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Is a Glide Path Necessary for the New Reciprocating NiTi Files?

It has been well established that nickel–titanium (NiTi) alloy files are able to maintain the original canal shape during the instrumentation procedure. However, they do come with one important disadvantage: a higher risk of file separation or breakage compared with stainless steel hand files. If a file breaks inside a canal, it is usually very difficult, if not impossible, to retrieve it, and it is not possible to further instrument and irrigate beyond it. The likelihood of a successful therapy can thereby be greatly diminished.

NiTi files principally break for 2 reasons:

- Cyclic fatigue occurs when the file has been bent too many times; repeated tension and compression stresses cause fatigue crack propagation, and the file simply breaks.
- Torsional failure occurs when the tip of the file engages inside the canal such that it does not rotate anymore, but the motor continues to rotate the rest of the file. If the torque control of the motor does not sense this, the file will break, leaving the tip firmly engaged inside the canal.

Many manufacturers of NiTi files have, with some success, actively developed new file designs and heat treatments of the NiTi alloy to improve cyclic fatigue and flexibility of the NiTi files, thereby reducing the risk of file breakage when they are used inside the canals. These improvements, however, have come at some cost to the torsional strength.

Over the years, research has discovered that one way to reduce the risk of torsional failure is to establish a "glide path" down to the apical area of the tooth prior to using the motor-driven shaping NiTi files. Creating a glide path of sufficient size before introducing the initial rotary NiTi file into the canal has been shown to significantly reduce the risk of file breakage. It is not clear, however, whether the new and improved NiTi files, particularly those that reciprocate within the canals rather than rotate 360°, need a glide path prepared as do the older NiTi files.

Kwak et al from Pusan National University, South Korea, investigated the effect of glide paths on new recipro-

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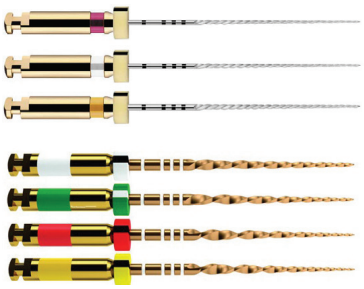

Figure 1. Top, ProGlider; bottom, WaveOne Gold. (*Images courtesy of Dr. Noah Chivian.*)

cating NiTi files by establishing glide paths in 15 resin endodontic training blocks using rotating files specifically designed to create such a path (ProGlider, Dentsply/Maillefer; Figure 1). An additional 15 blocks did not have glide paths.

To compare the newer file design and heat-treated alloy, the authors measured 2 types of WaveOne files (Dentsply/Maillefer): the older version WaveOne and the newer version, WaveOne Gold (Figure 1). The blocks were instrumented with the files while the authors carefully monitored the torque applied to each file. They found that WaveOne Gold had significantly reduced torque created if a glide path had been established; the older version generated a higher maximum torque than did WaveOne Gold regardless of the establishment of a glide path (Tables 1 and 2).

Conclusion

Based on this study, it is clear that, in order to reduce the risk of file breakage due to torsional failure, endodontists should create a sufficient glide path in the apical area of the canal prior to using these new, highly flexible NiTi files.

Kwak SW, Ha J-H, Cheung GS-P, et al. Effect of the glide path establishment on the torque generation to the files during instrumentation: an in vitro measurement. J Endod *2017;doi:10.1016/j.joen.2017.09.016.*

Table 1. *Maximum torque (Ncm) generated during instrumentation using WaveOne and WaveOne Gold with or without glide path preparation (mean ± standard deviation)*

File	With glide path	Without glide path
WaveOne	2.19 ± 0.20[b]	2.18 ± 0.21[b]
WaveOne Gold	2.00 ± 0.12[a]	1.89 ± 0.12[a]

Different superscript letters indicate significant differences between groups ($p < .05$). Maximum torque was not influenced by glide path ($p > .05$) but was influenced by NiTi file ($p < .05$).

Table 2. *Total torque (Ncm) generated during instrumentation using WaveOne and WaveOne Gold with or without glide path preparation (mean ± standard deviation)*

File	With glide path	Without glide path
WaveOne	24.50 ± 1.95[c]	25.57 ± 2.18[c]
WaveOne Gold	17.68 ± 2.01[a]	22.00 ± 2.14[b]

Different superscript letters indicate significant differences between groups ($p < .05$). Total torque stresses were influenced by glide path ($p < .05$) and NiTi file ($p < .05$).

Supine vs Upright Position for Inferior Alveolar Nerve Block

Pivotal for successful treatment, profound anesthesia prior to endodontic therapy is not always easy to achieve, especially in the lower molar area. To improve the likelihood of success, various approaches have been proposed, such as using solutions with or without vasoconstrictors, increased volume or increased concentration of the anesthetic solution, buffered anesthetic solutions, and Gow-Gates and Akinosi-Vazarani injection techniques. Studies have suggested that having the patient maintain an upright or semi-upright position after administering the inferior alveolar nerve block (IANB) increases its success, because the anesthetic solution diffuses down along the ramus and is therefore more likely to hit the target.

To explore the effect of patient position on IANB success, Crowley et al from The Ohio State University recruited 110 healthy adults (55 women, 55 men; age range, 20–36 years) for a crossover-design study. Participants received 2 IANB injections of 2% lidocaine with 1:100,000 epinephrine at least 2 weeks apart, 1 while seated upright and the other while in a supine position. Researchers randomly decided whether the patient was to be seated upright or in a supine position during the first injection, making each participant his or her own control.

A total of 3.2 mL of the anesthetic solution was injected by a computer-controlled local anesthetic device over a period of 1 minute and 52 seconds.

All patients were repeatedly asked whether they felt profound lip numbness after the injections; if numbness was not achieved within 15 minutes, the block was considered unsuccessful. After each injection, the first and second molars, premolars, central and lateral incisors, and a contralateral canine (as a control) were stimulated with an electric pulp tester (EPT) in 4-minute cycles for 60 minutes. Success was defined as the patient maxing out on the EPT without feeling the stimuli for 2 consecutive times and sustaining the numbness for 60 minutes.

The authors found no statistical difference between the 2 positions in achieving profound anesthesia for the molars and incisors, but the supine position significantly improved success for both premolars. There were wide differences in the success rates for the anesthesia: The second molars had a 65% to 73% success rate, but the central incisors had only an 8% to 11% success rate. Most importantly, neither position for IANB administration consistently provided complete pulpal anesthesia.

Conclusion

This study found that the patient's position is not critical to achieving profound IANB. It remains important to assess the patient's level of anesthesia prior to initiating therapy and, if numbness has not been achieved, then supplementary injections such as periodontal ligament or long buccal should be tried.

Crowley C, Drum M, Reader A, et al. Anesthetic efficacy of supine and upright positions for the inferior alveolar nerve block: a prospective, randomized study. J Endod *2017;doi:10.1016/j.joen.2017.09.014.*

Benefit of Ferrule or Post in Endodontically Treated Teeth

Over the years, there has been a great deal of discussion about how best to restore endodontically treated teeth, especially with regard to the need for a post. Some clinicians maintain that the role of a ferrule (Figure 2) is more important than that of the post, while others feel strongly that posts enhance the survival of endodontically treated teeth.

Unfortunately, no large randomized prospective study has adequately addressed this question. The solution, then, is a systematic review of similar, relatively small studies, with the findings of those that meet the preset inclusion criteria combined. The papers are critically analyzed, using methods decided upon prior to initiation of the review.

Naumann et al from Charité-Universitätsmedizin Berlin, Germany, sought to answer the question whether restoration with a ferrule or a post made a difference for survival of endodontically treated teeth. In their systematic review, they used the "PICO" process to obtain the best evidence:

- **P—patient:** adults with sufficient endodontic treatment needing dentine core buildup
- **I—intervention:** postendodontic treatment using posts, with or without ferrule support
- **C—comparison:** postendodontic treatment without posts, with or without ferrule support
- **O—outcome:** tooth and/or restoration survival

The inclusion criteria called for prospective human studies with observation times ≥5 years. Of nearly 2600 identified articles, only 8 met the strict inclusion criteria: 7 randomized controlled trials and 1 prospective clinical trial. Follow-ups in the 8 studies, which included a total of 1932 teeth in 1570 patients, ranged from 5 to 17 years. A common problem with most studies was that the reevaluation rate dropped the longer the observation duration lasted, to the point where only 30% to 40% of patients were available after 17 years.

The authors concluded that failure risk increases with the number of missing cavity walls, and if there are 4 remaining cavity walls, there is no justification for insertion of a post. Some studies also indicated no need for a post when there were 3 and 2 walls remaining, especially where resin composite core buildups were completed prior to single crowns, provided that a ferrule of 1.5 mm to 2 mm was present on the remaining walls.

Conclusion

Overall, most included studies failed to show a positive effect for posts. Therefore, only endodontically treated teeth without cavity walls might benefit from post placement. With little clinical evidence available about the influence of the tooth's location in

Figure 2. A ferrule. (*Image courtesy of Dr. Gerald Barrack.*)

the dental arch, clinicians should use their own judgment.

Naumann M, Schmitter M, Frankenberger R, Krastl G. "Ferrule comes first. Post is second!" Fake news and alternative facts? A systematic review. J Endod *2017;doi:10.1016/j.joen.2017.09.020.*

Effect of Delayed Crown Placement On Retention of Endodontically Treated Teeth

It has been demonstrated repeatedly that the quality of a coronal restoration after endodontic therapy is crucial to the long-term success and retention of the tooth. Crowning an endodontically treated tooth with a full coverage crown has also been shown to increase the tooth's retention. In addition, there is some indication that the timing of placement of the full coverage restoration has also an impact on success rate.

To that point, a recent study found that teeth crowned >4 months after endodontic therapy were 3× more likely to be extracted than were teeth crowned within 4 months. That study, however, was performed in a university setting with a relatively small sample of <900 teeth, so the question remains whether the same outcomes apply to a private practice setting.

To determine the effect of delayed crowning of endodontically treated teeth in a general setting, Yee et al from Marquette University School of Dentistry, Wisconsin, researched the database of Delta Dental of Wisconsin. They collected data from all insurance claims for endodontic therapy over a 13-year period, including in their total sample all teeth that had subsequently received core or post/core, and a crown. More than 160,000 teeth fit the inclusion criteria in the database. These teeth were then cross-referenced to see whether they had subsequently needed retreatment, apicoectomy or extraction.

The authors found that timing of post/core placement after endodontic treatment varied quite a bit. Although the average between the 2 procedures was 66.6 days, the median was only 14 days:

- 52% of the teeth were treated within 14 days
- 30% of the teeth were treated within 15 to 59 days
- 18% of the teeth were treated after ≥60 days

This gave the authors an opportunity to assess the question of timing with some ease.

The results showed no statistically significant difference in survival when the post/core was placed within the first 59 days; however, there was a statistically greater risk of needing retreatment, apicoectomy or extraction in the group in which the post/core had been placed at ≥60 days after completion of the endodontic therapy. The same result was found for timing of crown placement on the post/core. Teeth on which the crown was placed ≥60 days after the post/core placement fared worse than did those having the crown placed sooner.

The authors further broke down their sample to determine the effect of placing post/core vs only a core. They found that teeth treated with post/core placement showed a higher rate of failure. In addition, they discovered that when the endodontic therapy was completed by a trained endodontist, there was less reported failure than there was for those teeth completed by general practitioners.

Conclusion

While these types of studies provided an opportunity to investigate a large number of treatments, they did not directly assess the quality of the treatment rendered, and there was the chance that failure might not have been registered in the database because of coding issues or patients' having lost their insurance coverage when the failure occurred. Thus, there was some risk of overestimating the total long-term retention of the treated teeth. There is, however, no question that this study confirmed that the sooner the final restoration is placed on an endodontically treated tooth, the better the tooth's long-term prognosis.

Yee K, Bhagavatula P, Stover S, et al. Survival rates of teeth with primary endodontic treatment after core/post and crown placement. J Endod *2017;doi:10.1016/j.joen.2017.08.034.*

In the next issue:

- Ultrasonic removal of separated endodontic instruments
- Bacteria occurring in the apical area of the canal
- Cracked teeth treated with root canal outcomes

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