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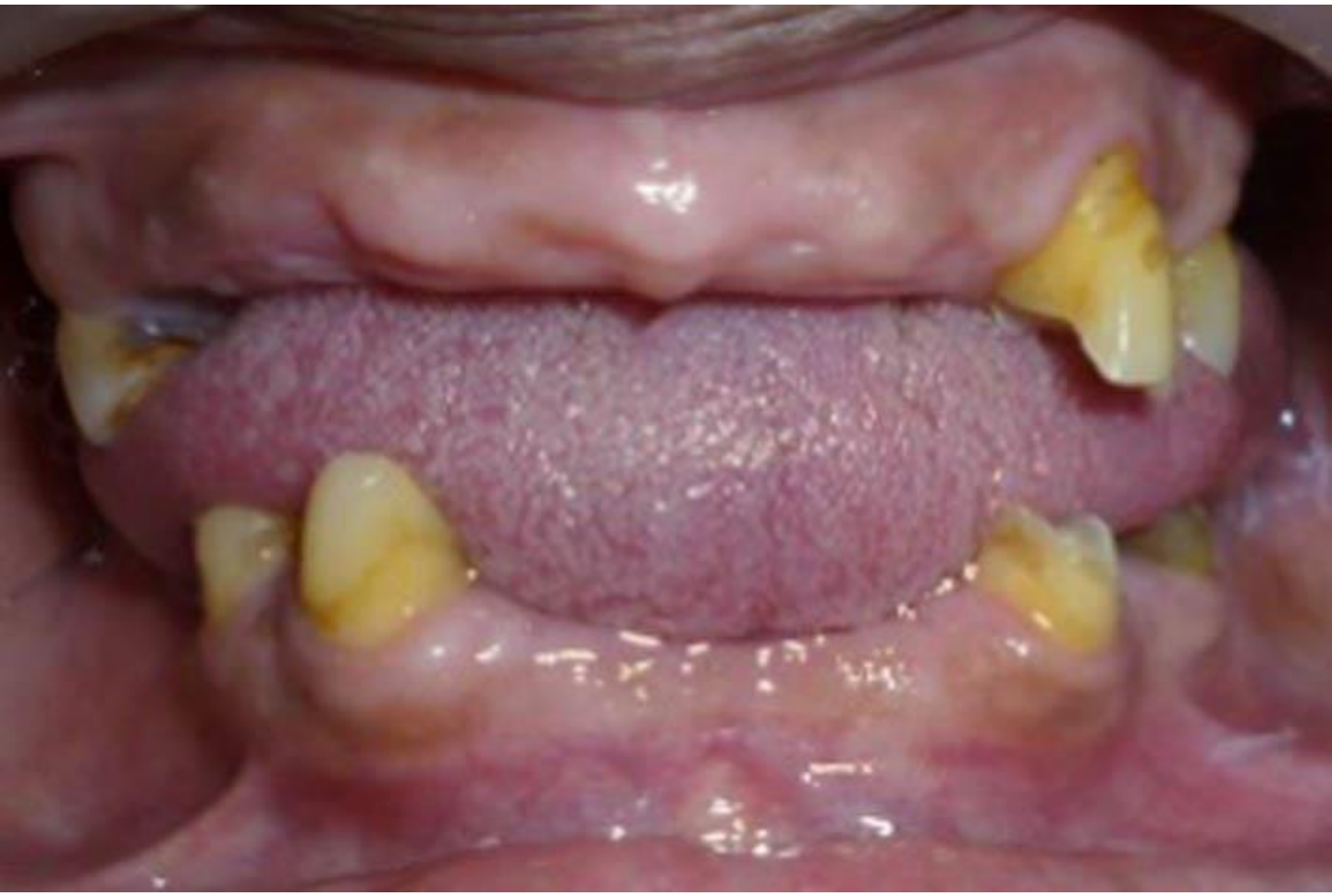

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EVALUATION AND COMPARISON OF CORONAL SEALING ABILITY OF THREE DIFFERENT OBTURATION METHODS – WARM LATERAL CONDENSATION, WARM VERTICAL CONDENSATION AND COLD LATERAL CONDENSATION: AN IN-VITRO STUDY

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ABSTRACT

Introduction: Success of non-surgical root canal treatment is predicted by meticulous cleaning and shaping of the root canal system, three-dimensional obturation and a well-fitting ‚leakage-free' coronal restoration. The techniques of obturation that are available have their own relative position in the historical development of filling techniques. The aim of this study was to evaluate and Compare Coronal Sealing Ability of three different Obturation Methods – Warm Lateral Condensation, Warm vertical condensation and Cold lateral condensation. **Material and Methods:** The present in vitro study comparing the coronal sealing ability of three obturation techniques was conducted in the department of Conservative Dentistry and Endodontics, SDMCDS, Dharwad. The sealing ability of 3 obturation methods was studied under a scanning electron microscope at the Indian Institute of Science, Bangalore. **Results:** Warm vertical condensation technique was found superior when compared to other techniques at the coronal 1/3rd region and statistical analysis was done to prove it. The sealing ability at the coronal 1/3rd, middle 1/3rd and the apical 1/3rd was 1.13±0.03, 4.00±0.34 and 3.50±0.92 respectively. **Conclusions:** It was concluded from our study that Warm vertical condensation technique was found superior when compared to other techniques at the coronal 1/3rd region.

KEYWORDS: Coronal sealing ability; obturation; warm vertical condensation

INTRODUCTION

Obturation of the root canal is an essential part of endodontic treatment and must be performed to the highest clinical standards.[1] The material chosen for root fillings is one of the critical determinants for the success or failure of endodontic treatment. The sealing properties of root canal filling materials constitute another important factor that can influence the success of treatment. Several in vitro experiments have demonstrated that some microorganisms can penetrate the coronal portion of root canal. fillings and eventually reach the apical region in some cases.[2,3] Hence, preventing coronal leakage is essential to the success of root canal treatment.[1] A key to successful endodontics and a major goal of contemporary nonsurgical root canal treatment is to seal completely, both the apical and coronal avenues of potential leakage and maintain the disinfected status reached by the chemical and / or mechanical cleaning, to prevent reinfection and percolation of bacterial substrates, allowing the periodontium to maintain its integrity and to achieve healing.[4-7] Ingle found that nearly 60% of endodontic failures were due to the incomplete obturation of the root canal system.[8] The aim of this study was to evaluate and Compare Coronal Sealing Ability of three different Obturation Methods - Warm Lateral Condensation, Warm vertical condensation and Cold lateral condensation.

MATERIALS AND METHODS

The present in vitro study comparing the sealing ability of three obturation techniques was conducted in the department of Conservative Dentistry and Endodontics, SDMCDS, Dharwad.

The sealing ability of 3 obturation methods was studied under a scanning electron microscope at the Indian Institute of Science, Bangalore.

Criteria for selection of teeth:

1. Non-carious teeth
2. Straight roots
3. Closed apex

The teeth were stored in 10% formalin solution. They were cleaned using 20% H_2O_2 to remove soft remaining tissue surrounding the teeth. The crowns of the teeth were removed at cement-enamel junction before access opening. After pulp tissue removal with broach, number 15 K-file was introduced into the canal of each specimen until it was seen just near the foramen. The working length was determined by subtracting 1mm from this length. The canals were prepared using circumferential filing with the apical matrix formed with the no. 50 file. After drying the canals thoroughly with paper points, zinc oxide powder and eugenol were taken on a clean, dry glass slab and mixed according to the manufacturer's instructions. The mixed material was placed in the root canal with the help of a lentulospiral to apply a thin coat on the walls of the canal. The teeth were divided into control group and experimental group, the first groups of 6 teeth were used as control group and second group of 30 teeth were used as the experimental group. In control group single cone method was used. The experimental groups were divided into three groups namely, Cold lateral condensation (Group A), Warm Lateral Condensation (Group B) and Warm vertical condensation (Group C). ***Warm lateral condensation:*** After placing the master cone to its proper depth, a cordless, rechargeable, battery operated GP heat condenser, ENDOTEC (Caulk, Dentsply) was used to provide uniform heat to the gutta percha mass. The heat condenser tip which was introduced alongside the master GP cone was with an ordinary spreader. After switching the activator button on, the condenser was gently forced apically and laterally into the canal with the rotary penetrating motion. It was placed for 6-15 seconds and then space just created by the condenser tip. The same procedure was repeated until the canal was completely filled. ***Warm vertical condensation:*** For this technique various hand held pluggers were used. Three pluggers, whose diameter were just slightly less than that of the canal preparation at any level were selected for working on the coronal, middle and apical one third of the canal. Following sealer placement and master cone insertion, a spreader was heated in a glass sterilizer and allowed to plunge 3-4 mm into the apical most extent of GP and was allowed to remain there till it began to cool, afterwards it was removed and the largest prefitted plugger used to vertically pack the GP mass apically. The procedure was repeated till the canal was fully fitted. ***Cold lateral condensation:*** The apical portion of the master gutta percha cone was coated with sealer and inserted slowly and gently into the canal to the measured length. A hand held spreader was inserted slowly and gently into the canal to the measured length. A hand held spreader was inserted apically alongside the master cone, wedging it against the canal wall and creating space for additional cone. The process was repeated several times until the wedged cones blocked further access to the canal. The protruding butt ends of the cones were removed with the blade and of the spreader instrument heated hot and GP mass was firmly condensed. The teeth were sectioned horizontally in three sections (coronal, middle and apical) with diamond disc. Sectioned parts were coated with 20 mm of gold palladium. They were later mounted on aluminum studs and were examined under Scanning Electron Microscope (SEM).

RESULT

In this in vitro study maxillary central incisors were chosen with single patent canals. They were obturated using three different techniques. ANOVA analysis was done between the three obturation techniques for the sealing ability at the coronal 1/3rd and it was found out that there was significant difference ($F=34.74$ and $p<0.001$) (Table 1). Further to find out the significant difference in the sealing ability between individual techniques F test was performed. The results of F test are as follows (Table 2): Between warm lateral condensation and warm vertical condensation the mean difference was 3.97 and 1.13 ($p<0.01$) which was significant.

1. Between warm lateral condensation and cold lateral condensation the mean difference was 3.97 and 5.79 ($p<0.01$) which was significant.
2. Between warm lateral vertical condensation and cold lateral condensation the mean difference was 1.13 and 5.79 ($p<0.01$) which

Table 1: Analysis between the three obturation techniques for the sealing ability at the coronal 1/3rd

Source of variation	Sum of squares	Degree of freedom	Mean sum of squares	Variation rate	p value
Between groups	110.48	2	55.24	34.74	<0.01
Within groups	42.94	27	1.59		
Total	153.42	29			

Table 2: The significant difference in the sealing ability between individual techniques

Obturation techniques	Sealing ability (µm) Range	Mean	S.D.	F-value*	S.D.**	Difference between groups
A) Warm lateral condensation	2.39-5.68	3.97	1.04	34.74 p<0.001	1.80	A-B p<0.01
B) Warm vertical condensation	1.08-1.16	1.13	0.03			A-C p<0.01
C) Cold lateral condensation	2.14-8.12	5.79	1.92			B-C p<0.01

**One factor ANOVA*
***Least significant difference*

Table 3: The sealing ability of warm vertical condensation at the coronal 1/3rd, middle 1/3rd and the apical 1/3rd

Region	Warm vertical condensation
Coronal 1/3	1.13±0.03
Middle 1/3	4.00±0.34
Apical 1/3	3.50±0.92

was significant. Warm vertical condensation technique was found superior when compared to other techniques at the coronal 1/3rd region and statistical analysis was done to prove it. The sealing ability at the coronal 1/3rd, middle 1/3rd and the apical 1/3rd was 1.13±0.03, 4.00±0.34 and 3.50±0.92 respectively (Table 3).

DISCUSSION

Achieving an adequate coronal seal is one of the most important goals in endodontics, but there is wide variation in the sealing ability of different Obturation Methods. Several techniques are commonly used to evaluate the sealing ability of root canal obturation materials including dye penetration, bacterial leakage,[9] fluid filtration,[10] radioisotope labeling,[11] and electrochemical methods.[12] Although each evaluation technique has its proponents, there is no general consensus in the profession as to which technique(s) is the best. In fact, some investigator have shown contradicting results when evaluating the same sample with different evaluation techniques.[13] In this study dye penetration method was used because of its simplicity and because a recent study has shown it to produce similar results to the bacterial leakage method.[14]. Schilder[15] introduced the warm vertical condensation technique. According to him, heat allowed the plasticized GP to flow apically and into the irregularities of root canal. Lifshitz *et al*.,[16] used the SEM to determine the effectiveness of warm vertical method and concluded that a wall to wall adaptation of GP was observable and simultaneous use of pluggers gave a synergistic action in providing a homogenous mass. We obtained the same findings with this technique particularly in the coronal 1/3rd, of the canal. Warm vertical condensation method used in our study was the same as done by Reader, Himel, Germain[17] and Dagher, Yared.[18]

CONCLUSION

A good coronal seal is one of the criteria for the success of the endodontic treatment. It was concluded from our study that Warm vertical condensation technique was found superior when compared to other techniques at the coronal 1/3rd region. However, further studies a need to be conducted in this regard.

CONFLICT OF INTEREST & SOURCE OF FUNDING

The author declares that there is no source of funding and there is no conflict of interest among all authors.

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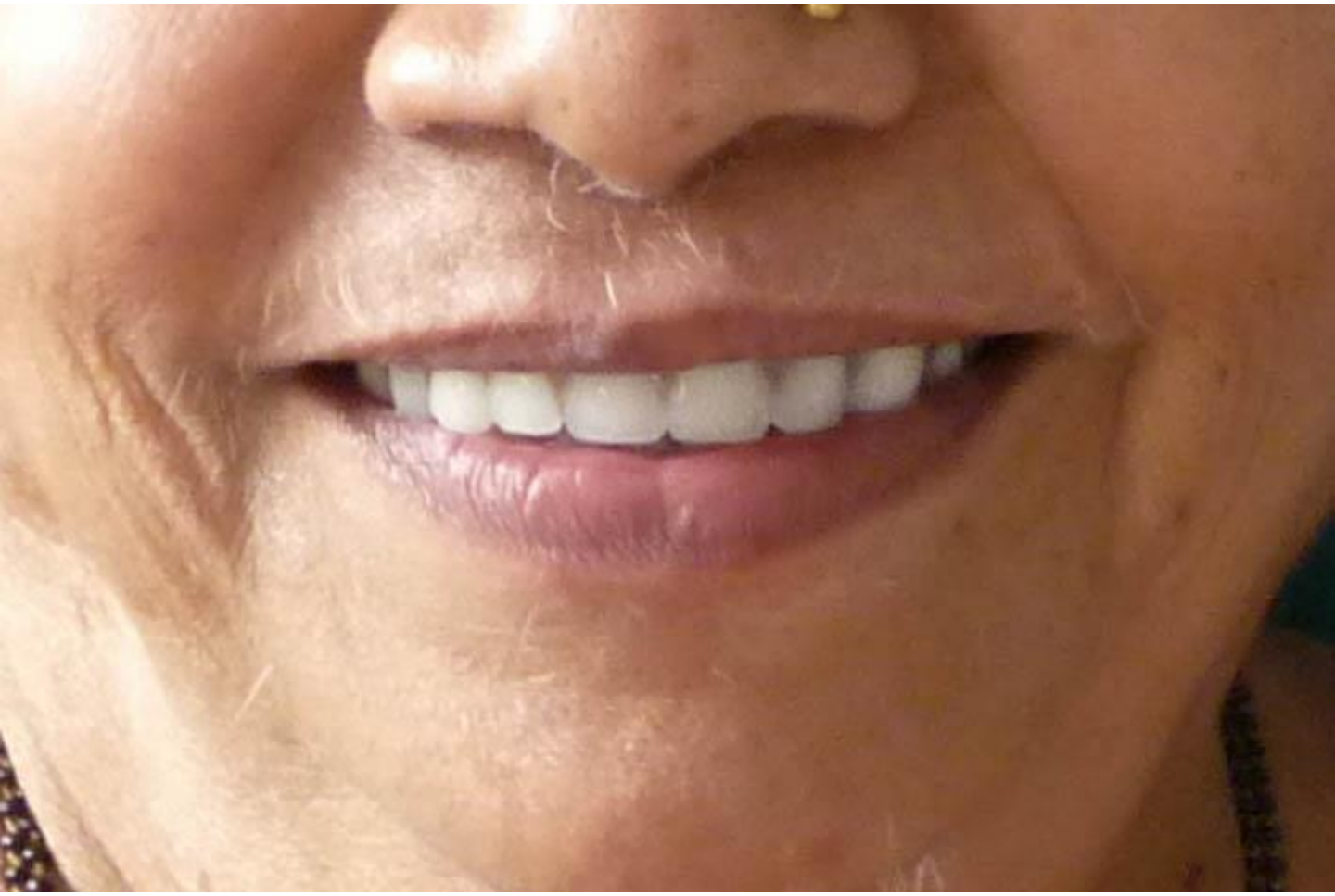

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