Retrospective Study on Type of Instrument Separated During Root Canal Treatment- An Institutional Study

Running title: Type of instrument separated during RCT

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ABSTRACT:

Endodontic instruments becoming separated within the root canal is an undesirable occurrence. A different device prevents the root canal system from being completely debrided and sealed. As a result, every effort must be taken to recover the shattered instrument. When an instrument separates from the canal, the clinician is left in a state of despair, worry, and, finally, optimism that nonsurgical retreatment approaches will aid in the removal of the device.

AIM:

The aim of the current study is to find the most common type of instrument separated during root canal treatment among 10 -70 years of age visiting private Dental College and Hospitals.

MATERIALS AND METHODS:

The current study is a descriptive study which is performed under university settings where the instrument retrieved data was collected from the Hospital Records management system at a Private Dental College. All the instruments fractured / separated during root canal treatment datas were collected.The sample size of the study was found to be n=40. The data was obtained and tabulated in excel, imported to SPSS software by IBM ,a statistical software with variables defined. The significance of this study was set at $p<0.05$,obtained using Chi square test and the results were interpreted.

RESULTS:

From the statistical analysis, it is observed that the type of instrument separated has equal gender predilection and the most commonly involved age group is around 30 - 40 years. The most commonly involved tooth for instrument separation in both the arches was found to be canines and the most commonly involved type of instrument separation was found to be rotary files Chi square statistical test was done and the p value was found to be 0.492 (Chi square -p value >0.05, not significant

CONCLUSION:

Within the limitations of the current study, it is found that instrument separation is more common among 30- 40 years of age with equal gender predilection, and higher incidence with canines.

KEYWORDS:

Instrument separation, type of instrument , fracture

INTRODUCTION:

Instrument fracture in endodontics is a common and troublesome occurrence that can hinder sufficient root canal cleaning and shaping and have a negative impact on the endodontic treatment prognosis(1). Tooth, separated instrument, operator, and patient are just a few of the factors that can cause an instrument fracture(2). Excessive torque causes most stainless steel instruments to fail, and torsional stress and cyclic loads cause Niti rotary files to fracture.(3).

Although Niti instruments are believed to be more flexible, the introduction of Niti alloys has not resulted in a lower incidence of instrument fracture, with stainless steel separation rates ranging from 0.25 percent to 6%(4). This difficulty can arise even in the most seasoned hands, frustrating both the clinician and the patient(5). The success rates for removing separated instruments may vary depending on the devices, procedures, methodologies, and protocols used(6). One of the various procedures for removing the shattered fragment is using a Masserman kit(7). Before a clinician makes the decision to remove a separated fragment, they should ensure the availability of and successful manipulation of the required materials, instruments and devices(8).

Each case has its own distinct qualities that will determine how the case is handled(9). However, a clinician may be fortunate enough to remove the detached instrument while attempting to bypass it, dislodging it coronally with other hand files, or irrigating the root canal(10). A loose piece, on the other hand, may be difficult to remove despite the use of many methods and technologies. Many technologies, procedures, and strategies for removing separated instruments have been described over the last few decades. Some are still in use, while others are just of historical significance.

Our team has extensive knowledge and research experience that has translated into high quality publications(11–20),(21–24),(25–29) (30) As a result, the study's goal is to analyse the different methods used for the management of retrieval of broken instruments.

MATERIALS AND METHODS :

This was a descriptive study which was performed under a University setting where all the patients between 10-70 years of age reported to a private dental hospital, Chennai, India. The data was collected by reviewing the patients records and analysed the data of 86000 patients who underwent Root Canal treatment between June 2019 to February 2021. The ethical approval was obtained from the Institutional Ethical Committee. The population size of the study who underwent instrument separation during root canal treatment was found to be n=38. The data was cross verified with photographs and was compiled for statistical analysis on SPSS(version 23.0) software. The minimising sampling bias was done by collecting data within the University and by using the simple random sampling method . There was a high internal validity and low external validity in our study. The patients between 10-70 years of age and the patients who underwent instrument separation during root canal treatment were included in the study.Improper and incomplete data ,repeated data ,were excluded. Chi square test was used to compare the groups ($p<0.05$) was considered significant and the results were interpreted.

RESULTS :

From the statistical analysis, it is observed that the type of instrument separated has equal gender predilection and the most commonly involved age group is around 30 - 40 years. The most commonly involved tooth for instrument separation in both the arches was found to be canines and the most commonly involved type of instrument separation was found to be rotary files .

DISCUSSION:

Two major issues must be addressed in order to improve long-term outcomes when the instrument separates in the root canal system(31). The initial step is to remove the metal fragment from the tooth while also preventing it from corroding. In a study, Barbosa et al. found that stainless-steel fragments did not corrode after two years(10,32). Strindberg et colleagues discovered that when separated instruments were present, the rate of apical tissue healing was lowered by 19% compared to control cases with no separated instruments(33). Fox et al. conducted a follow-up study on 66 cases, with a two-year average follow-up period(34). A favourable outcome was found in teeth with vital and necrotic pulp without periapical

lesions(35). In contrast, when a periapical lesion was present at the time of instrument separation the success rate reduced to 47%.

The type of instrument separated has an equal gender preference in our study, and the most usually involved age group is between 30 and 40 years. Rotary files were also the most prevalent kind of instrument separation(36). Similarly, the study conducted by Amish et al. yielded the same results. NiTi devices prefer to thread to the canal walls, and they have a higher tendency to fracture frequently, according to her research(8) .Niti instruments are more difficult to remove compared to stainless steel instruments for the following reasons(37), Niti tends to thread to the canal walls; they have greater tendencies to fracture repeatedly particularly when ultarsonics are used. They usually remain against the walls, not in the centre. They fracture in shorter lengths making its retrieval difficult.

The upper anteriors were revealed to be the most typically implicated tooth with instrument separation in our investigation. The results were consistent with the findings of Crystal et al investigation. The cause could be linked to a number of factors, including tooth structure, operator expertise, and instrument type(38). Anatomic parameters such as the type of teeth, the location, the root diameter, and the degree of root curvature all influence the instrument separation(39). In maxillary teeth, the instrument removal is more predictable. Fragment from the coronal third, with canals that are slightly bent or straight. Anatomical factors can be discussed in terms of vision and access to broken segments in order to securely manage and retrieve the shattered instrument. Furthermore, when there is a gap between the fragment and the root canal, instrument removal is more predictable.

When instruments are separated, doctors may be prompted to remove the fragment. However, one of the most crucial aspects of dealing with such circumstances is to take a methodical approach while remaining patient. There are several procedures for removing fractured segments, but each has its own set of difficulties, such as ledge formation, perforation, and so on(40). So another approach for the management of separated instruments is not to retrieve but to preserve the integrity of the remaining tooth structure by bypassing the fractured instrument.

The limitations of our study include a very small sample size and cannot be generalised to a larger population.

CONCLUSION :

Regardless of little experience of the endodontic residents, they were successfully managed to remove or bypass most of the separated instruments. Ultrasonic device was very helpful in removing the separated instrument.

ACKNOWLEDGEMENT:

The authors would like to acknowledge the help and support rendered by the Department of Conservative Dentistry and Endodontics , Saveetha Dental college and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University for their constant assistance with the research.

FUNDING:

The present project is funded by

- Saveetha Institute of Medical and Technical Sciences
- Saveetha Dental College and Hospitals
- Saveetha University
- Jembu Printers Private Ltd., Chennai.

CONFLICT OF INTEREST:

None declared

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FIGURES:

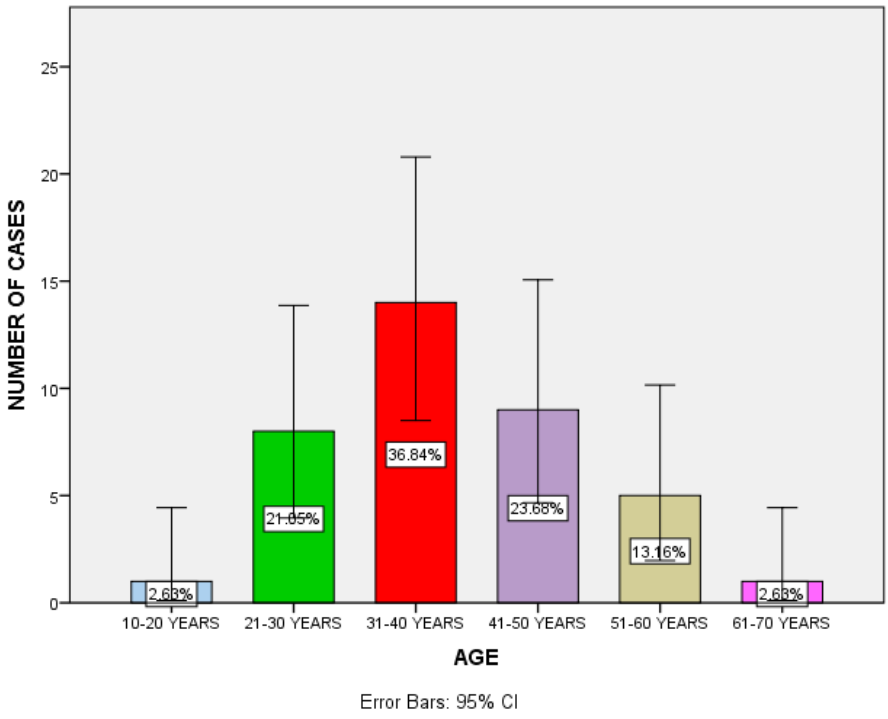

Figure 1 : Bar graph depicts the distribution of age groups of patients with the type of instrument separated. The x axis represents the age groups of the patients and the y axis represents the number of cases. The blue colour represents the age group between 10-20 years , Green colour represents the age group between 21-30 years , Red colour represents the age group between 31-40 years . Violet colour represents the age group between 41-50 years. Brown colour represents the age group between 51-60 years. Pink colour represents the age group between 61-70 years. 31-40 years age group patients were found to be associated with higher incidence of instrument separation(36.84%).

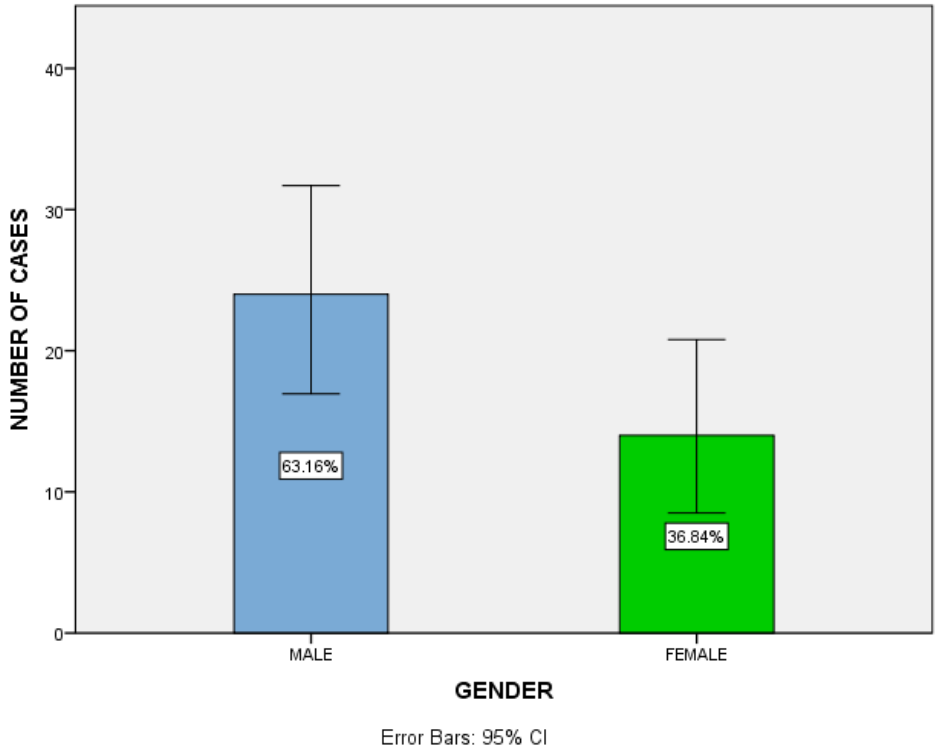

Figure 2 : Bar graph depicts the distribution of gender of patients with the type of instrument separated. The x axis represents the gender of the patients and the y axis represents the number of cases. The blue colour represents males and the green colour represents females. The type of instrument separated has equal gender predilection (50%)

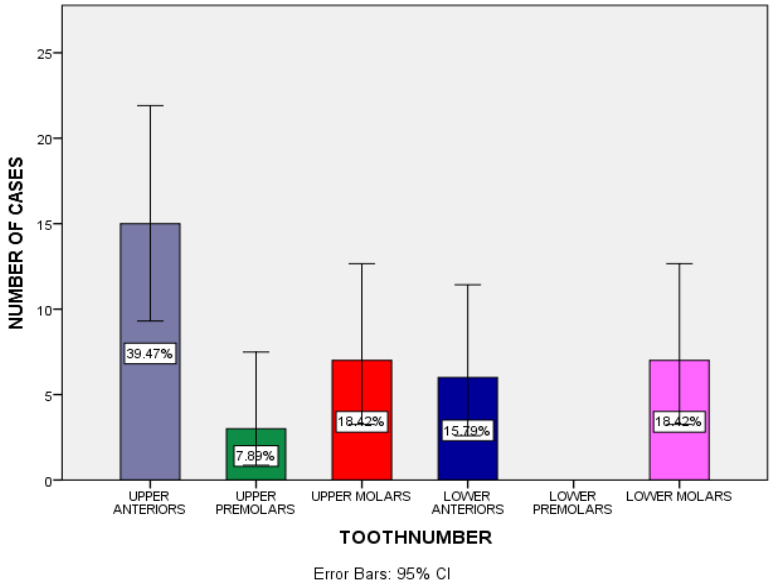

Figure 3: Bar graph depicts the distribution of tooth number of patients with the type of instrument separated. The x axis represents the tooth number of the patients and the y axis represents the number of cases. The blue colour represents upper anteriors . The green colour represents upper premolars . Red colour denotes upper molars , Dark blue represents lower anteriors. Pink represents lower molars.

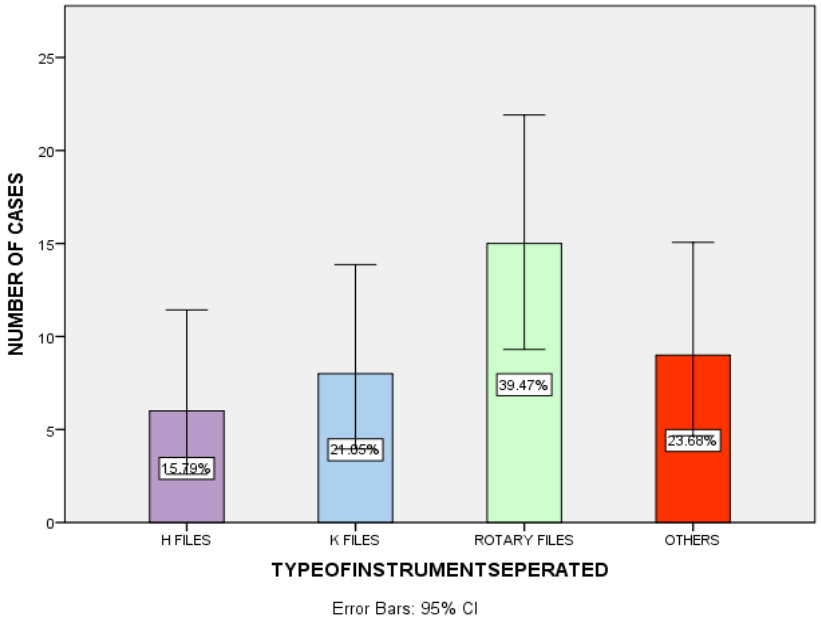

Figure 4 : Bar graph depicts the distribution of the type of instrument separated. The x axis represents the type of instrument separated and the y axis represents the number of cases. Violet colour represents H files , Blue colour represents k files, Green colour represents rotary files and Red colour represents other files.

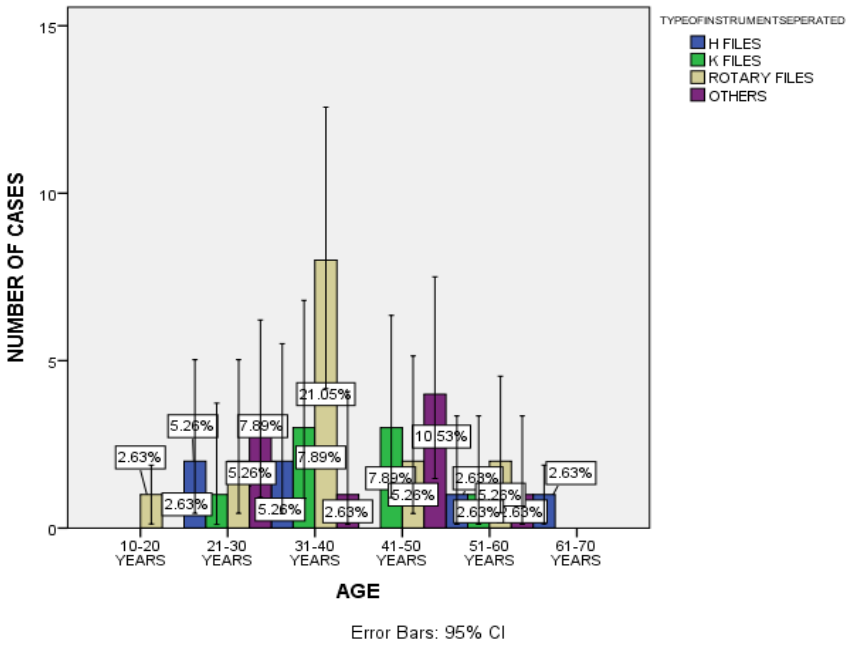

Figure 5: Bar chart showing association between age and No of instrument separation .X axis represents the age group of the patient and Y axis represents the number of instruments separated ; The blue colour represents H files , Green colour represents K files , Brown colour represents rotary files. Violet colour represents other types of files. Majority of the cases in the 31-40 years age group reported for instrument separation . Chi square test (24.919) was done and association was found to be not statistically significant. Pearson's Chi square P value - 0.467>0.05

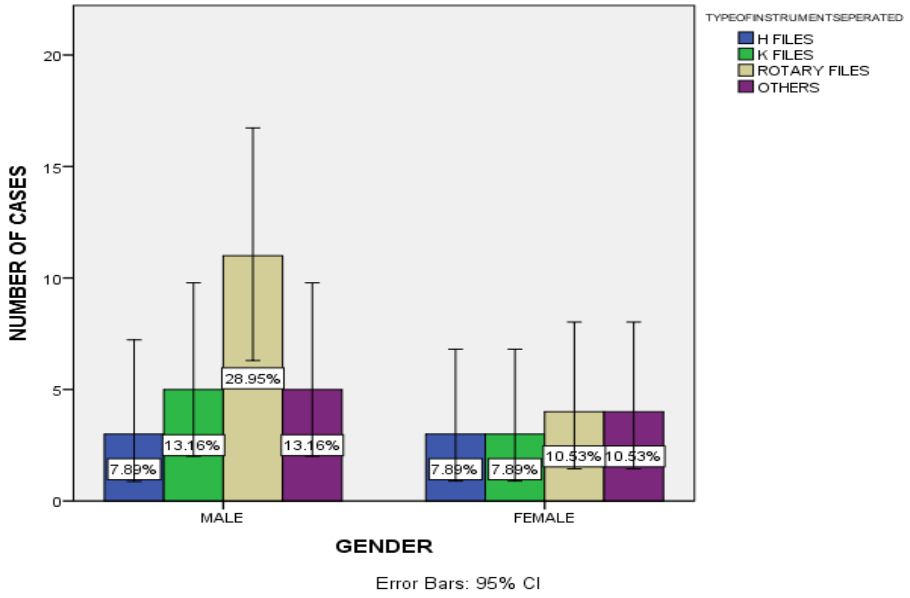

Figure 6: Bar chart showing association between gender and no of instruments separated , X axis represents the gender of the patient and Y axis represents the number of instruments separated; The blue colour represents H files , Green colour represents K files , Brown colour represents rotary files. Violet colour represents other types of files. Majority of the male cases reported for instrument separation. Chi square test (5.835) was done and association was found to be not statistically significant. Pearson's Chi square value P value - 0.323>0.05

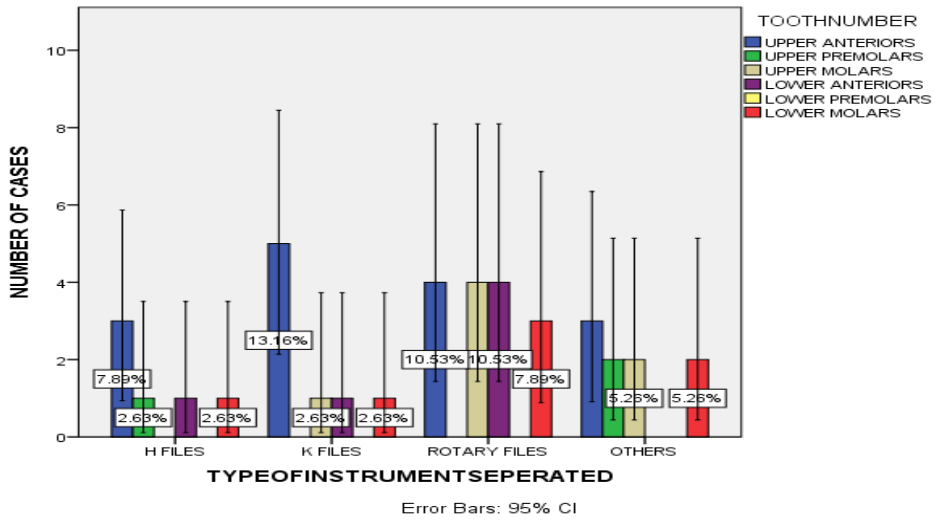

Figure 7 : Bar chart showing association between tooth number and No. of the instruments separated , the X axis represents the tooth number and the Y axis represents the number of instruments separated . The blue colour represents upper anteriors . The green colour represents upper premolars . Red colour denotes upper molars , Dark blue represents lower anteriors. Pink represents lower molars. Upper anteriors were found to have a higher prevalence of instrument separation in all the different types of files than other teeth . Chi square test (61.982) was done and association was found to be statistically significant. Pearson's Chi square P value - 0.000 <0.05.