Brazilian Dental Science
Ciência Odontológica Brasileira
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UNIVERSIDADE ESTADUAL PAULISTA "JÚLIO DE MESQUITA FILHO"
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CASE REPORT

doi: 10.14295/bds.2014.v17i3.973

Intracanal post reinforcement in anterior teeth to prevent fractures

Uso do reforço intracanal em dentes anteriores na prevenção de fraturas tardias

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ABSTRACT

Anterior tooth fracture after endodontic treatment is a real and multifactorial possibility because of root weakening due to tooth structure remnant loss and existing oblique occlusal forces. The fracture influenceson esthetics and causes masticatory dysfunction. Preventively, one of the treatments widely accepted is the use of intracanal posts made of metal, carbon fiber, fiberglass and ceramics. The metal and carbon fiber posts are very efficient but do not favor esthetics, while the fiberglass and ceramics posts are both durable and aesthetics. The reinforcement with these biomaterials is advantageous and leads to a favorable prognosis. This study showed a case in which intracanal reinforcement could have prevented the fracture of a devitalized maxillary anterior tooth and provided a brief discussion about the available options for this type of rehabilitation. The use of glass fiber reinforcement posts fordevitalized tooth structure is indicated to prevent dental fractures. Ceramic posts have been indicated in cases with insufficient coronal remaining to support thecore material.

KEYWORDS

Dental prosthesis design; Endodontics; Post and core technique.

RESUMO

A fratura de dentes anteriores após tratamento endodôntico é uma possibilidade real e multifatorial. Isso se deve ao enfraquecimento da raiz devido à perda do remanescente dental somado às forças oclusais oblíquas existentes. Esta fratura influencia a estética do paciente além de causar disfunção mastigatória. Na prevenção, um dos tratamentos utilizados e muito bem aceitos, é o uso de pinos intra-radiculares. Estes podem ser confeccionados em metais, fibra de carbono, fibra de vidro e em cerâmica. Os pinos de metal e de fibra de carbono são muito eficientes, porém não favorecem a estética, enquanto que os pinos de fibra de vidro e os de cerâmica são resistentes e favorecerem a estética. O reforço com esses biomateriais é vantajosos e leva a um prognóstico favorável. O presente estudo apresenta um caso clínico onde o reforço intracanal poderia ter prevenido a fratura de um dente ântero-superior desvitalizado e realiza uma breve discussão acerca das opções disponíveis para este tipo de reabilitação. O uso de pinos de fibra de vidro como reforço da estrutura de dentes desvitalizados é indicado na prevenção de fraturas dentárias, porém núcleos cerâmicos fundidos são indicados para remanescentes coronários insuficientes para suportar o material de preenchimento.

PALAVRAS-CHAVE

Planejamento de prótese dentária; Endodontia; Técnica para retentor intrarradicular.

BRIEF LITERATURE REVIEW

Esthetic satisfaction is increasingly important in oral health concept of population because is associated with social and professional success. The achievement of a "beauty smile" happens through restorative treatments providing shape, function and esthetics, taking into consideration an adequate planning together with a detailed diagnosis.

Additionally, the final outcome results from the use of specific operative proceduresand dental materials, comprising conservative endodontic treatments, esthetic intracanal posts, resin composite and metal-free ceramic systems.

The fracture of devitalized maxillary anterior teeth is common and can be associated with the oblique positioning of masticatory loads and structure weakening due to endodontic treatment [1,2].In such cases, intracanal posts are indicated to promote retention for the restorative material and help in the occlusal force distribution along with the root, by reinforcing the remaining structure [3].

The posts should be carefully selected to reduce the incidence of root fractures and preserve the root in failure cases.

Currently, intracanal posts can be classified as either direct (metal, ceramic or fiber-resin) orindirect (metallic or ceramic) [4];two different morphologies (active or passive); mechanical properties and cementation systems [5].

Considering the intracanal post diversity, the aim of this study was to report a clinical case in which intracanal post reinforcement in anterior teeth could have prevented the crown fracture in addition to the treatment performed after the fracture.

DESCRIPTION OF CASE

The study was approved by the Research Committee at the Sao Jose dos Campos School of Dentistry, UNESP- Univ Estadual Paulista (Protocol 070/2011 – PH/CEP).

A female patient aged 48 years searched emergencytreatment because of a severe crown fracture of the left maxillary central incisor. Two years before, the patient underwent endodontic treatment of this tooth after pulp involvement due to a caries lesion on palatal surface. At that moment, the patient was instructed to restore the tooth through fiber-glass intracanal post reinforcement adhesively cemented, but refused treatment. According to the patient, no traumatic event occurred to result in the fracture, only the masticatory function.The labial surface of the crown completely detached from the tooth remnant, leaving the palatal cervical third alone (Figure1).

After anamnesis and at clinical and radiographic examination, it was observed that the previous endodontic treatment was satisfactory (Figure 2).Thus, 2/3 of gutta-percha was removed from the total root length and the tooth was cleaned (0.2% Chlorhexidine, Byofórmula – Farmácia de Manipulação, São José dos Campos, Brazil). Tooth root was enlarged with the aid of size 3 largo bur.At this appointment, the tooth fragment was used as provisional restoration (Figure 3).

Following, at the next appointment, the provisional restoration was removed and a pre-fabricated ceramic (zirconium oxide) intracanal post (Cerapost, Komet-Brasseler, Germany) was chosen due to its resistance feature and the material core (leucite-reinforced feldspathic ceramic IPS Empress, Ivoclar/Vivadent) due to its favorable esthetic feature (Figure 4).

Then, root canal impression was performed with acrylic resin(red Duralay, Relliance Dental Mfg. Co., USA) to adapt the zirconium post to the internal root canal morphology. After the laboratorial procedure of IPS Empress ceramic injection, the post adaptation was checked clinically and radiographically by verifying the filling of 2/3 of the canal (Figure 5).

The indirectceramic post and core was cemented with Bistite II DC system (Tokuyama Dental Corporation, Japan).Tooth substrate

was etched with Bistite II adhesive system by applying: the mixture of"primer 1A + primer 1B" for 30 s followed by 3 s drying and application of "primer 2" for 20 s and 5 s drying (Figure 6).

The root portion of the ceramic post was conditioned with 10% hydrofluoric acidfor 60 s, comprehensively washed with water/ air sprayand dried with air jet.A silane-based bonding agent (Monobond-S, Ivoclar/Vivadent, Liechtenstein)was applied for 1 min and dried with air jets. A new provisional restoration was constructed and cemented.

The impression procedure was performed through customized individual cap and polyether-based material (Impregum, 3M ESPE, Germany). The individual caps were transferred through condensation silicon material (Oranwash and Zetaplus, Zermack, Italy) at a single impression. The infrastructurewas constructed in glass-infiltrated alumina-based ceramic with the aid of CAD/CAM Cerec device(VITA In-Ceram 2000 AL Cubes, Vita Zahnfabrik, Germany), onto the dyed working cast. Following infrastructure proof, the occlusion was registered with the aid of nº 7 dental wax and the color was selected (Vita 3D Master,Vita Zahnfabrik, Germany).

The coating and stratification ceramics was applied onto the infrastructure (Vita VM7, Vita Zahnfabrik, Germany), resulting in a metal-free crown.

The internal surface of the crown was sandblasted with 50 μm aluminum oxide particles for 15 s. The crown cementation was carried out with Bistite II DCsystem (Tokuyama Dental Corporation, Japan), following the manufacturer's instructions. The tooth remnant received the same etching procedure aforementioned described. Figures 7 and 8 show the final aspect of the case.

The patient was clinically and radiographically followed-up at every 6months. Figure 9 and 10 displays the clinical and radiographic follow-up of the case 5 years after the crown cementation.



Figure 1 - Tooth remnant after fracture.



Figure 2 - Radiograph to evaluate the previous endodontic treatment.



Figure 3 - Tooth fragment employed as provisional crown.

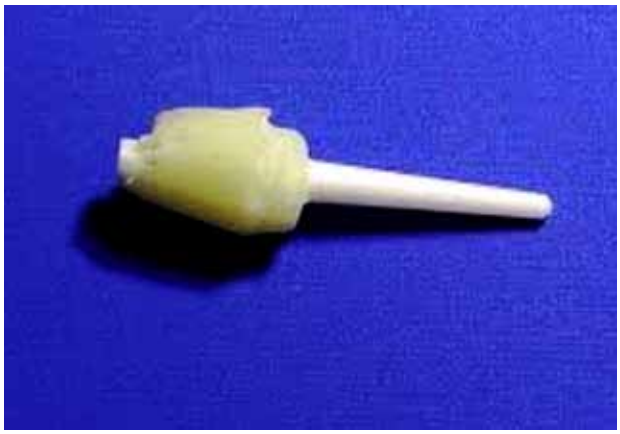


Figure 4 - Pre-fabricated zirconium oxide ceramic intracanal post.



Figure 5 - Radiograph image of post adaption.



Figure 6 - Cementation of intracanal post.



Figure 7 - Final case.



Figure 8 - Final case.



Figure 9 - 5-year clinical follow-up.



Figure 10 - 5-year radiographic follow-up.

DISCUSSION

Although maxillary anterior teeth received lighter occlusal loads than posterior teeth, coronal fractures occur mainly in devitalized teeth due to the oblique stress directions [2]. Accordingly, the rehabilitation of endodontically-treated teeth is an important factor for treatment success [1].

The use of glass-fiber posts aiming to reinforce weakened endodontically-treated roots is very common in clinical practice, but the literature lacks a consensus on this approach type.

The adhesively-cemented glass-fiber post creates a stiff beam inside the canal because the root portion and alveolar bone at one side and the crown remnant at other side supports it [2].

Hatta, in 2011,observed that endodontically-treated teeth reinforced with glass-fiber posts supported greater fracture load than those not receiving posts [2,3].

In another study, Sorrentino et al. found that glass-fiber posts increased the resistance of MOD restorations in devitalized teeth. The authors emphasized that the teeth restored with glass-fiber and resin posts showed “restorable” fractures, while those restored only with resin composite led to the catastrophic fracture of tooth remnant [6].

Notwithstanding, root canal preparation for installing the post can lead to a discreet structure weakening because of the tissue removed during root canal access and enlargement.

The use of intracanal posts is required to reestablish part of the structure lost due to endodontic treatment, replace the dentine, and provide the necessary retention for the future prosthetic rehabilitation [7,8]. Reinforcement posts are indicated in cases of either partial or total loss of the crown structure [9], when there is enough amount of remaining tooth structure and satisfactory root position [10].

Until the 80s, metal was the material of choice to construct posts. Currently, many post types have been used, among them:fiber-resin and zirconium [1].

Although fused posts and cores have still been considered as “gold standard” for large restorations of endodontically-treated teeth [11,12], its use has been associatedin the literature at risk of fracture because of its shape and rigidity [13,14].

The fiber posts are developed aiming to assure favorable esthetics; without compromising the resistance[15] andlong-term stability[16,17];and with modulus of elasticity similar to that of dentin [18,19].

Signore et al. followed-up intracanal posts from 5 to 30 years and observed high survival values reaching 98% of success for glass-fiber posts [20].

According to Oliveira, in 2011, the choice for the post type to be used depended on many factors, but the main one to be considered is the amount of tooth crown remnant [2]. Thus, fiber post followed by resin composite reconstruction should only be indicated for cases in which tooth remnant shows height between 2 and 4 mm and a minimum of 2 mm wall thickness after tooth preparation [2].

From a mechanical point of view, these dimensions are important to provide greater capacity of fracture toughnessof the post/resin set and reduce the risk of its displacement. If this minimum dimension is not achieved, fiber and resin composite posts must be replaced by ceramic posts.

Scottiand Ferrari, in 2003, affirmed that the used of resistant and stiff posts is necessary to support the restoration properly, and among them, ceramic posts are highlighted because of its esthetic feature, high resistance, and biocompatibility [4]. Ceramic post success has been clinically observed:Kern and Wegner, in 1998, e.g. followed-up 80 ceramic posts for 16.6 years and found no failures [21].

Although the literature has not reached a consensus on the material of choice for reconstruction and reinforcement of devitalized tooth remnants undergone fracture, either fiber posts with resin composite cores or ceramic posts are good options.

In this present study, the clinical case employing a pre-fabricated zirconium oxide-based intracanal post (Cerapost, Komet-Brasseler) because of resistance feature and leucite-reinforced feldspathic ceramics (IPS Empress, Ivoclar/Vivadent) because of favorable esthetics was clinically followed-up for 5 years. Currently, different impression materials, ceramic construction and cementation procedures have been available in dental market. Notwithstanding, the follow-up period of this present study shows the esthetic and functional outcome reached with the techniques and materials employed.

CONCLUSION

Glass-fiber intracanal reinforcement posts for devitalized teeth have been indicated to prevent tooth fractures. In cases of tooth crown undergone fracture, the decision of which post type to be indicated mainly depends on the amount of coronal remnant. Intracanal fused metal post can be used if the crown remnant was insufficient to support the core material.

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Date submitted: 2014 Mar 11

Accept submission: 2014 Jun 23