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CURRENT TRENDS IN GLIDE PATH PREPARATION OF ROOT CANALS

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The instrumentation and preparation of the root canal system is regarded as being a most important stage of endodontic treatment for this has an influence on the efficacy of subsequent procedures in endodontic therapy. Root canal instrumentation was originally aimed at facilitating the placement of medicaments in the root canal and little attempt was made to clear the organic contents from the root canal system. The focus of instrumentation then shifted to preparing the root canal space to facilitate the placement of root canal fillings but the methods employed were mostly unrelated to the anatomy of the canal system or to the properties of the obturation materials. In 1974, Schilder altered endodontic protocols forever with his innovative and revolutionary concepts that defined the design and biological objectives for optimally shaping canal spaces and for debriding root canal systems. There were several primary objectives – shaping the root canal system to have a smooth taper from orifice to apex; keeping the apical foramen as small as was practical and in its original position; and ensuring that the preparation flowed with the original anatomy of the root canal system. Other objectives were to confine preparation to the canal space, facilitate the removal of all tissue without forcing necrotic debris through the apical foramen, and ensuring that the final shape facilitated the placement of medicaments and exchange of irrigants.

However, the journey from orifice to apex can be perilous and proper root canal preparation remains one of the most difficult tasks in endodontic therapy. Canal scouting and preflaring are the first phases of canal instrumentation and it has also been noted that during these phases the clinician might more frequently encounter procedural difficulties.Among such problems are ascertaining the location of the root canals, access cavity preparation, canal preparation without procedural errors, and establishment and maintenance of working length. Canal systems can have multiple geometric planes and curve significantly more than the roots that house them. Two-dimensional radiographs fail to reveal these morphological variations of canals in different spatial planes. Instrumentation of canals with multi-planar curvatures and long, thin curved canals is fraught with possible procedural errors during either hand-file instrumentation or rotary nickel titanium (NiTi) instrumentation. These problems include instrument fracture, ledge formation, canal zipping or canal straightening, strip perforation, apical perforation, elbow formation and apical blockage. All of these errors can lead to incomplete debridement of the root canal system and contribute to decreased success rates of endodontic therapy.

Technical protocols for shaping root canals have evolved to enable achievement of the objectives outlined by Schilder and to reduce the occurrence of procedural errors. Serial instrumentation was developed using multiple, curved hand files and reamers.The step-back technique involved preparation of the apical region of the root canal first, followed by coronal flaring to facilitate obturation. Crown-down techniques commenced with preparation using larger instruments at the canal orifice followed by progressively smaller files when proceeding down the root canal. The balanced-force technique enabled the shaping of curved canals to larger sizes using modified stainless steel files.

Most of the procedural problems associated with achieving ideal shaping of curved canals were due

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to the stiffness of stainless steel instruments. The introduction of NiTi rotary instruments revolutionised endodontics as they have a lower modulus of elasticity than stainless steel instruments; and therefore exert fewer lateral forces on the dentine walls in curved canals. Even though NiTi instruments are stronger and more flexible than their stainless steel counterparts fractures may still occur within their elastic limit. Instrument breakage can happen without evidence of previous permanent deformation and even without prior use. Fracture is the most common procedural error that occurs during clinical use of rotary NiTi instruments, and the fear of such a mishap is the biggest deterrent to the adoption of the technology by clinicians.

Fracture of rotary NiTi instruments may occur as a result of cyclic flexural fatigue (bending stress) or through torsion (shear stress). Pronounced canal curvature is considered to be the major risk factor in instrument fracture due to cyclic fatigue (bending stress). Torsional stress occurs when there is: (1) an extensive contact area between the cutting surface of the instrument and the canal wall; (2) the canal cross section is much narrower than the cross-section of the tip of the instrument;and (3) when there is excessive axial pressure on the handpiece during instrumentation.

Originally, the term glide path is derived from aeronautics. Where in the glide path refers to the approach path of an aircraft when landing, usually defined by a radar beam. Its purpose is to establish a tightly controlled horizontal and vertical "corridor" that will take the incoming aircraft to the proper location at the end of the runway.Similarly in root canal treatment a vital step in the instrumentation process is preparation of the glide path to allow all subsequent instruments to move smoothly from the coronal orifice of the canal in an unimpeded progression to the apical constriction.

John West in 2006 defined the glide path as a smooth, though possibly narrow, tunnel or passage from the coronal orifice of the canal to the radiographic terminus or electronically determined portal of exit. The endodontic glidepath is a smooth radicular tunnel from canal orifice to physiologic terminus (foraminal constriction) of the root canal. The glidepath must be discovered if already present in the endodontic anatomy or prepared if it is not present. The glidepath can be short or long, narrow or wide, essentially straight or curved. Its minimal size should be a "super loose No. 10" endodontic file.

First, without the endodontic glidepath, the rationale of endodontics cannot be achieved. The rationale states that "any endodontically diseased tooth can be predictably saved if the root canal system can be non-surgically or surgically sealed, the tooth is periodontally sound or can be made so, and the tooth is restorable."1 A nonsurgical seal requires first the creation of a radicular path that can be cleaned of viable and nonviable bacteria, vital and non-vital pulp tissue, biofilm, and smear layer; then shaped to a continuously tapering funnel that can be predictably and easily obturated. Second, the glidepath is necessary for quality control. Sustainable excellent endodontic obturations are not possible without it.

According to West, it is very important that clinicians understand the following observations regarding root canal anatomy:

1. Most root canal foramina are at least the diameter of a No.15 hand instrument.

2. All root canal systems are different.

3. Many root canal systems are already essentially smooth-walled tunnels, albeit some of them are much narrower than a No.10 hand file.

4. After restorative procedures or a traumatic incident, the dental pulp responds by either becoming necrotic or calcific (from the crown toward the apex).

Every tooth that requires endodontic therapy presents its own set of anatomical challenges to effective instrumentation. Grossman states that "a dentist who has not separated an instrument has not done enough root canals".This threat of instrument fracture remains in contemporary endodontics. The preparation of a glide path not only helps to reduce the risk of instrument separation but also conveys to the clinician an intimate knowledge of the tortuous anatomy of the canal from the orifice to the terminus. The information gleaned during glide path preparation enables clinicians to adapt their shaping strategy to the nuances of the canal anatomy of each individual canal. While novel mechanical methods of glide path preparation serve to increase the efficiency of this essential prerequisite of canal shaping, the role of hand instruments should not be overlooked.

As it is rightly said by **Dr. Clifford J.Ruddle** *"If you own the glide path, you can consistently win the rotary game of endodontics".*