



Comparative analysis of various obturation techniques in mandibular molars - A retrospective clinical outcome study

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ABSTRACT

The primary objective of root canal treatment is the ability to remove irritants, to clean, shape and fill the root canal system three-dimensionally and prevent recontamination from bacterial irritants. Various Obturation techniques used for filling the root canals include lateral condensation, vertical compression, and thermoplastic gutta-percha techniques. The retrospective study aimed to evaluate the various obturation techniques used in mandibular molars. For this retrospective study data collection was based on patient records of Saveetha Dental College, Chennai and consisted of a total of 1903 cases evaluated based on the obturation technique within the time frame of 10th June 2019 to 1st March 2020. In this study, the obturation technique was evaluated based on the patients age, gender, procedure and based on the tooth in which obturation was done. Inclusion criteria consisted of the tooth that underwent endodontic treatment in patients within the age group of 18 to 60 yrs, a tooth with irreversible pulpal disease or chronic apical periodontitis, permanent tooth and mandibular molars. Exclusion criteria consisted of patients above 60 years, primary tooth, teeth in which root canal treatment was not undertaken, teeth with the presence of huge periapical lesions, severely calcified canals etc., severe periodontal disease, teeth apart from mandibular molars. All the values were then statistically analysed. In this study, 1930 patients (848 are females, and 1055 were males with a mean age of 24 years) were included. It was observed in this retrospective study that there was a significant difference between the various types of obturation technique used in mandibular molars. Single cone obturation technique has advantages over other techniques of obturation due to the fewer stress forces implied apically, thereby preventing an excess of sealer extrusion.

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INTRODUCTION

The success of root canal therapy relies on a wide range of factors such as proper diagnosis, access cavity preparation, accurate determination of the working length, preparation of the root canal in order to obtain a mechanical preparation with tapers, three dimensional sealing of the root canal, apical seal and the quality of the coronal restoration.

Proper endodontic diagnosis is an essential criterion in achieving successful treatment outcomes. Root canal disinfection involves removal of the bacterial biofilm that can be achieved by means of

following a proper irrigation protocol, final irrigant activation and complete sealing of the root canal space (Teja and Ramesh, 2019). Use of intracanal medicaments has also aided in disinfection of the root canal system, reduced inflammation and thereby reducing postoperative pain (Manohar and Sharma, 2018).

Inadequate seal of the root canal system can result in contamination and entry of microbes into the periapical tissues can further lead to the development of periapical diseases (Johnson and Kulild, 2011). Placement of a good coronal restoration is of utmost importance after root canal therapy to prevent coronal microleakage. Root canal space should be kept clean and moisture-free during the entire root canal therapy to prevent contamination from microbes.

Various Obturation techniques used for filling the root canal system include lateral compaction, warm vertical compaction, and carrier-based obturation techniques Lateral compaction technique of obturation is the most commonly used technique and this technique of obturation is preferred in case of wide canals (Cailleateau and Mullaney, 1997). Disadvantages of lateral compaction technique to other techniques is that this technique of obturation cannot fill the root canal irregularities (Collins, 2006).

In Carrier-based obturation technique, endodontic files are coated with thermoplasticized gutta-percha (Johnson and Johnson, 1978; Aqrabawi, 2006). Disadvantages of Lateral compaction and warm vertical compaction include such as lack of gutta-percha homogeneity, a high percentage of endodontic cement at the apical portion of the root and apical extrusion of gutta-percha (Wu et al., 2006). To overcome these disadvantages single cone obturation technique was introduced.

The Single cone obturation technique is simpler than other techniques of obturation because of factors such as the operator is subjected to less fatigue and this technique of obturation is a more passive technique of obturation inducing lesser strain on the root canal system (Cueva-Goig et al., 2012).

The single-cone technique of obturation uses a single cone with different tapers. This technique of obturation reduces the working time, allows easier, faster filling, and is a less fatigue technique. This technique of obturation is similar to other techniques in terms of quality of the obturation, apical microleakage and bacterial penetration.

The aim of this retrospective study was to evaluate the various obturation techniques used for obturation in mandibular molars.

MATERIALS AND METHODS

Study Design

A single centred retrospective study

Ethical Approval

Approval for this retrospective study was obtained from the Institutional Review Board of Saveetha Institute of Medical and Technical Sciences, Chennai, India on Date 18/04/2020. Ethical approval No -SDC/SIHEC/2020/DIASDATA/0619-0320.

Eligibility Criteria

Inclusion criteria consisted of tooth that underwent endodontic treatment in patients within the age group of 18 to 60 yrs., a tooth with irreversible pulpal disease or chronic apical periodontitis, permanent tooth and mandibular molars.

Exclusive criteria consisted of patients above the age group of 60 years, primary tooth, teeth in which root canal treatment was not undertaken, teeth with the presence of huge periapical lesions, severely calcified canals etc. severe periodontal disease, teeth apart from mandibular molars.

Data Extraction

This retrospective study was conducted based on the patient records collected from Saveetha Dental College and Hospital, Chennai in the year July 2019. Retrospective Data collection was done from a period of one year. Data was collected based on the obturation techniques used in Mandibular molars in patients who received Root canal treatment.

Sample Size

A total of 1903 clinical cases consisting of mandibular molars in which root canal treatment was completed were selected for this study. Data were derived from patient records of Saveetha Dental College, Chennai within the time frame of 10th June 2019 to 1st March 2020.

Groups

Based on the type of obturation techniques used for obturation of mandibular molars, there were three groups.

Group A

Lateral Compaction technique

Group B

Warm Vertical Condensation technique

Group C

Matched Taper Single Cone technique

Clinical outcome

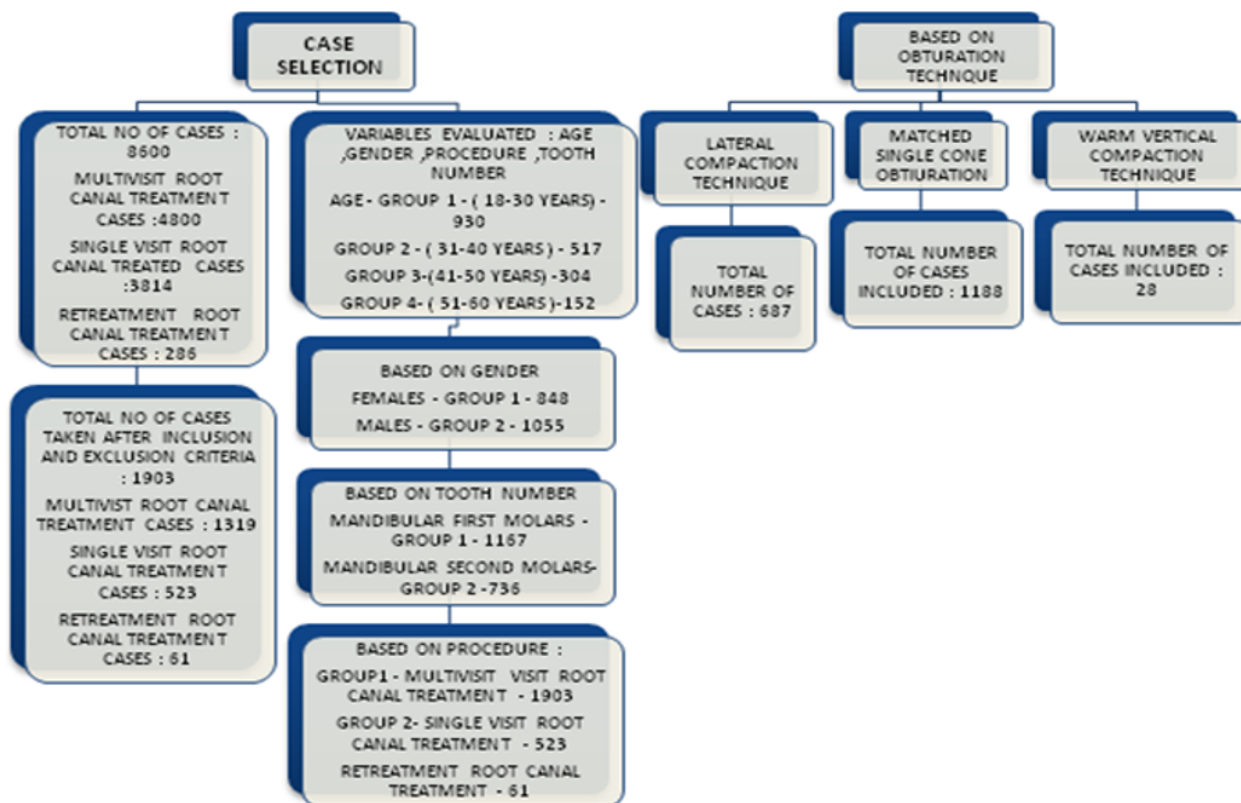


Figure 1: Shows Total Number of Cases and Cases Included

In this retrospective study, the technique of obturation used for mandibular molars was considered as the primary outcome of the study.

Statistical Analysis

Data entry was done using Microsoft Excel sheet and SPSS software. For this retrospective study, the chi-square test was used for statistical analysis between various obturation techniques used in mandibular molars. Age, the gender of the patient, the obturation technique and the tooth that was used were taken into consideration as independent variables. The tooth in which the obturation was done was considered as a dependent variable for statistical analysis. The final data was exported to excel and saved on a secure server for analysis.

RESULTS AND DISCUSSION

From clinical database system of a total of 8600 patients charts, collected over a period of one year, after applying the inclusion and exclusion criteria, around 1930 cases met with the criteria (Figure 1).

The data after applying the inclusion and exclusion criteria consisted of 1319 cases of multiple visit root canal treatment, 523 cases of single visit root canal treatment and 61 cases of treatment root canal treatment out of which 687 cases included lateral compaction technique of obturation, 1188 cases

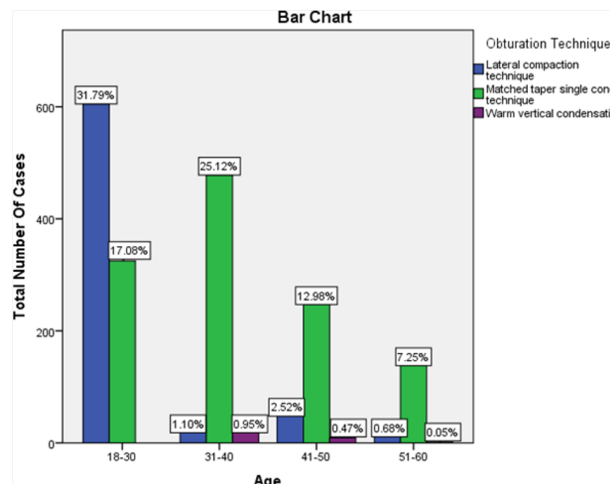


Figure 2: Bar chart showing the association between age and the type of obturation technique used

included matched taper single cone obturation, and 28 cases included warm vertical compaction in 848 females and 1055 males. From 8600, patient data initially collected only 1930 cases met the inclusion

and exclusion criteria (Table 1). According to the results of this study, matched taper single cone obturation technique was used in the majority of the cases (62.4%). Based on the age of the patient age group evaluated for a maximum number of cases

Table 1: Showing distribution of cases which were included for the study based on Age and Gender of the patient and type of obturation technique used

Patients Characteristics	No of Patients	Percentage
Gender		
Male	1055	55.4
Female	848	44.6
Age		
18- 30 years	930	48.9
31- 40 years	517	27.2
41-50 years	304	16.0
51-60 years	152	8.0
Type of Obturation Techniques		
Lateral Compaction	687	36.1
Matched Taper Single Cone Technique	1188	62.4
Warm Vertical condensation	28	1.5

Maximum number of cases were Reported in the age group of 18-30 years. Out of 1903 cases, 55.4% were male, and 44.6% were female

Table 2: Showing distribution of cases which were included for the study based on tooth type

Tooth Distribution	No of Teeth	Percentage Value
Jaw -Mandibular		
Teeth Number		
Posterior - multi-visit root canal treatment	1319	69.3
Posterior -Single visit root canal treatment	523	27.5
Posterior - Retreatment root canal treatment	61	3.2
Teeth Type-Molars		
First Molars	1167	61.3
Second molars	736	38.7

Out of 1903 cases, 61.3% were mandibular first molars, 38.7% were mandibular second molars

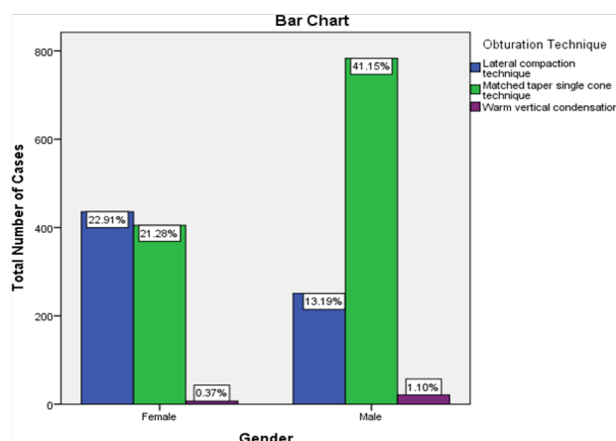


Figure 3: Bar chart showing association between gender and type of obturation technique used in mandibular molars

included 18-30 years, accounting 48.9% of overall cases. The age group of 31-40 years accounted for 27% of overall cases, 41-50 years accounted for

16%, and 51-60 years age group accounted for 8% overall cases. Based on the age group and technique of obturation that was used, maximum cases accounted for Matched single cone obturation (Figure 2) Based on the gender of the patient, males accounted for 55.4% cases, and females accounted for 44.6% cases. Based on gender and the type of obturation technique used maximum cases in males accounted for matched taper single cone obturation, and in females, maximum cases accounted for lateral compaction technique of obturation (Figure 3). Based on the procedure, maximum cases accounted for multi-visit root canal

treatment accounting 69.3% overall cases followed by single visit RCT accounting 27.5% overall cases and Retreatment Rct accounting 3.2% overall cases. Based on the procedure and type of obturation technique preferred maximum cases accounted for the lateral compaction technique of obturation (Figure 4). Based on the tooth number maximum cases accounted for mandibular first molars accounting

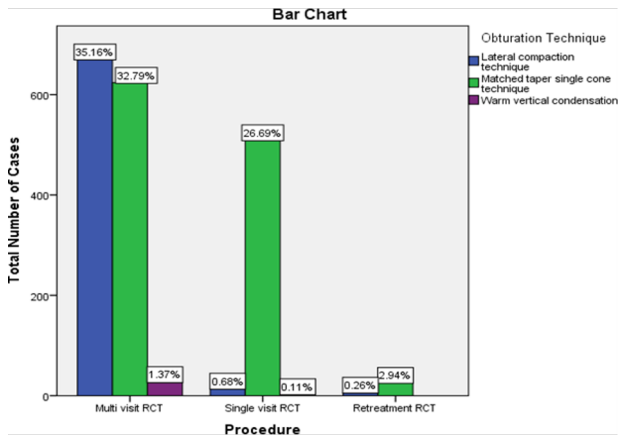


Figure 4: Bar chart showing association between procedured one and type of obturation technique used

61.3% of overall cases. Based on the tooth number and type of obturation technique used maximum cases accounted for matched single cone obturation for obturation of mandibular molars (Figure 5), (Table 2).

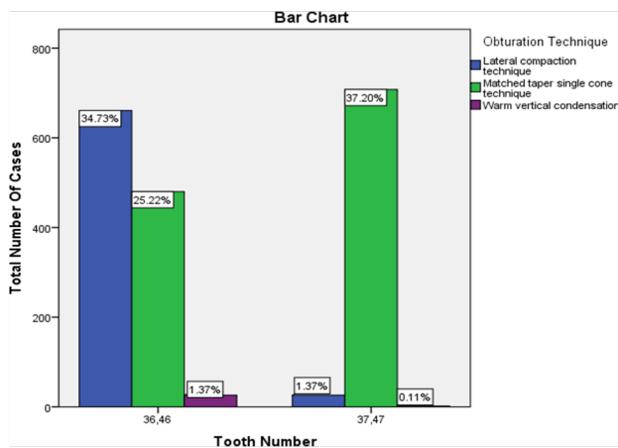


Figure 5: Bar chart showing association between tooth in which obturation technique was done and type of obturation done

There are various techniques of obturation that has been used for sealing the root canal system. The use of a single-cone technique along with a suitable resin-based sealer achieves the same success rate as other techniques of obturation according to several studies (Yilmaz, 2009; Somma, 2011). The primary objective of obturation of root canal therapy is to prevent reinfection of the root canal system and entry of microbes into periapical tissues. Solid core materials like gutta-percha and sealer help in achieving a complete seal of the root canal system and aid in disinfection (Schilder, 2006).

Figure 2, Majority of the cases in 31-40 years age group reported for lateral compaction technique of obturation.

Figure 3, Majority of the cases included males with matched taper single cone obturation technique.

Figure 4, Majority of the cases included Multi visit root canal treatment in which the lateral compaction technique of obturation was most commonly used.

Figure 5, Majority of the cases included mandibular molars in which matched taper single cone obturation technique was preferred.

In this study patients within the age group of 18-60 years were considered. The success of root canal treatment requires proper knowledge of the root canal anatomy and the variations that can be seen within it. Based on the tooth type, endodontic treatment of molars add difficulties during root canal treatment for dental students with limited clinical experience. Tooth type was considered as a prognostic factor for root canal treatment according to several studies (Benenati and Khajotia, 2002; Peak, 2001; Ng, 2007).

Factors such preoperative pulpal status, presence of apical periodontitis and quality of coronal restoration also play an essential role (Sjögren, 1990; Ray and Trope, 1995). Cuspal coverage, presence of proximal contacts, abutments, type of tooth are other factors that influence the success rate (Ng et al., 2010).

In Carrier-based Obturation technique, the apical third was tightly packed with gutta-percha in comparison to Lateral compaction technique of obturation (De-Deus, 2006). In Single cone technique of obturation, a single gutta-percha is used at environment temperature and is adapted to root canals with the help of a sealer (Gordon et al., 2005).

Single cone technique of obturation is insuitable for filling wider canals because of less adaption in the middle and coronal third and in filling possible anatomical variations of the root canal system (Monticelli, 2007; Whitworth, 2005). However, this technique of obturation is faster and easier in comparison with other techniques of obturation (Ozawa et al., 2009; Schäfer et al., 2012). In terms of radiographic quality of obturation Lateral condensation is similar to single cone technique of obturation (Hörsted-Bindslev et al., 2007). Single cone obturation systems, however, lacked a durable apical seal.

This retrospective study was undertaken based on the obturation techniques used in mandibular molars to emphasise that achievement of three-dimensional obturation is an important aspect to prevent reinfection of the root canal system. Endodontic treatment success involves sealing of the root canal space both coronally and apically.

Three-dimensional fillings of the root canal system should be as close to the cement-dentinal junction as possible.

Thermoplastic root canal obturation techniques use application of forces both laterally and apically to fill the canal in three-dimensionally, thereby inducing application of more stress on the root dentin. Passive root canal filling is a technique where there are fewer forces induced apically, reducing the stress on the root dentin and prevents extrusion of both the root canal sealer and gutta-percha. Single cone obturation technique is a passive obturation technique that prevents stresses on the root canal system and helps in maintaining the accurate placement of gutta-percha and prevents extrusion of sealer. The use of a bidirectional spiral along with the single cone obturation technique helps to carry the sealer along the length, moving the excess cement coronally and providing a three-dimensional seal. The use of bioceramic sealers, along with single cone obturation technique, have proved to be beneficial.

CONCLUSION

Within the limitations of this study, it can be concluded that single cone obturation technique has several benefits such as the possibility of a faster endodontic treatment, less induction of apical forces thereby reducing the stress of the root dentin, prevention of excessive extrusion of the root canal sealer and gutta-percha. Endodontic treatment with the use of more passive obturation technique should be recommended to reduce the induction of excessive stress on the root dentin.

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Overall Consensus

In agreement with the findings of this retrospective study.

Study Limitation

This Study included fewer cases that were obturated with warm vertical compaction technique and cold lateral compaction technique of obturation. Matched single cone technique of obturation is not beneficial for wide canals. It may not provide a three-dimensional seal in such cases leading to an invasion by microbes and contributing to the failure

of root canal -treatment.

Future Scope

More scope should be made to include warm vertical compaction and other techniques of obturation.

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The authors declare they have no funding support for this retrospective study.

Conflict of Interest

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

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