REVIEW IN NEW METHODS USED IN TREATMENT OF ENDODONTIC TREATED TEETH

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Abstract

Concerns about the best technique to recover a tooth after a root canal procedure frequently arise in dental clinics. While the importance of the ferrule impact on the predictable restoration of teeth with root canals is widely acknowledged, other factors, such as residual dental volume, tooth location, number of proximal contacts, timing of the conclusive restoration, and the existence of cracks, have been reported to influence restoration and tooth survival. Re-evaluation of scientific literature is prompted by the ongoing advancement of dental materials and treatments as well as a trend toward less aggressive endodontic-restorative techniques. The purpose of this review of literature is to offer an up-to-date summary of current clinical literature about the restoring of teeth with filled roots.

Keywords: Endodontic treated teeth, New method, Review , Treatment.

Introduction:

In recent years, post-endodontic interventions and the effects on the outlook for decayed teeth have received increasing attention. Both the alveolar bone and the root's apex can be exposed to bacteria and their byproducts as a result of these treatments, leading to the delayed failures. The outcomes of these "events" may be crucial in figuring out whether the endodontic therapy is successful in the long run [(1).]

Radiographs of teeth that had undergone endodontic treatment were examined by Ray and Trope to determine the association between the quality of the root canal filling and the coronal repair. They discovered that when effective endodontic treatments and good restorations were combined, 91.4% of the teeth had no periapical inflammation, but only 18.1% of the teeth had no peri-radicular inflammation as a result of bad restorations and endodontic treatments. Additionally, the success rate was 67.6% when effective permanent restorations were placed after subpar endodontic procedures and seemed to be radiographically sealed.

They came to the conclusion that the coronal restoration was substantially more important for maintaining apical periodontal health than the endodontic procedure's technical proficiency [(2)].

It's crucial to understand that teeth that have had endodontic treatment differ structurally from healthy teeth that have not. Following therapy, there may be significant changes in tissue physical properties, tooth structure loss, and coloring. It is now widely accepted that root-filled teeth are One of the trickiest approaches in clinical dentistry is the use of final restorations on teeth that are weaker and require particular care. Research has examined these tissue modifications at various levels, and as a result, it has been shown how they affect the tissue at different levels. The unique requirements entail maintaining appropriate retention for the final restoration and the highest level of resistance to tooth fracture, which is frequently referred to as anchoring [(3)].

Root filled teeth require successful endodontic and restorative procedures in order to survive. These teeth need to be repaired in a way that will allow them to bear masticatory stresses acting both vertically and laterally without breaking. The installation of an instantaneous core at the time of endodontic obturation during root canal therapy is advised to strengthen the coronal seal, a crucial component of endodontic therapy. The advancement of ceramic materials, and particularly dental CAD-CAM (Computer-aided design / Computer - aided manufacturing) technology, has resurrected the prospect of creating single-unit restorations, all-ceramic endo-crowns, which exhibit high biocompatibility and favorable mechanical qualities. The prepared canal and morphologically formed crown are now considered to be a single-unit repair [(4)].

Fracture resistance of bonded restorations was higher significantly than the cemented restorations, bonded endo-crowns showed the highest values of fracture load. Endo-crowns have higher failure resistance than restorations using fiber reinforced composite supports [(5)].

Restoration of Endo-dontically Treated Teeth (ETT)

To ensure that the pulpless tooth continues to function as a vital component of the oral masticatory system over the long term, a successful endodontic procedure must be combined with an effective post-endodontic repair. Persistent intra-radicular infection or problems with post-endodontic restorative procedures are the two main causes of endodontically treated teeth failing. Careful post endodontic restoration is necessary since the fracture of the tooth is exacerbated by the cumulative loss of tooth structure brought on by cavities, trauma, and

endodontic operations, as well as the loss of structural integrity. The ultimate restoration should ideally be prepared before the root canal procedure is started, though the restoration strategy may change as the procedure goes on [(6)].

The restoration the number of teeth that have undergone endodontic therapy evolved recently. The dentist's options for repairing teeth have expanded because to the availability of adhesive procedures. Due to their enhanced cosmetic outcomes, all-ceramic crowns and composite resin crowns frequently replace amalgam cores & cast metal posts with direct composite & fiber-posts [(7)]. According to studies, posts do not actually strengthen teeth; rather, they are intended to hold onto a core that will serve as the proper support for the final crown or prosthesis. Posts also contribute to stress distribution, and using restorative materials with dentine-like biomechanical properties enables reasonably equal stress distributions to the tooth and the surrounding tissues, providing protection against root-fracture [(8)].

According to the number of walls still present around the access cavity preparation, divided the restoration plan for endodontically treated teeth into the following categories [(9)].

Class I: Surrounding the access cavity preparation, there are four additional walls. Only intracoronal restoration of the access cavity is possible if all of the cavity's axial walls have a thickness of more than one millimeter. if adequate, so long as the tooth isn't put under excessive occlusal stresses.

Classes II and III: Preparation of the access cavity with two or three remaining walls; in these instances, a core followed by a crown is recommended.

Class IV: it's one of the remaining wall surrounding the preparation of the access cavity; in which instances, a post is specified.

Class V: Placement of posts is required in these situations since there is no remaining wall surrounding the access cavity preparation.

According to Cohen, the choice of postendodontic restoration relies on how much coronal tooth structure is still present [10]: as a result, teeth with less structural loss are stronger by nature and can be restored using simply coronal restoration; If more than 50% of the tooth's coronal structure is still present, it can be restored with a crown; if only 25% to 50% of the coronal structure is still present, it can be restored with a non-ridged post; and Rigid posts must be used to reconstruct the teeth with > 25% of their coronal structure or less than 3–4 mm of cervical tooth structure. However, because to various risks involved, including root perforation, root sensitivity, and failure of the teeth restored with posts, many authors are opposed to the use of posts teeth. Today, however, thanks to improvements in dental adhesives, resin cements, and acidetchable ceramics like leucite and lithium desilicate, it is possible to restore endodontically treated teeth using onlays and overlays that use the pulp chambers as a retentive resource. Endo-crown, which restores teeth that have undergone endodontic therapy and uses the pulp chamber as a retentive resource, is a conservative treatment method that makes use of such resources [11].

Post Length and Diameter

The post's length is determined by the sizes and shapes of the remaining root. For the purpose of choosing the appropriate post length, it has been suggested that root length be taken into account. It has been shown that retention and stress distribution are better the longer the post. However, using a long post might not always be an option, particularly if the remaining root is short or curved. According to several studies, the apical seal must be maintained by preserving 4-6 mm of gutta percha. In relation to Post Diameter, it has been observed that post diameter makes little difference in how well a post is retained, increasing post diameter increases resistance while also raising the chance of root fracture [10].

Esthetic Posts

While producing optical qualities equal to all-ceramic crowns, a metal-free post prevents the staining of the tooth structure that can happen with metal posts. The zirconia post (Cosmopost), which is made of the zirconium oxide ceramic (ZrO2-TZP1- ceramic) [12], is one form of all-ceramic post that is indicated in the anterior, aesthetically significant region of the maxilla and mandible. Particularly valued are the ZrO2-TZP-superior ceramic's compatibility, corrosion resistance, and great mechanical strength (high flexural strength and fracture toughness). However, cosmoposts are not recommended for people who have a deep overbite and bruxism, whether they actually have it or suspect they do. For improved mechanical retention, the

Zirconia post's surface is smooth and devoid of any serrations, grooves, or roughness. Hydrofluoric acid cannot be used to etch zirconium posts, hence it is impossible to attach a composite core material to the post, which causes a difficulty with core retention. This problem has been solved using a method that involves pressing a leucite-reinforced ceramic core material (Empress) onto a zirconium post [13].

Fiber-reinforced Composite Posts (FRC)

These posts are made of glass, quartz, carbon, or both embedded in an epoxy or methacrylate resin matrix. Fiber silanization before embedding improves the adherence of quartz or glass fibers to resin matrix [14]. The polymeric matrix protects the fibers from environmental deterioration brought on by high temperatures and humidity as well as acts as a load transfer medium between them, maintaining their condition within the composite structure. The fibers give strength and stiffness. The bulk of the material (between 40% and 65% vol.) is made up of fibers, which also give the matrix strength and stiffness and control how much weight an FRC structure can support [15]. It is impossible to duplicate the stress distributions pattern in a tooth that is otherwise healthy and has a functioning pulp. Particularly when the endodontic posts are inserted into the root canal, a completely distinct and artificial structure with stiffness completely different from that of the pulp chamber is present. Therefore, it is advantageous to utilize materials with mechanical characteristics that are very similar to these of natural dentin. The modulus of elasticity of posts reinforced with fibers is about (20) GPa, while that of cast metal-alloy posts, prefabricated metal posts, and ceramic posts is about (150) GPa. The mechanical characteristics of fiber reinforced posts are thus comparable to those of the natural dentin, which has a flexural modulus of roughly (18) GPa [16]. These posts are often utilized for highly cosmetic restorations and are attached with resin luting cements. They also include composite cores. These posts are contraindicated in situations when there is inadequate remaining tooth structure, excessive, or aberrant occlusal stresses, as they are not as powerful as conventional posts. Compared to carbon fiber posts, glass-fiber reinforced posts have less rigid fibers. They do not put the tooth at risk for root fracture due to their greater flexibility compared to carbon-fiber and metal posts. Unfortunately, it can also cause leakage, the disintegration of the cement, the core moving slightly, and early repair failure [17].

The Advantages and Disadvantages of the Fiber Reinforced Posts

Fiber reinforced posts have an aesthetic appeal, an elasticity that is comparable to dentin, are biocompatible, and can disperse stresses over a large surface area, raising the load threshold. They are also simple to handle, easy to install, and take less time. They exhibit strong resistance to fracture and favorable retention when used with adhesive bonding techniques. They are, regrettably, pricey, technique-sensitive, and have poor radiographic visibility. All post systems exhibit some proportion of failure but with different range. Post failure rates are higher when teeth are not repairable. Factors influencing the post- and core-recovery clinical [10].

The Clinical and the Technical Aspects of Fiber Post-restorations [18].

- Tooth isolation; the rubber dam should be used for tooth isolation as well as for all clinical adhesive dentistry treatments. Analyze the case using a radiograph to determine the post's length and diameter in relation to the tooth type.
- Gutta-percha removal and canal enlargement; these tasks can be completed quickly and effectively with Gates-Glidden or Largo drills. Using heated instruments like System B (SybronEndo, Orange, CA, USA) to remove the gutta-percha root filling is another option. Chance of perforating the root, it is best to use resin composite to fill any potential gaps between both the post and the canal.
- Removal of the temporary cement and sealer remains can be completed with ease by using ultrasonic tips, which are best aided by the magnification from the operating microscope.
- root canal drying: Prior to applying the bonding system, the root canal needs to be dried. For this, paper points or a regulated air stream from a Stropko irrigator (Vista Dental; Racine; WI: USA) may well be employed. It is advised to test the post in the root canal after deciding on the necessary post size [18].
- Bonding systems: Fiber posts can be cemented using both self-etching primers and three-step bonding systems because they both achieve a similar level of root dentine adhesion. On both side of the root dentine as well as the post, the primer is placed. Using a resin that is self- or dual-curing is advised. For the bonding agent to be distributed evenly throughout the depth of roots canal, microbrushes are required.
- Cement; composite resin It is also preferred to cement the post using the conventional core or dual-cured composites resins. These materials have more dentine-like mechanical characteristics. While flowable composite and composite resin cements have a significantly lower modulus of elasticity and that may, therefore, be the weakest portion of the restoration,

light-cured composites are too thick to be adequately introduced into the root canal.

- Insertion of the post; its posts are simply placed into roots canal during insertion.
- Build-up of a composite resin core; the same self-curing substance is used to make the composite resin core right away. To finish the core build-up, a composite resin that has undergone light curing is an option. Crown preparation can then be done within the same visit after that.

Endo-crown

Use of the dental pulp as an-extension of the crown itself, or an "endo-crown," is one postless treatment option for ETT. This method entails integrating the crown and core buildup into the solitary component, or "monobloc." The preparation for the endo-crown is less complicated and intrusive than for the post and core build-up with crown preparation, which reduces treatment times and expenses.

The endo-crown is a conservative, predictable, and clinically workable restorative method for maxillary premolars that have had endodontic treatment, according to a finite element study (FES). The survival percentage of the endo-crowns in posterior teeth was 90–95%, according to short-term clinical data [19].

Ramrez-Sebastià *et al* in (2014) suggested that endodontically treated incisors with (2) mm of ferrule can be restored with the use of endo-crowns with adhesive material. There haven't been any clinical trials with anterior endo-crowns yet. In a recent clinical experiment, Belleflamme et al. in (2017) examined (99) endo-crowns made of ceramics with polymer or lithium disilicate infiltrated, with success rates of (99.0%) and (89.9%) for a mean duration of (44.7) months [20, 21]. Endo-crowns, when the adhesive approach is appropriately applied, are a dependable way to restore severely damaged molars and premolars, even in the presence of considerable coronal tissue loss or occlusal risk factors such bruxism or unfavorable occlusal relationships [22].

An endo-crown is a single-piece repair that is anchored in the pulp chamber. Its key benefit is that it reduces the danger of recontamination after disobturation and does not necessitate the removal of root dentin for retainer implantation. When compared to dental preparations obtaining endo-crown restorations, conventional whole crown preparations result in more tooth wear, more clinical time, and higher laboratory costs. Endo-crown restorations may be milled using (CAD / CAM) technology, which reduces the need for the clinical adjustments'

procedures and incorporations of preparation-related flaws while also enabling one-session treatment [23].

The Indications and the contraindications of endo-crown

All molars teeth can benefit from the endo-crown treatment, but those with clinically low crowns, calcified the root canals, or extremely thin roots should especially consider it. Inability to ensure adhesion, a pulpal chamber that is < 3 mm deep, or a cervical margin that is < 2 mm wide for the majority of its circumference are all contraindications to the use of an endo-crown [24].

Preparation technique for endo-crown [24]

- **The Occlusal preparation:** In order to prepare, it is necessary to reduce the height of occlusal surfaces overall by at least (2) mm in the axial direction.
- **Axial preparation:** Undercuts in the access of the cavity are mostly removed during this stage.
- **Polishing the cervical band:** This stage uses a bur with the same taper as axial preparation bur, but with a bigger diameter and finer grain size.
- **Bonding Endocrowns** are bonded to prepared teeth using adhesives like self-adhesive RelyX Unicem (3M, St. Paul, Minn.) or composites like Multilink (Ivoclar, Schaan, Liechtenstein).

Fracture Resistance of Endo-crowns and Posts

According to in vitro tests, teeth repaired with endo-crowns have a similar level of fracture resistance, and in some cases even a higher level, than teeth replaced with post, core and conventional crowns. An in vitro study that looked at the endo-crown's fracture resistance under axial and transverse forces found in the observed values at the moment of fracture under axial loading were significantly higher than the average masticatory forces experienced by humans, which range from about (600 to 900) N. In in vivo research, (15) molar endo-crowns were evaluated again after an average of (26) months. Only one endo-crown failed after (28) months due to persistent caries. [5]. When compared to composite core build-up, the incorporation of fiber post led to larger fracture loads, although statistically speaking, this improvement was statistically insignificant after teeth crowning [25].

Ribbond System

The Ribbond endodontic post and core approach, which is advocated by numerous renowned speakers, reduces the possibility of root fracture and offers a number of benefits. After endodontic treatment, no additional teeth are extracted in comparison to prefabricated posts. The natural strength of the tooth is preserved, the risk of root perforation is eliminated, and because the Ribbond is formed when it is malleable, it conforms to the undercuts and contours of the canal naturally and offers additional mechanical retention. The tooth-post interface does not have any stress hotspots. The Ribbond post and core is exceptionally resilient and passive.

The transparent fibers from Ribbond allow for the natural flow of light through crowns and teeth since they take on the color features of the composite. This produces a quite aesthetically pleasing outcome [26].

The Technique [27]

To accommodate the size and shape of a prefabricated post, additional shaping is not necessary beyond the standard endodontic procedure. The process is briefly explained in the paragraphs that follow. This technique is fully explained in the Ribbond user guide, which is included with a purchase.

1. Make the canal ready for regular dentin bonding.
2. Inject into the canal a dual-cured, moderately filled composite, such as a luting composite.
3. Move the wet Ribbond through the luting composite in the canal to the apical end of the canal using the specific Ribbond post and core device.
4. Apply composite to the sticking-out Ribbond ends, mold them roughly into the core's shape, and cure.
5. Add composite to the core, cure it, and shape it.

Conclusion

Endo-dontically treated teeth must be restored using a variety of materials and methods. There is disagreement over whether a crown is necessary, and a composite restoration in the anterior with lingual access alone will work. Only when a tooth is too weak to hold a core is a post recommended if a crown is needed. Every effort should be made to preserve the coronal and radicular tooth structure during post-preparation. No post is perfect for every clinical circumstance, so the choice

of post should be based on the position of the tooth in the arch, any potential abutments, and the occlusion. The post should contain every mechanical component needed to repair the tooth. The optimum ferrule would be one that is close to mm in circumference to reduce the negative effects of lateral and rotational pressures on the repair and post.

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