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Association of type of file fracture and method of removal in a university setting

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ABSTRACT

Some mishaps tend to occur during treatment in the root canal system, for example, file fractures. The challenge of the removal depends on the type of file fractured and the method which is used to remove it, generally it is decided based on the level of the fracture. Any file can fracture inside the root canal which is based on the curvature, anatomy. Specific techniques and measures have been employed to remove this file from the root canal system. The aim of the study is to find the association of file fracture with the method of removal. The details of all patients who underwent a root canal treatment where noted and the details of 16 patients with file fractures during the procedure were shortlisted. The type of file fractures was analyzed, such as K files, rotary files, H files, other instruments. The method of removal was usually ultrasonic, mechanical, manual or combination of any of the above. Excel tabulation was done and imported to SPSS for results. Chi-square test performed. The most common and used file to fracture in the root canal system was rotary files which had a fracture incidence of 31% and most common method used to retrieve was using ultrasonic of an incidence of 37.5. Chi-square test shows $p>0.05$, which is statistically not significant. The study concludes that rotary files fracture the most and the method used to retrieve them was mechanical, but as a whole, the most common method used was ultrasonic.

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INTRODUCTION

Mishaps during treatment in the root canal system are possible such as file fractures, ledging or blockage of root canals. The successful revival of the broken file is the challenge faced in case an instrument is broken inside the root canal (Frota *et al.*, 2016). The risk of fracture occurs due to improper access opening or incomplete cleaning and shaping. This fracture of the file makes the chemico mechanical preparation more complex, which affects the long-term prognosis (Sjögren *et al.*, 1990). The use of nickel-titanium files gained popularity, and most of them tend to use nickel titanium Rotary files in clinical practice nowadays. Despite increased favor-

able qualities, a high incidence of fracture of this instrument is recorded at the present time (Siqueira, 2001). There is no standardized method of removal for safe and consistent removal. Time-consuming methods, when analyzed, are risky and have a very limited success rate (Siqueira, 2001; Inc and Kernel Networks Inc, 2019). Today broken instruments are most commonly retrieved using ultrasonic operating microscopes or micro tube delivery systems (Shenoy *et al.*, 2014).

If the instruments go beyond the apical foremen, then a surgical procedure is necessary. The foreign object if left inside, might cause inflammation. Prior to the procedure the position and size of the file fracture are to be assessed, the root canal anatomy and surrounding structures to be well studied (Kaufman and Neuman, 1983; Wang *et al.*, 2010). The method assessed here in the study was manual, ultrasonic, mechanical, and a combination of any of the above methods. Manual method is generally the use of any other instrument which is capable of pushing the broken instrument out. All of the analysis can be done prior to a Rvg which can be a very helpful diagnostic aid. The tooth after the endodontic procedure needs to be given a crown, in cases of the anterior tooth where discoloration is minimal and the damage is very minimal veneers can be used some times.

Veneers are a minimally invasive option for the treatment of discolored and malformed teeth (Ravinthar and Jayalakshmi, 2018). Based on certain surveys it was clear that the majority of the dental practitioners in Chennai have good knowledge, attitude but there was a lack of clinical practice regarding the different treatment modalities followed by general practitioners for Ellis class 2 fracture (Jose *et al.*, 2020) showing that they can handle can kind of emergency. Success rates are determined to show good prognosis just like how the ideal situation is to replant the tooth immediately after avulsion because the extra-oral time is an important determinant for the success of the treatment and for a good prognosis (Rajakeerthi and Nivedhitha, 2019). This study aims at finding the association between type of file fractures and method of removal.

MATERIALS AND METHODS

The patient records were reviewed and analyzed between June 2019 and March 2020. The details of all patients who underwent a root canal treatment where noted and the details of 16 patients with file fractures during the procedure were shortlisted. Cross verification was done with the help of radio graphs. To minimize sampling bias, all available data were included. Data was imported to excel.

Ethical Approval

The ethical approval for the retrospective study was obtained from the university (SDC/SIHEC/2020/DIASDATA/0619-0320).

Data collection

Tabulation of type of Files which is H file, K file, rotary file, other types of files was noted along with the method of removal such as mechanical, manual, ultrasonic and combination.

Statistical analysis

After Excel tabulation, the data was imported to SPSS [Version 19: IBM Corporation NY USA] for results and graphs. The inclusion criteria were the patients who had undergone a file fracture during endodontic treatment, and exclusion criteria were patients who had undergone endodontic treatment without any file fractures. The pros of the study were said to be the availability of the data. The dependent variable was the type of file and method of retrieval. The independent variable was age and gender. Statistical test performed was a chi-square test. The level of significance was set at 0.05.

RESULTS AND DISCUSSION

Among 16 cases, 56.25% were females and 43.75%were males Figure 1. 8 patients (50%) had a rotary file fracture, 3 patients (19%) H file is fractured, 2 patients (12.5%) K file fractured and 3 patients (19%)with other instrument fractures Figure 2. 37.5% of the files were removed with the ultrasonic method, 25% with mechanical, 25% with manual and 6.25% each with a combination of manual and ultrasonic and mechanical Figure 3 2 other files were removed by the manual method that is 25%, 1 K file was removed by a combination of using a manual ultrasonic method (6%), 4 Rotary files were removed by mechanical methods (25%), 3 H files, 1 K file, one other type of file, one rotary file was removed by ultrasonic (37.5%), one rotary file was removed by a combination of ultrasonic and mechanical (6%). Figure 4 Chi-square test shows $p>0.05$, which is statistically not significant.

The most common file to fracture was the rotary files, which is 50 % of the total. The most common method generally used is the ultrasonic method of 37.5 %. Location of the root canal and negotiating of it to full working length may lead to many iatrogenic errors such as fractured instrument or perforation. The teeth so affected won't always react to sensibility tests for some time. Teeth undergoing pulpal obliteration are usually asymptomatic (Kumar and

Antony, 2018). Yashen et al. Show that the type of tooth affects the removal of fragments (Shen *et al.*, 2004). The effects on the canal dimension and root canal irregularities on the success rate were found by Hulsman et al. (Hülsmann, 1994).

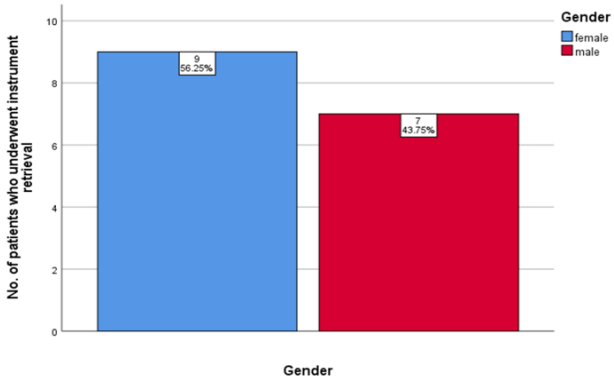

Figure 1: Distribution of gender among patients with instrument fractures.

Pain if present during this procedure can be calculated like how the postoperative level of pain was compared after activation of irrigants using EndoActivator with conventional needle irrigation during root canal therapy (Ramamoorthi *et al.*, 2015). In the present day, ultrasonic have a success rate of 93% in curved canals and 95% in straight canals (Hülsmann, 1994). Other studies also state that there had been a success rate of 55%-79% for the same as well as 53% and certain studies, 67% (Wang *et al.*, 2010).

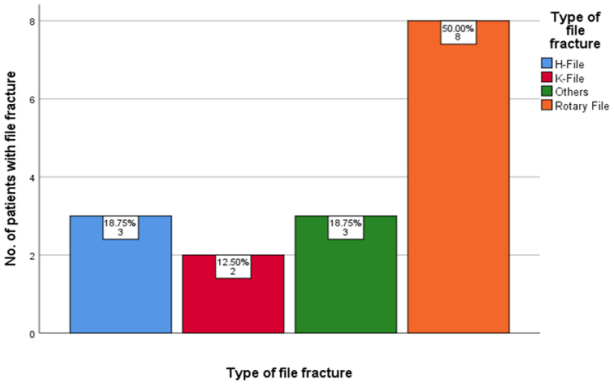

Figure 2: Frequency distribution of the type of file fractured.

It is always recommended that an irrigant is to be used as Irrigants play a crucial role in debridement and disinfection of the root canal space (Siddique *et al.*, 2019). Chlorhexidine would be used as a final irrigant (Noor and Pradeep, 2016). An effective intracanal medicament if used, will assist in the disinfection of the root canal. Intracanal medicament have been used to disinfect root canals between appointments and reduce inter appointment pain (Manohar and Sharma, 2018). The optimal time that a hypochlorite irrigant at a given concentration needs to remain in the root canal system is still an issue yet to be solved (Teja and Ramesh, 2019). The removal of the file from the root canal depends on techniques used (Ruddle, 2004). The Messermans kit is said to be effective but can be used only in certain places (Okiji, 2003). Yoldas stated in his study that the mechanical method was limited to only the posterior tooth (Yoldas *et al.*, 2004). The NiTi files being flexible and easily adaptable to the curvature of the canal is said to have a high incidence of fracture. Thus, it is recommended that files should be used until they retain their property alone, and it is recommended that the file is used only for 7 to 10 times. H files and K files need to be used very carefully and can be avoided in curved canals.

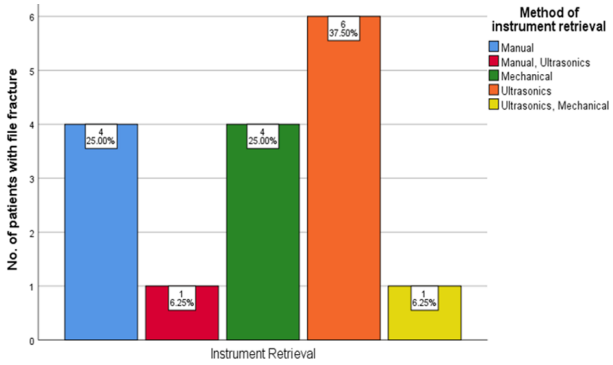

Figure 3: Distribution of methods used to retrieve instruments.

Friedman also considered this kit to be inferior to ultrasonic (Friedman *et al.*, 1990). The overall success rate of removal or bypassing the broken instrument was 82.22% (Gencoglu and Helvacioglu, 2009). The ultrasonic vibrations were generated to remove files from the root canal anatomy mechanical method of file removal states the use of special instruments or kits such as messerman kits to retrieve the broken instrument. There were three ways to approach a broken instrument which is to remove, bypass or block the canal with it (Suter *et al.*, 2005). If the instrument creates damage to the enamel, it is seen remineralization is required and that two remineralizing agents showed remineralization potential on enamel surfaces.

Casein phosphopeptide-amorphous calcium phosphate showed better remineralizing potential than calcium sodium phosphosilicate. Hence, CPP-ACP can be considered as the material of choice in remineralizing early enamel carious lesions (Rajendran *et al.*, 2019). Remineralizing agents such as fluorides, Casein phosphopeptide — Amorphous calcium phosphate (CPP-ACP), xylitol, and bio active

glass can be used to reduce demineralization and enhance remineralization (Nasim and Nandakumar, 2018). Matrix metallo proteinases (MMPs) play a significant role in the efficient tissue turnover and remodeling (Ramesh *et al.*, 2018).

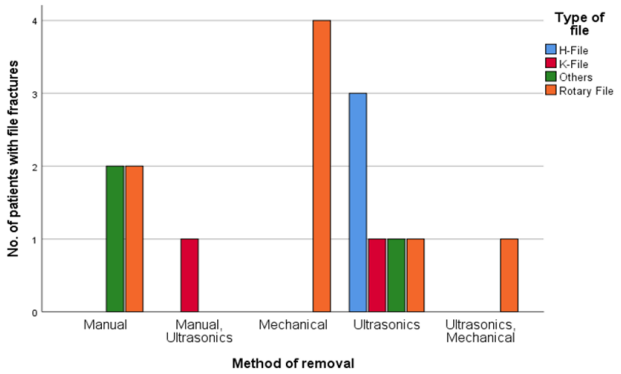

Figure 4: Association between type of file fracture and method of removal of the broken file.

If restoration is to be performed, RMGIC is superior regarding marginal adaptation and esthetics for restoring non carious cervical lesions (NCCLs) (Nasim *et al.*, 2018). As per certain studies, 39% of them are most likely to face a file fractured (Madarati *et al.*, 2008). NiTi Rotary instruments fracture range from 1.9% to 2.4% (Johnson, 2007; Wu *et al.*, 2011).

Manol et al. say that attempting to remove it should be done only after proper inspection of the radiograph of the areas with proper visibility (Brito-Júnior *et al.*, 2015). This should be done just like how the remaining dentin thickness of teeth after cleaning and shaping the root canal using three rotary instrumentation techniques using cone-beam computed tomography (CBCT) was evaluated (Ramanathan and Solete, 2015). The efficiency of diagnostic aids plays an important role in the treatment plan (Janani *et al.*, 2020).

CONCLUSION

Within the limits of the study, it was seen that the most common file to fracture within the root canal system was Rotary files. The preferred method of removal was a mechanical method, followed by ultrasonics for H files, the manual and ultrasonic method preferred for K files and other files. The limitations of the study show that the study is being performed in a different ethnic group. The study further aims at determining the success rate of instrument retrieval, which could be done in an economical manner.

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Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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