A New Perspective on the Endodontic Restorative Continuum

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The introduction of rotary nickel titanium (NiTi) instrumentation to endodontic instrumentation procedures has provided an inherent capacity for the maintenance of a greater degree of dentin thickness and as such preservation of tooth structure in the critical buccal lingual direction is maximized. The use of posts to rehabilitate the structure of endodontically treated teeth remains fraught with increasing uncertainty as new instrumentation protocols abound and as the adhesion era in dentistry flourishes resulting in more conservative non-invasive protocols. Retrospective studies demonstrate that non-metallic post systems will produce significantly more positive results than with prefabricated metallic posts (1,2). As the developments in adhesive restorative technologies and techniques enable functional and aesthetic reconstruction of debilitated tooth structure without traditional post/core construction, a more conservative non-invasive rehabilitation is possible for rebuilding the integrity of the residual tooth structure.

All these advances raise highly relevant questions; are posts still necessary? are the new composite reinforced fibre posts evidence based? are chairside fabricated composite reinforced fiber post systems preferable? are restorations without posts reliable and predictable? are there other ways to reinforce teeth? what parameters apply to the choice of reinforcement? what is a the ideal adhesive restorative procedure for endodontically retreated teeth.

The relevance of the need for post placement is definitely in question Adhesion of the newest generation of composite core materials to the remaining tooth structure has been shown to be more effective without post placement that with post placement provided the placement protocol is exacting(3). Numerous studies have shown that fibre reinforced posts demonstrate reduced stress vectors with a distribution literally approaching that of a tooth without a post. Increasingly, the literature validates the use of composite reinforced fibre posts in preference to metal systems (4,5).

Chairside fabricated composite reinforced fiber posts are an alternative to customized ones (6). Using improved restorative materials that stimulate the physical properties and other characteristics of natural teeth in combination with the proper design principles, the clinician can develop a tooth-restorative complex with optimal functional and esthetic results (7,8).

Restorations without custom made posts are also reliable and predictable in special cases and represent a viable option to traditional post/core construction. The cases presented in this article will amplify this approach.

The American Association of Endodontics has a white paper on the considerations for choice of the post-endodontic restorative modality. The considerations are; 1) the amount of remaining sound tooth structure, 2) occlusal function, 3) opposing dentition, 4) position of the tooth in the arch, as well as length, width and curvature of the root(s). The philosophy further states that, “The primary purpose and main indication for a post is to retain a core that can be used to support the final restoration. Posts do not reinforce endodontically treated teeth, and a post is not necessary when substantial tooth structure is present after a tooth has been prepared. In actuality, placing a post can predispose a tooth to fracture. In response to the discovery that posts do not strengthen teeth - they only serve to retain the core - research into design, shape, diameter, and length of posts now focuses on issues of retention.”

The policy of the American Association of Endodontists in regard to the endodontic-restorative continuum is as follows: In anterior teeth with intact marginal ridges, cingulum, and incisal edges, the placement of a lingual or palatal dentin-bonded composite resin is the treatment of choice. In posterior teeth, contemporary thought, in both research and clinical practice, supports the placement of a protective restoration with full cuspal coverage on these teeth. The research however, continues to question the concepts espoused. Macpherson and Smith have shown that combining of materials to reinforce weakened cusps is a worthy cost effective alternative to removing the cusp entirely and making a crown or protecting the cusp with a cuspal coverage gold inlay (9).

The buccal cusps of endodontically treated mandibular molars reinforced with a combination of horizontal pins and dentin adhesive were not significantly weaker than intact teeth. Of the restored teeth, those which had buccal cusps reinforced with horizontal pins and those treated with complete cuspal coverage amalgam restorations exhibited the most favorable restorative prognosis following cusp fracture (10). By using the current generations of restorative materials that simulate the physical properties and other characteristics of natural tooth in combination with proper design principles, the clinician can develop a tooth-restorative complex with optimal functional and esthetic results.

Vertical loading of the teeth did not generate harmful concentrations of stress. More challenging situations were encountered during working and nonworking micro motions, both of which generated inverted stress patterns. Supporting cusps were generally well protected during both working and nonworking cases (mostly subjected to compressive stresses). Nonsupporting cusps tended to exhibit more tensile stresses. High stress levels were found in the central groove of the maxillary molar during nonworking micro motion and at the lingual surface of enamel of the mandibular tooth during single-contact working micro motion. The occlusal load configuration as well as geometry and hard tissue arrangement had a marked influence on the stress distribution within opposing molars (11).

It may well be that full cuspal coverage is not mandated for predictable success of the restoration of the endodontically treated tooth. For the moment, there is not substantive evidence to suggest that maximal reduction and restoration will provide optimal long term success. Continued testing as new materials with more dramatic properties and possibilities come to the marketplace will invariably provide the answer this conundrum.

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Case I: Restoration of an endodontically treated mandibular molar

Fig 1: Immediate post-operative view.

Fig 2. Nano Bond (Pentron Corp., Wallingford, CT) self etch primer applied to the dentin

Fig 3: Splint-It® (Pentron Corp., Wallingford, CT) glass fiber is used to reinforce missing Walls of the build up.

Fig 4: Lingual view of the first Splint-It layer inside the pulp chamber.

Fig 5: A Hawe Lucifix transparent matrix (Hawe Neos Dental, Bioggio, Switzerland) is placed.

Fig 6: The missing proximal wall is rebuilt with a condensable resin (here Simile™, Pentron Corp., Wallingford, CT). On the top of the resin layer a second Splint-ITsecond glass fFiber is placed.

Fig 7: The glass fiber is then covered with a flowable resin (Flow-It® ALC®™, Pentron Corp., Wallingford, CT).

Fig 8a, Fig 8b: The cusps are build up in succession

Fig 9: Occlusal view of the completed restoration after finishing and polishing.

Case II: Restoration of an endodontically treated maxillary molar

Fig 1: Immediate post-operative view of endodontic procedure

Fig 2: The Ribbond (Ribbond®, Seattle, WA) is prepared to be cut in size. To obtain an accurate measurement of the needed length, thin foil was used.

Fig 3: The foil is placed to determine the measurement needed.

Fig 4: The Toffelmire matrix band is secured in place.

Fig 5: Self-etch primer used to condition the dentin and dried with an air blast directed from a Stropko irrigator before the application of bonding material.

Fig 6a: Applying Tetric® Flow Chroma (Ivoclar Vivadent, Amherst NY). During the light cure, this flowable resin changes colour to dark green. The discoloration eventually neutralizes.

Fig 6b: Passing with an explorer threw the resin minimizes the creation of voids.

Fig 7: The flowable resin immediately after curing demonstrating the change in colour. 37% phosphoric acid used to etch the enamel margins.

Fig 8: Separate applications of Primer and Bonding agent (Optibond FL, Kerr Dental, Orange CA)

Fig 9: The proximal wall buildup with Point 4™ (Kerr Dental, Orange CA).

Fig 10: Lingual view of the rebuilt external outline of the missing walls.

Fig 11a, Fib 11b: The glass fiber is activated using Silane (Monobond-S, Ivoclar Vivadent, Amherst NY). The Silane is then dried using a photothermal oven (D500 by Coltène/Whaledent Inc. Cuyahoga Falls, Ohio),

Fig 12: The Ribbond is placed on the rebuilt external walls.

Fig 13: The glass fiber is secured in place with a flowable resin (Revolution Formula 2, Kerr Dental, Orange CA).

Fig 14: A more opaque layer of flowable composite (Point 4 Flowable, Kerr Dental, Orange CA) is applied over the Tetric® Flow Chroma .

Fig 15: Before starting the build up of the cusps.

Fig 16: The occlusal relief immediately after the rebuilt with a condensable resin (Point 4 Kerr Dental, Orange CA).

Fig 18: Occlusal view of the completed restoration.

Fig 19: Lingual view of the completed restoration.