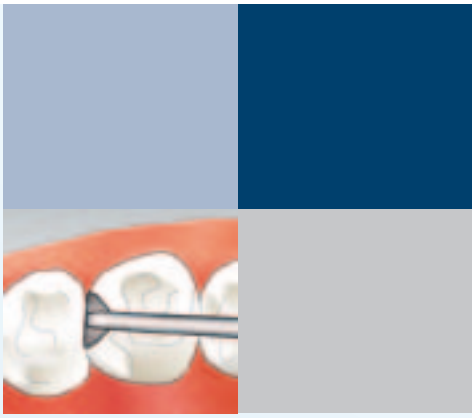
Preparation of adhesive inlays and onlays.



- Precise preparation of various bevel angles, around margins
- Prevention of undesired undercutting
- Precise preparation result
- Reproducible results
- Improved preparation margins for dental technicians
- No damage to adjacent teeth

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SONICflex® prep ceram.

For these complex repair techniques, the preparations and in particular the forming of the tooth margins, are outlined in the literature with precise geometrical specifications. The attempt to implement the required basic forms and margin geometries with an exclusive reliance on rotary instruments, often results in less than optimum results.

The SONICflex® prep sonoabrasive preparation tips, facilitate the complete avoidance of iatrogenic damage to adjacent teeth, whilst preparing the desired cavity geometry.

With clinically-proven, rotary instruments, old fillings and restorations may be efficiently removed and "basic preparation" performed. For "fine preparation" of bevelled proximal margins, diamond-coated instruments with oscillating motion are especially suitable. The newly-developed handpiece consists of the KaVo SONICflex LUX 2003 L or 2008 L airscaler, that oscillates within the audible range, in conjunction with various, specialised tips. These are specifically-formed, diamond-coated tips, with "non-continuous", non-diamond coated circumferential edges and "safe-sided", smooth backs. The non-diamond coated back faces the adjacent tooth surface during preparation work and indeed can be rested against it.

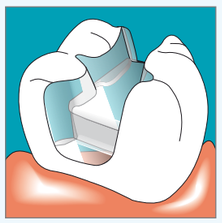
The enamel of the tooth is abraded by contact with the diamond-coated, oscillating surfaces. The tip geometry is transferred to the tooth tissue by means of a micro-machining processes. The resulting cavity or margin form, then corresponds in whole or in part, to the reverse 3-D shape of the oscillating preparation instrument. This process means that for the first time, it is possible to transfer various bevelled angles at the margins of a proximal cavity, in a well-defined and reproducible way (SONICflex® prep ceram).

The precise formation of preparation margins, provides dental technicians with a clear and unambiguous impression, which then forms the basis of their work. The overall restoration result can thus be improved.

Preparation with adhesive inlay techiques

Principles of the proximal adhesive inlay cavity

In the adhesive inlay technique, a divergence of approx. 6° degrees and a common insertion axis are required, for the occlusal cavity and the respective proximal boxes. The layer thickness of the proximal wall should be at least 1 mm. In the literature, similar bevel angles as for amalgam fillings (60° to 90°) are recommended, to achieve stable restoration margins, on the composite or ceramic inlays.



Adhesive inlay "ideal cavity"

This margin formation, which is not optimal for adhesive composites, is obviously of secondary importance, given the low volume and does not result in a lack of clinical success. The contact to the adjacent tooth should be formed, to facilitate the creation of a cast.

Conventional preparation of the proximal box with rotary instruments, e.g. after removal of the amalgam filling, is frequency associated with high losses of healthy tooth tissue and unnecessary expansion of the occlusal extension. In addition, irregular margin lines and bevel angles with unstable enamel structures are noted, when box cavities are prepared with rotary instruments.

There is a risk of damaging adjacent teeth, when proximal cavities are prepared with rotary instruments.

Design of tips for "adhesive inlay preparations": SONICflex® prep ceram

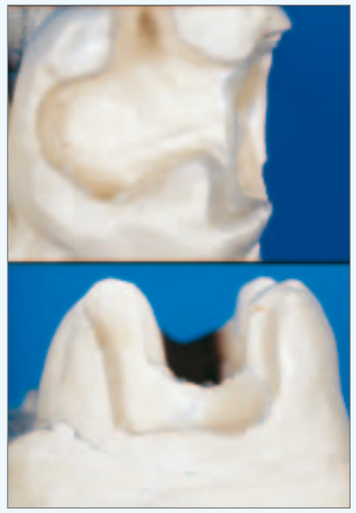
For improved control during the achievement of the desired cavity geometries, a sonoabrasive preparation tip has been developed for the adhesive inlay cavity: the SONICflex® prep ceram. Its basic form is trapezoidal and the preparation surface is coated with a 46µm-diamond layer. The occlusally divergent tip has a bevel angle of 75° cervically and a bevel angle of 60° laterally. The lateral and cervical surfaces are mutually linked through a pronounced, rounded profile.

SONICflex® prep ceram tip for proximal preparation for adhesive inlays. Left to right view of the lateral, total preparation and cervical areas. The instrument is characterised by a bevel angle of 60° on the lateral surfaces and a cervical bevel angle of 75°. It has a divergence of respectively 4° and 8°, plus rounded transitions.

Sequence of fine prepraration work

After initial preparation with rotary instruments, the SONICflex® prep ceram tip, making allowance for the planned insertion direction, is applied with a gentle pressure, against the lateral box wall and cervical curvature and held in position after activation of the drive. In a short time, the form of the areas of the tip that are in contact with the tooth material is transferred. Without torquing the instrument, move away from the preparation area. The cervical region and the two lateral surfaces are thus prepared.

To stabilise the guidance of the tip, its rear, non-diamond coated face, is rested against the adjacent tooth. For finishing the cavity edges, these should be briefly reworked with the same attachment, powered with low drive air-pressure. In the process, the tip edge is always guided somewhat proud of the cavity edge. As the instrument is prevented from completely filling the cavity, with their different extensions, individual corrections of the lateral and cervical bevel angles are possible, by rotation about the longitudinal and transverse axes.



It is often difficult or impossible to effectively finish cavity edges with rotary instruments. The consequences are areas with edge defects, irregularities and incorrect bevel angles. The example shows an inadequately prepared clinical cavity for a ceramic inlay.

Left: The preparation tip can be rested against the surface of an adjacent tooth, during fine preparation work. Right: The desired bevel angles are achieved cervically and laterally.

Reworking with the oscillating SONICflex® prep ceram tip, produces an ideally-formed cavity in the proximal area.

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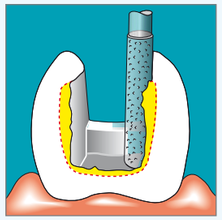
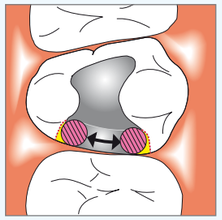
Proximal preparation sequence with adhesive inlay or onlay

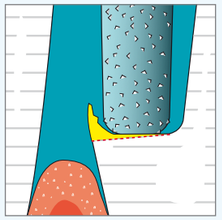
Rotary primary preparation



1. The primary preparation of the occlusal and proximal box cavities, is performed with cylindrical or conical grinding tools. Un-machined edges are indicated in yellow.

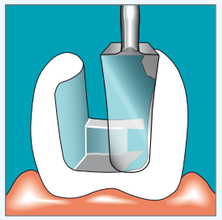


2. Undesirable contact with adjacent tooth surfaces must be avoided, by firm guidance of the instrument. The areas marked in yellow are "enamel lugs", that cannot be removed with rotary instruments.

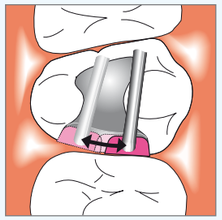


3. Thin enamel margins are frequently left behind in the cervical step, that are prone to fracturing (marked in yellow).

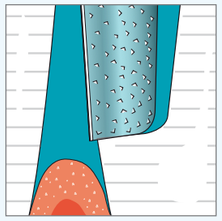
Sonoabrasive fine preparation



4. The longitudinal axis of the SONICflex® prep ceram tip, is aligned in accordance with the planned insertion direction of the inlay and the instrument is applied to the lateral box walls.



5. By parallel displacement of the tip, while maintaining the desired preparation axis, a box is created with minimal occlusal divergence. Rotation of the tip about the longitudinal axis, results in the bevel angle being precisely applied.

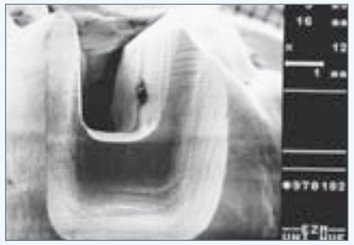


6. Formation of a defined cervical step, with the SONICflex® prep ceram tip. For finishing work, the instrument edge should be held somewhat outside the cavity border (arrow).

General information on the application

SONICflex® prep ceram tips for preparation of laboratory-created prosthetics, are covered with a fine diamond-coating (grain size 46 µm). In the oscillation-based process, the shaping and finishing is performed with the same diamond-coating. To this end, spray cooling at a flow rate of 15 to 30 ml/min is essential, both to avoid thermal damage to the pulp and for the removal of abraded tooth material.

Optimum abrasion performance may be achieved at a maximum drive air-pressure of 3.5 bar (output pressure at the MULTIflex coupling). The tips should be applied with a pressure of approx. 1.5 N. If too much pressure is applied, the abrasion power is reduced by attenuation of the oscillation.

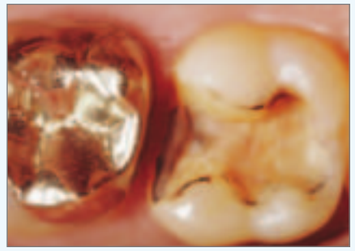


The REM view of the adhesive inlay cavity, shows the correct bevel angle and the even, rounded transition between the lateral and cervical cavity wall.

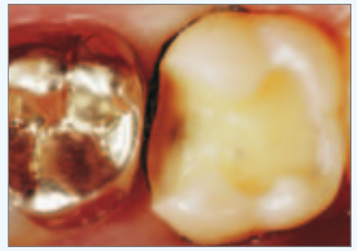
When the ideal application pressure is used during preparation, a specific sound-level is generated that can serve as an acoustic check. For finishing and edge finishing, the drive air-pressure that can normally be adjusted with the foot pedal, should be reduced according to individual requirements, to 2 bar pressure. At the same time, the oscillation amplitude can be reduced by increasing the application pressure and hence the control of the instrument can be improved. The SONICflex 2003 L or 2008 L should be set to power level I for finishing work.

Clinical case studies

1.1 The gold inlay on tooth 17 is loose.



1.2 After removal of the inlay, the real extent of secondary caries is clearly visible.



1.3 Complete box cavity for an adhesive inlay prosthesis. Proximal preparation was performed exclusively with the SONICflex® prep ceram tip. Comparison with the initial situation and subsequent well-defined cavity, make the extent of conservation of tooth tissue by sonoabrasion, clearly apparent. Little healthy tooth tissue is sacrificed, during secondary preparation.

1.4 Occlusal view of tooth 17, forms the master model.

1.5 Proximal view of plaster cast.

1.6 The closeness of fit and quality of the inlay, can be improved by optimised preparatory work.

1.7 Empress® inlay for tooth 17. The rounded, proximal-cervical transitions, may be clearly seen.

1.8 Situation with adhesively-fixed Empress® ceramic inlay, on tooth 17.

Evaluation

The desired geometry, or that predetermined by the tip, can be transferred to the initial cavity with the fine preparation described above, while conserving healthy tooth tissue. Only enough tooth material is removed, as is required to reproduce the form predefined by the instrument, in the marginal extremities of the cavity. Proximal cavities with predefined material thickness of the inlays, minimal occlusal divergence, margins formed to the nearest degree and evenly rounded proximo-cervical curvatures, may be easily created.

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Clinical case studies

2.1 Initial situation with several inadequate composite inlays, in teeth 25 to 27.

2.2 Precise tip-guidance during proximal preparatory work on the box, is significantly simplified with the oscillating tip, even with deep-lying cavity edges.

2.3 The proximal sections of the inlay, exhibit even layer thicknesses and proximal-cervical transitions.

2.4 Teeth 25 to 27 with rubber dam, for adhesive fixing of the ceramic inlay.

2.5 Teeth 25 to 27, seen in the follow-up check one year later.

3.1 Initial situation, with amalgam fillings in need of replacement.

3.2 Prostheses for teeth 24 to 27 - adhesive inlay and onlay restorations from Empress®.

3.3 Situation after removal of the failed amalgam fillings and caries excavation with rotary instruments.

3.4 After application of a dental adhesive, partial, structural fillings with light-cured composite (Tetric Flow® and Tetric® Ceram, VIVADENT, Schaan) are produced.

3.5 SONICflex® prep ceram tips were exclusively used for proximal box preparations.

3.6 Final result with integrated Empress® restorations.

Advantages of using SONICflex® prep

- No damage to adjacent teeth
- Precise transmission of the tip's geometry to the marginal cavity angles
  - no undesired undercutting
  - specific achievement of the bevel angles
  - harmonious transitions between cervical and lateral edge areas
  - marginal areas and preparation surfaces are smooth and free from defects
- Improve dental restoration by optimisation of cavity form
- Suitable for all fully ceramic, or fine-grain, hybrid composites (e.g. CEREC®*, EMPRESS®**, TARGIS VECTRIS®**, ...)
- Reproducibility of treatment results
- Reduction of treatment stress in critical processes
- Reduction of the "skill-dependency" of complex preparatory work, due to ease of operation
- Reduction of duration of preparatory work
- **Conservation of healthy tooth tissue**

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Literature

Hugo, B., Stassinakis, A. und Hotz, P.: New method für reproducible and standardized cavity preparation of class II lesions. J Dent Res 74 (Abstract 1274), 560 (1995).

Hugo, B.: Entwicklung und Anwendungsmöglichkeiten oszillierender Verfahren in der Präparationstechnik (Teil II) [Development and application possibilities of oscillatory processes in preparation techniques (Part II). DZZ 52, 11/97, S. 718-727

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Deliverable forms

Tip set with 2 tips, distal and mesial

SONICflex® prep ceram	0.571.0331
SONICflex® prep ceram A	1.006.2029
SONICflex prep gold A	1.006.2028
SONICflex® prep CAD/CAM	1.002.1988
SONICflex® prep CAD/CAM A	1.006.2024

Single tips SONICflex® prep gold

Tip no. 49	0.571.7212
Tip No. 49 A	1.006.1983
Tip No. 50	0.571.7222
Tip No. 50 A	1.006.1984

SONICflex® prep CAD/CAM

Tip No. 34, mesial	1.002.1984
Tip No. 34, mesial	1.002.1984
Tip No. 35, distal	1.002.1986
Tip No. 35 A, distal	1.006.1979

SONICflex® prep ceram

Tip No. 51, mesial	0.571.7252
Tip No. 51 A, mesial	1.006.1985
Tip No. 52, distal	0.571.7272
Tip No. 52 A, distal	1.006.1986

Accessories

Torque wrench	1.000.4887
Case for tips sterilisable up to 135°C	0.411.9101

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