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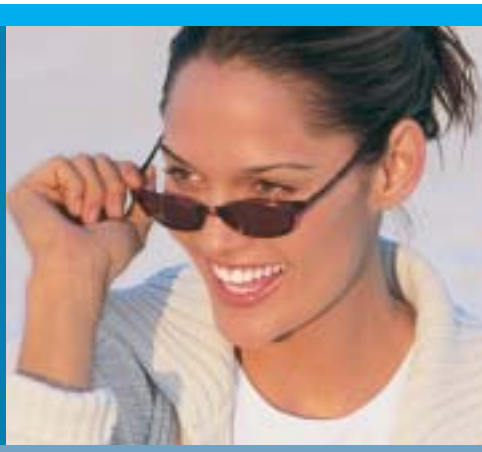
Cercon™

The All-Ceramic CAM System
Quintessence Special Edition



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Quintessence

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Special Edition

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Cercon® - The CAM All-Ceramic System by Degussa Dental

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Cercon® - The All-Ceramic CAM System by Degussa Dental

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Medical advancement is closely tied to the further development of methods, material, and devices. The section "Innovations" offers current information on innovations in the area of dentistry. Not all of the products and procedures described here have been proven in the long term. Ideas or work hypothesis may still be formulated. This section is intended to offer creative authors the possibility of scientific discussion. The Editor

Keywords: All-ceramics, zirconia, CAM, Cercon®

SUMMARY

Patient's demands for all-ceramic restorations continue to increase. With the all-ceramic CAM system Cercon®, Degussa Dental offers a complete system consisting of an innovative processing technology for the framework material zirconia, as well as new veneering ceramics optimally adapted to the framework. With its coordinated components, this system offers the dental technician a high degree of processing reliability. For the practicing dentist and the patient, the clinical study done at the University Dental Clinic of Zurich, successfully running now for the past 2.5 years, offers an assurance of safety.

Introduction

More and more patients demand all-ceramic restorations, although the ceramic veneering of precious metal alloys has been clinically and esthetically proven over decades. The essential reasons for striving for all-ceramic restorations is the freedom from metal and the desire for perfect esthetics. Additionally, dental materials are required to have a long life and a high degree of biocompatibility.

The technology currently available in the dental laboratory, however, has safely allowed essentially only single unit restorations with all-ceramics. The use of all-ceramic systems for bridges was — if at all possible — limited. Clinically, all-ceramic systems showed clearly higher damage rates percentage-wise as compared to conventional restorations based on precious metal alloys.

Many patients also desire all-ceramic restorations in the posterior dental segments. The only ceramic material reliably suitable for bridge framework in the posterior dental segment is the high-performance ceramic zirconia. It has been the center of dental research for a long time.

Today, zirconia is already being used in a few industry branches, such as for hip joint prostheses in medical technology. It was the aim of dental technology to develop an economical procedure with which individual frameworks could be fabricated in the dental laboratory. The procedure was to allow for optimal integration into existing work methods and operations in a dental laboratory. This objective was achieved by Degussa Dental with the all-ceramic CAM system Cercon®, which was first introduced to technical audiences during the IDS 2001 show in Cologne, and which was received with broad interest.

Characteristics of Zirconia

The high-performance ceramic zirconia has some fascinating features: It has outstanding characteristics, is biocompatible, and possesses an esthetically white color. By adding a small amount of yttrium oxide, a micro-structural transformation of the framework can be used specifically for an increased reliability of zirconia. The ceramics expert therefore talks of Y-TZP — zirconia stabilized with yttrium oxide.

The characteristics of the high reliability in zirconia essential for dentures also has the disadvantage that the processing of the material in its highly dense state is very difficult, i.e., is possible only with diamond tools. Some CAD/CAM procedures for dental technology do take this "rocky road" of a time-consuming and machine - and tool - wearing processing method.

The basic idea of the all-ceramic system Cercon® is to mill a ceramic design in its soft presintered condition, in order to then achieve the special reliability characteristics of the zirconia by a subsequent sintering process.

Fabrication Methods

By using precise industrial processing, it is possible to create extremely homogenous blanks from zirconia in a presintered (partially sintered or bisque) state. The sintering process then achieves 100% of theoretical final density in these blanks within the scope of measuring accuracy. In this way, the shrinkage from the presintered condition to the dense condition can be exactly calculated. The desired structure, i.e., the framework, can therefore be enlarged by the exact shrinkage in the sintering process.

This procedural idea was developed in collaboration between the ETH Zurich (Prof. *Gauckler* et al.), and the University Dental Clinic of Zurich (Prof. *Schärer* et al.) insofar as frameworks could be fabricated for a clinical study[1]. This study has now been running for approximately 2.5 years, and so far not a single case of damage has occurred. The one-year results have already been published[2].

Preparation by the Dentist

The preparation by the dentist is largely done in accordance with the principles common today for all-ceramic systems. A shoulder or chamfer with a preparation depth of approximately 1 mm is required. Occlusally, the stump of the tooth should not have any sharp margins: due to the milling tools, the system requires a minimum radius of approximately 0.4 mm, and an opening angle of at least 140°. Additionally, an area of 1.5 to 2 mm should be occlusally prepared for an esthetic veneer. Furthermore, a conical preparation of 6 to 8° of the stump of the tooth is recommended. Generally, the preparation of the tooth structure can be less invasive, because the minimum wall thickness for the framework is only 0.4 mm due to the high reliability of zirconia.

Procedural Steps in the Laboratory

After making an impression mold and fabricating a plaster model, the dental technician creates a wax model framework as is usual for precious metal alloys. All modeling materials common in the dental laboratory may also be used for the modeling. The wax model must be easily removable from the plaster model and without any undercuts (fig. 1). The wax model is then anchored onto a special holding appliance using wax rods. This holding appliance is clamped on the left side into the combined scanning and milling unit Cercon® brain (fig.2). The zirconia blanks are attached in their presintered condition (Cercon® base) on the right side. Cercon® base is available in three different sizes, each for anatomical lengths of 12 mm, 30 mm, and 38 mm. A barcode is attached to each blank, which contains the enlargement factor and other milling parameters.

Following the attachment of both holding appliances, Cercon® brain is started by the push of a button. Subsequently, a fully automatic procedure including scanning and a rough, as well as a fine milling process is performed on the occlusal and gingival aspects. The complete procedure takes approximately 35 min. for a single crown, and approximately 80 min. for a four-unit bridge.

Fig. 1 The wax model on the plaster model

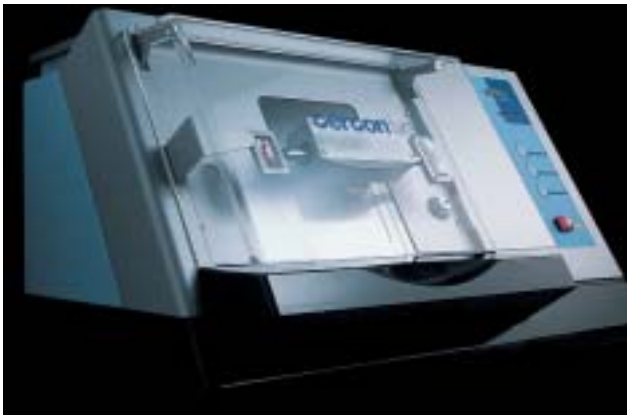

Fig. 2 The scanning and milling unit Cercon® brain specially developed for the framework material zirconia

Fig. 3 The high-temperature sintering furnace Cercon® heat

Fig. 4 The zirconia framework modeled to a perfect fit on the plaster model after the sintering process

Fig. 5 The zirconia framework veneered with new Cercon® ceram.

After the milling process is completed the holding appliance is removed from the Cercon® brain and the bridge framework is separated from the pin retentions. The framework is now ready for sintering.

The capacity of the sintering oven Cercon® heat is a daily production amount of approximately 30 units (fig. 3). It is recommended to start the sintering procedure in the evening — also by the push of a button — and to let it run overnight (sintering duration approximately 6 hrs).

The special feature of the Cercon® system is therefore the fact that the shinkage of the zirconia blanks is achieved evenly and linear in all three dimensions by the processes of scanning, enlarging, milling and sintering. This is the prerequisite required for fabricating framework to a perfect fit (fig. 4).

The high-strength, high-toughness zirconia framework can now be veneered using the veneering ceramic Cercon® ceram especially developed for zirconia. Zirconia has a coefficient of thermal expansion CTE of approximately 10 ppm/K, and Cercon® ceram was specially formulated for this CTE. The specific variation of opalescence and fluorescence allows for the perfect imitation of nature with Cercon® ceram (fig. 5).

With its wide selection of over 100 different shades available, Cercon® ceram meets all esthetic demands. In addition to the basic assortment, the special assortments “Light Dynamics,” “Chroma Dentins,” “Modifiers,” “Shoulder Pastes,” “Gum Shades,” and “Bleaching” will also be available. The very smooth fired surface of Cercon® ceram will further support the gingival-friendliness of this veneering ceramic material. A high level of compatibility between the framework material and Cercon® ceram has already been impressively proven in in-vitro testing.

The basic assortment will be available soon. The complete Cercon® system will be introduced to the market in October 2001.

Summary

Degussa Dental, the inventor of the Golden Gate System®, has achieved the development of a complete system with Cercon®: The framework material, the veneering ceramics, and the process technology in the form of both processing devices have been developed integrally so that optimal compatibility of the components is ensured. The Cercon® system was developed especially for the framework material zirconia.

This high-strength material, a harmonized system, and the successfully running clinical study provide a high degree of safety — to the patient’s benefit.

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