ASSESSMENT OF INSTRUMENT SEPARATION DONE IN MANDIBULAR MOLARS - A RETROSPECTIVE ANALYSIS

Nivedha V.M[1] , *Karthikeyan Murthykumar [2], Dr J.Mahalakshmi [3]

1) CRRI,Saveetha Dental College & Hospitals
Saveetha Institute of Medical and Technical Sciences (SIMATS)
Saveetha University Chennai,Tamilnadu, India
Email Id:151901047.sdc@saveetha.com
2)Senior Lecturer ,Department of Periodontics,Saveetha Dental College ,Saveetha institute of medical and technical sciences,Email:karthikeyanmurthykumar@gmail.com
3)Senior lecturer,Department of conservative dentistry and endodontics
Saveetha Dental College and hospitals,Saveetha Institute of medical and technical sciences,
Saveetha University, Chennai-600077,Email id: mahalakshmij.sdc@saveetha.com
Corresponding author: Dr. Karthikeyan Murthykumar
Senior Lecturer , Department of Periodontics ,Saveetha Dental College ,Saveetha institute of medical and technical sciences
Email:karthikeyanmurthykumar@gmail.com

ABSTRACT:

Introduction- Endodontic instruments rarely separate beyond the apical foramen. The fractured segments are constantly escorted with bacteria and dentine debris which is a foreign object and might produce inflammation. Besides ,the patients often observe the fractured segment as “a broken needle” and endure psychologically.

Aim: The aim of the present analysis is to access instrument separation done in Mandibular molars.

Materials and methods: This retrospective study was conducted at Saveetha Dental College and Hospital in Tamil Nadu, India, is comprehensible and utilizes a mixed qualitative/quantitative methodology to evaluate data gathered during analysis. A dental record of 34 patients were investigated that reported for instrument separation or file breakage. The evaluation of dental records includes, open ended survey, reflective journals.

Results: The association of Mesiobuccal, Mesiolingual and Distolingual canal with instruments like Rotary file, H-file, K-file ranges between to 30 - 50% in the first and second mandibular molar. The location of Separation is the factor deciding the resistance of the tooth fracture after the removal of the separated instrument, in accordance to our analysis the 80% of the instrument separation involves Mesiolingual canal in first and second mandibular molar. The Rotary file instrument accounts to 90% of the instrument separation in the mandibular molar where as other instruments like H-file, K-file ranges between 60-70%.The Results were analyzed and graphically represented using SPSS Software.Chi square test was done and the association was found to be statistically significant ($P = 0.123$, $p<0.01$).

Conclusion: Most of the instrument separation cases were found with rotary file instruments and the number of cases are more in mesiobuccal and distobuccal root of first molar and second molar respectively.

Keywords: Instrument separation,mandibular molars,eco friendly,innovative method

INTRODUCTION:

Endodontic instruments rarely separate beyond the apical foramen. The fractured segments are constantly escorted with bacteria and dentine debris which is a foreign object and might produce inflammation. Besides ,the patients often observe the fractured segment as “a broken needle” and endure psychologically.(1) Therefore, an attempt to remove the segment with a surgical approach is often required. Prior to the surgery, the precise position and size of the fractured instrument ought to be understood as well as its relation to the root apex and surrounding anatomic structure (2).

Instrument separation perhaps transpires in the course of the utilization of several endodontic instruments (hand or rotary files, Gates Glidden burs, lentulo, pluggers, spreaders) made of different materials v(NiTi, stainless steel). The calamity of instrument separation, is an exasperating situation for the clinician because it may prevent access to the apex and impedes full length instrumentation and obturation of the root canal. The outcome of such calamity resulting in a high level of difficulty of the certain case augments, while the tooth healing is challenged. The separation of an endodontic instrument instantly transforms from any level of difficulty at the preoperative stage, to a new level of severity (3).

The Occurrence of a separated instrument in the root canal might lead to a failure of the treatment of the tooth. The prediction depends on the degree of contamination of the canal at the moment of separation and the presence of apical pathology. The prospect of removing a fractured instrument is directly connected to visibility – i.e. possibility to create straight line access to it. Whilst the fragment is positioned inside or beyond the root canal’s curvature, visibility requires straightening of the root canal to a different extent, which may lead to removing excessive amounts of dentin and root weakening or even perforation. Another choice of technique, which historically paved the way for those broken instruments removal, called “bypass”.(4)Inserting a fine file between the fragment and the root canal wall may lead to negotiating the canal to full working length and enable thorough instrumentation and root canal obturation with the fragment remaining in situations. Incorporating the fragment in the root canal obturation material considerably improves the case prognosis. This technique does not require direct visibility to the Fragment (5).Our team has extensive knowledge and research experience that has translate into high quality publications(6–21).The aim of the present study was to assess the number of instrument separation done in mandibular molars.

MATERIALS & METHODS:

A dental record of 34 patients were analysed who reported with instrument separation or file breakage. Data was investigated and entered in the excel sheet. The male and female distribution among the study population was analysed. The collected data was divided into 4 parameters , the age of the patient, the gender of the patient , teeth number and instrument separation. The

parameters are grouped, data was copied to the software and statistically analysed. Statistical analysis was done on IBM SPSS software version 26.0. The significance level was at 0.005. Descriptive analysis and chi-square tests were carried out. Graphs were analysed.

RESULTS & DISCUSSION:

Rotary nickel titanium (NiTi) files are broadly used for cleaning and shaping of the root canals because of their higher flexibility compared to stainless steel (SS) files. In spite of the superior qualities of NiTi rotary files, a potential risk of breakage of NiTi instruments without visible warning . NiTi rotary files fracture due to excessive cyclic fatigue, torsional failure or a combination of both while most SS instruments fracture due to excessive torque (22). Cleaning and shaping of the root canal system is a significant phase of endodontic therapy. Procedural faults such as transportation, zipping, ledging, and perforations can be minimized with NiTi rotary instruments compared with stainless steel ones.(23) Nevertheless, NiTi rotary instruments have an inherent disadvantage leading to unexpected intracanal breakage. NiTi rotary endodontic files are known to experience few metal fatigue due to repeated usage. The torque necessary for failure of a previously used instrument was significantly lower compared with the new instruments. Therefore, it is recommended to discard the NiTi files after a certain number of clinical uses. Protected clinical usage of NiTi instruments requires an understanding of basic fracture mechanisms and their correlation to canal anatomy. The principal cause of NiTi separation has been attributed to torsional and fatigue failure of NiTi alloy. In the torsional failure mode the tip of the instrument is locked in the root canal while the remaining instrument continues to rotate. This type of failure is associated with unwinding of the instrument flutes. In the flexural failure the instrument fractures because of cyclic fatigue usually at the midpoint of the greatest curvature of the root canal. The file separates at the fracture line without unwinding of flutes (24).

The MesioBuccal canal of the mandibular molar is known for its greater curvature . In addition, the mesial canals of mandibular molars coalesce to form one major foramen in 49% of the cases . The canals join one another in the apical third with the main canal gradually curving to its terminus and the other joining it at an abrupt angle. The latter type of canal should be instrumented to the point where it joins the main canal because instrumenting it to full working length will force the file to navigate the abrupt curvature possibly leading to IS . A previous Study by Mandel (25) suggested that when other factors such as geometry of the canal, instrument speed, and sequence were kept constant, the ability of the operator seems to be an important factor of instrument failure. These findings are supported by Parashos (26) who report that the most important influence on defect rates of the NiTi instruments was the operator (27). Two instruments are separated by torsional and seven by flexure failure. Torsional failure of instruments decreases and flexure failure increases as the size of the instrument increases . Instrument separations may have occurred due to flexure failures of the majority of separated instruments belonging to higher sizes. This postulation is reinforced by the fact that separations

occurred more in the mesiobuccal canals of mandibular molars, which are known for their greater curvatures.(28) The higher incidence of separation in .06 taper Profiles compared to .04 tapered Profiles provide credence However, Sattapan noted a slightly higher incidence of torsional failure compared to flexure failure in Quantec files collected from an endodontic practice (29).

The location of Separation is the factor deciding the resistance of the tooth fracture after the removal of the separated instrument. Earlier Studies have shown that the process of removing an instrument from the coronal third has no effect on resistance to fracture. Conversely, instrument removal from the mesial third, and to a greater extent, from the apical third entail trivial dentin removal and increases the possibility of a vertical root fracture (30). Analogous findings relate to the position of the separated instrument and the canal curvature. The removal of an instrument separated before the curvature causes less dentin loss compared to an instrument that is separated inside the curvature or apically to the curvature (31). The Previous study done by Shahabinejad found that the location of the fragment does not statistically affect the strength that is required to fracture the tooth. Fu M and Zhang Z, conducted a retrospective study and recalled 66 teeth over a period of 1-5 years following attempts to remove fragments with the Ruddle technique where no case of fracture was detected. The study suggested that reason to be the conservative effort of removing the instrument, without excessive dentin removal, the prosthetic restoration, and the occlusal adjustment. Besides , the presence of periodontal ligament may relieve the pressure of the occlusal forces and reduce the possibility of tooth fracture (32). The rates for perforation from in vitro studies of instrument removal range from 5.5% to 13.3% (33). Whereas clinical research findings range from 0.5% to 11.6%1,20,28 (34). Perforations occurred in teeth where the instrument was in the apical third beyond the root canal curvature. Unique concern presents the retrieval of a separated instrument from the middle third of the mesial root of mandibular molars. (35)The shaping of a staging platform in combination with ultrasonics, removes considerable amounts of dentin. The remaining dentin thickness in the distal wall of the mesial root, the so-called “danger zone”, is notably reduced when a distal concavity is present (36).

Removing the instrument expected to succeed when the fragment is found in the coronal third, before the root canal curvature, the root canal curvature is not severe and concerns upper or anterior teeth. Conversely in cases where the fragment is found either in the apical third or beyond the root canal curvature, or visibility and access are impossible, removing the instrument is not suggested, as there is a high risk of perforation. Further impediments that may occur are the weakening of the mass of the tooth, secondary separation of the instrument, extrusion of the fragment into periapical tissues, transformation of the root canal, and raised surface temperature sufficient to cause tissue damage. Where the removal of the instrument is impossible or dangerous, the possibility of retaining the fragment in the root canal to be appraised. In case of the clinical symptoms existence, immediate surgical treatment is suggested, else instrumentation and obturation of the root canal coronally to the fragment can be performed, and the tooth

entered into a follow-up schedule. The option of a future surgical treatment, in case of failure, to be taken into account. Retaining the fragment in the root canal doesn't affect tooth prognosis, which depends mainly on the presence of a lesion, the infection of the root canal at the time of separation, and the quality of the root canal obturation (37).Most cases are found when rotary file instruments are used and the number of cases are more in mesiobuccal and distobuccal root for for first molar and second molar respectively.

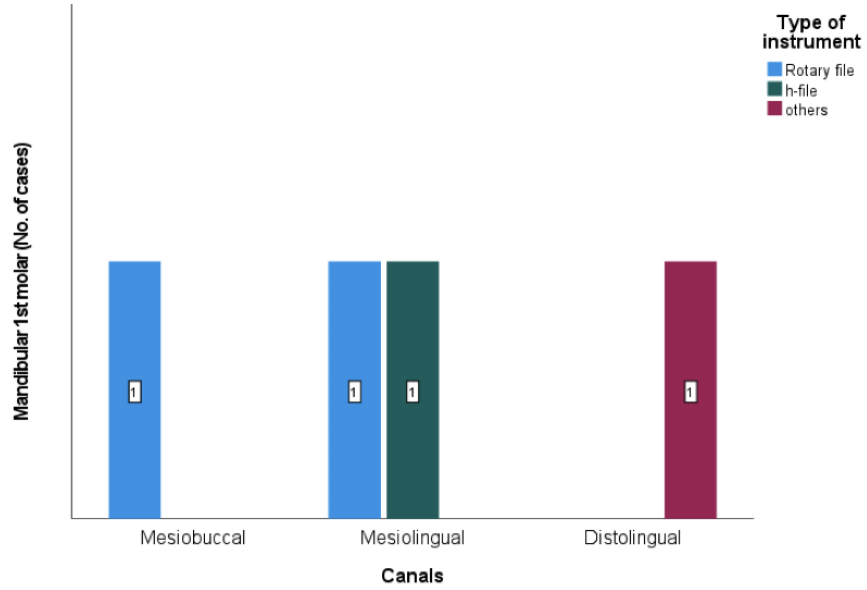

Figure1:The bar graph represents the association between canals and type of instrument in the first mandibular molar. X axis represents the canals in mandibular molar and Y axis represents the number of instrumentation cases in mandibular first molar.The blue bar, green bar and pink bar represents rotary file, h-file and others respectively.

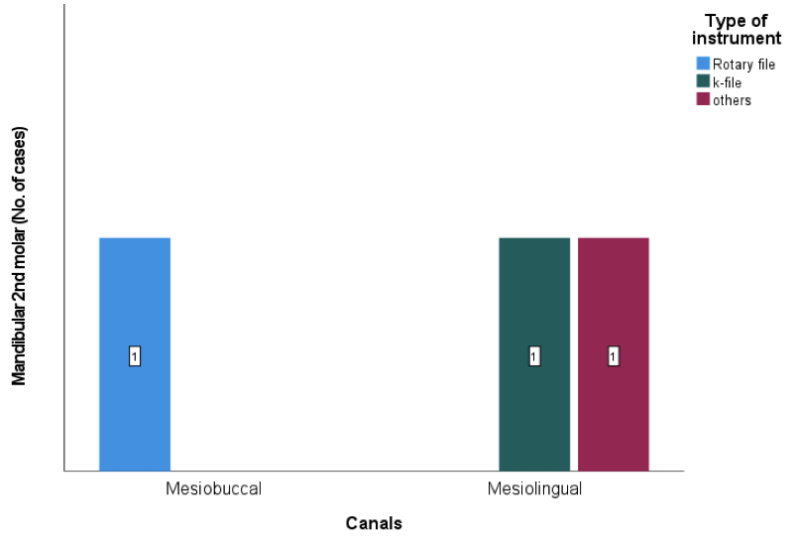

Figure 2:The bar graph represents the association between canals and type of instrument in the second mandibular molar.X axis represents the canals in mandibular molar and Y axis represents the number of instrumentation cases in mandibular second molar.The blue bar, green bar and pink bar represents rotary file ,k-file and others respectively.

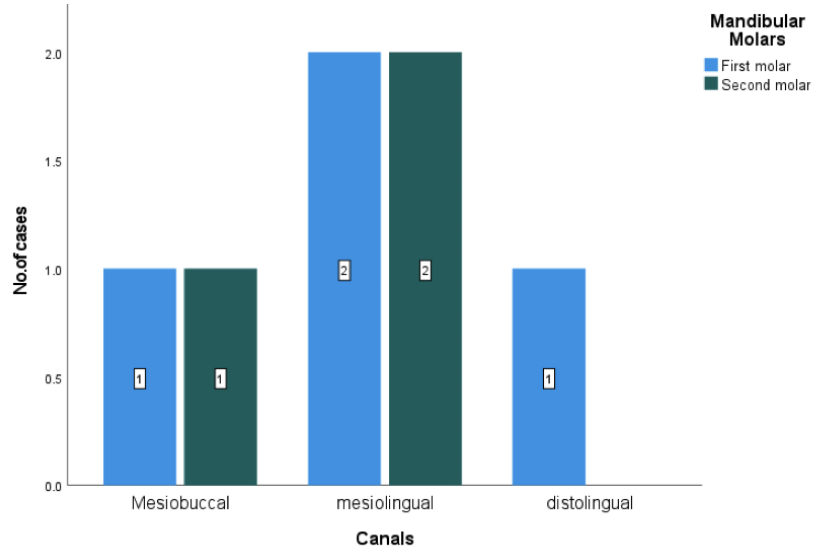

Figure3: The bar graph represents the canals involved in instrument separation in mandibular molars. X axis represents the no.of instrumentation cases and Y axis represents the mandibular

molar.The blue bar, green bar represents the first molar and second molar respectively.Chi square test was done and association was found to be statistically significant (P =0.105, p<0.01).

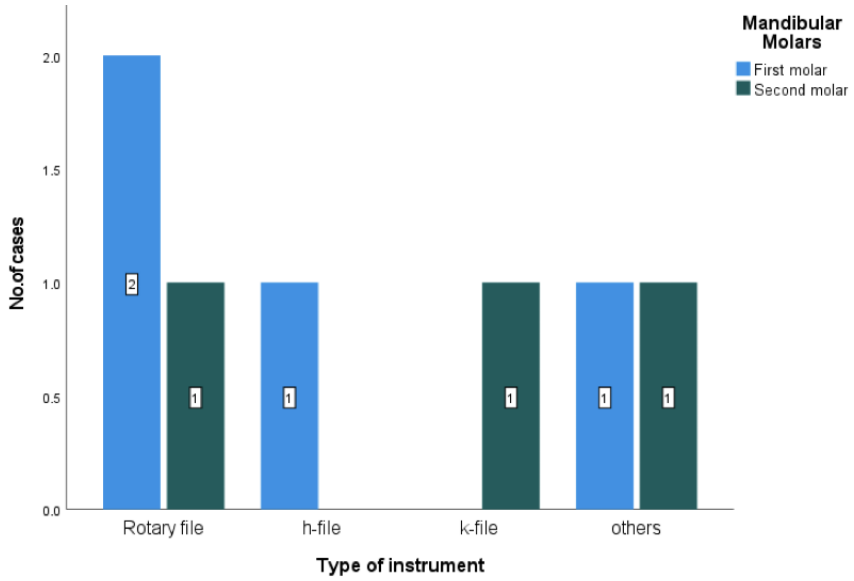

Figure4: The bar graph represents the type of instrument involved in instrumental separation in mandibular molar. X axis represents the type of instrument and Y axis represents the mandibular molar.The blue bar, green bar represents the first molar and second molar respectively.Chi square test was done and the association was found to be statistically significant (P =0.123, p<0.01).

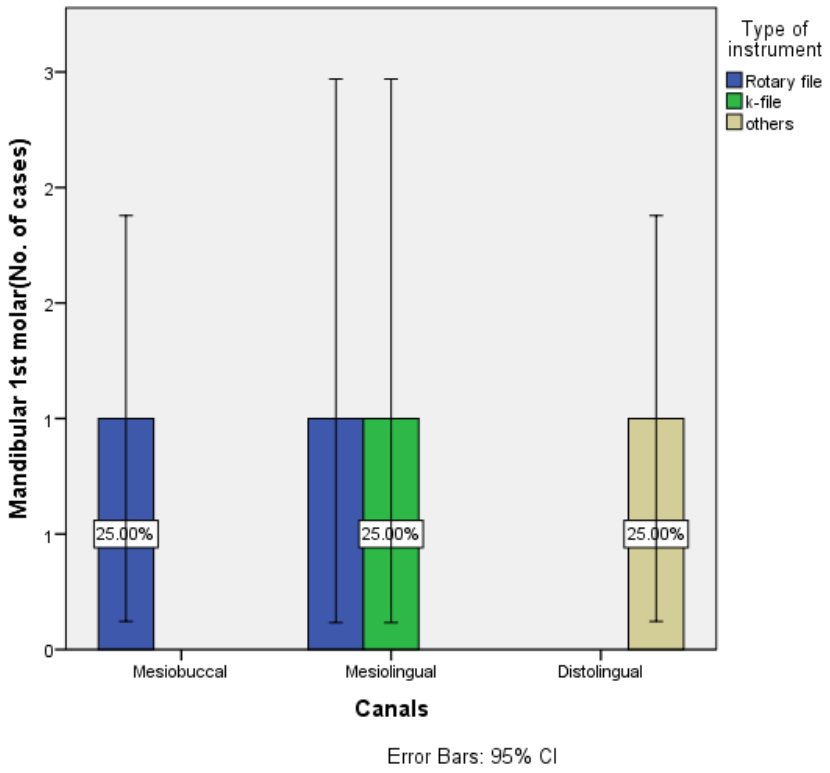

Figure 5:The bar graph represents the association between canals and type of instrument in the first mandibular molar. X axis represents the canals in mandibular molar and Y axis represents the number of instrumentation cases in mandibular first molar.The blue bar, green bar and pink bar represents rotary file, h-file and others respectively.

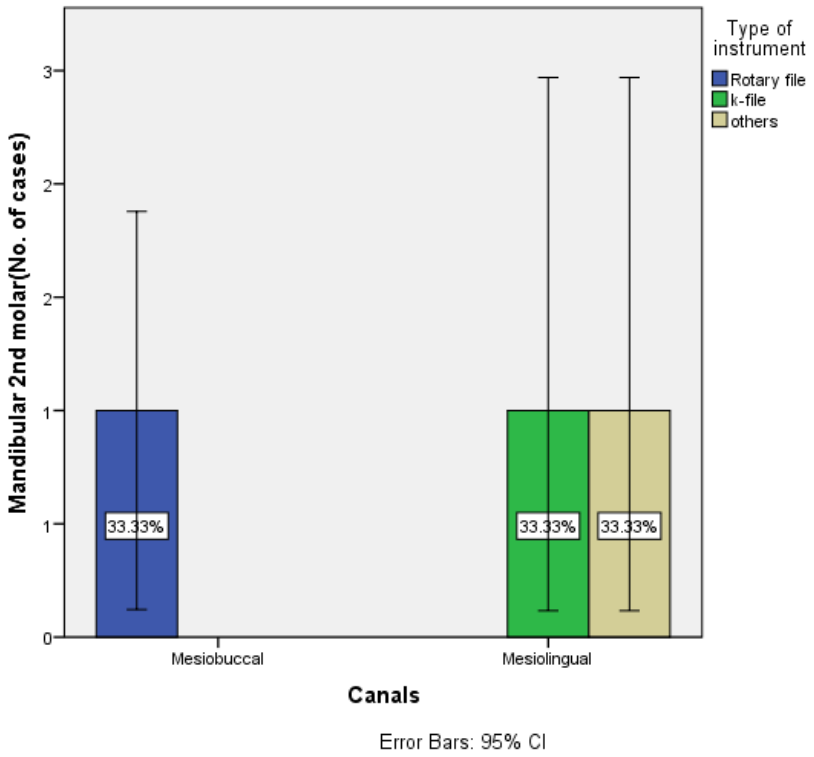

Figure 6:The bar graph represents the association between canals and type of instrument in the second mandibular molar.X axis represents the canals in mandibular molar and Y axis represents the number of instrumentation cases in mandibular second molar.The blue bar, green bar and pink bar represents rotary file ,k-file and others respectively.

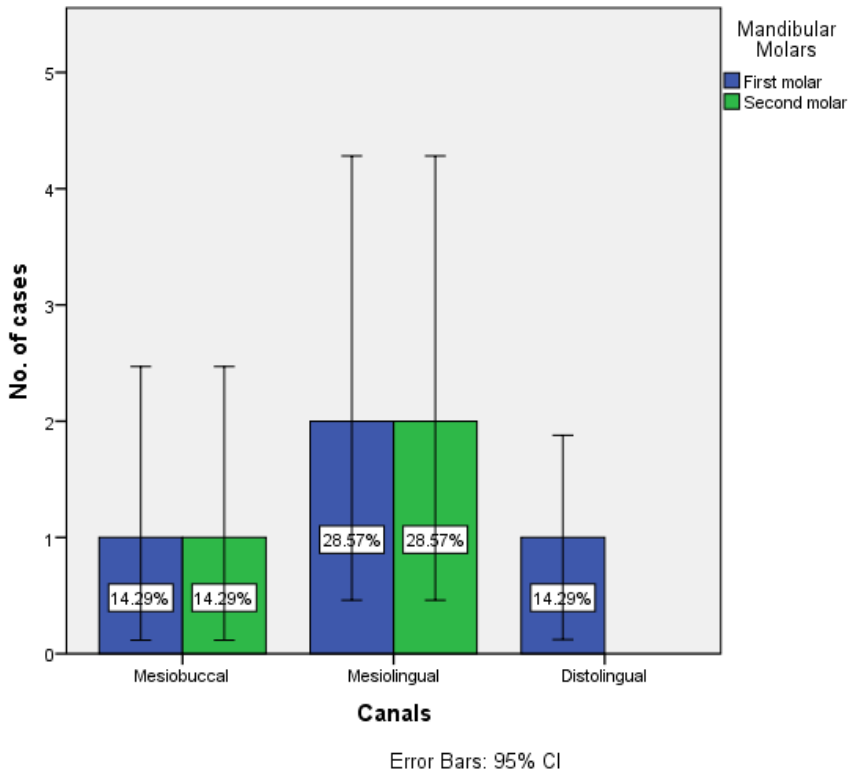

Figure 7:The bar graph represents the canals involved in instrument separation in mandibular molars. X axis represents the no.of instrumentation cases and Y axis represents the mandibular molar.The blue bar, green bar represents the first molar and second molar respectively.Chi square test was done and association was found to be statistically significant (P =0.105, p<0.01).

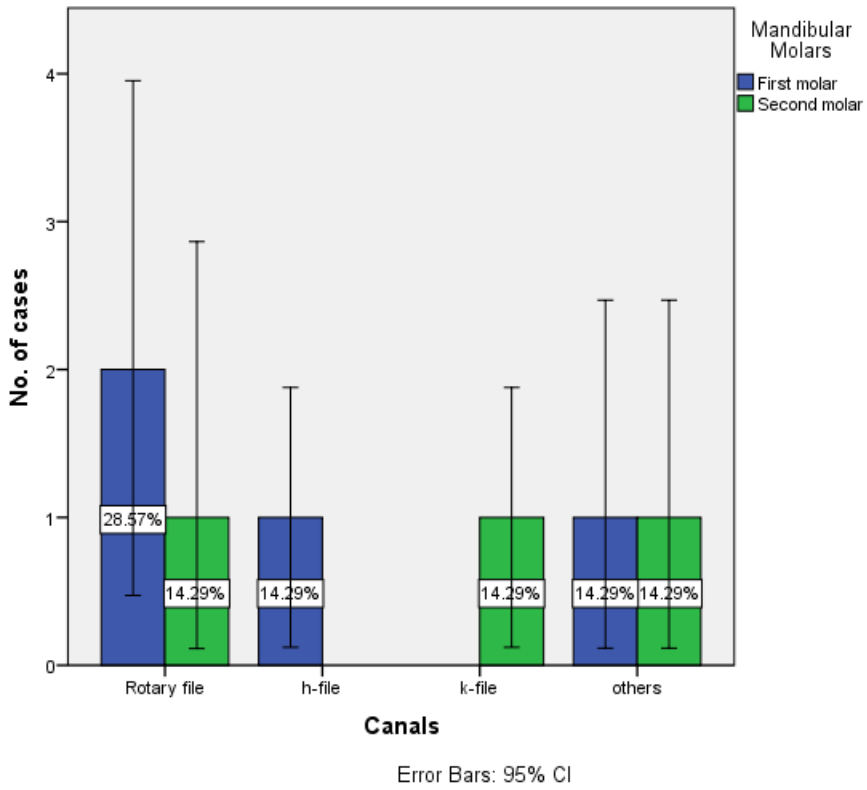

Figure 8:The bar graph represents the type of instrument involved in instrumental separation in mandibular molar. X axis represents the type of instrument and Y axis represents the mandibular molar.The blue bar, green bar represents the first molar and second molar respectively.Chi square test was done and the association was found to be statistically significant (P =0.123, p<0.01).

CONCLUSION:

Most of the instrument separation cases were found with rotary file instruments and the number of cases are more in mesiobuccal and distobuccal root of first molar and second molar respectively.

CONFLICT OF INTEREST: The author declares that there was no conflict of interest in the present study.

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