

Frequency of Procedural Errors during Root Canal Treatment Performed by House Officers in Private Teaching Dental Hospital

Syed Abrar Ali, Mehmood Hussain, Muhammad Shahzad, Hina Nafees

ABSTRACT

OBJECTIVE: To determine the procedural errors produced during the conventional root canal treatment and to find out the association of errors with particular teeth.

METHODOLOGY: This descriptive observational type study was conducted in Private Teaching Dental Hospital. A total 200 root canal treated teeth were assessed through peri-apical radiographs using non-probability convenient sampling technique. The data was collected from patient record files retrospectively performed by house officers in the duration of 1 year in department of Operative Dentistry. Data analysis was done by using SPSS version 22. Frequency and percentage statistics were used.

RESULTS: Out of sample size of 200 patients, 110 (55%) were females and 90 (45%) were males with age range from 10 to 50 years. The most frequently treated tooth was the mandibular right first molar (29.5%) followed by permanent maxillary right first molar (26%). The most frequent tooth to possess an error was the mandibular right first molar (59%), followed by maxillary right first molar (52%). Instrument separation was the most common procedural error 148 (74%), followed by ledge 25 (12.5%).

CONCLUSION: The results concluded that instrument separation was the most frequent procedural error and the most frequent tooth to possess an error was the mandibular right first molar.

KEYWORDS: Procedural Errors, Root canal treatment

This article may be cited as: Ali SA, Hussain M, Shahzad M, Nafees H. Frequency of Procedural Errors during Root Canal Treatment Performed by House Officers in Private Teaching Dental Hospital. J Liaquat Uni Med Health Sci. 2019;18(01):55-9.
doi: 10.22442/jlumhs.191810601

INTRODUCTION

The goal of the root canal treatment is to save the tooth¹. The complex morphology of the root canal system varies among individuals and populations^{2,3}. A clear understanding of the variation of root canal anatomy is an important criterion for a successful endodontic procedure involving cleaning and shaping of root canals^{4,6}. Endodontic errors such as instrument separation, ledge, strip perforation, apical perforation, zipping, apical transportation, overfilled, under filled teeth can occur during diagnosis, access preparation, instrumentation, obturation, and post-space preparation, make treatment completion difficult and jeopardize treatment outcome⁷.

A study by Siddique FA 2016⁸ on the frequency of procedural errors during RCT performed by interns was conducted in hospital setting in Pakistan showed apical transportation as the most common procedural error (12%) followed by ledge (10%) and instrument separation was found to be (4%). The high incidence of apical transportation in their study reflects the skills and technique followed by their interns, the other factors contributing to this high frequency of errors could be aggressive filing, failure to pre-curve the file

in case of curved root canals using fatigued files, use of stainless steel files and also the use of step-back technique⁸.

A study by Yousuf W 2015⁷ on endodontic procedural errors: frequency, type of error, and the most frequently treated tooth by postgraduate trainees was conducted in hospital setting in Pakistan showed (22.7%) teeth were GP extrusion, (8.9%) were under-filled, (0.9%) had instrument separation and (0.4%) had apical transportation. The most frequently treated tooth was right permanent mandibular first molar (11.3%). The reason for GP extrusion was due to inadequate length determination or over instrumentation.

A study by Alsulaimani R 2016⁹ on the correlation between endodontic mishaps and single-visit treatment amongst dental students was conducted in King Saud University Saudi Arabia showed the apical transportation as the most prevalent procedural error (39%) followed by ledge (34.5%).

A number of factors can affect the perception, clinical efficiency and performance of Interns^{10,11}. The procedural errors can be avoided by a dentist by relying on his knowledge, intuition, and patience

during the course of the treatment. In our Institution the students are taught the crown down technique with NiTi files. Several challenges are present at the house job [internship] level resulting in procedural accidents. Hence, further studies should be carried in future about etiology and management of procedural errors to improve the understanding of young clinicians that can help to obtain better clinical outcome.

METHODOLOGY

The study was Descriptive Observational type in which data was collected retrospectively at single point in time from record files. Sample size was calculated by using www.statistics.co.uk. At 95% confidence level, 80% power of study the sample size was calculated to be n=106 and increase to 200. The teeth were assessed through peri apical radiographs and reported in department of Operative Dentistry at Private Teaching Dental Hospital, Karachi from 1st January 2017 to 1st January 2018.

Inclusion criteria includes Root canal treated teeth, Maxillary and Mandibular molars with history of irreversible pulpitis or necrosed pulp. Patients aged between 10 years -50 years, Teeth prepared with conventional Ni Ti files, Root canal treatment performed by house officers, Preoperative and Postoperative periapical radiographs present in the record files, All root canal treatments was done under indirect supervision, however, if there is any procedural error occurred, it is obligatory in hospital policy for re-treating it and mentioned in the files.

Exclusion criteria was teeth with open apices, Teeth with blocked or calcified canals, External / internal root resorption, Periapical pathology (such as cysts and tumors) , Advanced periodontal conditions/perio-endo lesions, All teeth were prepared using the crown down technique. Irrigation was done using 2.5% NaOCl and was obturated using lateral condensation technique. Crown down technique was performed using hand protaper files and were used in the sequence of SX,S1, S2, F1 and F2. Working length was determined by using radiographs and it was acceptable if it was within 0–2mm of the radiographic apex by a periapical radiograph using a paralleling technique. Data was analyzed using SPSS version 22 using simple descriptive analysis.

Evaluation criteria were: Ledge was labelled on radiograph when file was deviated from the canal curvature and was short from the working length¹², Apical transportation was diagnosed radiographically when the filling material was located outside curve of the canal at the apical third¹², Apical perforation was diagnosed radiographically when the filling material

was extruding through the apical foramen¹², Strip perforation was diagnosed radiographically when extrusion of filling material was detected in the lateral wall of the root canal¹², Instrument Separation was diagnosed radiographically when a fractured instrument was detected inside a root canal or when its tip extended into the periapical area¹², Zipping was diagnosed radiographically when the apical termination of the filled canal appeared as an elliptical shape transported to the outer wall¹².

Before conducting this research, an approval has been taken from the “Ethical Committee of the Research Centre at Private Teaching Dental Hospital” and the Patient Record department.

RESULTS

Total n=200 root canal treated tooth were assessed out of which 110 (55%) belonged to females and 90 (45%) belonged to males. The mean age of the patients was 30.7[S.D±7.03] years. The most frequently treated tooth was the mandibular right first molar (29.5%) followed by permanent maxillary right first molar (26%), maxillary left first molar (13%), mandibular left first molar (12%), mandibular right second molar (9.5%), maxillary right second molar (7.5%), mandibular left second molar (5%) and maxillary left second molar (2%).The most frequent tooth to possess an error was the mandibular right first molar (59%), followed by maxillary right first molar (52%). (See Graph I). The most frequent separated file was SX-S280(53.6%) followed by F1–F3 69 (43.0%).(See Table I). Instrument separation was the most common procedural error 148 (74%), followed by ledge 25 (12.5%). (See Table II). Most procedural errors were performed by female house officers. (See Table III)

**GRAPH I:
DISTRIBUTION OF TEETH POSSESS AN ERROR**

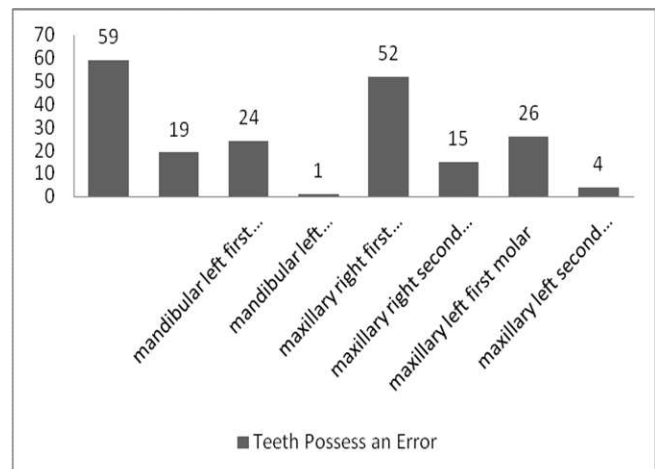


TABLE I: SHOWING DISTRIBUTION OF FILE NO. DURING INSTRUMENT SEPARATION ERROR

File Number	n	%
SX-S2	80	53.6
F1-F3	69	46.0
Total	149	100.0

TABLE II: SHOWING FREQUENT PROCEDURAL ERRORS

Procedural Errors	n	%
File separation	148	74.0
Ledge	25	12.5
Apical perforation	11	5.5
Strip perforation	2	1.0
Zippering	6	3.0
Sodium hypochlorite accident	3	1.5
Apical transportation	5	2.5
Total	200	100.0
n= sample size		

TABLE III: SHOWING DISTRIBUTION OF VARIOUS ERRORS MADE BY THE MALE AND FEMALE HOUSE OFFICERS

Procedural Error	HO Gender		Total
	Male	Female	
File separation	48	100	148
Ledge	11	14	25
Apical perforation	5	6	11
Strip perforation	1	1	2
Zippering	1	5	6
Sodium hypochlorite accident	1	2	3
Apical transportation	0	5	5
Total	67	133	200

DISCUSSION

Endodontic treatment can be considered a stressful procedure. It usually requires competent technical skills and experience, as well as an understanding of pulp anatomy and its variations. Knowledge of root canal morphology and pulp chamber will allow the

student to avoid any mishaps. Perforation of pulp chamber can occur while searching the canal orifices, drilling a tooth with a completely calcified chamber, orienting the bur to the wrong direction, or looking in wrong direction for the other canal. Endodontic treatment is frequently performed on first molar teeth¹³. In present study it is found that mandibular right first molar is most frequently treated tooth and 59% of procedural errors is associated with it. It is due to narrow and curved canals of these teeth which can negatively effect during root canal instrumentation and make RCT more challenging.

In the present study, Instrument separation was found to be the most common procedural error (74%) followed by ledge(12.5%). A study by Siddique FA 2016⁸ on the frequency of procedural errors during RCT performed by interns showed Apical transportation as the most common prevalent error (12%) followed by ledge (10%) and instrument separation was found to be (4%) which differs from the results in the present study. Csinszka K-IA¹⁴ showed 51.5% ledge formation by dental students using step-back technique. McKendry DJ 1988¹⁵ showed 37% ledge formation with K-Flex files. Shenoy A 2014¹⁶ reported 30% ledge formation using K-Files. Another study by Balto H 2010¹⁷ showed 14% ledges, 7% apical transportation, and 7% apical perforation which differs from the results in the present study.

The high incidence of Instrument separation in our study reflects the skills and technique followed by our house officers, the other factors contributing to this high frequency of errors could be aggressive filing, failure to pre-curve the file in case of curved root canals using fatigued files and setting larger MAF since the files become stiffer as the diameter of the files increases, using inappropriate sequence of files and use of poor quality of stainless steel files. Shenoy A 2014¹⁶ and Rambabu T 2014¹⁸ proposed that the blunt tip design of the modern hand and rotary instruments make coronal flaring easier and safer. Use of rotary NiTi instruments, minimizes the risk of procedural accidents during root canal treatment. Another study reported 0% ledge formation using ProTaper rotary system and 5.8% using hand files step back technique, but the initial startup cost for rotary instrumentation can be expensive, and the overhead cost is also high in maintaining a supply of files¹⁷.

Poor community awareness may also play a role which results in patients reporting to the dentist only

when they experience severe pain, leading to progression of the disease process to the extent that endodontic treatment is required. In our country patient's low income and lack of education (particularly awareness as regards oral health) act as a barrier to receiving even routine dental checkups. Thus, early detection of any disease process is often not possible and delays preventive treatment, leading to more cases of endodontic treatment. Furthermore, less expertise, lack of specialist practice, and an abundance of roadside quacks also contributed to patient's poor previous dental experience, making them reluctant to seek early dental treatment.

CONCLUSION

We concluded that the instrument separation was the frequent procedural error and the most frequent tooth to possess an error was the mandibular right first molar. This would help practitioners to determine which steps of the endodontic procedure requires greater diligence, in order to substantially improve the quality of their work and ensure better long term viability of the treatment.

STRENGTH

We included work that had been done by two different batches of house officers to avoid selection bias.

LIMITATIONS

In our study results showed that female house officers performed more procedural errors, the reason being that female enrollment already high. The other limitation is that one radiographic technique was used to assess the procedural error.

Conflict of Interest: No.

Funding: No

REFERENCES

1. Estrela C, Pécora JD, Estrela CRA, Guedes OA, Silva BSF, Soares CJ, et al. Common Operative Procedural Errors and Clinical Factors Associated with Root Canal Treatment. *Braz Dent J.* 2017; 28 (2):179-190. doi: 10.1590/0103-6440201702451.
2. Alrahabi M, Zafar MS. Evaluation of root canal morphology of maxillary molars using cone beam computed tomography. *Pak J Med Sci.* 2015; 31 (2):426-30. doi: 10.1266 9/pjms.312.67 53
3. Zafar MS, Alrahabi M. Cone beam computed tomography for exploring morphology of mandibular first molar. *BJMMR.* 2015; 6(5):514-21. doi:10.9734/BJMMR/2015/15189
4. Chaurasiya S, Yadav G, Tripathi AM, Dhinsa K. Endodontic Failure and its Management. *Int J Oral Health Med Res.* 2016; 2(5):144-48.
5. Hülsmann M, Peters OA, Dummer PM. Mechanical preparation of root canals: shaping goals, techniques and means. *Endodontic topics.* 2005;10(1):30-76.
6. Zafar MS. Assessment of Antimicrobial efficacy of MTAD, Sodium Hypochlorite, EDTA and Chlorhexidine for Endodontic Applications: An In Vitro study. *Middle-East J Sci Res.* 2014; 21(2): 353-7. doi: 10.5829/idosi.mejsr.2014.21.02.524
7. Yousuf W, Khan M, Mehdi H. Endodontic procedural errors: Frequency, Type of error, and the most Frequently Treated Tooth. *Int J Dent.* 2015; 2015: 1-7. doi:10.1155/2015/673914
8. Siddique FA, Sheikh AB, Raheed S, Najeeb S, Zafar SM. Frequency of Procedural Errors during Root Canal Treatment Performed by Interns. *BBJ.* 2016; 12(1): 1-8. doi: 10.9734/BBJ /2016/23768
9. Alsulaimani R, Almani K, Ababtain R, Binrabba R, Ashri N. The Correlation between Endodontic Mishaps and Single-Visit Treatment in King Saud University. *Int J Dent Oral Health.* 2016; 2(9): 1-5.
10. Alrahabi M, Zafar MS, Ahmed N. Effects of handpiece speed on the performance of undergraduate dental students in preclinical training. *J Taibah Uni Med Sci.* 2015; 10(1):50-55.
11. Karimi Z, Chala S, Sakout M, Abdallaoui F. Strategies for intracanal separated instrument removal: a review. *Dental Update.* 2017; 44 (7):636-46. doi: 10.12968/denu.2017.44.7.636
12. AbuMostafa A, Ahmad IA, Alenezy G, AlZoman A. Quality of root canal filling performed by undergraduate students in a Saudi Dental College. *J Dent Oral Hygiene.* 2015; 7(5):64-70.
13. Alhekeir DF, Al-Sarhan RA, Mokhlis H, Al-Nazhan S. Endodontic mishaps among undergraduate dental students attending King Saud University and Riyadh Colleges of Dentistry and Pharmacy. *Saudi Endodontic J.* 2013; 3(1):25-30.
14. Csinszka K-IA-, Maria MA, Monica M, Mihai P, Angela B. Identification of the Procedural Accidents During Root Canal Preparation Using Digital Intraoral Radiography and Cone Beam Computed Tomography. *Acta Medica Marisiensis.* 2016; 62(3):326-329. doi:10.1515/amma-2016-0028.

15. McKendry DJ, Krell KV, McKendry LL. Clinical incidence of canal ledging with a new endodontic file (Abstract). J Endod. 1988; 14:194-5.
16. Shenoy A, Mandava P, Bolla N, Vemuri S. A novel technique for removal of broken instrument from root canal in mandibular second molar. Indian J Dent Res. 2014; 25(1):107-10. doi: 10.4103/0970-9290.131157.
17. Balto H, Al Khalifah SH, Al Mugairin S, Al Deeb M, Al-Madi E. Technical quality of root fillings performed by undergraduate students in Saudi Arabia. Int Endod J. 2010; 43(4):292-300. doi: 10.1111/j.1365-2591.2009.01679.x.
18. Rambabu T. Management of fractured endodontic instruments in root canal: A review. J Sci Dent. 2014; 4(2):40-48.



AUTHOR AFFILIATION:

Dr. Syed Abrar Ali (*Corresponding Author*)

Associate Professor, Department of Operative
Hamdard University Dental Hospital/
Hamdard College of Medicine and Dentistry
Hamdard University, Karachi, Sindh-Pakistan.
Email: dentist4@hotmail.com

Dr. Mehmood Hussain

Associate Professor, Department of Prosthodontic
Hamdard University Dental Hospital/
Hamdard College of Medicine and Dentistry
Hamdard University, Karachi, Sindh-Pakistan.

Dr. Muhammad Shahzad

Associate Professor
Oral and Maxillofacial Surgery
LUMHS, Jamshoro, Sindh-Pakistan.

Dr. Hina Nafees

FCPS II Resident Operative Department
Hamdard University Dental Hospital/
Hamdard College of Medicine and Dentistry
Hamdard University, Karachi, Sindh-Pakistan.