

Obturation Related Errors by Undergraduates in Endodontics: Frequency and Type of Error- A Retrospective Study

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ABSTRACT

Introduction: Obturation procedure plays a key role in the success of root canal treatment. The aim of this study was to determine the obturation related errors in endodontics by undergraduate students and interns.

Material and methods: The present study was conducted on 1000 root canal treated teeth in the Department of Conservative Dentistry and Endodontics; Government Dental College and Hospital Srinagar Kashmir. Teeth in each group were evaluated for presence or absence of obturation related errors, *i.e.* underfill, overfill and improper lateral condensation.

Results: A total of 1000 root canal treated teeth were evaluated in the study; out of which 615 (61.5%) had procedural errors. The frequency of different errors were – underfill (16.5%); overfill (14%) and improper lateral condensation (31%).

Conclusion: Students as well as practitioners should show greater care to maintain accuracy of the working length throughout the procedure.

Keywords: Obturation Related Errors, Endodontics

Poor obturation in root canal technique can manifest in number of ways, *viz.* errors in length (overfill and underfill); errors in quality of obturation (voids, lack of homogeneity and uniform and continuous taper).

MATERIAL AND METHODS

The present study was conducted on 1000 root canal treated teeth in the Department of Conservative Dentistry and Endodontics; Government Dental College and Hospital Srinagar Kashmir.

Sampling: 1000 root canal treated teeth done by undergraduate students and interns of the Institution from November 2016 to October 2017 were included in the study. All the teeth were treated with ISO stainless steel hand files and obturated by cold lateral condensation technique.

Inclusion criteria

1. Patients age 12 to 70 years (Fig. 2 showing age distribution).
2. All maxillary and mandibular permanent anterior and premolar teeth.

Exclusion criteria

1. Teeth with open apices.
2. Molar teeth.
3. Teeth with calcified canals.
4. Teeth with external or internal resorption.
5. Teeth with periapical pathology.
6. Endo-perio lesions.
7. Teeth with large cysts or tumours.
8. Teeth to be treated for retreatment.
9. Deciduous teeth

Data collection

All the root canal treated teeth that fulfilled the inclusion criteria were included in the study, after approval by the ethical committee of the institution. All teeth treated with

INTRODUCTION

Bacterial eradication from the root canal system holds the key to a successful endodontic treatment¹. The primary determinant to achieve this and to prevent future encroachment of bacteria is a thorough and meticulous technique. For successful root canal treatment, each step should be done meticulously whether it is following aseptic technique, cleaning and shaping of the root canal, irrigation and disinfection of the root canal and last but not the least filling the root canal system. When all these measures are taken care of, success rate has been shown to be as high as 94%^{2,3}. Following of proper technique becomes more important in cases of apical periodontitis or in cases of retreatment. Chugal et al.⁴ in his study has showed that, for every 1 mm loss of working length, in teeth with apical periodontitis, failure rate increases by 14%.

Poor technique can be manifested in numerous ways. These include errors in length (*i.e.*, over fill and under fill), errors in cleaning and shaping (*i.e.*, ledge formation, apical transportation, perforations, and instrument fracture), and errors in quality of obturation (*i.e.*, voids, lack of uniform and continuous taper, and lack of homogeneity). Presence of such errors influence prognosis and treatment outcome.

Success rate has been shown to be reduced to mere 68% in underfills⁵⁻⁷ and 76% in overfills.⁶⁻⁸

The present study highlights the obturation related errors done by graduate students in anterior teeth and premolars.

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conventional ISO files were prepared using step-back technique and were obturated by lateral condensation technique.

Step-back technique was performed using ISO stainless steel hand K files (Dentsply Maillefer Switzerland). Coronal flaring was initially done with G.G drills size 01;02 and 03 (Dentsply Maillefer, Switzerland). K-files were used to clean and shape the canal in the following sequence #15; #20; #25; #30; #35; #40; #45; #50 and #60. Size 40 was taken as master apical file(MAF). Working length was deemed acceptable if it was within 0-2mm of radiographic apex as determined by periapical radiograph using bisecting angle technique.

Canals were thoroughly irrigated with 5% sodium hypochlorite (Prevest Jammu) and obturated with ISO G.P points (Dentsply Maillefer, Switzerland) and resinol resin sealer (Ammdent India).

For the purpose of our study underfill is defined as root canal filling material more than 2mm short of radiographic apex. Overfill means G.P points beyond radiographic apex. Any voids, lack of homogeneity and uniform taper were considered as improper lateral condensation.

Post obturation radiographs were taken using bisecting angle technique. Radiographic imaging data was transformed into computer. Teeth were grouped into two categories:

- a). Teeth with procedural errors.
- b). Teeth without errors.

Those having obturation related errors were further divided into type of error –underfill; overfills or improper lateral condensation (Fig.1). The overall distribution of obturation errors is shown in Fig.3.

STATISTICAL ANALYSIS

Three blinded examiners (one Professor, one associate professor and one assistant professor), who had been previously calibrated by the individual analysis of all the x-rays, evaluated the digital images together. The presence of underfill (yes/no), overfill (yes/no), improper lateral condensation (voids, lack of homogeneity or uniform continuous taper) was registered. Data was analyzed using SPSS version 20. Chi-square test was used to test the χ^2 value.

RESULTS

Total 1000 root canal treated teeth were assessed out of which 560 were maxillary teeth and 440 were mandibular teeth. 615 contained obturation related defects (61.5%) while 385 had no error. Among the obturation related errors 310 teeth had improper lateral condensation (31%); 165 had underfill (16.5%) and 140 teeth had overfills (14%) (figure 2). Comparisons between groups were analysed with chi-square tests at $P < .05$.

The most treated tooth was upper right first maxillary premolar(11.3%) followed by maxillary left first premolar(9.8%) and maxillary second premolar right(9.5%) and left(8.0%). The least treated teeth were mandibular central incisors(1.5%) on right and left side followed by mandibular canine, 1.7% on right side and 2.1% on left side

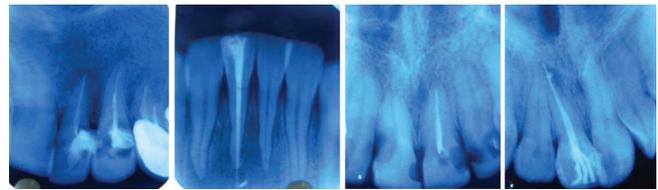


Figure-1: Obturation Errors- Underfill, Overfill, Improper lateral Condensation.

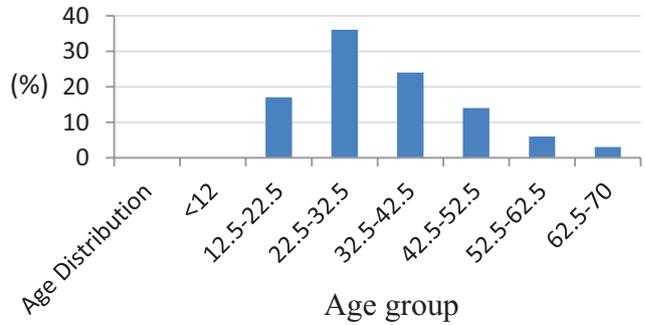


Figure-2: Age distribution of all root canal treatment cases.

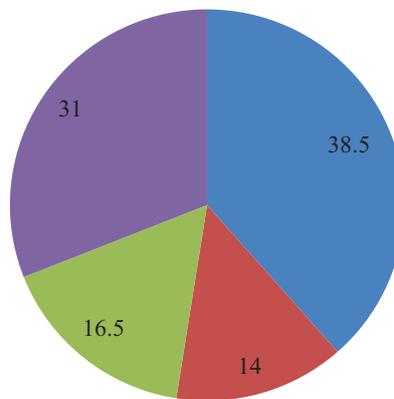


Figure-3: Overall procedural errors.

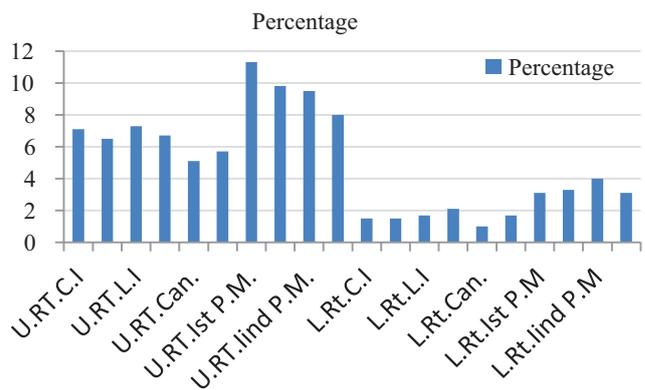


Figure-4: Frequency distribution of tooth being treated

(see Figure 4).

DISCUSSION

An alarmingly large majority (61.5%) of cases possessed a procedural error. This indicates a need for students and interns to be more meticulous with their technique. Also, it is

Tooth Group	No. of teeth treated	Normal	Underfill	Overfill	Improper lateral condensation	P value
Incisors	344	160	23	66	95	p<0.001
Canines	135	53	35	02	45	
Premolars	521	172	107	72	170	

Table-1: Over-all frequency distribution of teeth treated & errors in Obturation

Error-Underfill	Upper Central incisor	Upper Lateral incisor	Upper Canine	Upper I st Premolar	Upper II nd Premolar	P value
Right side	04	06	12	23	16	0.008
Left side	03	06	10	19	15	
	Lower Central incisor	Lower Lateral incisor	Lower Canine	Lower Ist Premolar	Lower IInd Premolar	
Right side	0	02	05	08	10	
Left side	0	02	08	08	08	

Table-2: Under-fill obturation error distribution in both arches

Error-Overfill	Upper Central incisor	Upper Lateral incisor	Upper Canine	Upper I st Premolar	Upper II nd Premolar	P value
Right side	12	14	02	15	10	0.056
Left side	10	11	00	14	11	
	Lower Central incisor	Lower Lateral incisor	Lower Canine	Lower I st Premolar	Lower II nd Premolar	
Right side	04	05	00	04	07	
Left side	05	05	00	06	05	

Table-3: Over-fill obturation error distribution in both Arches

Error-Improper lateral condensation	Upper Central incisor	Upper Lateral incisor	Upper Canine	Upper I st Premolar	Upper II nd Premolar	P value
Right side	18	19	18	29	36	0.782
Left side	17	18	20	27	35	
	Lower Central incisor	Lower Lateral incisor	Lower Canine	Lower Ist Premolar	Lower IInd Premolar	
Right side	05	06	03	09	13	
Left side	03	09	04	11	10	

Table-4: Improper lateral condensation distribution error in both Arches

important for mentors and guides to assist and guide young dentist at each and every level. It seems not enough effort is being made at critical steps during treatment to avoid errors. The most common error by far was improper lateral condensation (31%) (table 2). This may be due to inadequate sealer placement or inadequate packing of gutta percha during obturation.

The second major obturation defect noticed was underfill (16.5%). Literature has shown the highest failure rates in teeth filled more than 2mm short of the radiographic apex^{14,15}. This error may be produced by inadequate length determination, loss of working length, failure to recapitulate, inadequate filling technique, use of inflexible files, variations in canal morphology such as excessive curvature and narrow canals (particularly in upper first premolars), inadequate irrigation between each filing, and so forth. Furthermore, sclerotic canals and pulp stones may play a role in increased incidence of underfill in the older age group. Unquestionably, all efforts should be made to avoid this type of procedural error.

The next most common error was overfill (Table 2) which accounted for 14% of the total cases. Various studies have

demonstrated that this procedural accident has a negative effect on the prognosis of overall treatment outcome⁷⁻⁹. Although not acceptable, gutta-percha is relatively inert¹³ and if extruded beyond the apex has a minimal effect on the healing of the periapical tissues. There are conflicting results in numerous studies that has made this a controversial topic. Therefore, to be on a safe side one should show due diligence and avoid this error altogether.

Poor oral health awareness may 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 developing countries patient's low income and lack of education (particularly awareness as regards to oral health and hygiene) 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.

CONCLUSION

Special care should be taken when working on premolars,

which had a significantly higher error rate when compared to anterior teeth. Emphasis must be placed on community awareness programs to reduce the incidence of caries progressing to the point of requiring endodontic treatment. High risk patients should be provided with prophylactic treatment (such as fissure sealants and fluoride therapy) and regular routine checkups.

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