FOCUS ON: Minimally Invasive Endodontics

Clifford J. Ruddle, DDS, discusses predictably successful endodontics in the context of preserving healthy tooth structures.

Q: What are the goals of endodontic treatment? How does this relate to the concept of minimally invasive endodontics?

A: Said simply, the quintessential goals of predictably successful endodontics are to eliminate all organic substrate, within what is oftentimes a complex anatomical space, and fill root canal systems. To achieve these goals, it has long been recognized that some manner of access and root canal preparation are required. In fact, in the context of the current state of endodontic development, well-shaped canals are fundamental for cleaning and filling root canal systems, which in turn, promotes the long-term health of the supporting structures.

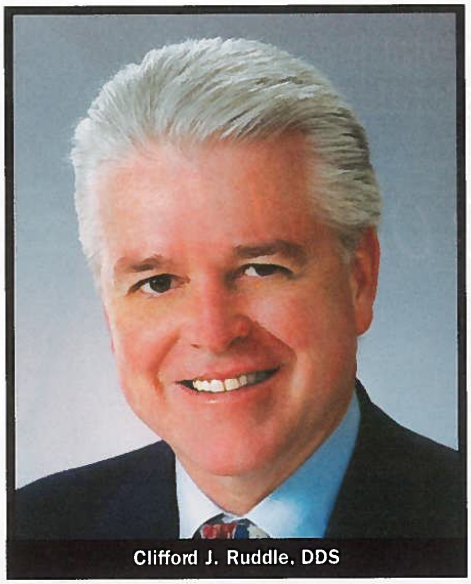
Minimally invasive endodontics (MIE) is a concept for respecting and maximally preserving healthy coronal, cervical, and radicular tooth structure while performing treatment. Ultimately, to be predictably successful, there must be a conscious balance between preserving and eliminating tooth structure when endodontically preparing teeth to fulfill the treatment goals. Although the concept of MIE applies to a variety of endodontic procedures, this idea is receiving considerable attention as it relates to cutting access cavities and shaping canals.

Q: Would you discuss the objectives of endodontic access in the context of MIE?

A: The biological objective of the endodontic access preparation is to eliminate all organic substrate from the pulp chamber and underlying root canal system. It should be appreciated that the access preparation will significantly influence a series of subsequent steps that serve to guide each case to a successful completion. The mechanical objective of the access preparation is to physically penetrate, funnel, and unroof the pulp chamber. Upon identifying the position of any given orifice, the internal axial walls should be flared, flattened, and finished.

The biological and mechanical objectives of endodontic access and the concept of MIE should coexist. This means the access cavity should not be needlessly restrictive or excessively large; rather, the access cavity should be just right. When the access preparation is too small, dentists tend to miss finding orifices and treating underlying root canal systems. Additionally, a restrictive access compromises placing instruments, reagents, and devices into canals. Further, limited access preparations impede visualizing internal fractures and their extent of propagation.

On the other hand, access cavities that are prepared too big weaken tooth structure and contribute to fractures and, at times, the loss of a tooth. Overprepared and frequently misdirected access cavities oftentimes exhibit gouged internal walls. A gouge produces an iatrogenic ledge or shelf within the cavity preparation that makes it needlessly difficult to insert instruments into canals. In the instance of provisionalization, restorations placed in access cavities exhibiting reverse funnels potentially collapse upon occlusal loading.


Clifford J. Ruddle, DDS

Serious clinicians understand and appreciate the importance of eliminating internal triangles of dentin to improve radicular access. Analysis of μCT images reveals that the coronal-most aspect of virtually all canals in multirooted teeth is anatomically positioned closer to the furcal-side concavity of the root. Histological evidence demonstrates that using an outward brushing motion to eliminate triangles of dentin produces more centered canal preparations within the mesiodistal dimensions of roots. The concept of MIE is to maximize furcal-side dentin, which, in turn, protects against weakening roots, strip perforations, and radicular fractures.

Q: Would you discuss the objectives for shaping canals?

A: The concepts concerning the role of canal preparation have differed markedly based on the development of endodontics at any given period of time. In 1974, Dr. Herbert Schilder first described the 5 mechanical objectives for shaping a canal that, when fulfilled, would promote the biological goals for long-term success. It is noteworthy that these objectives were published long before the more contemporary concepts of minimally invasive dentistry and endodontics were proposed. Randomly shaped canals and related root canal systems should be equally clean, yet the actual shape itself would understandably differ based on the root morphology and the obturation method chosen.

Canal preparation, or shaping, refers to the conscious development of a cavity preparation that is unique, specific, and appropriate for any given root canal and corresponding root. It is critical to understand we only shape canals to encourage 3-D cleaning and filling root canal systems. Shaping canals provides an effective reservoir for irrigant that, upon activation, can potentially penetrate, circulate, and digest tissue from the uninstrumentable portions of a root canal system. It is axiomatic that well-shaped canals promote 3-D cleaning and filling root canal systems.

Q: In the context of MIE, what are the controversies related to shaping canals?

A: Just like the endodontic access preparation, any given canal can be underprepared, overprepared, or prepared just right in accordance with Schilderian principles. Histological examination of endodontic failures indicates that underprepared canals, although instrumented, were neither cleaned nor well shaped. Leaving residual pulpal remnants, bacteria when present, and related debris continues to be a major cause for post-treatment disease.

On the contrary, overprepared canals violate both the mechanical objectives of canal preparation and the concept of MIE. Coronally overprepared canals weaken roots, predispose to hopeless fractures, and invite strip perforations. Apically overpreparing canals, presumably to exchange irrigant to the full working length, has long been linked to apical and lateral blocks, ledges, and apical perforations and transportations. Apical overinstrumentation continues to contribute to countless wet canals, post-treatment flare-ups, surgeries, and extractions.

Q: In closing, is there anything else you would like to add about MIE?

A: The mechanical necessity for endodontically accessing teeth and shaping canals is internationally recognized as an essential step in 3-D cleaning and filling root canal systems. The question to consider is, what is the smallest shape required to enable present and future technologies, methods, and techniques to effectively clean and fill root canal systems?

Dentists would be wise to contemplate the following analogy: *It is not logical to repair a car engine through a tail pipe when the alternative is to simply look under the hood.*

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