

# ASSOCIATION BETWEEN AGE AND TEETH REFERRED FOR RETRIEVAL OF SEPARATED INSTRUMENT - A RETROSPECTIVE STUDY

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## ABSTRACT:

Endodontic file fracture is an uncommon event. It is important to assess the variations in root and root canal morphology before initiating any endodontic treatment. Occurrence of instrument fracture is reported to range between 0.3% and 16.2%. The aim of the study is to assess the association between age and teeth referred for retrieval of a separated instrument. In this retrospective study a total of 82000 patient records were reviewed and data related to instrument retrieval were extracted and tabulated for data analysis. Statistical analysis was done using SPSS software and chi square test was used to determine the occurrence of instrument fracture in patients undergoing root canal treatment based on age and teeth. Occurrence of instrument fracture was found to be highest in the 31 to 41 years age group and there is no relation between age and teeth referred for retrieval of separated instrument.

**Keywords:** Age; Instrument separation; Occurrence; Teeth.

## INTRODUCTION:

Instrument fracture is often considered as an unpredictable uncommon event that can prevent root canal filling. The prevalence and incidence of instrument fracture will vary across different studies. So the endodontic management of instrument fracture occurring in canals and teeth are very difficult to manage (Suter, Lussi and Sequeira, 2005)(Patiño *et al.*, 2005).

It is important to assess the variations in root and root canal morphology before initiating any endodontic treatment (Tang *et al.*, 2015). Occurrence of instrument fracture is reported to range between 0.3% and 16.2%.

Factors including instrument design and usage, operator technique, material fatigue are also associated with instrument fracture. A wide range of instruments has been reported to fracture within the root canal system including Gates -Glidden burs, stainless steel(SS) endodontic files (K files, H files, barbed roaches), nickel titanium (Ni-Ti) rotary instruments, peeso reamers and spreaders. The prevalence of retained endodontic SS hand instruments has been reported in the range of 0.7% - 7.4%. The common perception is that Ni-Ti rotary instruments have a higher fracture incidence than SS hand instruments.

The first generation of Ni-Ti rotary instruments were first introduced during the mid-1990s. The most important characteristic of the first-generation Ni-Ti rotary files is having passive cutting radial lands along with fixed 0.04–0.06 tapers over the full working lengths. Some important Ni-Ti rotary instruments of first generation were LightSpeed Endodontics (1992), Profile-Dentsply (1993), GT system-Dentsply (1998) etc . Low procedural errors were found to be an advantage in First generation rotary instruments .(Yun and Kim, 2003).

The second generation of Ni-Ti rotary files was introduced in the year 2001. These instruments had active cutting edges with greater cutting efficiency, so the number of instruments required to achieve complete cleaning and shaping was almost less in comparison with the previous generation. Some of the instruments of this generation are ProTaper Universal-Dentsply, K3-SybronEndo, Mtwo-VDW etc (Kuzekanani, Walsh and Yousefi, 2009).

The Third Generation was introduced in late 2007. Here the manufacturers have highly focused on metallurgic properties of the Ni-Ti alloy using heating and cooling procedures on wires which will result in reduction of the separation risk of the instruments. This can be a boon for the practitioners. K3 XF Files-SybronEndo, Profile GTX Series–Dentsply, controlled memory (CM) Files and Vortex Blue (Dentsply Tulsa) are some third generation files in this group (Peters *et al.*, 2012).

In Fourth Generation files, instead of full rotation, the reciprocating NiTi rotary instruments have equal clockwise and counter- clockwise degrees of rotation. The reciprocation theory of canal preparation has led to development of the fourth generation of NiTi rotary instruments. The use of a single file technique in cleaning and shaping the root canal systems was found to be successful. Wave One-Dentsply, self-adjusting file (SAF)-ReDent Nova, and Reciproc-VDW are some of the instruments of fourth generation (Metzger, 2014).

In the fifth generation, the efficiency of canal shaping has been improved by offsetting the center of rotation . The offset design reduces the taper lock or the screwing effect which causes instrument separation. HyFlex/electrical discharge machining (EDM)-Coltene, Revo-S-Micro-Mega, One Shape Micro-Mega, and ProTaper Next-Dentsply are important files of the fifth generation (Ruddle, Machtou and West, 2013).

Shape memory property of rotary Ni-Ti instruments may be related to distortion of Ni-Ti instruments since it is often not visible without magnification. Rotary Ni-Ti instruments fail either due to fatigue and torsional fracture. Instruments that fracture as a result of torsional overload results in twisting and bending of files.

Our team has conducted various comparative studies/reviews (Teja and Ramesh, 2019),(Teja, Ramesh and Priya, 2018), (Rajendran *et al.*, 2019),(Rajakeerthi and Ms, 2019),(Siddique *et al.*, 2019), in vitro studies (Ramanathan and Solete, 2015),(Ramamoorthi, Nivedhitha and Divyanand, 2015),(Manohar and Sharma, 2018),(Ravinthar and Others, 2018),(Jose, P. and Subbaiyan, 2020) and cohort studies (Janani, Palanivelu and Sandhya, 2020),(Noor, S Syed Shihaab and Pradeep, 2016),(Kumar and Antony, 2018),(Nandakumar and Nasim, 2018),(Hussainy *et al.*, 2018) over the past 5 years.The aim of the study is to assess the association between age and teeth referred for retrieval of separated instruments.

## **MATERIALS AND METHODS:**

This retrospective study was done in a hospital setting. Patients reported from June 2019 to March 2020 were reviewed. Patients from the same geographical location were selected as the study population. Patients undergoing treatment for instrument retrieval were included in inclusion criteria. Patients undergoing treatment other than instrument retrieval were considered as exclusion criteria. Ethical approval was obtained from the Institutional Ethical committee of Saveetha University. 82000 patient records were reviewed and data related to instrument retrieval were extracted .Data includes age, gender

and instrument retrieval procedures. The collected data was tabulated in the excel sheet. Statistical analysis was done using SPSS software(version 9.0.3). Statistical analysis between the variables - age and teeth was done using chi square test. The outcome data was represented in the form of a bar graph.

## **RESULTS AND DISCUSSION:**

In this study, 18 patients reported to Saveetha dental College for instrument retrieval. Instrument fracture incidence was found to be highest in the age group of 31-41 years (44.44%) , followed by 18-30 years (22.22%), 42-50 years (22.22%) and 51-60 years.(11.11%) [Graph 1] .

Maxillary lateral incisors (16.66%) were the most referred teeth for instrument retrieval followed by maxillary central incisors ,premolars, canines and mandibular teeth. [Graph 2]

(Tzanetakis *et al.*, 2008) reported that prevalence of instrument fracture in the apical third(52.5%) was significantly higher when compared with middle third (27.5%) and coronal third(12.5%) of canals. (Di Fiore, Genov and Komaroff, 2006) found that instruments are fractured more in molars (47%) compared to premolars (41%) and anteriors (12%). He concluded that premolars and molar teeth with curved canals in particular are prone for instrument fracture.The management of the problem should be based on the effect of fracture instrument on endodontic prognosis(Haikel *et al.*, 1999).

Comparative studies may suggest that Ni-Ti rotary instruments have similar fracture rate to hand instruments, the hand instruments are used initially to create glide path with remainder of instrumentation completed with rotary instruments (Kuhn, Tavernier and Jordan, 2001). Ni - Ti is a versatile alloy with properties such as memory , super elasticity, corrosion resistance and biocompatibility . There are 2 to 3 times more elastic than SS files during torsional fracture (Yared and Dagher, 2000). However , the low yield and tensile strength of SS instruments is higher than Ni-Ti due to increased susceptibility to fracture at lower loads seen in Ni- Ti files (Mozayeni, Golshah and Nik Kerdar, 2011).

Many techniques have been developed to retrieve fracture instruments from root canals but iatrogenic accidents such as perforation, ledge formation, zipping may occur. The ideal management of separated instruments is to prevent the occurrence in the first place itself. Prevention can be greatly facilitated by negotiating and shaping instruments as disposable items. Avoiding reusing of instruments after the completion of each endodontic case will reduce breakage and lost clinical time. However in some cases, the instrument might break and the broken file segment may not be able to be bypassed or retrieved. Several methods and techniques have been followed for the removal of separated solid objects such as silver points and fragments of endodontic instruments.(Fors and Berg, 1986). Examples of such systems include Masseran Endodontic Kit (Masserann, 1966) , Cancellier IRS and Ruddle IRS.

Recently, the use of piezoelectric ultrasonic units with the compatible tips have vastly helped incremental removal of dentin surrounding separated instruments as well as their vibratory removal (Nagai *et al.*, 1986) .The IRS system has been used widely for the removal of intracanal obstructions such as silver points, carrier-based obturators or broken file segments. The IRS system is indicated when ultrasonic efforts prove to be unsuccessful to remove broken instruments that are lodged in the straightaway portions of the root or partially around the canal curvature (Nagai *et al.*, 1986) . Limitations of the study are small sample size and single centered study. Hence future scope of including larger sample size with multi centered study would give better results.

## **CONCLUSION:**

Within the limitations of the study, it was found that there is no association between age and teeth referred for retrieval of separated instruments. Clinician's experience, case selection,

magnification, armamentarium, limiting file reuse and skill of the operator have been reported to decrease the incidence of fracture.

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#### **AUTHOR CONTRIBUTIONS:**

**P.S. Karthikeson** contributed in concept, acquisition of data analysis, interpretation of data and also drafting the article and revisiting it critically for important intellectual content and manuscript preparation. **Deepak.S**, contributed in study design, correction, alignment, preparation of manuscript and supervision. **Kiran Kumar. P**, contributed to alignment and formatting and final approval of the submitted version of the manuscript.

#### **CONFLICT OF INTEREST:**

This research project is self funded and it is not sponsored or aided by any third party. There is no conflict of interest.

#### **REFERENCES:**

- [1] Di Fiore, P. M., Genov, K. A. and Komaroff, E. (2006) 'Nickel–titanium rotary instrument fracture: a clinical practice assessment', International. Wiley Online Library. Available at: <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1365-2591.2006.01137.x>.
- [2] Fors, U. G. and Berg, J. O. (1986) 'Endodontic treatment of root canals obstructed by foreign objects', International endodontic journal, 19(1), pp. 2–10.
- [3] Haïkel, Y. et al. (1999) 'Dynamic and cyclic fatigue of engine-driven rotary nickel-titanium endodontic instruments', Journal of endodontia, 25(6), pp. 434–440.
- [4] Hussainy, S. N. et al. (2018) 'Clinical performance of resin-modified glass ionomer cement, flowable composite, and polyacid-modified resin composite in noncarious cervical lesions: One-year follow-up', Journal of conservative dentistry: JCD, 21(5), pp. 510–515.
- [5] Janani, K., Palanivelu, A. and Sandhya, R. (2020) 'Diagnostic accuracy of dental pulse oximeter with customized sensor holder, thermal test and electric pulp test for the evaluation of pulp vitality: an in vivo study', Brazilian Dental Science, 23(1), p. 8.
- [6] Jose, J., P., A. and Subbaiyan, H. (2020) 'Different Treatment Modalities followed by Dental Practitioners for Ellis Class 2 Fracture – A Questionnaire-based Survey', The Open Dentistry Journal, pp. 59–65. doi: 10.2174/1874210602014010059.
- [7] Kuhn, G., Tavernier, B. and Jordan, L. (2001) 'Influence of structure on nickel-titanium endodontic instruments failure', Journal of endodontics. Elsevier. Available at: <https://www.sciencedirect.com/science/article/pii/S0099239905606929>.
- [8] Kumar, D. and Antony, S. (2018) 'Calcified Canal and Negotiation-A Review', Research Journal of Pharmacy and Technology. A & V Publications, 11(8), pp. 3727–3730.
- [9] Kuzekanani, M., Walsh, L. J. and Yousefi, M. A. (2009) 'Cleaning and shaping curved root canals: Mtwo vs ProTaper instruments, a lab comparison', Indian journal of dental research: official publication of Indian Society for Dental Research, 20(3), pp. 268–270.
- [10] Manohar, M. P. and Sharma, S. (2018) 'A survey of the knowledge, attitude, and awareness about the principal choice of intracanal medicaments among the general dental practitioners and

nonendodontic specialists', Indian journal of dental research: official publication of Indian Society for Dental Research. Medknow Publications and Media Pvt. Ltd., 29(6), p. 716.

- [11] Martin, B. et al. (2003) 'Factors influencing the fracture of nickel-titanium rotary instruments', International. europepmc.org. Available at: <https://europepmc.org/abstract/med/12702120>.
- [12] Masserann, J. (1966) '[The extraction of posts broken deeply in the roots]', Actualites odontostomatologiques, 75, pp. 329–342.
- [13] Metzger, Z. (2014) 'The self-adjusting file (SAF) system: An evidence-based update', Journal of Conservative Dentistry, p. 401. doi: 10.4103/0972-0707.139820.
- [14] Mozayeni, M. A., Golshah, A. and Nik Kerdar, N. (2011) 'A Survey on NiTi Rotary Instruments Usage by Endodontists and General Dentist in Tehran', Iranian endodontic journal, 6(4), pp. 168–175.
- [15] Nagai, O. et al. (1986) 'Ultrasonic removal of broken instruments in root canals', International endodontic journal, 19(6), pp. 298–304.
- [16] Nandakumar, M. and Nasim, I. (2018) 'Comparative evaluation of grape seed and cranberry extracts in preventing enamel erosion: An optical emission spectrometric analysis', Journal of conservative dentistry: JCD, 21(5), pp. 516–520.
- [17] Noor, S. S. S. E., S Syed Shihaab and Pradeep (2016) 'Chlorhexidine: Its properties and effects', Research Journal of Pharmacy and Technology, p. 1755. doi: 10.5958/0974-360x.2016.00353.x.
- [18] Patiño, P. V. et al. (2005) 'The influence of a manual glide path on the separation rate of NiTi rotary instruments', Journal of endodontia, 31(2), pp. 114–116.
- [19] Peters, O. A. et al. (2012) 'An in vitro assessment of the physical properties of novel Hyflex nickel-titanium rotary instruments', International Endodontic Journal, pp. 1027–1034. doi: 10.1111/j.1365-2591.2012.02067.x.
- [20] Rajakeerthi, R. and Ms, N. (2019) 'Natural Product as the Storage medium for an avulsed tooth--A Systematic Review', Cumhuriyet Dental Journal, 22(2), pp. 249–256.
- [21] Rajendran, R. et al. (2019) 'Comparative Evaluation of Remineralizing Potential of a Paste Containing Bioactive Glass and a Topical Cream Containing Casein Phosphopeptide-Amorphous Calcium Phosphate: An in Vitro Study', Pesquisa brasileira em odontopediatria e clinica integrada. SciELO Brasil, 19. Available at: [http://www.scielo.br/scielo.php?pid=S1983-46322019000100364&script=sci\\_arttext](http://www.scielo.br/scielo.php?pid=S1983-46322019000100364&script=sci_arttext).
- [22] Ramamoorthi, S., Nivedhitha, M. S. and Divyanand, M. J. (2015) 'Comparative evaluation of postoperative pain after using endodontic needle and EndoActivator during root canal irrigation: A randomised controlled trial', Australian endodontic journal: the journal of the Australian Society of Endodontology Inc, 41(2), pp. 78–87.
- [23] Ramanathan, S. and Solete, P. (2015) 'Cone-beam Computed Tomography Evaluation of Root Canal Preparation using Various Rotary Instruments: An in vitro Study', The journal of contemporary dental practice, 16(11), pp. 869–872.
- [24] Ravinthar, K. and Others (2018) 'Recent Advancements in Laminates and Veneers in Dentistry', Research Journal of Pharmacy and Technology. A & V Publications, 11(2), pp. 785–787.
- [25] Ruddle, C. J., Machtou, P. and West, J. D. (2013) 'The shaping movement: fifth-generation technology', Dentistry today, 32(4), pp. 94, 96–9.
- [26] Siddique, R. et al. (2019) 'Qualitative and quantitative analysis of precipitate formation following interaction of chlorhexidine with sodium hypochlorite, neem, and tulsi', Journal of conservative dentistry: JCD, 22(1), pp. 40–47.

- [27] Suter, B., Lussi, A. and Sequeira, P. (2005) ‘Probability of removing fractured instruments from root canals’, *International endodontic journal*, 38(2), pp. 112–123.
- [28] Tang, W.-R. et al. (2015) ‘Prevention and management of fractured instruments in endodontic treatment’, *World Journal of Surgical Procedures*. Baishideng Publishing Group Inc., 5(1), pp. 82–98.
- [29] Teja, K. V. and Ramesh, S. (2019) ‘Shape optimal and clean more’, *Saudi Endodontic Journal*. [saudiendodj.com](http://www.saudiendodj.com). Available at: <http://www.saudiendodj.com/article.asp?issn=1658-5984;year=2019;volume=9;issue=3;spage=235;epage=236;aurlast=Teja>.
- [30] Teja, K. V., Ramesh, S. and Priya, V. (2018) ‘Regulation of matrix metalloproteinase-3 gene expression in inflammation: A molecular study’, *Journal of conservative dentistry: JCD*, 21(6), pp. 592–596.
- [31] Tzanetakis, G. N. et al. (2008) ‘Prevalence and management of instrument fracture in the postgraduate endodontic program at the Dental School of Athens: a five-year retrospective clinical study’, *Journal of endodontia*, 34(6), pp. 675–678.
- [32] Yared, G. M. and Dagher, F. E. B. (2000) ‘Cyclic fatigue of ProFile rotary instruments after clinical use’, *International endodontic journal*. Wiley Online Library. Available at: <https://onlinelibrary.wiley.com/doi/abs/10.1046/j.1365-2591.1999.00296.x>.
- [33] Yun, H.-H. and Kim, S. K. (2003) ‘A comparison of the shaping abilities of 4 nickel-titanium rotary instruments in simulated root canals’, *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*, pp. 228–233. doi: 10.1067/moe.2003.92.

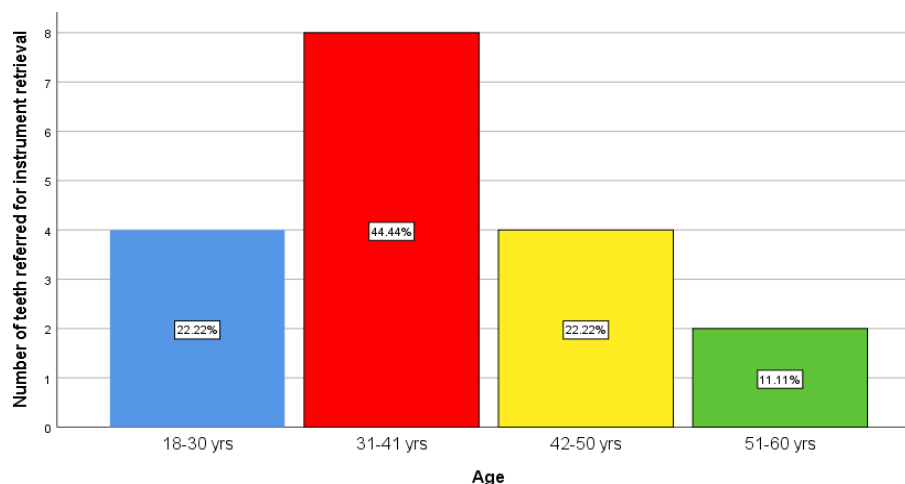


Figure 1 : Bar graph represents frequency between age and total number of teeth referred for instrument retrieval. X axis represents age and Y axis represents number of teeth referred for instrument retrieval. Instrument fracture was found to be highest in the age group of 31-41 years (44.44%).

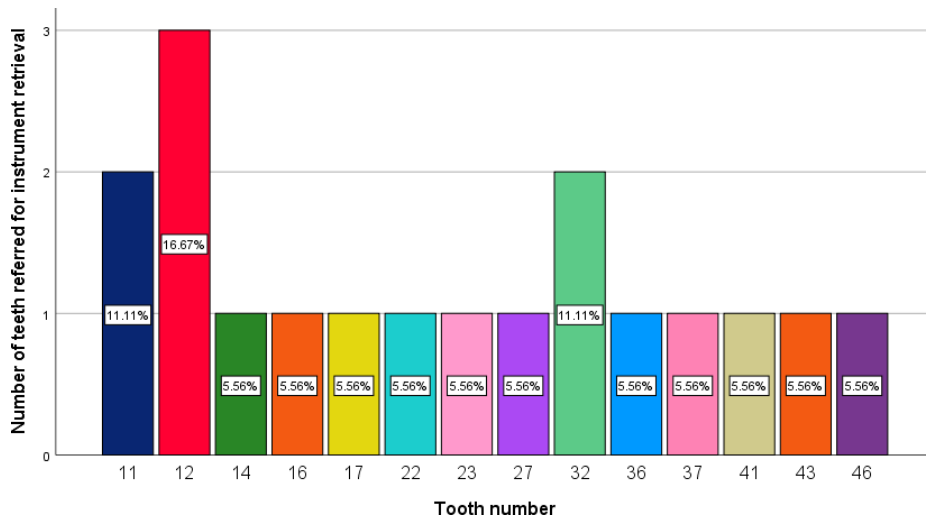


Figure 2 : Bar graph represents the frequency between number of teeth referred for instrument retrieval and Tooth number. X axis represents teeth and Y axis represents number of cases referred for instrument retrieval. Maxillary lateral incisors were the most commonly referred teeth for instrument retrieval (16.67%).

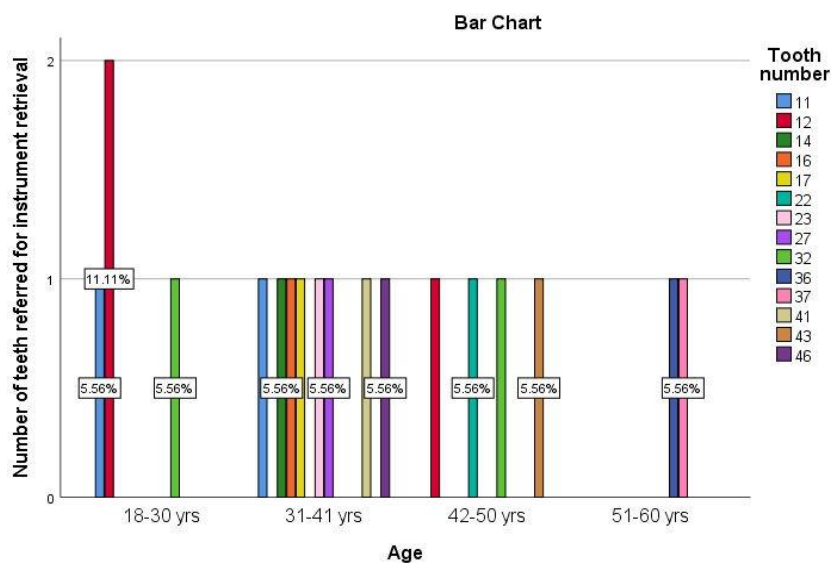


Figure 3 : Bar graph represents association of age with total number of teeth referred for retrieval of separated instrument. X axis represents age and Y axis represents number of teeth referred for retrieval of separated instruments. Chi square test was used, p value= 0.420(p>0.05) indicating not statistically significant. There is no association between age and number of teeth referred for instrument retrieval.