

Short Communication

Advances in Structural Preservation During Root Canal Therapy

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The primary goal of endodontic therapy is the long-term retention of a functional tooth by preventing or treating apical periodontitis. However, there are many other factors that impact endodontic outcomes such as the quality of the restoration and structural integrity of the tooth after root canal preparation. Contemporary research efforts are currently directed to better understanding dentine behaviour and structure during aging and function. An alternative approach is to minimize structural changes during root canal therapy, which may result in a new strategy that can be labeled 'minimally invasive endodontics'. This paper focuses on describing minimally invasive dentistry in endodontics from a conceptual perspective, relating to diagnosis, access opening, instrumentation and obturation of the root canal system.

Key words: Minimally invasive dentistry, caries removal, pulpal diagnosis, periapical diagnosis, gouging.

INTRODUCTION

Minimal invasive dentistry (MID) can be defined as maximal preservation of healthy dental structures (Ericson, 2007). This is a concept that can embrace all the aspects of the profession. The main goal is tissue preservation, preferably by preventing diseases from occurring and intercepting its progress, but also by removing and replacing it with as little tissue loss as possible. With regards to endodontic procedures, it ranges from diagnosis to making a decision not to treat, to a minimally but purposefully crafted access opening, based on anatomical challenges, to minimal removal of dentin during access opening, enlarging and shaping of root canal to retain as much sound dentin as possible to retention of tooth structure during disassembly and retreatment or considering apical surgical intervention, to perform a crown lengthening procedure to establish sound

tooth structure margins for core/crown restorations as opposed to tooth extraction and implant or bridge placement (Murdoch-Kinch and McLean, 2003; Nový and Fuller, 2008).

DIAGNOSIS

Diagnosis of endodontic problems can be a challenging part of treatment process. It can frustrate clinicians and patients. Part of the difficulty is that it is not always a black and white issue; there are many shades of gray including subtle nuances in the patient's history that must be addressed when making treatment decisions (Tables 1 and 2).

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Table 1. How the examination results correlate with the diagnosis.

Pulp diagnosis	EPT test results	Thermal test results
Normal	Responsive	Sharp feeling to cold that subsides quickly
Reversible pulpitis	Responsive	Sharp feeling to cold that may linger very slightly no throbbing or aching
Irreversible pulpitis	Responsive	Throbbing/aching/lingering pain with hot or cold, aching pain several minutes after stimulus is removed
Necrotic	No response	No response

Table 2. How the examination results correlate with the periapical diagnosis.

Periapical diagnosis	Radiographic	Percussion	Palpation
Normal	No lesions	Not sensitive	Not sensitive
Acute periradicular periodontitis	No lesions	Sensitive	Not sensitive
Chronic periradicular periodontitis	Lesion	Not sensitive	May/May not be sensitive
Chronic periradicular periodontitis with symptoms	Lesion	Sensitive	May/May not be sensitive
Suppurative periradicular periodontitis	Lesion, sinus tract	May/May not be sensitive	May/May not be sensitive
Acute periradicular periodontitis	Lesion/No lesion	Sensitive	Sensitive/Swelling

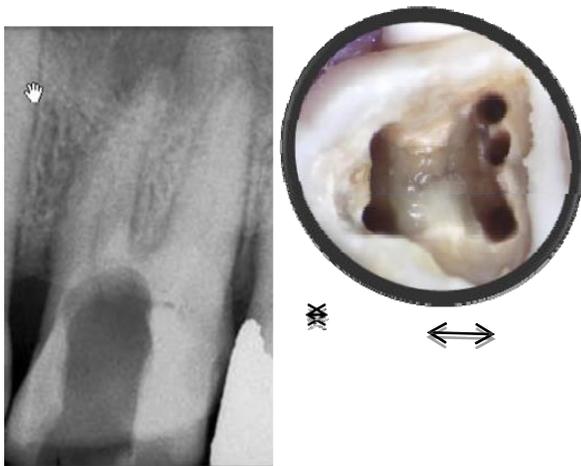


Figure 1. Gouging.

Access opening

Knowledge of anatomical structures and its variations is essential, so that from caries removal to root canal enlargement, sound tooth structure should be preserved; especially important is the prevention of gouging cervically laterally or into the floor of pulp chamber (Figure 1) (Gutmann, 2013).

Endo access has been performed which gives good access to canal orifice, but imagine the thickness of dentin that will remain mesially and distally if a crown was

prepared for this tooth (Ericson and Kidd, 2003). The endodontics has been perfectly performed but the tooth is compromised due to excessive loss of tooth structure during access. This is why we keep access limited and you will see sometimes what appears to be incomplete opening of pulp chamber. This is by design and allows important tooth structure to be maintained that contributes to the strength and durability of tooth.

Limiting tooth destruction becomes a greater challenge when attempting to treat teeth with calcified pulp chambers or canals. Assessing the degree of calcification prior to attempting treatment is the key to preventing iatrogenic damage to the teeth. One important aspect of learning to limit the removal of healthy tooth structure for access is that it actually makes endodontic procedures much more difficult (especially in second and third molars) and increases the chances of missing canals, so you need to balance these potential issues with benefits of doing so. Among the objectives of access opening, the point of conservation of tooth structure need to be over emphasized than the other major objectives like, obtaining straight line access, identification of orifices and de-roofing the pulp chamber.

ROOT CANAL INSTRUMENTATION

Even though judicious orifice location and careful canal preparation are essential, efforts should be made to minimize the excess removal of cervical tooth structure in

the canal orifice through the sequential use and gates glidden burs. A number of literature indicates that the laws of tooth structure cervically weakens the tooth and makes it susceptible to fracture. Even during widening with gates glidden burs, it should not be placed deep into the root canal as this tends to straighten the canal and weaken the canal walls predisposing then to cracks, stripping defects, etc.

The clinician has to carefully decide with which instrument and how wide to shape a given canal to achieve antimicrobial efficiency without weakening tooth structure (Lertchirakaran et al., 1999). Most NiTi instruments used according to the current guidelines allow wider shapes without major preparation errors and without excessively reducing radicular walls. Remaining dentin thickness was greater than 0.58 mm with GT rotaries, profile and Hero. Earlier studies had indicated considerable thinning of dentin walls after ultrasonic instrumentation, predispose to vertical fracture. So it would seem reasonable to develop better methods of canal cleaning and disinfection that can be used in presence of retained, sound tooth structure.

OBTURATION

Schilder suggested that the ideal root canal obturating material should be well adapted along the entire length of root canal walls and produce a homogenous mass. Currently, with the application of adhesive dentistry in endodontics, the present concept of obturation of root canal is not just the 3-dimensional filling of root canal and accessory canal, but also the reinforcement of root, also known as mono block effect.

Vertical root fractures are complications that are mostly seen in root canal obturated teeth and often lead to extractions. This is mainly due to the force with which the endodontic instrument (plugger, heater, spreader) is applied to the tooth's root canal during the endodontic treatment.

According to (Piskin et al., 2008), the spreader size larger than 25 number causes significant reduction in fracture resistance of roots and another study by Lertchirakarn et al. (1999) which state that fracture can result from excessive lateral condensation forces during root filling (Piskin et al., 2008; White and Eakle, 2000). Only light pressure is required during lateral compaction because the gutta-percha is not compressible and because as little as 1.5 kg of pressure is capable of fracturing the root. The use of strong well placed bonded cone materials and a post (only when necessary) prior to crown placement would help to tie the components of

tooth together to resist both functional forces and occlusal leakage.

CONCLUSION

Caution must be exercised when espousing the concepts of MIE in that there are proponents that would have you believe that MIE exists solely with the framework of preserving a few millimeters or less of cervical tooth structure while their empirical claims lack documented and meaningful studies (Clark and Khademi, 2010; Clark et al., 2013).

The long term treatment outcome can be measured vis-a-vis the extent of invasion. Less invasive procedure generally would seem to provide for a greater degree of predictability. On the other hand, it should be incumbent on each practitioner to know the expected outcome for any procedure, however invasive it may be.

Conflict of Interests

The author(s) have not declared any conflict of interests.

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