

Comparison of Separation of Manual and Rotary Files during Endodontic Treatment: A KAP Survey

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ABSTRACT

OBJECTIVE: To determine the frequency of manual and rotary instrument separation during endodontic treatment amongst experienced dental practitioners and house surgeons.

METHODOLOGY: The present study was conducted in various dental teaching hospitals registered with Pakistan Medical and Dental Council (PMDC) from July 2018 to January 2019. The sample size calculation was obtained by taking 50% prevalence rate using Open EPI software (version 3.01) at 95% confidence interval and $\alpha=5\%$ and was calculated to be 250. A self-administered questionnaire containing 22 closed ended questions was designed to evaluate different reasons of separation of manual and rotary endodontic instruments amongst experienced dental practitioners and house surgeons.

RESULTS: A total of 250 participants were included in this study, out of them 192 were house officers and 58 were dental practitioners. 122 (63.5%) of the house surgeons and 30 (51.7%) of dental practitioners experienced instruments breakage during root canal treatment. When the types of files were assessed, the results showed that the separation of K-files was most frequent than H-files and Ni-Ti rotary files. 106 (55.2%) of the house surgeons and 23 (39.7%) of the dental practitioners reported separation of K-files during root canal treatment.

CONCLUSION: The present study concluded that majority of the house surgeons experienced K-file separation than H-file and Ni-Ti rotary files than Dental practitioners during root canal treatment.

KEYWORDS: Endodontic instruments, File fracture, Instrument separation, Mishaps.

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INTRODUCTION

Separation of Endodontic instruments is considered to be one of the most troublesome hazards¹⁻³ that compromises endodontic treatment and might impact on the prognosis⁴. Fracture of the instruments is caused by incorrect movements of the instruments or by the use of deformed instruments that have lost their capacity of performing the procedure^{5,6}. The endodontic treatment is dependent on the quality of the cleaning and shaping of the root canal system and during these procedures, the risk of separation of an instrument occurs mostly due to negligence of the operator^{7,8}. The conventional approach to endodontic treatment implicates the use of stainless steel hand files of predetermined diameters and taper⁹. Root canal treatment has been plagued with a relatively high possibility of procedural mishaps¹⁰ such as perforations, ledge formation, overfills, underfills, instrument separations¹⁰⁻¹². Recently it has been reported that nickel-titanium (Ni-Ti) rotary instruments used for root canal treatment enhanced the skills to prepare root canals effectively and efficiently¹³. Separation rates of rotary Ni-Ti instruments reported between the range of 1.3% and 10.0%, whereas

separation rates of stainless steel instruments were ranged between 0.25% and 6¹³⁻¹⁹. The reason of this higher frequency of instrument separation reported might be because of slight standardization in terms of techniques used, operator skills and experience, position of the tooth and curvature of the root^{5,14,16,17,20-23}. Separation of endodontic instruments in many circumstances resulted from incorrect or overuse of an endodontic instrument²⁴. Files with a rotational speed of 350 rpm were more likely to get separated than those with 250 rpm and 150rpm. Decreased angle of curvature of the root canal significantly reduces the likelihood of instrument separation²⁵. During root canal treatment, separation of endodontic instruments often leads the operator to a state of frustration and anxiety initially and later develop a state of confusion about treatment and its prognosis²⁶. Bortnick KL2001²⁷ reported that there was no difference in the file separation when hand- and rotary instruments were compared. Panitvisai P 2010⁵ reported that the distortion of rotary instruments was mostly operator related. The rationale of the present study was to assess the frequency of separation of manual and rotary files during root canal treatment performed by house surgeons and experienced Dental Practitioners.

The aim of this current study was to determine the frequency of manual and rotary instrument separation during endodontic treatment amongst experienced dental practitioners and house surgeons.

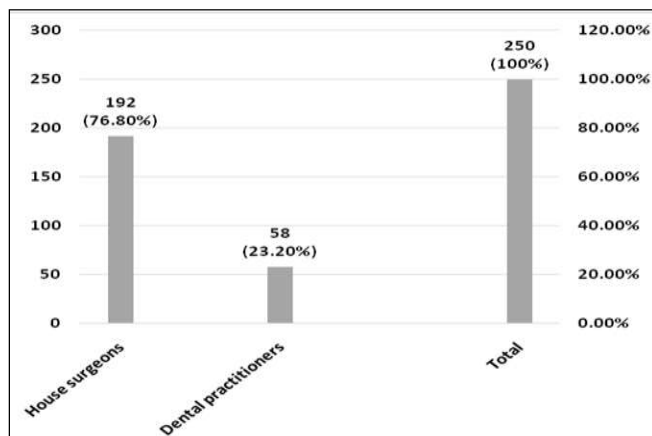
METHODOLOGY

The present study was conducted in private dental colleges registered with Pakistan Medical and Dental Council (PMDC) from July 2018-January 2019. The study was approved by the Research Department and ethical approval was given by the ethical committee, Baqai Dental College, Baqai Medical University. A self-administered questionnaire containing 22 closed ended questions was designed to evaluate different reasons of separation of manual and rotary endodontic instruments amongst experienced dental practitioners and house surgeons. A pilot study was conducted on 20 participants to assess the reliability of the questionnaire with Cronbach’s alpha score of 0.6. The sample size calculation was obtained by taking 50% prevalence rate using Open EPI (version 3.01) at 95% confidence interval and $\alpha=5\%$ and was calculated to be 250. The house surgeons who had completed their two months rotation in Endodontic Department and experienced dental practitioners from various dental teaching hospitals of Karachi were included in the study. Questionnaires were to the participants of the dental colleges and were collected the next day. All the participants were instructed that questionnaires must be filled completely. Data was analyzed for descriptive analysis (frequency and percentages). Chi-square test was applied to compare frequency of instrument breakage amongst house surgeons and Dental Practitioners by using IBM SPSS software version 22. P-value was set at 0.05.

RESULTS

A total of 250 participants were included in this study, out of them 192 were house surgeons and 58 were dental practitioners. (Figure 1).

FIGURE 1: DISTRIBUTION OF PARTICIPANTS



One hundred and twenty two (63.5%) house surgeons and 30(51.7%) of dental practitioners experienced instruments breakage during root canal treatment. Separation of manual instruments during root canal treatment was reported by 109(56.8%) of house surgeons and 28(48.3%) of dental practitioners. When the types of files were assessed, the results showed that the separation of K- files was the most frequent than H-files and Ni-Ti rotary files, 106(55.2%) of the house surgeons and 23(39.7%) of the dental practitioners reported separation of K-files during root canal treatment (Table I).

Question regarding taking radiograph after separation of instruments, 133(69.3%) of the house surgeons and 42(72.4%) of dental practitioners responded that they took radiographs after instrument separation. The most common area of instrument separation was the apical area. 116(60.4%) of the house surgeons and 33(56.9%) of the dental practitioners reported that their instrument separated in the apical area (Table II). One hundred and twenty (62.5%) of the house surgeons and 33(56.9%) of dental practitioners reported that they were using old instrument during root canal treatment (Table III).

90 (46.9%) of the house surgeons and 34(58.6%) of dental practitioners reported that they discard their instrument when appears shiny (Table IV).

TABLE I: FREQUENCY OF MANUAL AND ROTARY INSTRUMENT SEPARATION

Variables	House surgeons	Dental Practitioners	p-value
Did you experience any incident of instrument breakage?	Yes 122(63.5%) No 70(36.5%)	Yes 30(51.7%) No 28(48.3%)	0.10
Did you experience breakage of manual instruments?	Yes 109(56.8%) No 83(43.2%)	Yes 28(48.3%) No 30(51.7%)	0.16
Are K files mostly fractured?	Yes 106(55.2%) No 86(44.8%)	Yes 23(39.7%) No 35(60.3%)	0.02
Are H files mostly fractured?	Yes 73(38%) No 119(62%)	Yes 26(44.8%) No 32(55.2%)	0.33
Are Nickel Titanium rotary files mostly fractured?	Yes 86(44.8%) No 106(55.2%)	Yes 13(22.4%) No 45(77.6%)	0.002

TABLE II: SEPARATION OF MANUAL AND ROTARY INSTRUMENTS ACCORDING TO FREQUENCY OF BREAKAGE AREA

Variables	House surgeons	Dental Practitioners	p-value
Did you take any radiograph after breaking the instrument?	Yes 133 (69.3%) No 59(30.7%)	Yes 42(72.4%) No 16(27.6%)	0.70
Did the instrument break in apical area?	Yes 116(60.4%) No 76(39.6%)	Yes 33(56.9%) No 25(43.1%)	0.63
Did the instrument break in middle area?	Yes 57 (29.7%) No 135 (70.3%)	Yes 23 (39.7%) No 35 (60.3%)	0.15
Is the frequency of breaking instruments 5%?	Yes 80(41.7%) No 112(58.3%)	Yes 27(46.6%) No 31(53.4%)	0.51
Is the frequency of breaking instruments 15%?	Yes 91(47.4%) No 101(52.6%)	Yes 20(34.5%) No 38(65.5%)	0.08
Is the frequency of breaking instruments 25%?	Yes 57 (29.7%) No 135 (70.3%)	Yes 14(24.1%) No 44(75.9%)	0.41

TABLE III: QUALITY OF ENDODONTIC INSTRUMENTS AND CANAL CONFIGURATION

Variables	House surgeons	Dental Practitioners	p-value
Do you re-use the instrument?	Yes 120(62.5%) No 72(37.5%)	Yes 33(56.9%) No 25(43.1%)	0.44
Do you think re-usable instruments are more prone to fracture?	Yes 166(86.5%) No 26(13.5%)	Yes 51(87.9%) No 7 (12.1%)	0.77
Do you think instruments handling technique can cause its fracture?	Yes 164(85.4%) No 28(14.6%)	Yes 54(93.1%) No 4(6.9%)	0.12
Do you think mostly instruments are broken during initial visit?	Yes 121(63%) No 71(37%)	Yes 35(60.3%) No 23(39.7%)	0.71
Do you think canal configuration has something to do with instrument breakage?	Yes 148(77.1%) No 44(22.9%)	Yes 46(79.3%) No 12(20.7%)	0.72
Can you recognize when to stop using the instrument?	Yes 138(71.9%) No 54(28.1%)	Yes 48(82.8%) No 10 (17.2%)	0.09

DISCUSSION

A successful root canal treatment depends upon proper root canal cleaning and shaping without any

TABLE IV: DECISIONS REGARDING DISCARDING OF ENDODONTIC INSTRUMENT

Variables	House surgeons	Dental Practitioners	p-value
Do you think use of lubrication can reduce the chance of instrument breakage?	Yes 145(75.5%) No 47(24.5%)	Yes 48(82.8%) No 10(17.2%)	0.25
Do you discard your instrument when it shows shiny appearance?	Yes 90 (46.9%) No 102(53.1%)	Yes 34(58.6%) No 24(41.4%)	0.11
Do you discard your instrument when distance between its flutes increases?	Yes 141(73.4%) No 51(26.6%)	Yes 48(82.8%) No 10(17.2%)	0.14
Do you discard your instruments when it has sharp bends?	Yes 166(86.5%) No 26(13.5%)	Yes 53(91.4%) No 5(8.6%)	0.31

endodontic mishaps such as separation of manual and rotary files. To minimize these mishaps, the operators should establish the methods for proper usage of Ni-Ti files which is based on the information attained from continuing medical education courses or articles reporting survey data²⁸⁻³¹. The present study reported that majority of the house surgeons and dental practitioners experienced separation of manual and rotary endodontic instruments during root canal treatment. Pedir SS 2016³² in a study reported dissimilar results when asked about incident of instrument breakage. Mozayeni MA 2011³³ in a study reported that majority of the general practitioners broke Ni-Ti files than hand files during root canal treatment. Lee W 2012³⁴ in a study reported that 54.6% of the respondents experienced file separation during root canal treatment. Alrahabi M 2015³⁵ reported instrument separation of 5.56% of Ni-Ti instruments corresponding only 1.1% of stainless steel instruments. Sonntag 2003³⁶ in a study reported that Ni-Ti instruments were more prone to fracture when compared with their stainless steel instruments. The reason of instrument separation is due to cyclic fatigue of the rotary instruments on repeated usage³⁷. Stainless steel files are more resilient to fracture and easily identifiable signs included visible unwinding of flutes, tip distortion, roll-up of flutes and corrosion prior to separation³⁸. Pedir SS 2016³² in a study reported that higher percentage of separation cases with dental practitioners and students were of stainless steel hand files followed by Ni-Ti rotary files. Andrabi SM 2013³⁹ reported that the incidence of instrument separation

has increased with the increased use of Ni-Ti instruments hand or rotary. Simon S 2008⁴⁰ reported that Ni-Ti instruments are not brittle than a stainless steel instrument of equivalent size.

The preparation techniques were related to the frequency of file separation²⁸. Experienced dental Practitioners perform cleaning and shaping of the root canal by using different file systems and different preparation techniques to avoid procedural mishaps²⁸. It is also recommended that Ni-Ti rotary instruments should be thrown away after single use which is ideal for reducing the risk of file separation; however, the increased cost of Ni-Ti files has forced dental practitioners to reuse them²⁸. The frequency of reusing Ni-Ti files differed according to experience and therefore experienced dental practitioners had a strong tendency of reusing the files 6-10 times. This happened due to the experience based opinion that a file can be safely re-used more and it seemed that experienced dental practitioners do not rush through a procedure, so that it could decrease the chance of torsional failure^{41,42}. This study reported that 120 (62.5%) of the house surgeons and 33(56.9%) of dental practitioners reported re-use of instrument during root canal treatment.

Instrument separation was 33.5 times more likely to occur in the apical one third than the coronal one third of the tooth¹⁷. The present study reported that majority of the house surgeons and the dental Practitioners broke instrument in the apical area. Patil TN 2017⁴³ in a study reported similar results that the Dental Practitioners most commonly broke instrument in apical one third area.

The incidence of file separation decreases with the canal irrigation protocol and with controlled speed and torque of the hand piece. The gel form of a lubricant was the main factor to influence mechanical stresses on instruments and therefore aqueous solutions were superior to gel type preparation. Furthermore, the addition of a chelating agent caused some further decrease in torque, torsional load, and force values and this effect worked immediately⁴⁴. This present study reported that majority of the house surgeons and the dental practitioners used lubricant to reduce chances of file separation during root canal treatment. Patil TN 2017⁴³ in a study reported similar results that irrigation/ lubrication of the instrument decreases the file separation.

Endodontic instruments should be checked before being introduced into a root canal to make sure that the spirals are regularly aligned and if the blades are not spaced equally, it is an indication that the instrument has been strained and that the torque has caused the blades to become irregularly spaced. A quick glance is sufficient to determine whether the

instrument has been strained and should be discarded⁴⁵. The present study reported that most of the house surgeons and the dental practitioners discarded the instruments when it has sharp bends or when distance between flutes increased.

Patil TN 2017⁴³ in a study reported similar results that the dental practitioners discarded files after repeated re-use.

Strength of the present study is that it is one of the studies that emphasized only on manual and rotary file separation during root canal treatment performed by house surgeons and experienced house surgeons from different dental colleges. The study has limitations that include the small sample size, limited dental teaching hospitals.

CONCLUSION

Frequency of instrument breakage was reported to be high amongst house surgeons when compared to Dental practitioners and this is due to that they do more cases than house surgeons. Majority of the house surgeons reported experience of breakage of manual instruments than rotary instruments.

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