CEREC – a completely new restorative procedure – was ‘born’ a quarter of a century ago. Admittedly, there were initial teething troubles. However, from the outset the CEREC ‘parents’ were convinced that their brainchild had the potential to revolutionize dental treatment. And they were proved right. More than 250 clinical studies testify to the quality and longevity of all-ceramic chairside restorations. CEREC restorations also come out top in terms of cost-benefits/survival rates.

The CEREC system not only fulfils strict clinical demands, but has also enabled and determined the development of numerous other computerized therapy procedures. For example, the short-wavelength blue light emitted by the CEREC AC camera provides the basis for capturing entire jaw arches with unprecedented precision. As a result analog impression-taking methods will be superseded more and more by digital methods. This will have a far-reaching impact on many other conventional treatment methods.

There are many reasons to celebrate the CEREC success story. To mark CEREC’s 25th birthday we will be holding a high-profile conference and training event. So join in the celebrations and meet the rest of the CEREC community in Las Vegas.

Content:
- CEREC 25 in Las Vegas
- Clinical performance of the CEREC system
- Tips & Tricks inEos Blue
- CEREC meets GALILEOS

1. CEREC 25 in Las Vegas

Registrations are in full swing

As announced in the December 2009 issue of “Dental Information”, the eagerly awaited “CEREC 25th Anniversary Celebration” will take place at Caesars Palace in Las Vegas from 26 to 28 August 2010. The program will comprise more than 50 lectures and workshops featuring over 50 distinguished speakers from the international dental community.

The list of contributors will include some of the most eminent exponents of dental CAD/CAM – for example, the ‘father’ of CEREC, Prof. Dr. Dr. Werner Mörmann; the inventor of biogenerics, Prof. Dr. Dr. Albert Mehl; Dr. Frank Spear; Dr. Gordon Christensen; Dr. Rella Christensen; Imtiaz Manji; Dr. James Klim; Dr. Mark Morin; Dr. Sameer Puri; Dr. Mark Hyman; Fred Joyal; Dr. Dennis Fasbinder; Dr. Bernd Reiss; Dr. Klaus Wiedhahn; Matt Roberts, CDT; and many more besides. The scientific and practice-oriented lectures and workshops will offer valuable and unique opportunities for continuing education – for dentists, practice teams and dental technicians. Detailed information about the program and the speakers is available at www.cerec25.com

The CEREC 25th Anniversary Celebration is the culmination of a unique success story. Thousands of dentists and dental technicians from all over the globe will gather at this event, where they will be able to swap ideas and experiences across national boundaries. Anyone who is interested in the integration of digital technology into dental practices and laboratories simply cannot afford to miss the CEREC 25th Anniversary Celebration.

Entertainment is an indispensable part of a proper birthday celebration. The five-time Emmy winning comedian and actor Dennis Miller will transform CEREC 25 into a uniquely memorable experience. Our CEREC 25 Party in the “Pure” night club will make a big impact on the guests.

Registrations and additional information for the CEREC 25th Anniversary Celebration can be made via www.cerec25.com. If you book before 30 April 2010, you will qualify for our reduced “Early Bird” rates. The regular rates will apply after this date.

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2. Clinical performance of the CEREC system

25 years of experience - In praise of the world’s most successful dental restoration system.

Progress often entails considerable effort. At the 1984 Olympics Carl Lewis, USA won the 100 metre sprint in a record-breaking 9.99 seconds. In 2008 Usain Bolt, Jamaica covered the same distance in 9.58 seconds. This represents a gain of just 0.41 seconds – after 24 years of effort and progress in sports medicine, ergonomics and materials research. Without wanting to belittle these spectacular sporting achievements, all-ceramic CAD/CAM dental restorations made sensational progress over the same period. Indeed, they heralded in an entirely new era in dentistry. CEREC first saw the light of day 25 years ago and is one of the most frequently investigated restoration systems on the market. Over the past quarter century 20 million CEREC restorations have been created worldwide.

Twenty-five years ago the proponents of computer-aided all-ceramic restorations displayed visionary foresight. In the following years dedicated practitioners built on this vision by achieving increased restoration survival rates and by developing cost-effective working practices for the various generations of the CEREC system. In their role as CEREC multipliers, university academics, clinicians and dental practitioners have carried out follow-up studies and demonstrated that adhesively bonded, chairside restorations i.e. without resorting to temporaries produce outstanding long-term results. Following the publication of internationally reported long-term study data CEREC was awarded the “Gold standard”. In other words, the survival rates after 18 to 20 years are in a corridor that had previously been dominated by metal-based restorations.

Temporaries weaken the enamel margins

When examining the clinical performance of CEREC it is important to discuss the influence of enamel integrity and marginal quality, as well as the effect of temporaries on cavity treatment. In an experiment involving a chewing simulator Roland Frankenberger, Marburg University established that the placement of temporary restorations has a significant negative impact on the integrity of the tooth enamel. Cracking occurred especially in the oral and vestibular surfaces and marginal chipping was also observed. Such enamel defects did not occur in cavities which had been treated immediately using chairside-fabricated CEREC ceramic inlays. Frankenberger concluded that the elimination of the temporary restoration reduces the risk of enamel cracking and marginal chipping. The CEREC inlay creates a force-locked bond with the hard tooth tissue and reinforces the cavity walls. By contrast, the non adhesively luted temporary inlay lies like a wedge in the cavity and transmits the chewing forces directly to the weakened residual tooth. Under the influence of chewing forces the tooth is subjected to torsional stress due to the low elastic modulus of the temporary composite material. This results in an uneven stress distribution, with stress peaks at the interface between the tooth and the temporary. The transmitted force also deforms the inadequately protected cusp walls. In addition, the contamination of the hard tooth tissue with temporary cement compromizes the subsequent bond between the enamel/dentine contact surfaces and the silanized ceramic material. An examination of luting systems revealed that conventional multi-bottle systems are still superior to self-adhesive systems. The selective etching of the enamel enhances the bond with the hard tooth tissue, as well as the quality of the margins. Wider adhesive gaps are not detrimental to margin quality. (Frankenberger, R., Lohbauer, U., Taschner, M., Pitschelt, A., Nikolaenk, S.A.: Adhesive luting revisited: influence of adhesive, temporary cement, cavity cleaning, and curing mode on internal dentin bond strength. J Adhes Dent 2007; 9 Suppl 2: 269-73 - Frankenberger, R.: Hat der Randspalt ausgespielt? Zur Widerstandsfähigkeit der Klebefuge von Cerec-Inlays. ZWR 2007; 116 (3): 9-11).

Total length of enamel cracks according to TML
Measurements of enamel margin defects with and without the deployment of temporary restorations. Cavities treated with chairside ceramic restorations shown at the bottom of the graph displayed the least occurrence of enamel cracks.

**CEREC conforms to the gold standard**

More than 250 clinical investigations of CEREC restorations have been carried out. In particular, the long-term studies by Bernd Reiss, Winfried Walther, Tobias Otto, Sabatino de Nisco and David Schneider fulfill the requirements of evidence-based study design. Treatment was carried out under the conditions of a private dental practice. Reiss and Walter monitored 1,010 CEREC inlays and onlays, some of which had been fabricated using the CEREC I system. After a service time of 15 – 18 years 84.4 percent were clinically perfect. The following failure criteria were applied: loss of the tooth or restoration; fracture with partial loss of the tooth or restoration; marginal caries; marginal repairs; endodontic complications. Up to the endpoint of the study (18.3 years) no further events were observed. The survival rate was in a corridor which had previously been occupied exclusively by cast gold fillings. Dental adhesives were not yet available at the beginning of the study. If the patients are separated into two groups i.e. patients treated with and without the use of a dental adhesive, a significant difference is revealed. Without dental adhesive the survival rate fell to approx. 80 percent after 16 years; with dental adhesive the survival rate was 90 percent. (Reiss, B.: Clinical results of Cerec inlays in a dental practice over a period of 18 years. Int J Comp Dent, 2006; 9: 11-22).

Similar conclusions were drawn by the authors Otto, de Nisco and Schneider (Aarau, Switzerland). Beginning in 1989, these dentists monitored a total of 200 inlays and onlays and evaluated them on the basis of modified USPHS criteria after a period of 17 years. 187 of the restorations were still in place. Of these, 95 were still intact after allowing for technical criteria. Failures with Charlie and Delta ratings (USPHS) occurred between the 6th and 13th year. In most cases these failures were attributable to ceramic fractures. Overall a survival rate of 88.7 percent was achieved, while the annual failure rate was 0.75 percent. The success rate was thus significantly higher than that of layered lab-produced ceramic inlays and was approximately equivalent to that of alternative long-term restorations – e.g. cast-gold inlays, which have a survival rate of 87 percent after 20 years and an annual failure rate of 0.7 percent. (Otto, T., Schneider, D.: Long-term clinical results of chairside Cerec CAD/CAM inlays and onlays. A case series. Int J Prosthodontics, 2008; 21: 53-59).

Gerwin Arnetzl (Graz University) reported positive findings after 15 years. Between 1988 and 1990 he placed 358 two and three-surface inlays made of Dicor, Optec, Hi-Ceram, Duceram and CEREC 1 (Mark I) using the adhesive bonding technique. The control group consisted of cemented gold inlays. After 15 years CEREC and gold had a survival rate of 93 percent. This was significantly higher than the equivalent figure for lab-produced sintered ceramic inlays, which had a failure rate of 32 percent. (Arnetzl, G.: Different ceramic technologies in a clinical long-term comparison. 20-year CEREC anniversary, Berlin, 2006. - Arnetzl, G.: Different ceramic technologies in a clinical long-term comparison. In: Mörmann, W., (ed). State of the art of CAD/CAM restorations. London: Quintessence, 2006: 65-72).

Anja Posselt and Thomas Kerschbaum (Cologne University) analyzed the performance of 2,328 CEREC restorations placed in 794 patients in a dental practice. The survival rate after nine years was 95.5 percent. The filling size, tooth vitality, the prior treatment of caries profunda (CP), the type of tooth and the location of the filling – separated according to the upper and lower jaw – did not have any significant influence on the expected success rate. The most common reasons for failure were tooth extractions (22.9%) and fractures (17.1%). (Posselt, A., Kerschbaum, T.: Langzeitverhalten von CAD/CAM-gefertigten Keramikrestaurationen. Int J Comp Dent, 2003; 6: 231-248. – Gekürzt in ZWR 113, 2004; 1: 15-20).

Reinhard Hickel and Jürgen Manhart (Munich University) 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 outcome: CEREC restorations displayed up to 25 percent fewer failures than cast gold fillings. (Hickel, R., Manhardt J.: Review of the clinical survival of direct and indirect restorations in posterior teeth of the permanent dentition. Oper Dent, 2004, 29; 5: 481-508).

Within the framework of a meta analysis, the clinical survival probability of high-quality conservative restoration types was investigated together with the respective production costs. Gold inlays and CEREC inlays had the highest success rates. The CEREC restorations perform better in terms of cost-effectiveness compared with durability. Cast gold inlays occupy second place due to their higher production costs. (Grandjour, A., Kerschbaum, T., Reis, A., Lauterbach, K.W.: Technology assessment in dentistry. A comparison of the longevity and cost effectiveness of inlays. Int J Technol Assoc Health Care, 2005; 21: 319-325).

**Blue light sees more clearly**

In the new CEREC AC acquisition centre the wavelength of the optical digital camera has been reduced to 470 nanometres i.e. it is now in the blue spectrum. The light beam is concentrated by means of an aspherical lens system and is aligned parallel to the CCD image sensor. This has resulted in increased light sensitivity and an enhanced depth of field. The image acquisition time has been reduced by 50 percent, and the
serial image function speeded up. Surfaces are acquired with greater accuracy, at both short and long range. A new calibration method eliminates distortions at the image margins. This virtually eliminates systematic errors when combining individual images.

Albert Mehl (Zurich University) tested the accuracy of the CEREC AC in comparison with a high-definition stationary reference scanner. His in vitro investigation established an accuracy of measurement of 19 µm for single images. This was very close to the accuracy limits of the extraoral reference scanner. In the case of quadrant images the deviations averaged 35 µm. Measurements performed under real-life practice conditions revealed that the user-related influence was only very slight (tolerance: 10 µm). The initial assumption that the superimposition of several single images would lead to inaccuracies in the overall model has not been confirmed. Superimposition deviations of max. 11 µm are clinically irrelevant and can be ignored. Additional angled images significantly increase the number of measuring points on steeply inclined and/or undercut areas. In the proximal area, in particular, the CEREC AC delivers high-precision images of the preparation margin. This facilitates the improved design of the contact points with reference to the adjacent teeth. In the case of quadrant images the CEREC AC also facilitates the exact determination of different directions of insertion. (Mehl, A., Ender, A., Mörmann, W., Attin, T.: Accuracy testing of a new intraoral 3D camera. Untersuchungen zur Genauigkeit einer neuen intraoralen 3D-Kamera. Int J Comp Dent 2009, 1).

Gerwin Arnetzl (Graz) compared the accuracy of digital impressions and conventional elastomer impressions. Given that a conventional impression subsequently retracts to 98.5 percent, this results in an inaccuracy of fit of 35 – 75 µm for an inlay cavity. To this must be added a further tolerance of 46.5 µm (mean value) in the case of cast objects. Indirectly fabricated crowns therefore display deviations of 114 µm (as confirmed in the scientific literature). Digital impressions generated by different users on the CEREC AC achieve an accuracy of approx. 11 µm (Mehl 2009). In relation to entire quadrants the deviations of analogue impressions are between 72 and 101 µm. By contrast, the measurement error tolerance of the CEREC AC (taking into account precision-enhancing angled images) is in the region of 35 µm. Possible sources of error include incorrect scanner calibration, magnetic interference during image processing, image noise, and software-related factors. On the basis of the above data Arnetzl concludes that – subject to the proper handling of the camera – digital impressions generated on the CEREC AC are more accurate than conventional elastomer impressions. (Arnetzl, G.: Lecture at the DGCZ annual meeting 2009. Publication in progress).

In addition to the above-mentioned studies, authors such as Bindl, Fasbinder, Jedynakiewicz, Martin, Mörmann, Richter and Wiedhahn have acquired extensive experience with CEREC over the past quarter of a century – also in the field of prosthetic rehabilitation – and presented their findings to the international dental community. The unanimous opinion is that the CEREC system fulfills demanding clinical requirements and, as the “doyen of computerized dentistry”, has continuously spawned new applications. On the basis of its 25-year clinical performance CEREC is capable of setting the parameters for future computerized therapy procedures.

Manfred Kern
28 January 2010

3. Tips & Tricks

Rotating multi-colored blocks with CEREC 3D V3.65

For some restorations, multi-colored blocks deliver optimal aesthetic results due to their improved light transmission properties. When using these blocks, it is important to achieve the optimal position of the restoration design within the block before milling. Up until now, it was only possible to move the virtual block around the restoration design laterally, using the “Position” tool. In this CEREC News edition, we will cover rotating the block, as introduced with the Service Pack CEREC V3.65.

Changing the rotation axis

In the milling preview, before choosing a block, set the sprue location. Rotational movement toward / away from the sprue, as well as clockwise/counter-clockwise movement of the sprue itself, is not possible. This strictly limits rotation to the sprue axis, you’ll want to set the sprue accordingly – either on the mesial or distal side in cases of buccal/lingual rotation.

Choosing a multi-colored block

Choose “Select” from the group “Block Visualization”.

Choose a multi-colored block. In CEREC 3D V3.65, the following types are available:

- SIRONA CEREC Blocs PC
- VITA TriLuxe
- VITA TriLuxe forte
- VITA CAD-Temp multicolor
- IVOCLAR VIVADENT IPS Empress CAD Multi
Positioning and rotating the block

Once the virtual block is displayed, position the block so that the chroma layers can be discerned. In most cases, you’ll want to view from the opposite direction as the sprue location. Double-click the desired arrow under “View”.

Use the “Position” and “Rotate” tools to manipulate the block around the restoration. Only two directions are active on the “Rotation” tool: “Lingual” rotates the block clockwise, “Buccal” counterclockwise (when viewing the ceramic side of the block with the block holder pointing away from you).

Position before rotate

If the restoration is too close to the boundaries of the virtual block, the entire structure briefly flashes red and a short tone can be heard.

This is not only the case with the “Position” tool, but also when a rotation would move part of the restoration outside the block. In order to avoid constant red flashes when rotating, center the block around the restoration using “Position” first. Then rotate the crown as desired.

View results

Have a look at the restoration from different angles to make sure everything is set to your liking. Then have fun milling!

That wraps it up for this edition. If you have any questions or comments, please feel free to contact me at christopher.goodson@sirona.com
Until next time, take care and happy milling!

4. inEos Blue

NEW: CAD/CAM scanner featuring Bluecam technology inEos Blue – precision, speed and control

Dental laboratory scanning in a new light: the new inEos Blue boasts Bluecam technology, upgraded scanning software, plus a whole range of user-friendly features. Discover for yourself how the inEos Blue liberates you from standardized scanning routines and allows you to define the scanned area in line with your individual requirements. Experience a new dimension in scanning speed. And exploit the built-in Bluecam technology in order to acquire exact data and achieve precise restoration results.

Further information

5. CEREC meets GALILEOS

The combination of GALILEOS and CEREC sets new standards in implant planning. You can count on
achieving precise prosthetic results – every time. This means that you can plan and place more implants than in the past.

CEREC crowns your implant planning

- Improved diagnostics
  on the basis of high-precision 3D X-rays.
- Simultaneous prosthetic and surgical planning
  without the need for complex adjustments to the implant and the superstructure.
- Improved counselling and patient loyalty
  quicker decisions, enhanced skills, plus positive recommendations for your dental practice.
- Reliable outcomes and perceptible time savings
  thanks to our centrally produced surgical guides (In the near future you’ll be able to fabricate these guides in house with the aid of the CEREC MC XL)*
  * Currently undergoing development and clinical trials.
- Optimum chairside superstructures
  temporaries, custom abutments and permanent restorations, all from a single source.
- Efficient and cost-effective workflow
  no unnecessary referrals to other dental professionals.

GALILEOS – the new dimension for your practice.

Regardless of whether you purchase your own GALILEOS system or collaborate with a GALILEOS dentist – GALILEOS will be a key factor in the success of your dental practice. GALILEOS is a sure-fire investment for all dentists who want to extend their implantology services. For diagnosis, patient counselling, therapy and prevention.

- Unprecedented diagnostic and therapeutic reliability
- Well-informed patients are more willing to accept proposed courses of treatment
- Recruitment of new patients on the basis of personal recommendations
- Higher degree of forensic certainty

The OPEN SI dongle is required for the export of CEREC data to the implant planning software (Sirona Implant). In addition, CEREC 3D V3.60 and Service Pack V3.65 (included on the product CD) have to be installed.

The price for the OPEN SI dongle is €3,990.00. Members of the CEREC Club can purchase the OPEN SI dongle for €990.00. When placing orders for the dongle, please quote the CEREC Club contract number.