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Available Online: <https://ipharmsciencia.edwiserinternational.com/home.php>***Evaluation of the Commonly Separated Instruments and Site of Occurrence in a Dental College*****Jose J, Sugumaran S\***

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## Article info

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**Abstract**

Endodontic instrument separation is an unfortunate complication which can hinder the cleaning and the cleaning and shaping procedure and affecting the outcome of the treatment. The cause of instrument separation is a multifactorial process and is caused by various factors in a dental college due to the operators undergoing a practical education, it is inevitable that separation of instruments occurs. This retrospective analysis aims to assess the commonly separated instrument and the site of occurrence in a dental college. A retrospective observational analysis was done using electronic data obtained from the DIAS system of Saveetha Dental college. A total of 20 samples was assessed. The data was taken from the time frame APRIL 2019 to APRIL 2020. The assessment was done radiographically. The tabulated data was analysed using SPSS (21.0) and the type of instrument separation and site of instrument separation occurrence. A chi square test was done to assess the correlation between the site of occurrence and type of instrument fractured and was found to be statistically insignificant ( $p > 0.005$ ). From the results achieved it was seen most separated instruments are rotary files and H Files. Location of instrument fracture was seen in coronal and middle third more often than apical third.

**Keywords:** Graduate endodontic program; Hand instrument; Instrument separation; NiTi.

**Introduction**

Separation of endodontic instruments is an unfortunate event which occurs in a common dental practice which hinders the root canal procedure and affects the outcome [1,2]. Various factors have an influential effect on the incidence of instrument separation such as the type of instrument, complexity of the root canal, operator ability and fatigue of the instrument [3,4]. This separation of instrument is attributed to various factors such as canal calcification which plays an influential factor in the preparation process [5-8].

NiTi instruments have become very popular in endodontic practice and are seen to be more flexible than stainless steel instruments [9] and help in preparation of curved canals effectively. The reported instrument separation range from stainless steel was seen to be 0.25% and 6% [10] and the separation of NiTi instruments reported range being 1.3% and 10% [11]. During these cases diagnosis plays a crucial role for the determinant of success of treatment [12,13].

When an instrument separation is seen in a root canal system; 2 main concerns need to be assessed. The first is the presence of the metal fragment and its location in the root canal system and the possibility of corrosion in the long run [14]. The effect on healing is also seen that reduced healing is seen in the periapical tissues with the presence of instrument fracture [15]. In the presence of a periapical lesion and instrument separation the success rate is reduced considerably to 47% and without periapical lesions it is seen to have a success rate of 89%. Variety of approaches are present for management of separated instruments dividing into 2 major approaches, orthograde and/or surgical approaches [16].

Orthograde approaches of management of instrument separation being [17].

- ✓ Attempt to remove the fragment.
- ✓ Attempt to bypass the instrument.
- ✓ Cleaning and shaping at the level of the separated instrument.

The incidence of separation of an instrument in the canal causes immense frustration to the operator and could enable them to potential litigation [18]. The increased incidence of instrument separation in a study environment is by various factors with the operator ability to use instruments and the fatigue level of the instruments being a crucial factor for instrument separation in practice. The present retrospective study aims to analyse the different types of instrument separation and the most common location of instrument separation in a dental college.

#### **Material and methods**

The study was approved by SRB board of Saveetha Dental College. The data were collected using electronic medical records patients and analysed the data of 86000 patients between June 2019 and March 2020. Data which had instrument retrieval successfully managed were taken into this study.

Demographic data such as patients age, gender, teeth, location of instrument separation and type of instrument separation was collected

#### **Inclusion criteria**

- ✓ Patients aged 18-70 years.

- ✓ Instrument separation done in the dental college only (Permanent teeth).

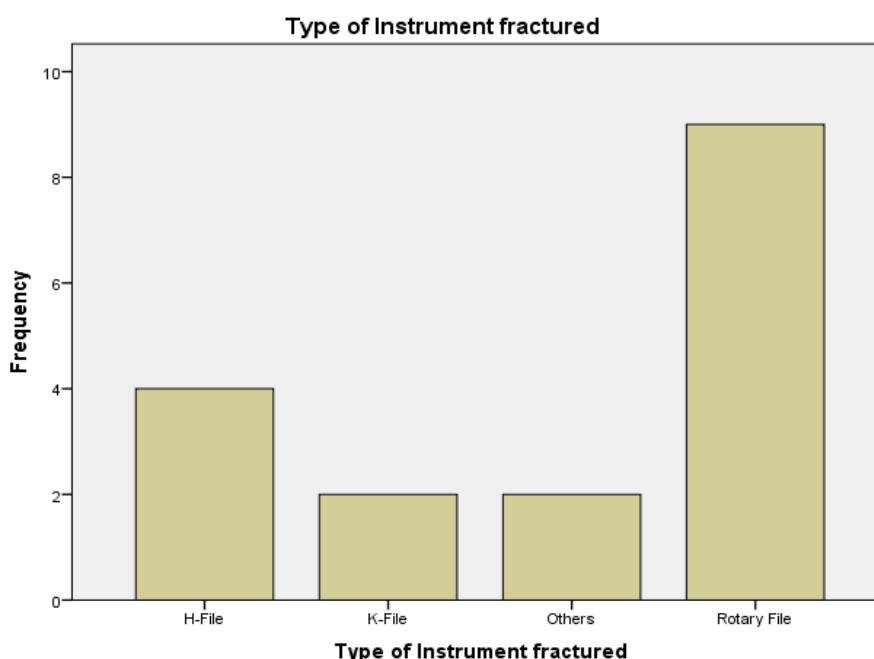
#### **Exclusion criteria**

- ✓ Patients below age 18 years and above age 70 years.
- ✓ Duplicate values.
- ✓ Instrument separation in primary teeth.

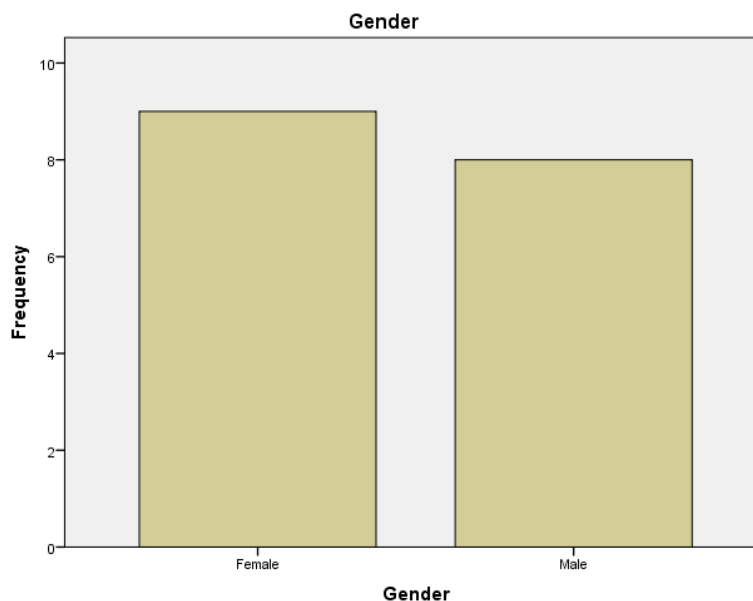
Duplicate values and data which was incomplete was removed. The total sample size was 20 which was reduced to 16 which was finally included in the study. Cross verification of the data was conducted using radiographic methods by 2 calibrated operators and in case of a disagreement a 3rd operator was asked to assess the radiograph.

#### **Results and discussion**

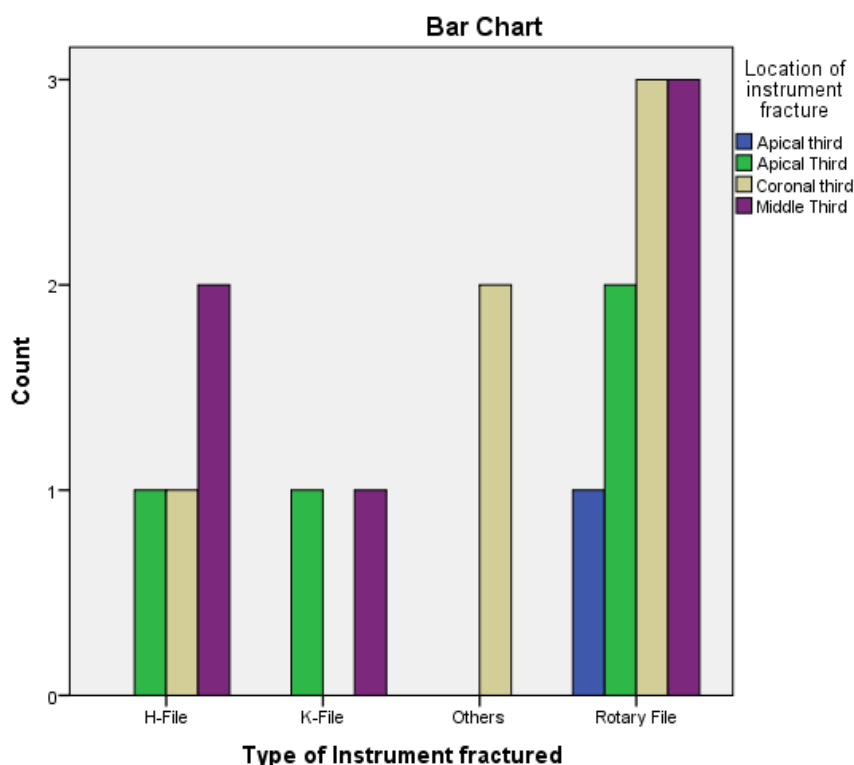
The data was interpreted and analysed using SPSS 21.0 (IBM Corp, USA). Association of the patient such as patient age, gender, tooth number, type of instrument and location of the instrument fracture was assessed. Correlation analysis was done to check the correlation between the type of instrument and location of instrument separation. Chi Square test was done to check the correlation and was found to be statistically insignificant ( $p > 0.005$ ) (Figures 1 to Figure 3).



**Figure 1:** Frequency of the commonly separated instruments in the root canal. X axis denotes the type of instrument fractured in the canal and Y axis denotes the number of instruments fractured. From the analysis done it is seen rotary files have the higher incidence of instrument separation in the root canal.



**Figure 2:** Incidence of occurrence of instrument separation based on gender. X axis denotes the gender of the patient (Male, Female) and Y axis denotes the frequency of instrument separation seen. The incidence of instrument separation is seen to be relatively higher in females than in males.



**Figure 3:** Incidence of type of fracture and the location of fracture in the canal for all assessed instruments. X axis denotes the type of instrument fractured and Y axis denotes the frequency of fracture based on the location in the canal. Incidence of instrument fracture in the coronal third and middle third of the canal is seen to be highest followed by apical third. Rotary files are the most frequently separate instrument in the canal. A correlation analysis showed that statistically insignificant difference was seen between the type of instrument fractured and location of the instrument fractured (p value =0.715).

Cleaning and shaping of the root canal system is a crucial phase of the endodontic therapy with the presence of different procedural errors that can be minimized such as zipping, ledging and perforation using NiTi rotary Instruments [19]. NiTi instruments however have an inherent disadvantage leading to unexpected intracanal breakage. This is due to the different fatigue levels experienced by the instrument such as torsional fatigue and cyclic fatigue [20] as well as pain levels are seen to increase for the patient during this phase [21,22].

The results of this study showed high incidence of instrument separation by a rotary file system. This could be due to various factors such as improper usage of instruments and repeated use of the rotary file system. This could lead to increased stress distribution and is always recommended to discard these instruments from a certain usage [23]. The use of intracanal irrigants and intracanal medicaments have shown various effects on these separated fragments with some causing corrosion of the file [24–28].

In our present study it was seen that distribution of intracanal separation was seen to be almost equal in male and female population [N= 17, n1 = 8, n2= 9]. It is known that NiTi instruments are more difficult to remove compared to stainless steel ones [29]. This is due to factors such as higher threading into the root canal walls. The presence of NiTi fragments usually present in the outermost wall of the root canal [30], compared to stainless steel where instruments are difficult to remove and had an influence in the results of our study.

Location of separated instruments play a crucial role for removal of instruments. It is seen that instruments separated at the coronal third above the point of curvature [31]. This location can be determined by various methods with Cone beam computed tomography considered the most desired method [32]. In our study it was seen the maximum amount of instrument separation was seen in the coronal third followed by middle third and apical third. This could be due to various methods of instrument separation removal used. The ultrasonic instruments have the ability to transmit ultrasonic energy to the broken fragment [33]. The success rate for removal of broken fragments is seen to be highest using ultrasonics which is seen to be around 85% to 95% respectively [34].

Parashsos et al. [35] had reported the influence of NiTi instruments due to various factors such as geometry of the canal, instrument speed and sequences were kept constant. The ability of the operator plays a crucial role and has a longer learning curve to master the instrumentation strategy.

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The preparation of a manual glide path before rotary instrumentation has shown to decrease instrument separation drastically [36].

Some of the strategies which have been used for instrument separation removal are based on the staging platform [37] and the ability of the clinician to clinically visualize the instrument which increases the probability of instrument retrieval chances drastically [38].

The other strategies showing good amount of success rate for instrument retrieval are

- ✓ Chemical Solvents.
- ✓ Mini forceps.
- ✓ Hypodermic syringe needles.
- ✓ Masserman Instrument.
- ✓ File Removal System.
- ✓ Laser irradiation technique.
- ✓ Terrauchis kit-Highest success rate.

Though the presence of different methods it has a certain level of expertise is required to be achieved by the operator. Various treatment methods are taught in an educational institute and clear emphasis must be given for the treatment of these procedures which will be beneficial in the long run [6,39]. In our study, a correlation analysis was done to analyse the type of instrument fractured and location of instrument fracture was seen to be statistically insignificant which maintained our null hypothesis that no correlation is seen between the location and type of instrument. The limitations of the current study are Very small sample size and more parameters if assessed would give a much better-quality assessment. The future scope of the study needs to be done on a larger sample size and more grading sample is required and a prospective based study would help assess the long-term prognosis.

## Conclusion

The highest amount of instrument separation is seen in coronal third, followed by middle third and apical third. There was no association between the location of instrument fracture and type of instrument fracture indicating it did not influence the incidence of instrument separation taken place by the operator. Though instrument retrieval is a complex procedure, the avoidance of this is very important with almost all operators experiencing this in their clinical practice. In a dental college setup, the application of lab programs and model studies would help the graduate operators to have better skills to tackle this situation in a much better way in their practice.

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