

# Restoration of Endodontically Treated Anterior Teeth with Cast Metallic Post or Prefabricated Fibre Post Placement: 2 Case Reports and Critical Literature Review

## SUMMARY

*With a wide variety of post systems and materials available for the restoration of lost tooth structure of endodontically treated teeth, the clinical decision of which to use constitutes a challenge to dental practitioners. Cast metal post and cores are widely used for restoring endodontically treated teeth with extensive loss of coronal tooth structure and to retain metal-ceramic crowns. When dental aesthetics is of primary concern, the selection of the underlying restorative material becomes an important factor to consider. The fibre-reinforced posts combined with all-ceramic crowns offer a highly aesthetic outcome in anterior region restorations, but long-term evaluation is necessary in order to assess their clinical performance and longevity.*

*The purpose of this paper was to present and compare 2 restorative options with regard to materials (cast metallic post and core versus prefabricated fibre post and composite resin core) for the prosthetic rehabilitation of cases with inadequate aesthetic appearance or fractured maxillary anterior teeth. Furthermore, the article reviews the main indications, advantages, and disadvantages from the use of the 2 post types combined with the final restorations, in order to allow the dental practitioner make the selection of appropriate restorative materials.*

**Keywords:** Cast Post; Fibre Posts; Metal Ceramic Crowns; All-Ceramic Crowns

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## Introduction

Endodontically treated teeth (ETT) have been problematic in most cases as a result of dental caries, fractures, previous restorations and endodontic procedures. Several post system techniques and materials are currently used to build up ETT with moderate or severe loss of coronal tooth structure and to retain final restorations<sup>1,2</sup>.

Following root filling, the custom-made cast metallic post and core with metal-ceramic crowns was the traditional restoration of choice<sup>1,3</sup>, but this has changed. The patients' primary motivation for seeking superior dental aesthetics, particularly in the anterior aesthetic zone, has prompted the development of non-metallic restorations<sup>4-6</sup>. Several new types of polymeric and

more aesthetic quartz and glass-fibres posts, combined with direct resin composite cores, provide an aesthetic foundation for an all-ceramic crown and have overcome the aesthetic limitations of metallic posts and cores in the anterior teeth<sup>4,6-8</sup>.

Until recently, there has been controversy in the dental community regarding which material or technique is the most favourable for the restoration of ETT<sup>9-11</sup>. It seems that the amount and retentive capacity of the remaining tooth structure<sup>12</sup>, the position of the tooth in the dental arch, the functional or para-functional loading on the tooth, and the treatment plan to restore aesthetics and function all influence the selection of the most appropriate post system for each case<sup>11-14</sup>.

The aim of the present work was to present and discuss 2 restorative options with regard to materials (cast

metallic post and core *versus* prefabricated fibre post and composite resin core) for the prosthetic rehabilitation of cases with inadequate aesthetic appearance or fractured maxillary anterior teeth. The focus of the discussion was to compare indications, advantages, and disadvantages of the 2 alternative types of posts to aid the clinician in the choice of an appropriate restoration of ETT.

## Case Reports

### 1<sup>st</sup> Case

A 28-year old female patient presented with a chief complaint of inadequate aesthetic appearance of the maxillary anterior teeth. She had been aware of a gradual aesthetic deterioration of her dental appearance over many years. The anterior teeth #13, #12, #11 and #21 had been restored several years ago but the patient's aesthetic demands were not satisfied (Fig. 1). Clinical examination revealed metal-ceramic restorations without satisfactory depth of colour, inadequate length, a grey shadow along the gingival margin and uneven occlusal level.



Figure 1. Maxillary anterior teeth with the existing metal-ceramic restorations

Preliminary diagnostic aids for treatment planning included panoramic radiograph, periapical radiograph of the maxillary teeth, and a diagnostic wax-up of the maxillary teeth on mounted study casts, using an intraoral centric relation registration. After the root canal treatment of the maxillary anterior teeth #13, #12 and #11, the treatment planning for this patient included:

- Indirect technique for fabrication cast metallic post and cores;
- Custom-made posts and cores cementation with zinc phosphate cement in the canal space of the maxillary anterior teeth #13, #12 and #11. Teeth were prepared with a circumferential chamfer including a 1.5 to 2 mm ferrule preparation (Fig. 2);



Figure 2. Cast posts and core after cementation

- Placement of long-term (4 weeks) interim prostheses on the prepared maxillary teeth;
- All -ceramic restorations (single crowns) for the maxillary anterior teeth #22, #21, #11, #12 and a metal-ceramic FPD for teeth #13-(14)-(15)-16 (Figs. 3 and 4).

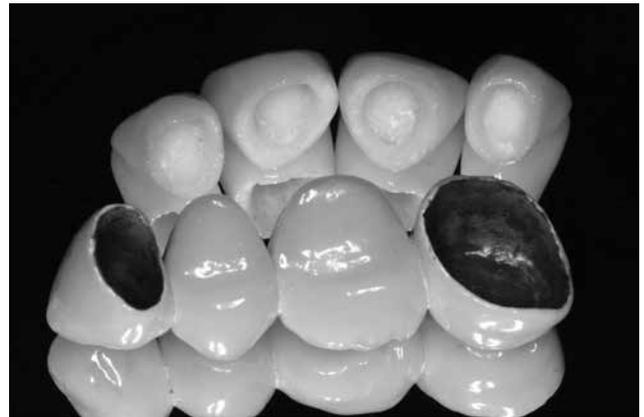


Figure 3. All-ceramic crowns for the maxillary incisors and a metal-ceramic FPD for the maxillary right teeth



Figure 4. The new restorations in situ

The all-ceramic crowns for the anterior teeth were fabricated with the e-max ceramic system (Ivoclar Co, Liechtenstein) using high opacity material for the ceramic framework, in order to avoid shimmering of the underlying metal post. The treatment outcome fulfilled the patient's expectations concerning the aesthetic appearance of the anterior teeth.

## 2<sup>nd</sup> Case

A 21-year-old man was presented with a chief complaint of injury to the lip and fractured maxillary right and left central incisors and the right lateral incisor (Fig. 5). The fracture of maxillary incisors, caused by a motorbike accident occurred 1 month earlier. After a thorough intraoral examination, the root canal treatment of the maxillary anterior teeth #21, #11 and #12 was performed. Since an aesthetic outcome was important in this case, the treatment planning included the use of fibre-reinforced posts and resin composite cores combined with the placement of zirconia all-ceramic crowns.



Figure 5. Fractured maxillary right and left central incisors (#11, #21) and right lateral incisor (#12)



Figure 6. Glass fibre posts inserted; composite resin build-up and preparation of central incisors and lateral incisor for crowns



Figure 7. The zirconia all-ceramic crowns were tried on the core and checked for marginal fit



Figure 8. The all-ceramic crowns in the mouth after cementation

The option was discussed with the patient, and the following treatment plan was carried out:

- The root canals of the maxillary incisors were prepared to receive a glass fibre-reinforced composite post (FRC Dowelec Plus, Ivoclar Vivadent AG, Liechtenstein) of an appropriate diameter and length. Special matching stainless steel reamers were used for the preparation of the recipient site of the post, leaving 4 mm of intact gutta-percha apically;
- A dual-curing composite resin (Variolink II, Ivoclar Vivadent AG, Liechtenstein) was used for luting the fibre posts, according to the manufacturer's instructions. A composite material (Multicore flow, Ivoclar Vivadent AG, Liechtenstein) was used for building up the core (Fig. 6);
- The zirconia all-ceramic crowns (In-ceram zirconia, Vita, Germany) were tried on the core and checked for marginal fit and occlusion (Fig.7);
- Final cementation of all-ceramic crowns was carried out (Fig. 8) using dual-curing composite resin (Variolink II, Ivoclar Vivadent AG, Liechtenstein).

The treatment outcome fulfilled the patient's requirements concerning the aesthetic appearance of the anterior maxillary teeth.

## Discussion

Custom-made metallic posts and cores combined with all-ceramic crowns and metal-ceramic FPD were used in the first clinical case due to the patient's coronal destruction, extensive loss of anterior teeth structure and the demand for aesthetic and functional rehabilitation. Fibre posts with composite resin cores and zirconia all-ceramic crowns were designed to be used in the second clinical case due to the amount of remaining coronal tooth structure and the high aesthetic demand.

The restoration of ETT with different post and core systems is a topic that is extensively studied and yet remains controversial from many perspectives<sup>3,14-16</sup>. The main function of a post is to build up and securely retain a core for crown retention, but this post does not strengthen or reinforce ETT<sup>17-21</sup>. The choice of appropriate post and core restorations is often complicated and should be guided by knowledge of their physical properties, indications, advantages and disadvantages, as well as the amount of coronal structure missing and aesthetic case need.

It generally is agreed that post and core materials should have as many of the following desirable features as possible:

- Adequate post adaptability within the root<sup>20,21-23</sup>;
- Maximum retention of a crown<sup>1</sup>;
- Conservation of remaining tooth structure<sup>11</sup>;
- Biocompatibility and compatibility of post material with the core<sup>24-26</sup>;
- Uniform stress distribution along post length during function<sup>27,28</sup>. It has been reported that a well-adapted, passively luted, parallel-sided post provides the most retention with the least stress<sup>22,29</sup>;
- Physical properties, such as compressive strength to resist intraoral forces, modulus of elasticity (stiffness), and coefficient of thermal expansion, similar to those of dentin<sup>2,30</sup>;
- Rapid setting, dimensionally stable core material, resistant to leakage of oral fluids at the core/tooth interface, that is easy to use with high compressive strength and rigidity<sup>1,31</sup>;
- Pleasing aesthetics, when indicated;
- Easy removal from the root.

In most cases, the choice of cast metallic post or prefabricated fibre-reinforced composite restorations relies on clinical judgment and experience. Possible indications for use of custom-made metallic cast post and cores include:

- Restorations of ETT with moderate-to-severe loss of coronal tooth structure. 2 retrospective studies of ETT with extensive loss of tooth structure reported success rate of 89-98.5% after at least 7 years, using cast post and cores with single crowns as foundation restorations<sup>32,33</sup>;

- Restorations of ETT used as abutments of extensive tooth-supported fixed partial dentures. The use of cast post and cores must be particularly considered when multiple abutments are prepared in complicated periodontic<sup>34</sup> and tooth wear<sup>17,35</sup> prosthodontic treatments;
- Restorations of posterior teeth with insufficient tooth structure and root divergence to support a crown, therefore requiring fabrication of separate element, 2-piece cast post and cores with different paths of insertion that link on placement<sup>1,36</sup>.

Cast gold or silver-palladium alloy post and core build-up has some advantages over a prefabricated post:

- The cast post and core is customized to fit the root canal space, and both post and core are cast as a single unit with good compressive strength that withstands normal or para-functional occlusal forces and minimizes the possibility of separation<sup>36-38</sup>;
- The angulation and the design of the core of the cast post can be modified to produce a more convenient shape for the crown of proclined teeth, particularly when multiple anterior abutments are prepared<sup>1,37,38</sup>;
- The anti-rotational projection of the shape of the post for anterior wide, single-rooted teeth and the placement of multiple dowels at multi-rooted teeth provides the opportunity to control the design characteristics of a post and core build-up<sup>1,36</sup>.

However, disadvantages of the cast post and core system are considerable:

- Aesthetic problems in anterior metal-ceramic restorations as their metallic colour leads to a greyish discoloration of the root, thus shadowing at the thin gingival tissue<sup>38,39</sup>;
- Several aesthetic problems in anterior all-ceramic coronal restorations, as the cast post and core may shine through or at least decrease the depth of translucency of the all-ceramic crown<sup>38-40</sup>;
- Cast post and core placement procedure requires 2 appointments, dental laboratory fabrication, and additional financial cost<sup>1,38</sup>;
- Very difficult removal from the root.

The availability of new aesthetic prefabricated fibre post systems has created the need for a systematic evaluation of their physical properties and clinical performance<sup>2,5,6,41,42</sup>. For direct build up of the coronal tooth structure after luting a fibre post, many types of resin composite materials have been proposed<sup>5,41</sup>.

There are some possible indications for use of fibre-reinforced posts in combination with composite materials, such as:

- All-ceramic restorations of anterior ETT with mild-to-moderate loss of coronal tooth structure, visible in smile. It has been reported that in ETT restored with fibre dowel-composite core and all-porcelain crowns, the survival rate of the tested posts was high

(96%) after 24 months of observation<sup>6</sup>. According to some authors the fibre posts' root fractures are rare compared with metallic posts<sup>6,13,43</sup>;

- Direct resin restoration of anterior teeth without crown coverage when vitality and aesthetics have been lost and the patient requires economical treatment option. It has been reported that restorations of ETT with fibre posts and direct resin composites exhibit favourable clinical results after short-term (30 months) observation<sup>5</sup>.

Prefabricated fibre post systems have some advantages over cast post and cores:

- Best aesthetics; a white or tooth-coloured dowel prevents the "shine-through" effect that occurs with metal dowel systems and improves the translucency and appearance of all-ceramic crowns<sup>2</sup>;
- Uninterrupted bonding at all interfaces and adhesive integration between 5 components of the fibre-reinforced composite resin system (dentine surface, luting cement, fibre post, core build-up, and crown)<sup>2,43</sup>;
- Fibre posts are also more flexible, require less dentin removal to accommodate a shorter and thinner dowel, and lead to lower susceptibility to root fracture<sup>44,45</sup>;
- Involve less-time consuming chairside procedure and requires 1 appointment to complete the restoration<sup>1,2</sup>.

However, there are also some reported disadvantages of these restorations such as:

- Composite resins present volumetric contraction during and after the process of polymerization, resulting in stress concentration at the adhesive interface<sup>46,47</sup>;
- Composite materials present low wear resistance<sup>48</sup> and microleakage;
- Very few long-term clinical results for their clinical performance and longevity are available<sup>5,41,49-50</sup>.

## Conclusion

Selection of the most suitable post and core systems is challenging and should be guided by knowledge of their indications, advantages and disadvantages, as well as the amount and quality of remaining tooth structure and aesthetic requirements.

The use of cast metallic posts and cores are recommended to restore severe loss of coronal tooth structure and to retain metal-ceramic crowns. Prefabricated fibre posts and all-ceramic restorations offer a promising alternative to the restoration of anterior ETT with cast metallic posts and porcelain fused to metal crowns. The use of fibre posts with resin composite core is preferred when the hard dental tissue loss is moderate

and dental aesthetics is of primary concern. The new fibre posts provide impressive aesthetic results in the anterior aesthetic zone, but long-term clinical trials are necessary in order to assess their mechanical properties and clinical performance.

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