Comparison between Rotary (Mtwo) and Manual (H-Files) Techniques for Instrumentation of Primary Teeth Root Canals

Abstract

Background: The aim of the study is to compare instrumentation time between manual (H-files) and rotary (Mtwo) files along with patient and operator compliance in primary lower molars.

Materials and Methods: 30 primary teeth were selected and divided into two groups of 15 in each group instrumented with H-files and Mtwo files respectively. Time taken for instrumentation was calculated using stopwatch. Patient and operator compliance was recorded through questionnaire.

Statistical Analysis Used: Chi Square test was used to compare the distribution of teeth and number of canals. Independent Student t test was used to compare the mean time taken for instrumentation with both techniques in different canals and the mean overall time for instrumentation where P value is less than 0.001. Chi Square Goodness of Fit test was used to compare the patient’s and operator’s perspective regarding instrumentation techniques.

Results: The instrumentation time recorded with Mtwo files is less when compared with H-files. 66.7% children preferred H-files over Mtwo, 60% children reported pain while using H-files, 60% of children were scared on sight of Mtwo rotary system. Operator could manage 80% of children easily while using H-files, but it was found that operator ease of comfort was more with Mtwo rotary system.

Conclusion: Time taken for instrumentation with Mtwo files was less as compared to H-files. It was convenient for the operator to manage the child using H-files but with the use of Mtwo files, marked reduction in the instrumentation time was appreciated.

Keywords: H-files, instrumentation time, Mtwo rotary system, operator compliance, patient compliance

Introduction

The premature loss of primary teeth may cause changes in the chronology and sequence of eruption of permanent teeth. Maintenance of primary teeth until physiological exfoliation contributes to mastication, phonation, and esthetics and prevents deleterious habits in children.[1]

Pulpectomy is the treatment of choice for primary teeth with necrotic or irreversibly inflamed pulp. Successful treatment depends on the technique of instrumentation, irrigation, disinfection, and obturation of the root canal.[2] Biomechanical preparation is the most time consuming step of root canal therapy (RCT), especially in pediatric dentistry.[3]

Conventional endodontic treatment for primary teeth often causes fatigue to the operator and child. K-files and Hedstrom files (H-files) are normally used for instrumenting root canals. Hedstrom files are recommended since they remove hard tissue only on withdrawal and penetrate readily with a minimum resistance, which prevents pushing infected material through the apices. Recently, endodontics has been revolutionized with the introduction of rotary nickel-titanium (NiTi) systems. The use of rotary instrumentation in permanent teeth has proven to be efficient with decreased instrumentation time in curved molar root canals.[1] This is the first clinical study which was designed to compare instrumentation time between manual (H-files) and rotary (Mtwo) instrumentation techniques along with patient and operator compliance in pulpectomy of primary lower molars.

Materials and Methods

This interventional, clinical based study was conducted in the department of pediatric and preventive dentistry of a dental college hospital after obtaining approval from the institutional review board and ethics committee (MRADC and Maharashtra Dental Council). Thirty primary teeth with necrotic or irreversibly inflamed pulp were selected and divided into two groups of 15 teeth each. Group I teeth were instrumented with Mtwo files, and Group II teeth were instrumented with H-files. The instrumentation time was calculated using stopwatch. Patient and operator compliance was recorded through questionnaire. Chi Square test was used to compare the distribution of teeth and number of canals. Independent Student t test was used to compare the mean time taken for instrumentation with both techniques in different canals and the mean overall time for instrumentation where P value is less than 0.001. Chi Square Goodness of Fit test was used to compare the patient’s and operator’s perspective regarding instrumentation techniques.

Results:

The instrumentation time recorded with Mtwo files is less when compared with H-files. 66.7% children preferred H-files over Mtwo, 60% children reported pain while using H-files, 60% of children were scared on sight of Mtwo rotary system. Operator could manage 80% of children easily while using H-files, but it was found that operator ease of comfort was more with Mtwo rotary system.

Conclusion:

Time taken for instrumentation with Mtwo files was less as compared to H-files. It was convenient for the operator to manage the child using H-files but with the use of Mtwo files, marked reduction in the instrumentation time was appreciated.

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H/ECIRB/2017-18). Written and informed consent from the parents/guardian of the child was taken, with a video recording of the same.

It was a split mouth study which included 15 children aged 5 to 8 years with at least two lower primary molars in each child indicated for pulpectomy, where the tooth was instrumented with Mtwo rotary and the other with H–files.

Children and teeth were selected based on following criteria:

**Inclusion criteria**
1. Patients with positive and definitely positive behaviour (*FRANKL*)
2. Molars indicated for pulpectomy with at least two-third roots intact
3. Retained primary teeth without permanent tooth buds
4. Patient whose parents gave written consent to be part of study.

**Exclusion criteria**
1. Teeth indicated for extraction
2. Patients with negative and definitely negative behaviour (*FRANKL*)
3. Teeth with pathological resorption (external and internal)
4. Teeth with perforated roots or root fractures
5. Patients with one molar for pulp therapy.

All the procedures were done by a single operator. Preoperative radiographs were taken for each tooth using 0 size intraoral periapical radiographic film to evaluate the periapical and furcal condition of the tooth. After evaluation, local anesthesia was administered and access was gained using endo Z access opening bur and high speed handpiece. Coronal pulp tissue amputation was done using spoon excavator. Root canal patency was determined with No. 10 K‒file and working length was determined by taking an intraoral periapical radiograph. The preparation of canals was done using Mtwo rotary system in group 1 and manual H‒files in group 2. Manual instrumentation with H‒files was achieved by in and out filing motion. The preparation was completed with 21mm H‒files (size 15 to 35). Rotary canal preparation was done with 21 mm length Mtwo NiTi files driven by Xmart endomotor handpiece at speed between 250 and 350 rpm as recommended by the manufacturer. A total of four Mtwo instruments (10/0.04, 15/0.05, 20/0.06, and 25/0.06) were used to prepare canals up to the determined working length of the root canals.

The instrumentation time was recorded in seconds using a stop watch for each canal separately. Even the time taken for instrument exchange was considered. Patient and operator compliance was recorded after completing instrumentation of both the teeth in each child through questionnaires [Figure 1].

The data obtained was collected and tabulated, Statistical Package for Social Sciences [SPSS] for Windows, Version 22.0. Released 2013. Armonk, NY: IBM Corp., was used to perform statistical analyses. Chi Square test was used to compare the distribution of teeth and number of canals. Independent Student *t* test was used to compare the mean time taken for instrumentation with both techniques in different canals and the mean overall time for instrumentation where *P* value is less than 0.001. Chi Square Goodness of Fit test was used to compare the patient’s and operator’s perspective regarding instrumentation techniques.

**Results**

Distribution of teeth and canals in the present study is demonstrated in Table 1.

The mean instrumentation time was less with Mtwo files when compared with H‒files in individual canals and tooth as a whole, which was statistically significant (*P* < 0.001) [Table 2 and Figure 2].

![Figure 1: Questionnaire. Colour - H – files; Motor – rotary system (Mtwo)](image)

| Variables | Categories | H files (%) | Mtwo rotary (%) |
|-----------|------------|-------------|-----------------|
| Tooth selected | Tooth number 74 | 3 (20.0) | 1 (6.7) |
| | Tooth number 75 | 6 (40.0) | 6 (40.0) |
| | Tooth number 84 | 2 (13.3) | 2 (13.3) |
| | Tooth number 85 | 4 (26.7) | 6 (40.0) |
| Number of canals | 3 canals | 8 (53.3) | 10 (66.7) |
| | 4 canals | 7 (46.7) | 5 (33.3) |
66.7% of children preferred H–files over Mtwo, 60% children reported that while instrumenting with H–files there was more pain, whereas 40% of children were scared on seeing H–files and 60% on seeing Mtwo rotary system [Table 3 and Figures 3, 4].

It was found that 80% of the children could be managed well with the use of H-files when compared to Mtwo rotary system which was 20%. This was found to be statistically significant ($P < 0.001$) [Table 3 and Figure 4].

But from operator’s preference of use of endodontic instruments in the present study it was found that operator ease of comfort was more with Mtwo rotary system as compared to H–files, though it was not statistically significant [Figure 4].

**Discussion**

Successful outcomes of endodontic procedures for the treatment of primary teeth with necrotic pulps are dependant on preoperative root resorption, canal accessibility and evidence of normal bone support. Rotary biomechanical preparation of deciduous teeth was first described by Barr et al. who put forth the advantages and disadvantages of using rotary files in primary teeth.[4]

Previous studies have been carried out comparing rotary system with K-files for manual instrumentation. In this study, H-files were chosen to study the time taken for instrumenting the canals when compared with Mtwo files. Instrumentation with Mtwo files was carried out in a sequence recommended by Azar et al.[5]

The instrumentation time recorded in the present study for rotary system (Mtwo) was less than that with H–files. This can be attributed to high cleaning efficacy of Mtwo files which have an S-shaped cross section and a noncutting tip. Their positive rake angle with two noncutting edges is responsible for effective dentine cutting and achieving symmetrical root canals.[6] The low fracture rate of Mtwo may be due to the increasing pitch length from tip to shaft, which reduces the tendency of the files to screw-in, thus minimizing the risk of instrument fracture,[7] when compared with H-file which is constructed from round Stainless steel wire by machine grinding forming a series of intersecting cones. This design produces sharp edges at the base of each cone, which cuts tooth structure only on pulling. The cross-section of this instrument shows that it is comma shaped (tear drop) with one cutting edge. At the junction between of the each two cones, the shaft of the instrument is weak facilitating its breakage if used in any form of rotation (reaming action). Therefore, H-files are to be used in filing action only. The results of present

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**Table 2: Mean time taken (min) between two instrumentation techniques in different types of canals and the mean overall time for instrumentation**

| Time taken for canals | Method      | n  | Mean   | SD    | SEM   | Mean difference | t    | P       |
|-----------------------|-------------|----|--------|-------|-------|-----------------|------|---------|
| MB                    | H files     | 15 | 3.46   | 0.36  | 0.09  | 0.94           | 7.396| <0.001* |
|                       | Mtwo rotary | 15 | 2.52   | 0.34  | 0.09  | 0.94           | 7.390| <0.001* |
| ML                    | H files     | 15 | 3.47   | 0.36  | 0.09  | 0.94           | 7.561| <0.001* |
|                       | Mtwo rotary | 15 | 2.54   | 0.34  | 0.09  | 0.94           | 7.561| <0.001* |
| DB                    | H files     | 15 | 3.42   | 0.36  | 0.09  | 0.94           | 7.561| <0.001* |
|                       | Mtwo rotary | 15 | 2.49   | 0.31  | 0.08  | 0.94           | 7.561| <0.001* |
| DL                    | H files     | 7  | 3.22   | 0.09  | 0.04  | 1.00           | 22.365|<0.001* |
|                       | Mtwo rotary | 5  | 2.22   | 0.04  | 0.02  | 1.00           | 22.365|<0.001* |
| Total time            | H files     | 15 | 12.37  | 1.38  | 0.36  | 3.54           | 8.994| <0.001* |
|                       | Mtwo rotary | 15 | 8.83   | 0.64  | 0.17  | 3.54           | 8.994| <0.001* |

*Statistically significant. SD=Standard deviation, SEM=Standard error mean, ML=Mesiolingual, DB=Distobuccal, DL=Distolingual, MB=Mesiobuccal
study were in contradiction to the in vitro studies by Katge et al.,[1] where they compared the cleaning efficacy and instrumentation time between manual H-files and rotary Mtwo files in primary molar root canals and Madan et al.[8] where they compared cleaning capacity and instrumentation time in primary molar root canals using K-files and Profiles. Both the studies concluded that the difference in instrumentation time with rotary and manual method can be considered as a matter of operator’s experience. Present study results are in accordance with in vivo studies by Govindaraju et al.,[9] Vieyra and Enriquez,[10] Makarem et al.,[11] and in vitro studies by Ramazani et al.,[12] Pathak,[2] Ramezanali et al.,[13] Katge et al.,[14] where they concluded that instrumentation with rotary system takes less time for root canal preparation when compared with manual method. It might be due to more cutting efficiency of rotary files with positive rake angle which is responsible for effective dentine cutting, varying in number of files in different rotary systems and experience of operator. 

In the present study patient compliance for instrumentation techniques was evaluated through questionnaire. The results showed that children preferred H-files and were more scared of the sight of rotary system and this could be attributed to the appearance of it which resembles an airrotor, that commonly provokes fear and anxiety in children.[14,15] This could be the reason that helped the operator to manage children easily while using H-files, although operator was comfortable while using rotary system for root canal preparation as its cutting efficiency is high[3] compared to H-files which also reduced the operator’s effort for instrumentation and increased the ease of comfort. 

**Conclusion**

To conclude from the present study:

Time taken for instrumentation with Mtwo files was less as compared to H-files in individual canals and the tooth as a whole which was stastically significant. Though it was convenient for the operator to manage the child using H-files but with the use of Mtwo files, marked reduction in the instrumentation time was appreciated resulting in minimising the chairside time thereby positively influencing the child’s behavior.

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Nil. 

**Conflicts of interest**

There are no conflicts of interest.

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