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ORIGINAL RESEARCH

Comparative evaluation of efficacy of three different gutta-percha obturation techniques during root canal therapy

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ABSTRACT:

Background: The root canal was packed with this non-plastising gutta-percha in cold lateral compaction, which was gradually moved towards a thermoplastising rubber-like material aimed at increasing root canal adaptability. The cold lateral condensation technique is the most frequently used obturation techniques by general dentists, and it is used in many countries. The present study was undertaken for assessing the efficacy of three different gutta-percha obturation techniques during root canal therapy. **Materials & methods:** 75 extracted single rooted teeth (mandibular first premolars) were obtained and were stored in Saline. Three groups were formed: Group A – 25 single rooted teeth were obturated with Lateral condensation, Group B – 25 single rooted teeth were obturated with Single cone technique, and Group C – 25 single rooted teeth were obturated with Obtura II technique. The extent of Dye penetration was measured using Stereo microscope of 20x magnification. Measurements were recorded from the apex of the tooth to the most coronal extent of the dye penetration. All the results were recorded in Microsoft excel sheet and were analysed by SPSS. **Results:** Mean microleakage among specimens of group 1, group 2 and group 3 was found to be 0.25 mm, 0.24 mm and 0.28 mm respectively. While making inter-group comparison, non-significant results were obtained. **Conclusion:** All the three obturation techniques can be used with equal effectiveness in patients undergoing root canal therapy.

Key words: Gutta-Percha, Obturation

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INTRODUCTION

Dental caries is a biofilm-mediated, sugar-driven, multifactorial, dynamic disease that results in the phasic demineralization and remineralization of dental hard tissues. Caries can occur throughout life, both in primary and permanent dentitions, and can damage the tooth crown and, in later life, exposed root surfaces. The balance between pathological and protective factors influences the initiation and progression of caries. This interplay between factors underpins the classification of individuals and groups into caries risk categories, allowing an increasingly tailored approach to care.¹⁻³

Since the introduction by Bowman in 1867, Gutta-percha has been the most commonly used solid core endodontic obturation material worldwide. The root canal was packed with this non-plastising gutta-percha in cold lateral compaction, which was gradually moved towards a thermoplastising rubber-like material aimed at increasing root canal adaptability. The cold lateral condensation technique is the most frequently used obturation techniques by general dentists, and it is used in many countries, such as Belgium, Hong Kong, India, Iran, Jordan, Saudi Arabia, Turkey, UK and the USA.⁴⁻⁶

The root canals are provided with accessory and lateral channels, bag bottoms and communications between different conduits. Some of these areas are difficult to seal using traditional techniques. The lateral filling technique has been the most widely used. However, with this method many irregularities occur in the final mass of the gutta-percha as well as difficulty in reproducing some channels and existing anfractuositities. In order to eliminate some of these problems, the technique of vertical condensation of tempered gutta-percha was described. From here, new methods were introduced that employ thermoplasticized gutta-percha at high or low temperature. Different studies have shown that these techniques achieve a better seal. Obtura II and ultra fill: both are thermoplasticized gutta-percha injection systems that use a gun and needles of different calibers to take the gutta-percha into the root canal. They are similar techniques but they differ in some aspects.^{7- 9}The present study was undertaken for assessing the efficacy of three different gutta-percha obturation techniques during root canal therapy.

MATERIALS & METHODS

The present study was undertaken for assessing the efficacy of three different gutta-percha obturation techniques during root canal therapy. A total of 75 extracted single rooted teeth (mandibular first premolars) were obtained and were stored in Saline.

Inclusion Criteria:

- Caries free
- Completely formed
- Single rooted with an unobliterated straight canal and root length of 14 mm.
- Tooth extracted for Periodontal & Orthodontic reasons.

Root standardization of 14 mm was done with slow speed micro motor hand-piece under a constant water flow. The specimens were stored in sterile water until the procedure was performed. All the specimens were randomly divided into three groups and access cavities were prepared using diamond burs with air rotor handpiece. After pulp tissue removal from plup chamber, # 15 K- file were introduced into canal until it was seen at the tip of apical foramen. Pro Taper rotary files were used to clean and shape the canals using 17% EDTA as a canal lubricant. Each of the root canal was dried using paper points (Pro Taper size F4). Instrumented single rooted teeth were randomly assigned one of the three groups. These three groups include

Group A – 25 single rooted teeth were obturated with Lateral condensation.

Group B – 25 single rooted teeth were obturated with Single cone technique.

Group C – 25 single rooted teeth were obturated with Obtura II technique.

The patency of individual canal were checked with a# 10 K-file, after which the apical stop was checked

with ProTaper file F4. Each canal was then be irrigated with 2 ml of 3% NaOCl followed by normal saline and dried with absorbent paper points. All canal preparations and obturations were performed by the operator under aseptic environment throughout this study. Obturation was done in all the specimens as per their respective study groups. All the teeth were coated except the apical 3 mm with two layers of nail varnish, allowing each layer to dry between coats. The roots were immersed in a sealed bottle containing 2% Methylene blue dye upto 3 mm from the apical portion of the root leaving rest of the root portion out of dye. The roots were removed from the dye and rinsed with tap water. The roots were kept in 5% nitric acid solution for 5 days. Samples were then placed in methyl salicylate for enhancing the translucency, and at the end of third day complete transparency were achieved. The extent of Dye penetration was measured using Stereo microscope of 20x magnification. Measurements were recorded from the apex of the tooth to the most coronal extent of the dye penetration. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software.

RESULTS

In the present study, a total of 75 freshly extracted single rooted tooth specimens were analysed. All the specimens were broadly divided into three study groups with 25 specimens in each group. Mean microleakage among specimens of group 1, group 2 and group 3 was found to be 0.25 mm, 0.24 mm and 0.28 mm respectively. While making inter-group comparison, non-significant results were obtained.

TABLE 1: Distribution of specimens into different study groups

Group	Type of obturation technique	Number of specimens
Group 1	Lateral condensation technique	25
Group 2	Single cone technique	25
Group 3	Obtura II	25

TABLE 2: Mean microleakage among different study groups

Microleakage	Group 1	Group 2	Group 3
Mean (mm)	0.25	0.24	0.28
SD	0.055	0.069	0.079

TABLE 3: Individual group comparison of mean microleakage

Multiple comparison	t-value	p-value
Group 1 versus group 2	0.996	0.127 (non-significant)
Group 2 versus group 3	1.740	0.228 (non-significant)
Group 1 versus group 3	1.112	0.775 (non-significant)

DISCUSSION

The debridement and neutralization of any tissue, bacteria or inflammatory products within the root canal system is important for endodontic success. The outcome of endodontic treatments does not rely on a proper disinfection process only, but also on tight-sealed fillings of the canals as barriers to prevent re-infection. Therefore, root filling material is necessary to obturate the root canal in fluid tight seal 3-dimensionally on the main canal as well as the accessory canals. The ideal root filling material should have inert properties, good adhesive ability and result in voids-free obturation along the root canals.⁶⁻⁸

Root canal obturation should be ended to the apical constriction. Many obturation techniques and equipments are presented so far to enhance and improve the quality of root canal seal. These include cold lateral condensation, vertical condensation, obtura II, System B, Ultrafill, Thermafill, Successfill, Simplifill, thermomechanical condensation, and chloroform dip technique. Lateral condensation technique is one of the most common methods of root canal obturation.⁹⁻¹¹ Hence; the present study was undertaken for assessing the efficacy of three different gutta-percha obturation techniques during root canal therapy.

In the present study, a total of 75 freshly extracted single rooted tooth specimens were analysed. All the specimens were broadly divided into three study groups with 25 specimens in each group. Mean microleakage among specimens of group 1, group 2 and group 3 was found to be 0.25 mm, 0.24 mm and 0.28 mm respectively. Sinhal TM et al evaluated sealing ability of newly introduced C-point system, cold lateral condensation, and thermoplasticized gutta-percha obturating technique using a dye extraction method. Sixty extracted maxillary central incisors were decoronated below the cemento-enamel junction. Working length was established, and biomechanical preparation was done using K3 rotary files with standard irrigation protocol. Teeth were divided into three groups according to the obturation protocol; Group I-Cold lateral condensation, Group II-Thermoplasticized gutta-percha, and Group III-C-Point obturating system. After obturation all samples were subjected to microleakage assessment using dye extraction method. One-way analysis of variance revealed that there is significant difference among the three groups with P value ($0.000 < 0.05$). Tukey's HSD post hoc tests for multiple comparisons test shows that the Group II and III perform significantly better than Group I. Group III performs better than Group II with no significant difference. All the obturating technique showed some degree of microleakage. Root canals filled with C-point system showed least microleakage followed by thermoplasticized obturating technique with no significant difference among them.¹¹

In the present study, while making inter-group comparison, non-significant results were obtained. Safai P et al compared microleakage in a tapered single-cone method versus lateral and vertical condensation after diving simulation. One hundred and thirty five extracted single-rooted teeth were used. Following instrumentation and irrigation to #30.06 Mtwo rotary system, obturations were performed in three groups of 45 teeth: Group 1, tapered single-cone with Endoseal MTA sealer; Group 2, lateral condensation with AH26 sealer; Group 3, vertical condensation with AH26 sealer. At all three pressures, the least microleakage was recorded in Group 3, vertical condensation. Although the differences between vertical condensation, lateral condensation, and tapered single-cone methods were statistically significant ($P < 0.001$), the vertical condensation and lateral condensation groups did not differ from each other ($P > 0.05$). Vertical condensation may be the best technique, based on sealing ability, for people who frequently experience pressure alterations.¹² Elenjikal MJ et al compared the quality of root fillings in artificially created internal resorption cavities filled with warm vertical compaction, lateral condensation, Obtura II along with System B, E and Q plus along with System B, and Thermafil, and to calculate the percentage of gutta-percha, sealer, and voids using an ImageJ software. Results between the warm vertical compaction (group I), lateral condensation (group II), Obtura II with System B (group III), E and Q plus with System B (group IV), and Thermafil (group V), group III showed the highest percentage of gutta-percha plus sealer and gutta-percha, and least number of voids, which was statistically significant ($P < 0.000$). It can be concluded that Obtura II along with System B was found to be the most suitable obturation technique for the management of teeth exhibiting internal resorption. Thermafil was found to give the poorest obturation quality when used to fill the teeth with internal resorption.¹³

CONCLUSION

From the above results, the authors concluded that all the three obturation techniques can be used with equal effectiveness in patients undergoing root canal therapy.

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