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# RESEARCH ARTICLE

## NECESSESITY OF GLIDEPATH: A REVIEW ARTICLE

**[1]Ruchi Gupta, [2,*]Ashvin G John, [3]Midhun Ramachandran, [4]Pudu Tirupati, [5]Sushma Shan, [6]Tony Jose and [7]Arvind Bhateja**

[1]Senior lecturer, Department of Conservative dentistry and Endodontics, D J College of dental sciences and research, Modinagar, Ghaziabad

[3,4,5,6,7]Post Graduate Student, Department of Conservative dentistry and Endodontics, D J College of dental sciences and research, Modinagar ,Ghaziabad

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**ABSTRACT**

According to West, a glide path is defined as a smooth radicular tunnel from the canal orifice of the canal to the physiologic terminus of the root canal. A glide path is achieved when the file forming it can enter from the orifice and follow the smooth canal walls uninterrupted to the terminus.Cleaning and shaping of the root canal is the single most important phase of endodontic therapy. The main goal of root canal instrumentation is to obtain a continuous tapering funnel flowing with the shape of the original canal from the coronal access to the apex and so the Glidepath is the answer. It is the starting point of radicular preparations. Without it,cleaning and shaping becomes unpredictable or impossible because there is no guide for endodontic mechanics.

***Corresponding author:* Ashvin G John,**



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## INTRODUCTION

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 (Schilder, 1974). 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 placementof medicaments and exchange of irrigants. However, the journey from orifice to apex can be perilous and proper rootcanal preparation remains one of the most difficult tasks in endodontic therapy. Canal scouting and preflaring are the first phases of canal instrumentation and the clinician might more frequently encounter procedural difficulties during these phases. Most of the procedural problems associated with achieving ideal shaping of curved canals were due to the stiffness of stainless teel instruments. The introduction of NiTi rotary instruments revolutionized endodontics , these 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 (shearstress). 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 hand piece during instrumentation. The instrumentation technique used and the preparation of a proper glide path therefore play a significant role in reducing torsional stress.

In the last decade, nickel titanium (NiTi) manual and rotary instrumentation have revolutionized the field of endodontics. Because these instruments are rotated in root canals, they are subjected to structural fatigue that eventually leads to failure. Torsion and fatigue through flexure are the main two reasons why rotary NiTi instruments fracture. Cleaning and shaping of the root canal is the single most important phase of endodontic therapy. The goal of root canal instrumentation is to obtain a continuous tapering funnel flowing with the shape of the original canal from the coronal access to the apex and so the Glidepath is the answer. It is the starting point of radicular preparations. Without it, cleaning and shaping becomes unpredictable or impossible because there is no guide for endodontic mechanics.

The endodontic Glide-path is a smooth radicular tunnel from canal orifice to physiologic terminus (foraminal constriction). Its minimal size should be a "super loose No. 10"endondontic file (Schilder, 1974; Peters, 2004; Hülsmann, 2005; Jafarzadeh, 2007; Cunningham, 1992; Kartal, 1997; Haikel, 1999; Mullaney, 1979). The Glidepath must be discovered if already present in the endodontic anatomy or prepared if it is not present. The Glide path can be short or long, narrow or wide, essentially straight or curved without the endodontic Glide path, the rationale of endodontics cannot be achieved. In summary, glide path creation is essential for prevention of rotary file separation and most effective rotary use . In order to be safe, before rotary shaping, the dentist must always discover that a glide path already exists or that one needs to be created.

**Definition:** According to West, a glide path is defined as a smooth radicular tunnel from the canal orifice of the canal to the physiologic terminus of the root canal. A glide path is achieved when the file forming it can enter from the orifice and follow the smooth canal walls uninterrupted to the terminus.This confirms that there is a pathway for rotary instruments to passively follow in the canal[14].

**Importance of Endodontic Glide path:** Without the endodontic Glide path, the rationale of endodontics cannot be achieved. The rationale states that "any endodontic ally diseased tooth can be predictably saved if the rootcanal system can be non-surgically or surgically sealed, the tooth is periodontally sound or can be made so, and the tooth is restorable. The Glide path is necessary for quality control. Sustainable excellent endodontic obturation are not possible without it. Nickel-titanium (NiTi) rotary instruments were introduced to improve root canal preparation. In clinical practice these instruments are associated with an increased risk of fracture, mainly because of bending normal stresses (failure by fatigue) and torsional shear stresses (failure by torque) .What the rationale of endodontics requires is the entire length of the root canal system be cleaned and shaped. Glidepath is prerequisite to this mechanical objective. A glide path is achieved when the file forming it can enter from the orifice and follow the smooth canal walls uninterrupted to the terminus.

**The lack of glide path establishment may result in:**

- Ledge Formation.
- Blockage of root canals.
- Transportation.
- Zip Formation.
- Perforation.

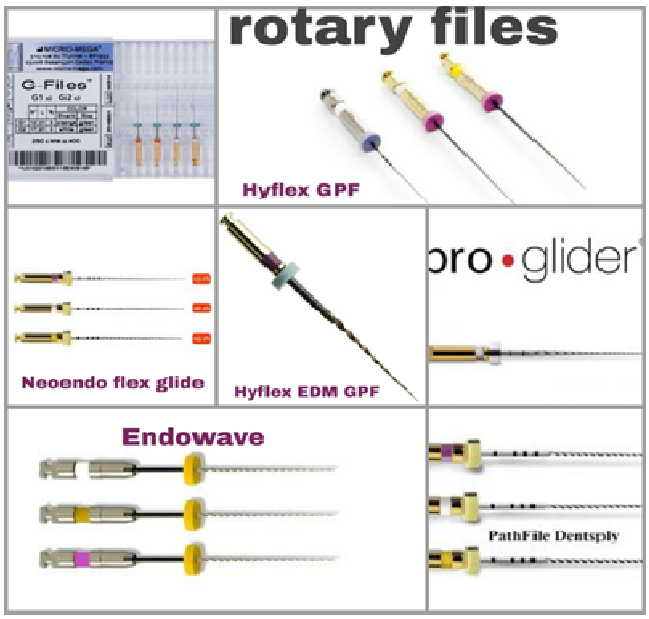
A glide path helps prevent torque failure and cyclic fatigue. Initially, when rotary files were introduced there was no recommendation for glide path creation. Subsequently, instrument fracture became a significant issue until glide path creation became known as an adjunct to safe rotary use (Goerig, 1982; Fava, 2012). A glide path is now recommended by virtually all manufacturers of rotary nickel titanium files. Without a glide path, rotary files can easily screw themselves into canals by engaging more dentin than ideal and separate. The glide path assures the operator that the tip of the file will not become locked as it moves apically and that the canal is free and clear of significant debris and blockage, could lead to iatrogenic events (Van der Vyver, 2011). Creating an .02 tapered glidepath is critical for the safe and effective use of nickel-titanium rotary shaping instruments. Glidepath can be further described as a manual glide path created with handfiles, or a mechanical glide path created with rotary files.

**Instruments in Preparation of Glide Path**

| Manual | Mechanical |
|---|---|
| • K- Files | • PathFiles |
| • C + files | • G –files |
| • C- Pilot files | • Safesiders |
| • C files | • V-files |
| • Hi-5 Files | • PreShaper |
| • Pathfinders TM CS | • EndoWave |
| • PathfindersTM | • Hyflex GPF |
| • Senseus Profinders | • Hyflex EDM GPF |
| • K-Finders | • Proglider |
| • S-Finders | • Neo endo flex glide files |
| • D-Finders | |

Various NiTi rotary glide-path instrument systems, such as G-file (Micro-Mega, Besanc ,on, France), ScoutRace (FKGDentaire SA, La Chaux-de-Fonds, Switzerland), and PathFile (Dentsply Maillefer, Ballaigues, Switzerland), have been introduced. These systems comprise two to three sequential and multiple instruments. Recently, single glide-path files have been introduced: One G (Micro-Mega) and ProGlider (Dentsply Maillefer). While One G has an ISO 14 diameter at the D0 tip and 3% constant taper, Pro Glider has an ISO 16 diameter at the D0 tip and a progressive taper. Compared to manual glide-path preparation with stainless-steel (SS) hand files, procedures using NiTi rotary instruments are faster and maintain the original canal anatomy better, resulting in less modifications of canal curvatures and ultimately leading to fewer canal aberrations. It was reported that NiTi rotary glide-path files do not produce apical transportation, even when the files repeatedly reach the apical terminus of the working length (WL) up to 10 times. Moreover, Berutti et al and Kwak *et al.* reported that glide-path preparation using rotary instruments is less sensitive to clinician expertise; under experimental conditions, an in experienced clinician using NiTi rotary glide-pathfiles produced a more conservative preparation than an experienced endodontist who used SS hand files (Kubde, 2012; Anil Dhingra, 2014; Cassim, 2013).

**Glide Path Controversy: Can We Do Without It?:** Initially, when rotary was introduced, clinicians believed in beginning the canal preparation directly with rotary instruments. However, now most of the researchers agreed that "getting to the apex" or "slipping and sliding to the physiologic terminus" represents the most important factor in root canal preparation. Creating a smooth glide path to physiologic terminus resembles a child riding down a slide in the park, randomly going down with the flow of the slide.





Regardless of how efficient, safe, or simple system one is using, if a glide path is not present, mechanical files will eventually break. Blum et al. suggested that a glide path should be initially created with small flexible stainless steel hand files, to ensure that there will be sufficient space available for the rotary instrument to follow in the root canal. Berutti et al. recommended manual preflaring of the root canal to create a glide path before using NiTi rotary instrumentation and reported reduced torsional stress and increased the lifespan of rotary NiTi instruments. Patiño et al. also reported that the separation rate of the rotary NiTi instruments was significantly reduced when their use was preceded by glidepath preparation. Undoubtedly, "crown-down" preparation technique or "pre-enlargement" or "preflaring" or "early coronal enlargement" allows removal of restrictive coronal dentin and provides a better access to the apical third part of the canal. Once the glide path has been created, this canal path is much more likely to be maintained with the larger instruments. Since most of the canals are large in young adults, a rotary instrument can safely follow to the physiologic terminus. As age increases, particularly if teeth are heavily restored, the rotary system may not even fit in the canal orifices. Scientific literature and clinical experience clearly show that successful outcomes will be more likely and iatrogenic mishaps will be minimal when instrumentation follows a designated route, a reproducible glide path (Goerig, 1982; Fava, 2012).

**Glide path preparation techniques *K File*:** Several authors have recommended using stainless steel K-files by hand for preparing the glide path. The advantages of using stainless steel hand files and K-files compared with rotary NiTi files for creating the glide path are

- K-files provide better tactile sensation; less potential for separation;
- When a small size k-file is removed from the canal, the file often retains an impression of the canal, and in this way alerts the operator to the curvatures present in the canal;
- The stiffness of stainless steel hand files aids in path-finding and in negotiating blockages and calcifications;
- Lower cost;
- No need for a dedicated hand piece

*Disadvantages* of k-file are, due to their relative rigidity and their tip that in many cases is aggressive, so that in curved and/ or calcified canals they can easily produce ledges or transportation. In 2008, Kinsey and Mounce described a technique using a reciprocating hand piece attached to small size K-file for glide path preparation (Anil Dhingra, 2014).

**Glide path preparation using a reciprocating hand piece:** The main advantages of using the reciprocating hand piece are to reduce glide path preparation time and hand fatigue with narrow, multi-planar root canals compared to the conventional manual technique. With this technique, a small size K-file is used by hand to negotiate the root canal to length. The M4 reciprocating hand piece is then attached to the file, and when activated it moves the file alternatively 30 degrees clockwise and 30 degrees counterclockwise.

**Rotary NiTi files**

**Path Files (Dentsply/Maillefer)**

**Path File NiTi rotary files have the following advantages:** Less canal transportation than with manual K-files, suitable for curved canals, more flexible than K-files, faster instrumentation time than with manual K-files, no apical foramen transportation when the working length is too long, no ledgeswhen the working length is too short. The flexibility of PathFile is guaranteed by the nickel titanium alloy and by their low taper, which is only 0.02. Path File can be used at a speed of 300 rpm and at a very high torque, approximately 5-6 N/cm.

**Technique:** Negotiate straight line access; negotiate a manual Glide Path with standard stainless steel K-File #008, #010 in the presence of root canal lubricant. Identify the working length with the #010K-File in combination with an apex locator followed by irrigation. Use the Path File™ #013 to working length followed byirrigation. Use the Path File™ #016 to working length followed by irrigation. Use the Path File™ #019 to working length followed by irrigation. Before starting the canal shaping with NiTi Rotary Shaping Files, confirm working length with a K-File#015 combined with an Apex Locator. Recently introduced G-files (Micro Mega), G1and G2 are the rotary Ni-Ti files used to create the glide path. The system consists of two rotary instruments that can be

used for glide path enlargement after and establishment of a glide path with a number 10 K-file

**G-File Instrumentation Sequence**

- Determine the working length with small diameter number 8 or number 10 k-files.
- Rotating G1 instrument is introduced into the canal, progressing with a slow movement without any apical pressure until the working length has been reached. After irrigation, the G2 instrument is used in the same way.
- The last file is used again to check canal patencyand confirm the working length.

**V-Glide Path™2 File Instrumentation Sequence**

- Establish patency with no.10 K File.
- First no. 13 file is introduced into the canal, tillthe working length.
- The canal is first irrigated and then no 17 file isused up to the full working length

**Pre Shapers Instrumentation Sequence**

- Pre Shapers are single use instruments.
- Achieve patency and determine the working length with a size 10 hand files
- Use Pre Shapers size 14/0.2 to full working length.
- Use Pre Shapers size 18/0.2 to full working length.
- Glide path in done (Anil Dhingra, 2014).

**Endo Wave Mechanical Glide Path (MGP) (J Morita, California, USA)**

10 tip size, file No.2 (white) has an ISO 15 tipsize and file No.3 (yellow) has an ISO 20 tip size. All three The EndoWave Mechanical Glide Path kit consists of three files that can be used to enlarge the glide path. **:** No.1 (purple) has an ISO instruments have a constant taper of 2% and can be rotated at 800 rpm at a torqueof 30gcm or 0.3N/cm.

**Scout-RaCe files (FKG Dentaire, La Chaux-de-Fonds, Switzerland):** Scout-RaCe files (FKG) are 2% tapered instruments which have been electro-polished to remove any irregularities formed during grinding andhave a triangular cross section. The system consists of three instruments with a RaCe flute design (alternating cutting edges) and non cutting tip. They are available in ISO tip size 10 (purple), 15 (white) and20 (yellow) and should be used in a sequential manner (600 rpm) after initial canal exploration with a size 06 or 08K-file to working length.

**RaCe ISO 10 (FKG Dentaire):** RaCe ISO 10 is another system from FKG and consists of three files that progressively increase in taper: 2% (yellow disc), 4% (black disc) and 6%(blue disk). All have the same apical diameter of 0.1mm. The main indications for these instruments are constricted and obliterated canals, as well asabrupt coronal curvatures.These files will scout the canal and also create coronal preflaring because of the increasing taper of the instruments (Cassim, 2013).

**ProGlider(PG):** The system consists of a single instruments, with variable progressive taper. It is available with 21,25, and 31mm length and tip size16 with a taper of 0.02 at the tip of the file used at 300rpm and 4Ncm torque (www.coltene.com).

**HYFLEX EDM GPF (Coltene):** They are available in 25mm length with tip size 10and taper of 0.05and used at300 rpm and 1.8 NCm torque (www.dentsply.com).

**Neoendo Flex Glide file(Orikam):** They comes with standard tip sizes(13,16,19) with 0.02 taper at the tip of the file and used with with a torque of 1NCm and rpm 200 (www.orikamhealthcare.com/product/neoendo).

- The advantages of using NiTi rotary instruments for glide path preparation are:
- Reduced operating time;
- Reduced canal aberrations (ledges, zips and apical transportation);
- Better maintenance of original anatomy;
  - Less operator fatigue;
  - Less hand fatigue.
  - Reduced apical extrusion of debris
  - Reduced post-operative pain;
  - An easy-to-learn technique;
- The disadvantages of using NiTi rotary instruments for glide path preparation are:
- Additional cost;
- Increased risk of file fracture;
  - Decreased tactile sensation13.

**Conclusion**

In conclusion the endodontic Glide path is the secret to radicular rotary safety. If used properly, will increase life of rotaryinstruments; produce a safe rotary result and an endodonticexperience that you truly control.By creating a glide path we can maintain theoriginal canal anatomy with less modification ofcanal curvature and fewer canal aberrations. It also provides the clinician with more confidence toprepare more complex & challenging endodontic cases.

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