Journal of Advanced Medical and Dental Sciences Research

@Society of Scientific Research and Studies

Journal home page: www.jamdsr.com doi: 10.21276/jamdsr Index Copernicus value = 82.06

(e) ISSN Online: 2321-9599; (p) ISSN Print: 2348-6805

Original Research

An in-vitro study to compare the cleaning efficacy of root canals with Mtwo NiTi rotary files and Hand K-files

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***ABSTRACT*:**

Background: Debris is defined as dentine chips and residual vital or necrotic pulp tissue attached to the root canal wall, which in most cases is infected. The apical third of the root canal is the most difficult area to clean due to complex anatom y of this region like deltas, lateral canals, isthmuses and ramifications. Despite the advances made in instruments and instrumentation techniques, the design and the physical limitations of the endodontic instruments can lead to inadequate cleaning of the root canal system. **Aim of the study:** To compare the cleaning efficacy of root canals with MtwoNiTi rotary files and Hand K-files. **Materials and methods:** The study was conducted in the Department of Endodontics of Dental institution. For the study, 150 extracted maxillary incisors with completely formed apex, non-carious and with single root canal was selected. The teeth were randomly grouped into three groups, Group 1, Group 2 and Group 3 with 50 teeth in each group. The instrumentation of specimens of Group 1 was done using stainless steel K-files, in Group 2 was done using Mtwo NiTi rotary files and in Group 3 only irrigation was done without any instrumentation (Control group). **Results:** On comparing the control group with K-files and Mtwo rotary files, we observed that both the techniques were able to remove the ink from the canals. Statistically significant difference was observed in the apical, middle and coronal thirds of root canals on comparing control group with Group 1 and 2. On comparison between Group 1 and 2, non-significant difference was observed in the cleaning efficiency of the canals at apical, middle and coronal region. **Conclusion**: Within the limitations of the present study, it can be concluded that Mtwo NiTi rotary files and Hand K-files are equally effective in cleaning the root canals.

Keywords: K files, root canals, Mtwo rotary files, hand files.

Received: 2 January, 2020 Accepted: 28January, 2020

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This article may be cited as: Mushtaq F, Mushtaq U. An in-vitro study to compare the cleaning efficacy of root canals with Mtwo NiTi rotary files and Hand K-files. J Adv Med Dent Scie Res 2020;8(2):211-214

INTRODUCTION:

An efficient chemomechanical preparation is essential for effective canal disinfection and thereby contributes to the success of the endodontic procedure. [1] Conventionally, hand files are used for cleaning and shaping and are time-consuming. [2] The length of the appointment is strongly associated with the child's behavior. [3] Debris is defined as dentine chips and residual vital or necrotic pulp tissue attached to the root canal wall, which in most cases is infected. [4] The apical third of the root canal is the most difficult area to clean due to complex anatomy of this region like deltas, lateral canals, isthmuses and ramifications. [5] Despite the advances made in instruments and instrumentation techniques, the design and the physical limitations of the endodontic instruments can lead to inadequate cleaning of the root canal system. Shaping procedures can be completed more easily, quickly and predictably using NiTi rotaryj instruments, but effective cleansing of the root canal system, especially in the apical one third, has not yet been demonstrated. [4-6] Both manual and mechanical instrumentation leave debris in the root canal space.Hence, the present study was conductedto compare the cleaning efficacy of root canals with MtwoNiTi rotary files and Hand K-files.

MATERIALS AND METHODS:

The study was conducted in the Department of Endodontics of Dental institution. The ethical clearance for the study was approved from the ethical committee of the hospital. For the study, 150 extracted maxillary incisors with completely formed apex, non-carious and with single root canal were selected. The teeth were kept in 5% Sodium hypochlorite solution for 2 days to remove organic debris on the teeth and for disinfection of teeth. After removing from NaOCl solution, teeth were thoroughly cleaned with distilled water and remnant calculus from the surface of teeth was removed with ultrasonic scalar. The teeth were kept in formalin solution until used. Access cavity preparation for all teeth was done using round diamond bur. After access preparation, the patency of the root canals was verified using no.15 K-file. Barbed broaches were used to take out pulp from the canal. After removal of pulp, the root canals were rinsed with 2mL normal saline. Then, using 30-guaze needle root canals were packed with India ink. To assure the penetration of ink, no. 15 K-file was introduced into canal and then kept for 72 hours in wet conditions at room temperature. The teeth were randomly grouped into three groups, Group 1, Group 2 and Group 3 with 50 teeth in each group. The instrumentation of specimens of Group 1 was done using stainless steel K-files, in Group 2 was done using Mtwo NiTi rotary files and in Group 3 only irrigation was done without any instrumentation (Control group).

The instrumentation of all the specimens was done by the same operator. The working length of the root canals was standardized at 20 mm for all the teeth. Specimens of Group 1 were cleaned using K-file # 35 as master apical file and step back up to K-file # 50. Specimens in Group 2 were cleaned with the Mtwo rotary system. The instrumentation sequence was 10/.04, 15/.05, 20/.06, and 25/.06. The instruments were discarded after using on 4 teeth. In group 3, no instrumentation of the canals was done. After completion of instrumentation, the canals were irrigated with 5 ml normal saline dried with paper points, pulp chamber sealed with temporary cement and stored in moistened gauze. Now, the teeth were completely decalcified by immersing the specimens first in hydrochloric acid for 2 days and dehydrated by immersing successively in alcohol solutions. Then, teeth were cleared in methyl salicylate.

The cleared specimens were viewed under stereo microscope at 10X for checking the amount of residual india ink at coronal, middle and apical region of the canals and scored from 0 to 3. Score 0 was awarded to wholly clean canal, 1 was awarded to hardly any ink residues, 2 was awarded to incomplete ink removal and 3 was awarded to no ink removal. The results were evaluated.

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistically significant.

RESULTS:

Table 1, 2 and 3 shows the cleaning efficacy scores of K-files, Mtwo rotary files and Control group, respectively. On comparing the control group with K-files and Mtwo rotary files, we observed that both the techniques were able to remove the ink from the canals. Statistically significant difference was observed in the apical, middle and coronal thirds of root canals on comparing control group with Group 1 and 2. On comparison between Group 1 and 2, non-significant difference was observed in the cleaning efficiency of the canals at apical, middle and coronal region.

Table 1: Cleaning efficacy scores of K-files

SCORES	Apical region	Middle region	Coronal region
0	17	16	23
1	22	21	21
2	11	13	6
3	0	0	0

Table 2: Cleaning efficacy scores of M-two rotary files

SCORES	Apical region	Middle region	Coronal region
0	27	24	32
1	18	19	17
2	5	7	1
3	0	0	0

Table 3: Control group

SCORES	Apical region	Middle region	Coronal region
0	0	0	0
1	0	0	0
2	0	0	0
3	50	50	50

DISCUSSION:

All the instrumentations of the pulp space leave debris in the root canal.[3,6,7] This debris increases the risk of bacterial contamination which may lead to the failure of endodontic treatment.[8] Debris may be compacted along the entire length of the canal surface and results in reduced adaptation of sealer and gutta-percha.Ramezanali F et al compared the cleaning efficacy and instrumentation time of hand K-files and Mtwo rotary system for preparation of human primary molars. The study was conducted on 100 extracted primary maxillary and mandibular intact molars with no resorption. Canals were divided into 5 groups (n=20): in group I, canals were instrumented using K-files up to #25 for mesial and buccal canals and #30 for palatal and distal canals. In group II, canals were prepared using Mtwo rotary files (15/0.05, 20/0.06 and 25/0.06 for mesial and buccal canals and 15/0.05, 20/0.06, 25/0.06 and finally 30/0.05 for distal and palatal canals). In group III, root canals were only irrigated with saline. Groups IV and V were the positive and negative control groups, respectively. The mean score of cleanliness of Mtwo was not significantly different from K-file group. However the mean instrumentation time in Mtwo group was significantly shorter. They concluded that although there were no differences regarding the cleaning efficacy of either system, Mtwo rotary files were far more time efficient. [7] Azar MR et al compared the effectiveness of manual K-files and two rotary systems–Mtwo and ProTaper for root canal preparation in primary molars. India ink was injected to 160 mesiobuccal and distal root canals of mandibular primary molars. The teeth were randomly divided into three experimental groups and one control group. In each experimental group, either manual instruments (K-files) or rotary instruments (Mtwo or ProTaper) were used to prepare root canals. There were no significant differences in cleaning efficiency between manual and rotary instruments. Only ProTaper files performed significantly better in the coronal and middle thirds than in the apical third of the root canal. They concluded that manual K-files and the Mtwo and ProTaper rotary systems showed equally acceptable cleaning ability in primary molar root canals. [8]

In the present study, we included 150 maxillary central incisors and randomly grouped into 3 groups. We observed that Hand K files and rotary NiTi files were efficacious in cleaning the root canals as compared to the control groups. However, on comparing the cleaning efficacy of both the groups, it was observed that the results are statistically non-significant. Thus, both the techniques provide similar efficacy in cleaning the root canals. The results on comparison with previous studies are consistent. Mehlawat R et al compared the timing of instrumentation and cleaning efficacy between manual K files and NiTi rotary files in extracted primary molars. In-vitro study was conducted in 90 root canals of extracted primary molars which were subdivided in three groups viz. Control (No instrumentation), Manual (K files), Rotary (ProFiles) with 30 canals in each group. Mean timing of instrumentation in rotary group was 3.54 ± 1.14 min and 4.32 ± 1.04 min in manual group. Mean cleaning efficacy scores in manual and rotary groups were 2.03 and 1.66 in coronal third, 1.08 and 1.18 in middle third and 0.67 and 1.08 in apical third respectively. Inter-group comparisons showed no statistically significant difference in cleaning efficacy among test groups in all thirds of root canals. They concluded that NiTi rotary technique has comparable cleaning efficacy, with significantly less timing of instrumentation compared to manual K-files. [9] Panchal V studied efficacy of rotary and hand root canal instrumentation in primary teeth. They reported that rotary instrumentation shows equivalent cleaning efficiency than hand files depending on the system of instrumentation and techniques used. However, use of rotary in primary teeth leads to improved shaping of canals providing better quality of treatment in less time. [10]

Katge F et al compared the cleaning efficacy and instrumentation time between manual Hedstrom files (H-files) and rotary Mtwo files in primary molar root canals. A total of 90 primary root canals were selected using standardized radiographs. The canals were injected with India ink with 30 gauge insulin syringe and divided into three groups. Group I—30 root canals instrumented with H-files, group II—30 root canals instrumented with Mtwo files, and group III—control group in which no canal instrumentation was done. No significant difference was seen in cleaning efficacy between H-files and Mtwo files in coronal, middle, and apical thirds of the root canal. The instrumentation time recorded for H-files was significantly less than that of Mtwo files. They concluded that there was no significant difference in cleaning capacity. [11]

CONCLUSION:

Within the limitations of the present study, it can be concluded that Mtwo NiTi rotary files and Hand K-files are equally effective in cleaning the root canals.

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