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Case Report

An alternative method for fabricating a custom-made metal post with a ceramic core

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Abstract – The restoration of anterior non-vital teeth with metal posts and cores and all-ceramic restorations may lead to compromised esthetics because of the semitranslucence of ceramics and the metallic color of the underlying post and cores. This article presents a technique that combines the optical properties of ceramic cores with the mechanical properties of custom-made cast metal posts. The technique involves heat pressing of the core from leucite-enriched glass-ceramic to the underlying custom-made metal post and may provide additional esthetic benefit for anterior teeth especially with little remaining coronal dentin and with small root volume.

Sabire Deger, Gökhan Akgüngör, Babür Caniklioglu

Department of Fixed Prosthodontics, Istanbul University, Turkey

Key words: cast post; ceramic core; heat pressed ceramic

Dr Sabire Deger, Department of Fixed Prosthodontics, Faculty of Dentistry, Istanbul University, 34390 Çapa / Istanbul, Turkey
Fax: +90 212 534 4496
e-mail: sabdeger@yahoo.com

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The choice of an appropriate restoration for endodontically treated anterior teeth is guided by strength and esthetics. Cast posts and cores are commonly used because of their superior mechanical properties. However, if an all-ceramic crown is chosen as the final restoration, the color and opacity of the post may lead to discoloration and shadowing both the gingiva and cervical tooth. To solve this esthetic problem, tooth colored fiber and zirconia post systems have been introduced that are capable of resisting occlusal loads while offering light transmission characteristics similar to those of natural teeth (1, 2).

Recent reports suggest that the rigidity of the post should be equal or close to that of the root to distribute the occlusal forces evenly along the length of the root. With a modulus of elasticity similar to dentin, it was argued that fiber post could reduce stress concentration and thus the rate of catastrophic root fracture compared with cast metal post (3–5). However, a flexible post can be detrimental, especially when only small amount of natural tooth structure left. In such cases, occlusal loads may cause the post to flex with eventual micromovement of the core, and the cement seal at the margin of the crown may fracture (6). Therefore, fiber posts appear to be more useful in teeth that retain adequate coronal dentin, so that the core can be made from materials adhere to dental tissues.

Another possible treatment option is zirconia posts, which can be used in combination with composite and also with ceramic core materials. According to the results of Rosentritt et al. (7), the fracture strength of teeth restored with zirconia posts and heat-pressed ceramic cores were significantly lower than those restored with zirconia posts and composite cores. Changes within the inner structure of the zirconia material during the heating process might be the explanation (8). Additionally, zirconia posts and custom made ceramic cores exhibited significantly lower fracture strength values compared with metal post and cores (7, 8). The high incidence of catastrophic root fractures accompanied with post fractures may be attributed to the stiffness and lack of the plastic deformation of the zirconia posts (9).

However, the available diameters of the most esthetic post systems do not permit a conservative root canal preparation. This is especially important for mandibular incisors, maxillary first premolars and lateral incisors, which recommended post diameter has been reported as 0.7, 0.9 and 1.3 mm, respectively (10). Therefore, custom-made cast posts and cores are especially indicated when the loss of dental substance is sufficiently significant to need maximum retention for coronal reconstruction, particularly if part of the root core edge is located at juxtagingival or subgingival level (11) and also for teeth with small root volume.

Several techniques have been proposed to reduce the influence of the cast posts and cores to the final color of the all-ceramic restorations including the application of an opaque porcelain to the metal core (12, 13), coating the core with opaque resin (14), veneering the metal core with porcelain (14) or the use of opacious luting cement (15). This article describes an alternative technique that involves heat pressing of the core from leucite-enriched glass-ceramic to the underlying custom-made metal post.

Technique

1 Prepare the root canal to the desired length and diameter. Remove undercuts from the pulp chamber. Make a keyway at the coronal end of the root canal to provide adequate metal and ceramic thickness (Fig. 1).

2 Adjust an appropriate size prefabricated plastic burnout post pattern (Parapost, Whaledent International, New York, NY, USA) to the prepared root canal and leave an extension for the retention of the ceramic core. After lubrication of the root canal, reline the plastic post with an autopolymerizing acrylic resin material (Pattern Resin, GC Corp, Tokyo, Japan) to ensure an optimal adaptation to the canal.

3 Prepare a rounded 120° shoulder on the core extension at the entrance to the root canal. This will provide adequate ceramic thickness and prevent the grayish discoloration especially in the cervical tooth area (Fig. 2).

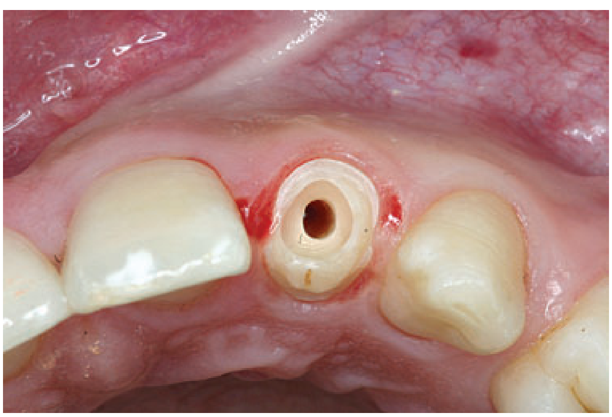

Fig. 1. Preparation of the root canal entrance.

4 Reduce the thickness of the core extension increasingly to the incisal part.

5 Cast the post using a porcelain metal alloy (Wiron 99, Bego, Bremen, Germany) and coat the core extension with opaque ceramic to mask the metal.

6 Verify the fit of the post in the canal and build up the core with autopolymerizing acrylic resin. Once the resin has polymerized, prepare the core pattern in the usual manner for an all-ceramic crown (Fig. 3).

7 Remove and invest the resin core with the cast metal post. After the burnout and preheating process, heat-press the core from leucite reinforced glass-ceramic with the desired shade (Finesse, Ceramco, Burlington, NJ, USA).

8 After verifying the fit, cement the metal post and ceramic core assembly using a self-curing resin cement. The post-and-core is ready to undergo impression for the all-ceramic crown (Fig. 4).

9 Cement the finished all-ceramic crown to the core in the usual manner (Fig. 5).

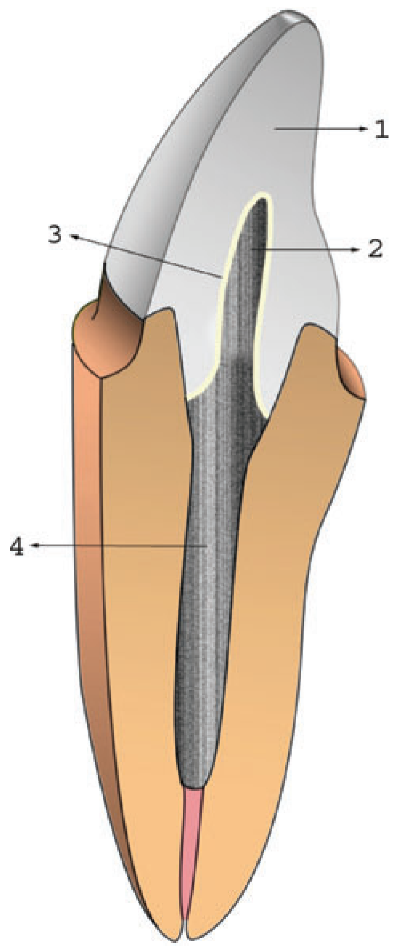

Fig. 2. Schematic diagram of the custom-made metal post and ceramic core: (1) heat-pressed ceramic core, (2) core extension, (3) opaque ceramic layer, (4) cast metal post.

Fig. 3. The core is built from autopolymerizing resin and prepared for an all-ceramic crown.

Fig. 4. Heat-pressed ceramic core cemented in tooth.

Fig. 5. Postoperative view of the cemented all-ceramic crown.

Discussion

The technique described above combines the mechanical properties of the custom-made metal posts with the esthetic properties of the ceramic cores. Another advantage of this technique is that it allows a conservative root canal preparation by using a base metal alloy with a high rigidity. Several studies support the opinion that the strength of endodontically treated teeth is directly related to the bulk of residual dentin and the preservation of the tooth structures during the post preparation is one of the most important factors (16–18). Therefore this technique will be suitable for teeth with small root volume, especially for mandibular incisors, maxillary lateral incisors and premolars.

Another possible application of this technique is its use for elliptical or flared root canals. The conservative canal preparation, which has been carried out according to the canal geometry and the optimum adaptation of the cast post make this technique suitable for such cases. Furthermore, failure that can arise with the impression or cast production procedures can be eliminated.

A similar technique that involves layering of the conventional ceramic material on the custom-made cast post and core as for a metal ceramic restoration has been reported in a previous study (14). The major disadvantages of this indirect procedure appear to be the difficult laboratory procedures and the low accuracy because of the firing shrinkage of the ceramic layer. In the present technique, the heat pressed ceramic material was not only used because of their optical properties, additionally the direct build-up of the ceramic core with autopolymerizing resin enables a better adaptation to the remaining coronal dentin.

The joint between the ceramic core and the underlying core extension seems to be the weak point of this technique. With the use of a porcelain alloy and coating the core extension with opaque porcelain, a chemically bond should be expected. However, further *in vitro* studies are needed to evaluate the retention of the heat pressed ceramic core to the cast metal post.

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