

## Comparison Of Quality Of Obturation Using Radiographs - A Retrospective Study

Research Article

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### Abstract

Root canal obturation fills up the potential space that can be recolonized by microorganism in future. It provides a complete filling of the canal in all dimensions to prevent ingress of bacteria and their toxins and their flow into the periapical tissues. So, the aim of this study was to compare the technical quality of three different obturation techniques using radiograph. Data was retrospectively retrieved from periapical radiographs of 57 root canal treated posterior teeth for the assessment of obturation quality. Data was divided into three groups. Group I- Lateral condensation technique, Group II-Single cone matched taper technique, Group III- Continuous wave compaction. Mann Whitney U and Chisquare test was applied to compare the difference in technical quality of obturation between three techniques. The assessment of the overall scores for the obturation quality between three techniques showed that Group II- Single cone matched taper technique had highest scores followed by continuous wave compaction and lateral condensation technique. Within the limitations of the present study, it can be concluded that Single cone obturation technique resulted in overall good obturation when compared to Lateral condensation and Continuous wave compaction techniques.

**Keywords:** Root Canal Obturation; Lateral Condensation; Single Cone Obturation; Continuous Wave Compaction.

### Introduction

Pulp necrosis is a clinical state indicating the death of pulpal tissue with or without bacterial invasion. When the necrosis is due to ischemia with superimposed bacterial infection, it is called as pulp gangrene. When the necrosis is non-bacterial in origin, it is called pulp mummification. Pulpal death could be caused due to mechanical, chemical, bacterial or thermal insults. This is managed by endodontic or root canal therapy. Sometimes root canal therapy is also done electively for prosthodontic reasons to gain the support of the adjacent teeth. Irrespective of the reason for doing root canal therapy, the final outcome depends on how well a clinician manages to achieve maximum disinfection and create a tight hermetic seal with the root filling material [1, 2].

Root canal obturation fills up the potential space that can be recolonized by microorganism in future. After the removal of pulp,

the root canal is cleaned and shaped, disinfected with irrigant and medicaments and finally obturated to prevent reinfection. It provides a complete filling of the canal in all dimensions to prevent ingress of bacteria and its toxins and their flow into the periapical tissues [3-7].

Obturation of the root canal system is achieved with gutta-percha and a sealer [8]. The maintenance of the seal is also crucial to optimize the outcome of root canal treatment [9]. Epley et al, 2006 and Schilder et al, 2006, have mentioned that an ideal root canal obturating material should be well-adapted to the canal walls without any irregularities and the entire length of the canal should be densely compacted with a homogeneous mass of gutta-percha [5, 10]. But, most obturations fail to seal the canal completely. [11]. Teeth with inadequate filling with voids or dead spaces or underextended filling, overfilling, extending beyond the apex, unfilled canals require retreatment before permanent coronal

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restoration. These might create problems by favouring bacterial proliferation in the empty spaces [12] or the overextended obturation can trigger inflammatory reaction in the periapical tissue resulting in severe post obturation pain sometimes accompanied by swelling, periodontal ligament breakdown and periapical lesion rarely. It might also cause alveolar bone necrosis in the periapical area and discoloration mucous membrane covering tooth apex, or even a neurological complication such as paresthesia [13, 14].

Poor quality of obturation has been associated with no healing in most of the cases. Ideally an obturation material should fill upto the apical terminus without any excessive material extending into periapical tissues, it should completely seal the root canal in three dimensions, it should be dense radiopaque without any voids or dead space [15]. The endodontic treatment success is dependent on both the quality of the obturation and the final restoration. The quality of the endodontic obturation is usually evaluated using radiographic images upon completion [15, 16]. Previously our team has a rich experience in working on various research projects across multiple disciplines [17-31] Now the growing trend in this area motivated us to pursue this project.

## AIM

The aim of the present study was to compare radiographic quality of three different obturation techniques-Lateral condensation, Matched taper single cone obturation and Continuous wave compaction.

## Materials And Method

### Study Design

Single centered retrospective study .

### Eligibility Criteria

**Inclusion criteria:** Permanent maxillary and mandibular premolars and molars in which root canal treatment were indicated either clinically or recommended due to elective endodontics were included in the study.

**Exclusion criteria:** Radiographs with superimposed canal fillings or over-projection of anatomical structures, Teeth with severely curved roots, sclerosed canals, tooth indicated for endodontic retreatment or tooth with apical root resorption were excluded from study.

**Data Extraction:** It was a retrospective study which was conducted from March 2018 till December 2018 at Saveetha dental college and hospital. The data used in the current study consisted of a sample of periapical radiographs of patients who received root canal treatment.

**Sample Size:** A total of 57 cases were taken for the study and were divided into three groups-19 samples in each group which were categorised based on the chosen method of obturation.

### Groups

The total sample was broadly divided into three groups based on

the technique of obturation which was chosen for the root canal treatment.

Group I: Lateral condensation

Group II: Single cone obturation technique

Group III: Continuous wave compaction

All the selected cases were treated according to their respective method of obturation and post operative periapical radiographs were obtained immediately after the obturation. The radiographs were evaluated by the same endodontist. Films were examined using handheld X-ray film viewers with magnifying lenses that could be moved in different angulations for varying magnification. The obturation quality was evaluated according to length, density, taper of the obturation using the criteria given by Barrieshi et al, 2004 (Table 1) and were scored as Ideal, Good and Unsatisfactory. (Table 2)

**Statistical Analysis:** The analysis of the data was performed using SPSS 14.0. The chi-squared statistical test was used to compare obturation quality of root filling in terms of length, density and taper with respect to each obturation technique.

The overall assessment of obturation quality (length, density and taper) between obturation methods were analyzed by applying Mann Whitney-U Test. A P-value <0.05 was considered statistically significant.

## Results And Discussion

The assessment of the overall scores for the obturation quality between three techniques showed that Group 2- Single cone matched taper technique had highest scores followed by continuous wave compaction and lateral condensation technique. All the 19 cases (100%) of single cone matched taper technique showed good obturation when compared to the other two techniques (Table 4). Also, the difference in the obturation quality among three groups revealed to be statistically significant with a P value of 0.000 (Graph 4)(Table 3).

When the obturation techniques were compared based on each parameter- Taper, density and length, the differences were statistically significant with P value less than 0.05.(Graph 1)(Graph 2)(Graph 3)

The present study aimed at assessing the quality of the obturation based on three parameters -Taper, Density and Length. 69% of the teeth had adequate density. In that 33% of the cases were obturated by Single cone matched taper technique, 23% cases were treated by continuous wave compaction and 7% of cases were obturated by Lateral condensation (Graph 3). Similarly, 93% of cases had uniform taper. Only 23% of cases treated by lateral condensation had uniform taper (Graph 2). The overall percentage of teeth with adequate length in the study was 64%. The percentage of root fillings with adequate length was 17.5% with lateral condensation technique, 26% with Single cone obturation and 21% with Continuous wave compaction. Continuous wave compaction was the only technique which was found to be associated with overfilling in this study (Graph 1).

There are multiple factors which influence the quality of obtura-

**Table 1. Criteria used for the assessment of quality of obturation.**

Parameter	Criteria	Quality of obturation
Length of the obturation	Adequate	Root filling ending less than or equal to 2mm from the radiographic apex
	Overfilling	Root filling beyond the radiographic apex
	Short filling	Root filling greater than 2mm from the radiographic apex
	Flush	Root filling at the radiographic apex
Density of the root filling	Adequate	No voids present between the obturating materials and the root canal walls
	Inadequate	Voids present between the obturating materials and the root canal walls
Taper of the obturating materials	Adequate	Consistent taper from the orifice to the apex
	Inadequate	No consistent taper from the orifice to the apex

**Table 2. Scoring criteria.**

Score	Criteria
0	Obtured canals have no quality of ideal obturation
1(Unsatisfactory)	Obtured canals have one quality of an ideal obturation
2(Good)	Obtured canals have two qualities of an ideal obturation
3(Ideal)	Obtured canals have all three qualities of an ideal obturation- Adequately filled, Smooth coronal taper, No voids

**Table 3. Overall scores of the three obturation techniques.**

Group	Mean Score
I-Lateral condensation	17.47
II-Single cone matched taper	39.08
III-Continuous wave compaction	30.45

**Table 4. Percentage of cases with good, ideal and bad obturation in three groups.**

Score	Lateral condensation	Single cone	Continuous wave compaction	Total
1(Unsatisfactory)	10.50%	0%	7%	17.50%
2(Good)	22.80%	10.50%	10.50%	43.90%
3(Ideal)	0%	22.8%	15.80%	38.60%

**Figure 1. Showing the comparison of obturation quality based on the length. The percentage of root fillings with adequate length was 17.5% with lateral condensation technique, 26% with Single cone obturation and 21% with Continuous wave compaction.**

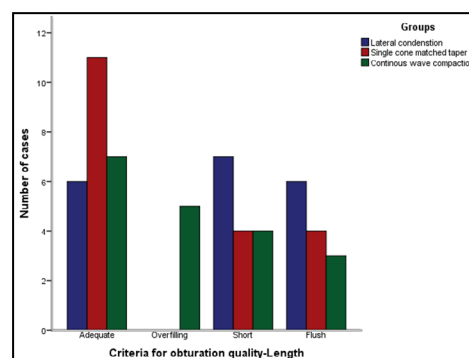


Figure 2. Showing the comparison of obturation quality based on the taper. 93% of cases had uniform taper. Only 23% of cases treated by lateral condensation had uniform taper.

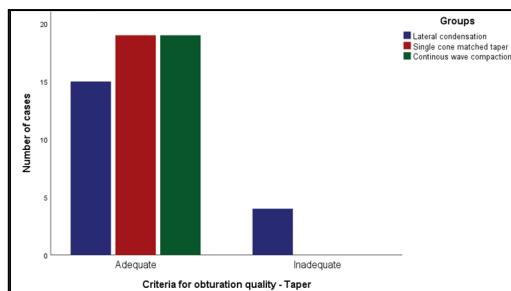


Figure 3. Showing the comparison of obturation quality based on the density. 69% of the teeth had adequate density. In that 33% of the cases were obturated by Single cone matched taper technique, 23% cases were treated by continuous wave compaction and 7% of cases were obturated by Lateral condensation.

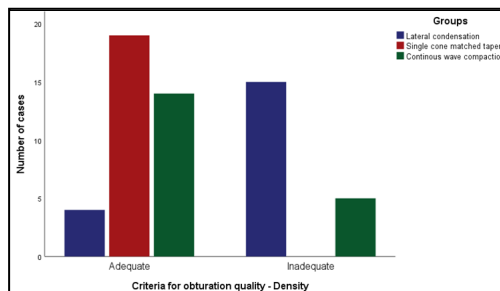
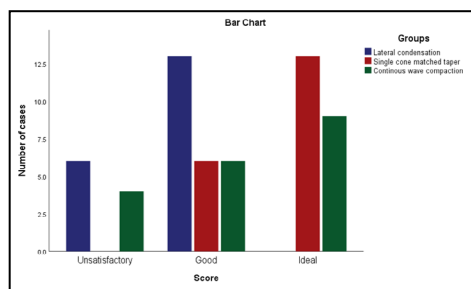


Figure 4. Showing the overall quality of the three obturation techniques. Group 2- Single cone matched taper technique had highest scores followed by continuous wave compaction and lateral condensation technique.



tion like Core material, sealers, the preparation, the taper, presence of any voids/irregularities, length of the obturation etc. [32, 33]. Studies have reported that the chances of success of an endodontic therapy is increased when the root canal filling is within 0-2 mm of the radiographic apex and of uniform taper and density without any voids or dead space [15, 34, 35]. Continuous tapering of the root canal apically from the orifice facilitates proper cleaning, shaping, and obturation [36]. Smith et al.1993 had found that obturation within 0-2 mm from the radiographic apex reported the least post-endodontic diseases compared to those shorter than 2 mm of the radiographic apex [37].

There are many obturation techniques. But still lateral compaction is the most commonly taught and practiced worldwide and is regarded as the benchmark against which other obturation techniques are evaluated. This method has some advantages including low cost and the ability to control the length of the fill. However, its ability to conform to the complex anatomy of the root canal has been questioned due to voids, spreader tracts, incomplete fusion of gutta-percha cones, and lack of surface adaptation etc [38] and these obturations were done with standardized .02 taper gutta-percha cones, usually with zinc-oxide-eugenol-based sealers. Because large volumes of this soluble sealer were used, dissolution of the sealer may have had a negative effect on the outcome [39].

The single-cone matched taper technique was introduced in the late 1960s. After the canal preparation and ensuring the apical stop, a gutta-percha, silver or titanium point was selected and locked at the limit of the root canal preparation. By using a thin and uniform cement layer, a single point would promote the root canal sealing. Although in this study the maximum number of matched taper single cone obturation cases had ideal obturation, there are studies which have demonstrated that the cement pellicle between the point and the root canal walls allowed the leakage of the fluids [40]. In contrast, Holland et al.2004 evaluated the influence of the type of endodontic cement and of the filling technique on the apical marginal microleakage using the single-cone and lateral condensation techniques in single-rooted teeth. They found that the single cone obturation technique achieved the best sealing of the root canal than lateral condensation. The single-cone technique sealing quality depends on the adaptation of the single cone to the walls of the canal [39]. Single-cone obturations have not been well regarded because of the use of large amounts of sealer. Porosities in large volumes of sealer, setting contraction and dissolution of the sealer are the main disadvantages of this technique [41].

Continuous wave compaction technique is a method of root canal obturation with thermoplasticized gutta percha using tapered

pluggers to pack the heat softened gutta-percha into the root canal system. This technique has the advantage of enhanced application and faster packing of gutta percha into the root canal system [42].

Keçeci et al, 2005, compared different combinations of root canal preparation and obturation technique. Continuous wave groups had significantly more apical extrusion of sealer. So they concluded that the continuous wave technique was faster than lateral compaction and it extruded more sealer [43]. These study findings are in accordance with this study results.

Aminsobhani et al, 2015 did an in vitro study to compare the obturation quality of lateral compaction and continuous wave compaction and found that Lateral condensation technique was associated with more number of voids than continuous wave compaction technique [42].

Our institution is passionate about high quality evidence based research and has excelled in various fields [21, 44-53].

## Conclusion

Within the limitations of the present study, it can be concluded that Single cone obturation technique resulted in overall good obturation when compared to Lateral condensation and Continuous wave compaction techniques.

## Clinical Significance

The importance of maintaining the original shape of a root canal to promote periapical healing in endodontic cases has been demonstrated in several studies. The endodontic treatment success is dependent both on the quality of the obturation and the final restoration. The quality of the endodontic obturation is usually evaluated using radiographic images upon completion. This study has tried to evaluate the various factors which can influence the obturation and its finding helps us in understanding the advantages and limitations of these three obturation methods.

## Study Limitations

This study has limited itself to the characteristics of the obturation like taper, density and length. It doesn't explain the influence of the mechanical preparation of the root canal and the obturation materials which were used for the obturation.

## Future Scope

Future studies should focus on evaluating the other factors like canal preparation method, obturation material, irrigation and irrigation techniques, intracanal medicament etc and their effect on root canal obturation.

## Data Availability

The experimental data used to support the findings of this study are included within the article.

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## Conflicts Of Interest

All authors declare that they have no conflicts of interest. In addition, all authors have read and approved the manuscript as submitted, are qualified for authorship, believe the submission represents honest work and take full responsibility for the reported findings.

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