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NEW CONCEPT OF FRONTAL TEETH RESTAURATION FOR EXCELLENT FUNCTION AND AESTHETIC

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Abstract: This clinical case report aimed to investigate impact of a novel inner ferrule (IF) preparation around root canal on the subsequent esthetic restoration. Material and Methods: This clinical research involved a case report featuring endodontically treated teeth (ETT) restored using a newly developed ceramic post. Special drills (Edenta AG GmbH, Switzerland) were utilized for root canal preparation, involving horizontal preparation around the cervical portion of the root canals and post spaces. Experimental samples (ETT) were prepared with and without a 2mm IF preparation. The newly designed zirconia ceramic posts (TZ-3Y-SBE, Tosoh, Japan) were cemented with Multilink Automix (Ivoclar), upgraded with MultiCore (Ivoclar), and crowned with an all-ceramic zirconia crown (Zirkonzahn, Italy). Results: Our clinical case provided insights into a new type of all-ceramic aesthetic restoration of prepared teeth (ETT) with a new IF preparation design and a new zirconia post-core design. Conclusion: The novel horizontal IF preparation around the root canal was developed to accommodate the initial retentive coronal ring of the newly designed zirconia posts. The incorporation of IF preparation and coronal retentive rings within the zirconia post structure effectively enhances the fracture resistance of ETT. This new modern aesthetic rehabilitation in all restored teeth significantly reduces the severity of root fractures for excellent function and aesthetic restoration of ETT.

Keywords: Endodontically treated teeth, zirconia post, inner ferrule, aesthetic restoration

Field: Medical Sciences and Health

1. CASE REPORT

Modern trends have led to the widespread use of metal-free ceramics for ETT restoration, enhancing esthetics with tooth-colored posts and cores. This report elaborates on the treatment of a 48-year-old female patient presenting with more than ten years old metal ceramic crowns restorations in the anterior region. The treatment involved the placement of metal-free zirconia ceramic crowns supported by novel Y-TZP ceramic posts featuring retentive coronal segments for the left upper central incisor (Fig. 1).

Fig. 1. INNER FERRULE PREPARATION

Source: author

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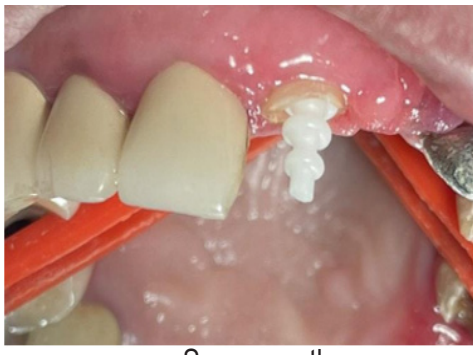
Dental examination and treatment plan

The intraoral examination of the patient unveiled a substantial loss of remaining dentin in the endodontically treated left upper central incisor, requiring restoration (Fig. 1). Our new contemporary treatment included preparing of ETT for application of new zirconia ceramic post (Fig. 2).

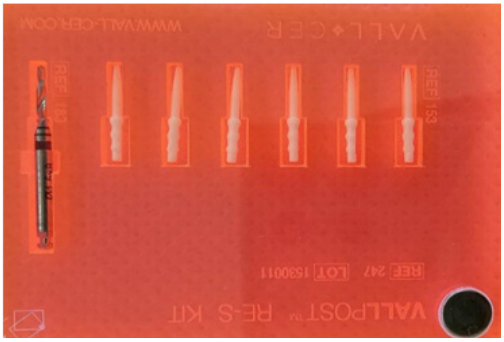
Fig. 2. 2mm IF PREPARATION FOR Y-TZP RETENTIVE POST



Source: author

The initial step involved the preparation of the remaining coronal dentin (Fig. 1). Subsequently, root preparation was carried out using specialized drills (Edenta AG GmbH, Switzerland) until reaching the final post length (Fig. 3).

Fig. 3. SPECIAL DRILLS AND Y-TZP RETENTIVE POST



Source: author

To mitigate the risk of root perforation, two-thirds of the gutta-percha point were removed, creating ample space for the zirconia post. Simultaneously, a 2 mm depth of inner ferrule (IF) was established in the cervical region surrounding the endodontically treated canal (Fig. 1) to accommodate the initial retention ring (Fig. 2). Subsequent to the completion of the ETT preparation, the cementation process used composite cement (Multilink Automix, Ivoclar) in accordance with the manufacturer's guidelines. The dentin was conditioned with 37% orthophosphoric acid for 15 seconds, followed by the application of a primer (Syntac Primer, Ivoclar) for an additional 15 seconds. After that, the working area was dried. Subsequently, a dentinal adhesive (Syntac Adhesive, Ivoclar) was applied for 10 seconds.

Fig. 4. COMPOSITE MULTICORE (Ivoclar)

Source: author

A thin layer of luting agent (Heliobond, Ivoclar Vivadent) was applied to both the dentin and post surfaces for 10 seconds. The composite cement's base and catalyst were mixed and subsequently applied to the root and post surfaces. Following the insertion of the post into the canal, core buildup was executed using MultiCore (Ivoclar) (Fig. 4), utilizing a lamp for 40 seconds polymerization. After all that procedure of remaining prepared dentin in the coronal part of the tooth, an impression was taken utilizing a silicone-based material (Zetaplus and Oranwash L, Zhermack, Italy). In laboratory setting, the crown was meticulously crafted using zirconia ceramic via the dental MAD/MAM system and then in clinical setting, was successfully cemented (Fig. 5). The crown's cementation process replicated that of the zirconia post. Following the placement of the final zirconia crown onto the tooth, a thorough evaluation of marginal fit was conducted using a dental explorer.

Fig. 5. FINAL ZIRCONIA CERAMIC CROWN (Zirkonzahn, Italy)

Source: author

2. DISCUSSION

For teeth exhibiting severe coronal destruction, the translucency of all-ceramic crowns can be effectively preserved through the utilization of ceramic post-core materials, as highlighted by Kramer EJ. et al. (2019) and Kharboutly NA. et al. (2023). The study aims to present the contribution of the new inner ferrule, in addition to outer ferrule preparation, to achieve a double ferrule effect, significantly increasing fracture resistance and retention, reducing micro leakage, improving light transmission, enhancing esthetic advantages, and increasing the radio density of zirconia posts. This clinical case discusses the patient with post-endodontic restauration of upper left incisor. With the treatment of this female patient an aesthetic and functional dental concerns was attained. An aesthetic improvement was accomplished by utilizing Y-TZP dowel. For core buildup was used MultiCore to uphold the all-ceramic crown.

According to Ozkurt Z. (2010); Faria A. (2011); Sawant A. (2017); Qudaih AM. (2020); and Badami V, Ketineni H. (2022), the selection of a post should adhere to various principles, including the IF preparation for obtaining additional retention and stabilization and reparable failure mode.

Jovanovski S., Cotic J. et al. (2018) and Jovanovski S., Marion L. (2021) affirm that the primary advantage of their new zirconia post lies in their cylindrical conical post and retentive coronal rings, which mitigate the risk of root fracture.

Oblak et al. (2004); Dakskobler A., et al. (2007) and Jovanovski S. (2012) 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.

The author, Jovanovski (2012), in this clinical case report, underscores the significance of adequately preparing the coronal tooth structure for a new designed zirconia retentive post. This preparation establishes a ferrule effect, facilitating optimal stress distribution from the crown, core, and post to the dentin. However, a new IF preparation method was introduced for the restoration of ETT using the metal-free Y-TZP ceramic post and crown for tooth restoration. In modern dentistry, the need for new aesthetic solutions and the use of zirconium oxide ceramics as one of the leading materials for achieving biocompatibility and high aesthetics, as well as anatomical-morphological, functional and aesthetic restoration with increased fracture resistance is more pronounced.

The increase in fracture resistance and significant increase in repairable fractures in modern esthetic prosthetic restorations is extremely important for the success of our restorations in daily clinical prosthetic practice.

The process of obtaining a new type of internal (radicular) preparation around the endodontically

treated canal was shown for precisely fitting the retentive form of the newly designed zirconium oxide post to obtain an internal "Ferrule effect" which, in addition to the external one, significantly increases the strength of the entire restored radicular-coronal dental complex.

3. CONCLUSIONS

In this clinical report,

- A Y-TZP ceramic post upheld the all-ceramic crown of the upper left incisor.
- IF dentin preparation was performed to facilitate the placement of the Y-TZP post retentive ring.
- The implementation of IF preparations and retentive zirconia post aids in augmenting the ETT strength and reducing the severity of unrepairable fractures.
- Irrespective of the number of older dilemmas regarding restoring ETT in the literature, we managed to achieve biocompatibility, high fracture resistance and an aesthetic restoration.
- This newly innovative treatment strategy provided the patient with a dentition that looks natural, ensuring excellent functionality and aesthetic restoration of ETT.

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