

CLINICAL MANUAL



cercon[®]
smart ceramics

Clinical Manual

Cercon[®] smart ceramics – Safety³

DeguDent
A Dentsply Company

Table of contents

Introduction	3
At a glance: The Cercon® smart ceramics system	4-5
Indications of Cercon® base: Ceramic veneering	6
Preparation recommendations for Cercon® base: Ceramic veneering	7-11
Impression	12-13
Cementing	14-18
Access cavities and removal of restorations	19
Clinical performance of Cercon® restorations	20-23
Product recommendations	24
References	25

Acknowledgement

We thank Sven Rinke, Dr. med. dent, M. Sc., Geleitstraße 68, 63456 Hanau, Germany, for providing copy and illustrations for this document.

Introduction

The range of indications for all-ceramic restorations has been continuously extended since the early 1980s. The driving forces behind the rapid development and popularization of all-ceramic restorations include the advent of new ceramic materials with better fatigue strength as well as innovative cementing procedures.

Looking at current developments in restorative dentistry, all-ceramic restorations and implant prosthodontics are vying for the title of fastest-growing rehabilitative method. Prompted by CAD/CAM technology, zirconia has entered restorative dentistry with a vengeance and opened up new indications for all-ceramics.

10 years ago, the Cercon® smart ceramics system was first presented as a CAM system for fabricating zirconia-based crown and bridge frameworks in the dental laboratory, blazing the trail for a more widespread use of zirconia restorations in dental offices and dental laboratories. Today, the Cercon® smart ceramics system has become a multi-functional CAD/CAM system offering both centralized and local production options and boasting more than 5.7 million restorative units delivered worldwide. Ongoing innovations and development efforts with regard to the Cercon software and hardware have resulted in completely new indications such as custom all-ceramic abutments. Cercon® smart ceramics is one of the clinically most well-documented all-ceramic systems on the market. Current literature reviews confirm that most clinical studies on zirconia restorations have been performed on the Cercon system. Not surprisingly, the Cercon system offers the greatest bandwidth of indications for which evidence from clinical studies is available – the result of an ongoing commitment to clinical research.

Comprehensive evidence from research in clinical dentistry and material science has resulted in consistent automation efforts for Cercon restorations. Today, the Cercon® smart ceramics system is the only system in the world with a clinically proven strategy for preventing chipping – a level of safety afforded by diligent research and development.

The present manual succinctly summarizes the specific aspects of clinical procedures (preparation, impressioning, cementing) for zirconia restorations as well as the available evidence on their clinical performance. It is meant to guide the daily work of clinicians and technicians alike, presenting efficient procedures and assisting in therapeutic decision-making.

At a glance: The Cercon® smart ceramics system

System development

- Framework ceramics: Cercon® base
- Processing – scanning and design: Cercon® eye/Cercon® art and 3Shape system
Milling: Cercon® brain and Cercon® brain expert
- Sintering: Cercon® heat/Cercon® heat plus
- Veneering: Cercon® ceram kiss/Cercon® ceram love



Production

- Locally at many dental laboratories
- Centrally at one of DeguDent's Compartis® network production centres

Optional warranty

- Five-year framework warranty

Material

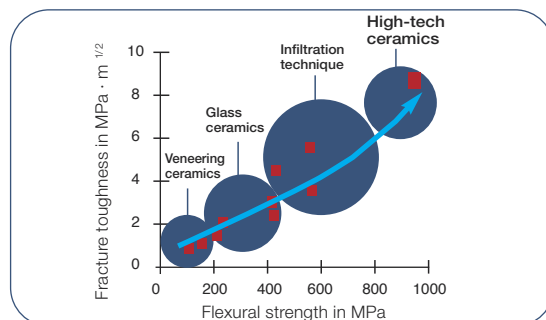
- Zirconia (Y-TZP)
- Fine-grained
- High sintering activity
- Strength approx. 1,300 MPa



Significantly higher strength

The statistical fracture resistance and fatigue strength of veneered crown and bridge restorations on zirconia frameworks is higher by a factor of 2 to 3 compared to other all-ceramic systems (glass ceramics, infiltration ceramics, aluminium oxide, lithium disilicate).

A combination of high flexural strength and higher fracture toughness and partially stabilized zirconia is the foundation on which the long-term clinical success of these restorations is built.



At a glance: The Cercon® smart ceramics system

Excellent biocompatibility

In various in-vitro and in-vivo trials, Y-TZP zirconia did not exhibit any mutagenic or carcinogenic activity during chromosome aberration testing or in the Ames tests. Publications agree that no local toxic effects are to be expected on contact of zirconia ceramics with bone or soft tissue.



Five shades, one quality

- Cercon® base (white)
- Cercon® base light (light ivory)
- Cercon® base medium (medium ivory)
- Cercon® base colored (dark ivory)
- Cercon® base ht (highly translucent)
– available Q2/2011



Translucency

Partially yttria-stabilized zirconia has the combined advantage of being extremely strong and also translucent. Its pronounced light transmission capacity allows the fabrication of natural-looking restorations. At the same time, its semi-opacity allows the use of its material even on discoloured tooth substance.

Clinical advantages

Thanks to its combination of various favourable characteristics (biocompatibility, strength, translucency, low thermal conductivity), yttria-stabilized zirconia is an ideal material for fixed dental restorations. The material offers the following clinical advantages:

- Broad range of indications in the anterior and posterior segments
- Occlusion can be evaluated at the try-in
- Temporary cementation option available
- Conventional cementation option available



Indications of Cercon® base: Ceramic veneering

Framework material	Zirconia (Y-TZP)
Indications in the anterior and posterior segments	<ul style="list-style-type: none"> • Abutments • Primary telescope crowns • Crown • Multi-unit bridges (with no more than two pontics between abutment crowns)
Contraindications in the anterior and posterior segments	<ul style="list-style-type: none"> • Bruxism or recalcitrant parafunctional habits (as usual for all ceramically veneered frameworks) • Insufficient available space • Inlay bridges • Custom endodontic posts • Endosseous implants
Temporary cementation	Possible
Definitive cementation	<ul style="list-style-type: none"> • Adhesive cementing • Conventional cementing



Framework dimensions (anterior und posterior):

Wall thickness, single crowns	0,4 mm
Margin thickness, single crowns	0,2 mm
Wall thickness, bridges	0,4 mm
Margin thickness, bridges	0,2 mm



Additional dimensional requirements for the anterior region:

Number of pontics	2
Connector cross-section	7 mm ²

Additional dimensional requirements for the posterior regions:

Number of pontics	2
Connector cross-section	9 mm ²

Additional dimensional requirements for bridges with cantilevered pontics:

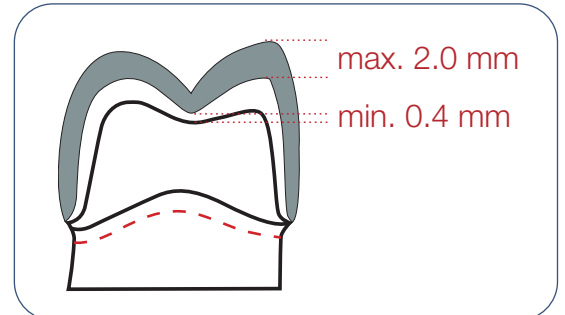
Cantilever pontic at tooth position (only one pontic, up to one premolar width)	Up to the second premolar
Connector cross-section for this cantilever pontic	12 mm ²



General preparation recommendations for Cercon® base: Ceramic veneering

Framework design

To ensure long-term clinical stability, minimum wall thickness requirements must be observed strictly, and the framework must be designed close to anatomic shape, especially in the molar region in order to provide the best possible support. The maximum thickness of the occlusal veneer must not exceed 2 mm; the thickness of the proximal veneer must be limited to 1 mm.



Generally, a highly anatomic framework modelling technique is necessary to provide maximum support for the ceramic veneer.



Special aspects related to superstructures

Implants-supported Cercon frameworks can be used to restore both anterior and posterior metal and all-ceramic abutments.

To achieve the best possible aesthetic result, a combination with prefabricated or custom-designed zirconia abutments is recommended.

The shape of certain prefabricated abutments deviates considerably from that of the prepared tooth. This is why the requirements regarding a highly anatomic framework modelling are so strict; it is the only way to ensure proper support for the veneer. Failure to comply with this rule may result in increased veneer failure rates.



Preparation recommendations for Cercon® base: Ceramic veneering

General

The margins of zirconia restorations should be prepared with chamfers or internally rounded shoulders. Other guidelines:

- 6° to 10° preparation angle
- Rounded line angles and point angles
- Flattened cusp/fossa plane

The restoration's minimum wall thickness will depend on the indication. The minimum wall thickness for anterior crowns should be at least 0.4 mm in all cases. Posterior crowns and bridges, too, require a minimum wall thickness of 0.4. A minimum circumferential depth of 1.0 mm will generally be sufficient.

- Considering that a minimum wall thickness of 0.3 mm is recommended for metal frameworks, the required reduction for all-ceramic restorations is comparable to or only marginally greater than that for metal-ceramic restoration.

Zirconia facilitates crowns with a ceramic shoulder on the vestibular aspect or circumferentially. For laboratory-made ceramic shoulders, the shoulder preparations offer advantages over chamfer preparations.



General preparation recommendations for all-ceramic anterior crowns



Zirconia crown with the vestibular ceramic shoulder

Connector cross-section

The required connector areas should be taken into account at the planning stage for the dental preparation. The minimum connector area for zirconia bridges is:

- 7 mm² in the anterior segment
- 9 mm² in the posterior segments

Typical fractures of all-ceramic bridges in the connector area are characterized by fracture surfaces that extend into the neighbouring coping, which will be considerably thinner than the connector. For this reason, copings on bridge abutments should always be reinforced occlusally. For four-unit bridges, we recommend increasing the framework thickness to 0.6 to 0.7 mm on the occlusal aspect and on the side facing the pontic.



Pronounced connector design to enhance framework strength

Preparation recommendations for Cercon® base: Ceramic veneering

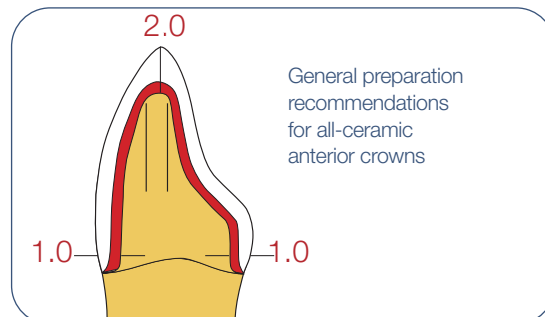
Anterior

Initial results of clinical studies would indicate that zirconia restorations with a feather-edge margin in the anterior segment are a distinct possibility (Schmitt et al. 2010). Cylindrical diamond instruments, pre-head round, are suitable for chamfer preparations. Shoulder preparations with internal line angles are best performed using tapered diamond instruments with rounded edges.

Anterior preparations must ensure not only a minimum circumferential depth of 1.0 mm but also a taper of between 6° and 8° for the axial preparation walls. The transitions between the axial walls on one hand and the palatal and incisal surfaces of the other must be rounded (minimum radius: 0.4 mm). The incisal reduction should be 2.0 mm, for predominantly aesthetic reasons. The minimum width of the incisal edge in the vestibular-oral direction for CAD/CAM-manufactured restorations should be at least 0.8 to 0.9 mm to ensure exact reproduction of the internal framework surfaces by the milling unit.

The palatal contours of maxillary incisors and canines are best shaped using a carat-shaped instrument (e.g. a palatal cutter as described by Marxkors). This instrument is also suited for rounding the transition areas between the axial walls and the incisal edge.

Rotary instruments with an average grain of 30 µm are recommended for finishing the preparation.

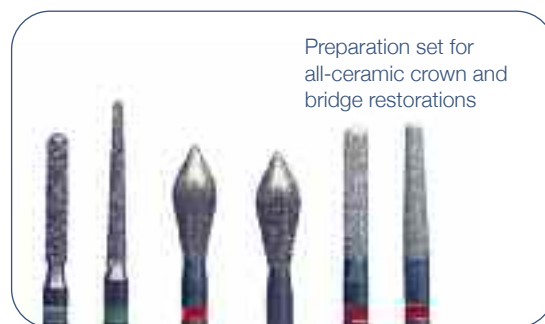


Preparation recommendations for Cercon® base: Ceramic veneering

Posterior

For posterior restorations, a minimal thickness of the occlusal veneer of 1.0 mm must be ensured. Given the minimum framework thickness requirements, a reduction of at least 1.5 mm should be attempted occlusally. The taper of the axial walls of the preparation should be between 6° and 8°. All transitions between the axial walls and the occlusal surface must be rounded, with the occlusal relief presenting a simplified version of the occlusal surface. A relatively large opening angle of the occlusal surfaces of between 120° and 140° ensures exact reproduction of the internal surfaces of the restoration during the milling process and, hence, a good internal fit.

Carat-shaped rotary diamond instruments as described above for the anterior segment has proven valuable for preparing the occlusal surfaces of the posterior segment as well. These instruments are guided perpendicularly to the tooth axis. The same instrument can be used for rounding the transition areas between the axial and occlusal surfaces if the instrument is guided parallel to the tooth axis and the rounding is performed with the tapered instrument tip.



Preparation recommendations for Cercon® base: Ceramic veneering

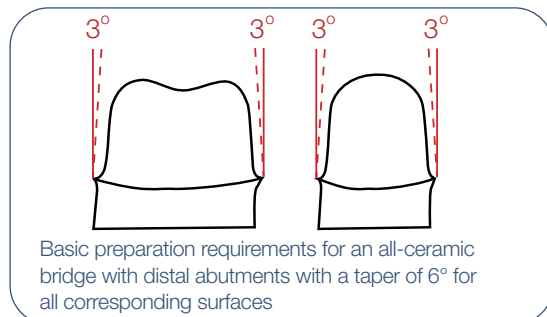
Anterior and posterior bridges

The preparation for all-ceramic bridges generally follows the same recommendations as those for single crowns with regard to cutting depth and design.

The taper of the preparation is particularly crucial in the case of bridges because it ensures that the geometries of all die preparations lend themselves to successful scanning. Parallel or steep preparation walls will result in inadequacies during data acquisition and, consequently, insufficient fit. Optimum scannability requires a taper of the corresponding walls of all bridge abutments of at least 6°.

For wide-span or multi-part bridges, it is recommended to take an alginate impression of the finished preparation for control purposes. Pouring this impression in a fast-setting dental stone will allow the dentist to evaluate the scannability of the preparation based on the taper of the axial preparation walls.

To improve retention for bridges on reduced-height abutments, vertical retention grooves may be included in the restoration. To ensure good scannability and millability, the semicircular grooves should have a radius of at least 0.8 mm (instrument diameter: 1.6 mm).

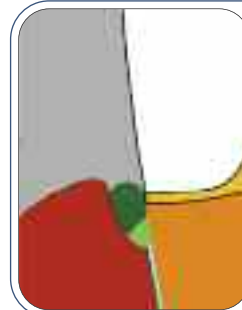


Impression

Materials and methods

Impressions can be taken in the familiar way using standard materials (hydrocolloid, polysiloxane, polyether) and methods (correction impression, double-mix technique, monophasic technique).

For polysiloxane, both the correction impression and the double-mix or monophasic techniques may be employed. Only the double-mix or monophasic techniques are available for polyether impressions.



Schematic representation of the double-cord technique for gingival retraction



Polysiloxane and polyether impressions using the double-cord technique



Working cast with precisely represented preparation margins for gingival retraction

Impression

Practical aspects

To achieve a reproducible and safe representation of the preparation margin, the use of braided retraction cords (e.g. Ultrapak, Ultradent Products, USA) and the double-cord technique has proven valuable. This technique requires inserting a first, thin cord into the sulcus that remains there throughout impressioning. A second cord is then placed above the first one, then removed immediately before taking the impression. The first cord serves to prevent sulcular bleeding while at the same time preventing the gingiva from folding back onto the preparation margin. The second cord serves to provide additional lateral displacement of the gingiva, ideally allowing the impression material to flow approximately 0.5 mm beyond the preparation margin.

Following the application of the lower-viscosity component, distributing the impression material by air pressure is recommended both for the correction method and for the double-mix technique. The air stream should be directed toward the sulcus in order to ensure good adaptation of the impression material to the surface of the preparation.



Double-mix, double-cord technique

Cementation: Temporary

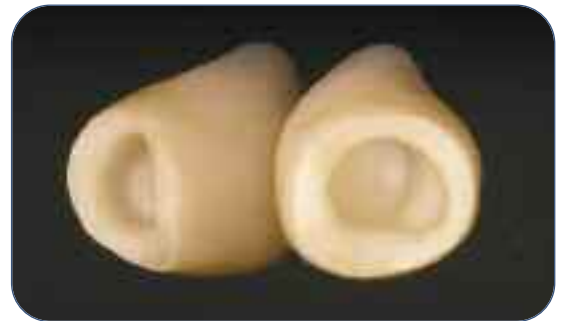
Materials and methods

Thanks to the high flexural and fatigue strength of partially yttria-stabilized zirconia frameworks, it would appear that provisional cementing (e.g. using Integrity Temp Grip, DENTSPLY DETREY, Germany) can be performed in a manner similar to metal-ceramic restorations. Clinical studies (Rinke and Jenatschke, 2003; Rödiger et al., 2010) have shown that zirconia restorations without ceramic shoulders may be cemented temporarily for a limited period.

It should be pointed out, however, that any removal of provisionally cemented zirconia restorations carries a risk of damage, especially when certain peak loading levels are exceeded. If the bridge includes ceramic shoulders, immediate definitive insertion (conventional or adhesive) is recommended, since the ceramic shoulders are more prone to fracture when removing temporarily cemented bridges.

Provisionally cemented zirconia restorations should be worn only for a short period of time (2 to 3 weeks), as a creeping loss of retention or loosening of the restoration, which may well go undetected, may result in damage to the restoration even during normal masticatory function. When removing restorations prior to definitive cementing, the possible clinical advantage of providing a provisional restoration should be weighed against the risk of damage to the restoration.

To prevent damage to the ceramic veneer, special tools with plastic tips are required (e.g. the crown-removing forceps by Stoma) when removing provisionally cemented restorations. Any direct contact between metallic tools and the ceramic material must be avoided.



Cementation: Definitive

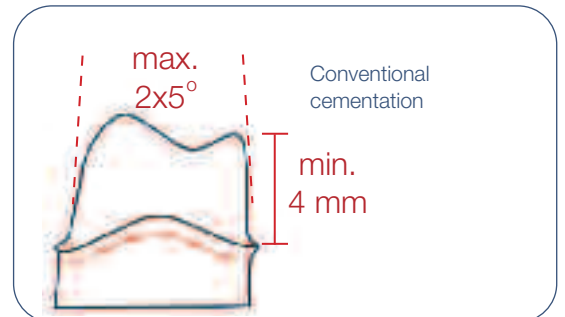
Materials and methods

In principle, all conventional cements are suitable for cementing zirconia restorations. Conventional cementing can be recommended if the following conditions are met:

- Sufficient preparation height (≥ 4 mm)
- 3° to 5° preparation angle

Especially in the case of bridges in the posterior mandible, the indication for conventional cementing should be critically reviewed, as clinical studies have shown an increased risk of retention loss after conventional cementing (Rödiger et al., 2010).

Composite cements (e.g. cements containing a reactive phosphate monomer) are suitable for adhesive cementing. These cements can form a chemical bond with zirconia upon proper conditioning.



Preparing the restorations

Regardless of the cementing method used, the cementing surfaces of the restoration should be conditioned in order to improve retention. Micro-roughening by sandblasting the cementing surfaces with $50 \mu\text{m}$ aluminium oxide at a maximum pressure of 2 bar can improve retention and optimize the bond in the case of adhesive cementing without adversely affecting the mechanical properties of the restoration.



Cementation: Definitive

Conventional cementing

Generally, the use of phosphate-based or glass-ionomer cements does not increase the fracture risk of zirconia restorations. However, when considering the use of phosphate and even glass-ionomer cements it should be noted that these form almost no adhesive bond with the hard tissue of the teeth or with zirconia. Due to the subtractive production process, CAD/CAM frameworks will always exhibit a slightly looser fit than cast-gold frameworks. If this is compounded by additional adverse factors, retention can be significantly reduced. Especially in the case of bridges in the posterior mandible, the indication for conventional cementing with straight zinc-phosphate or glass-ionomer cements should be critically reviewed, as clinical studies on the use of these agents have shown an increased risk of retention loss after conventional cementing (Rödiger et al., 2010).

Several in-vitro studies have shown that the retention of zirconia crowns after cementing with resin-modified glass-ionomer cements is significantly higher than when conventional zinc-phosphate cements or straight glass-ionomer cements are used. Another advantage is that the resin-modified glass-ionomer cements come in different shades and translucencies. The choice of a translucent agent would be ideal in most cases, because it safely prevents visible cement extrusions at the cementation gap. Cementing zirconia crowns with resin-modified glass-ionomer cement does not require preparing the teeth beyond thorough cleaning and drying.

Given the increased retention and improved optical properties accompanied by simpler clinical handling, resin-modified glass-ionomer cements would appear more suitable than straight zinc-phosphate or glass-ionomer cements.



Cementation: Definitive

Adhesive cementing

If too little retention is available, zirconia crowns should be cemented adhesively, either with self-adhesive cements (Piwowarczyk et al., 2005) such as SmartCem2 (DENTSPLY DEtREY) or with resin cements with a reactive phosphate monomer reaktivem Phosphatmonomer (Panavia TC or Panavia F2.0). Especially the use of resin cements with reactive monomer is well supported by numerous in-vitro studies as well as by clinical studies.



Practical aspects

Straight adhesive cementing requires preparing the teeth with a primer or adhesive system. As in conventional cementing, the crowns or sandblasted; the bond can be further improved by applying an additional bonding agent. To keep resin particles from migrating into the sulcus and to prevent contamination of the adhesive with sulcular fluid, a thin retraction cord (e.g. Ultrapak size 00) should be placed in the case of gingival or subgingival crown margins. The adhesive cementing of crowns presupposes a completely healthy gingiva, because contamination with blood will greatly impair the treatment result. All the usual conditions for adhesive cementing must be met ...



- ... A working area that is dry and free of saliva
- ... Completely polymerized composite and adhesives
- ... Good wettability of the bonding surfaces
- ... Complete removal of excess cement



Cementation: All-ceramic implant superstructures

Specific aspects

All-ceramic implant superstructures can generally be cemented by conventional or adhesive methods. To improve retention, both metal and ceramic abutments can be conditioned by sandblasting (50 µm aluminium oxide, max. 2 bar). When selecting a cementing method, an important aspect, in addition to providing adequate retention, should be the removal of excess cement. Especially when that transition zone from the abutment to the all-ceramic superstructure is located subgingivally, care must be taken to ensure that any excess cementing agent can be removed completely, as residual cement will increase the risk of iatrogenic peri-implantitis. Resin-modified glass ionomer cements as well as self-adhesive cements are more advantageous in this respect than the classic composite cements.

All-ceramic primary copings should preferably be cemented adhesively in order to ensure adequate retention. Because the margins are usually easily accessible, removing excess cementing agent will generally not be a problem with this indication.

Recommended cement types

The following three groups of materials can be recommended for cementing zirconia restorations today:

1. Resin-modified glass-ionomer cements (Permacem, DMG)
2. Self-adhesive cements (SmartCem2, DENTSPLY DETREY)
3. Composite cements with a reactive phosphate monomer (Panavia 21, Panavia F 2.0, Kuraray)



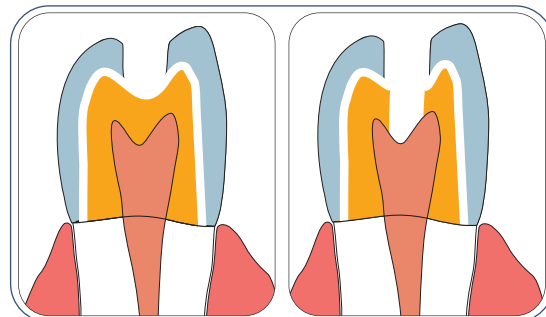
Access cavities and removal of restorations

Access cavities

Cercon restorations can generally be removed reasonably quickly and without clinical complications, provided that the tools used are appropriate for the material. It is recommended to prepare an access cavity in two steps. In the first step, the veneer is removed with a diamond instrument, making sure the framework is not perforated.

In the second step, the ceramic material of the framework is perforated in a controlled manner using a diamond instrument of appropriate size. A distance of 0.5 mm from the veneer should be kept in order to avoid chipping of the veneer as the ceramic framework is segmented.

The structural strength of the Cercon crowns will remain intact after preparing the access cavity, so that the restoration may be left in place. The access cavity is best close with an adhesive composite restoration. Incidentally, the radiopacity of zirconia restorations is similar to that of metal-ceramic restorations.



Particularly well suited for preparing access cavities and removing crowns: Cylindrical diamond instruments, pre-head round, with a 125–150- μ m grain in a 4:1 angled handpiece and maximum irrigation

Removal of restorations

To remove the Cercon restoration, it must be slit open along the axial wall all the way to the occlusal surface or incisal edge. A special imprint is used to bend the resulting wings of the restoration upward, causing the restoration to fracture. In the case of adhesively cemented restorations, residual cement on the tooth surface may be ultrasonically removed.



Clinical performance of Cercon® restorations

After more than 10 years of clinical use, there is a large published body of studies on the clinical performance of zirconia restorations. A current literature review has identified 13 studies on the clinical performance of zirconia bridges. It was shown that the Cercon system is the best-researched zirconia system with the broadest range of clinically supported indications (Al-Amlid et al., 2010).

To evaluate the clinical performance as evidenced by clinical studies, direct comparison with metal-ceramic restorations might be in order. In a prospective study, Sailer et al. (2009) followed 38 metal-ceramic bridges with a high-gold framework and 38 three- to five-unit zirconia bridges. After the observation period of three years, the survival rate for both types of restorations was 100%. Christensen and Plöger (2010) examined a total of 293 three-unit metal-ceramic and all-ceramic bridges fabricated using various systems. After a three-year observation period, no significant difference was found between the survival rates of the zirconia frameworks and the metal-ceramic restorations. Three-unit to four-unit zirconia bridges showed high overall survival rates after a mean observation period of 3 to 5 years, comparable with metal-ceramic bridges.

A specific evaluation of the survival probability of bridges designed with Y-TZP frameworks was performed in another systematic literature review published by Schley et al. (2010). An affiliation of nine studies on the clinical performance of zirconia bridges including 310 three- to four-unit yielded a 5-year survival probability of 94.3%.

The most common technical complication observed was fracturing (chipping) of the ceramic veneer, which, however, did not necessarily result in the restoration having to be replaced. 91.7% of all restorations remained free of biological complications throughout the 5-year period.



Clinical performance of Cercon® restorations

The authors concluded that the survival rates of zirconia bridges are promising, but that modifications to the ceramic veneering technique are required to reduce the incidence of technical complications.

This requirement has already been met for the Cercon system. Based on a cooperative effort with the universities of Aachen and Heidelberg featuring extensive FEM simulations and comprehensive in-vitro testing, internal tension within the ceramic veneer could be identified as the main cause of increased chipping.

Studies have shown that allowing 6 minutes of long-term cooling during fabrication of the ceramic veneer results in a significant reduction of the near chipping (Rues et al., 2010).

Meanwhile, a comparative clinical study on methyl-ceramic and zirconia-based crowns (Cercon) in the molar region has shown that differences in chipping behaviour were no longer present after an observation period of one year (Rinke et al., 2010). Furthermore, two clinical studies have shown that veneering by overpressing also significantly reduces the incidence of chipping (Beuer et al., 2009; Christensen and Plöger, 2010). Based on these results of materials science and clinical research, we can conclude that technical complications in the form of chipped veneers can be effectively avoided by taking the following precautions:

- Highly anatomical framework modellation
- Long-term cooling of the ceramic veneer (6 minutes)

The Cercon®-System is the only zirconia system with a scientifically and clinically verified concept to prevent chipping.



Clinical performance of Cercon® restorations

Another clinically relevant aspect that is unique to the Cercon system is that it is clinically documented for the extended indications of

- Multi-span bridges
- Cantilever bridges



Multi-span bridges

The clinical performance of multi-span Cercon bridges has been examined by one clinical study over an observation period of two years (Schmitter et al., 2009): "The study indicates that such restorations are possible in principle; however, no more than two adjacent teeth may be replaced per bridge span." However, the short observation period and the limited number of cases included in the study only allowed a preliminary estimate of clinical performance. Consequently, this approach should be considered only if strict indication exists.



Clinical performance of Cercon® restorations

Cantilever bridges

For Cercon cantilever bridges, two studies are extent covering observation periods of up to 4 years (Rinke, 2006; Wolfart et al., 2009). No framework fracture was observed in either of these studies, and survival rates were 92% after 3 and 4 years, respectively. All failures were caused by biological complications (tooth fractures, root fractures, endodontic complications). The study results available so far show that zirconia cantilever bridges are sufficiently fracture-resistant. As in bridges with metal frameworks, cantilever bridges to replace molars are associated with an elevated failure risk. Including endodontically treated abutments also increases the risk of premature loss. If the distal bridge abutment or even both abutments have been endodontic treatment, the idea of rehabilitating the patient with a cantilever bridge should be viewed with great caution.



The clinical recommendations with regard to tooth preparation, impression are the same as for zirconia-based bridges with distal end abutments. We recommend the following for cantilever bridges:

- The mesiodistal length of the cantilever must not exceed 8 mm (1 premolar width)
- The cantilevered pontic should be connected at least to two splinted crowns (double crown) or to a bridge with abutments at either end.
- The cross-sectional area of the connector to the cantilevered pontic must be at least 9 mm².
- The wall thickness must be at least 0.4 mm. It is recommended to provide for a thickness of 0.6 mm of the axial wall of the framework (the wall facing the pontic).
- Extensions may be mesial or distal. Cantilevered pontics should be located no further distally than the region of the first molar.
- The preparation should follow the well-known recommendations for zirconia all-ceramic restorations, i.e. it should feature a shoulder with a rounded internal line angle or a 90° chamfer with a 1.0-mm cervical cutback.
- If the design of the extension bridge provides adequate retention thanks to a sufficient axial height of the abutment (at least 4 mm), the bridge can be cemented with traditional zinc phosphate or glass ionomer cements. However, it is recommended to cement the bridge adhesively to ensure better retention.

Product recommendations

The following recommended products from the DENTSPLY group's portfolio will greatly assist you in achieving restorative success:

Impression

Aquasil Ultra
(DENTSPLY DETREY, Konstanz, Germany)

Veneering

Cercon® ceram Kiss
Cercon® ceram love
(DeguDent, Hanau, Germany)

Adjustments

TwisTec
(DeguDent, Hanau, Germany)

Provisional cementing

Integrity Temp Grip
(DENTSPLY DETREY, Konstanz, Germany)

Definitive cementation – conventional

SmartCem2
(DENTSPLY DETREY, Konstanz, Germany)

Definitive cementation – conventional/adhesive

DENTSPLY Cementation System
(DENTSPLY DETREY, Konstanz, Germany)

References

- Al-Amleh B., Lyons K., Swain M.:** Clinical trials in zirconia: a systematic review. *J Oral Rehabil* 2010;37:641-652
- Beuer F., Edelhoff D., Gernet W., Sorensen J.:** Three-year clinical prospective evaluation of zirconia-based posterior fixed dental prostheses (FDPs). *Clin Oral Investig.* 2009;13:445-451.
- Christensen RP., Ploeger B.J.:** A Clinical Comparison of zirconia, Metal and Alumina Fixed-Prosthesis Frameworks Veneered with Layered or Pressed Ceramic: a Three Year Report *J AM Dent Assoc* 2010, 141, 1317-1329.
- Piwowarczyk A., Lauer H.C., Sorensen J.A.:** The shear bond strength between luting cements and zirconia ceramics after two pre-treatments. *Oper Dent.* 2005 May-Jun;30(3):382-8
- Rinke S., Jenatschke R.:** A Temporary Cementation of Zirconia-based Single Crowns and Fixed-partial-dentures - Results from a Clinical Trial. *J Dent Res* 82 (Spec Iss B): abstract No. 818, 2003
- Rinke S., Roediger M., Huels A.:** 2111 Practice-based retrospective study on the complication rate of molar crowns. *J Dent Res* 89 (Spec Iss B): abstract No. 2111, 2010
- Rinke S.:** Klinische Bewahrung von vollkeramischen Extensionsbrucken: 30-Monats-Ergebnisse. *DZZ* 2006;61;422-426
- Roediger M., Gersdorff N., Huels A., Rinke S.:** Prospective evaluation of zirconia posterior fixed partial dentures: four-year clinical results. *Int J Prosthodont*, 2010 Mar-Apr;23(2):141-8.
- Rues S., Kroger E., Muller D., Schmitter M.:** Effect of firing protocols on cohesive failure of all-ceramic crowns. *J Dent.* 2010 Dec;38(12):987-94. Epub 2010 Aug 27. PubMed PMID: 20801183.
- Sailer I., Gottnerb J., Kanelb S., Hammerle C.:** Randomized controlled clinical trial of zirconia-ceramic and metal-ceramic posterior fixed dental prostheses: a 3-year follow-up. *Int J Prosthodont.* 2009 Nov-Dec;22(6):553-60
- Schley J.S., Heussen N., Reich S., Fischer J., Haselhuhn K., Wolfart S.:** Survival probability of zirconia-based fixed dental prostheses up to 5 yr: a systematic review of the literature. *Eur J Oral Sci.* 2010 Oct;118(5):443-50.
- Schmitt J., Wichmann M., Holst S., Reich S.:** Restoring severely compromised anterior teeth with zirconia crowns and feather-edged margin preparations: a 3-year follow-up of a prospective clinical trial. *Int J Prosthodont.* 2010 Mar-Apr;23(2):107-9.
- Schmitter M., Mussotter K., Rammelsberg P., Stober T., Ohlmann B., Gabbert O.:** Clinical performance of extended zirconia frameworks for fixed dental prostheses: two-year results. *J Oral Rehabil.* 2009;36:610-615.
- Wolfart S., Harder S., Eschbach S., Lehmann F., Kern M.:** Four-year clinical results of fixed dental prostheses with zirconia substructures (Cercon): end abutments vs. cantilever design. *Eur J Oral Sci.* 2009 Dec;117(6):741-9.

Fascination Prosthetics

28009/1103/GVD
Last revision: 03/2011

