What are the benefits of “white steel”?

Summary of an interview with Prof. Dr. Peter Pospiech, Director of the University of Saarland Clinic for Prosthodontics and Dental Materials in Homburg. This mentor of full ceramic restoration plans to treat his patients exclusively with full ceramics within the next few years.

The demand for full ceramic restorations, which are usually produced with the help of computers, has been increasing for years. Thus, some 1.8 million full ceramic inlays, crowns and bridges were inserted in Germany during the past year alone. What were the driving forces behind this trend? Was it the patients’ general awareness of aesthetics or their desire for increased safety through biological compatibility?

Full ceramics can replace metal in the mouth

In the past, metal was primarily used to treat defective teeth. Thus, for example, amalgam was used for “plastic” (molded) fillings and precious metal was used for cast fillings, crowns and bridges. As a substance which is alien to the human body, metal does represent a mechanically stable repair material, however, is aesthetically unsatisfactory and chemically unstable when inserted in the oral cavity. Due to their composition, ceramic materials more closely resemble natural dental enamel, which consists of over 90 per cent inorganic material. The biomimetic and dark-colored crown margins, all of which are stumbling blocks in metal ceramics, are no longer a problem with full ceramics. 

Cell biologists and dermatologists therefore attest to the high tissue compatibility of this material. Patients who react sensitively to certain metals can alternatively be treated with full ceramics in many cases. 

As far as natural appearance and biocompatibility are concerned, full ceramics are today’s first choice. Attractive solutions can be achieved more easily using these materials, since their tooth-like light transmission properties are not impaired by a metal framework. In addition, the “chameleon effect” attributed above all to silicate ceramics enables adaptation to the artificial crowns and bridges located in the surrounding row of teeth. The considerably lower thermal conductivity in comparison to metal provides the basis for enhanced wearing comfort. Corrosion, blocking of transmitted light and dark-colored crown margins, all of which are stumbling blocks in metal ceramics, are no longer a problem with full ceramics.

While alloys with a high gold and titanium content were once the only means of avoiding incompatibility reactions, they also failed to satisfy the patients’ wishes for an attractive, metal-free solution. Metal crowns and bridges still set the “gold standard” when it comes to durability. However, after 12 years of clinical testing, full ceramic inlays and onlays have also attained the “gold standard” – i.e. a survival rate of 90 per cent, which is comparable to that of metal restorations. Ten years of clinical experience have shown that full ceramic crowns made of silicate ceramics and infiltrated oxide ceramics have survival rates of 85 per cent. This corresponds to the durability of metal-supported restorations. However, despite considerable advances in the development of materials, full ceramic restorations have not yet become standard therapeutic solutions for comprehensive restorations in routine dental care. Not every patient is suitable for this type of treatment. The space required for the minimum wall thicknesses of these materials, and especially for bridge segments, must be available. Patients who grind their teeth are especially at risk. It is therefore advisable to fit them with a protective mouth-piece to be worn at night. Nevertheless, a full ceramic restored tooth and the tissue surrounding it have a health-promoting appearance. Can still be achieved with a metal-supported restoration.

Editorial

Why a CEREC Newspaper? Aren’t there enough papers already? Well, maybe not.

These are fast-paced times; changes seem to occur almost every day. And that also applies to dentistry and dental technology, where new methods of treatment and innovative work techniques are constantly being discussed. And where questions such as: “Do I really need this?” “Should I invest here?” and “Will this be a lasting innovation” or “Will it already be replaced by another one tomorrow?” constantly arise. Take for example the computer-aided manufacture of full ceramic restorations. During the past few years, technological quantum leaps have been achieved in this area and high-performance ceramic materials have entered the market. And yet the same old question still remains: “Are these systems adequate-ly perfected, practically tested and proven, economically justifiable and future-safe?”

This is the gap that the “CEREC Newspaper” intends to close. It will provide information for everyone interested in the clinical and technical aspects of modern CAD/CAM technology in dentistry. Materials, techniques and equipment will be introduced, new topics will be discussed and interesting information will be brought into focus – always under the perspective of “What can I do better, faster, more simply or more economically than with my traditional possibilities?”.

Software and hardware specialists and users of CAD/CAM from clinics, practices and laboratories will use this forum to provide scientific evidence as a basis for your future decisions concerning computer-aided dental restoration systems.

Dr. Wilhelm Schneider
45 minutes in the name of the crown

“The operation must be extremely easy and the occlusal surface must be calculated automatically.”

That’s right. And it must be possible to automatically adapt it to the antagonists just like the proximal contact points. “Hhm, OK – but what about the aesthetics?” “The aesthetics are simple. Multi-coloured blocks from which the crowns are milled.” “Not bad. And what about bonding?” “Well, what you really should have for bonding is a material that adheres to dentine better than adhesive bonding materials and can be worked as easily and quickly as cement...”

Discussions of this sort probably took place regularly during the early years of computer-aided dental restoration, especially whenever Professors Werner Mörmann and Francois Duret reported on their inventions and innovations at dental congresses. Today, 20 years later, these visions of yesterday have become reality. Technical advances have brought about new possibilities and today CEREC is the easy-to-operate system that Professor Mörmann had envisioned many years ago. Everything can be displayed, moved, rotated and evaluated from all perspectives and in 3D on the monitor. The possibility of interpolating multiple images of the preparation and of the antagonists enables exact adaptation of the proximal and occlusal contact points to neighbouring and opposed teeth. At the same time, the manufacturing accuracy has constantly been improved until it now has reached, and in some cases even surpassed, the precision of laboratory work. The scope of indication was also extended – from inlays to onlays, partial crowns and veneers, culminating in full ceramic crowns for the anterior and posterior tooth regions. Since inlays, onlays and partial crowns are also always equally important, the latest version of CEREC software concentrates on the production of crowns. You can select the best fitting crown from several different dental databases and CEREC then automatically adapts it to match the neighbouring teeth and antagonists. Fully automatic milling of the crown from a single “multi-coloured” ceramic block takes slightly more than 10 minutes, after which the enamel coating can be applied by your dental assistant. Then you insert the crown, remove the excess material and check the contact situation. Finished! A lot has changed regarding bonding materials too. Although long-term clinical studies involving traditional adhesive materials are still yielding outstanding results, some companies are beginning to recommend the use of “self-adhesives” which attain equally good or better adhesion coefficients for ceramics and dentine, but can be worked much like traditional cements. Thus, for the first time ever, it is now possible to economically produce and fit aesthetic, durable, full ceramic crowns with a high degree of clinical perfection during a single treatment session. And what’s really great is that this type of treatment is not only fun to perform, but that patients will recommend you to others.

What are the benefits of “white steel”?

The zirconium oxide ceramics used for crowns and bridges are so robust that they can withstand a pressure of 10 tons per cm². Ceramic restorations are milled from industrially manufactured ceramic blocks with the help of a computer and CAD/CAM software. One advantage of this process is the uniform quality of the ceramic materials. Moreover, you always have the entire operating process completely under control, since the design is checked on screen regarding the feasibility of the minimum wall thicknesses, the insertion axis, and the strain placed on the occlusal surface. In addition, reproducible data which can be used to reveal the failure risk factors in critical cases is provided prior to each design step. Last year alone some 600,000 restorations were produced with computer-aided systems and inserted in Germany. Zirconium oxide ceramics appear to be opening up a new perspective that will enable dentists to use this “white gold” instead of bridges made of precious metal. Metal will remain an important factor in dental practices over the medium term since, based on experience, good results have also been obtained with metal-supported crowns and bridges. However, aesthetics will certainly play a limiting role here, especially regarding crown margins, where problems such as a lack of colour depth and corrosion frequently occur. A large body of data based on 5 years of clinical experience is now available regarding zirconium oxide ceramics used for inlay bridges, crowns, multi-segment bridges and implant crowns. All of the studies conducted at university clinics during this period have revealed no occurrence of framework fractures whatsoever, but only incidents also observed to a similar degree in connection with metal ceramics.
2328 inlays cannot be wrong

CEREC restorations have a survival rate of 95.5% after 9 years.

A study conducted by Dr. Anja Posselt and Prof. Dr. Thomas Kerschbaum is especially remarkable for several reasons. First, an unusually large number of restorations were examined (784 patients with 2328 CEREC inlays). And second, all of the fillings examined had been manufactured chairside and adhesively inserted during a single appointment at a conventional dental practice over a period of several years. Afterwards, these restorations were carefully examined at the Center for Dental & Oral Medicine and Craniofacial Surgery at the University of Cologne. The margin quality, edge gap, and fractures in the edges of the dental enamel and the ceramic materials were checked for all of these restorations 9 years after the date of insertion. The clinicians conducting the study concluded that 95.5% of the inlays examined were still clinically intact. Only 55 CEREC restorations were judged to be a failure; the reasons for this included extraction of a tooth (n = 8), reconstruction of an occlusal surface (n = 5), tooth fracture (n = 6) and inlay fracture during trepanation (n = 5), all of which constitute events that also occur in connection with cast gold fillings. Comparisons contrasting upper jaw with lower jaw treatments and involving a previous Cp treatment showed no influence on the results of treatment. Molar inlays tended to fare slightly better (96 per cent). Whereas single-surface fillings showed a survival rate of 99.2 per cent after 8 years, this figure dropped to 92.7 per cent in connection with four-surface restorations. CEREC restorations which had primarily been manufactured for avital teeth showed a slightly lower survival probability of 94 per cent. All results are significant, with a confidence interval of 95 per cent. If the large number of inlays examined is also taken into account, this data excludes the possibility that a random result was obtained. The authors reached the conclusion that, based on these survival probability figures, CEREC inlays have already reached the “gold standard”, i.e. attained the durability of cast fillings. The findings of this internationally recognized study were published in the International Journal of Computerized Dentistry, Vol. 6, 5, pp. 251-258, 2005.

CEREC Chairline – perfect workflow

“Treatment workflow is only comfortable if you have a smooth transition between patient counseling and the CEREC restoration process per se”, says Munich dentist Dr. Hans Müller. This was precisely the objective of integrating CEREC into the treatment center.

Perfect workflow:
With CEREC Chairline, the CEREC camera is always within easy reach.

High-quality ambiance in the treatment room:
Integration saves workspace in the treatment room. The cable runs are integrated in the treatment center to prevent tripping hazards.

Superior ergonomics during treatment:
Image acquisition is triggered from a comfortable treatment position by actuating the foot switch of the treatment center. The viewing screen is optimally positioned for viewing by the operator and the patient.

Perfect operation:
Integration makes the CEREC treatment self-explanatory. If you wish, you can allow the patient to experience the design and manufacture of his own restoration without having to assume an uncomfortable posture or interrupt your own workflow.

Since the costs are only slightly higher than for a modular solution, CEREC Chairline is an interesting offer for anyone who needs a new treatment center and would also like to make use of the appeal that treatment with the CEREC system has for most patients. And the resulting increase in practice revenue also helps finance the treatment center.

CEREC crowns with biomimetic occlusal surfaces

It generally pays to learn from nature. And in most cases you will find that the “natural” solutions are not only unbelievably simple, but also function outstandingly. One case in point is the innovative way CEREC calculates the occlusal surface.

Technological advance often makes things affordable today which have long been possible, however, until recently were too expensive and too complex for practical application. Today it is possible to manufacture full ceramic crowns in the practice very quickly and very simply. You have the choice of producing an optical impression via a model or directly in the patient’s mouth. You acquire several optical impressions of the preparation and the neighbouring teeth comparable to a bite registration or an FGP almost the way you would with an intraoral camera, except that you use the CEREC 3D measuring camera instead. Based on these images, CEREC then calculates a model which is displayed in 3D on the monitor screen and can be examined from all perspectives. In the first step, you then trim the model of your bite registration – on screen with CEREC, of course. This is not only faster and more precise, but very easy to do as well. Then you show CEREC where the preparation margin is located and CEREC detects it automatically and precisely. Since you have an exact idea where the proximal contacts should be located, you simply mark these points by double-clicking the neighbouring teeth and CEREC automatically adapts the crown to suit your wishes. You select the best fitting crown from a dental database; for this purpose, the databases of several manufacturers, such as Vita, Ivoclar Vivadent and Heraeus Kulzer as well as an Asian tooth library with a selection of smaller teeth are all at your disposal. In addition, a dental database from American dental technician Lee Culp featuring access to various degrees of abrasion (youth, adult, mature) is also optionally available. CEREC thus gives you all the information you need to perfectly fit crowns. In a manner quite similar to the natural process of toothing, CEREC rotates and moves the exact occlusal surface of the database crown in all directions until it optimally matches both the existing and the opposite row of teeth.
(Continued from page 5)

CEREC crowns with biomimetic occlusal surfaces

Then CEREC moves all cusps individually to create additional possible contact points.

Finally, possible premature contacts are milled virtually. You can then either accept the suggested milling process or modify it using all of the tools provided by CEREC 3D. Your crown will then be milled from a ceramic block with high precision in only a few minutes.

The idea for this biomimetic automatic adaptation process was conceived and further developed in cooperation with Professor Kordass of the University of Greifswald. Renowned for his work in the field of “Applied Computer Science in Dental, Oral and Craniofacial Medicine” and as a recognized expert on “virtual articulation”, Professor Kordass played a decisive role in opening up a new chapter of CAD-generated restorations with CEREC and may well have written dental history in the process. Because this process is not only adopted directly from nature, but also can be performed much faster and more efficiently than a wax-up of an occlusal surface. Furthermore, it enables you to manufacture full ceramic crowns of high clinical perfection easily and cost-effectively and – if you prefer – to insert them during the same treatment session.

It used to be commonly assumed that patients who choose ceramics are primarily interested in natural-looking fillings and crowns. However, most patients are actually motivated by a desire for metal-free restorations as a means of minimizing their overall health risks. As many people probably already have learned from television broadcasts, press releases or their dentists, it is certainly beneficial to your health not to have any metal inserted in your mouth. Ceramics are chemically insoluble and corrosion-resistant and, since they do not trigger any interactions with the tissue, are completely biologically compatible as well. Having considered the recent rise in the occurrence of allergies and the resulting increase in the health awareness expressed by many patients, it only follows that there is also a growing potential for biologically compatible treatment with full ceramics.

Most patients considered it important to preserve healthy tooth substance as far as possible and by any means necessary. This aspect of full ceramics was ranked second in the patient survey. And it actually involved two points: First, a defect-orientated preparation is much more substance-saving for an adhesive partial crown than for a traditional crown. And second, in case the neighbouring teeth have been treated with metal, only the restoration which is actually defective must be replaced. Therefore, only carious hard dental tissue must be removed for defect-oriented restorations. No retention surfaces required for metal restorations and as a consequence, the preparation is much more substance-saving.

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The choice is yours!

M1® and C2® offer you many natural tooth features including a motor-driven programmable true-profile design element and a manual true-profile design element. Furthermore, both have a truly different design and individual treatment concept.

M1®
- L-shaped aluminium support arm system
- Intuitive control panel with single functions
- Face control with M1 functionality

C2®
- Silent drives with tear-resistant support arm system
- Innovative control panel with LED cursor navigation
- “Switch-free” operation optional

Kindly contact your Sirona distributor for further information relating to M1® and C2®. Sirona puts technology into practice.

What does CEREC offer for patients and dentists?

According to surveys conducted by the Arbeitsgemeinschaft für Keramik in der Zahnheilkunde (Association for Ceramics in Dentistry), 1.8 million full ceramic restorations were inserted in Germany this past year. What were the driving forces behind this trend? A patient poll conducted by the Deutsche Gesellschaft für Computergestützte Zahnheilkunde (German Society for Computerized Dentistry) examined the question of why some patients have opted for full ceramic restorations and for CEREC.

The clinical worth of CEREC restorations has been substantiated by a large number of studies. This also applies to full ceramic crowns, which already have been successfully manufactured with CEREC for several years. Thus, for example, patients who had been fitted with CEREC crowns made of feldspathic ceramics underwent follow-up examinations as part of a study conducted in Zurich. The rate of loss of the restoration during a single clinical appointment. No temporary filling is required. This comfort and convenience meets the high expectations of today’s patients. Especially patients who work full-time are bound to appreciate the time savings involved here.

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