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A NEW AESTHETIC CONCEPT FOR TEETH RESTAURATION – CASE REPORT

Dentistry

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ABSTRACT

Background: To investigate impact of novel inner ferrule preparation around cervical part of root canal. **Methodology:** A case report featuring endodontically treated tooth restored with newly designed zirconia ceramic post. Special drills were used for horizontal root canal preparation around cervical part and post spaces in canal, leaving at least 3 mm gutta-percha apical seal. Zirconia ceramic posts were cemented with Multilink Automix, upgraded with Multi-Core and zirconia crowns. **Results:** IF preparation design and new post-core design with retentive rings in the coronal part showed stronger retentive coronal design. **Conclusion:** IF preparation and retentive rings of the zirconia post contribute to increased fracture strength. Rehabilitation significantly reduced the severity of root fracture for excellent function and aesthetics.

KEYWORDS

Endodontically treated teeth, zirconia post, inner ferrule

INTRODUCTION

Endodontically treated teeth with insufficient coronal structure are often restored with crowns. They are considered less resistant due to loss of tooth structure during conservative access cavity preparation[1]. Teeth with significant loss of structure require protection to direct forces preventing longitudinal fractures[2]. If there is insufficient dentin to support crown restoration, post-core system is necessary for retention, support, and coronal-radicular stabilization. Restoration of endodontically treated teeth (ETT) involves various materials and principles[3].

Cast metal post-core systems have long history of successful clinical use due to superior physical properties[4,5,6,7]. Successful outcomes may be compromised in these cases as the low elastic modulus of cast metal post-cores can cause stress concentrations in the surrounding radicular dentin, leading to root fractures[8,9].

It is essential to consider metallic, fiber, and ceramic posts, whether prefabricated or customized. The increasing demand for esthetic and biocompatible restorations has driven the development of tooth-colored, translucent, metal-free post-core systems[10,11,12].

The fiber posts are recommended in situations with small loss of root structure due to their elastic modulus being close to dentin and having limited fracture resistance. In contrast, metal posts are suitable when greater amount of coronal structure is missing, especially in cases requiring support for removable or fixed partial prostheses[13]. Over last two decades, the use of esthetic metal-free ceramic crowns in restoring ETT with severe coronal destruction has increased. Prefabricated and CAD/CAM zirconia ceramic post systems have been introduced to satisfy the growing esthetic's emphasis[14,15].

The transparency of all ceramic crowns can be successfully maintained using ceramic-post-core materials. The choice of root post should adhere to principles such as preparation of tooth structure (ferrule effect) and failure mode[16, 17, 18]. It is important to adequately prepare coronal tooth structure for zirconia ceramic posts with retentive ring in coronal part, providing an additional inner ferrule (IF) effect for most favorable stress distribution[19, 20]. A few studies investigated effect of inner/outer ferrule preparation around the root canal cervical peripheral surface on the fracture strength of ETT[21, 22]. New zirconia posts with coronal retentive form have been shown to improve fracture strength and esthetic of all ceramic restorations. Modern trends led to widespread use of metal-free ceramics for ETT restoration, enhancing esthetics with tooth-colored posts and cores. This clinical study presents case report in which destroyed coronal dentin was replaced with a zirconia post[23].

Case Report

A 55-year-old female patient with erosion and discolorations in upper frontal teeth was treated with zirconia-ceramic crowns and upper left canine root with zirconia ceramic post with retentive coronal part.

Figure 1: Teeth discoloration

Intraoral examination revealed significant loss of coronal dentin in endodontically treated left upper canine. Probing depths within the physiological range, and no pathological mobility was observed (Figure 1). Treatment plan included preparing endodontically treated root canal and new zirconia ceramic post. Due to compromised vertical post space, new zirconia post-core was inserted to improve adaptation and retention, with advantage of stronger retentive coronal design (Figure 2).

Figure 2: Zirconia post-core

Temporary restoration of remaining coronal tooth structure was removed, and gutta-percha was pulled out from root canal with special drills (Figure 3). Root preparation to the final post length, diameter and depth was finished.

Figure 3: Special drill for Y-TZP retentive post

Two-thirds of the gutta-percha point were removed, leaving sufficient space for zirconia post. A 2 mm IF depth was prepared in the cervical part around root canal for first retention ring. After final preparation of ETT, cementation procedure used composite cement (Multilink Automix, Ivoclar).

Dentin was cleaned, conditioned with 37% phosphoric acid 15 seconds, then primer (Syntac, Ivoclar) for 15 seconds, followed by drying. Dental adhesive (Syntac, Ivoclar) was applied for 10 seconds and dried. After applying a thin layer of luting agent (Heliobond, Ivoclar Vivadent) on the dentin and post for 10 seconds, both the base and catalyst of the resin cement were mixed and applied on the root and post surface. After inserting the post into the canal, core buildup was done with MultiCore (Ivoclar), using polymerization lamp for 40 seconds. Next, an impression was taken with silicone-based material.

In laboratory, using the dental Manual Aided Design/Manual Aided Manufacturing system (Zirkonzahn, Italy), the zirconia ceramic crowns were fabricated. After seating the crown over canine, marginal fit was examined using dental explorer (Figure 4). The crown's cementation procedure was similar as with zirconia post. During trial appointment, post adaptation was verified in mouth, and control radiograph was taken.

Figure 4: Zirconia ceramic crowns

DISCUSSION

Aesthetic advantage was achieved using zirconia ceramic dowel and composite core to support metal-free ceramic crown. Oblak and Jovanovski have introduced prefabricated zirconia ceramic post systems with a retentive design in the coronal portion, primarily increasing the fracture strength of restored ETT, and secondarily, satisfying the trend towards heightened esthetic awareness[24,25].

The choice of post should adhere to principles such as preservation of tooth structure, retention and resistance, ferrule effect, failure mode, and retrievability[26]. Although alternative tooth-colored dowel-and-core systems are available, primary advantage of our zirconia dowel systems lies in their cylindrical conical post and retentive coronal rings, reducing incidence of root fracture[27]. For teeth with severe coronal destruction, translucency of all-ceramic crowns can be successfully maintained with use of ceramic post-core materials[27]. Whenever possible, preparing post space should conserve coronal and radicular tooth structure[28]. Retention form is associated with preparing geometry, including post's taper, length, diameter, surface texture, luting agent, and passivity. However, professionals can only intervene with post's taper, length, and diameter. It's important to adequately prepare coronal tooth structure for new zirconia post with retentive ring in coronal part, providing inner ferrule effect that enables the most favorable stress distribution from the crown, core, and post to dentin[29].

CONCLUSION

IF preparations and retentive rings in coronal part of zirconia post contribute to increasing the fracture strength of ETT and reducing severity of root fracture. They achieve biocompatibility, high fracture resistance, and aesthetic restoration. Treatment approach provided natural-appearing, ensuring excellent function and aesthetic.

REFERENCES:

[1] Sarkis-Onofre R., Amaral Pinheiro H. et al. (2020) Randomized controlled trial comparing glass fiber posts and cast metal posts, J Dent. M: 96:103334.
[2] Sawant A, Chunawalla Y, Morawala A, Kanchan NS, Jain K, Talathi R. (2017) Evaluation of novel glass fiber reinforced composite technique for primary anterior teeth with deep carious lesions: a 12-month clinical study. Int J Clin Pediatr Dent. 10: 126–130.
[3] Libman WJ, Nicholls JI. (1995) Load fatigue of teeth restored with cast posts and cores and complete crowns. Int J Prosthodont; 8: 155-61.
[4] Sorensen JA, Engelman MJ. (1990) Ferrule design and fracture resistance of endodontically treated teeth. J Prosthet Dent 1990; 63: 529-36.
[5] Martinoff JT. (1984);
[6] Goodacre CJ, Spolnik KJ. (1994). The prosthodontic management of endodontically treated teeth: a literature review. Part I. Success and failure data, treatment concepts. J Prosthodont; 3: 243-250.
[7]. Fernandes AS, Dessai GS. (2001) Factors affecting the fracture resistance of post-core reconstructed teeth: A review. Int J Prosthodont; 14: 355-363.
[8]. Clarisse CHN, Dumbrigue HB, Al-Bajat IM, Griggs AJ, Wakefield WC. (2006) Influence of remaining coronal tooth structure location on the fracture resistance of restored endodontically treated anterior teeth. J Prosthet Dent. 95: 290-96.
[9]. Faria A, Rodrigues R, Antunes R, Mattos M, Ribero R. (2011) Endodontically treated teeth: Characteristics and considerations to restore them. Journal of Prosthetic Research. 55: 69-74.
[10]. Cloet E, Debels E, Naert I. (2017) Controlled clinical trial on the outcome of glass fiber composite cores versus wrought posts and cast cores for the restoration of endodontically treated teeth: a 5-year follow-up study. Int J Prosthodont. 30:71–79.
[11]. Batista VES, Bitencourt SB, Bastos NA, Pellizzer EP, Goiato MC, Dos Santos DM. (2020) Influence of the ferrule effect on the failure of fiber-reinforced composite post-and-core restorations: a systematic review and meta- analysis. J Prosthet Dent. 23: 239–245.
[13]. Gegauf AG. (2000) Effect of crown lengthening and ferrule placement on static load failure of cemented cast post- cores and crowns. J Prosthet Dent 2000; 84: 169-79.
[14]. Bateli M, Kern M et al. (2014) A retrospective evaluation of teeth restored with zirconia ceramic posts: 10-year results. Clinical Oral Investigations; 18(4):1181-1187.
[15]. Stankiewicz N, Wilson P. (2008). The ferrule effect. Dent Update 35: 222-4.
[16]. Sh Ying, S Chen, S Wang, L Xu, X Wang, F He, W Liu (2022). Outcome of teeth restored with CAD/CAM zirconium dioxide post-cores: a retrospective study with a follow-up period of 3–6 years. BMC Oral Health. 2022; 22: 236.
[17]. Oblak C, Jevnikar P, Kosmac T, Funduk N, Marion Lj. (2004) Fracture resistance and reliability of new zirconia posts. J Prosthet Dent; 91: 342-8.
[18]. Dakskobler A, Jevnikar P, Oblak C, Kosmac T. (2007). The processing-related fracture resistance and reliability of root dental posts made from Y-TZP. J Eur Ceram Soc; 27: 1565-70.
[19]. Kosmac T, Dakskobler A, Oblak C, Jevnikar P. (2007). The strength and hydrothermal stability of Y-TZP ceramics for dental applications. Int J Appl Ceram Technol; 4 (2): 164-74.
[20]. Jovanovski S., Cotic J., Kocjan A., Oblak C., Jevnikar P. (2018) Fracture resistance of endodontically treated maxillary incisors restored with zirconia posts: effect of the internal plateau preparation. Advanced in Applied Ceramics. 118, (1-2): 78-82
[21]. Pereira JR, Valle AL, Shiratori FK, Ghizoni JS, Melo MP. (2009) Influence of intraradicular post and crown ferrule on the fracture strength of endodontically treated teeth. Braz Dent J. 20 (4): 297-302.
[22]. Jovanovski S., Popovski J., Dakskobler A., Marion Lj., Jevnikar P. (2017) The influence of Crown Ferrule on Fracture Resistance of Endodontically Treated Maxillary Central Incisor. Balk J Dent Med; 21: 44-49
[23]. Jovanovski S., Cotic J., Kocjan A., Oblak C., Jevnikar P. (2018) Fracture resistance of endodontically treated maxillary incisors restored with zirconia posts: effect of the internal plateau preparation. Advanced in Applied Ceramics. 75.
[24]. Oblak C, Jevnikar P, Kosmac T, Funduk N, Marion Lj. (2004) Fracture resistance and reliability of new zirconia posts. J Prosthet Dent; 91: 342-8.
[25]. Jovanovski S., Marion Lj. (2021).The effect of new internal ferrule design preparation on the fracture resistance of endodontically treated central incisors. UBT Knowledge International Center: 552-570
[26]. Ozkurt Z, Iseri U, Kazazoglu E. (2010) Zirconia ceramic post systems: a literature review and a case report. Dent Mat Journal. 29 (3): 233-245.
[27]. Faria A, Rodrigues R, Antunes R, Mattos M, Ribero R. (2011) Endodontically treated teeth: Characteristics and considerations to restore them. Journal of Prosthetic Research. 55: 69-74.
[28]. Kramer EJ, Meyer-Lueckel H, Wolf TG, Schwendicke F, Naumann M, Wierichs RJ. (2019) Success and survival of post-restorations: six-year results of a prospective observational practice-based clinical study. Int Endod J. 52: 569–578.
[29]. Jovanovski S. (2012) Assessment of the effect of treatments of the ceramic posts and their effect on resistance on the endodontically treated teeth. PhD, Faculty of Dental Medicine, Skopje, Macedonia.