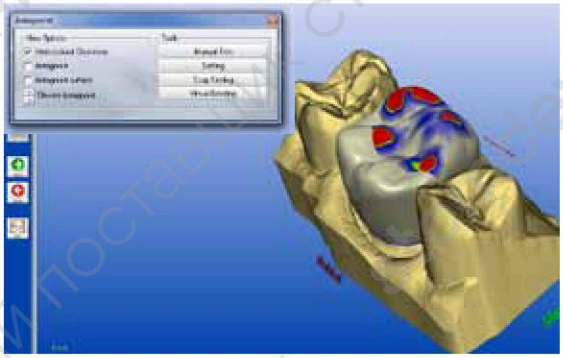
The “Antagonist” button displays the complete antagonist model. This function is useful in connection with a buccal registration. Only in this case is the antagonist acquired in its full anatomical form.



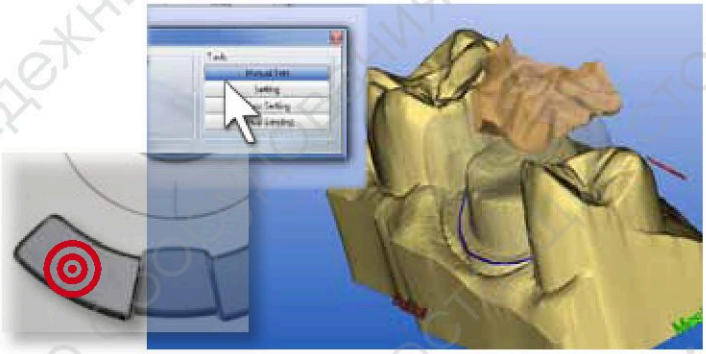
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3. Adjusting the occlusal contacts

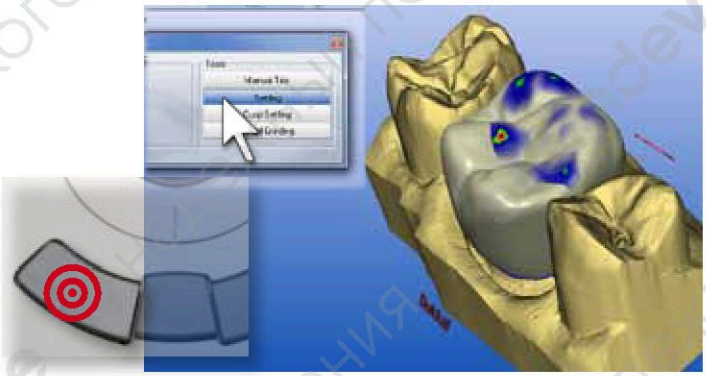
The tools contained in the “Antagonist” menu facilitate automatic corrections to the restoration in cases where the system has not generated an optimum proposal. The extent of these adjustments varies from case to case.



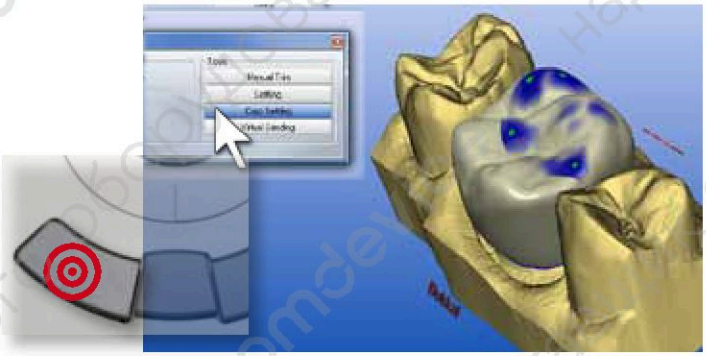
Begin by checking the bite registration. By clicking “Manual trim” you can view the antagonist surface and trim any defects or artefacts from the bite registration. Imaging errors and marginal artefacts can lead to excessively strong pre-contacts and prevent the correct seating of the restoration.



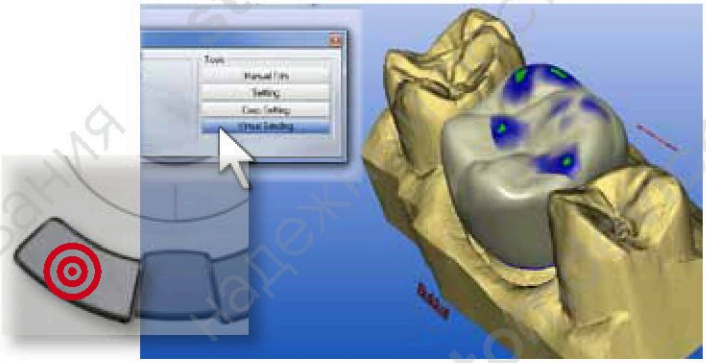
If the occlusal contacts are too strong on all the cusps and on the marginal ridge, you should use the “Settling” tool. This re-adapts the entire restoration to the bite registration.



With the aid of the “Cusp settling” tool you can adapt the individual cusps to the antagonist surfaces. The exterior contours and the marginal ridge of the restoration are not affected. Only the occlusal surfaces are adjusted.

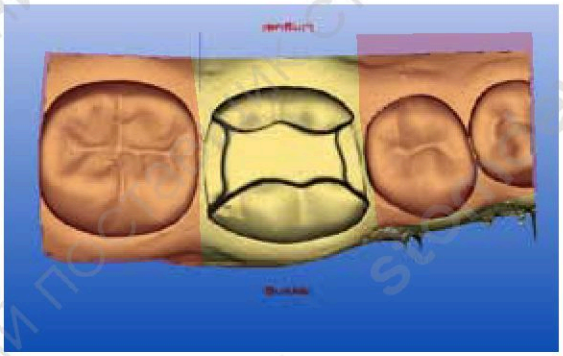


The final tool to be applied is “Virtual grinding”. This tool reduces the contact strength by a uniform amount predefined in the “Parameters” menu. You should apply this tool only when the position and extent of the occlusal contacts correspond to your wishes. This should be the last tool used for all restorations with bite registration.

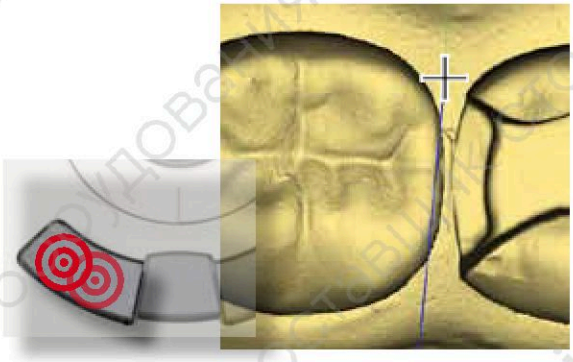


4. Trimming the 3D model

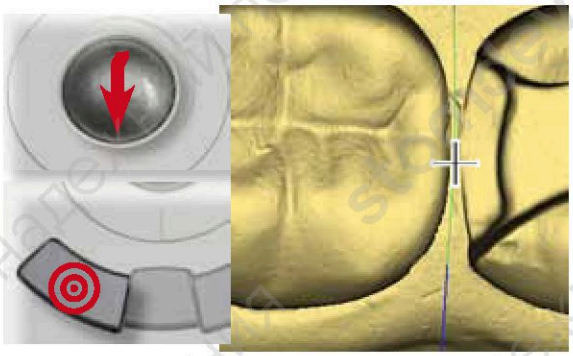
The function of the "Trim" tool is to hide the adjacent teeth comparable to creating a sawcut model. This allows you to check the preparation from all angles and then optimally adapt the proximal surfaces of the restoration.



Trimming is performed using the so-called trim line, which dissects the model between the preparation and the adjacent teeth. To define the starting point of the trim line, double-click the proximal area between the preparation and the adjacent tooth.

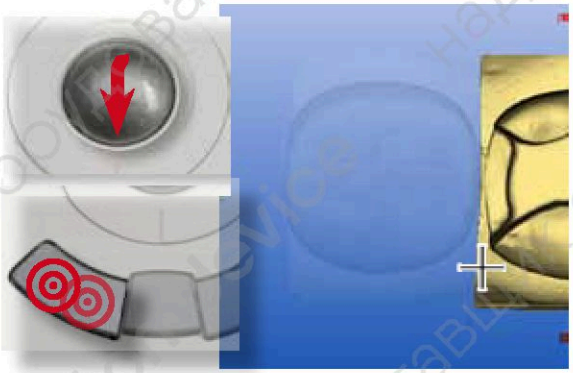


Move the cursor through the proximal area performing single clicks where necessary. This allows you to modify the direction of the trim line. As soon as the cursor has been moved beyond the proximal region you can define the endpoint of the trim line by means of a double click. The adjacent tooth is now hidden.

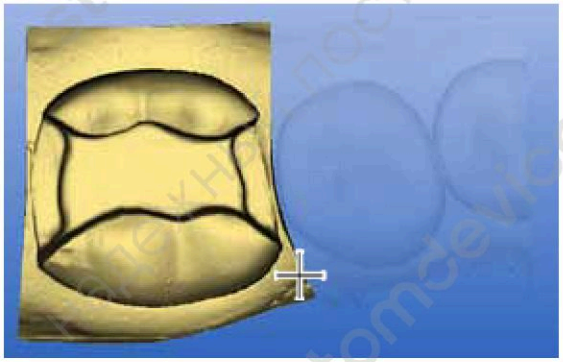


As soon as the cursor has been moved beyond the proximal region you can define the endpoint of the trim line by means of a double click. The adjacent tooth is now hidden.

Attention:
After you have confirmed the trim line with a double-click of the left trackball button, it is possible that the preparation may be hidden. The CEREC 3D software always hides the smaller portion of the 3D model. If this situation occurs, double-click the transparent area of the model with the left mouse. This displays the preparation once again.



To hide the mesial adjacent tooth insert a trim line in the second proximal space.

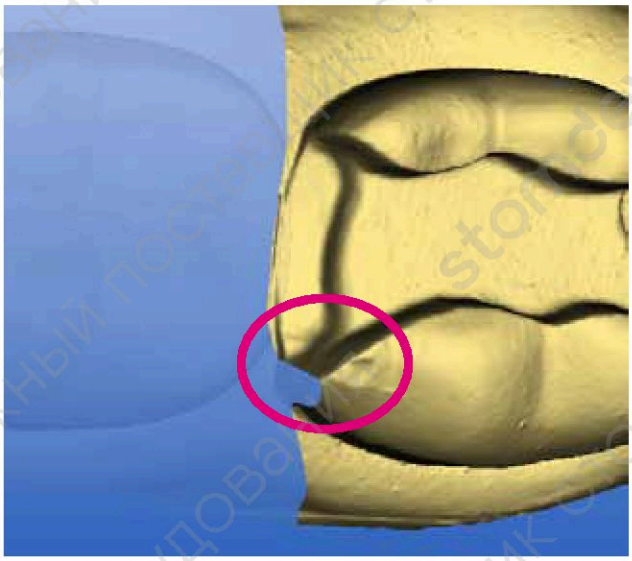




Click the green icon "Next" to proceed to the next design step.

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Attention:
The trim line must be inserted very carefully in order to avoid cutting off areas of the preparation. This can lead to errors during the margin detection process, resulting in incorrectly dimensioned restorations. Rotate the 3D model in such a way that you have an optimum view of the proximal area. Maintain as much distance as possible from the preparation margin. Enter a sufficient number of single clicks in order to define the changes of direction in the trim line.



5. The preparation margin

The preparation margin defines the border between the tooth and the restoration. It is essential that the preparation margin is clearly defined (see “Preparation guidelines”).

There are three methods for entering the preparation margin:

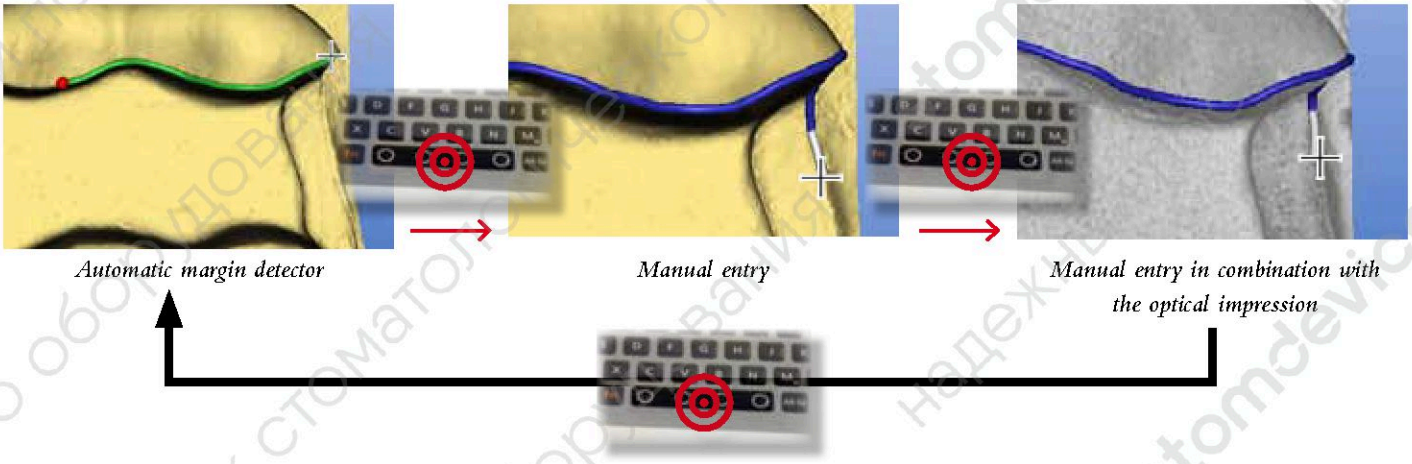
1 **Automatic margin detector**
The CEREC 3D software automatically detects the preparation margin, when the cursor is moved along the preparation border. This mode is recommended for all cases with clearly defined supragingival preparation margins.

2 **Manual**
The dentist defines the preparation margin by means of single clicks with the left mouse. The manual mode is recommended for equigingival preparation areas which – due to the lack a clearly defined margin – are not suitable for automatic detection.

3 **Manual with monochrome screen image**
The original camera image is projected onto the model in order to facilitate the manual entry of the preparation margin.

Mode 3 is recommended for equigingival preparations, as well as in the case of very narrow proximal areas between the preparation and the adjacent tooth. In this case the 3D model cannot accurately display the relevant structures. This results in blurring. In the monochrome image these structures are clearly visible, thus allowing the preparation margin to be entered correctly.

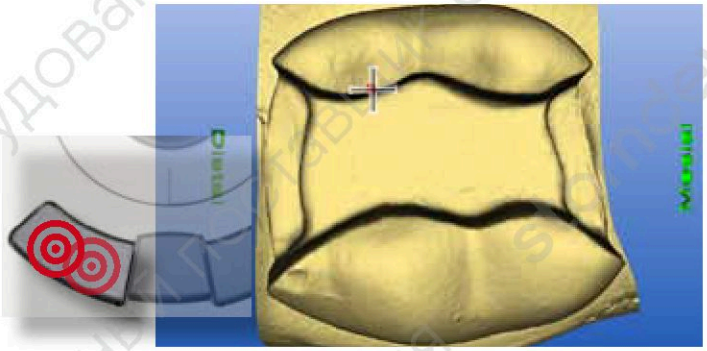
Press the spacebar to toggle between the various entry modes.



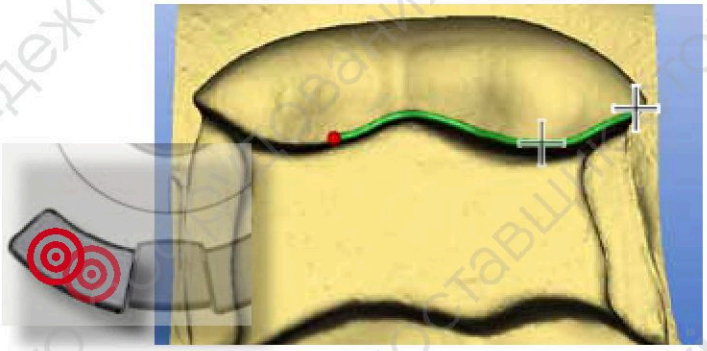
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Entering the preparation margin

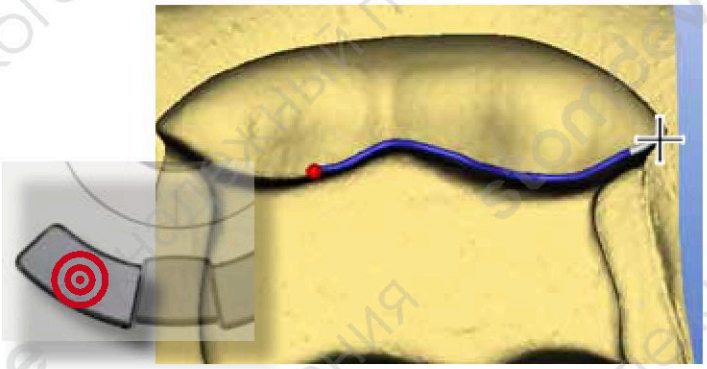
Begin with a double click of the left mouse at a clearly visible position on the preparation margin. A red dot marks the starting point.



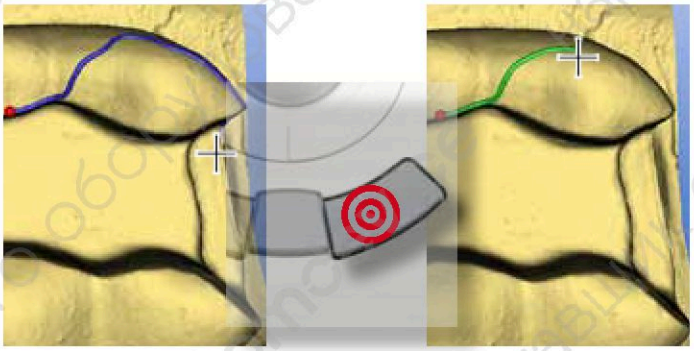
Move the cursor along the preparation margin. A green line appears indicating that the automatic margin detector is active.



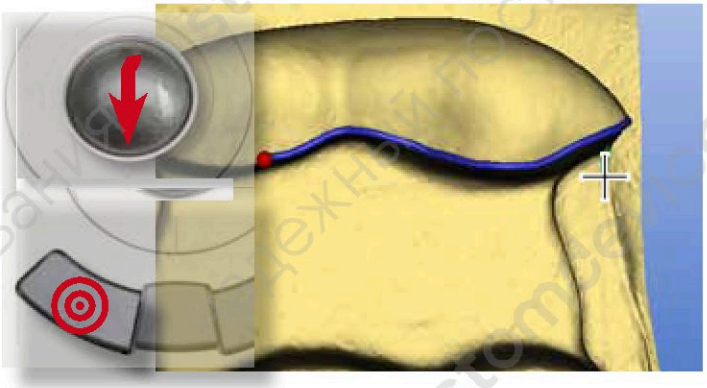
Fix the line with a single click at the transition between the lingual-occlusal and the mesial-proximal margin. The line now appears in blue and will not change its position.



If the line has not been fixed in the correct position, press the right trackball button. This cancels the original line and allows you to re-enter the preparation margin.

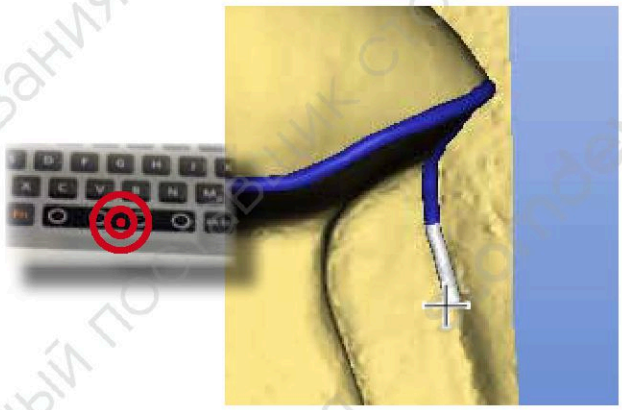


In the case of a slightly subgingival preparation in the mesial proximal area it is not possible to distinguish the margin from the surrounding gingival tissue as both are at approximately the same height. In such cases you should move the cursor to the relevant area and fix the line with a single click.

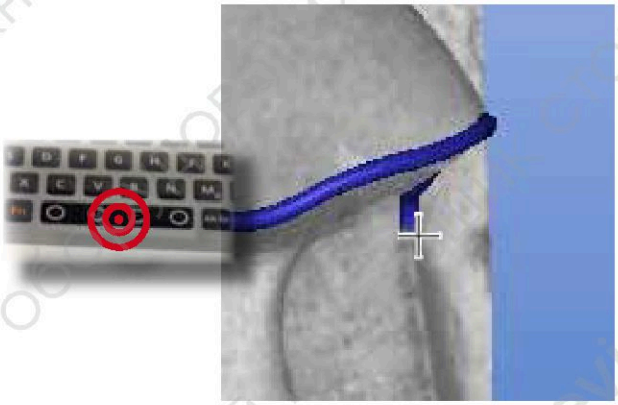


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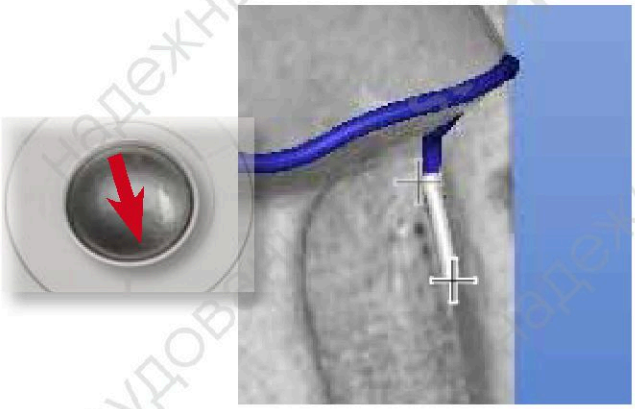
Press the space-bar in order to activate the manual margin-entry function. In the manual entry mode a straight white line is inserted between the fixed blue preparation margin and the cursor. You can modify the direction of this line and with a single click attach it to the preparation margin.



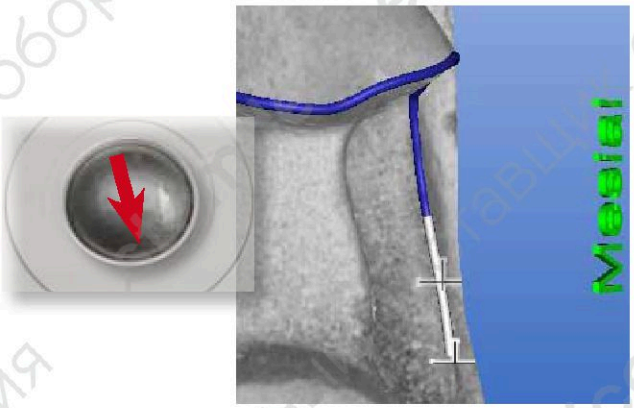
To increase contrast, you can once again click on the space-bar. This projects the optical impression over the 3D model.



Move the cursor along the preparation margin. After approximately 0.5 cm fix the line by means of a single click on the preparation margin.

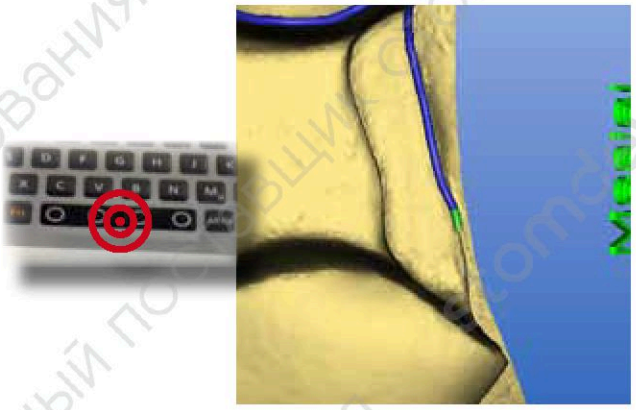


Continue to move the cursor along the preparation margin. Fix the line again after a further 0.5 cm. Repeat this procedure until you reach a clearly supragingival part of the preparation margin.

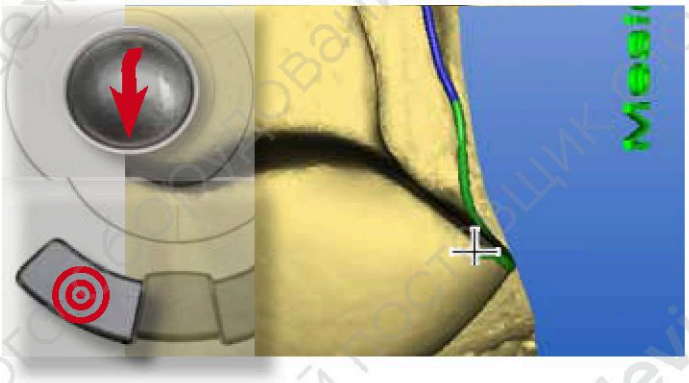


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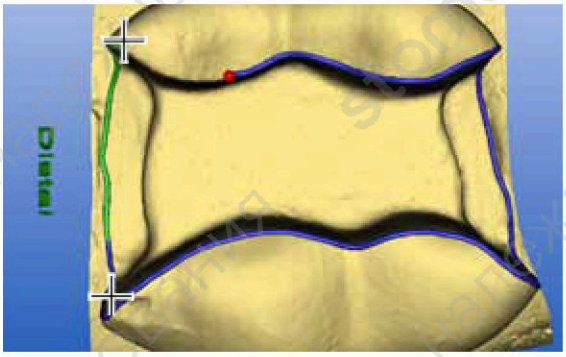
Press the space-bar once in order to return to the automatic margin detection function.



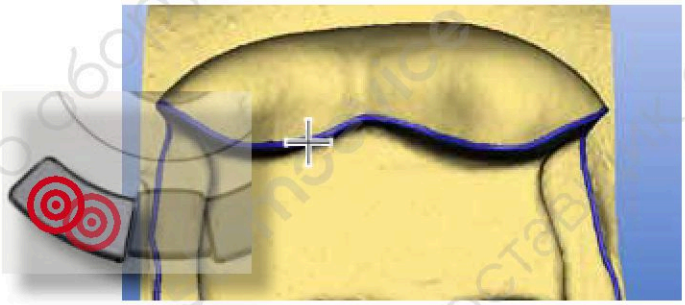
Move the cursor along the preparation margin until you reach the transition between the mesial-proximal and the buccal-occlusal areas of the preparation. Fix the preparation margin with a single click.



Continue the automatic margin detection process and mark the occlusal-proximal transitions by means of single clicks.

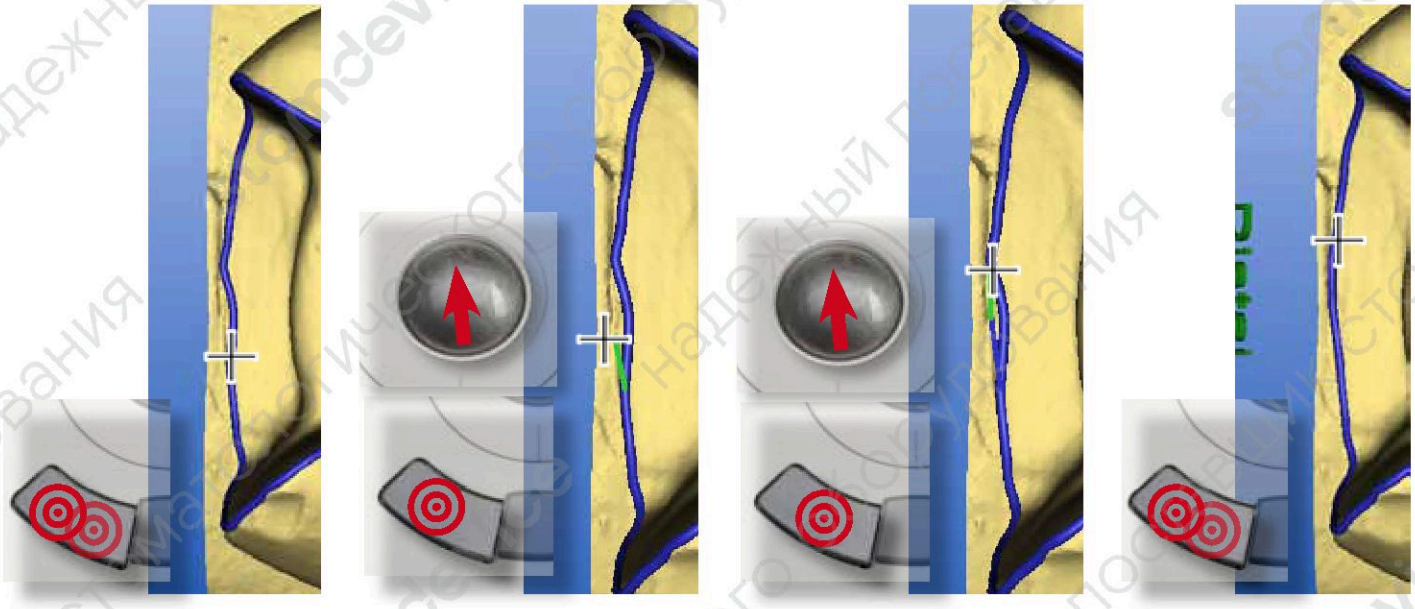


To complete the margin detection process double-click the starting point – the red dot. Rotate the preparation in all directions to check the correct positioning of the preparation margin.



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In the event of deviations between the actual and the detected preparation margin you can make manual modifications. Double-click the correct area of the preparation margin activating the manual entry function and then make the necessary adjustments. Conclude this process with a double click.





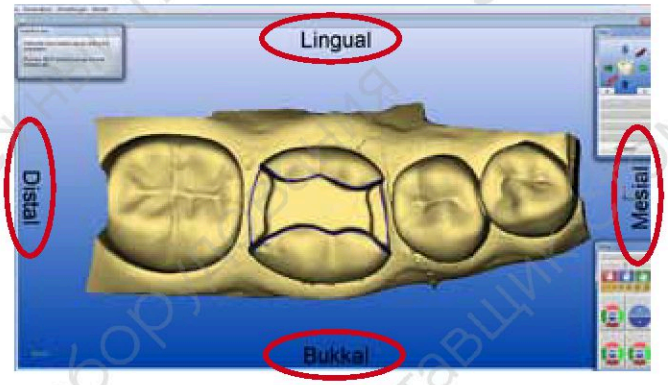
After the margin entry process has been completed click the green icon “Next”. This takes you to the next step to define the insertion axis.

6. Defining the insertion axis

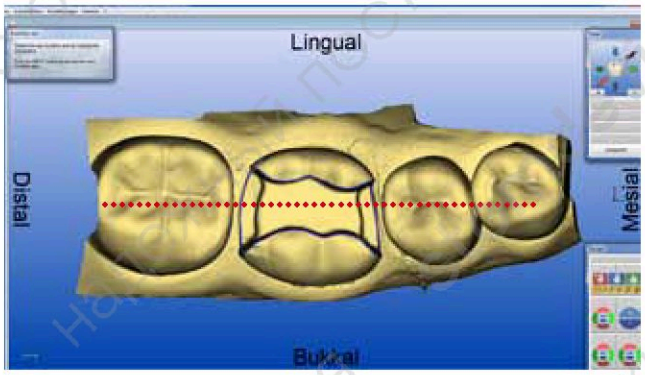
The insertion axis determines the alignment of the 3D model in the virtual design. This is very important for the generation of the initial restoration proposal and milling the restoration.

The insertion axis is modified by rotating the 3D model. The key criteria for the correct insertion axis are as follows:

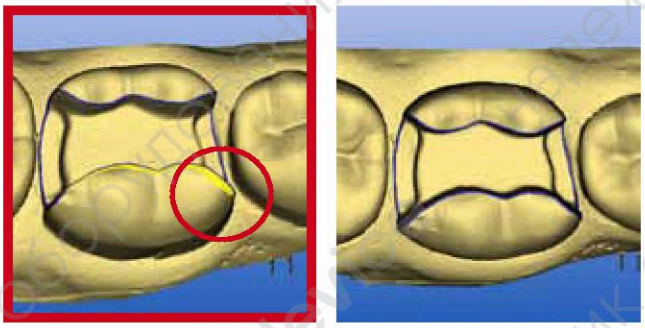
1 The 3D model must be aligned in accordance with the following directional designations: - lingual
- buccal
- mesial
- distal



2 The preparation must be horizontally aligned. To realign the preparation, position the cursor on the right-hand side of the model, click and hold down the left mouse and move the trackball either up or down. This rotates the entire 3D model.



3 No undercuts marked in yellow should be visible in the proximal area. To realign the preparation position the cursor directly on the model, click and hold down the left mouse and move the trackball in the direction in which you want to move the model. In this way you can eliminate any yellow undercuts.

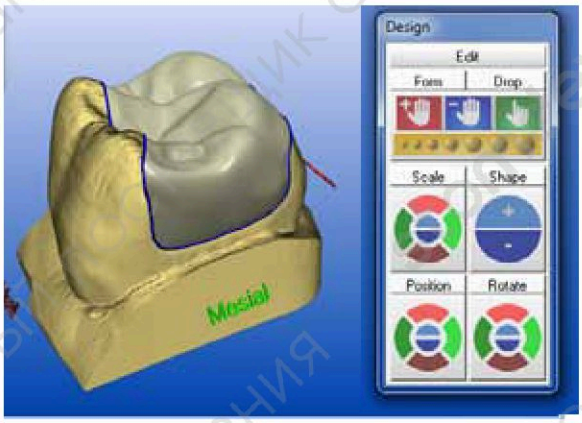




Click the green icon “Next” to finalize the insertion axis and generate the restoration proposal.

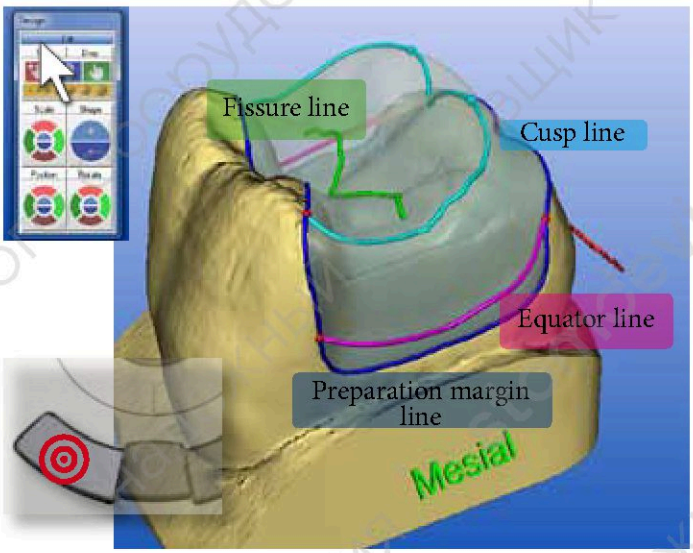
7. The “Design” window

The “Design” window contains software tools for adapting the restoration. Various tools can be deployed, depending on the restoration type and the restoration proposal generated by the system. In general, the adjustments should follow the principle “from outside towards the centre”. For example, there is no point in adjusting the occlusal contacts if the restoration is then subsequently rotated in order to achieve a correct position in the dental arch. The functions of the design tools are described in the following paragraphs with reference to a partial crown.



“Edit”

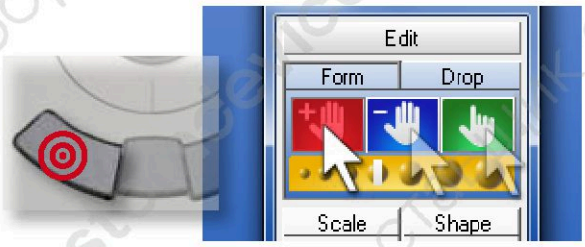
Click the “Edit” button to display the four design lines: the blue preparation margin line; the pink equator line; the turquoise cusp line and the green fissure line. Red dots mark the starting and finishing points of the design lines. The turquoise dots on the fissure line indicate the positions of the cusp tips. The “Edit” tool is not intended for the adjustment of fully anatomical restorations. Instead, it is it is better suited to the design of crowns and bridge frameworks. In the “Correlation” and “Biogeneric reference” modes the “Edit” tool is used to edit the copy line.

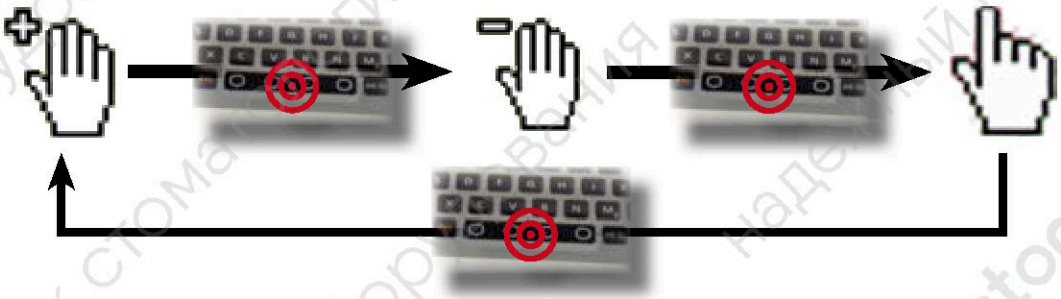


“Form”

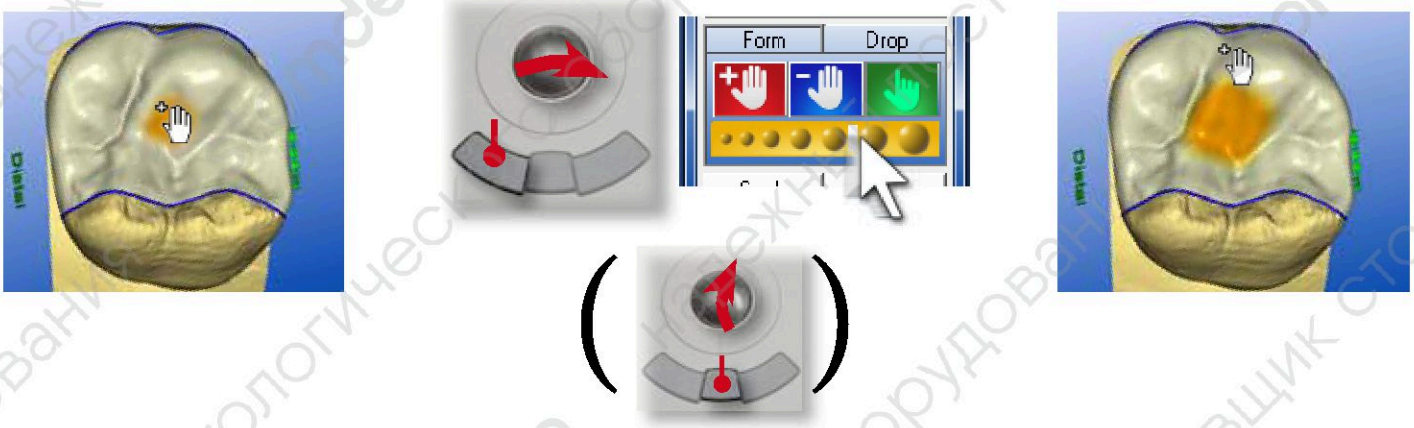
The highly versatile “Form” tool functions like a digital waxing knife and enables you to make adjustments to all areas of the restoration surface. “Form +” adds material. “Form -” removes material. “Smooth” smooths the restoration surface.

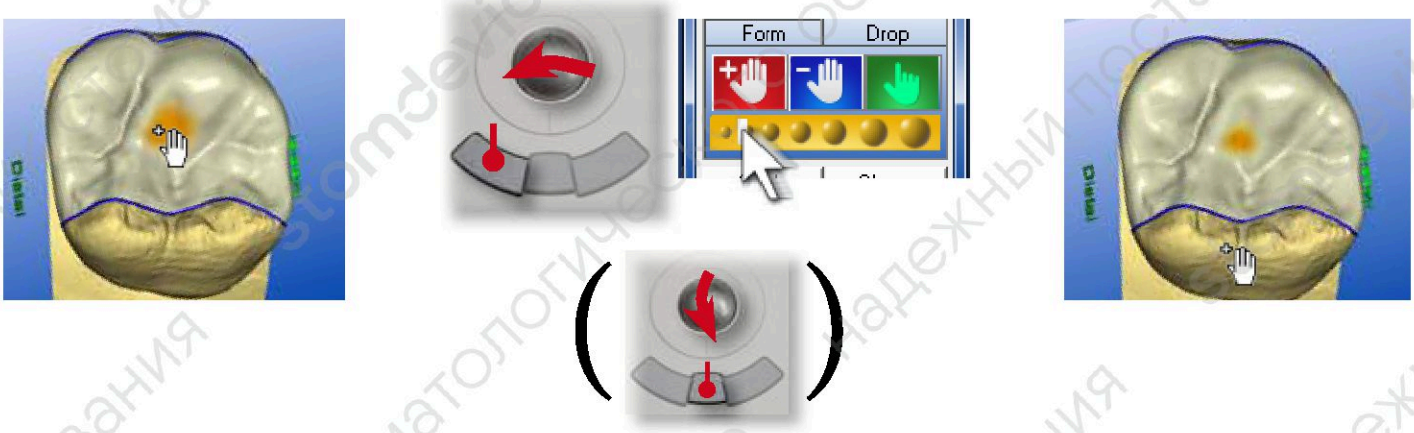
To activate the various “Form” modes either click the relevant icon or press the spacebar. The cursor symbol indicates which mode is currently active.





The working area of each tool can be individually adjusted – either by moving the orange slider bar or by pressing the central mouse and moving the trackball upwards (larger) or downwards (smaller). The diameter of the orange circle indicates the working area.





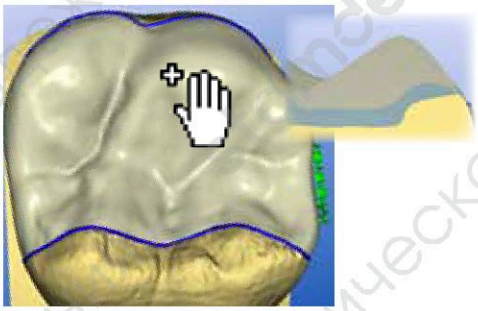
“Form +”

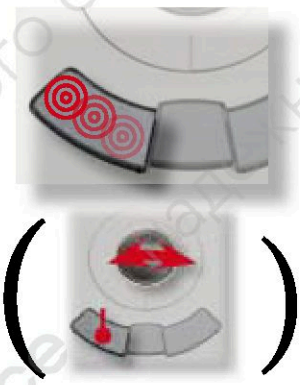
The “Form +” tool adds material to the restoration surface. When you left-click the “+” icon, the cursor appears as a hand with a “plus” symbol and 25 µm of material is applied in the direction of the monitor. Progressively less material is applied towards the edges of the working area in order to achieve a smooth transition. To modify larger areas keep the left mouse pressed and move the cursor backwards and forwards. Material is then applied continuously. However, this technique requires a certain amount of practice.

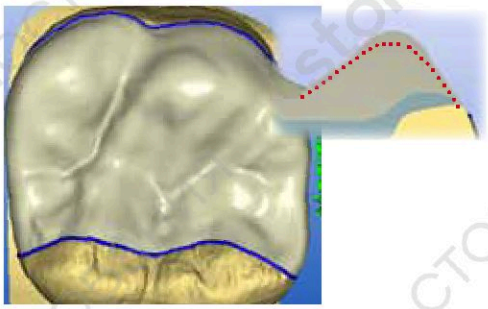


"Form –"

The "Form -" tool has the opposite effect to that of "Form +". When you left-click the "-" icon, 25 µm of material is removed underneath the cursor a hand with a "minus" symbol. Progressively less material is removed towards the edge of the working area.

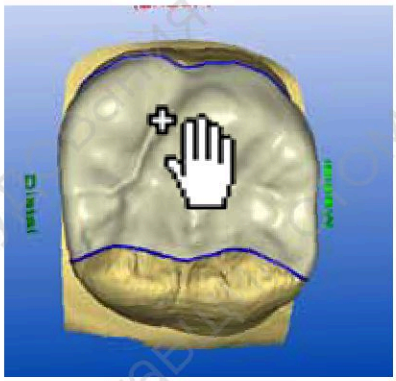


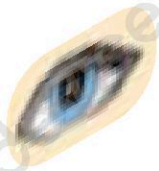


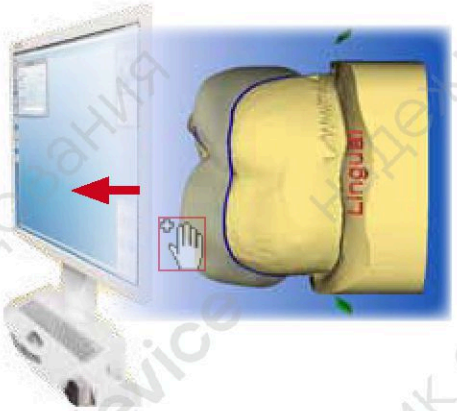


Attention:
The "Form +" and "Form -" tools always operate in the direction of the monitor. Depending on the current position of the model, material will be applied/removed in different directions. For this reason it is essential to position the model correctly before activating the "Form" tool.

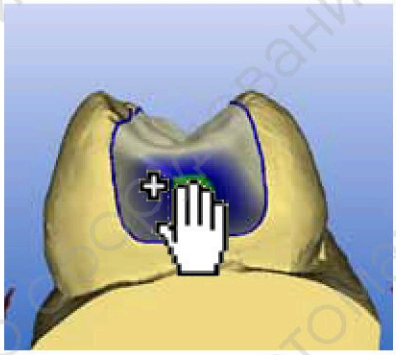
When the model is positioned in the standard occlusal view, "Form +" applies material to the occlusal surface – for example, to raise the height of a cusp.

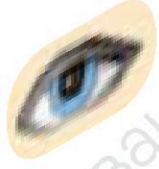


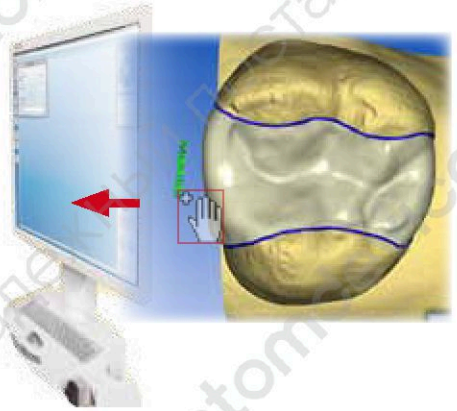




When the model is viewed from the mesial direction, material is applied to the mesial surfaces – for example, to reinforce the proximal contacts.





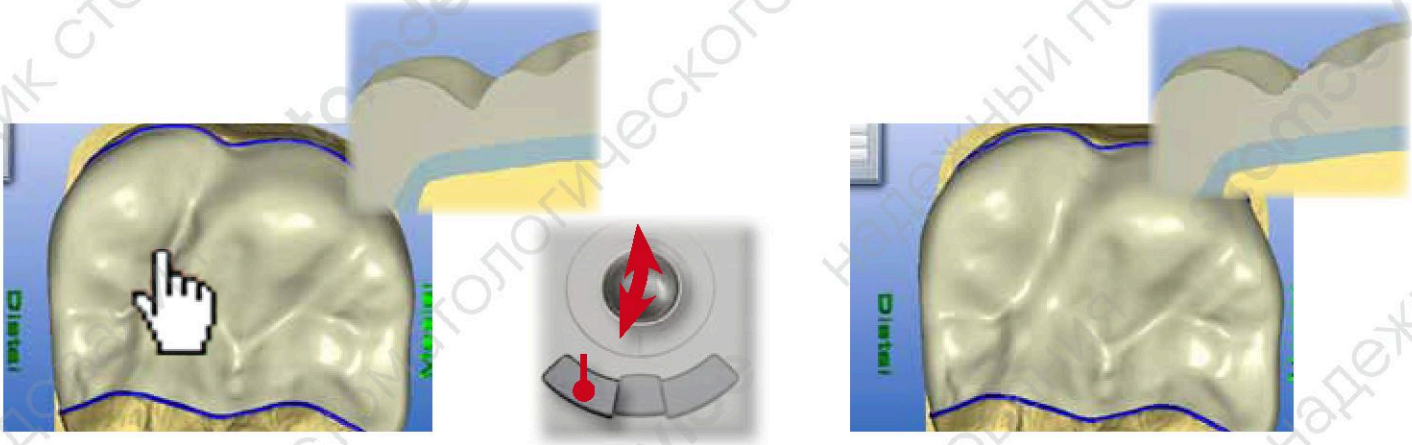


“Smooth”

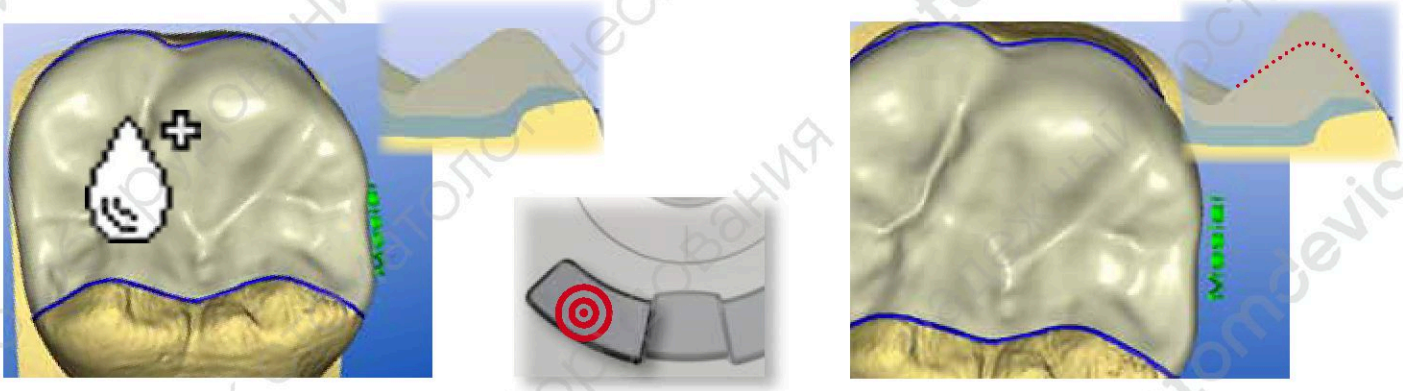
This tool smooths the restoration surfaces. In other words, it progressively reduces curved surfaces until an even plane is achieved. The “Smooth” tool has no effect on straight surfaces. A good method is to examine a clearly visible restoration border and ascertain to what extent the “Smooth” tool needs to be applied.



Attention:
Curved surfaces also include concave surfaces – for example, in the fissure relief. In this case the “Smooth” tool lowers the entire occlusal morphology. For this reason the “Smooth” tool should be applied sparingly in the occlusal area.



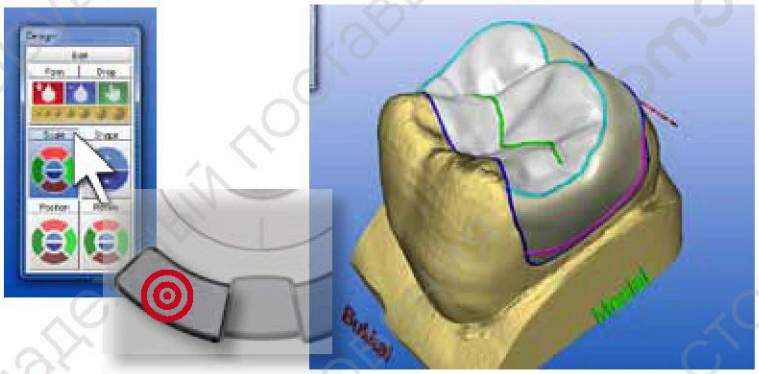
“Drop”
The “Drop” tool is similar to the “Form” tool, with the exception that it applies material less smoothly at the edges. Hence this tool is more suitable for the design of crown and bridge frameworks. Anatomically sized crowns require a lot of subsequent smoothing. As a rule the “Drop” tool is not suited for this purpose.



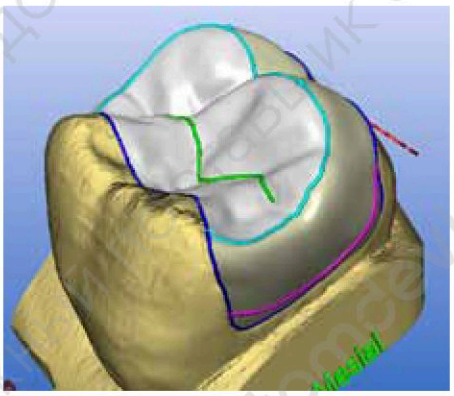
"Scale"

The scale tool enlarges or decreases individual segments of the restoration. In this way you can modify large areas of the restoration – for example, when designing crown and bridge restorations.

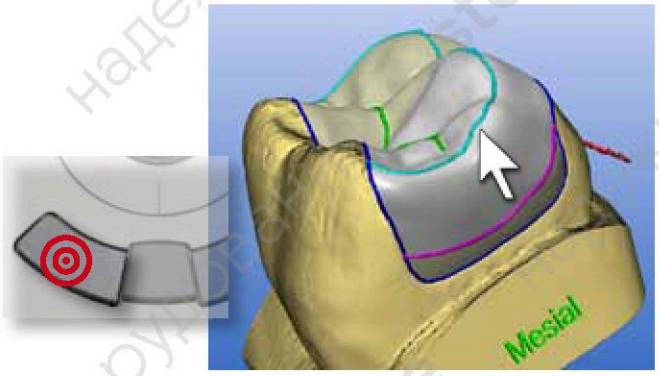
When you click the "Scale" button the design lines are displayed (also "Edit" tool): the blue preparation margin; the pink equator line; the turquoise cusp line with cusp tip dots; and the green fissure line.



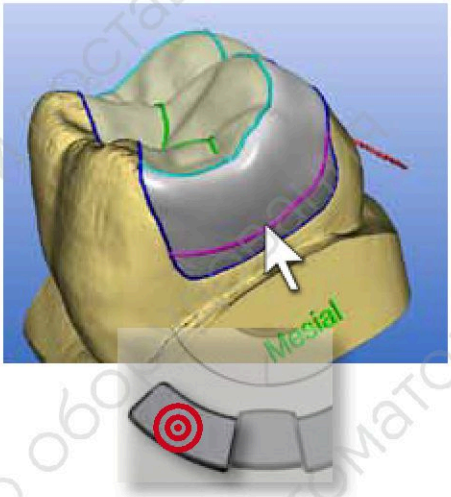
The restoration is divided into segments, each of which can be activated separately. The active segment is highlighted in white. By clicking the design line you can activate the chosen segment. The occlusal segment is activated by default when the "Scale" tool is switched on.



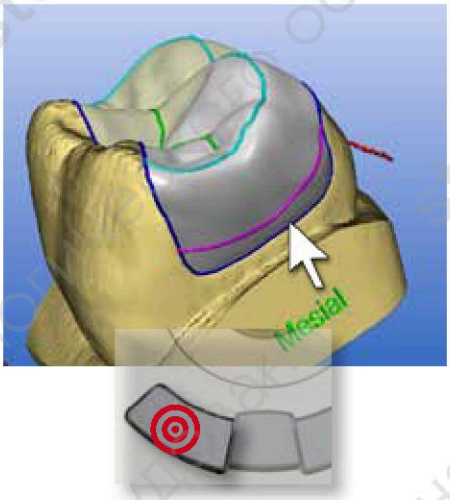
Click the mesial marginal ridge or cusp line. The mesial cusp segment is now activated and is highlighted in white.



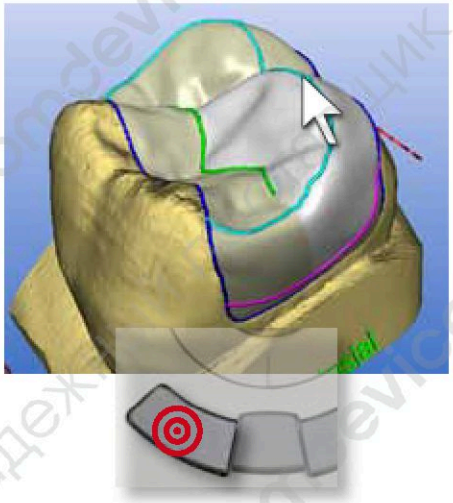
The other restoration segments can be activated as follows:



Mesial-proximal segment: click the mesial equator line



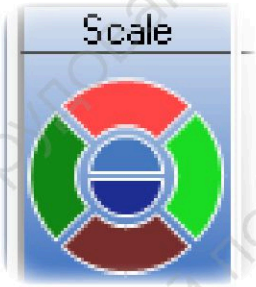
Mesial restoration segment: click the mesial preparation margin line

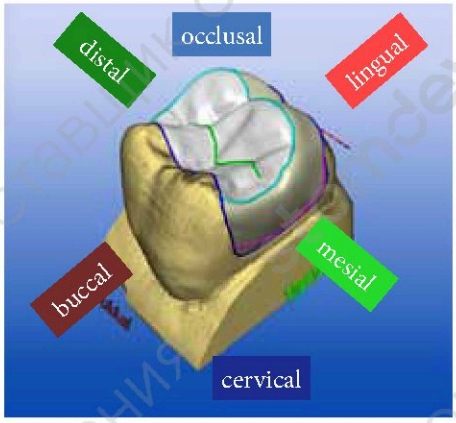


Cusp segment: click the cusp tip dots on the marginal ridge line

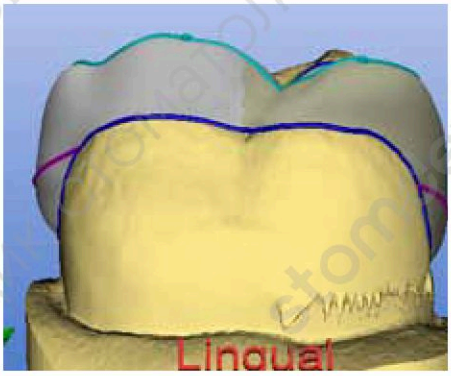
https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

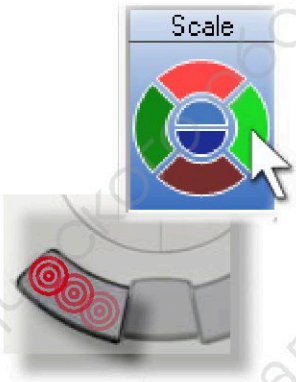
The active segment can be moved by clicking one of the colour-coded fields in the “Scale” tool. The colour-coded designations are identical to those used for the 3D model in the “View” window.

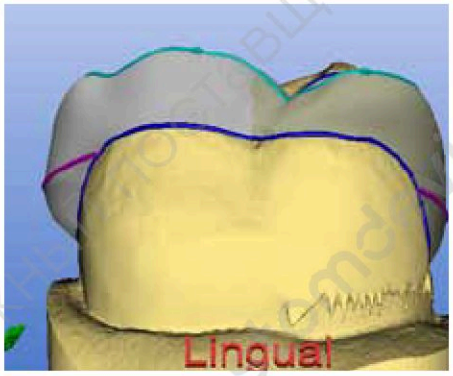




In this case the mesial restoration sectors are active and can be moved by means of repeated clicks on the light green mesial button in the “Scale” tool.

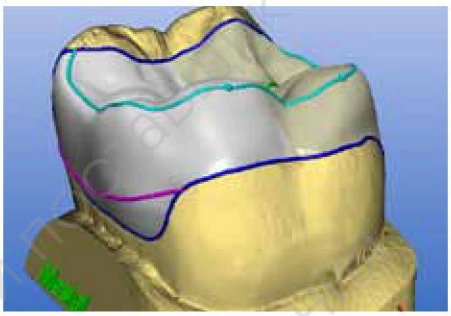




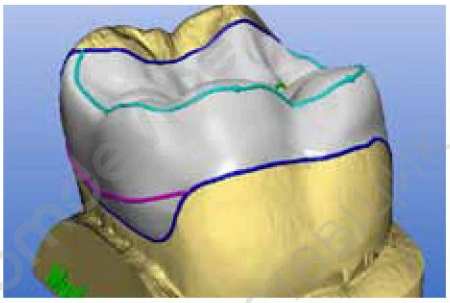


Circular segment

By pressing the space-bar you can define circular segments encompassing the entire restoration. This is useful if you want to scale up or scale down the complete restoration.

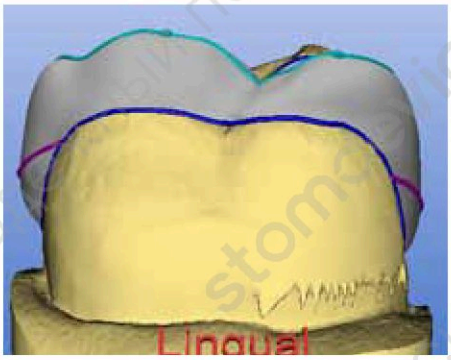




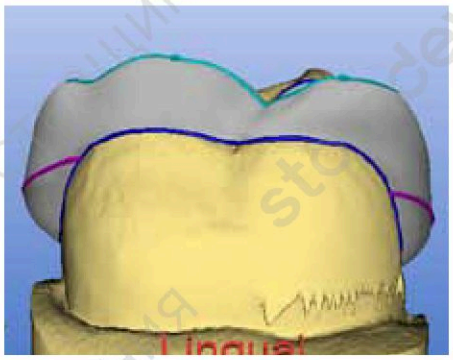


Press the space-bar to activate the mesial and distal restoration segments. The entire restoration surface is now marked in white.

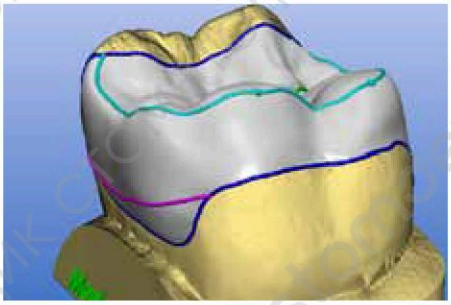
By clicking the light green button of the “Scale” tool you can scale up the restoration both mesially and distally.



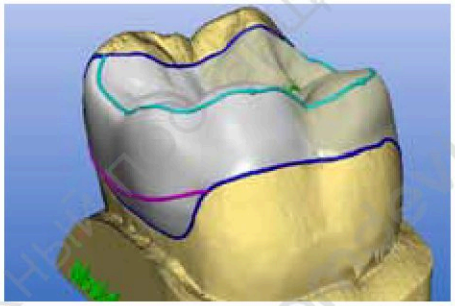




To deactivate the circular segment press the spacebar. The restoration segment is now active.



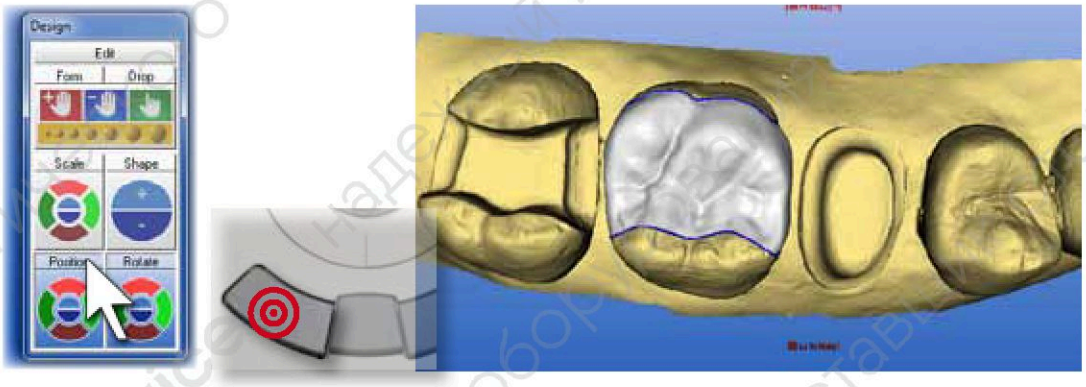




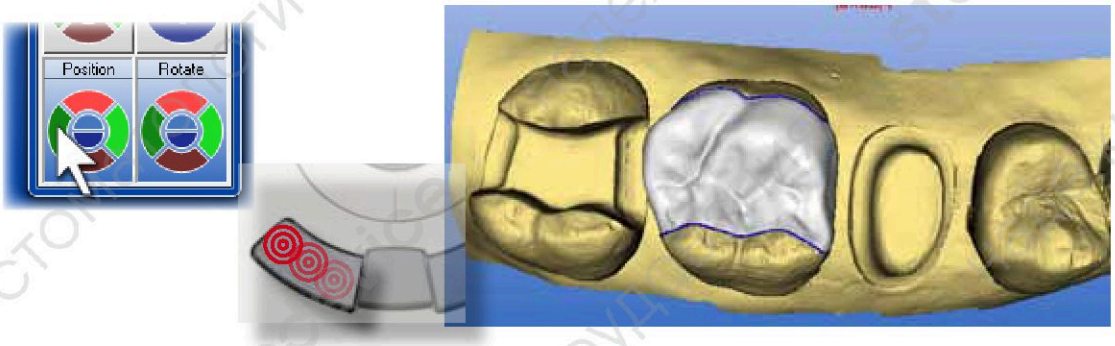
“Position/Rotate”

The “Position” and “Rotate” tools reposition and rotate the entire restoration. This enables you to achieve the correct position in the dental arch. These tools are either simultaneously active or inactive.

To activate the “Position/Rotate” function click the “Position” button in the “Design” window. The entire restoration is now marked in white.



By clicking the colour-coded directional buttons you can reposition the restoration. The colour coding system is analog to that used in the “Scale” tool.



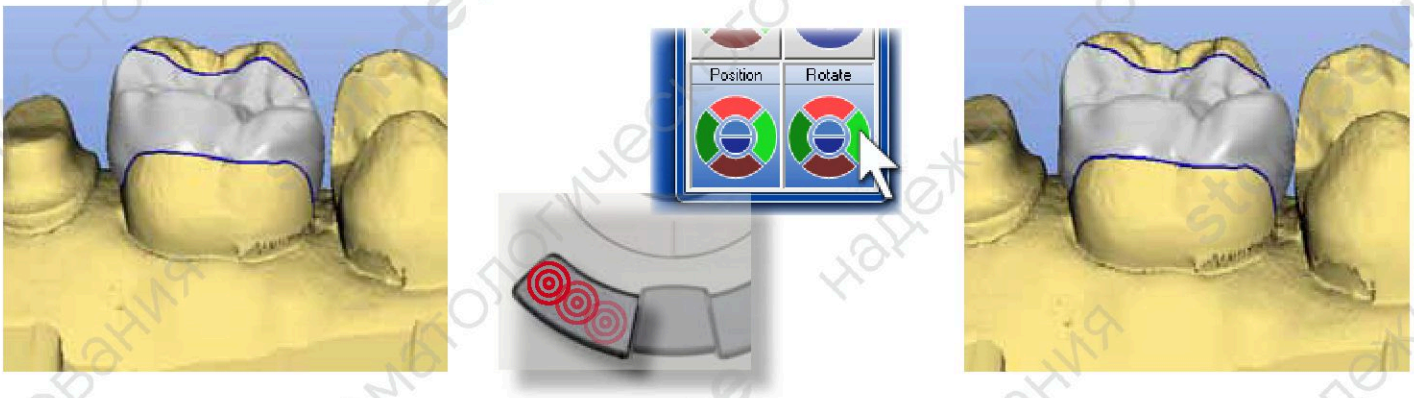
When you select the standard mesial view you are in an ideal position to make bucco-oral and occlusal adjustments.



The “Rotate” tool allows you to rotate the restoration along all three spatial axes. For example, by clicking the light blue button you can rotate the restoration in a clockwise direction.



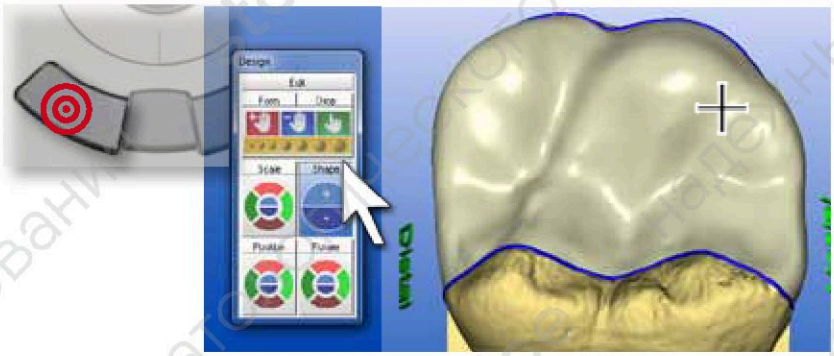
The light green and dark green buttons rotate the restoration along the bucco-oral axis. The light green button rotates the mesial area of the restoration towards cervical.



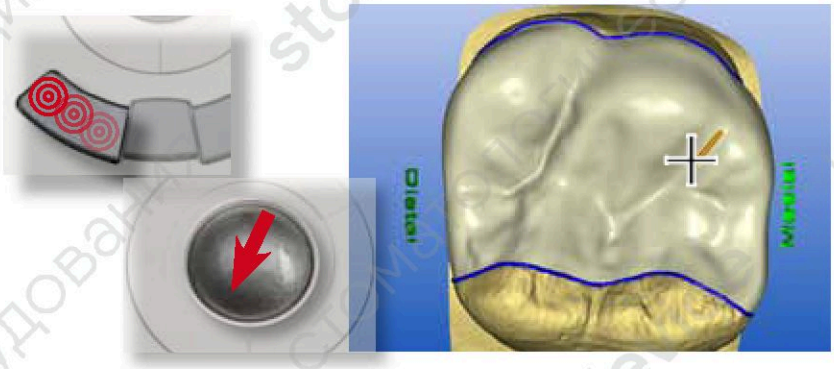
"Shape"

The "Shape" tool enables you to enter lines and areas on the restoration which can then be elevated or lowered by means of the "+" and "-" buttons. This tool is particularly useful for the accentuation of the fissure relief.

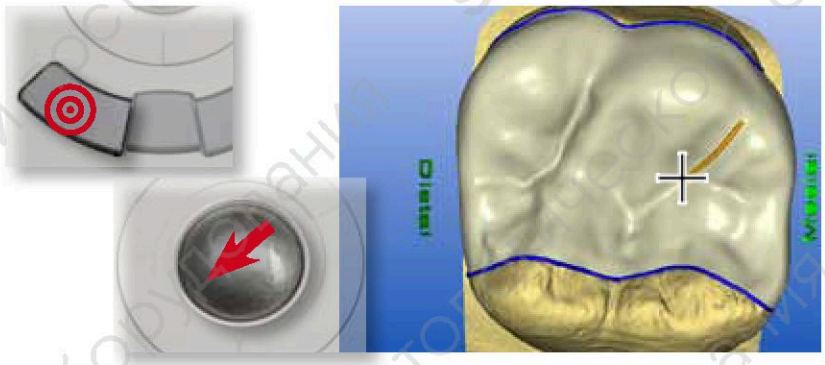
Click the "Shape" button in the "Design" window and then move the cursor to the starting point of the fissure line which you want to accentuate. The model is shown here in the standard occlusal view. 1



Double-click the line with the left mouse and move the cursor along the fissure line. 2

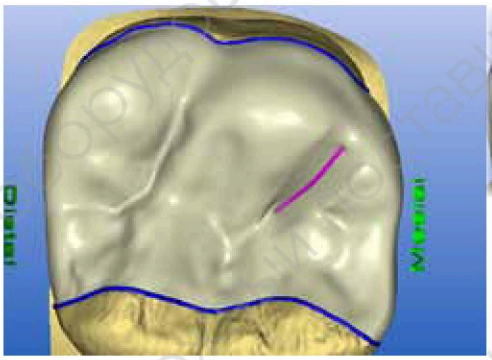


To change direction fix the line with a single click of the left mouse and then continue moving the cursor. 3



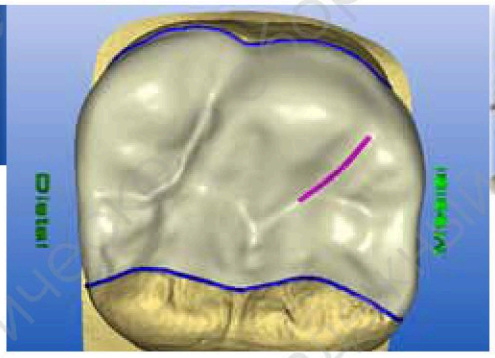
4 End the line with a double-click.



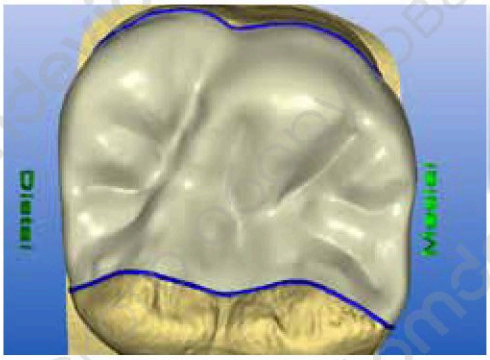


5 When you click the "-" button the area below the line will be lowered. Lowering or elevating always takes place in the direction of the monitor.





6 In this way it is possible to achieve a more pronounced fissure relief. However, this tool should be used sparingly. There is a risk of non-compliance with the minimum wall thickness limits.



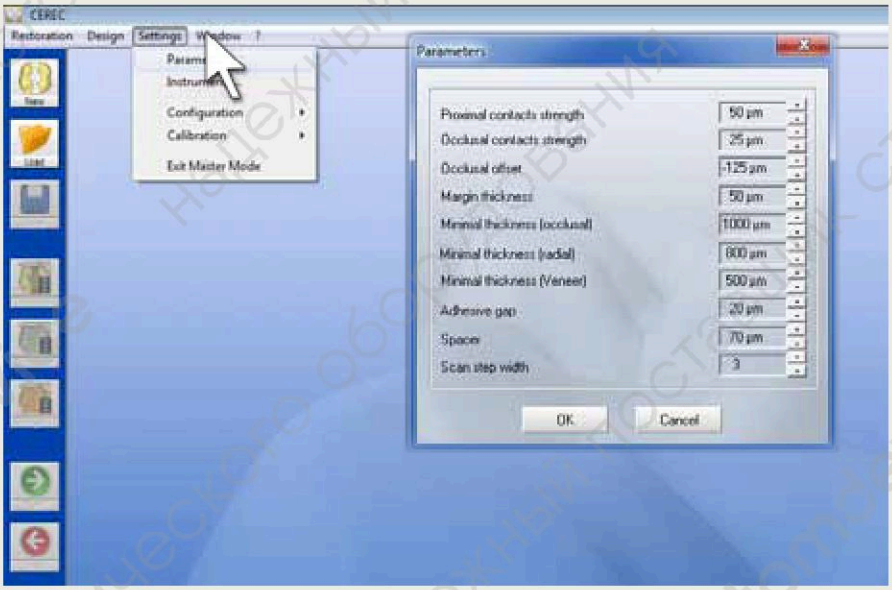
8. Parameters

Parameters

The “Parameters” menu allows you to modify important settings e.g. the width of the adhesive gap in order to facilitate the optimum fabrication of restorations. The parameters differ according to the user, type of material, specific processing step and milling machine. The standard settings are based on clinical experience and can be modified in line with your individual requirements.

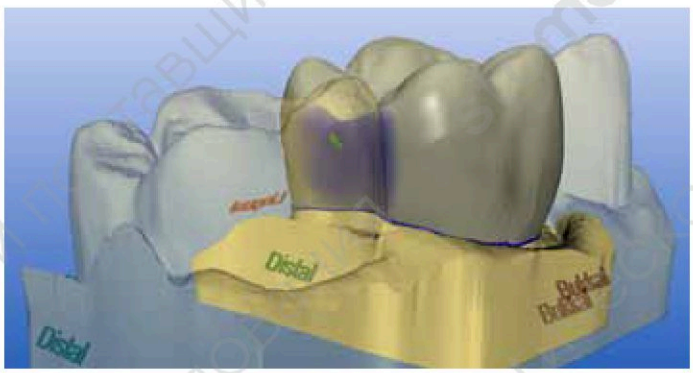
The parameters can be found under the “Settings” menu. The following settings can be changed:

1 Proximal contact strength
2 Occlusal contact strength
3 Occlusal offset
4 Margin thickness
5 Minimum thickness (occlusal)
6 Minimum thickness (radial)
7 Minimum thickness (veneer)
8 Adhesive gap
9 Spacer
10 Scan step width

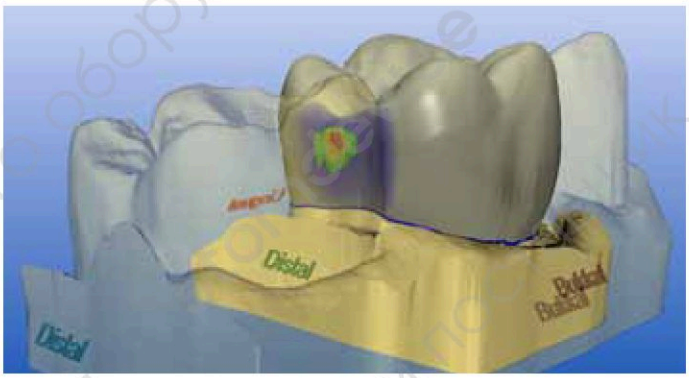


1 Proximal contact strength

This parameter determines the strength of the proximal contacts in the initial restoration proposal. This parameter also applies when the proximal contacts are adjusted automatically with the aid of the “Contact” tool. The recommended setting for chairside procedures involving CEREC Optispray and subsequent high-gloss polishing is +75 µm.



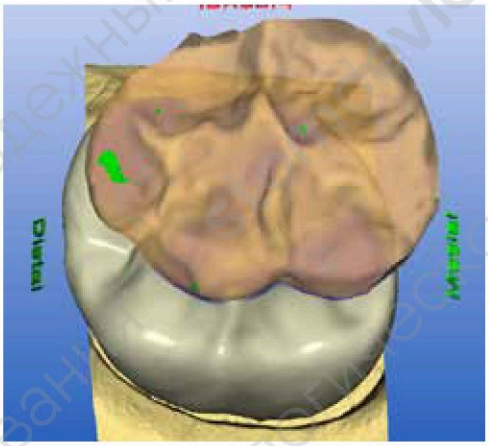
Proximal contacts = 25µm



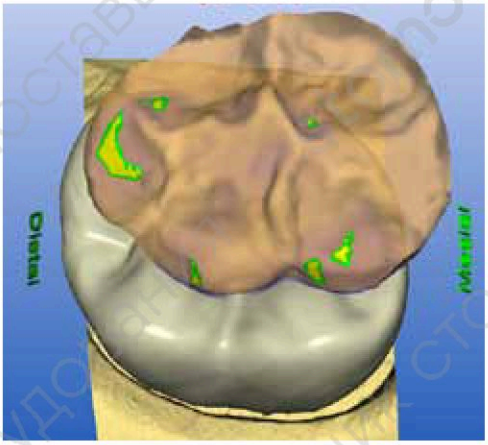
Proximal contacts = 100µm

2 Occlusal contacts

This parameter determines the strength of the occlusal contacts in the initial restoration proposal. It can also be modified via the “Virtual grinding” tool in the “Antagonist” menu. The recommended setting is 25 µm.



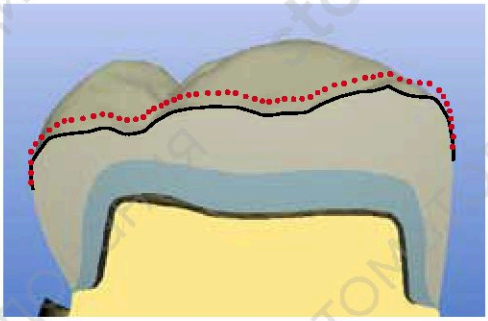
Occlusal contacts = 25µm



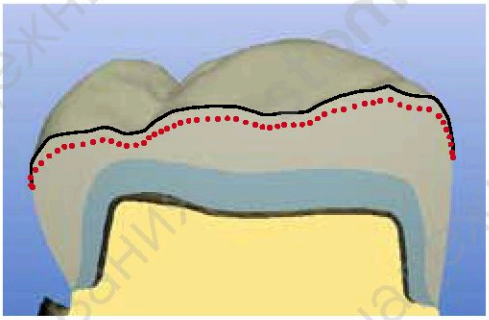
Occlusal contacts = 75µm

3 Occlusal offset

This parameter raises or lowers the occlusal surface before the milling process is initiated. It is not visualized in the software. On the basis of clinical experience the recommended setting is -75µm. This ensures adequate occlusal contacts when the restoration is placed with the aid of a highly filled luting composite.



Occlusal offset = 100µm



Occlusal offset = -100µm

4 Margin thickness

This parameter determines how much material is removed additionally from the restoration at the margins. The margin is widened by a corresponding amount before milling is initiated. This is necessary in order to prevent chippings during the milling process. The recommended setting is 50 µm.



Margin thickness = 0µm

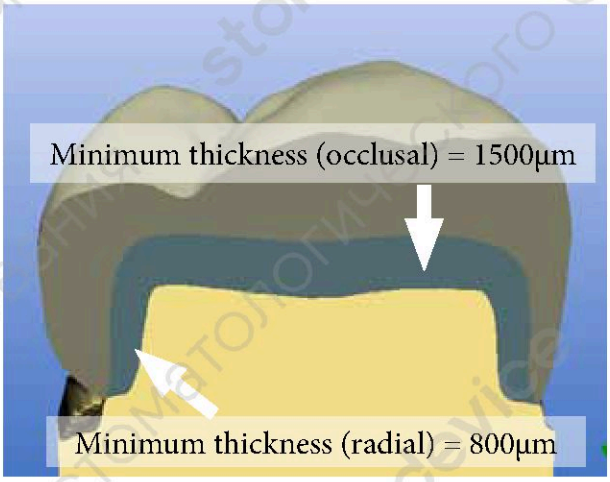


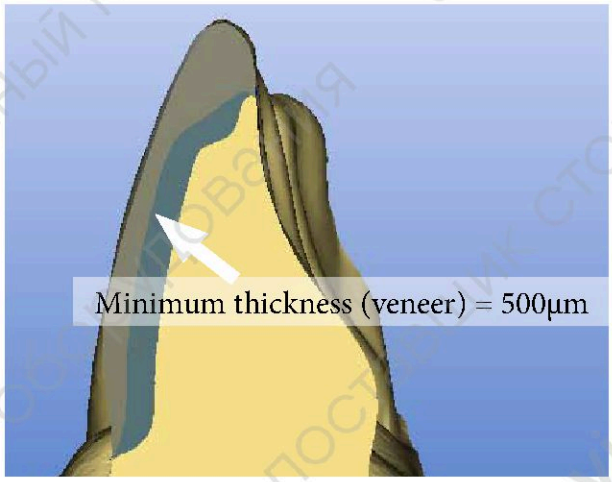
Margin thickness = 100µm

Minimum thickness
5 occlusal, 6 radial, 7 veneer

These parameters determine the minimum material thickness of the initial restoration proposal. Areas which do not meet this minimum requirement e.g. as a result of manual adjustments to the restoration are shown in blue. It is essential to maintain the minimum material thickness, as this guarantees the stability of the restoration.

The recommended settings for chairside treatment are as follows:
minimum thickness (occlusal): 1,500 µm; minimum thickness (radial): 800 µm; minimum thickness (veneer): 500 µm.





8 Adhesive gap, 9 Spacer

These parameters influence the fit of the milled restoration. They determine the space between the restoration and the tooth and hence the friction. Ceramic restorations should display a passive fit – i.e. there must be a sufficient gap for the adhesive bond. This gap is determined by the non-reflective powder as well as by the "Adhesive gap" and "Spacer" parameters. The recommended settings are as follows: adhesive gap: 20 µm; spacer: 40 µm.



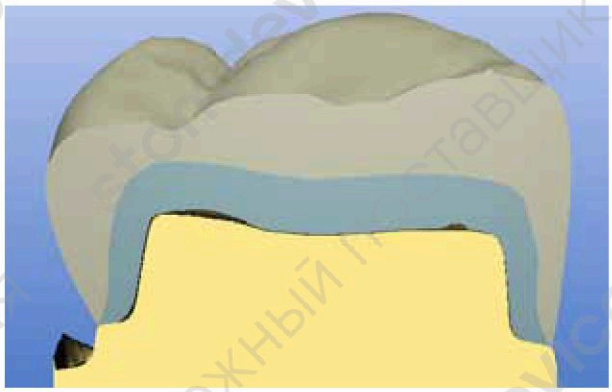
Adhesive gap = 0µm



Adhesive gap = 100µm



Spacer = 100µm



Spacer = 0µm

IV. Restoration types

1. Partial crown design (biogeneric; buccal scan)

Onlays and partial crowns are the most frequently used restoration type in day-to-day clinical practice. They are ideal for replacing large-sized amalgam fillings, repairing fractured teeth and covering cusps e.g. in the case of undermining caries. In these cases, onlays and partial crowns are a tissue-conserving alternative to conventional crowns. The dentist can adopt a defect-oriented preparation technique – i.e. it is possible to preserve and retain the maximum amount of residual tooth tissue.

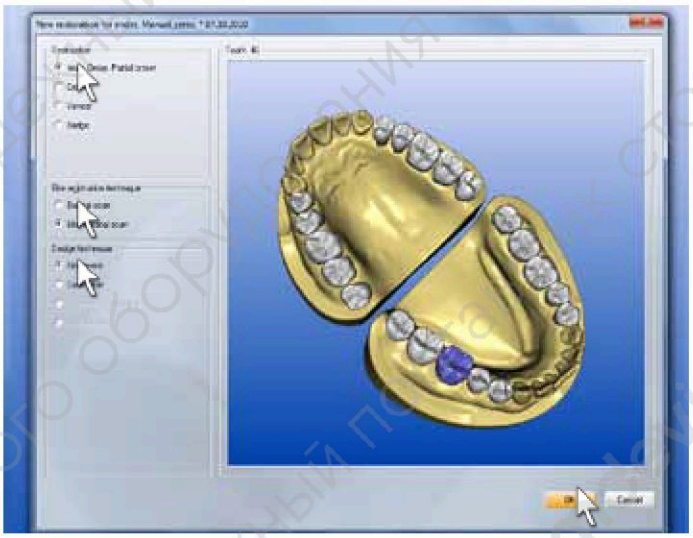
1

Selecting the restoration type

Open the "New" dialogue box and select "Inlay, onlay, partial crown", "Buccal scan" and "Biogeneric" in the left-hand column.

Select the tooth you want to restore (in this case tooth 36) and then click the "OK" button.

The cursor jumps automatically to the "Acquire preparation" icon in the acquisition window.



2

Acquisition technique

Begin the digital optical impressions at the distal neighboring tooth. Capture the preparation by means of angled impressions. Then acquire the mesial neighboring teeth as far as the first premolar. Finally, acquire angled buccal impressions in the area of the premolars for the purpose of buccal registration.





The opposing jaw is captured from the second molar to the first premolar. In this case as well, angled buccal impressions are required at least in the area of the premolars.



The bite occlusion is acquired from the buccal direction in the area of the first premolar at the level of the occlusal plane.

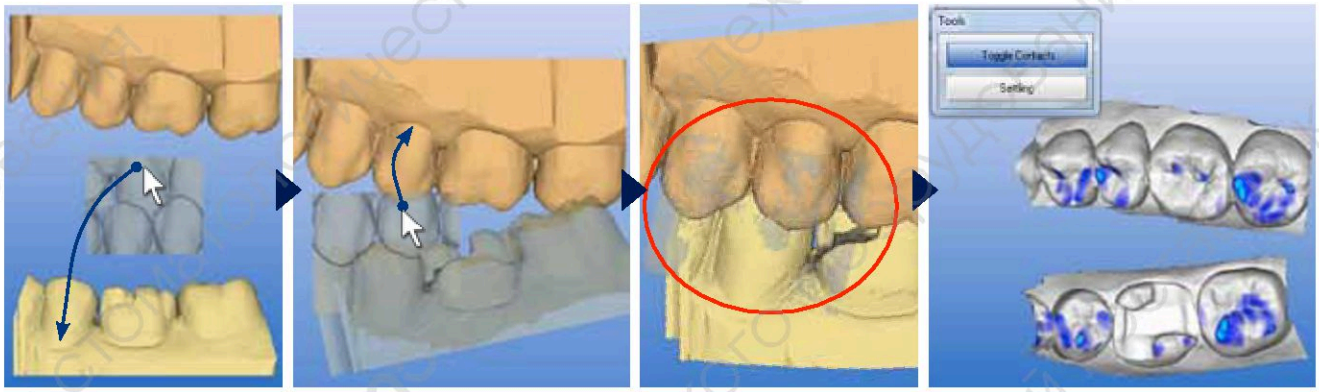


Assigning preparation model and antagonist model

3



The preparation and the antagonist are assigned to each other by means of the buccal impression. Drag the buccal impression onto the preparation model. Then drag the buccal impression together with the preparation model onto the corresponding tooth surfaces of the antagonist model. The CEREC 3D software assigns the models automatically on the basis of the buccal impression. Click the “Toggle contacts” button to display the occlusal contacts on the 3D model. In the event of significant deviations from the clinical situation you should check the optical impressions and repeat them if necessary. The “Settling” function should not be used in connection with partial-jaw impressions.

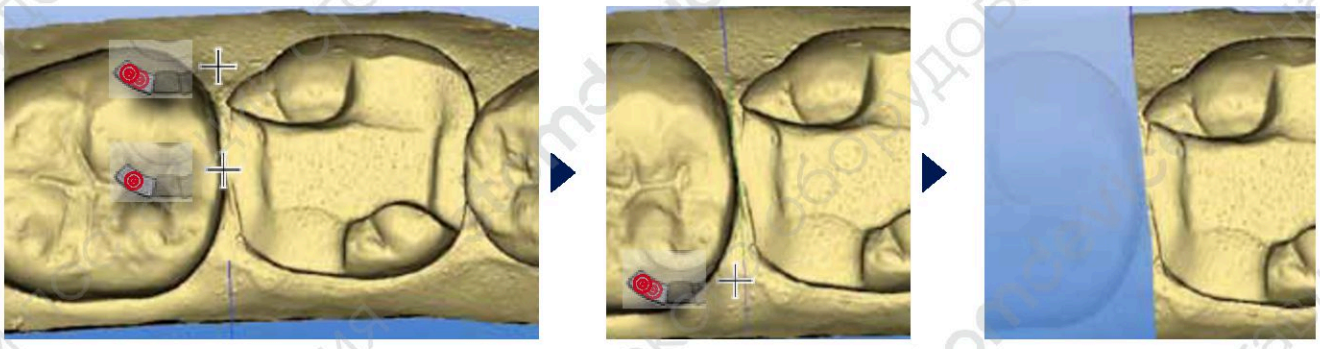


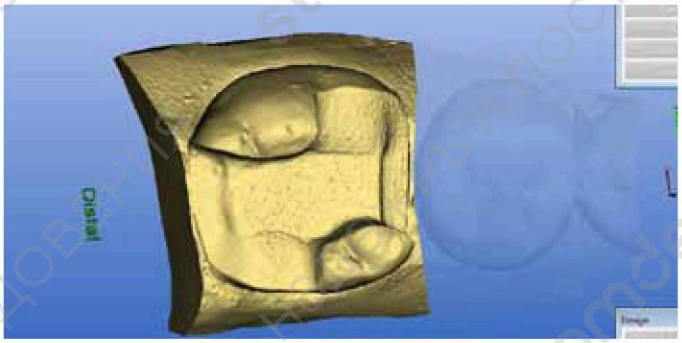
Trimming the 3D model and the antagonist model

4



Rotate the model in such a way that you have an optimum view of the distal proximal area. Begin the trim line with a double click of the left mouse at the entrance to the proximal space. Move the cursor to the proximal space between the preparation and the adjacent tooth. Single-click the line with the left mouse whenever you want to change the direction of the line. Double-click the left mouse when you have reached the other end of the proximal space. The distal adjacent tooth is now hidden.



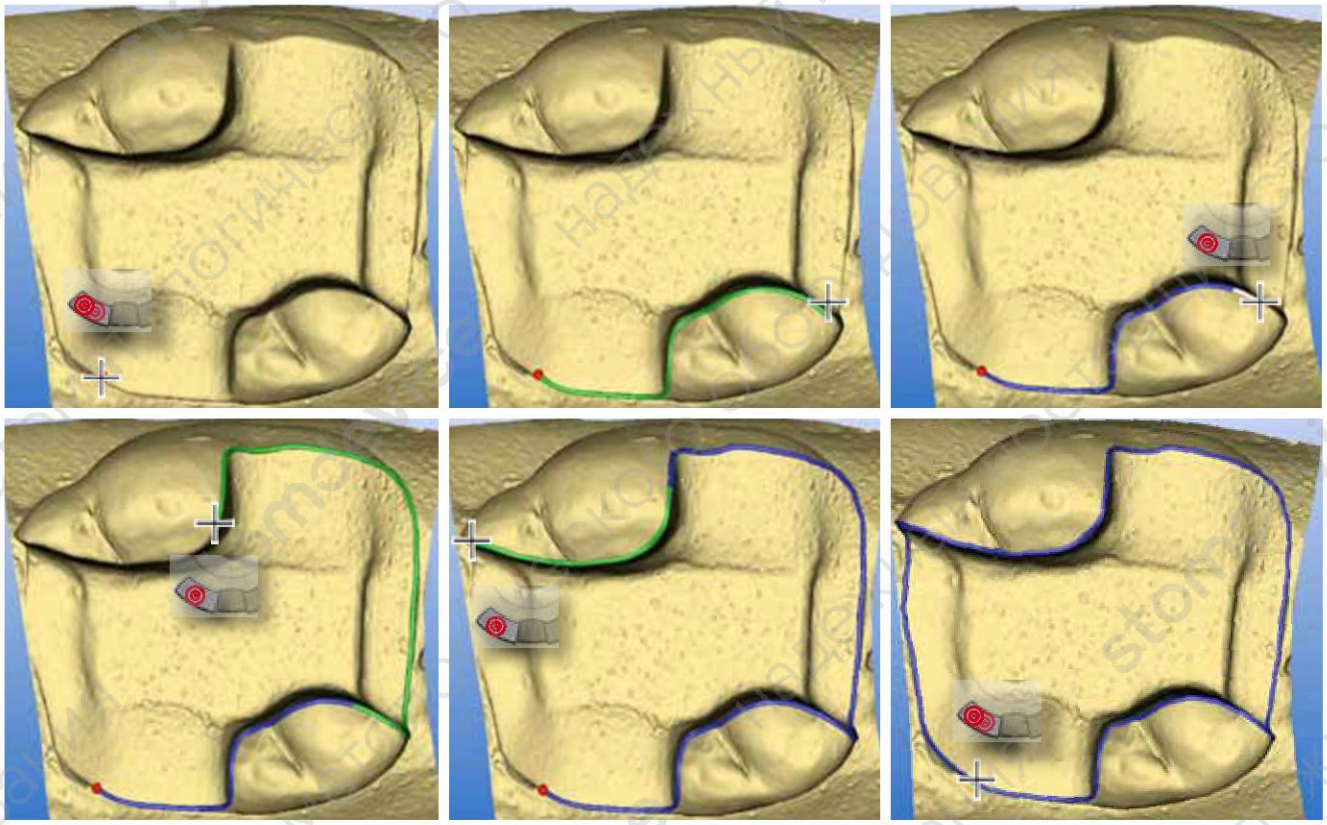


Repeat these steps to hide the mesial adjacent tooth.

5 Entering the preparation margin



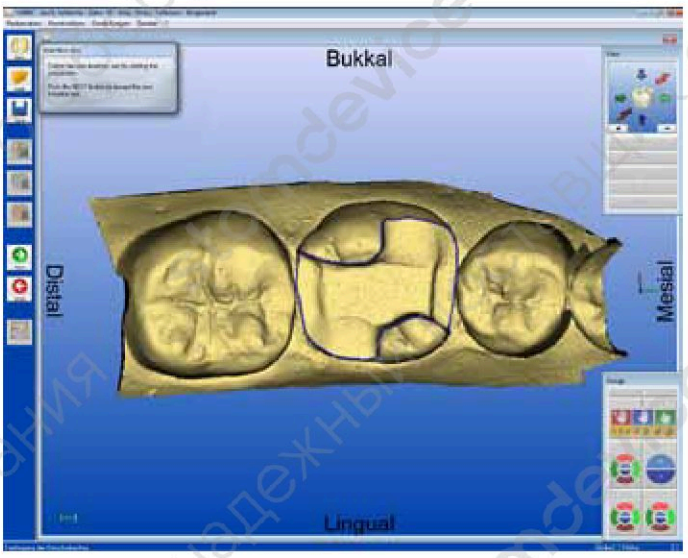
Begin with a double click of the left mouse at a clearly defined position on the preparation margin. Move the cursor along the preparation margin. The automatic detector marks the preparation margin with a green line. Fix the preparation margin line with a single click of the left trackball button at the transition from the occlusal to the proximal area. Continue moving the cursor along the preparation margin until you reach the buccal cusp. Fix the line with single clicks at the transitions to the occlusal area and the distal-proximal area, respectively. Complete the margin entry process by double-clicking the starting point red dot.



6 Defining the insertion axis



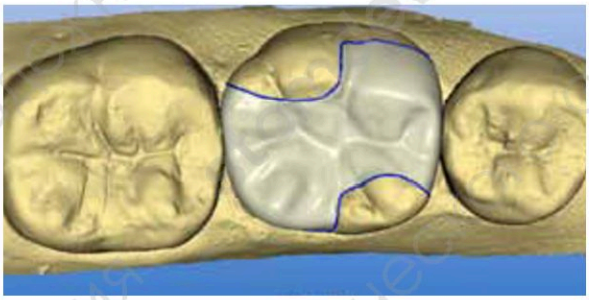
Rotate the 3D model in such a way that the directional designations “Mesial”, “Distal”, “Buccal” and “Lingual” are correctly assigned to the model and the preparation is horizontally aligned. In addition, make sure that there are no undercuts marked in yellow in the area of the preparation margin.



Biogeneric restoration proposal

7

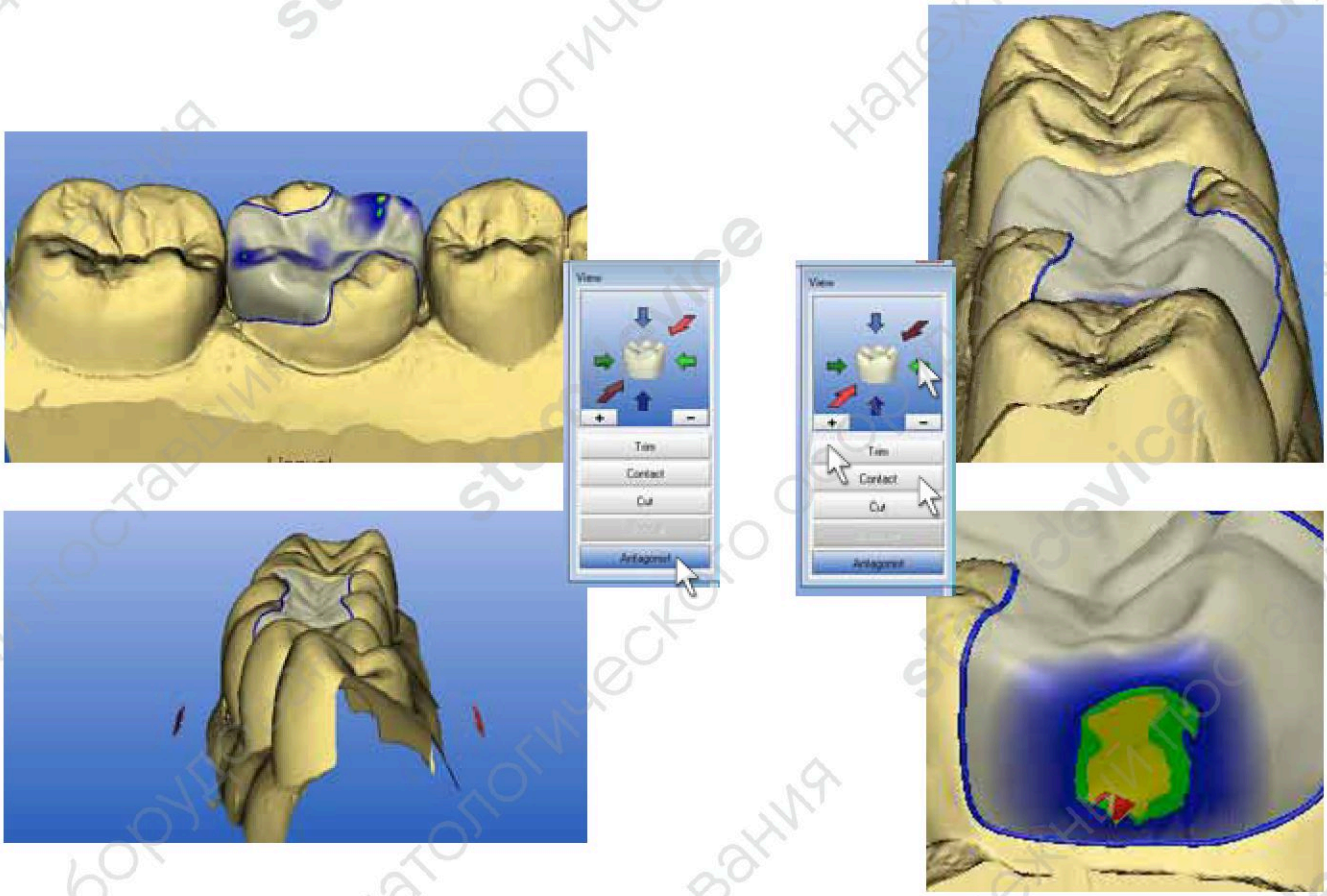
The CEREC 3D software computes the restoration proposal. The morphology of the distal adjacent tooth is analyzed. A morphologically typical tooth is then adapted to the preparation. The proximal contacts are defined and – finally – the occlusal contacts are adapted to the antagonist model.



Evaluating the restoration proposal

8

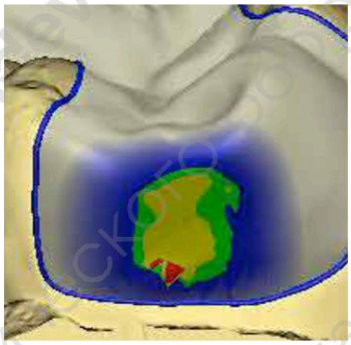
The restoration proposal can be quickly evaluated in the “View” window. Select the standard views to check the restoration from all angles. Ensure that the restoration is properly aligned in the dental arch with reference to the main fissure line. The height of the marginal ridge must correspond to that of the adjacent teeth. To display the occlusal contacts click the “Antagonist” button. To hide the adjacent teeth click the “Trim” button. To check the position and strength of the proximal contacts click the “Contact” button.



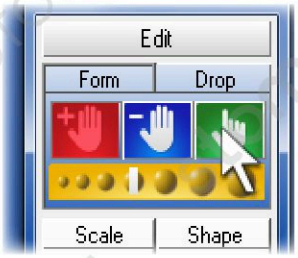
9 **Adjusting the proximal contacts**

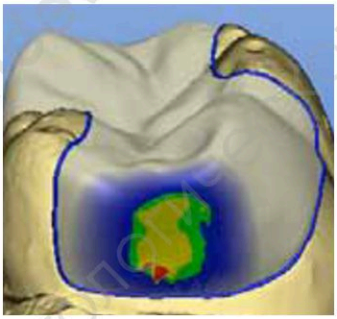
Click the "Trim" button to hide the adjacent teeth. The "Contact" button activates the colour-coded visualization of the proximal contacts. In clinical terms you should aim at achieving an extended green-yellow contact situation at the transition from the central to the occlusal third of the proximal surface.

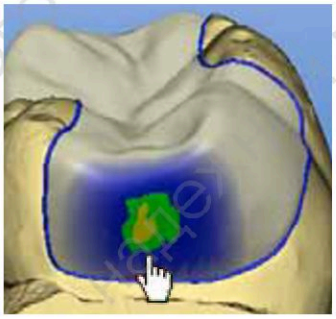


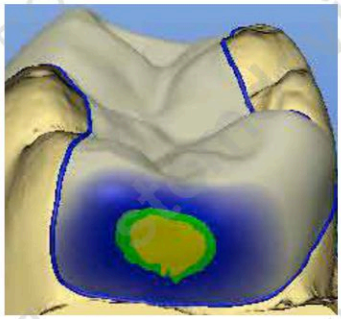


In this example the mesial proximal contact extends too far in the cervical direction. With the aid of the "Smooth" tool you can eliminate the penetration of the adjacent tooth in the cervical third. The distal proximal contact is optimally adjusted in terms of strength and extent and does not require any adjustment.





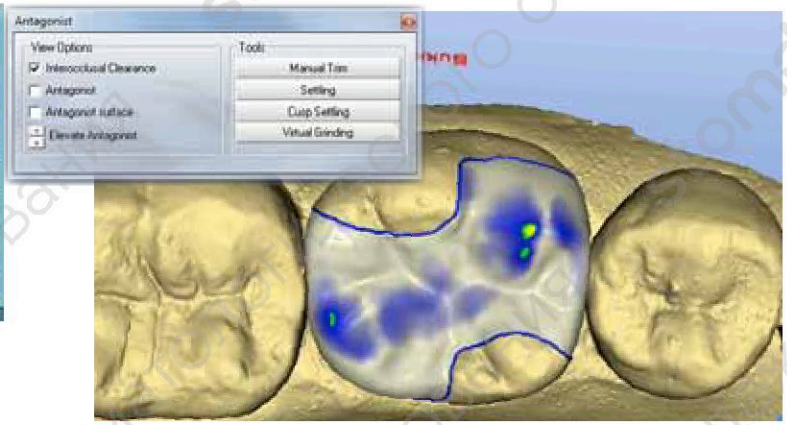




10 **Adjusting the occlusal contacts**

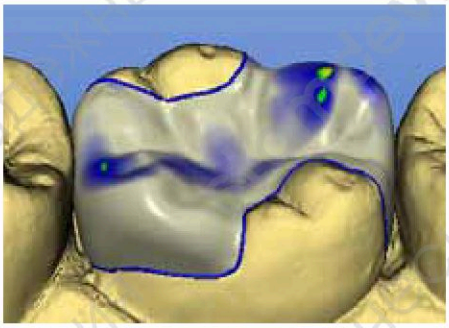
To view the position and strength of the occlusal contacts click "Antagonist" and then "Interocclusal clearance". The colour coding system is the same as in the case of proximal contacts. In clinical terms you should aim at achieving small green contact points on the supporting cusps.

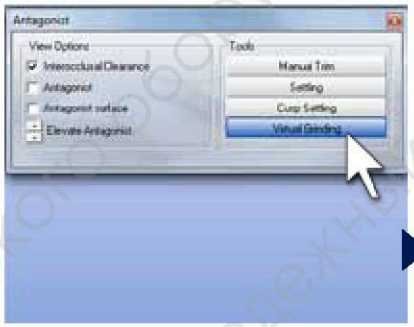


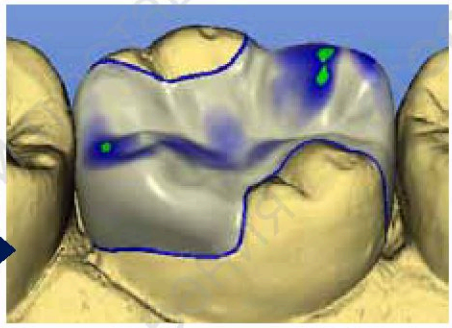


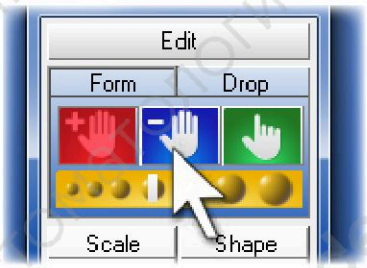
Attention:
Avoid any contacts on the marginal ridges and shear cusps.

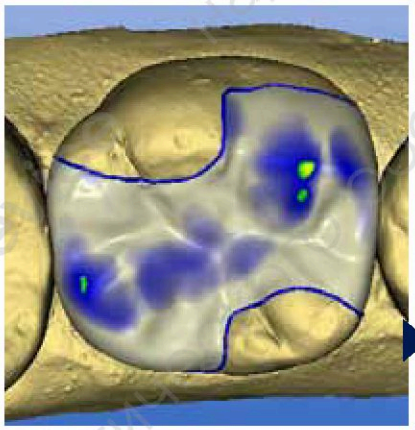
In our case the occlusal contacts on the mesio-buccal cusp are too strong. Click the “Virtual grinding” button in the “Antagonist” menu and reduce the contact strength to 25 µm. Then eliminate the contact in the distal area of the marginal ridge. This concludes the contact adjustment process.

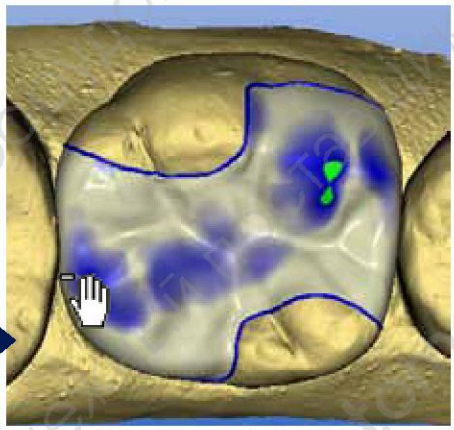








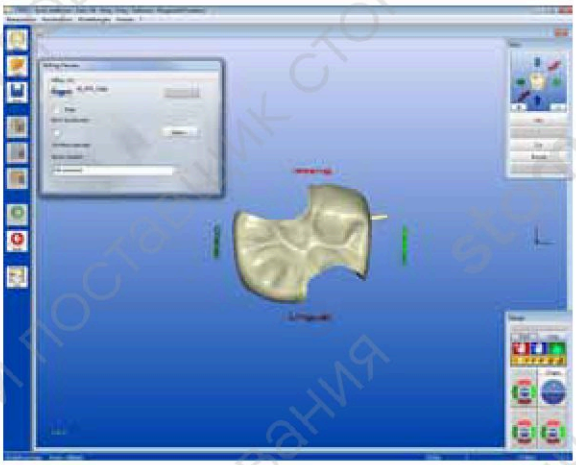


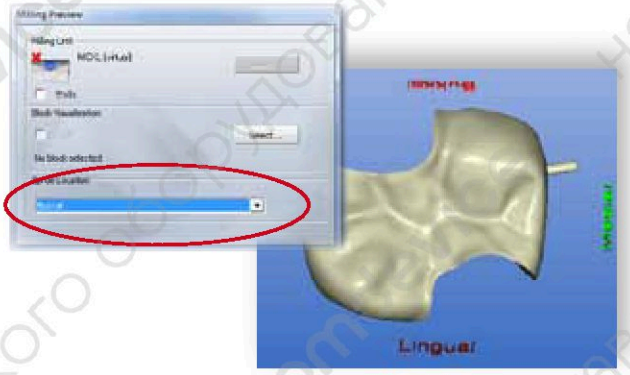


Milling preview

11

In the milling preview you can check the minimum wall thickness of the restoration (fissure >1.5 mm).





On partial crowns the sprue should be located on the lingual side, where it does not affect adjusted proximal contacts.

Milling

12



Click the “Mill” icon to start the milling process.

Case study

Initial situation:
In this case a partial crown and an inlay needed replacing due to their defective margins. While the local anaesthetic was taking effect, the opposing jaw was captured as far as the first premolar with the aid of the CEREC 3D camera. In addition, the patient's bite occlusion was acquired in the premolar area.



Following the fitting of a rubber dam, the fillings were removed and the cavities finished. Here it was important to create a clearly defined preparation margin.



The cavities were powdered and optical impressions obtained of the preparations. Supplementary impressions were acquired as far as the first premolar. The premolars provided the basis for the superimposition of the buccal registration.



The restorations were milled (material: Vita MKII 2M2C), tried in and proximally adjusted. Prior to insertion the proximal surfaces were highly polished. Both restorations were placed in a single treatment session (Syntac Classic, Heliobond, Tetric Classic A3).



As part of the overall dental rehabilitation procedure a defective filling in the second premolar and a distal carious defect in the first premolar were treated using CEREC inlays. All the restorations were highly polished using Sof-Lex discs and diamond paste.

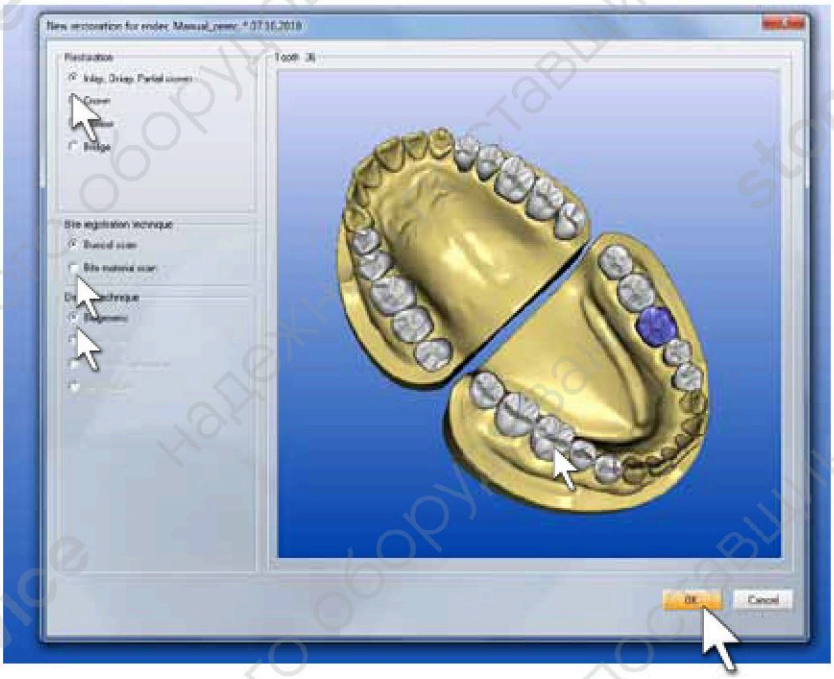


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2. Inlay design (biogeneric; bite material)

Selecting the restoration type

Open the “New” dialogue box and select “Inlay, onlay, partial crown”, “Bite material scan” and “Biogeneric” in the left-hand column. Select the tooth you want to restore (in this case tooth 46) and then click the “OK” button. The cursor jumps automatically to the “Acquire preparation” icon.



1

Acquisition technique

2

The preparation is acquired by means of angled and supplementary optical impressions. The preparation and the adjacent teeth must be captured in full. It is recommended that you begin the optical impressions at the distal neighboring tooth for optimal retention of the powder coating. A static bite registration is created and captured from the occlusal direction, together with the adjacent teeth.

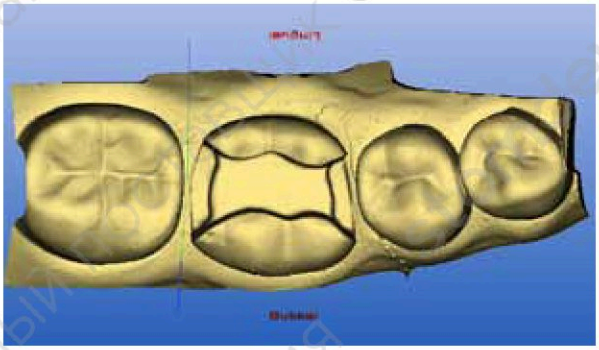




3 Computing the 3D model



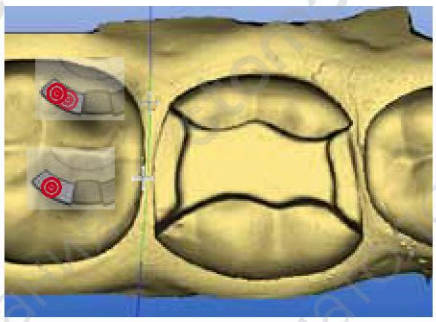
Click the green icon “Next”. The 3D models of the preparation and the antagonist are computed and automatically superimposed. For this reason it is necessary to acquire the adjacent teeth in both models.

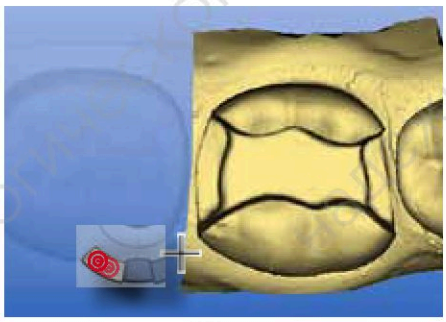


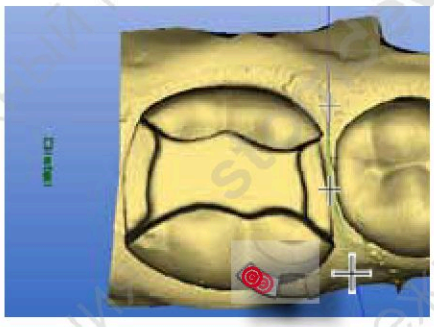
4 Trimming the 3D model



Rotate the model in such a way that you have an optimum view of the distal proximal area. Begin the trim line with a double-click on the left mouse at the entrance to the proximal space. Move the cursor between the preparation and the neighboring tooth and single-click the line whenever you need to change direction. Double-click the left mouse when you have reached the other end of the proximal space. The distal neighboring tooth is now hidden. Repeat these steps to hide the mesial neighboring tooth.





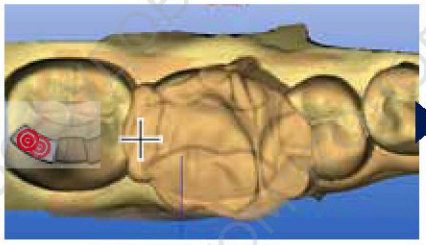


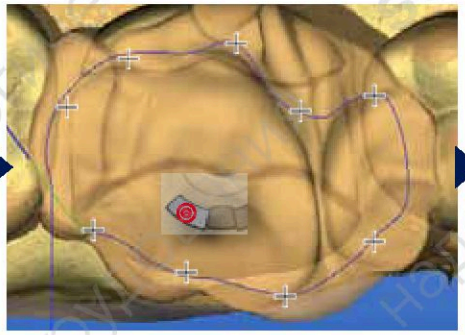
5 Trimming the antagonist

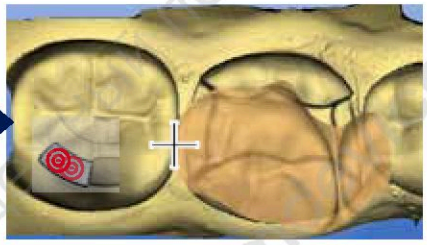


The bite registration is displayed as a brown area on the preparation. Enter a trim line around the impressions of the antagonist teeth. Begin with a double click and then enter single clicks to change the direction of the line. Complete this process with a double click.

The marginal areas of the bite registration should no longer protrude into the preparation, as this will prevent the correct generation of the restoration proposal.





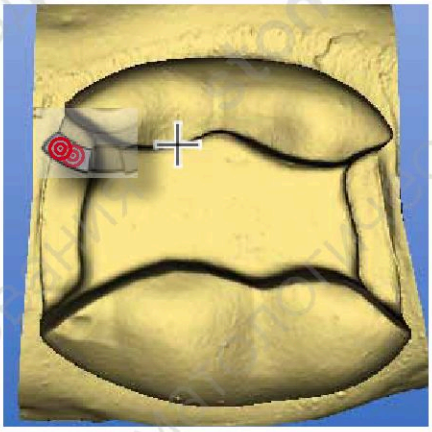
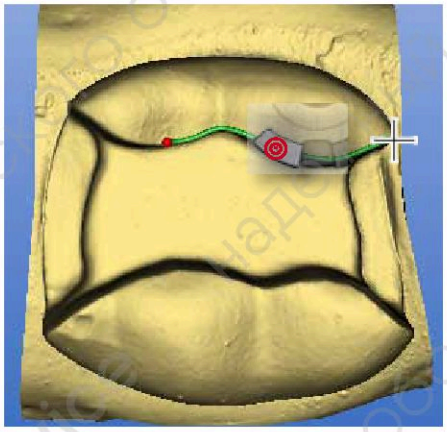
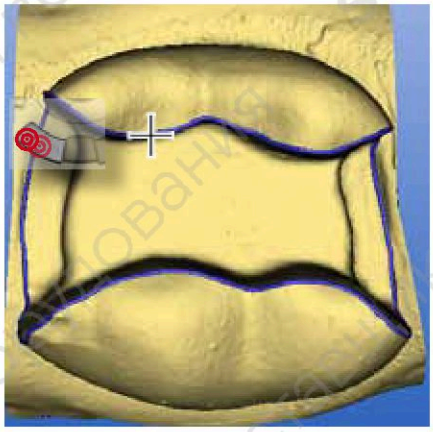


Entering the preparation margin

6



Begin with a double click on the preparation margin. Fix the preparation margin line with a single click at the transition from the occlusal to the proximal area. To complete the margin entry procedure double-click the starting point the red dot. Do not rotate the model when entering the preparation margin. Only do so at the end in order to check the results and make manual adjustments.

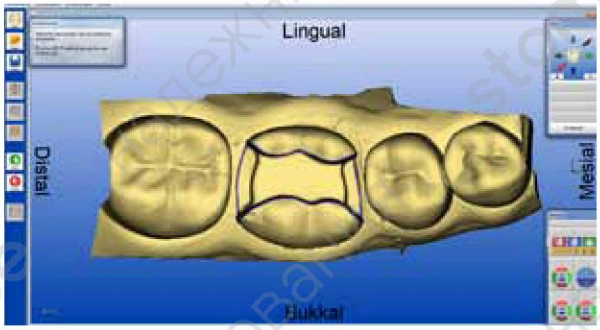




Defining the insertion axis

7



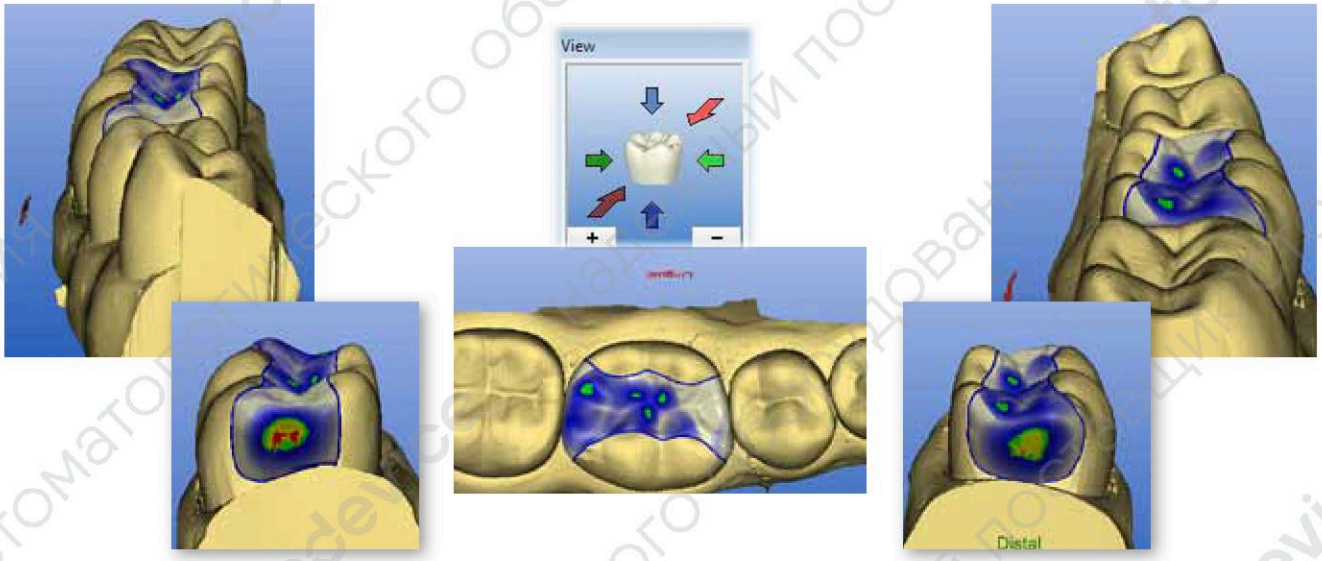
Rotate the 3D model until the preparation is horizontally aligned. Tilt the model in such a way that no undercuts marked in yellow can be seen in the area of the preparation margin and the entire margin is visible.



8 Evaluating the restoration proposal

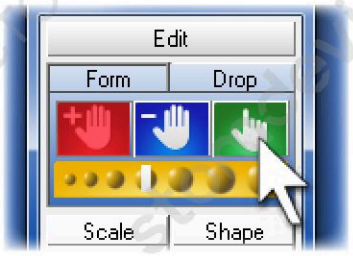


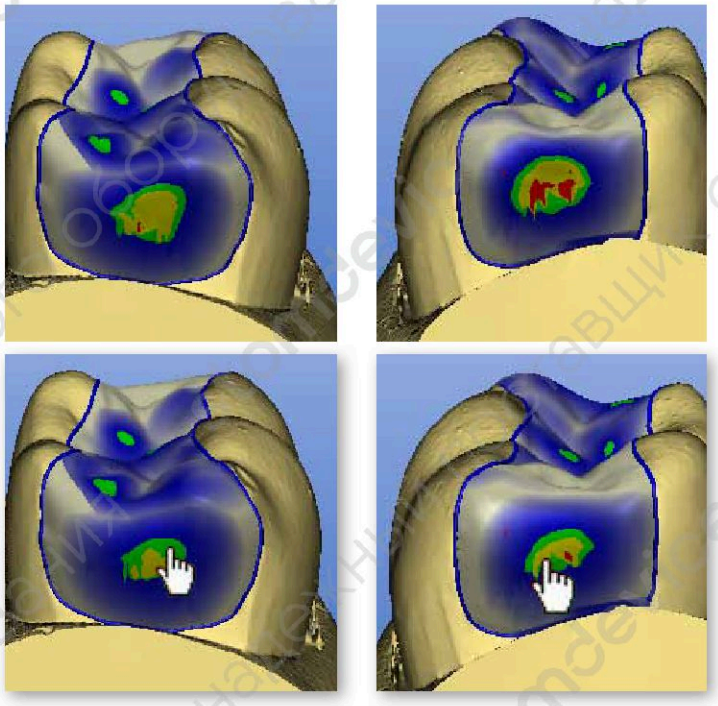
The restoration proposal can be quickly evaluated in the standard view windows. Ensure that the restoration is properly aligned in the dental arch with reference to the main fissure line. The height of the marginal ridge must correspond to that of the adjacent teeth (see image). To adjust the alignment of the restoration use the “Position/Rotate” tool.



9 Adjusting the proximal contacts

To hide the adjacent teeth click the “Trim” button. To view the colour-coded contacts click the “Contact” button. You should aim at achieving an even yellow marking (penetration: 50–100 µm) at the transition from the upper to the middle third of the crown. In this case the software has proposed contact surfaces which are adequate in terms of their position and size. The strength of the contacts can be reduced slightly with the aid of the “Smooth” tool.





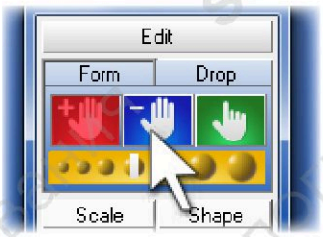
Adjusting the occlusal contacts

10

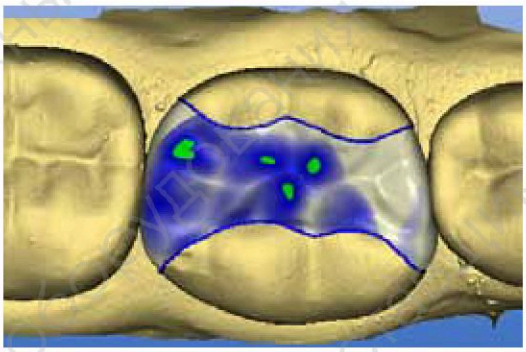
To view the position and strength of the occlusal contacts click “Antagonist” and then “Interocclusal clearance”. In clinical terms you should aim at achieving small green contact points on the supporting cusps.

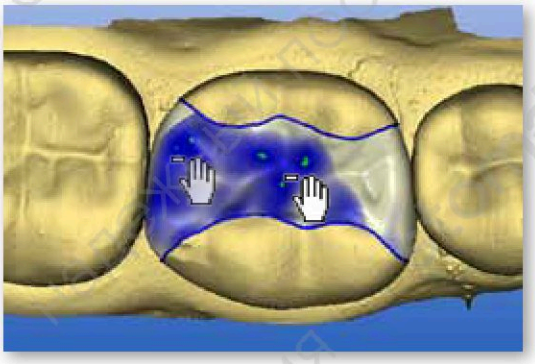
Attention:
Avoid creating contacts on the marginal ridges and functional cusps.

In our case the occlusal contacts are slightly too large. With the aid of the “Form -” tool the contacts can be reduced until they appear as small green dots.









Milling preview

11



In the milling preview you can once again check the minimum wall thickness of the restoration (fissure >1.5 mm). In the case of an MOD inlay the sprue location should be on the mesial or distal side. You can now start the milling process.



Milling

12



Click the “Mill” icon to start the milling process.

Case study

Initial situation:
In our clinical example a defective composite filling in tooth 14 needed replacing due to the presence of secondary caries.



While the local anaesthetic was taking effect a static bite registration was created and optical impressions acquired of the antagonists.



Following the fitting of a rubber dam, the preparation procedure was performed. During this process proximal caries was discovered in tooth 13, which was treated immediately with a composite filling prior to acquiring the optical impression.



The restoration was milled out of a CEREC Bloc S3-M 12. Following the removal of the sprue, the proximal surfaces of the restoration were highly polished. The restoration was then adhesively bonded to the tooth using Syntac Classic, Heliobond and Variolink Ultra. After initial polishing had been carried out the occlusal contacts were sufficient.



Following final polishing and the removal of adhesive residues the tooth functions were fully restored.



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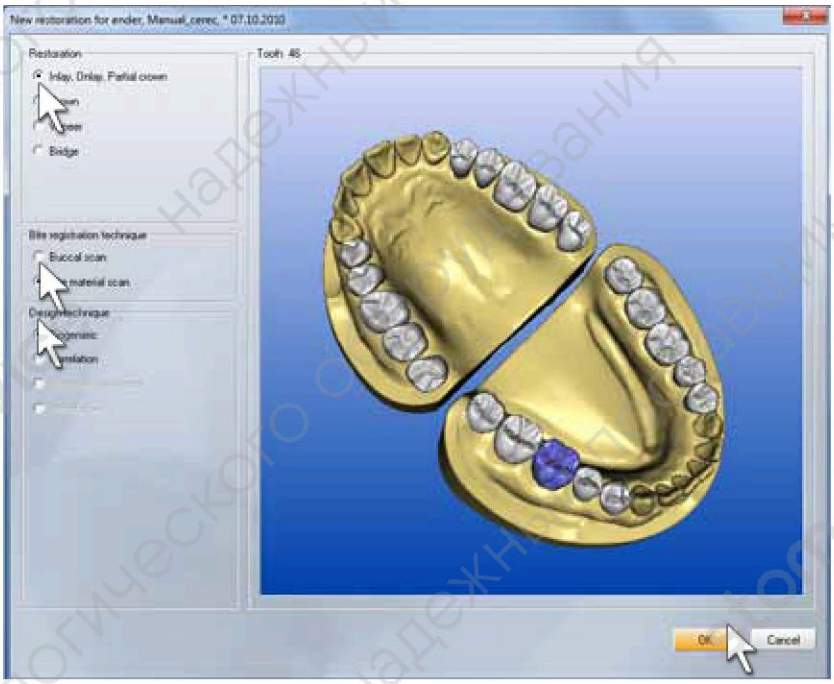
3. Crown design (biogeneric; buccal scan)

A chairside CEREC crown restoration provides a quick and cost-effective alternative to a lab-produced crown. It eliminates the need for a conventional impression, a temporary restoration as well as a repeat visit (including the administration of a local anaesthetic) in order to fit the final lab-produced crown.

Selecting the restoration type

1

Select “Crown”, “Buccal scan” and “Biogeneric” in the left-hand column of the dialogue box. Select the tooth you want to restore and then click the “OK” button. The cursor jumps automatically to the “Acquire preparation” icon.



Acquisition technique

2

Acquire the preparation scan by means of angled and supplementary optical impressions. For the purpose of buccal registration the supplementary impressions must extend as far as the first premolar.

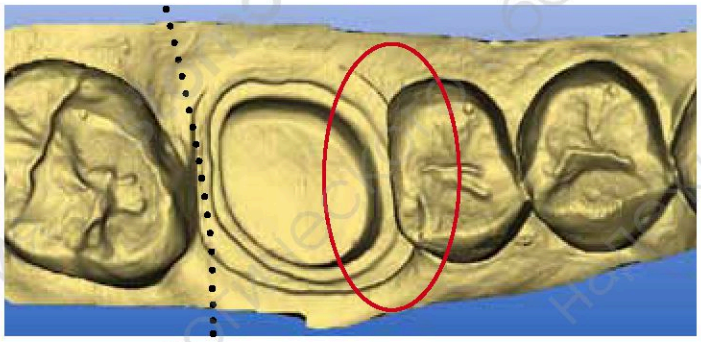
Then acquire the quadrants from the occlusal-buccal direction. The terminal bite occlusion is acquired from the buccal direction in the area of the first premolar at the level of the occlusal plane

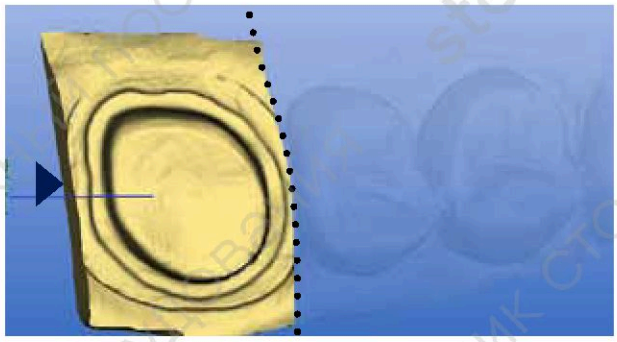


3 Trimming the 3D model



To hide the adjacent teeth rotate the model in such a way that you can optimally insert the trim line.

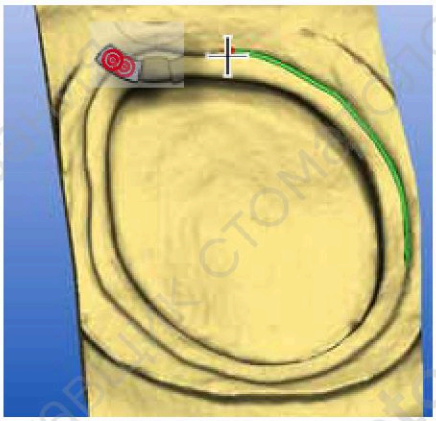


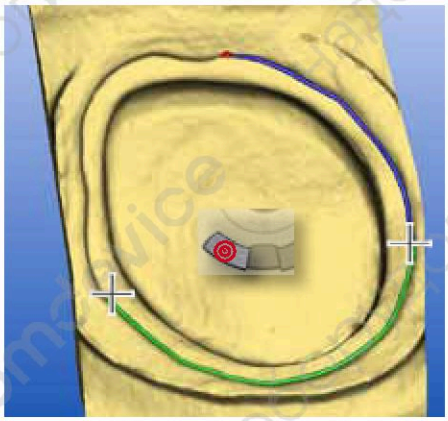


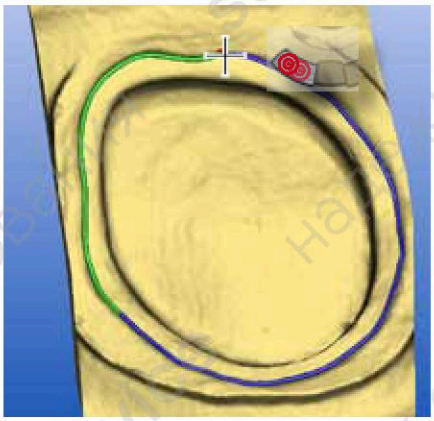
4 Entering the preparation margin



Begin at a clearly visible position on the preparation margin. Move the cursor along the preparation margin and fix the line with a single click after you have covered approximately one third of the total distance. Conclude the margin entry process with a double click of the left mouse at the starting point with the red dot.





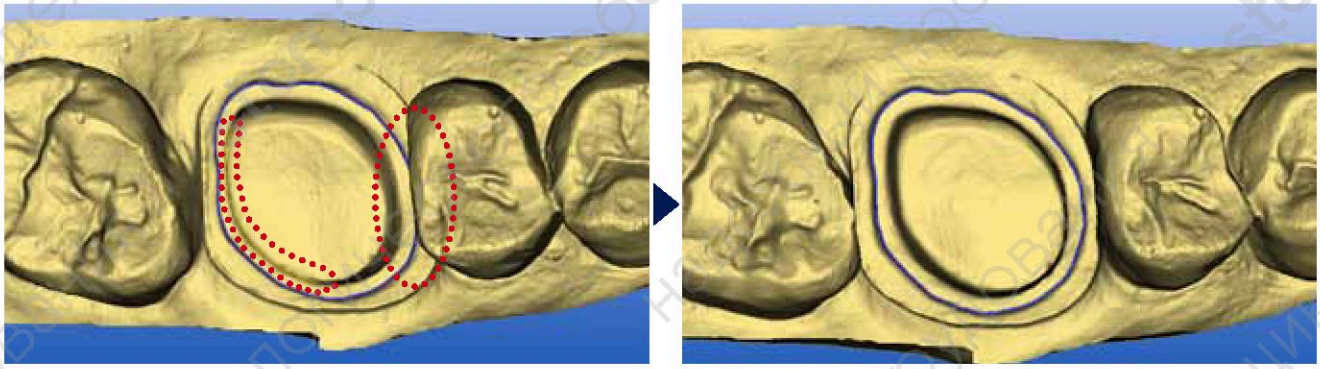


Defining the insertion axis

5



Check the insertion axis. In our example the 3D model is tilted slightly in the distal direction. An undercut is visible marked in yellow and the mesial preparation margin is not completely visible. Rotate the model in order to correct these errors.



Evaluating the restoration proposal

6



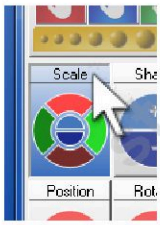
The next step is the computation of the restoration proposal. The software analyzes the morphology of the distal adjacent tooth and generates a morphologically matching restoration proposal. From the occlusal viewpoint you can see that the crown is optimally positioned in the dental arch. The occlusal contacts are very well distributed. The mesial and distal standard views indicate that the buccal cusps are too low and are positioned too far in the buccal direction. The mesial and distal marginal ridges are too deep. The proximal contacts are good in terms of their position and size.

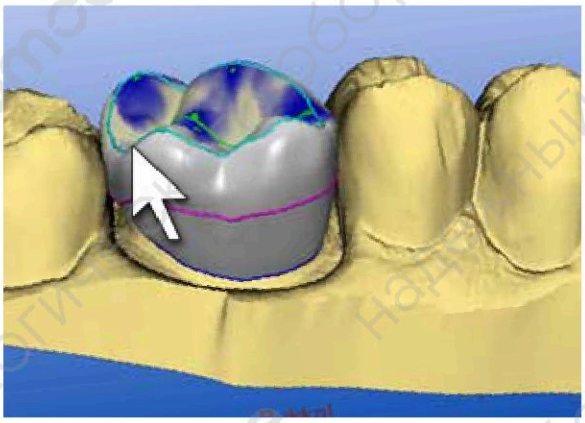


7 **Adjusting the outer contour**



Begin with the adjustment of the buccal cusps. Activate the “Scale” tool and then click the buccal preparation margin in order to activate the buccal restoration segment.



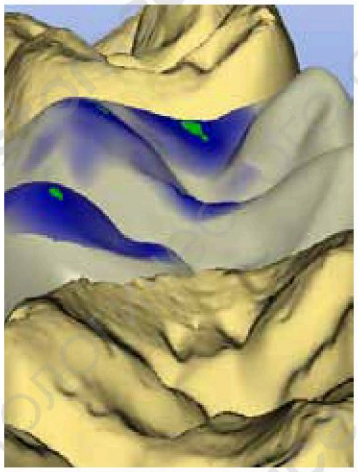
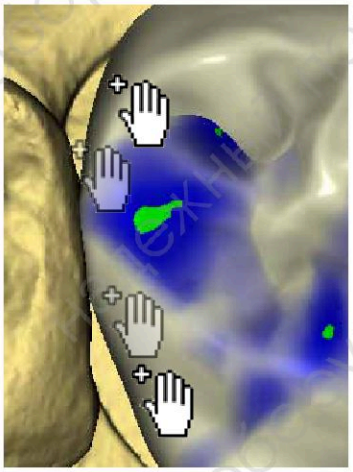
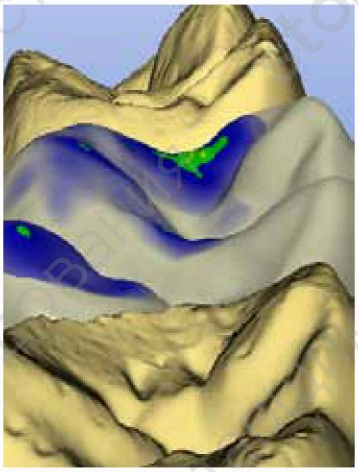


Click the light blue “Occlusal” button of the “Scale” tool to move the buccal side of the restoration in the occlusal direction. Then click the light red “Lingual“ button and move the buccal side of the restoration towards palatinal. These modifications can most conveniently be monitored from a mesial viewpoint.

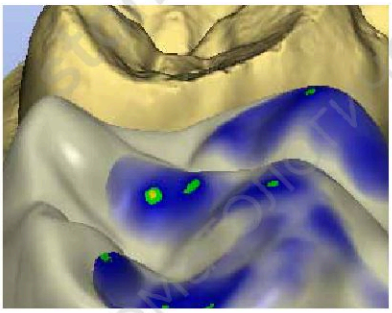
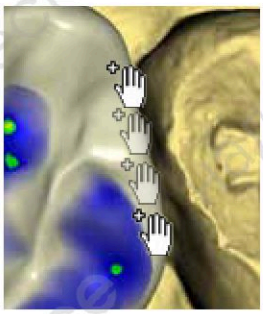
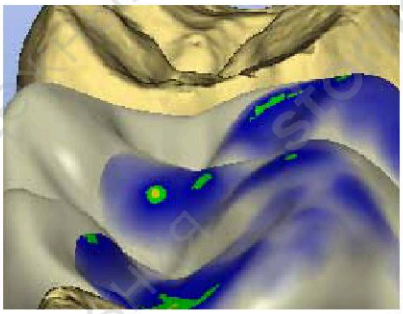


Use the “Form +” tool to modify the marginal ridges. From the distal viewpoint you can define those areas to which additional material will be applied. Apply the material in the occlusal standard view. Attention: the material is always applied in the direction of the monitor! These modifications can then be evaluated from a distal viewpoint.



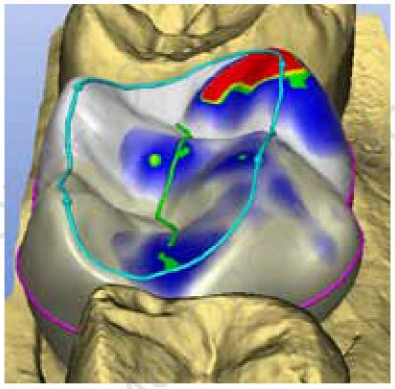
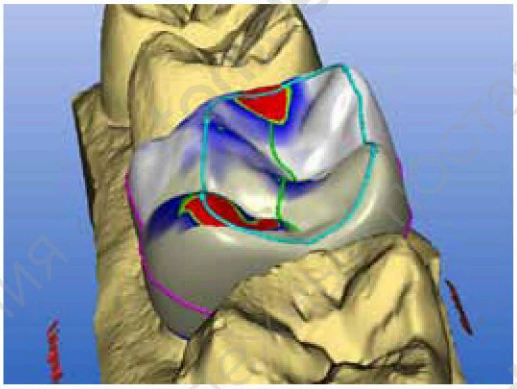




Adjust the distal marginal ridge using the “Form +” tool.

Attention:
The “Scale” tool is not suitable for such local adjustments, as it always changes the entire restoration segment. This results in massive occlusal pre-contacts shown in red.

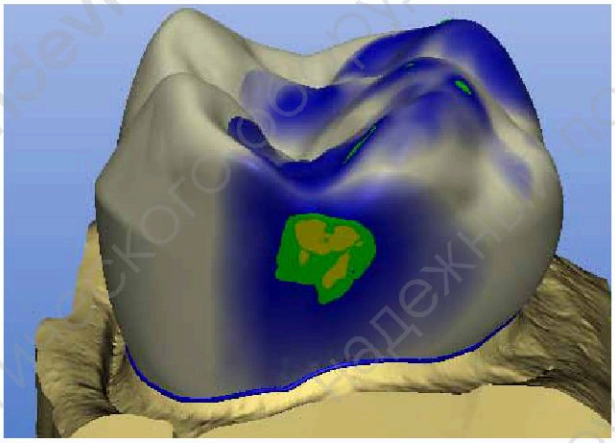


8 **Adjusting the proximal contacts**

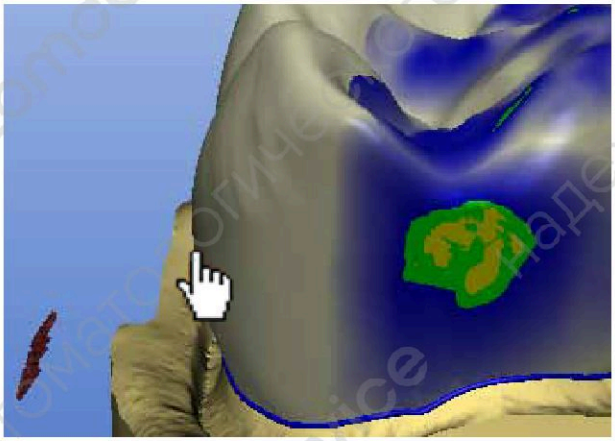
After you have finalized the outer contour you can adjust the proximal contacts and smooth the outer surfaces of the restoration. To display the proximal contacts activate “Trim”, followed by “Contact”.

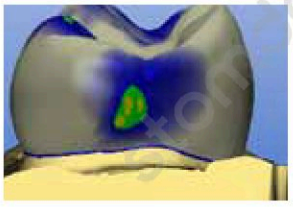




The mesial contact point is optimally adjusted. From this viewpoint you can now smooth the sharp edge created by the “Scale” tool.



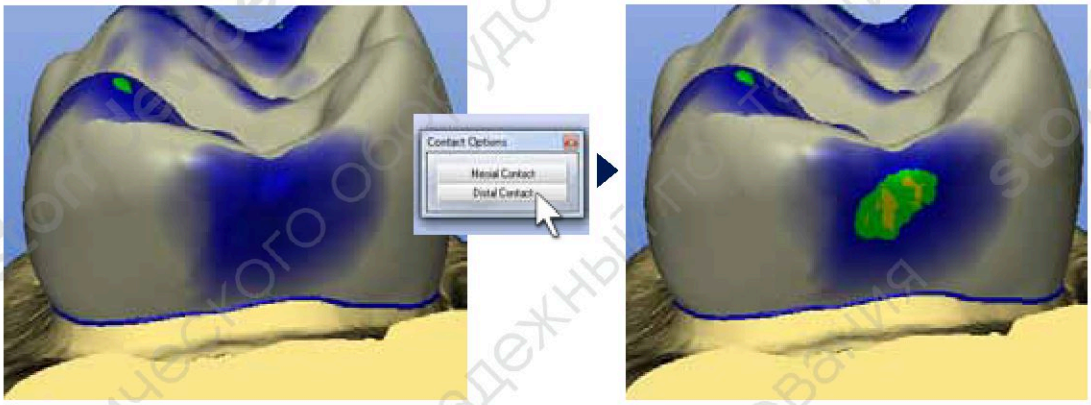








Following the smoothing of the outer contour, the distal proximal contact has been erased. When you click “Distal contact” in the “Contact options” window, a new proximal contact is automatically generated. Thanks to the newly defined outer contour, this contact is now optimally positioned.

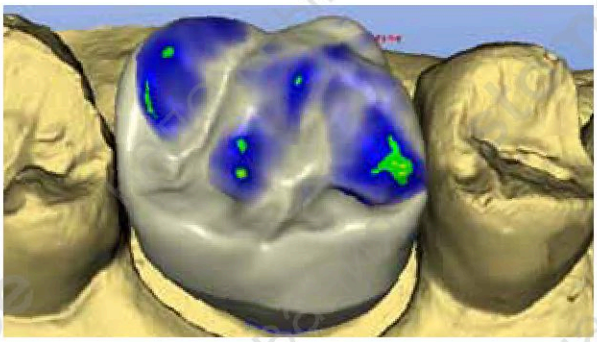


Adjusting the occlusal contacts

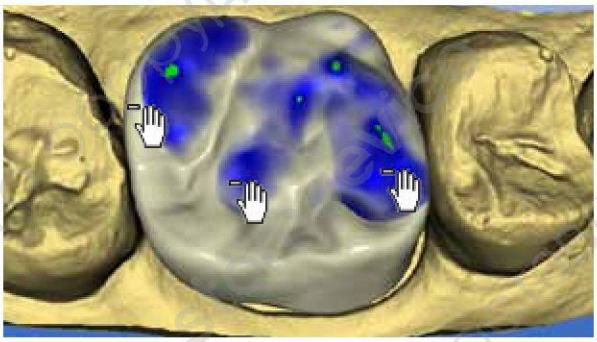
Now that the outer contour corresponds to your requirements you can adjust the occlusal contacts. For this purpose you should use the “Form -” and “Virtual grinding” tools in the “Antagonist” dialogue box.

Then activate the “Virtual grinding” tool and adjust the contact strengths. If the antagonist dialogue box cannot be seen, click the “Antagonist” button in the “View” window





Begin by eliminating the contacts on the marginal ridges and the transverse crest using the “Form -” (form minus) tool. This task should be performed in the occlusal standard view.

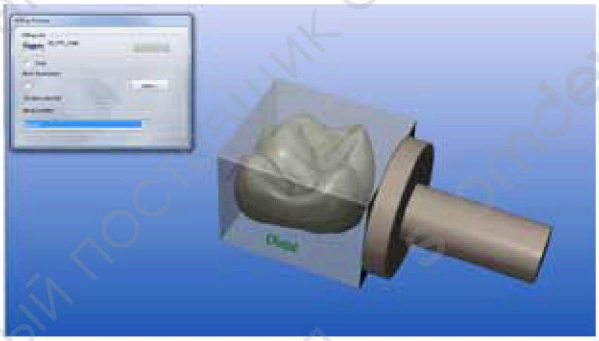


10 **Milling preview**



In the milling preview you can check the minimum wall thickness of the restoration (fissure >1.5 mm).

Move the sprue location to the buccal or lingual side.



Select a multilayered polychromatic ceramic block and position the crown within the block in accordance with your specific requirements.

11 **Milling**



To start the milling process click the “Mill” icon in the left-hand icon bar.
Select the same ceramic block as is shown in the “Block visualization” menu of the milling preview.

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Case study



Initial situation:
The patient was referred to the dental practice following an endodontic treatment review of tooth 14. It was decided to restore the tooth by means of a full crown milled out of e.max CAD (Ivoclar).



A step preparation was created with a chamfered inner step (0.8 - 1 mm) and an occlusal reduction of approximately 2 mm. All the edges were rounded with the aid of Sof-Lex discs.



After CEREC Optispray had been applied to the preparation, the optical impressions were acquired. The treatment situation in the premolar area is ideally suited for buccal registration.



The try-in of the milled e-max crown displayed an optimum proximal fit. The restoration was then crystallized, stained and glazed. This process took approximately 40 minutes. Due to their enhanced strength, e-max CAD crowns are recommended for the restoration of root-treated posterior teeth.



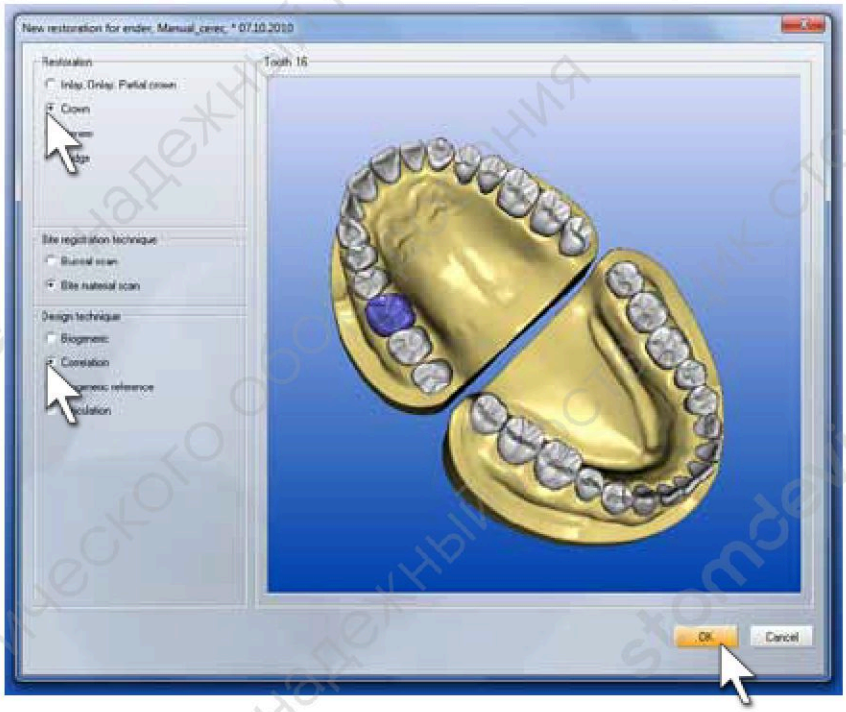
The finished crown was adhesively bonded by means of Multilink.

4. Crown design in “Correlation” mode

In “Correlation” design mode the at least partially intact initial situation is copied and transferred directly to the new restoration. This procedure is used to replace an existing crown in the event of secondary caries.

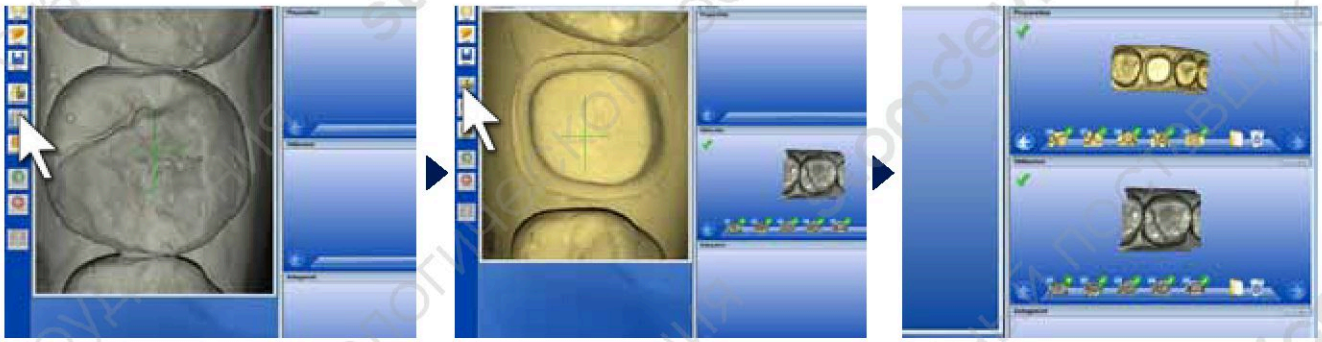
1 **Selecting the restoration type**

Select “Crown” and “Correlation” in the left-hand column. Then select the tooth you want to restore and click the “OK” button. The cursor jumps automatically to the “Acquire preparation” icon.



2 **Acquisition technique**

Prior to preparation of the tooth, occlusal and angulated digital impressions of the existing initial situation must be acquired. The proximal areas of the neighboring teeth must also be captured, if necessary by means of supplementary impressions. The tooth is then prepared and captured (“Acquire preparation”). A bite registration is not necessary, due to the fact that the occlusal surface is identical before and after treatment.

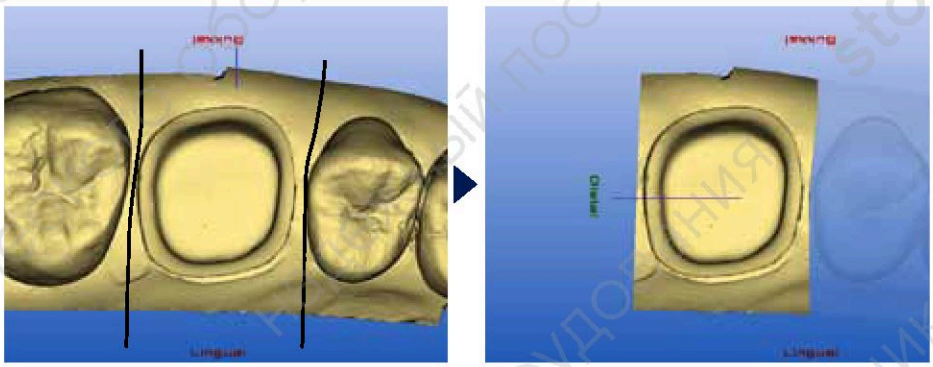


Trimming the 3D model

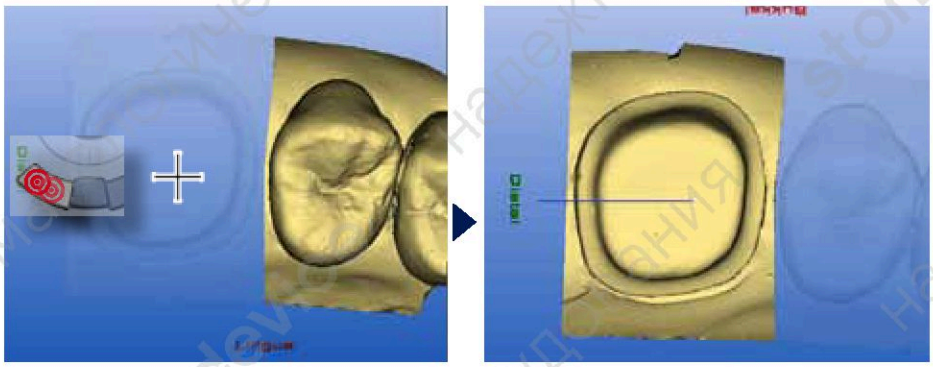
3



Following the computation of the 3D model the neighboring teeth are trimmed.



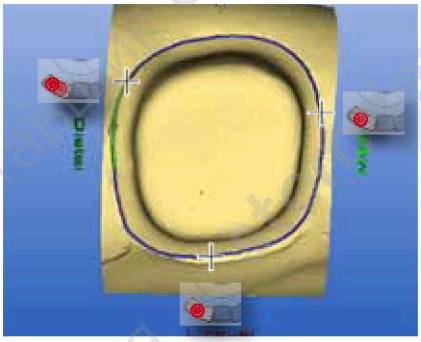
Attention:
After you have confirmed the trim line with a double click of the left mouse, it is possible that the preparation may be hidden. The CEREC 3D software always hides the smaller portion of the 3D model. If this situation occurs, double-click the transparent area of the model with the left mouse to display the preparation once again.



4 Entering the preparation margin



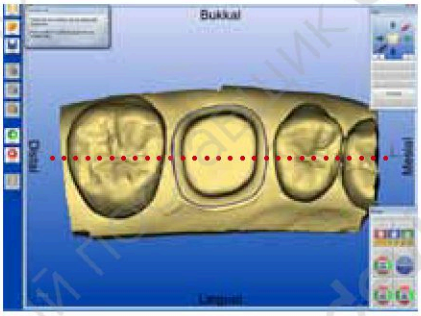
Begin with a double-click on the preparation margin. Move the cursor along the preparation margin and fix the line with a single click after you have covered approximately one third of the total distance. Conclude the margin entry process with a double-click of the left mouse at the starting point.



5 Defining the insertion axis



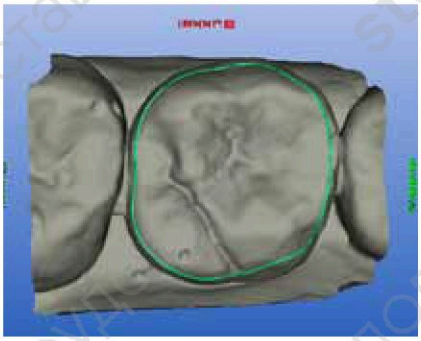
Check the insertion axis of the preparation and ensure that the preparation is horizontally aligned on the monitor.

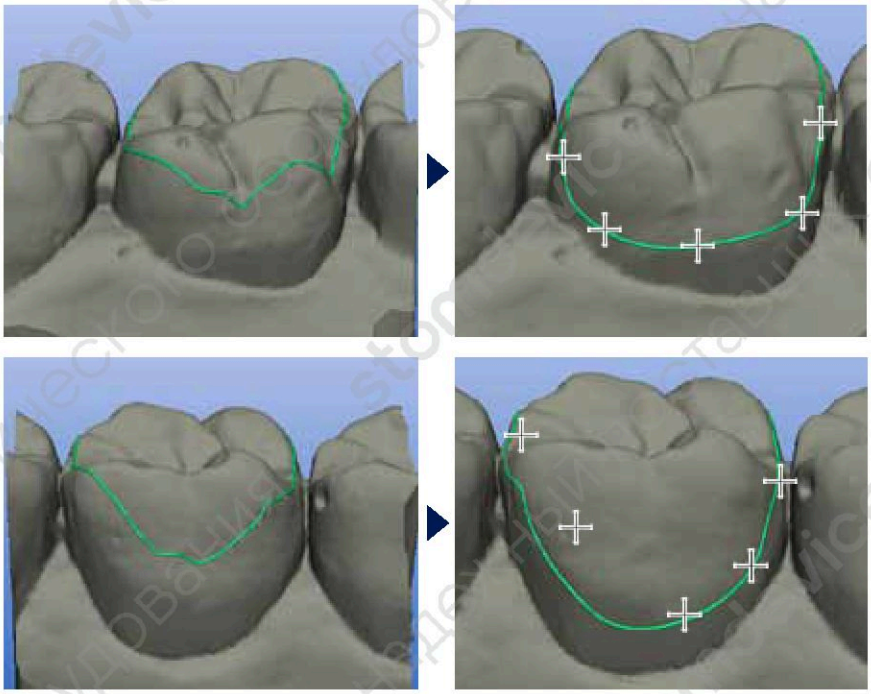


6 Editing the copy line



Begin with the initial optical impression of the occlusal situation. All areas within the green copy line are identically copied directly into the new restoration. The goal is to copy all the intact areas of the existing crown. For this reason the copy line has been extended in a cervical direction in the buccal and palatinal areas. This is why it is important to capture these areas by means of angled optical impressions.



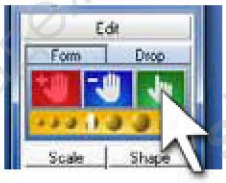


Adjusting the proximal contacts

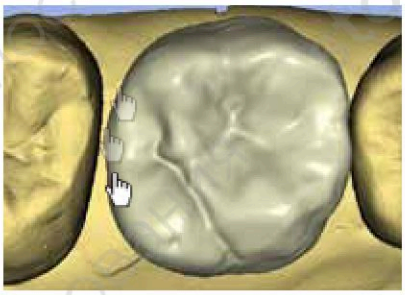
7



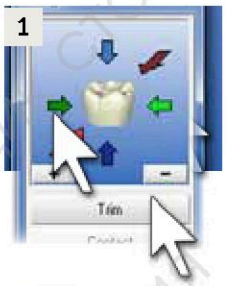
The restoration proposal requires only very minor adjustments in the marginal and proximal areas. Check and adjust the proximal contacts. In the distal area you can see an uneven surface. This can be removed using the “Smooth” tool.



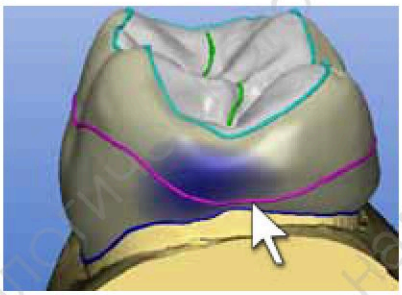


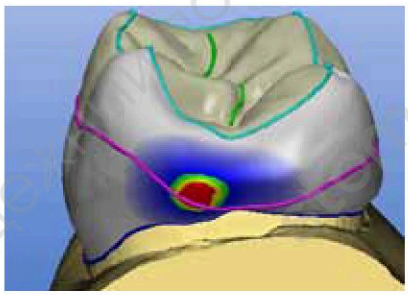


Switch over to the distal standard view and activate **“Trim” (1)**, followed by **“Scale” (2)** Click the distal equator line and then click several times on the dark green button **(3)** of the **“Scale”** tool in order to create a proximal contact.





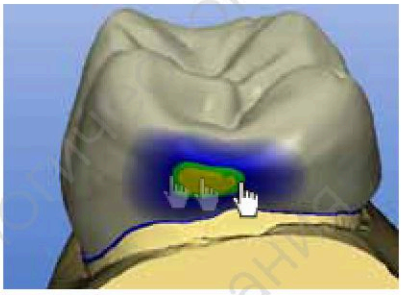






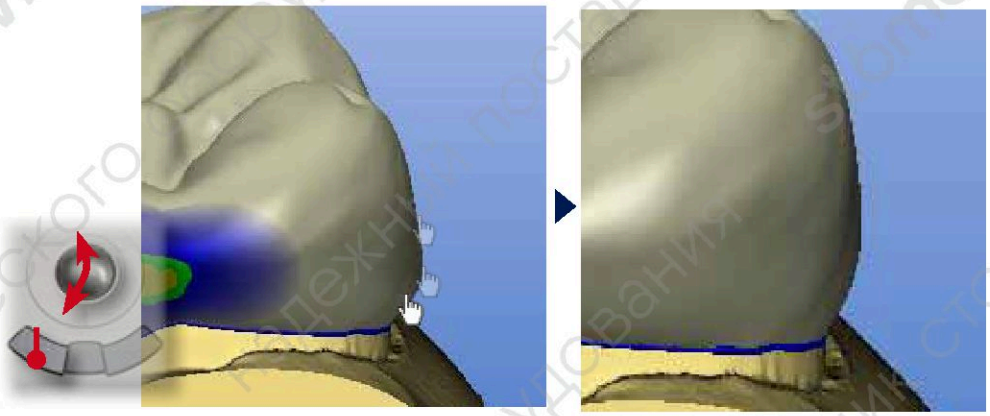
Finally, you can adjust the yellow contact surface by means of the “Smooth” tool.





8 **Smoothing the restoration**

It may be necessary to smooth the contours of the restoration in the marginal area. As the occlusal surface of the restoration is identical to the original crown, no adjustments are necessary occlusally.



9 **Milling preview**



Check the minimum wall thickness of the restoration (fissure >1.5 mm) in the milling preview.

The sprue should be located on the buccal or lingual side of the restoration. In the case of full crowns it is advisable to use multicoloured polychromatic ceramic blocks, as these are better capable of imitating the shading gradations of natural teeth. A multicoloured polychromatic block can be selected in the "Block visualization" menu. Use the "Position" tool in order to position the crown correctly within the block.



10 **Milling**



To start the milling process click the "Mill" icon in the left-hand icon bar. Select the same ceramic block as is shown in the "Block visualization" menu of the milling preview.

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Case study



Initial situation:
In this case the patient requested replacement of a cast gold crown. As the occlusion and morphology of the existing restoration were absolutely satisfactory, the "Correlation" design mode was chosen. The restoration was powdered, captured and then saved in the "Occlusion" image catalogue.



This was followed by the preparation. Iron sulphate (ViscoStat) was used to control bleeding. A gingival retraction cord (Ultrapak) was deployed.



The preparation and the adjacent teeth were powdered and captured using the CEREC Bluecam.



The milled restoration was initially tried-in and then the proximal contacts were highly polished.

The restoration was adhesively bonded using Syntac Classic and Variolink II and then polished with the aid of Sof-Lex discs and diamond paste. In comparison with the initial situation, the outer contour and occlusal relief have been optimally transferred. In clinical terms the "Correlation" design mode delivers a significant advantage in terms of speed.

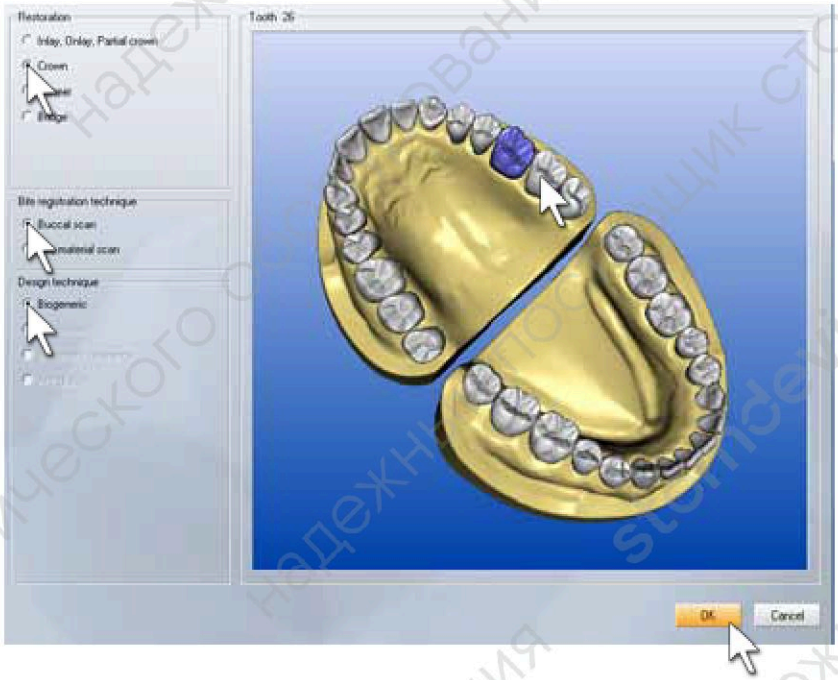
https://stomdevice.ru - стоматологическое и зуботехническое оборудование с доставкой по России и СНГ

5. Quadrant restoration (biogeneric; buccal scan)

CEREC quadrant restorations – i.e. the restoration of several teeth during a single appointment – significantly reduces overall treatment time. It is possible to perform the design and milling operations in parallel. In other words, while the first restoration is being milled, you can concentrate on designing the second restoration and mill it once the first restoration is finished milling. Only one local anaesthetic and one rubber dam are required. Placement and polishing can be performed in a single operation. As a result the time needed for the second restoration is reduced by ca. 50–60 percent.

1 **Selecting the restoration type**

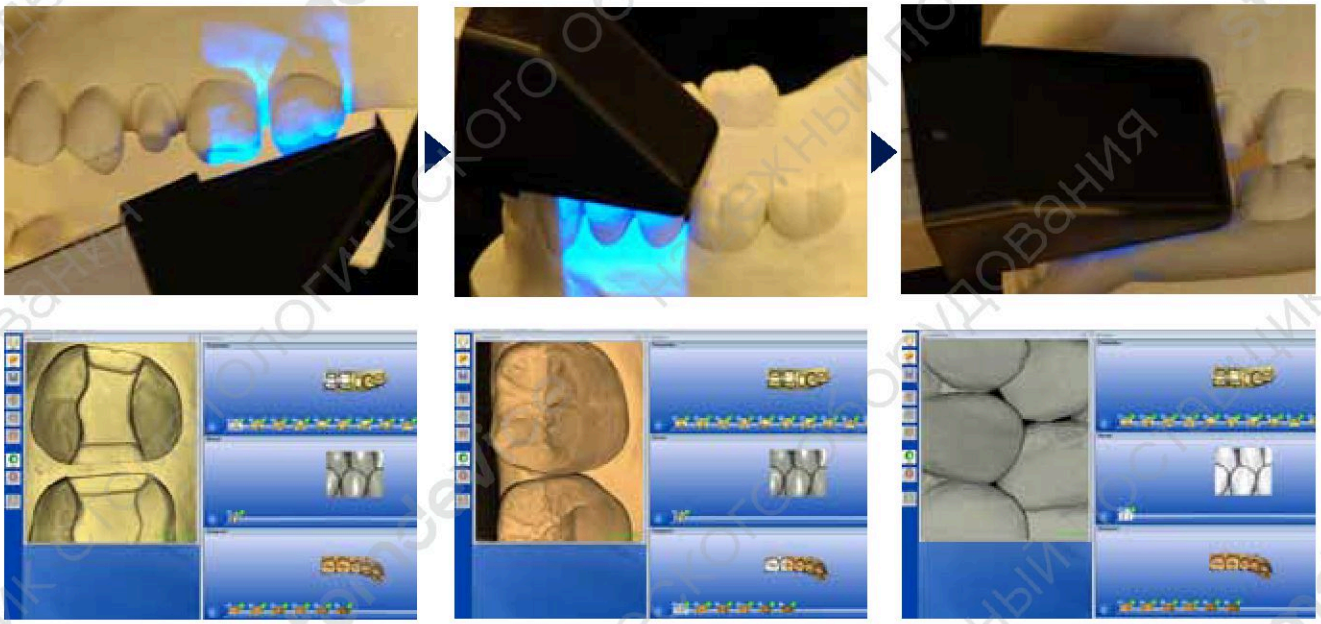
Begin with the smallest restoration – in this example with the inlay preparation of tooth 27. Select “Buccal scan” and “Biogeneric”, click tooth 27 and then confirm your selection by clicking “OK”.



Acquisition technique

2

When performing a quadrant restoration you should capture the prepared teeth together with their mesial and distal neighbours = minimum requirement. Begin by capturing the preparation from tooth 27 to tooth 23 by means of angled and supplementary impressions. Then capture the opposing jaw from tooth 37 to 33 from the occlusal and buccal angle. Finally, acquire an optical impression of the patient's terminal bite occlusion in the area of the canine or first premolar at the occlusal plane.

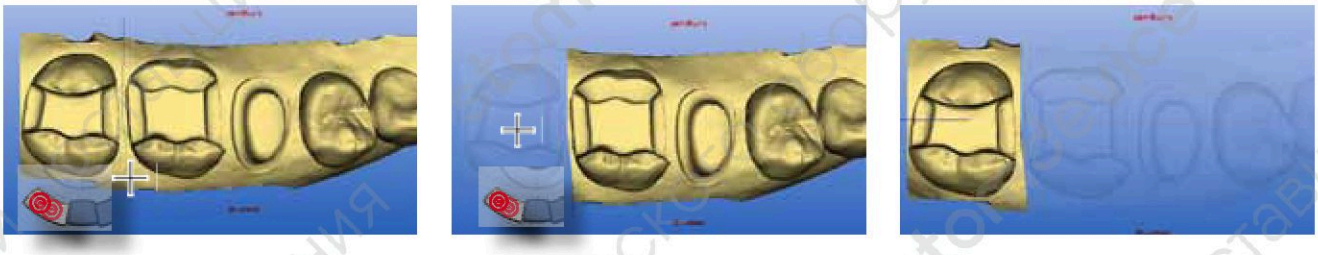


Trimming the preparation

3



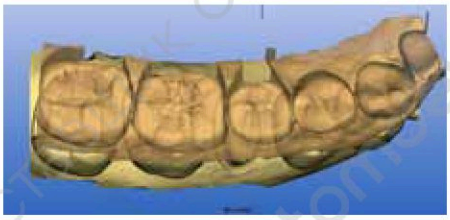
When you trim the inlay preparation, it may be hidden from view due to the fact that it constitutes the smaller portion of the 3D model. To display the inlay preparation simply double-click the transparent area of the 3D model.



4 **Trimming the antagonist**



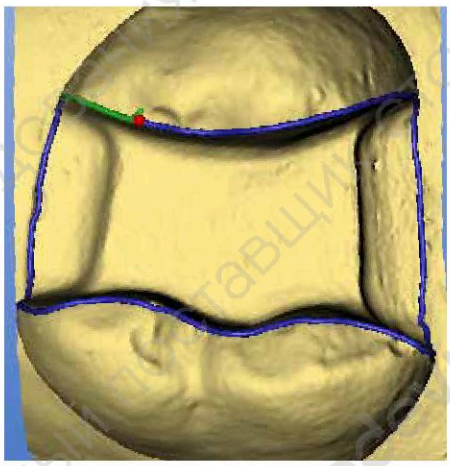
As a buccal registration is available, the antagonist does not have to be trimmed. To proceed simply click the green icon “Next”.



5 **Entering the preparation margin**



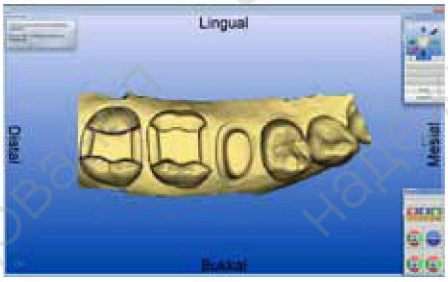
Begin by entering the occlusal preparation margin. Fix the preparation margin line at the transition from the occlusal to the proximal area. When you have finished entering the preparation margin rotate the model and make any necessary manual adjustments.



6 **Defining the insertion axis**



You can now define the insertion axis. Make sure that there are no undercuts in yellow and ensure that the preparation is horizontally aligned on the monitor.

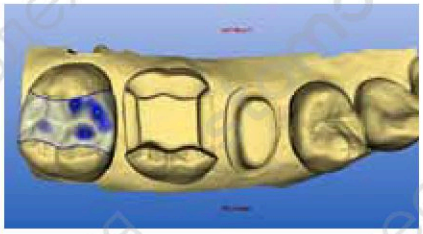


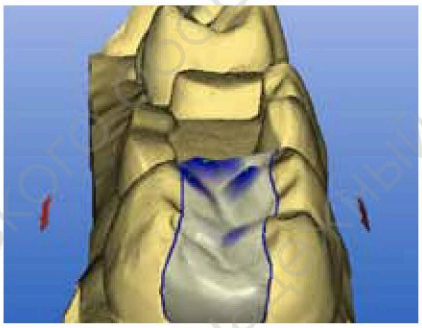
Evaluating the restoration proposal

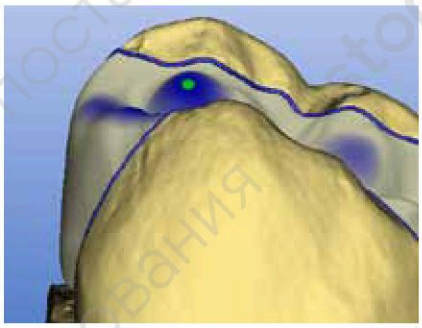
7



Evaluate the restoration proposal from various viewpoints. In this way you can obtain an overview of the necessary adjustments and then proceed systematically from cervical towards occlusal. In this example the mesial area of the restoration is excessively protuberant, and there is an occlusal contact point on the mesio-buccal cusp.

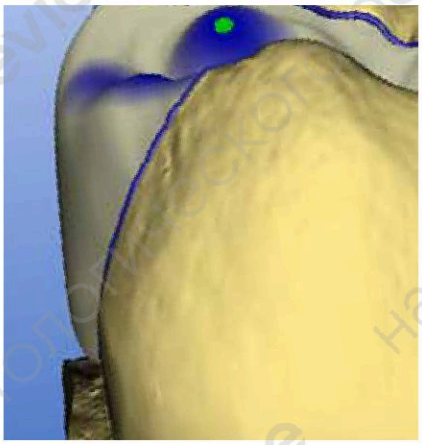


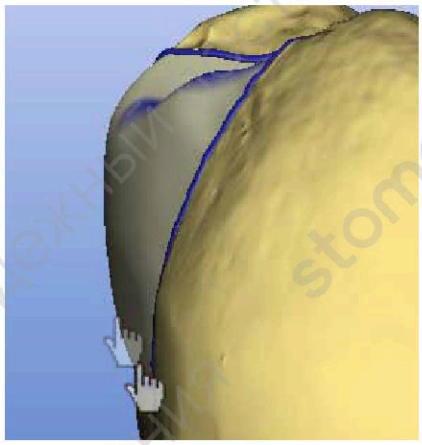




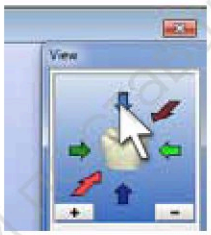
The adjustments are made with the aid of the “Smooth” tool. Select the palatinal view and smooth the mesio-proximal contour.

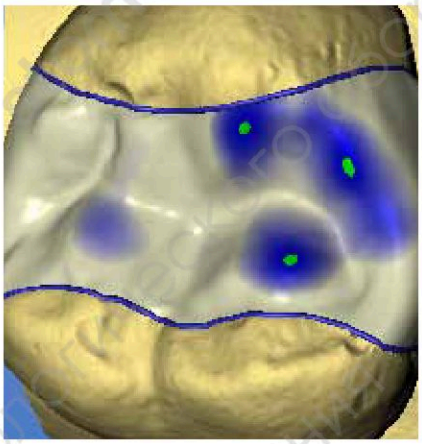


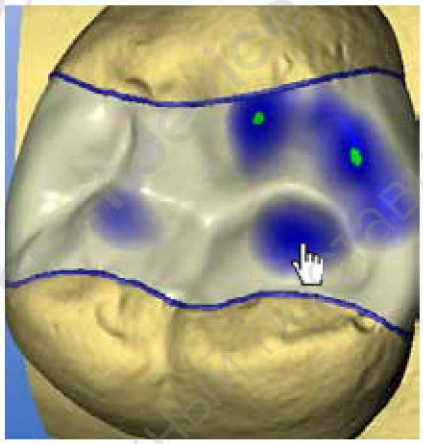




Then select the occlusal standard view and reduce the occlusal contact on the mesio-buccal cusp.





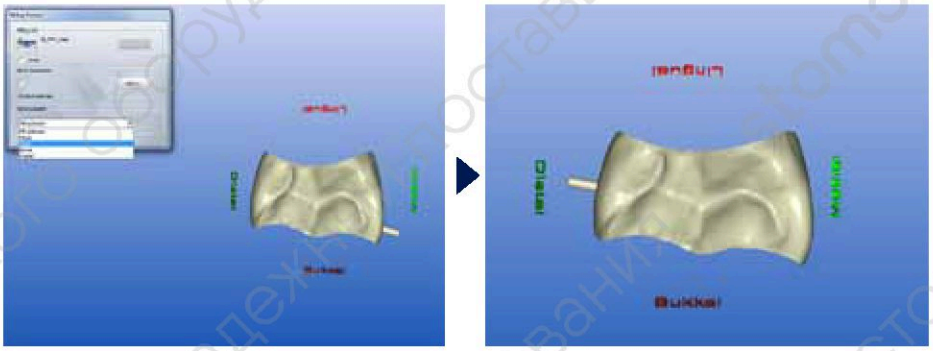


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8 **Milling preview**



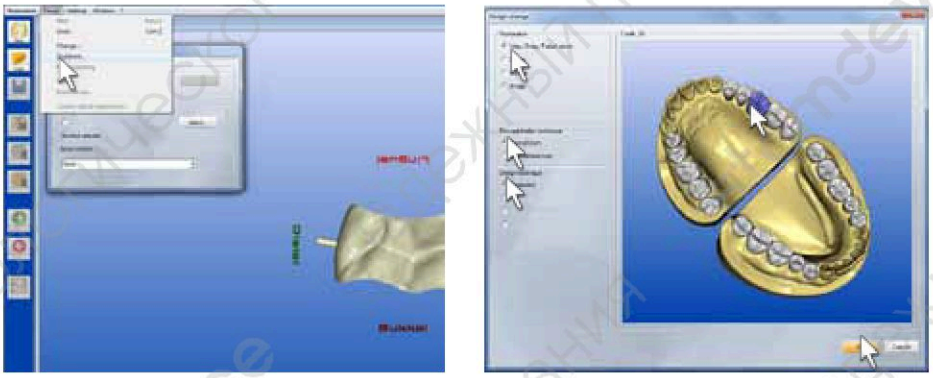
Check the minimum thickness of the ceramic in the “Milling preview” window. Then relocate the sprue to the distal side of the restoration, where there is no proximal contact.



9 **Selecting the “Quadrant” function**



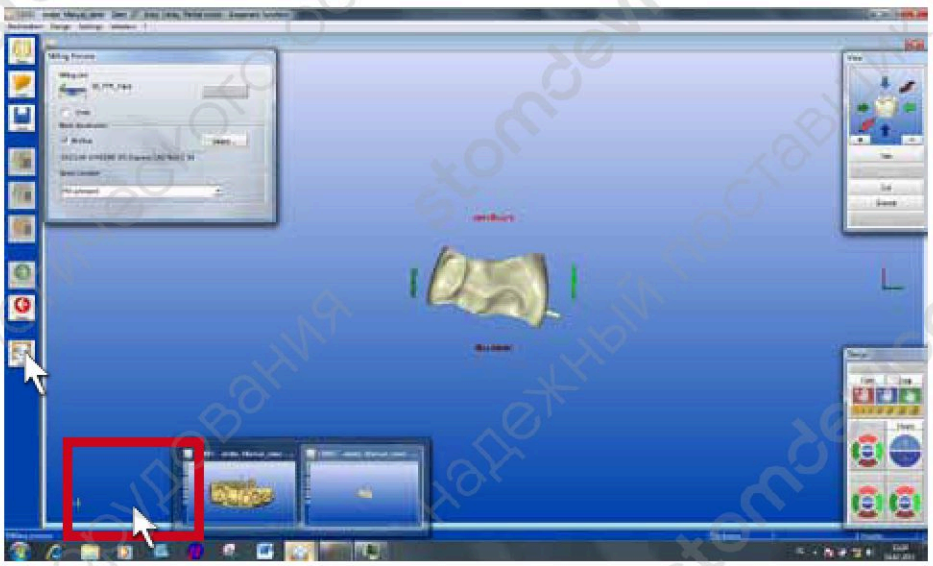
Open the “Design” window and then click “Quadrant”. In the new “Change design” window you can now select the second restoration in the quadrant. Select “Inlay, onlay, partial crown”, “Buccal scan” and “Biogeneric”, click tooth 26 partial crown preparation and confirm your selection by clicking “OK”.



10 **Milling**



Wait until a second CEREC 3D program is launched. There, the existing inlay design is already loaded and the milling process can be initiated. To return to the first CEREC 3D program click the corresponding icon in the Windows task bar.



Fixating the model

11

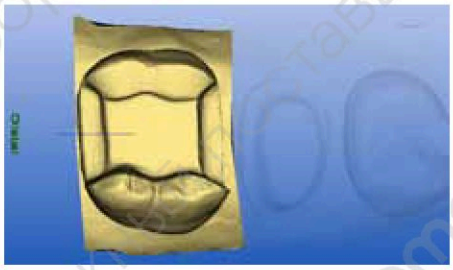
With the aid of the “Fix” function you can define the new centre of the 3D model. Select tooth 26 and then click “Fix” in the “Centre” window in the top left corner of the monitor.



The subsequent design steps follow the standard pattern for CEREC restorations:



Trimming the preparation

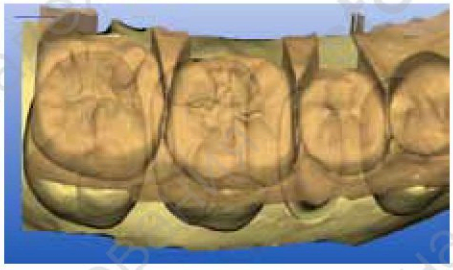


12



Trimming the antagonist

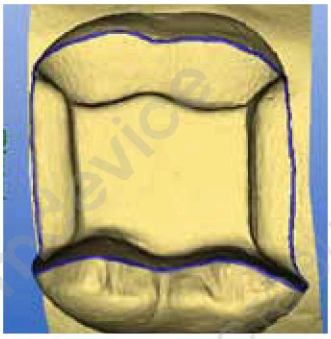
You can skip this step if you have already acquired a buccal registration.



13



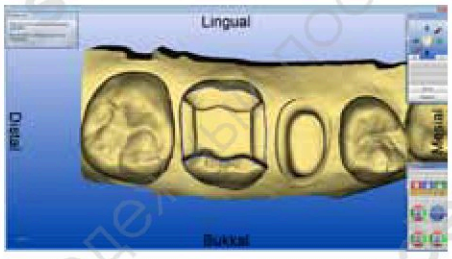
Entering the preparation margin



14



Defining the insertion axis

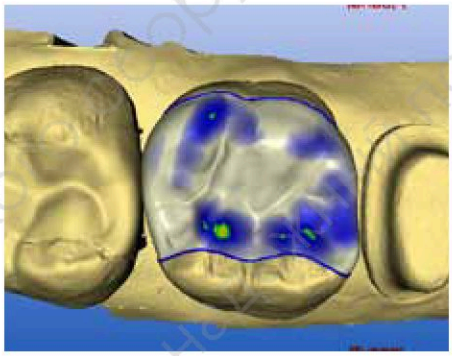


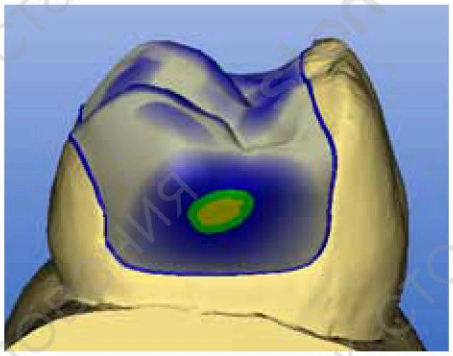
15

16 **Evaluating the restoration proposal**

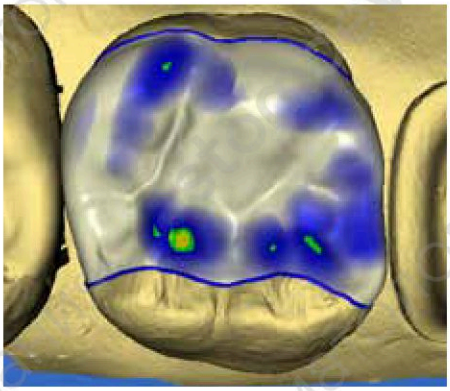


Evaluate the restoration proposal from various viewpoints. In this way you can obtain an overview of the necessary adjustments and then proceed systematically from cervical to occlusal. In our example the palatinal occlusal contacts are too weak, whereas the buccal occlusal contacts are too strong. The proximal contact has been well designed.

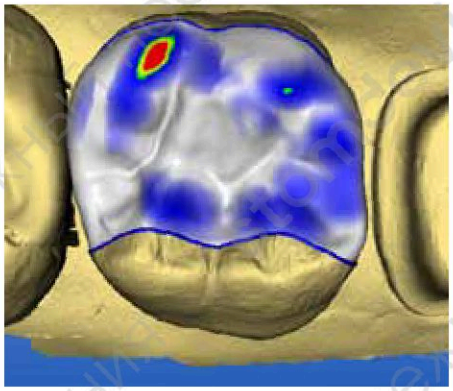




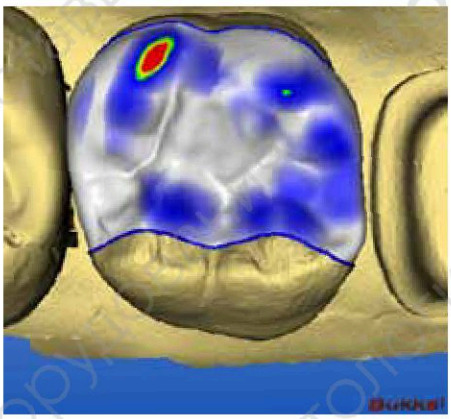
17 Begin by adjusting the occlusal contacts. Activate the “Rotate” tool and then click the dark red “Buccal” button. This moves the palatinal cusps in the occlusal direction and simultaneously lowers the buccal cusps towards cervical.



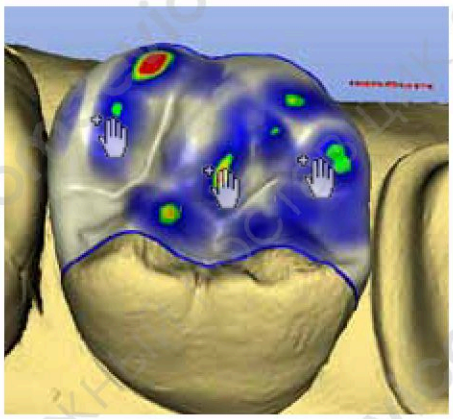




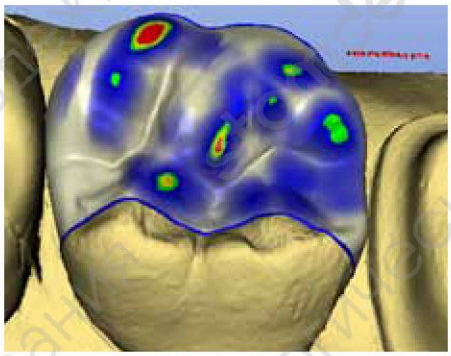
18 The next step is to build up the missing central occlusal contacts in the area of the mesial palatinal cusp. Activate the “Form +” tool and select a medium-sized working area. Add material in the area of the cusp slopes. In this case it is necessary to rotate the restoration so that you can view it from an occlusal-buccal perspective. The “Form +” tool operates in the direction of the monitor surface.



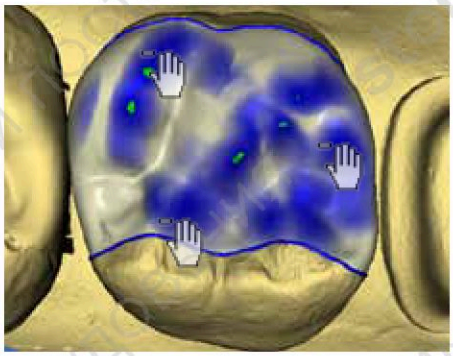




Now you can activate the “Form -” tool to fine-tune the contacts. In this case you should select the occlusal standard view.





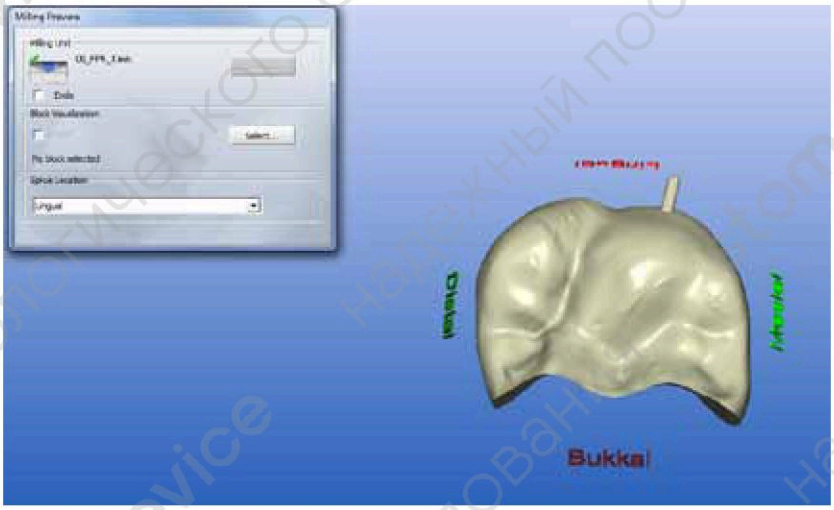


Milling preview

19

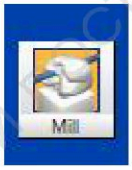


Relocate the sprue to the lingual side of the restoration. This will ensure that you receive optimum proximal contacts.



Milling

20

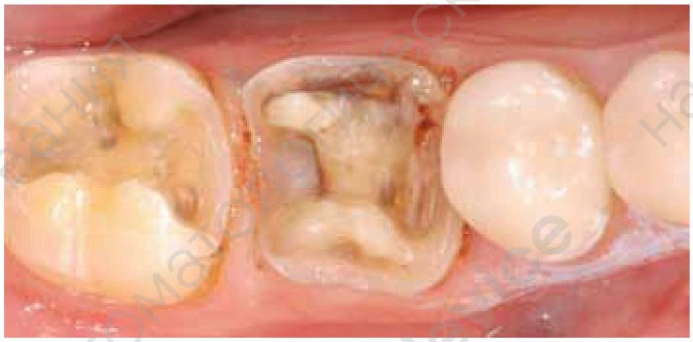


Start the milling process..

Case study



Initial situation:
As part of a bite elevation procedure CEREC onlays are to be placed on teeth 46 and 47. Teeth 44 and 45 had previously been restored using CEREC onlays at an earlier appointment..



A minimally invasive preparation technique was adopted. A classical crown preparation was unnecessary due to adhesive bonding. The amalgam fillings were removed and the tooth stumps adequately reduced. The inner edges were rounded.



The preparations were powdered and then acquired with the CEREC Bluecam. Following this, the opposing jaw and the patient's terminal bite occlusion were acquired.



The restorations were milled out of Empress CAD A3 blocks. This was followed by the try-in and the adjustment of the proximal contacts. Prior to adhesive bonding the restorations were glazed.



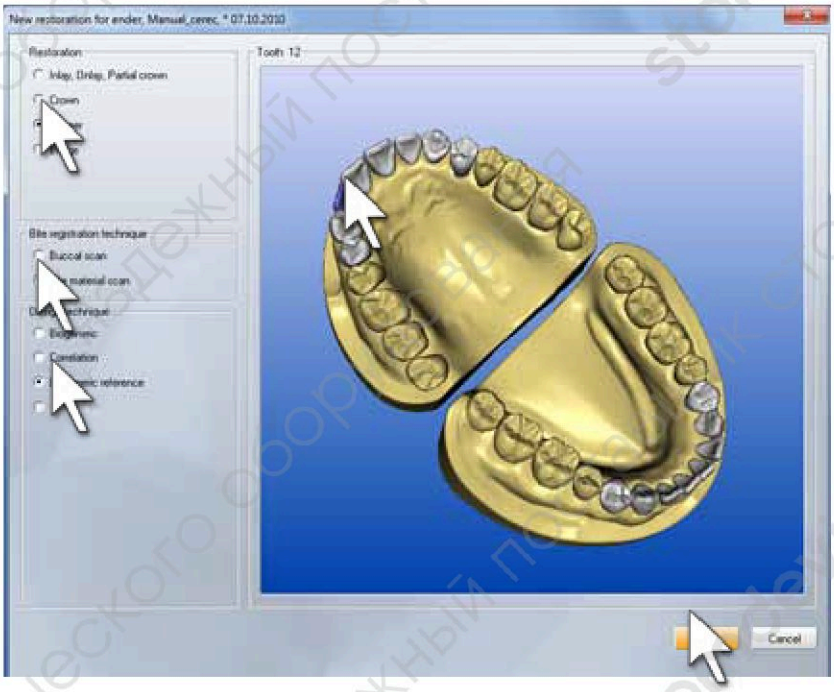
The restorations were bonded using Syntac Classic and Variolink Ultra.

6. Veneer design (biogeneric reference mode)

Like the “Correlation” design mode, “Biogeneric reference” relies on a reference tooth in order to optimize the morphology of the restoration. This design mode is ideally suited to contralateral teeth in the anterior area.

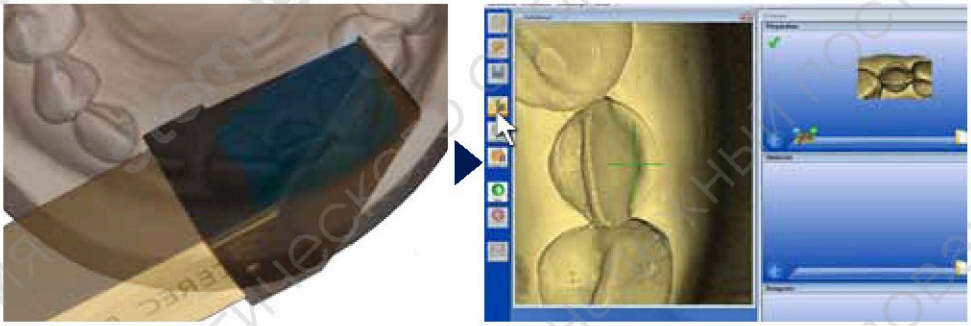
1 **Selecting the restoration type**

Select “Veneer”, “Bite material scan” and “Biogeneric reference” in the left-hand column. Select the tooth you want to restore in this case tooth 12 and then click the “OK” button. The cursor automatically jumps to the “Acquire preparation” icon.

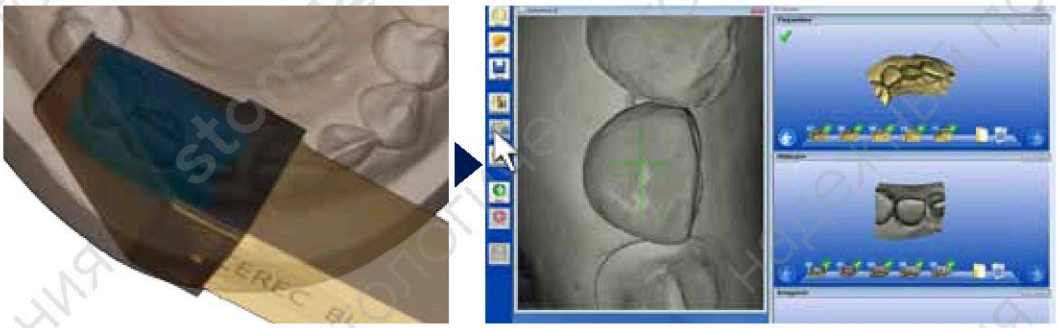


2 **Acquisition technique**

Acquire optical impressions of the preparation. Use angled and supplementary impressions in order to capture the entire outer contour of the preparation, as well as the neighboring teeth. When you capture the preparation you must point the CEREC Bluecam camera towards distal. When you cross the centreline turn the camera so that the tip once again points distally.



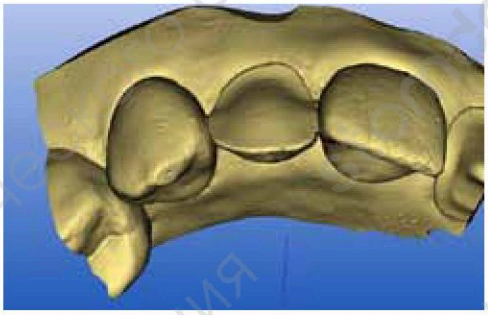
Following this, the reference tooth is captured in the "Acquire occlusion" image catalogue. In this case you should capture the contralateral tooth, which provides the optimum basis for designing the restoration. Acquire the entire outer contour with the aid of angled optical impressions. Make sure that the tip of the CEREC Bluecam camera is pointing distally.



3 **Trimming the 3D model**



In the case of this veneer preparation the proximal contacts are not captured.
For this reason the 3D model does not need to be trimmed.

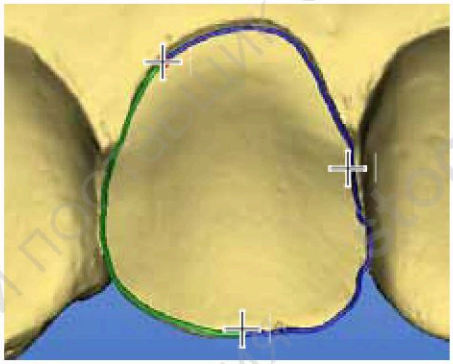


Entering the preparation margin

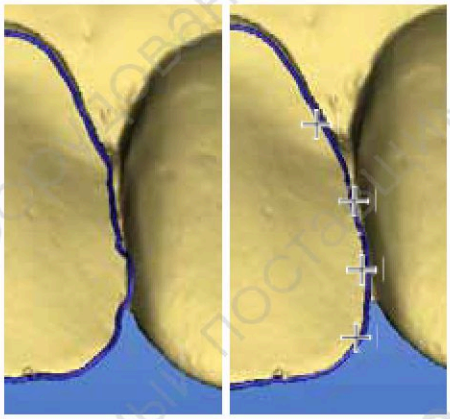
4



Begin with a double click with the left mouse on the preparation margin. Move the cursor along the preparation margin and fix the line with a single click after you have covered approximately one third of the total distance. Conclude the margin entry process with a double click of the left mouse at the starting point the red dot.



The preparation margin in the area of the mesial proximal contact is manually corrected.



Defining the insertion axis

5



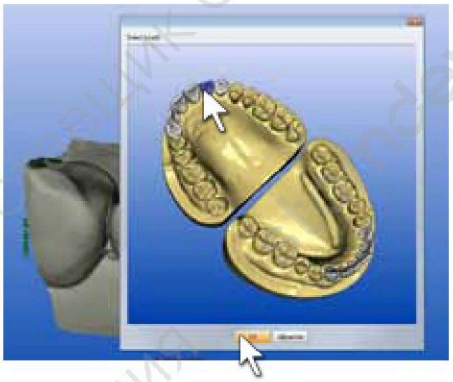
You can now define the insertion axis. Here you must pay close attention to the directional designations “labial” and “lingual”. A misalignment can lead to distorted restoration proposals.



6 **Selecting the reference tooth**



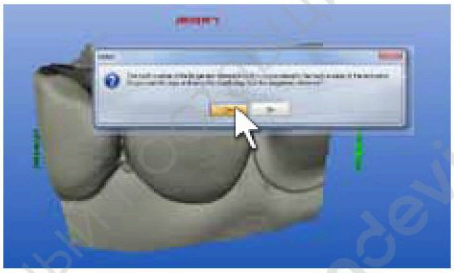
In the next window the tooth model including the reference tooth is displayed together with the odontogram to the reference tooth. In this case select tooth 22 and then click "OK".



7 **Activating the "Contralateral mode"**



The contralateral tooth provides a very accurate basis for the adaptation of the restoration being a mirror image of the original morphology. To activate the contralateral design mode click the "YES" button. The morphology of the reference tooth is then transferred identically to the new restoration.

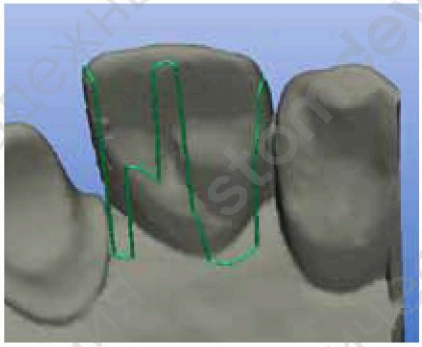


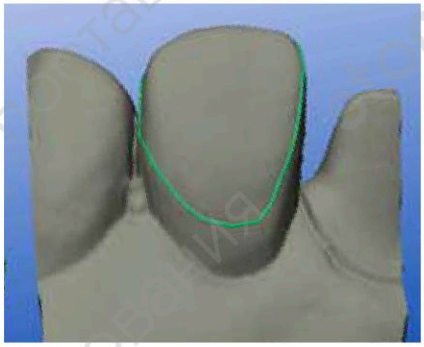
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Selecting the reference tooth

8

The grey model shows the optical impression of the reference tooth. Double-click the incisal edge of tooth 22. The CEREC 3-D software analyzes the tooth and proposes a copy line. The area within the copy line can then be transferred identically to the new restoration.

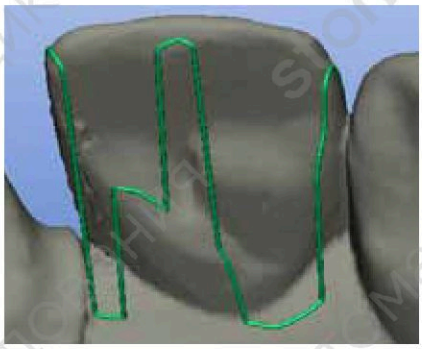
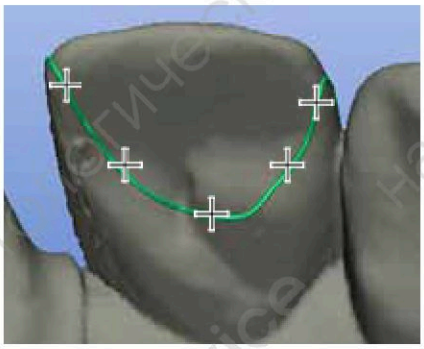
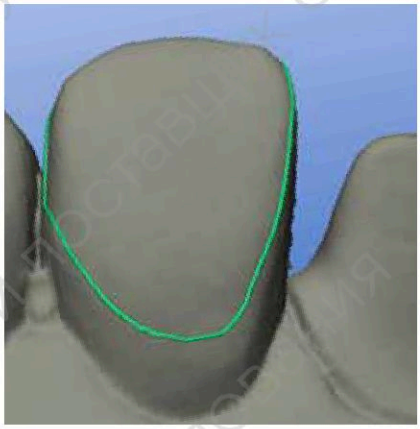
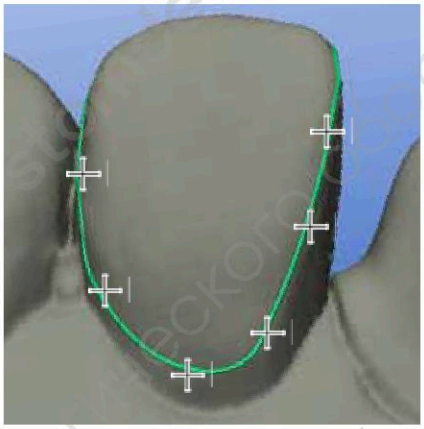




Editing the copy line

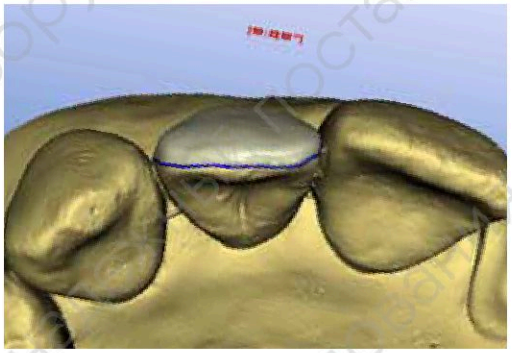
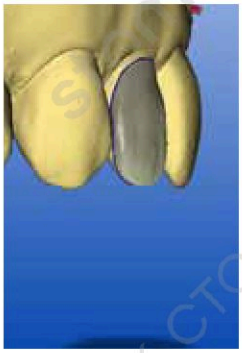
9

From the buccal and palatinal viewpoint you can now edit the copying line. Extend the copying line in such a way that the largest possible area is transferred to the restoration. For this reason angled optical impressions are very important when capturing the reference tooth.

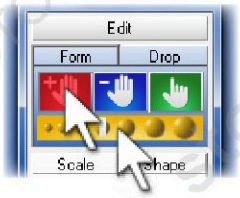





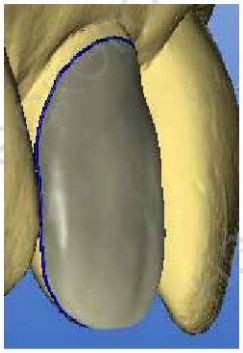
10 **Evaluating the restoration proposal**

Evaluate the restoration proposal from various viewpoints. In this case only minimal adjustments to the mesio-labial contour are necessary. Thanks to the large copy area, the incisal edge and the morphology of the veneer have been optimally computed.

Use the “Form +” tool to adjust the mesio-labial contour. Rotate the 3D model in such a way that you can view it from the mesio-labial perspective (material is applied in the direction of the monitor surface). Adjust the size of the “Form +” tool and then add material to the mesial area. Check the changes from the distal viewpoint.



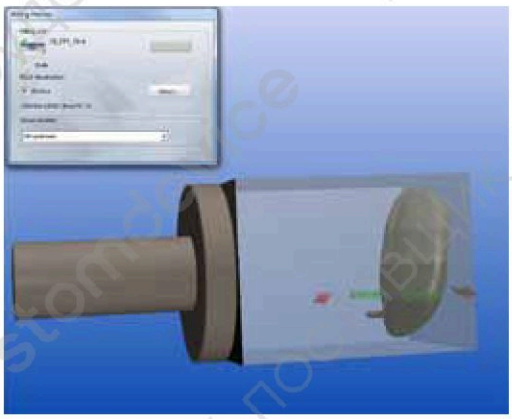





11 **Milling preview**



Select a multilayered polychromatic block in the milling preview. If necessary, the position of the restoration can be changed using the “Position/Rotate” tool.



12 **Milling**



Start the milling process. Select the same ceramic block as defined in the “Block visualization” menu.

Case study



Initial situation:
Teeth 11 and 12 had previously received root canal treatment following an accident. In addition, tooth 11 had a discolored composite filling. The patient requested an aesthetic correction. As a preparatory step teeth 11 and 12 were internally bleached.



Tooth 21 was used as the reference for the veneer restoration. Prior to the preparation the reference tooth was captured using the CEREC Bluecam.



A minimally invasive preparation technique was used for tooth 11. Approximately 0.5 mm of tissue was removed buccally. The composite filling was completely removed.



Wherever possible, anterior restorations should be characterized and glazed. The restoration was milled out of an Empress CAD Multi A3 ceramic block, stained and then glazed in the ceramic furnace.

The veneer was bonded to the tooth using Syntac Classic and Filtek A3B composite.

The finished restoration blends in harmoniously with the existing upper anterior tooth row.

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7. Temporary bridge

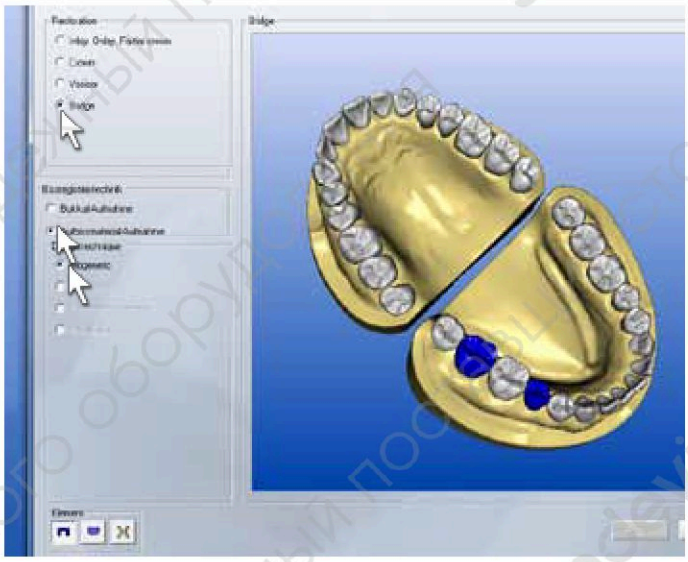
Temporary bridge (biogeneric, buccal scan)

Modern polymers provide the basis for the computer aided design and manufacture of long-term temporary restorations for crowns and bridges. Compared with conventional self-curing materials, modern polymers offer superior mechanical properties and are easy to machine and polish.

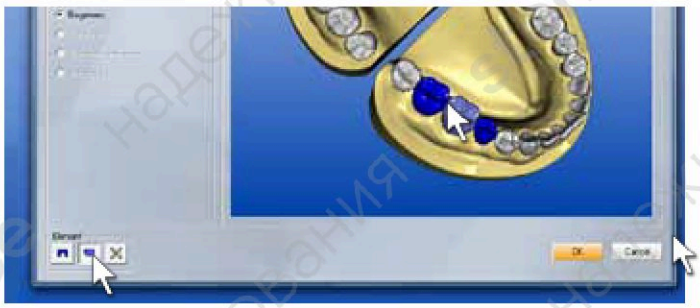
1

Selecting the restoration type

Select “Bridge”, “Buccal scan” and “Biogeneric” in the left-hand column of the “New” dialogue. In this example teeth 45 and 47 are selected as the copings for the planned bridge restoration.



Switch to the “Element” menu, select “Pontic” and then click tooth 46. Confirm your selection with “OK”.



2

Acquisition technique

Capture the preparation by means of angled and supplementary impressions. It is important to obtain an impression of the bridge pontic. In this case portions of both coping preparations must be visible. The impressions of the preparation should extend as far as the canine. The antagonists should also be acquired by means of angled and supplementary impressions, likewise extending as far as the canine. An impression of the patient’s terminal bite occlusion should be acquired in the area of the first premolar. For clinical reasons it is advis able to acquire the patient‘s terminal bite occlusion before the entire support zone is removed.

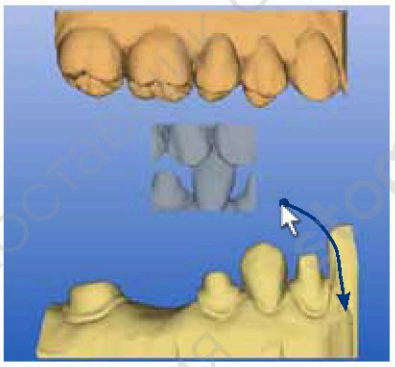


Assigning preparation and antagonist models

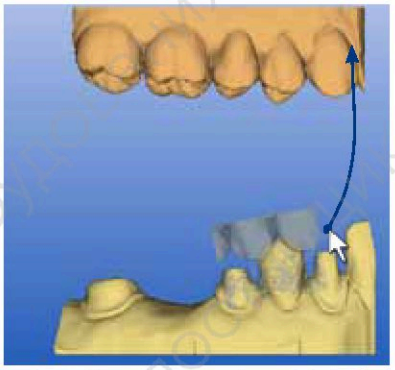
3



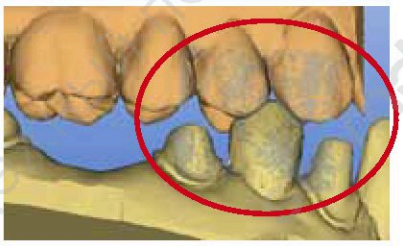
The preparation and the antagonist are assigned to each other by means of the buccal scan impression.



Drag the buccal impression onto the preparation model. Then drag the buccal impression together with the preparation model onto the corresponding tooth surfaces of the antagonist model.



The CEREC 3D software assigns the models automatically on the basis of the buccal impression.



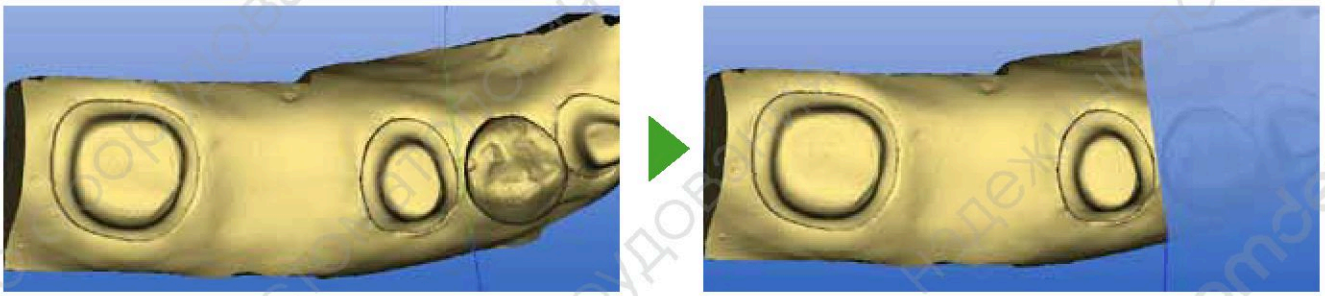
Click the “Contacts” button to display the occlusal contacts on the 3D model. In the event of significant deviations from the clinical situation you should check the optical impressions and repeat them if necessary. The “Settling” function should not be used.

Trimming the 3D model

4



Rotate the 3D model in such a way that you can optimally guide the trimming line through the proximal area. Begin the trim line with a double click with the left mouse. Insert the line between tooth 44 and 45. Single click the line with the left mouse whenever you want to change direction. To complete this process double-click the left mouse.



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5 **Trimming the antagonist**



By buccal scan the antagonist does not have to be trimmed.



6 **Entering the preparation margin**



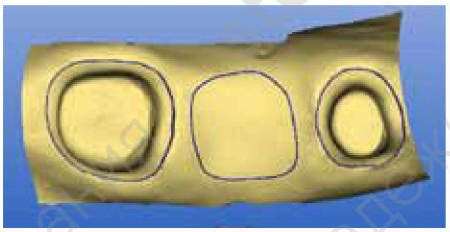
Always begin by entering the preparation margin on the distal coping.



Then enter the baseline of the pontic. This line determines the size of the gingival contact surface. It should correspond to the cross section of the root.



Finally, mark the preparation margin of the mesial coping.



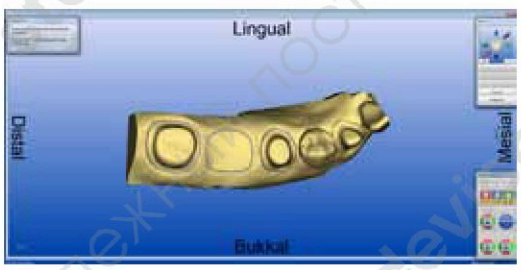
Manual adjustments to these lines can be made only after completion of all margins.



7 **Defining the insertion axis**



Now check the insertion axis. In the case of bridge restorations it is especially important that the preparations are aligned horizontally on the monitor.



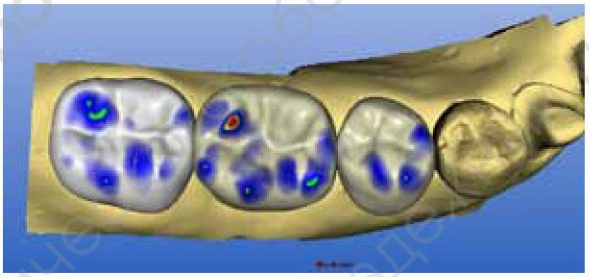
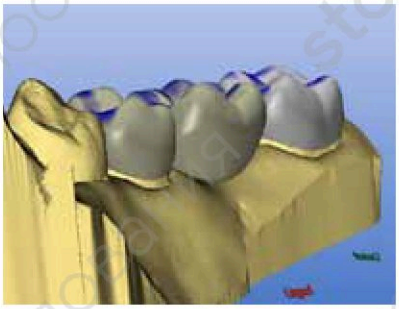
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Evaluating the restoration proposal

8



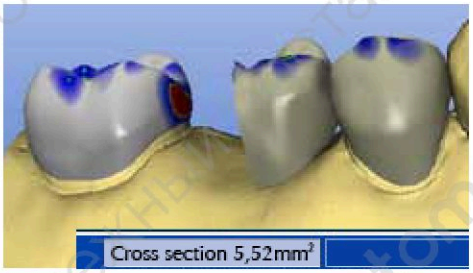
The evaluation of the restoration proposal reveals that the pontic is slightly too narrow in the bucco-oral area. The buccal contour of the mesial abutment is too protuberant. The occlusal contacts on the lingual cusps have to be reduced. It is also very important to check and adjust the connector cross-sections between the bridge units.

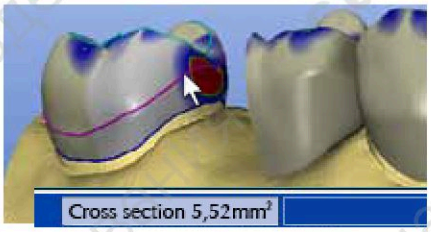
Adjusting the connector cross sections

9

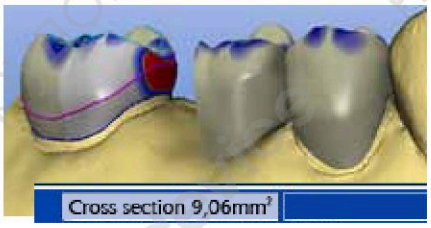
Click “Contact”. The mesial connector cross-section is displayed. It corresponds to the contact surface between the copings and the pontic. In the case of three unit bridges in the molar area the connector cross section should be 9 mm². In our example the contact needs to be reinforced.

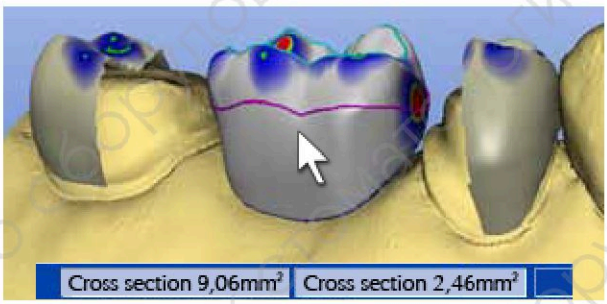
Activate the “Scale” tool and press the spacebar once in order to activate the circular segments. Then click the mesial equator line.

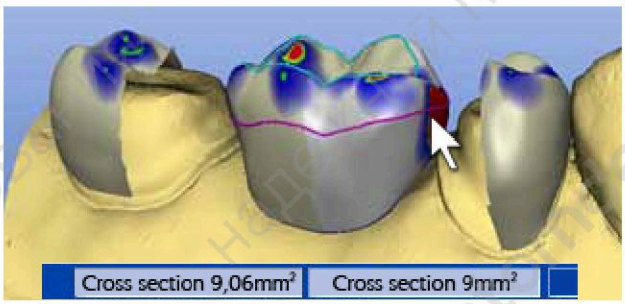



To reinforce the proximal contact click the mesial button of the “Scale” tool several times. This connector cross section is now 9.06 mm².

Double-click the pontic to adjust the mesial connector. The mesial pontic is now shown in white and can be adjusted. The mesial and distal copings cannot now be modified. Use the “Scale” tool to increase the mesial connector to 9 mm².

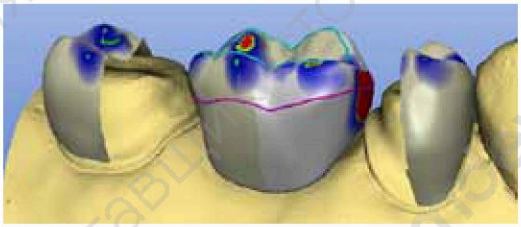




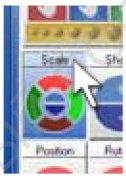
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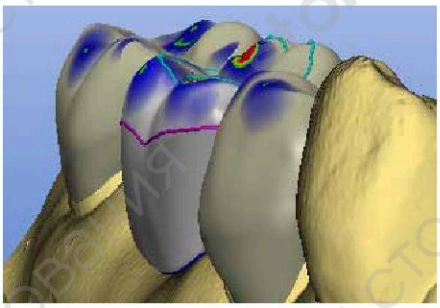
10 **Adjusting the outer contours**

Deactivate “Contact” and rotate the model to the mesial view.

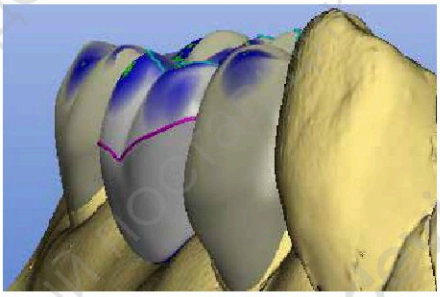


Click the buccal equator line in order to activate the buccal restoration segment.

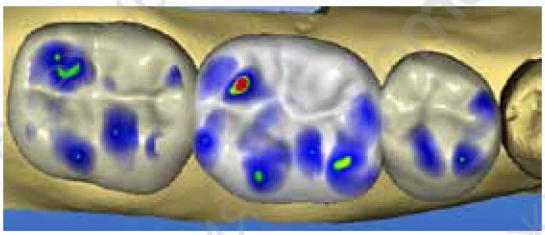




Click the light red buccal button of the “Scale” tool several times in quick succession and then click the dark blue “Cervical” button. This moves the tooth equator towards buccal and cervical.

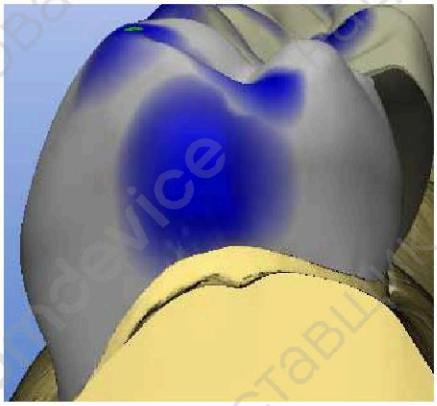


In the occlusal standard view you can now see that the size of the pontic has been optimally adjusted.

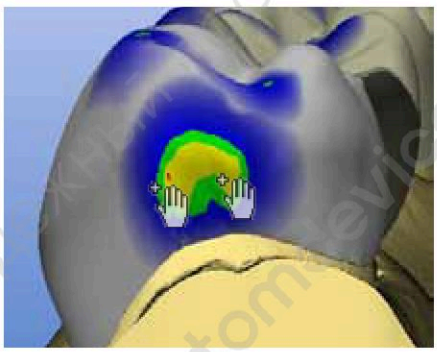


11 **Adjusting the proximal contacts**

Double-click the mesial abutment, activate “Contact” and rotate the model so that you can view it from the standard mesial perspective.



With the aid of the “Form +” tool you can add material in order to create the proximal contact. The proximal contact should appear as a yellow surface.

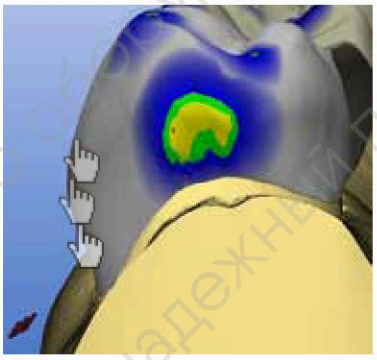


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Adjusting the outer contour

12

While maintaining the same perspective, you can smooth the buccal contour of the mesial abutment with the aid of the “Smooth” tool in the event that the contour is too protuberant.

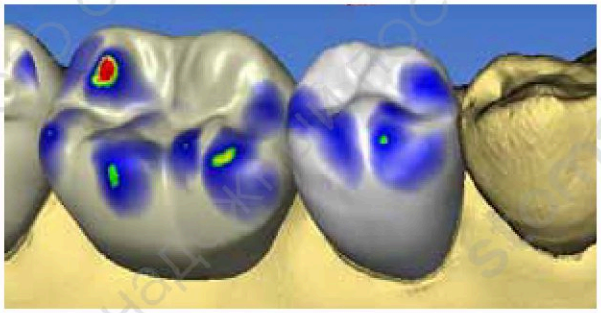




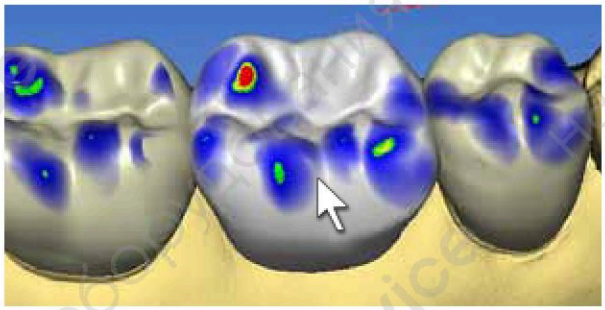
Adjusting the occlusal contacts

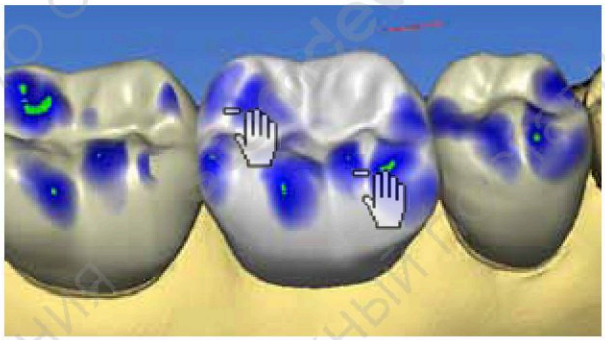
13

You can now adjust the occlusal contacts. Please note that only the bridge unit which is highlighted in white can be adjusted at any one time. From an occlusal-buccal viewpoint, you can see in our example that the mesial coping does not need any adjustment.



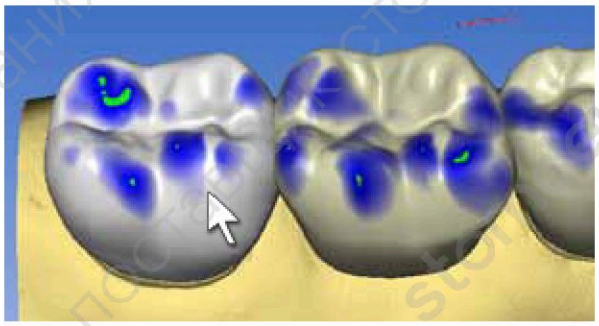
Double-click the pontic and completely remove the disto-lingual occlusal contact with the aid of the “Form -” tool

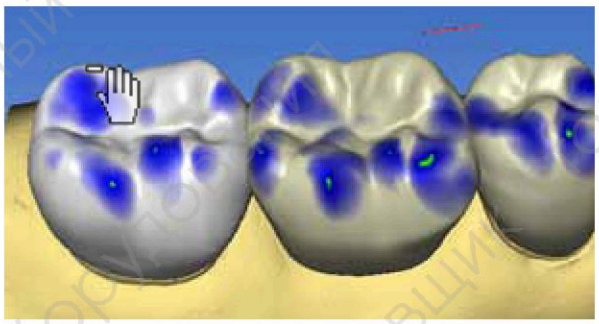




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Double-click the distal coping and eliminate the disto-lingual occlusal contact with the aid of the “Form -” tool.





14 Milling preview



Activate the milling preview and once again check the minimum thickness of the restoration (fissure > 1.5 mm).

Relocate the sprue to the distal side of the restoration.

If required, a multi-layered block (CAD-Temp, VITA Zahnfabrik) can be selected. You can use the “Position/Rotate” tool to position the restoration within the block.





15 Milling



To start the milling process click the “Mill“ icon in the left-hand icon bar. Select the same polymer block as defined in the “Block visualization” menu.

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Case study



Initial situation:
A zirconium oxide bridge on teeth 13 to 15 had to be replaced due to a large-sized veneer fracture on tooth 13.

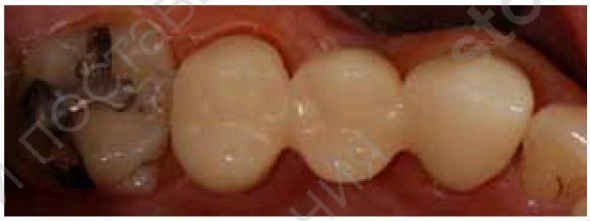




Following the removal of the old bridge restoration, all cement residues were removed and the preparation finalized.



The bridge was milled out of VITA CAD-Temp 2M2C. Following the milling process it was highly polished with the aid of a polishing motor. The milling time was approximately 20 minutes.



Finally, the bridge was provisionally cemented using TempBond NE.



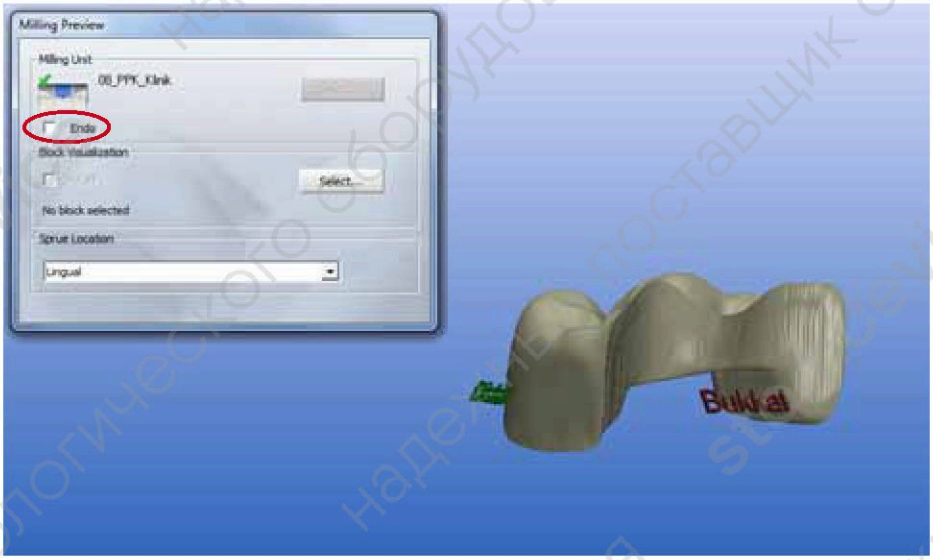
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V. Milling

Milling is performed with either the CEREC MC XL or CEREC 3 milling unit. Industrially produced all-ceramic blocks available from various manufacturers are milled. These blocks come in various shades and sizes (see “Chairside materials”). The restoration is simulated in the milling preview. It is important to carry out a final check of the minimum material thickness before you start the milling process.

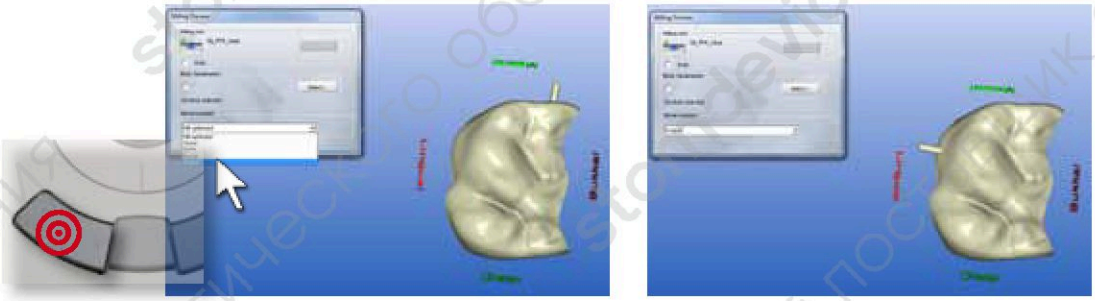
Milling preview

The milling preview indicates the currently selected milling unit. The “Endo” checkbox denotes a special milling mode which is reserved exclusively for veneers and endo crown preparations. This milling mode must be deactivated for all other preparation types.



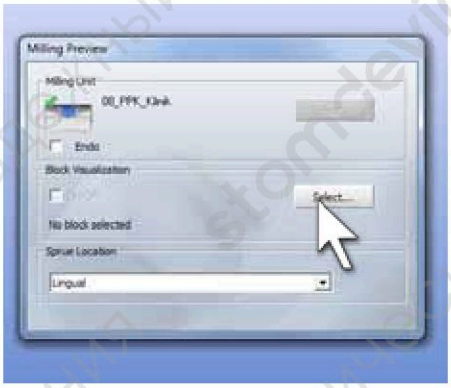
Sprue location

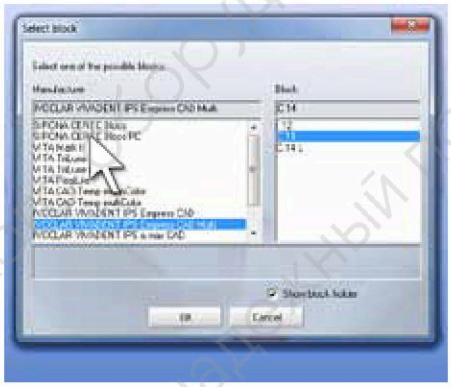
Wherever possible the sprue should be located on an outer surface where there is no proximal contact. This facilitates the easy proximal adjustment of the restoration following the milling process. The sprue can be repositioned via the “Sprue location” menu.

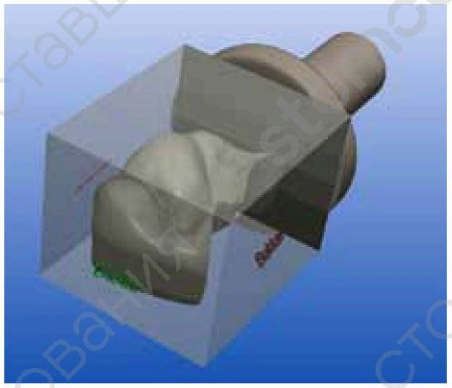


Multicoloured blocks

The position of the restoration within the ceramic block is simulated via the “Block visualization” menu. This enables you to adjust the position of the restoration within layered multicoloured blocks.





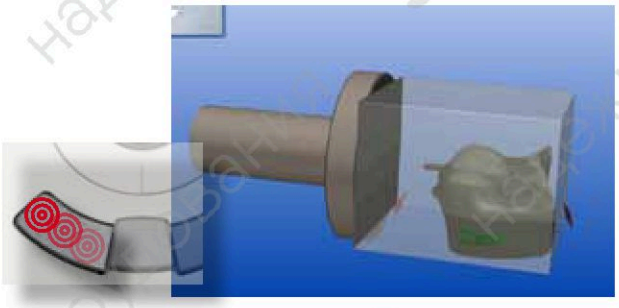


With the aid of the blue buttons in the “Position” tool you can move the restoration upwards (= higher proportion of enamel) or downwards (= higher proportion of dentine) within the block.

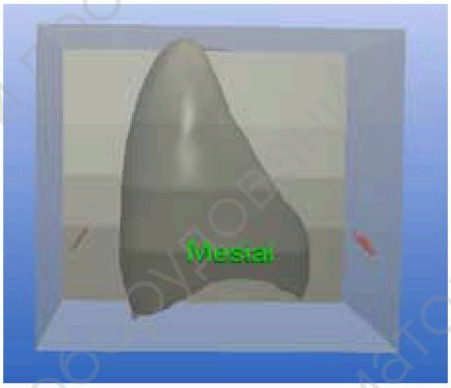








In the case of anterior restorations you can also rotate the block. This enables you to position the restoration at an angle relative to the multicoloured layers and hence achieve a smoother shade transition.



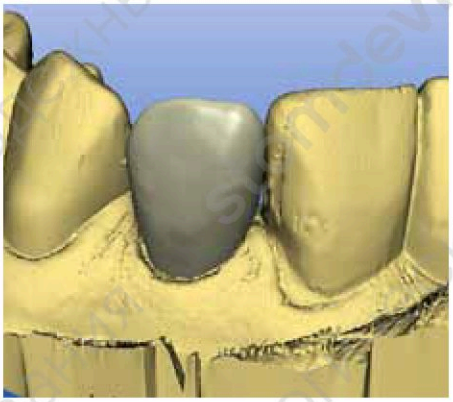
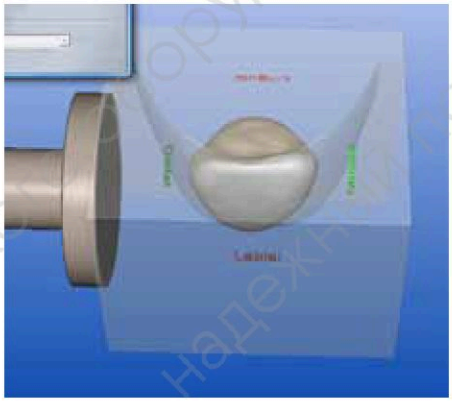
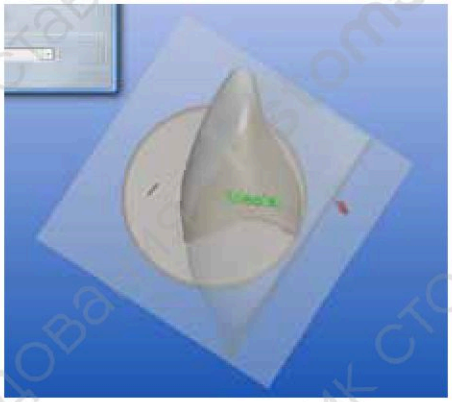




Attention:
The rotation function is available only in connection with the CEREC MC XL milling unit.

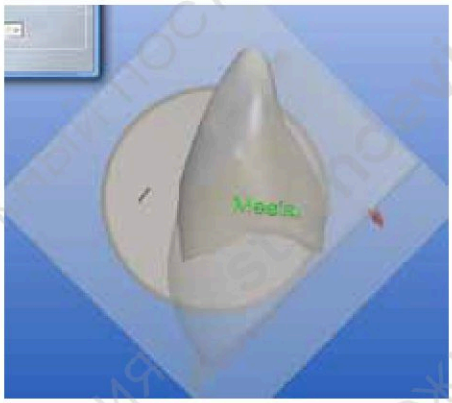
Milling VITA RealLife blocks

The VITA RealLife blocks have been specially designed for anterior crowns. Consisting of a curved dentine core surrounded by an enamel coating, the block structure accurately imitates the shade transitions of a natural tooth.

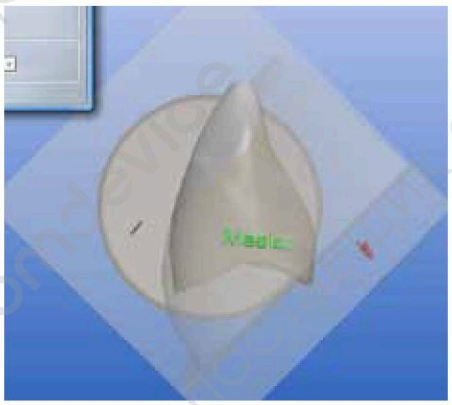
Via the light red “Lingual” button of the “Rotate” tool the cervical area of the crown can be rotated and hence repositioned within the dentine core. This enhances the colour intensity of the crown.





With the aid of the dark blue “Cervical” button of the “Position” tool the crown can be repositioned cervically within the dentine core. In this way the dentine portion of the incisal edge is enhanced from palatinal.

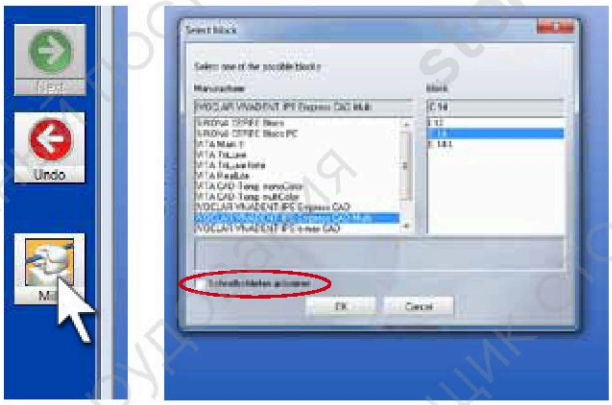




The position of the crown within the block depends largely on the specific clinical situation and requires a certain amount of experience on the part of the dentist. A detailed description of a clinical case is available as a PDF document on the Vita Zahnfabrik website.

Attention:
VITA RealLife blocks can be milled only on the CEREC MC XL.

When you click the “Mill” icon the block selection dialogue box is displayed. Here you have the option of selecting a multicoloured block. Otherwise select the smallest shown block size. The “Fast” milling mode reduces milling times by approximately 40%. However, the surface of the finished restoration is rougher and therefore requires additional subsequent finishing.



Insert the block type you have selected in the milling preview into the CEREC milling unit. Ensure that the block is correctly aligned and then press the “Start” button of the milling unit.

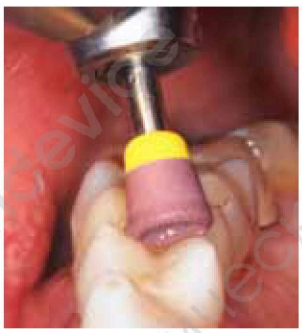
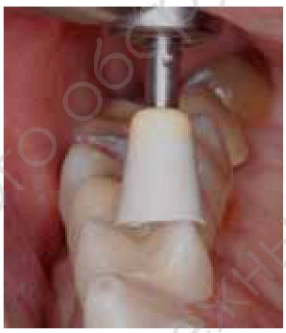
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VI. Finishing

All-ceramic restorations can be finished by means of high-gloss polishing or glazing in a ceramic furnace. Each of these procedures is equally valid, based on the scientific investigations in relation to material quality. They deliver convincing results and are comparable in terms of time input. Polishing is the preferred procedure for posterior restorations; it is highly effective and does not require any additional equipment. It is recommended that anterior restorations are characterized with the aid of shading products and then glazed. The lithium disilicate ceramic e.max CAD (Ivoclar) can be simultaneously glazed and crystallized.

1. High-gloss polishing:

Chairside CAD/CAM ceramics are industrially manufactured and – compared with layered labside ceramics – have virtually no pores. As a result a high gloss finish can be achieved with the aid of a suitable ceramic polishing instrument. The proximal surfaces should be polished **before** the restoration is adhesively bonded. After bonding has been completed these areas are no longer accessible. The outer surfaces and the occlusal surfaces can be polished **after** adhesive bonding has been performed. Rubber polishing attachments can be deployed very precisely on small restorations.


Sof-Lex discs can be deployed very effectively on large-sized partial crowns and full crowns. Brushes (e.g. Occlubrush) and diamond polishing paste should be used in order to achieve a high-gloss finish.






2. Glazing:

A ceramic glaze is applied to the restoration and then fired in a high-temperature furnace. Prior to glazing it is important to check the fit of the restoration and adapt the surfaces accordingly. To avoid bubble formation the glaze should be applied thinly.






VII. Adhesive bonding

Chairside CAD/CAM materials belong to the category of glass ceramics. In the absence of additional support they are incapable of cushioning chewing forces and therefore have to be firmly connected to the tooth tissue as is the case with tooth enamel. Only in this way can the chewing forces be dissipated without destroying the ceramic material. Adhesive bonding significantly increases the maximum fracture load. The ceramic material is thus able to withstand normal chewing forces. The interplay between the adhesive system applied to the tooth, the luting composite and the pretreatment of the restoration is a decisive factor for long-term survival of the restoration.

The procedure described here involving Syntac Classic and Variolink Ultra/Tetric Classic has been in use for many years at Zurich University. Further information can be found in the book "All-Ceramics at a Glance" (AG-Keramik, 2010). Key factors are the proper use of the materials; strict adherence to the prescribed application times of the adhesive components and the complete isolation of the preparation site from moisture using rubber dam. In difficult situations the rubber dam can even be glued.











Adhesive bonding step by step

1. Pretreatment of the ceramic

1. Etch the inner surfaces of the restoration with 5 – 9% hydrofluoric acid (60 seconds)
2. Rinse off the hydrofluoric acid (60 seconds)
3. Dry off the etched surface
4. Apply Monobond S/Monobond Plus (60 second)
5. Dry the surface with an air blower
6. Apply Heliobond air-blow immediately to create a thin film
7. Keep the restoration away from light



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2. Pre-treatment of the tooth




The tooth enamel is etched for 30 seconds with 37 % phosphoric acid. The dentine surface is etched for 15 seconds (total etch).



The etching gel is rinsed off for 30 seconds. The etched pattern on the enamel is then checked.




Syntac primer is applied to the dentine for 15 seconds and then air-blown to create a thin film, which must remain motionless in the air stream.






Syntac adhesive is applied for 10 seconds and then air-blown to create a thin layer.





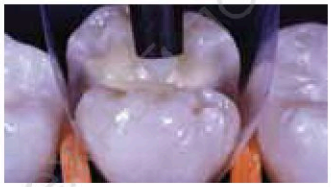

Heliobond is then applied to the enamel and dentine and carefully air-blown to create a thin coating.





Then the Heliobond coating is light-cured for 40 seconds (optional).

3. Placing the restoration



The luting composite is applied to the cavity.



With the aid of a ball-tipped instrument and a spatula the composite is moulded to the cavity walls and base.



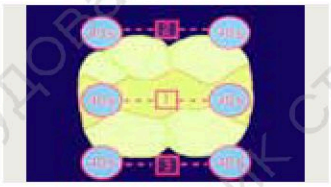
The restoration is inserted into the cavity with a diamond-tipped pinzette.



Thanks to its thixotropic properties, the composite is liquefied when an ultrasound handpiece is applied. This means that the restoration can be placed effortlessly into its final position.



The composite residues are removed with the aid of a probe. If wedges and band matrices have not been used, the proximal residues can be removed with dental floss.



This is followed by light-curing the luting composite for 6 x 40 seconds.

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4. Adhesive bonding at a glance

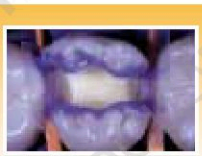
Adhesive bonding of CEREC inlays using a fine-hybrid composite “high viscosity cementation”



Cavity



Enamel etching gel
Selective etching of the enamel



Apply for 30 seconds.
Spray-rinse for 40 seconds.
Dry



Syntac Primer
Enamel and dentine



Apply for 15 seconds.
Air-blow



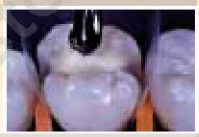
Syntac Adhesive
Enamel and dentine



Apply for 10 seconds.
Air-blow



Heliobond
Enamel and dentine



Air-blow to create a thin layer

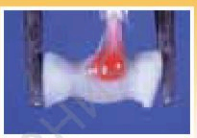
Light curing (6x)



Restoration



IPS Ceramic Etch



Apply for 60 seconds.
Spray-rinse for 40 seconds.
Dry



Monobond-S



Apply for 60 seconds.
Air-blow



Heliobond



Apply.
Air-blow

Keep away from light



Tetric Classic Cavifil





Apply to cavity walls and base

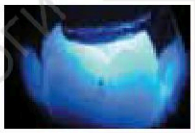
Insert





“High viscosity” ultrasound (Siroson handpiece)
Removal of residues

Light cure





Cure occlusally and proximally for 40 seconds each

Polish with a flexible disc







High-gloss polishing with a diamond paste and Occlubrush

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VIII. Materials

1. Chairside materials

Various materials are available for chairside applications. Feldspar and leucite glass ceramics are suitable for inlays, partial crowns, crowns and veneers.

Feldspar ceramics and leucite-reinforced glass ceramics

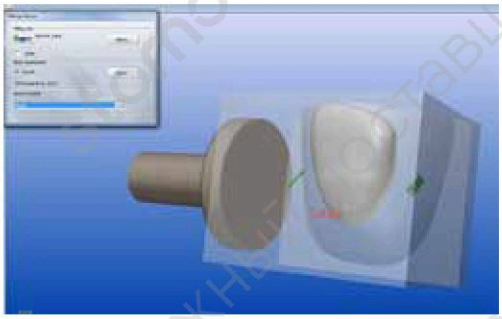
Feldspar ceramics e.g. CEREC Blocs (Sirona), Trilux (VITA Zahnfabrik) and leucite-reinforced glass ceramics e.g. Ivoclar Empress CAD are ideal materials for chairside applications with the CEREC system. These materials possess outstanding enamel-like abrasion properties and are easy to polish. They are available in a wide variety of shades and translucencies. In addition, various multicoloured blocks are available for crowns and partial crowns which simulate the gradual dentine-enamel shading transition of a natural tooth. This allows lifelike restorations to be created without the need for additional staining. Due to their high degree of translucency, ceramic restorations display a pronounced "chameleon" effect – i.e. they adapt themselves to the neighboring teeth.



VITABLOCS RealLife have been specially developed for highly aesthetic anterior restorations. The innovative block structure imitates the natural curvature of the dentine core and the enamel coating between the cervix and the incisal edge.



The CEREC software automatically positions the restoration at the enamel-dentine transition of the block and hence speeds up the design process. The restoration can be freely positioned in all three dimensions. This increases the design options open to the dentist. In addition, the angle of the restoration within the block can be freely defined.



Lithium disilicate ceramics

Lithium disilicate ceramics (e.g. Ivoclar e.max CAD) are reinforced ceramics. The restoration is milled out of the blue, semi-sintered block. It is then crystallized for ca. 30 minutes in a furnace (e.g. Programat CS) and only then attains its final physical properties. Lithium disilicate restorations achieve a high degree of flexural strength (360 MPa) and are therefore suitable for adhesive bonding (e.g. using RelyX Unicem) or conventional bonding. In addition, they display outstanding aesthetic properties in terms of shading, translucency and brightness.



Polymer materials

Various polymer blocks e.g. Vita CadTemp, Ivoclar TelioCAD, Merz artBloc Temp are available for the chairside fabrication of temporary crowns and bridges.





2. Labside materials

Oxide ceramics

Additionally, the CEREC system is also capable of machining high-strength aluminium oxide and zirconium oxide ceramics – e.g. Sirona inCoris AL and Sirona inCoris ZI. As a rule this process is performed in the dental laboratory using the inLab system. This provides the basis for fabricating customized abutments, as well as copings and bridge frameworks from zirconium dioxide for individual veneering. Sirona's infiniDent production centre caters for an extended spectrum of materials – e.g. non-precious metals and titanium.





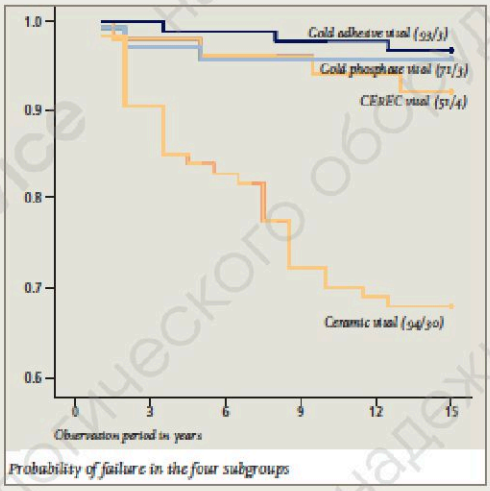
IX. Clinical studies

The CEREC procedure is one of the most closely scrutinized dental treatment methods. The studies listed below are representative of the large number of scientific investigations relating to the CEREC CAD/CAM system.

1. Clinical survival rates

The longevity of CEREC restorations in comparison with labside equivalents has been the subject of numerous scientific investigations. The results show that all-ceramic chairside restorations fabricated on the CEREC system are at least fully comparable with lab-produced ceramic restorations:

Arnetzl G, Different Ceramic Technologies in a Clinical Longterm Comparison. In Mörmann WH (ed.) State of the Art of CAD/CAM Restorations, 20 Years of CEREC, Berlin: Quintessence, 2006: 65–72



Probability of failure in the four subgroups

Long-term clinical evaluation of posterior restorations and reasons for failure:

The authors reviewed the scientific literature over a period of ten years and calculated the annual failure rates of various materials used for Class I and II cavities.
The main reasons for failure were as follows: secondary caries, fractures, inaccuracy of fit, wear, and post-operative hypersensitivity.

Hickel, R.; Manhart, J.
Title: Longevity of restorations in posterior teeth and reasons for failure.
Source: J-Adhes-Dent. 2001 Spring; 3(1): 45–64
ISSN: 1461-5185
Accession No.: 11317384

Long-term evaluation of 2,328 chairside CEREC inlays and onlays

A group of 794 patients in a dental practice received a total of 2,328 CEREC inlays and onlays. On the basis of a Kaplan-Meier analysis the expected success rate was 95.5% after nine years. Thirty-five restorations were rated as failures. The most common reasons for failure were subsequent tooth extractions. There was no correlation between failure, restoration size, topography or vitality. Forty-four selectively examined restorations revealed an average adhesive gap of 263 µm.

Summary:

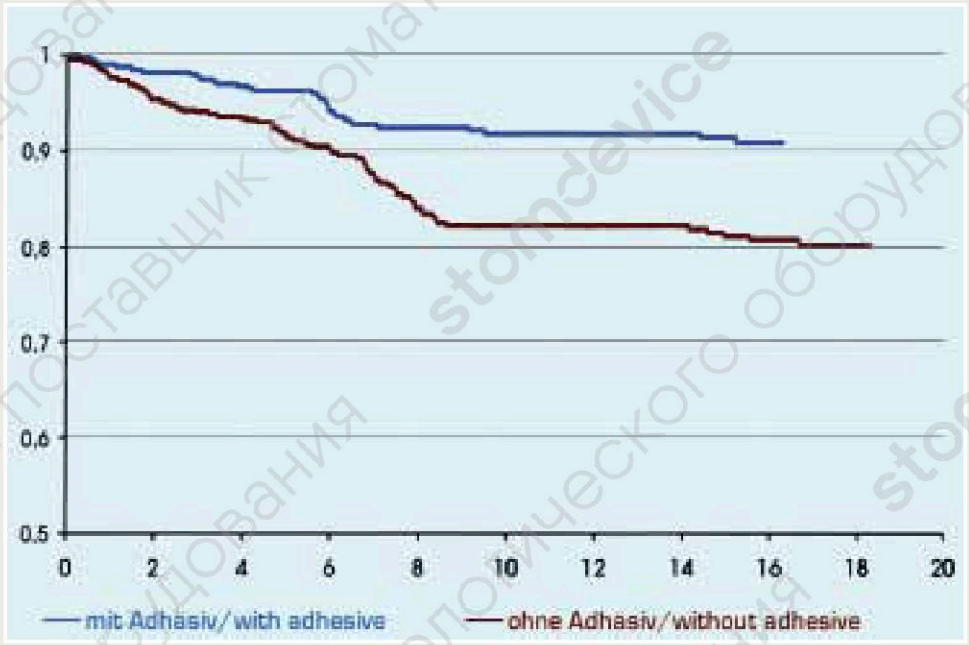
The longevity of CEREC restorations is comparable to that of gold restorations.

Posselt, A.; Kerschbaum, T.
Title: Longevity of 2,328 chairside CEREC inlays and onlays.
Source: Int. J. Comput. Dent. 2003; 6(3): 231-248
ISSN: 1463-4201
Accession No.: 14601187

Eighteen-year clinical study of 1,011 inlays/onlays

Over the period 1987 to 1990 a total of 1,011 CEREC inlays/onlays were fabricated on the CEREC 1 system for 299 patients. The results were broken down according to restoration size, restoration location, initial vitality and the use of dental adhesives. The expected survival rate after 18 years according to Kaplan-Meier was extremely high (84.4%). Premolars performed slightly better than molars. Two and three-surface inlays survived for a longer period than one-surface inlays. There was a significant difference between non-vital teeth (50%) and vital teeth (88%). The restorations bonded with a functional dentine adhesive had a 10% higher survival rate.

Reiss, B.,
Titel: Eighteen-Year Clinical Study in a Dental Practice.
Source: In Mörmann WH (ed.) State of the Art of CAD/CAM Restorations, 20 Years of CEREC, Berlin: Quintessence, 2006: 57–64



Survival rate of ceramic inlays over a period of 18 years (Kaplan-Meier). With a survival rate of 90%, restorations bonded with the aid of a dentine adhesive conform to the "gold standard".
Source: Dr. Bernd Reiss

Survival rate of adhesively bonded CEREC restorations

Temporary restorations are a frequently underestimated factor in the survival probability of ceramic inlays and onlays. Chairside CEREC restorations are created and placed during a single treatment session, thus eliminating the need for temporaries. In the case of conventional labside restorations temporaries are indispensable. The non-adhesively bonded temporary inlay lies like a wedge in the cavity and transmits the chewing forces directly to the weakened residual tooth. This means that the cavity walls lack any proper stabilization for several days. The provisionally treated tooth is subjected to torsional stress. This results in an uneven stress distribution, with stress peaks at the interface between the tooth and the temporary. The transmitted forces also deform the inadequately protected cusp walls and can lead to fractures (Mehl et al 2004).

It has been observed that patients with extensive cavities return to the dental practice suffering from initial enamel cracking and/or minimal partial fractures – i.e. traumas which can endanger a successful treatment outcome (Frankenberger). A further problem is the contamination of the treatment site with temporary cement, which is difficult to remove (Frankenberger et al 2006).

By contrast, the immediate insertion of an inlay creates a contamination-free adhesive bond with the hard tooth tissue and stabilizes the weakened cusps.

It can be confirmed that the high survival rate of CEREC restorations is attributable in part to the immediate placement of the final restoration. The reinforcement of the residual tooth and the adhesive bond apparently offset the consequences of a wider adhesive gap. This conclusion has been reached in various long-term clinical studies.

Mehl, A. Kunzelmann, K.H., Folwaczny, M., Hickel, R.:
Title: Stabilization effects of CAD/CAM ceramic restorations in extended MOD cavities.
J Adhesiv Dent 6 (2004).

Frankenberger, R., Krämer, N., Lohbauer, U., Nikolaenko, S.A., Reich, S.M.:
Title: Marginal integrity: Is clinical performance of restorations predictable in-vitro?
J Adhes Dent (2006).

Frankenberger, R., Lohbauer, U., Taschner M, Petschelt, A., Nikolaenko, S.A.:
Title: Adhesive luting revisited: Effect of temporary cement, cement removal, and curing mode on internal adaptation.
J Adhes Dent (2006)

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2. Accuracy of fit

The marginal gaps of CEREC restorations are meanwhile comparable to those of the labside all-ceramic restorations. It is important to bear in mind that CEREC restorations are adhesively bonded. This method differs fundamentally from the conventional bonding method with the aid of phosphate and glass ionomer cements. The conventional bonding method necessitates much narrower marginal gaps due to the fact that the cement is washed out as time progresses. Adhesive bonding creates an impermeable and durable bond between the restoration and the hard tooth tissue – also in cases where the adhesive gap exceeds 50 µm.

Bindl A, Mörmann WH.
Title: Marginal and internal fit of all-ceramic CAD/CAM crown-copings on chamfer preparations
Source: J Oral Rehabil. 2005 Jun; 32(6): 441–7.

Reich S., Gozdowski S., Trentzsch L., Frankenberger R., Lohbauer U.
Title: Marginal fit of heat-pressed vs. CAD/CAM processed all-ceramic onlays using a milling unit prototype.
Source: Oper Dent. 2008 NovDec; 33(6): 644–50.

3. Optical impressions

The accuracy of optical impressions is currently the subject of intensive scientific investigation. Initial results show that, in relation to single-tooth and bridge restorations, the accuracy of the CEREC Bluecam is comparable to that of conventional impressions. In the case of single tooth preparations the degree of accuracy is approximately 20 µm. In the case of three-unit bridge restorations the equivalent figure is around 40 µm.

Mehl A., Ender A., Mörmann W., Attin T.
Title: Accuracy testing of a new intraoral 3D camera.
Source: Int J Comput Dent. 2009; 12(1): 11–28. English, German.

X. Digital impression solution – CEREC Connect

CEREC Connect is Sirona's digital impression solution. It designates an Internet portal via which digital impressions generated by the CEREC Bluecam are transmitted to a dental laboratory for further processing. On the basis of the digital model the laboratory can fabricate a broad spectrum of restorations – from inlays to bridges. If required, the laboratory can order a stereo-lithographed polymer model (SLA model) from infiniDent, Sirona's central production service. This provides the basis for veneering the restoration for example.

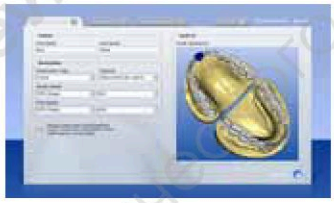
The CEREC Connect process

1



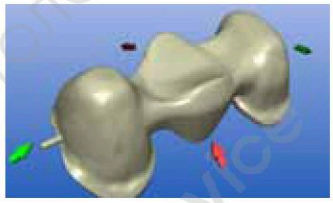

The starting point is the preparation. This is powdered and then captured with the aid of the CEREC Bluecam. The opposing dentition is also captured. The upper and lower jaws are then assigned to each other on the basis of the buccal registration. The dentist has the option of acquiring a quadrant, an anterior arch or the entire jaw.

2

The data is transmitted to the dental laboratory via the CEREC Connect portal. To this end the dentist fills in an online order form. Additional information can be included e.g. patient photographs.

3

After receiving the digital impressions and the order form the dental technician begins immediately with the design and milling of the restoration. If required, an SLA model can be ordered from infiniDent.




The milled restoration is then finalized on the basis of this SLA model. In future it will also be possible to machine models on the inLab MC XL milling unit.

4



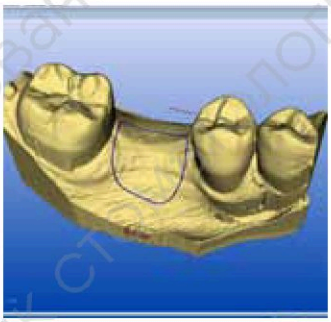

The finished restoration is then sent to the dentist for placement.

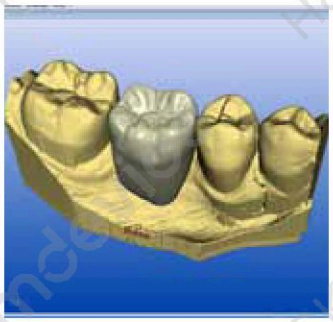
Treatment: Dr. Daniel Wolf

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XI. Integrated implantology solutions – CEREC meets GALILEOS

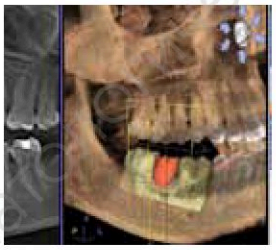
Implant therapy has meanwhile become a standard dental procedure. The precise positioning of implants plays a key role in the long-term durability of prosthetic restorations. Surgical guides enhance the safety and predictability of the treatment outcome. The available bone structure and the axial alignment of the prosthetic restoration are important factors here. Traditionally, this information has been acquired by means of computer tomography with a very high radiation dose. In addition, it was necessary to produce surgical guides on the basis of wax-ups (labour-intensive and costly). Digital cone beam volumetric tomography (CBCT) delivers precise 3D X-ray images at a much reduced radiation dose. The CEREC procedure is a tried-and-tested solution for acquiring digital impressions and designing crowns. The combination of these two procedures for dentists and patients is enhanced and safer implant planning as well as significant cost and time savings.



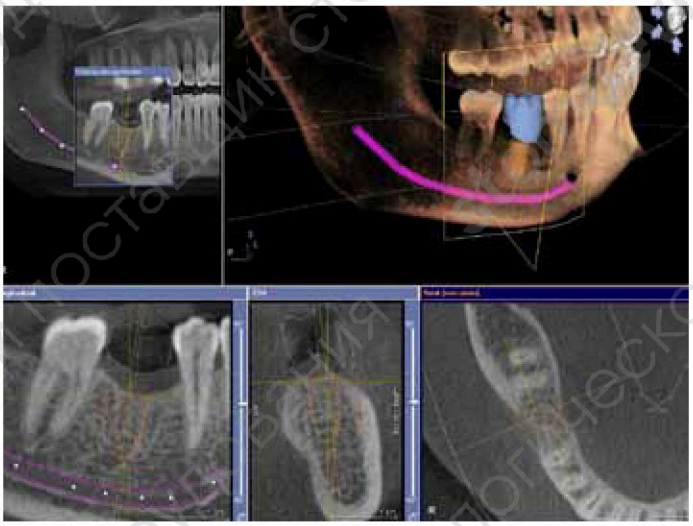


The gap is captured with the aid of the CEREC Bluecam. The crown restoration is then designed with reference to the neighboring teeth and the antagonist.





The restoration data is merged with the data generated by the Sirona GALILEOS CBCT system. The restoration is then visualized in the implant planning software.



The required implant is selected in the extensive in-built database. The mandibular nerve is displayed in the screen image. The angulation and position of the implant are adapted to the bone situation and the prosthetic axis. This provides the optimum basis for planning the surgical procedure. If required, the planning data can be used to create a surgical guide.

Treatment: PD Dr. Andreas Bindl

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Authors' curricula vitae



Dr. Andreas Ender

Andreas Ender completed his dental studies in 2001. Beginning in 2002 he worked as a junior resident in a private dental practice. Since 2002 he has been a research associate in the Computer Assisted Restorations Department of the Clinic for Preventive Dentistry, Periodontology and Cariology at the Centre of Dental Medicine at Zurich University (Directors: Professor Mehl, Professor Mörmann and Professor Attin).

In 2006 he obtained a doctorate in dentistry (Dr. med. dent.).

His activities centre on the development and deployment of CAD/CAM technology (in particular the CEREC 3D system) and the training of students in the CAD/CAM sector. His research projects focus on polymer materials for CAD/CAM bridges, the accuracy testing of intraoral and extraoral scanners, and 3D volume changes following surgical procedures on human and animal models.



Prof. Albert Mehl

In 1989 Albert Mehl completed his dental studies at the Friedrich Alexander University, Erlangen-Nuremberg. This was followed by a Master's degree in physics. In 1992 he worked as a junior resident at the Polyclinic for Conservative Dentistry, Periodontology and Paediatric Dentistry at the Friedrich Alexander University, Erlangen-Nuremberg. He then moved to a similar position at Ludwig Maximilian University, Munich, where he was appointed Professor in 2002. This was followed in 2003 by a further doctorate in biology. Since 2010 Albert Mehl has been Professor at the Department of Computer Assisted Dentistry at Zurich University.

Albert Mehl's research activities centre on the physical and mechanical properties of dental filling materials, with special reference to ceramics and composites. In the area of CAD/CAM dentistry his research interests centre on scanners and software developments, some of which have already been translated into marketable products. His research into the functional and biological morphology of teeth created the basis for the Biogeneric Tooth Model.
Over the years he has received numerous awards – e.g. from the Dental Ceramics Group (2002) and the Society for Dental IT (2007).

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