full arch with the temporary crown in place. The provisional was then re-
moved from the mouth and screwed on to an implant replica fixed to a stable support with wax. The second scan, performed in 360°, the modified shape of the temporary crown, in-
cluding the gingival profile (Fig. 17). These files can be easily matched in the CAD software when the techni-
cian designs the definitive crown (Figs. 18–20). If a monolithic material is used, the technician may copy the entire shape of the temporary. When a screw-retained crown will be lay-
ered with ceramic afterwards, at least the gingival profile can be duplicated in a reliable way.

Definitive crown

The technician preferably screw-re-
tained devices. Owing to the an-
gulation of the implant, it was nec-
essary to relocate the screw access hole. In CAD, the design for a colout-
chromium support that copied the gingival profile of the temporary was prepared, and the screw access was brought to the palatal aspect (Fig. 70). The file was sent to the Arc solutions milling centre in Helsingborg in Swe-
en. High-quality material and CAM production guarantee an excellent outcome in terms of connection and smooth surfaces (Figs. 38–40). The technician layered feldspathic ceramics to obtain the final anatomy and texture. The patient was totally satisfied with the result and did not wish for intervention for the maxil-
lar right central incisor. Minor gin-
gival asymmetries, though evident at high magnification in photogra-
phy, are not really disturbing when viewed at social distance if all other parameters, like colour, incisal edge, tooth texture, correct proportion of the incisal two-thirds of the tooth and transitions, are respected (Figs. 40–42).

Conclusion

Innovative technologies enable extremely accurate diagnosis and treatment planning. Affordable high-quality CBCT has profoundly changed our profession. In the cur-
rent case, the detailed X-Antid traumatic (g) images allowed for planning and performing implant placement in the optimal mesiodistal position. Correct distances to the lateral inci-
or and the nasopalatine duct were obtained. Final choices will always re-
main related to the experience, skills and equipment of the performing team. After collecting all of the neces-
sary information and knowing what technology can provide, it is possible that one team will opt for GBR and monolithic crowns, where another one might opt for predictability of surgery and employ innova-
tive milling strategies to deliver a predictable, beautiful solution. In the actual challenging bicuspidal di-
ension, the implant was perfectly planned and guided into to the cen-
tre of the native bone. Guided bone regeneration was limited to the min-
imum and minor buccal exposure of the implant was predicted. Review-
ing the case described above, the fact that bone volume could be matched with the dental prooperative situ-
ation and the CAD virtual wax-up made the whole procedure, from extraction to final restoration, high-
ly predictable. Bone volume, bone quality, extent of GBR indicated and the type of prostodontic solution were all known before starting treat-
ment thanks to the implant plan-
ning with the AIS 3D App software.

Both the clinician and patient were well informed and prepared, avoid-
ing surprises, improvisations and unnecessary stress. New develop-
ments like smart, scannable healing abutments will help to continue cre-
ating treatment outcome and com-
fort improvements.

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New materials for a classic indication

Cementation of all-ceramic restorations using Variolink Esthetic

By Drs Eduardo Mahn & Juan Pablo Sánchez, Chile

Zinc phosphate cements are seen as classic luting materials for the ce-
mentation of metal-ceramic crowns. Along with all-ceramic materials, glass ionomer cements (GICs) and resin-modified glass ionomer ce-
ments (RMGICs) were introduced.

Generally, luting cements are ex-
pected to meet certain require-
ments: they should provide an op-
timum bond to the tooth structure and restorative material, must not be soluble in water, should be suit-
able for application in thin coatings and should offer long-term stabil-
ity. This is in contrast to the proper-
ties of classic cements, which are water soluble and do not establish an adhesive bond to the enamel or dentine (zinc phosphate cements) or establish only a minimally adhesive bond and only to the dentine (GICs and RMGICs). Nonetheless, these cements show remarkable survival rates if used for the appropriate in-
dication even if they have certain limitations.

Problem 1: Opacity

The opacity of the luting material is a critical issue for all-ceramic crowns, as well as ceramic inlays and onlays. Almost any colour can theoretically be reproduced with ceramics by ex-
ploring their natural translucent prop-
erties. Using an opaque luting material appears to be counter-pro-
ductive in achieving this. Further critical issues are the limitations involved in the anterior region and the location of the cement line in the visible area for inlays and onlays. For instance, if a tooth is restored with a veneer, the basic shade of the tooth is maintained; only the enamel is replaced, usually by using a translu-
cent ceramic that covers the natural dentine. In such a case, it is essential to use a translucent luting material to adjust the natural shape.

Problem 2: Adhesion

The comparatively low bond strength of conventional cements is also problematic. Classic prepara-
tions around the tooth create a high degree of friction and retention. However, the retention is signifi-
cantly reduced with partial crowns, veneers or onlays. It is therefore ad-
visable to use a luting material that is capable of providing a strong adhe-
sive bond. Both problems led to the widespread use of luting composite materials. Perhaps their only disad-
vantange is the removal of excess ma-
terial. These luting materials are hard and solid and not water soluble; and they have a high adhesive strength, making removal of excess diffi-
cult. Early luting composites were equipped with a self-cure mecha-
nism. Users had to wait a few min-
utes until the composite was almost fully set before they could remove the excess material. This period was risky because of the moisture in the mouth. Blood or saliva could come into contact with the non-polymer-
ised composite and cause damage.
ZirCAD MT Multi
The most esthetic high-strength, multi-translucent\(^1\) zirconia

\(^1\) Composed of different material classes
Dual-curing luting composites

These issues led to the rise of dual-curing composites for the cementation of all-ceramic crowns. Dual-curing luting composites are usually delivered in double-push syringes with a mixing tip. During extrusion, the base and catalyst are automatically mixed. The material can be applied directly. The main advantage is that the curing process can be accelerated with light and excess material can easily be removed. At the same time, the self-cure mechanism ensures a reliable cure, even with relatively thick or opaque ceramic layers. Nonetheless, there are some situations in which excess material cannot be removed all that easily because the setting reaction takes place too quickly or the material does not cure down to the depth of the composite layer. After one second of light curing, the surface is set and excess can be broken off, but the material is still paste-like at the interface to the crown or tooth. Excess can be polymerised en bloc and pulled off as a ring in one go with no uncured material left in contact with the tooth or crown. In addition, the luting composite does not contain amine, which is another advantage, since amine may be implicated in discoloration of the cement line over time.

One material, five shades

VarioLink Esthetic (Ivoclar Vivadent) is based on the value shade concept. The shades are classified according to the effect to be achieved with the cement. Five shades are available: Light+, Light, Neutral, Warm and Warm+. In this way, the shade spectrum ranges from an opaque white tone (Light+) to an opaque yellow-brownish shade (Warm+). In between lie shades such as a coconut water white and a neutral tone (very translucent) and a warm tone (comparable to A3). In addition, the luting composite is available in an LC (light curing) and a DC (dual-curing) version. The LC version is designed for relatively thin restorations, such as inlays, onlays and veneers. The DC version is suitable for more extensive and opaque restorations. The luting composite is used in conjunction with the light-curing single-component Tetric N-Bond Universal (Ivoclar Vivadent).

Clinical case

A 45-year-old male patient presented to the practice with a restoration on tooth 46. The tooth had been endodontically treated and tempomered with a filling (Fig. 6). The temporary was removed, the tooth built up with Tetric N-Ceram Bulk Fill (Ivoclar Vivadent) and then prepared for the crown restoration (Fig. 7). An impression was taken with a one-step, two-phase impression technique using a putty and light-body silicone. After scanning the model, the crown was designed in the software suite (InLab, Dentsply Sirona) and milled from an IPS e.max CAD lithium disilicate block (Ivoclar Vivadent; Figs. 3a & b). The next step was to etch and silanate the ceramic crown with the new glass-ceramic primer Monobond Etch & Prime (Ivoclar Vivadent). This primer combines a ceramic etching and silanating component in a single material and therefore eliminates the need for the ceramic to undergo hydrofluoric acid etching (Fig. 5). After the etching and silanating step, the crown was rinsed with water and dried. The isolated enamel was then etched (Fig. 6). The adhesive (Tetric N-Bond Universal) was applied and dispersed with a strong stream of air. The dual-curing version of the VarioLink Esthetic luting composite was used for seating owing to the thickness of the crown and the low trans- lucency of the ceramic material (Fig. 7). The luting composite was applied into the crown. The restoration was then seated (Fig. 8) and light-cured from each side for two seconds. Excess composite was easy to remove owing to the Ivocerin photoinitiator (Ivoclar Vivadent), which provides a fast and thorough cure with a minimum amount of energy (Fig. 9). For final polymerisation, the restoration was light-cured from each quarter for 20 seconds (Fig. 10). Figures 11a & b show the oral situation after placement of the crown. Although the cement line was located above the gingival margin, it was not visible owing to the favourable tone and opacity of the luting composite. Figures 13a & b show radiographic control images of the restoration: the radiopaque build-up material and cement can easily be distinguished from the tooth structure. This aspect is particularly important in situations where excess cement cannot be seen with the naked eye.

Conclusion

The cementation methods used in conjunction with all-ceramic materials have changed for single-crown restorations. VarioLink Esthetic is a protagonist of the latest generation of luting composites. Excellent bond strength values, coupled with user-friendly handling characteristics and highly aesthetic properties, make this material an asset in day-to-day dental restorative care.

For more information contact:
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Fig. 9: Excess removal is easily achieved owing to the new technology based on the Ivocerin photoinitiator.

Fig. 10: Final curing. Excess luting material was removed beforehand (quartz technique).

Fig. 11: Sealed crown after excess removal.

Figs. 12a & b: Intraoral and occlusal views of the completed restoration.

Figs. 13a & b: Radiographic control images before and after the treatment.

Fig. 24: For more information contact: