

Original Article

Assessment of efficacy of NiTi rotary instruments and stainless steel hand instruments in root canal preparations of permanent molar: A comparative study

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Abstract

Background: To improve the speed and efficiency of root canal therapy, stainless steel instruments have been used in a variety of preparation techniques, in an attempt to produce the appropriate canal shape. However, studies have shown that procedural incidents occur commonly, producing aberrations such as formation of hourglass-shaped canals, zips, elbows and canal transportation. Nickel-Titanium (NiTi) rotary instruments are thought to reduce such aberrations. Hence; we undertook the present study to assess and compare the efficacy of engine-driven method (Ni Ti Rotary) and conventional manual methods with stainless steel K-files in performing root canal therapy in permanent molars. **Materials & methods:** The present study included assessment of efficacy of engine-driven method (Ni Ti Rotary) and conventional manual methods with stainless steel K-files in performing root canal therapy in permanent molars. 50 extracted teeth were randomly divided into two study groups as follows: Group I: Teeth in which Conventional stainless steel instruments were used, Group II: Teeth in which NiTi rotary instruments were used. Root canal therapy was performed in both the study groups by same experienced and endodontist. All the results were analysed by SPSS software. **Results:** Time of preparation in teeth of group I and group II was 9.36 and 14.62 minute respectively. Significant results were obtained while comparing the mean preparation time in both the study groups. **Conclusion:** Rotary instruments are less time consuming and increase the efficacy of the operator in performing root canal therapy.

Key words: Root canal therapy, Rotary, Stainless steel

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This article may be cited as: Chitkara N , Tangri T, Babu AK, Ahuja M, Dahiya AK, Sharma P. Assessment of efficacy of NiTi rotary instruments and stainless steel hand instruments in root canal preparations of permanent molar: A comparative study. HECS Int J Com Health and Med Res 2017;3(3):7-10

INTRODUCTION

The technical demands and level of precision required for successful performance of endodontic procedures have traditionally been achieved by careful manipulation of hand instruments within the root canal space and by strict adherence to the biologic and surgical principles, essential for disinfection and healing.¹⁻³ To improve the speed and efficiency of the treatment stainless steel instruments have been used in a variety of preparation techniques, in an attempt to produce the appropriate canal shape. However, studies have shown that procedural incidents occur commonly, producing aberrations such as formation of

hourglass-shaped canals, zips, elbows and canal transportation. Nickel-Titanium (NiTi) rotary instruments are thought to reduce such aberrations.⁴⁻⁶ Hence; we undertook the present study to assess and compare the efficacy of engine-driven method (Ni Ti Rotary) and conventional manual methods with stainless steel K-files in performing root canal therapy in permanent molars.

MATERIALS & METHODS

The present study was conducted in the department of conservative dentistry of the institution and included assessment of efficacy of engine-driven

method (Ni Ti Rotary) and conventional manual methods with stainless steel K-files in performing root canal therapy in permanent molars. Ethical approval was taken from institutional ethical committee and written consent was obtained after explaining in detail the entire research protocol. A total of 50 freshly extracted teeth were included in the present study. They were randomly divided into two study groups as follows:

Group I: Teeth in which Conventional stainless steel instruments were used,

Group II: Teeth in which NiTi rotary instruments were used.

Root canal therapy was performed in both the study groups by same experienced and endodontist. Inward 3D states of the trenches was dictated by intracanal impressions made utilizing light bodied and substantial bodied vinyl poly silioxane impression materials. Light bodied materials were filled over the floor of the mash chamber over which the putty material massaged with hand to encourage the result of light bodied material into the root trench. The substantial bodied likewise goes about as help for the coronal part of the impression and for simple evacuation. The impression was seen inside 24 h under stereomicroscope to evaluate the stream, decrease and smoothness of the dividers. All the results were analysed by SPSS software. Chi- square test and student test were used for the assessment of level of significance. P- value of less than 0.05 was taken as significant.

RESULTS

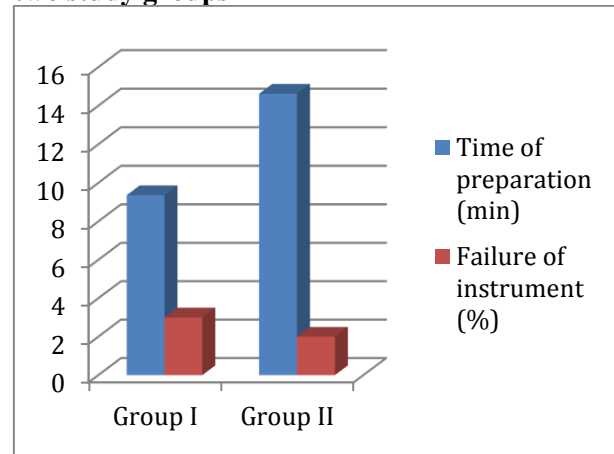
Descriptive values of various parameters in both the groups are shown in **Table 1** and **Graph 1**. Time of preparation in teeth of group I and group II was 9.36 and 14.62 minute respectively. Significant results were obtained while comparing the mean preparation time in both the study groups. As far as failure of instrumentation was considered, we observed non- significant results.

Table 1: Description of various paraemtes in the two study groups

Parameter	Group I	Group II	P- value
Time of preparation (min)	9.36	14.62	0.02*
Failure of instrument (%)	3	2	0.25

: Significant

Graph 1: Values of various paraemtes in the two study groups



DISCUSSION

Cleaning and shaping of the root canal system is one of the main goals in endodontics which can be carried out using different systems and techniques. To reach this aim, stainless steel hand instruments have been traditionally applied. Lack of flexibility of instruments causes errors during endodontic treatments which lead to decreased success rate. After introducing rotary nickel-titanium (NiTi), their usage became popular.⁷⁻⁹ NiTi instruments super elasticity along with their advanced design made them favorable for effective and safe instrumentation of narrow and curved root canals using low torque handpieces. The ability of some NiTi rotary systems in maintaining the root canal curvature has been studied. Fracture susceptibility is considered as a major disadvantage of these instruments.¹⁰⁻¹² Hence; we undertook the present study to assess and compare the efficacy of engine-driven method (Ni Ti Rotary) and conventional manual methods with stainless steel K-files in performing root canal therapy in permanent molars.

In the present study, we observed that rotary instruments are less time consuming and more efficacious in comparison to hand instrumentation. A Dafalla A et al compared hand stainless steel K-files and Nickel-Titanium Profile 0.04 taper 29 series rotary instruments for their efficiency, procedural errors and time consumed in preparation of root canal system. A total of 46 maxillary and mandibular first premolars extracted for orthodontic purposes were collected (two contralateral teeth from each individual). The samples were divided into two groups of 34 canals each. Teeth in the first group were prepared with stainless steel hand K-files while the second

groups were prepared with profile 0.04 taper series 29 rotary files. Preparation period was recorded for both groups. Impression material was introduced into the prepared canals so that the replica of prepared canals was achieved. These were assessed under stereomicroscope to assess the efficiency in preparing canals in respect to canal smoothness, ability of impression material to flow and quality of taper. Statistical analyses were performed using t-test, Chi-square and Fishers exact tests. Results showed significantly shorter preparation time for Profile than K-file. 8.8% of the canals prepared with K-files showed canal blockage, while all canals prepared with Profile remained patent. Alterations in working length working distance appeared in 23.5% of canals prepared with K-file and 11.7% in canals prepared with Profile. Failed instruments in K-files were significantly higher, mostly deformation ($P < 0.001$). Profiles failed instruments were in the form of fracture and no deformation was detected. Both systems showed unsatisfactory walls smoothness and flow. Within the limitation of this study it was concluded that Profile 0.04 taper series 29 rotary systems prepare canals more rapidly, and have lower incidences of fracture and blockages, and only limited loss of working length. Canal preparation with K-file was time consuming and showed higher incidence of deformed instruments; overall, rotary instruments seem to offer greater advantages.¹³

Taşdemir T et al compared ex vivo root canal preparation with conventional stainless steel K-files and Hero 642 rotary Ni-Ti instruments. Mesio Buccal canals of 20 maxillary first molars were used. After preparation with Hero 642 rotary instruments and stainless steel K-files, the amount of transportation that occurred was assessed using computed tomography. The teeth were scanned by computed tomography before instrumentation. One millimetre thick slices were prepared from the apical end point to the pulp chamber. The first two sections were 3 mm from the apical end of the root (apical level) and 3 mm below the orifice (coronal level). A further section (mid-root level) was recorded, dividing the distance between the sections of apical and coronal levels into two equal lengths. Ten teeth were instrumented using Hero 642 rotary instruments and another 10 teeth were instrumented using stainless steel K-files. Following the completion of the instrumentation, the teeth were again scanned and compared with the cross-sectional images taken prior to canal preparation. Amount of transportation and centreing ability was assessed. Student's t-test was used for statistical analysis. Less transportation

occurred with Hero 642 rotary instruments than stainless steel K-files at the mid-root and coronal levels. Hero 642 rotary instruments had better centreing ability than K-files at all three levels. Hero 642 rotary instruments transported canals less, especially at the middle and coronal thirds of the root canals than stainless steel K-files. Hero 642 instruments had better centreing ability.¹⁴

CONCLUSION

From the above results, the authors concluded that rotary instruments are less time consuming and increases the efficacy of the operator in performing root canal therapy.

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Conflict of Interest: None

Source of Support: None

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