Effectiveness of the ProFile.04 Taper Series 29 Files in Removal of Gutta-Percha Root Fillings During Curved Root Canal Retreatment

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The purpose of this in vitro study was to evaluate the capacity of ProFile.04 Taper Series 29 files to remove gutta-percha during curved root canal retreatment. Forty-four mandibular molars whose mesial roots presented between 26 and 40 degrees of curvature, determined by Schneider’s method, were selected. The root canals were enlarged to ISO size 35 and obturated with laterally condensed gutta-percha using Sealer 26. The teeth were randomly divided into three groups for gutta-percha removal: GI: size 2 Gates Glidden drills; GII: size 6 ProFile.04 Taper Series 29 files; GIII: size 7 ProFile.04 Taper Series 29 files. The penetration of the instruments was measured with millimetered x-rays and clinical observation. The ProFile.04 Taper Series 29 files removed the endodontic filling material better than the Gates Glidden files.

Key Words: endodontic retreatment, rotary instruments, ProFile.04 Taper Series 29 files.

INTRODUCTION

In spite of the evolution of instruments and the development of new techniques, there are still a considerable number of endodontic treatment failures (1). In fact, the inefficiency of treatment to reestablish healthy periapical tissues results in endodontic retreatment in an attempt to repair and recover the dental element involved.

In 1989, Wilcox (2) reported that the success of endodontic retreatment is directly related to the capacity of removal of not only the gutta-percha but also of the sealing agent. Several methods for gutta-percha and sealer removal from the root canal system have been proposed in the literature, with the cleaning of the wall being the most studied aspect (2-6). The cleaning of the apical third is considered the most important step and must be accomplished with hand instruments. Rotary instruments are commonly used for gutta-percha removal from the cervical and middle thirds (1). According to Hulsmann and Stoltz (7), the utilization of rotary instruments as coadjuvant in the retreatment process presents advantages because of clinical time reduction.

In 1996, Imura et al. (8), evaluating the remaining amount of gutta-percha on the root canal wall after the utilization of Canal Finder, hand instrumentation and the combination of both, concluded that the hybrid technique took significantly less time for filling material removal than the other two.

The ProFile.04 Taper Series 29 is a motor system that uses nickel-titanium files (NiTi) showing good flexibility (500 times more than stainless steel alloys), resistance to plastic deformation and fracture, and designed to be used with rotary clock-wise motion generated by electric motors or an air handpiece at slow speed (150-350 rpm) and high torque (10-55 Nm) (9). These attributes ease their manipulation in root canals with stressed curvature (10,11) and, when compared to stainless steel instruments, they are more efficient in relation to the maintenance of the original path of the...
During retreatment, the Gates Glidden drill is commonly used in the cervical and middle root. However, because of the alloy attributes, its penetration is limited because of the angle of canal curvature (1). Fracture of instruments in the root canal can lead to serious consequences in endodontic treatment (13). There is much research evaluating the resistance to deformation and fracture in simulated clinical conditions (10,11,13-16).

In 1994, Brantley et al. (17), evaluating the incidence of the Gates Glidden drill fracture, reported that fracture occurred next to the portion near the handpiece, characterizing it as a safe instrument for the use in the root canal. In the same study, the authors emphasized that instrument deformation indicates that the limit of the metal elasticity was exceeded, and therefore, must not be used. Generally, stainless steel instruments deform before fracture which does not occur with NiTi instruments.

Tompson and Dummer (14) evaluated the modeling capacity produced by ProFile.04 Taper Series 29. They reported that the time necessary for canal preparation was not influenced by canal shape and that the canal shape did not influence instrument deformation.

In 1999, Yared et al. (16) evaluated the ProFile.06 Taper rotary instrument fatigue cycle after dry heat sterilization and clinical use in the presence of sodium hypochlorite (NaOCl). They concluded that size 40-15 instruments can be safely used for the instrumentation of human mandibular molars up to ten times, depending on the pressure and time of use. NaOCl and sterilization did not increase the fracture risk.

In the same year, Blum et al. (15) investigated the areas of direct contact between the ProFile and the dentine in the root canal system during preparation using crown-down and step-back techniques. The authors reported that the localization of the contact areas near the instrument extremity during torque development indicates that great care must be taken when using the rotary technique, particularly with the ProFile.04 Taper instruments, independent of preparation technique. The transition between .04 and .06 Tapers was delicate, because of displacement at the contact point on the instrument corpus.

The aim of this in vitro study was to evaluate the capacity of gutta-percha removal from curved root canals by ProFile.04 Taper Series 29 instruments.

MATERIAL AND METHODS

 Forty-four first mandibular molars with completely formed apices and mesial canals presenting curvature between 26 and 40 degrees, determined radiographically by the method described by Schneider (18), were selected for this study. The teeth were stored in a 1% thymol solution until use.

 The teeth were placed in a radiographic mount to maintain a constant position and focal length and presurgery x-rays were taken. Cavity access was performed and a #10 K-file was inserted into the root canal until the tip of the instrument was visible at the x-ray apex, and the working length was calculated as 1 mm short of the apex. The canals were prepared for obturation with NiTi-flex files (Tulsa Dental Products, Tulsa, OK, USA) and Gates Glidden drills (Maillefer, Ballaigues, Switzerland), using the crown-down pressureless technique. When a #30 NiTi file could be easily inserted to the working length, the preparation was considered complete. Irrigation with water was done after each instrument change.

 The master cone (Dentsply, Petrópolis, RJ, Brazil) was selected and adapted for obturation. The root canals were then dried with paper points. Sealer 26 (Dentsply) was mixed according to manufacturer instructions and was applied 1 mm short of the working length with a #35 NiTi file and the master cone, coated with sealer, was then placed into the canal. Medium-fine accessory cones (Dentsply) were laterally condensed until they could not be introduced more than 5 mm into the canal.

 The access openings were sealed with Coltosol (Vigodent SA Indústria e Comércio, Rio de Janeiro, RJ, Brazil) and the teeth were stored in 100% humidity at 37°C for 7 days to allow the sealer to set.

 The teeth were divided according to the angle of curvature into 3 treatment groups containing 29 obturated canals in each group: group I: size 2 Gates Glidden drills; group II: size 6 ProFile.04 Taper Series 29 files; group III: size 7 ProFile.04 Taper Series 29 files. For gutta-percha removal, a handpiece with low speed and high torque, able to develop up to 3000 rpm, with the possible heating of the gutta-percha and consequently its removal, was used. The instruments were used with soft pressure and vertical motion with 2 mm amplitude until resistance was encountered.

 The removal process was done by a single opera-
The teeth were again placed on the radiographic mount and a millimetered radiograph was taken. During the procedures, penetration was clinically measured decreasing the working length value by the measurement reached by the instruments in each canal, using a mm-rule. At the end of the procedures, a new measurement was taken using millimetered radiography. The values obtained in the clinical and radiographic measurements were compared, and a change less than 0.5 mm was obtained.

RESULTS

The results obtained subtracting the working length and the measure of the penetration reached by the instrument are represented in the Figure 1. The average distance from the working length for size 2 Gates Glidden drills was 5.19 mm (range, 4.0-7.50 mm). The average distance of size 6 ProFile.04 Taper Series 29 files was 1.53 mm (0.0-5.0 mm). Size 7 ProFile.04 Taper Series 29 files penetrated an average distance of 2.31 mm (0.0-6.0 mm) (Figure 2).

Data were analyzed by ANOVA and Bonferroni’s test (F = 66.00; p < 0.01), which showed significant differences comparing size 2 Gates Glidden drills and ProFile.04 Taper Series 29 files (Figure 2); however, there were no statistically significant differences between the groups of size 6 and size 7 ProFile.

Three instruments were fractured during the study. Two size 7 ProFile.04 Taper Series 29 files were fractured and one size 2 Gates Glidden drill. Fracture occurred twice with 26° angle of curvature and once with 27°.

DISCUSSION

The utilization of rotary instruments as a coadjuvant in the retreatment of root canals results in a reduction of surgery time and better cleaning of the apical third, because it allows the operator to dedicate more time to this important step of the treatment (7,8).

Comparing the penetration obtained with size 2 Gates Glidden drills and the ProFile.04 Taper Series 29 instruments (Figure 3), the latter showed the best results. The great flexibility of ProFile provided by its alloy seems to be the factor that led to this outcome. NiTi instruments are more elastic and flexible for twist-
ing and curving when compared to those made of stainless steel (9,19,20).

Both size 6 and 7 files presented good average penetration which can be easily explained by their composition of the same alloy. The better results of size 6 ProFile (Figure 2) were probably a consequence of instrument diameter, considering that penetration is limited by contact with the canal walls and thus, the one that is more compatible with the shape generated by instrumentation gives the better results.

Three instruments fractured during the study probably because the limit of metal elasticity was surpassed. One of the fractures occurred with size 2 Gates Glidden drills near the handpiece. It was removed using simple cotton pincers. This is in agreement with the results of Brantley et al. (17) in which fracture occurred at a similar position. These results and those obtained by Hulsman and Soltz (7) show that the Gates Glidden drill is relatively safe when used to remove filling material from the root canal.

In spite of the two other fractures occurring with size 7 ProFile.04 Taper Series 29, in which removal was not possible because the instrument fractured in the extremity between D₂ and D₃, we do not consider the use of ProFile to be risky because only 2 of a total of 58 instruments fractured. However, the impossibility of removal of the fractured segment presents a disadvantage of this instrument and requires great care during ProFile use.

The lack of fracture for the size 6 ProFile group may be due to the drill diameter, the canal shape established during instrumentation or curvature position. This observation is in agreement with Pruett et al. (13) who concluded that the curvature angle and size of NiTi rotary instruments are more important than the speed when considering predisposition to fracture.

The angle with two fractures was 26º and one fracture at 27º. These results are similar to Pruett et al. (13). Nevertheless, this incidence suggests that curvature was not the outstanding factor, considering that the fractures occurred at the smallest angles of all samples.

It was not possible to establish a relationship between the pressure applied during instrument manipulation and fracture occurrence because in spite of the fact that a sole operator performed all procedures, we cannot be certain that a similar pressure was constantly applied during the removal of filling material.

The area of direct contact of the instrument along the canal wall may be considered a possible reason for fracture. This was observed by Blum et al. (15) during rotary preparation of the root canal, in which a fracture occurred in the transition between Tapers .04 and .06 because the location of contact changed from the body of the instrument to the tip.

However, we believe that the fractures occurred due to instability caused by the gutta-percha mass that, inadvertently, stuck on the tip of the instrument. After the second fracture with ProFile, everytime the gutta-percha stuck on the most apical portion, it was removed with a cotton pincers. After this modification, fracture did not occur.

We conclude that the ProFile file allows a much better removal of filling material from root canals with curvature between 26 and 40 degrees compared to the Gates Glidden drill. Despite the favorable impression obtained when using the ProFile.04 Taper Series 29 file during the initial phase of endodontic retreatment, the results obtained must be interpreted with care. Further studies are needed for clarifying the importance of pressure, generated heat and safety limit for filling removal and risk of extrusion.

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RESUMO


REFERENCES


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