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Recent Advances In Post-Endodontic Restorations: A Paradigm Shift From Macro-Retention To Biomimetics

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Abstract
For decades, the "post and core" was the bread and butter of restorative dentistry, often applied with a mechanical mindset: the deeper the metal, the better the retention. However, as our understanding of biomechanics has matured, so has our approach to the endodontically treated tooth (ETT). We are currently witnessing a profound shift away from rigid, macro-retentive anchors towards "Biomimetic Dentistry" interventions that seek to emulate the physical properties of natural dentin. This review explores this evolution, critically analyzing the move from prefabricated posts to customized fiber reinforcement, the disruptive rise of the "post-less" endocrown, and the non-negotiable importance of tissue preservation. It reflects on the current state of the art, arguing that the best post is often no post at all.
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I. Introduction

Historically, Literature attributes the brittleness of endodontically treated teeth (ETT) to moisture loss. Reasearchers believed that without a pulp, the dentin "dried out." While dehydration plays a minor role, modern literature has clarified the real cause : the loss of structural integrity.

The traditional access cavity, combined with aggressive canal shaping and the subsequent removal of dentin to accommodate a rigid post, leaves the tooth structurally compromised. For a long time, clinicians operated under the misconception that posts "reinforce" the root. Posts serve one purpose only: to retain the core. If they are placed at the expense of the remaining tooth structure, the risk-benefit ratio is unfavourable(1).

This realization has sparked in the era of adhesive and biomimetic dentistry. Today, the goal is not just to restore, but to restore the biomechanical behavior of the tooth. This review highlights how materials science and digital technology are helping us achieve this, moving from the rigid mechanics of the past to the flexible, adhesive future of the present.

The Biomechanical Reality: Why Modulus Matters

To understand why metal posts are declining in acceptance, we have to look at the **Modulus of Elasticity (MOE)**. Natural dentin has an MOE of approximately 18.6 GPa. It is designed to flex slightly under load, acting as a shock absorber.

In contrast, a cast metal post (approx. 200 GPa) or even a titanium post (110 GPa) is far too rigid. When a tooth with a metal post is subjected to masticatory forces, the post does not flex with the root. Instead, it acts like a wedge, concentrating stress at the apex or along the canal walls. This stress concentration is the primary driver of root fractures (2). The development of materials that mimic the flexural behavior of dentin, specifically fiber-reinforced composites.

The Evolution of the Fiber Post

Fiber posts composed of carbon, quartz, or glass fibers in a resin matrix—have become the standard for cases where intraradicular retention is unavoidable. This similarity allows for the creation of a "monoblock," where the post, cement, and root flex in union (3).
However, a standard fiber post has a limitation: it is round, but root canals are almost never perfectly round.

The "Anatomic Post" Solution

Clinically, clinicians frequently encounter oval or ribbon-shaped canals. Placing a round fiber post in an oval canal forces us to rely on a thick layer of resin cement to fill the gaps. This cement layer is the weak link it is prone to polymerization shrinkage, bubbles, and eventual debonding.

To overcome this, the **Anatomic Post** technique (or relining technique) has gained traction. This involves "customizing" a standard fiber post with composite resin inside the lubricated canal before final cementation. This simple chairside step transforms a generic post into a custom-fit restoration, ensuring a minimal, uniform cement thickness and significantly higher bond strength (4).

The "Post-Less" Era: The Rise of the Endocrown

An endocrown is a monolithic restoration that anchors into the pulp chamber, utilizing the surface area of the chamber walls and the saddle-like stability of the pulpal floor for retention..

Why it works

Why drill into the canals and risk perforation or fracture when we have enough surface area in the pulp chamber available for bonding

- **Material Choice:** Lithium Disilicate (E.max) is currently the gold standard here because it can be etched and bonded chemically. Zirconia, while strong, relies more on friction and is harder to bond to, making it less ideal for this specific indication (5).
- **The Ferrule Factor:** While a traditional crown requires a 2mm ferrule to prevent fracture, the endocrown is more forgiving. It distributes stress differently, directing forces down the long axis of the tooth rather than against the cervical collar. Recent meta-analyses suggest that endocrowns in molars perform as well as, or better than, traditional post-and-core crowns (6).

Adhesion:

Most of the fiber posts or endocrowns work without effective adhesion. Bonding to root canal dentin is very difficult. It is a "hostile" environment: deep, dark, moist, and possessing a high configuration factor (C-Factor) that creates immense shrinkage stress.

Navigating the Chemistry

The introduction of **Universal Adhesives** containing **10-MDP** has simplified. Acidic universal adhesives can inhibit the setting of dual-cure resin cements. Clinicians must ensure they are using a compatible system, often requiring a separate "Dual Cure Activator" to ensure the cement sets properly in the apical third where the curing light cannot reach (7).

Furthermore, the concept of "Active Seating" incorporating the adhesive into the dentin is crucial in the canal space to infiltrate the smear layer effectively.

The Role of Irrigants: A Lesson from Our Research

As endodontists, we often forget that the restorative phase begins during the root canal treatment. The chemicals we use to clean the canals affect the dentin's ability to bond later.

A recent study has highlighted that prolonged exposure to strong irrigants like Sodium Hypochlorite (NaOCl) and high-concentration EDTA can deplete collagen fibrils and significantly lower dentin microhardness (8). This structural degradation makes the tooth more prone to fracture before we even place a restoration.

Current Protocol: Recent studies suggest a final rinse with Ethanol or Chlorhexidine before bonding. We must neutralize the oxygen-releasing effects of NaOCl, as oxygen inhibits the polymerization of resin cements.

Digital Dentistry and Preservation

CAD/CAM technology is not just about speed; it's about preservation. With intraoral scanners, we can now capture the internal geometry of the pulp chamber with micron-level precision. This allows for the fabrication of one-piece post-and-cores or endocrowns that fit passively, reducing the internal stress on the tooth. Furthermore, **Guided Endodontics** is emerging as a technique to locate calcified canals through a 3D-printed guide, preserving the precious Peri-Cervical Dentin (PCD) that gives the tooth its structural integrity (9,10).

II. Discussion: Making The Clinical Decision

The ferrule effect remains the single most critical factor for survival. If you have 2mm of sound dentin around the circumference, the type of post does not affect. If pulp chamber is deep, the Endocrown is likely the superior choice..If the canal is wide and weak, a rigid post is not indicated. **Polyethylene Fibers (Ribbond)** or an anatomic fiber post to reinforce the walls, preventing wedging effect. (11).

III. Conclusion

The field of post-endodontic restoration has evolved. We have moved away from the "mechanistic" era, where we treated teeth like inanimate objects to be screwed and cemented, into the "biologic" era.

Respect the dentin, every millimeter of dentin removed for a post space is a millimeter of fracture resistance lost. The technique sensitivity of bonding agents in the root canal cannot be overstated. **Think biomimetically,** Use materials that move, flex, and behave like the tooth structure they are replacing.

As we align with future requirements, the integration of bioactive materials and minimally invasive guided protocols will likely make the traditional metal post-and-core a dental relic.

References

[1]. Dietschi D, Duc O, Krejci I, Sadan A. Biomechanical Considerations For The Restoration Of Endodontically Treated Teeth: A Systematic Review Of The Literature--Part 1. Composition And Micro- And Macrostructure Alterations. Quintessence Int. 2007;38(9):733-43.

[2]. Goracci C, Ferrari M. Current Perspectives On Post Systems: A Literature Review. Aust Dent J. 2011;56 Suppl 1:77-83.

[3]. Ferrari M, Vichi A, Grandini S. Efficacy Of Different Adhesive Techniques On Bonding To Root Canal Walls: An SEM Investigation. Dent Mater. 2001;17(5):422-9.

[4]. Grandini S, Goracci C, Monticelli F, Borracchini A, Ferrari M. SEM Evaluation Of The Cement Layer Thickness After Cementation Of Three Different Post Systems. J Prosthet Dent. 2005;93(3):277-84.

[5]. Bindl A, Mörmann WH. Clinical Evaluation Of Adhesively Placed Cerec Endo-Crowns After 2 Years--Preliminary Results. J Adhes Dent. 1999;1(3):255-65.

[6]. Govare N, Contrepois M. Endocrowns: A Systematic Review. J Prosthet Dent. 2020;123(3):411-18.

[7]. Magne P, Kim TH, Cascione D, Donovan TE. Immediate Dentin Sealing Improves Bond Strength Of Indirect Restorations. J Prosthet Dent. 2005;94(6):511-9.

[8]. Nasreen F, Sebastian VM, Junjanna P, Maratt VH. A Comparative Evaluation Of The Effect Of 8% And 17% Ethylenediaminetetraacetic Acid Exposure For 1 Min And 10 Min On The Fracture Resistance Of Endodontically Treated Roots: An In Vitro Study. J Contemp Dent Pract. 2021;22(10):1154-58.

[9]. Bitencourt SB, Turssi CP, Basting RT, Amaral FL. CAD/CAM Fabricated Customized Composite Post And Core: A Case Report. Oper Dent. 2016;41(4):356-62.

[10]. Juloski J, Radovic I, Goracci C, Vulicevic ZR, Ferrari M. Ferrule Effect: A Literature Review. J Endod. 2012;38(1):11-9.

[11]. Belli S, Eskitascioglu G. Biomechanical Considerations In Restoring Endodontically Treated Teeth. Endod Topics. 2016;20:80-98.