Fast, functional aesthetic solution for anterior tooth trauma

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CEREC and oral surgery? In times when patients go to a practice to receive complete, aesthetic, state-of-the-art treatment as quickly as possible, I think they go together very well. I did not always think so. Certainly, CEREC was always interesting; I have used it since 2003, but I did not always find the results convincing. In 2014, I had a closer look at an event in Salzburg, Austria, and learnt two things: the system had been further developed, and in particular, the precision had been improved considerably. It fits well in my practice; I use it almost every day because I have many patients who have busy jobs and do not have much time. I experience a great workflow in the practice that gives me maximum flexibility. Depending on the indication and the patient’s wishes, I can decide whether to make the restoration myself or outsource it to a laboratory, which I often do for more elaborate bridges. Then, I send the scan directly to my partner laboratory via Sirona Connect—that is very reliable.

I mainly use conventional ceramic materials (VITA ENAMIC, VITA Zahnfabrik; CEREC Blocs C PC, Dentsply Sirona; IPS e-max and Telio CAD, Ivoclar Vivadent; and Celtra Duo, Dentsply Sirona) to treat my patients. The possibility of using implants in the premolar and molar region with screw-retained all-ceramic crowns is especially interesting. Sintering or crystallisation in the CEREC SpeedFire furnace is fast and fits smoothly into the workflow.

The advantage for my practice, where I also employ two other dentists, is obvious. We produce laboratory tasks right in the practice and have the entire workflow under control, and our patients are satisfied. They are still really impressed by the technology today. They are treated immediately, have no problems thanks to the precise fit, and feel like they are involved because they can watch us create the design and view the planning process live in CEREC. And yes, patients do talk about that with their friends and family. This case study shows how the digital processes, including implant planning, with CEREC work.

Treatment of an anterior tooth trauma with an immediate implant

The female patient, born in 1989, came to my practice with problems at tooth #21 caused by a childhood trauma. The gingival margins were reddened and bled when probed. The intraoral radiograph showed post-traumatic resorption of the root, and the tooth could therefore not be preserved (Figs. 1 & 2). The tooth was to be replaced by an implant with an all-ceramic crown immediately after extraction. To plan the procedure, a 3-D radiograph (Orthophos XG 3D, Dentsply Sirona) was taken. It was important to assess the available horizontal and vertical bone and evaluate apical osteolytic processes after the failure of endodontic treatment and in the region of the crestal bone due to progressive dentinal resorption. The integrity of the vestibular lamina was preserved, and there was sufficient apical bone to allow immediate implantation with immediate loading (Fig. 3).

After scanning the upper jaw, tooth #21 was deleted in CEREC to simulate the initial postoperative situation. The prosthetic proposal for tooth #21 was used to optimise implant planning and to produce the surgical guide (Figs. 4 & 5). In the implant planning software (Galileos Implant, Dentsply Sirona), the prosthetic proposal was superimposed over the CBCT data for the optimal positioning of the implant. In this way, sufficient vestibular distance was ensured, and the correct size of the implant for optimal primary stability could be selected (Fig. 6).

When extracting tooth #21, it was important to preserve the vestibular lamina to allow immediate implantation. For this reason, the Sharpey’s fibres were carefully severed with a periosteal, and the tooth was gently removed (Fig. 7). The tooth had pronounced dentinal resorption, confirming the previously made diagnosis (Fig. 8). The SiroLaser Blue (Dentsply Sirona) with a wavelength of 970 nm was used to disinfect the alveolus. An OsseoSpeed EV 4.8–15 mm implant (Astra Tech Implant System, Dentsply Sirona) was inserted immediately using a surgical guide (SICAT OPTIGUIDE, SICAT; Fig. 9). At > 35 Ncm, sufficient primary stability was achieved.

After the intraoperative scan with a ScanPost (Dentsply Sirona) to complete the temporary restoration, the vestibular alveolus was filled with a bone substitute material (Figs. 10 & 11).
Fig. 1: Single-tooth exposure of tooth #21 after recurrent marginal gingivitis. Owing to the initial diagnosis of extensive resorption, the tooth could not be preserved.

Fig. 2: Initial situation: tooth #21 exhibited marginal redness of the gingiva that bled when probed.

Fig. 3: The initial situation in 3-D in the Sidexis 4 imaging software (Dentsply Sirona) showed good apical bone substance with the possibility of immediate implantation.

Fig. 4: Tooth #21 was deleted in CEREC to simulate the initial post-op situation.

Fig. 5: The prosthetic proposal was also used as the basic file for producing the surgical guide with the gap at position #21.

Fig. 6: The intraoral CEREC scan superimposed over 3-D image data for optimal positioning of the implant in the Galileos Implant planning software.

Fig. 7: Gentle extraction preserving the vestibular lamina.

Fig. 8: The resorption of tooth #21, external view. This confirmed the accuracy of the diagnosis from the imaging procedure.
Designing the temporary screw-retained crown included processing the composite crown (Telio CAD) produced with CEREC and extraorally attaching the TiBase (Telio CAD, Ivoclar Vivadent on Dentsply Sirona TiBase). The crown was screwed in situ, and the screw channel was sealed with composite (Figs. 12 & 13).

The situation after the temporary restoration (Fig. 14) was aesthetic and free of inflammation. The temporary was positioned 0.5 mm short of occlusion. The patient came for a follow-up after one week. At this visit, we used the soft laser (SiroLaser Blue, wavelength of 660 nm) to activate wound healing (Fig. 15).

Four months after this treatment, the patient came to the practice for the final restoration. We had previously sent the scan to the partner laboratory via the Sirona Connect portal. There, the abutment was designed with the inLab software (Dentsply Sirona), milled and attached with a titanium base.

The temporary was then removed, and the abutment was inserted using a transfer key. The vestibular contour was completely preserved (Figs. 16 & 17). After sealing the screw channel with a PTFE strip, an all-ceramic, custom-veneered crown was inserted for a perfect aesthetic outcome of the anterior tooth (Fig. 18).

Coordinated system supports the workflow

For this case, I used the digital workflow from Dentsply Sirona. After having tested different systems, it proved to be especially efficient and easy. The individual steps, from imaging and diagnosis using the scan, ordering the surgical guide and planning surgery up to producing the temporary restoration and the final prosthesis, are very well coordinated. The interface to SICAT is included in the planning software and enables one-click ordering. Even if I do not use a surgical guide for every implantation, I find it to be very useful depending on the indication.

I also use laser in my practice depending on the indication. In the case of this patient, there was an inflammatory process at the tooth (granuloma). With the laser, I can achieve thorough disinfection of the alveolus and also activate wound healing.

I found that the CEREC Software 4.5.2 has brought another major advance in the accuracy of fit compared with the preceding versions. In addition, it is fast and reliable. The optimised processes proved to be especially advantageous for implants, as in this case, I particularly appreciate the option of implementing screw-retained solutions with CEREC. In my practice,
I place more than 100 implants a year with CEREC—I generally use screw-retained crowns. They considerably reduce the risk of peri-implantitis owing to the absence of cement.

For implants in the anterior tooth region, I produce long-term temporaries with CEREC. They have the significant advantage in that they do not look like temporaries, do not feel like temporaries to patients, and thus ensure better quality of life. The patients are also convinced of this. The follow-up radiograph (Fig. 19) before the final restoration with a custom-veneered ceramic crown showed good osseointegration of the implant. The gingivae were externally completely free of inflammation.

Discussion

Given the great aesthetic demands and the need for rapid results, thorough consideration must be given to the options available for treating anterior teeth. In my view, conservation by means of conventional techniques was not possible in this case owing to the comprehensive and advanced internal resorption of tooth #21 due to previous trauma. Upon extracting this tooth, it was particularly evident that it was not worthy of conservation (Fig. 8). The young age of the female patient and the integrity of the adjacent teeth meant that a bridge was ruled out as an alternative. In light of the favourable anatomical situation with fully conserved vestibular bone lamella, immediate implantation was the optimal treatment option for improved conservation of the bundle bone and, along with it, the hard and soft tissue. The fixed provisional crown supported the soft tissue, was aesthetically pleasing and offered the patient a highly satisfactory solution. Moreover, the digital workflow offered the patient additional comfort (impression without a tray).

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In addition to the primary wishes of the patient regarding prosthetic treatment, namely safety, comfort and aesthetics, are the need for an efficient treatment process, high cost-effectiveness and a minimal number of therapy sessions. Owing to the possibilities offered by CAD/CAM, these desires can in many cases be fulfilled. While a dental technician is indispensable for complex and aesthetically demanding restorations (e.g. in the anterior region), single-tooth restorations (e.g. inlays, partial crowns and complete crowns) can in many situations be realised within the dental practice. For the patient, this has the great advantage, among others, that only one therapy session is needed. Various materials are suitable for such an indication. Mainly, these are materials from the large family of glass-ceramics, which in combination with the adhesive technique optimally fulfil the requirements for conservation of dental hard tissue, biocompatibility, stability and aesthetics.

Overview of dental ceramics in everyday clinical practice

The diversity of materials in everyday prosthetic practice is constantly increasing, especially regarding dental
ceramics. For the practitioner, it is important to maintain an overview in order to select the optimal material for the indication. Dental ceramics can be broadly divided into ceramics with a glass phase (e.g. silicate ceramics and glass-infiltrated ceramics) and ceramics without a glass phase, the oxide ceramics (e.g. zirconium dioxide). Differences exist in, among other things, the materials’ photo-optical properties and characteristics (e.g. flexural strength and fracture toughness). To perform single-tooth restorations chairside, a high-strength glass-ceramic is often used, such as lithium disilicate ceramic or lithium silicate ceramic. To obtain the final strength level of 360–400 MPa, these ceramics are crystallised after milling. There are also pre-crystallised blanks available that only need to be polished. However, in this case, the strength is greatly reduced. For several months, the family of CAD/CAM glass-ceramics has been augmented with a further class of materials: lithium aluminosilicate ceramics (n!ce, Straumann).

Pre-crystallised and high strength

In terms of materials science, the n!ce fully crystallised glass-ceramic is a lithium disilicate reinforced with lithium aluminosilicate. Its flexural strength is 350 MPa (± 50). Its great advantage is its easy and efficient processing. The range contains blanks in two translucency levels: HT (high translucency) and LT (low translucency). Both translucency levels are available in different shades (Bleach, A1, A2, A3, B2 and B4 of the VITA classical shade guides) and cover a large number of restorative indications in everyday clinical practice. The fully crystallised milling blocks were developed specially to fabricate complete crowns, partial crowns, inlays, onlays and veneers. The blanks are compatible with different block holders for different milling machines (Fig. 1). The glass-ceramic blocks can therefore be processed with conventional milling machines and require no investments in additional hardware or software. The material can be milled, polished and seated without crystallisation firing. This saves time and effort in daily practice. Individual characterisation is possible if required.

Case report

Initial situation

The patient wished to have the large-surface amalgam fillings in the upper and lower jaw (Figs. 2a & b) removed.

![Fig. 2a](image1)
![Fig. 2b](image2)

**Figs. 2a & b:** The patient desired replacement of the large-surface amalgam fillings in the upper (a) and lower jaw (b) with full-ceramic restorations.

![Fig. 3a](image3)
![Fig. 3b](image4)
![Fig. 3c](image5)

**Figs. 3a–c:** The prepared teeth are readied for intraoral digitalisation (intraoral scanning).
Figs. 4a & b: Illustrative image of the CAD construction in the posterior segment of the maxilla. Figs. 5a & b: CAD construction in the mandible. Fig. 6: Milling of a nice restoration. Fig. 7: Polishing of a nice restoration. Fig. 8: The teeth are conditioned for adhesive bonding of the glass-ceramic restorations. Fig. 9: Restorations inserted in the mandible. Figs. 10a & b: Occlusal view after the treatment: glass-ceramic crowns (a), composite fillings and a bridge of lithium disilicate (b).
and replaced with full-ceramic restorations created with the least possible effort. These were single-tooth restorations (partial crowns). In the maxillary posterior region, a bridge restoration was indicated, which was produced from lithium disilicate ceramic. All other indirect single-tooth restorations were to be fabricated from n!ce. The material is biocompatible and relatively strong without additional crystallisation firing, while featuring natural photo-optical properties.

Preparation
The aim was a new minimally invasive treatment performed within the dental practice. No functional disorders were present and no periodontal abnormalities were identified either. A vitality test was performed on all of the teeth and a positive result was found up to tooth #46. This tooth had undergone root canal therapy.

After anaesthesia and fitting of the rubber dam, the amalgam fillings were removed and the teeth were prepared in a minimally invasive way for full-ceramic restorations (Figs. 3a–c). The restoration guidelines for n!ce are a rounded design, with no angles or sharp edges, and a shoulder preparation with rounded inner edges and/or chamfer. The manufacturer specifies 1 mm as the minimum layer thickness for complete crowns and partial crowns, which was complied with in the preparation.

Construction and milling
Digital impressions of the situation were captured with an intraoral scanner. To prevent mirror images or undesired reflections, the teeth were first dried to the maximum extent. This was followed by bite registration (scan) and importation of the data into the CAD software.

The scans were checked and artefacts were removed. After the virtual model calculation and assignment of the jaws with the bite register, the preparation boundary could easily be marked and the insertion axis defined with a few clicks. The automated, biogeneric initial suggestion of the software was a valuable aid in constructing the restorations. Only minor changes were made to the initial suggestion. The restorations were constructed within a short time (Figs. 4 & 5) and the data was transferred to the CAM machine. In the milling preview, the design was finally checked, for example for values below the minimum wall thickness. The n!ce blocks were then secured and the restorations were milled (Fig. 6). Milling was performed in the fine mode and took about 25 minutes.

Completion
After removing the milled restorations from the machine, the milling pins of the blank were removed with a fine-grain arkansas stone. The restorations milled from n!ce showed finely tapered margins and a 1:1 reproduction of the construction. On trial placement in the mouth, the fit was judged as very good. At some sites, the approximate contact points were adjusted as required. Final polishing of the restorations outside the mouth produced a high-gloss finish. For a natural appearance, the n!ce restorations can be polished with a standard polishing set for lithium disilicate glass-ceramic. A classical polishing protocol was used in this case—coarse burs, ceramic polisher, zirconium oxide polishing paste (Zirkopol, Feguramed) and brushes (Fig. 7)—and the restorations were then cleaned in an ultrasonic bath. The complete crowns and partial crowns were then ready to be fitted. An additional crystallisation firing as for comparable materials is not necessary for n!ce.

Insertion
The insertion of restorations in the mouth was performed with an adhesive under rubber dam isolation. The same adhesive cements used for lithium disilicate can be used for n!ce. Before insertion, the ceramic restorations were cleaned with phosphoric acid (30 seconds). Conditioning of the bonding surface was performed according to the protocol, with 20-second etching with a 5 % hydrofluoric acid gel. After cleaning and conditioning the teeth, final insertion of the restorations was performed (Figs. 8 & 9), and the functional criteria underwent a final check. The two small amalgam fillings in teeth #34 and 35 were replaced with direct composite fillings.

Conclusion
In combination with the intraoral scanner and the chairside CAM machine, n!ce glass-ceramic offers the possibility of fabricating indirect single-tooth restorations easily, safely and comfortably within the dental practice. The lithium aluminosilicate ceramic is supplied in the fully crystallised state; thus, no crystallisation firing is necessary. Mill, polish, seat—the procedure described offers high comfort for the patient and high productivity in everyday practice.

about
Dr Johannes Beiter holds a Master of Science in Periodontology and Implant Therapy and specialises in these fields. Since 2012, he has been a dentist specialising in oral surgery.