|| Print ISSN: 2589-7837 || Online ISSN: 2581-3935 ||
International Journal of Medical Science and Diagnosis Research (IJMSDR)
Available Online at www.ijmsdr.com
PubMed (National Library of Medicine ID: 101738824)
Original Research Article
Volume 4, Issue 3; March: 2020; Page No. 28-32

COMPARATIVE STUDY ON APICAL SEALING ABILITY: LATEST NOVEL SEALER VERSUS TRADITIONAL SEALERS WITH BIOCOMPATIBLE OBTURATION SYSTEM AN IN-VITRO STUDY

Bhavika Bhavsar[1], Piyushi M.Tiwari[2], Narendra P.Tiwari[3], Thingujam Debica[4]

[1]Professor and HOD, Department of Conservative Dentistry and Endodontics, RKDF Dental College & Research Centre, Bhopal, Madhya Pradesh

[2]PG Student, Department of Conservative Dentistry and Endodontics, RKDF Dental College & Research Centre, Bhopal, Madhya Pradesh

[3]Assistant Professor, Department of Physiology, People's College of Medical Sciences, Bhopal, Madhya Pradesh

[4]PG Student, Department of Prosthodontics, RKDF Dental College & Research Centre, Bhopal, Madhyapradesh

Conflicts of Interest: Nil

Corresponding author: Dr. Bhavika Bhavsar

Introduction

Obturation of root canal system is the most important step in successful root canal treatment. It is defined as, the three dimensional filling of the entire root canal system as close to the cementodentinal junction as possible[1] . The purpose of obturation is to seal the cleaned, shaped and disinfected root canal system and to prevent re-infection good obturation should create a good seal; this includes apical and coronal seal as well as lateral seal. There have been several materials and techniques developed to achieve [2] .However, irregularities such as fins, isthmuses, and lateral canals are often present and can pose challenges to clinicians during obturation[3]. Hermetic apical seal are the goals of endodontic treatments, which cannot be obtained without using a sealer because gutta-percha does not bond to dentin walls and the sealer is capable of filling imperfections and increasing the adaptation[4]. Recently, bioceramics have gained popularity in the modern practice of endodontics because of their physicochemical and biological properties[3] & resin based sealers are formulations to improve the characteristics such as flow, setting time, and adhesion, allowing their use as endodontic sealers[5]. resin–based sealers that are specifically designed for endodontic application. This genre of bondable root canal sealers has been aggressively promoted with the highly desirable property of creating monoblocks within the root canal space. Gutta percha does not chemically bond to the dentin wall hence, does not fulfill the ideals of monoblock system. The term monoblock refers to the scenario wherein the canal space become perfectly filled with a gap-free, solid mass that consists of different materials and interfaces, with the purported advantages of simultaneously improving the seal and fracture resistance of the filled canals[6].Single file nickel-titanium (NiTi) instruments with heat-treated special alloys, different manufacturing methods and rotary have been used increasingly due to their popularity and reduction of instrumentation time and procedural errors in complex canal systems [7]. There are a variety of techniques used to obturate the root-canal system, which can be divided into two basic groups: cold lateral compaction or warm vertical compaction [8]. Warm vertical (WV) percha has been shown to lead to satisfactory results in terms of homogeneity and to fill a high percentage of the root canal area with gutta-percha material[9]. The present study was conducted to compare the apical sealing ability of three different obturating techniques & to determine establishment of bond between gutta percha with different sealers. To evaluate the empty spaces at the apical of the canal by macro-lens photography'. To evaluate lateral bond of sealers with dentinal wall.

Materials and Method:

Total 30 mandibular premolar having single root canal were taken. All premolars were cut at a distance of two millimeters apical to the cementoenamel junction with the help of carborundum disc and decoronated at 17mm Mounted on the wax block then working length is taken by Rapex-6 Electronic apex locator. .Biomechanical prepration is carried out using X-Smart Plus Endomotor (Dentsply maillefer, switzerland) and with AF BLUE S-one single file rotary system(Fanta rotary file 25, 4%) at 400 rpm, 2.5N· crown-down technique according to the manufacturer's instructions. The final enlargement was carried out depending upon the initial size, 3%sodium hypochlorite was used to irrigate the canals between each instrument. After the final enlargement the canals were irrigated with normal saline using disposable syringe and needle of twenty-six gauge. The canal was dried with sterile paper points.

Canal Obturation

Group A- Obturation With Gutta Flow 2Sealer (ColteneENDO) & densely packed the obturation (n=10). This is cold filling system of root canal.

- **Group B**- Obturation with down pack warm vertical condensation using obturating pen((walldent)with

sealmaxR-bismuthoxide, matheramine, titanium oxide (maarc) resin based sealer,(n=10) Down packing /Warm vertical condensation obturation system(figure:1) with optimum apical pressure to achieve the tight seal of root canal using obturation pen & resin based sealer

- **Group C** - Lateral condensation obturation using zinc oxide eugenol sealer (n=10)

The access cavity was sealed with composite and the teeth were stored in 100% humidity. One week post obturation period was needed. one week to ensure the setting of the sealer.

Microleakage Measurements

The obturated roots were dried with cotton pellets and coated on their external surfaces with two coats of nail polish, except for apical two millimeter that apical area covered with modeling wax. After the nail polish had dried. They were thoroughly washed with normal saline. The teeth were left to dry for twenty-four hours. Then roots were placed in methyl-salicylate for three hours .Linear dye penetration was measured by vertical sectioning teeth, for each specimen with Macro-Lens photography.

In Macro Photography a camera with a single lens reflex (Macro lens DSLR camera-140x power, Canon) is used) .

Calculation- TNLA= TSA-TLA (figure.1)

TNLA (Total Non Leakage Area)

TSA (Total surface area per unit of square) – TLA (Total Leakage Area)

Total Surface Area of Apical Half=11.16mm^2(figure.2)

TLA=Total surface per square of diameter of apical section

TLA=L X W of Leakage (in mm)^2

The same formula is applied for all the specimen in the study & statistical analysis is done by collected data. The results are given on the basis of statistical analysis.

STATISTICAL ANALYSIS-

Type of Data is Quantitative

TYPE OF TEST-

Mann-Whitney (Wilcoxon) Test-

The specimens in group "B" shows minimum dye penetration as compared to group "A".Group "C" is shows maximum dye penetration.

Table 1:

	Group -A	Group -B	Group -C
Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
	2.06 ± 1.19	1.196 ± 0.79	2.994 ± 1.3

The results is highly significant when **inter group comparison** is done.

Table 2: Intergroup comparison between Group A and Group B

	Group-A (n=10) Mean ± SD	Group-B (n=10) Mean ± SD	Mann Whitney 'U' test
Group A VS Group- B	2.42 ± 1.19	1.196 ± 0.79	19.92
'p' value RESULT / SIGNIFICANCY		HIGHLY SIGNIFICANT	0.0002

Results

The specimens of our study were evaluated under higher magnification, which was required for the measurement of dye penetration in millimeter.

In the present study maximum amount of dye penetration was noticed in lateral condensation technique as compared to vertical condensation /downpack with resin sealer and single cone with guttaflow-2 sealer. The least dye penetration was observed in the vertical condensation /downpack method (figure.3).

Discussion

Root canal obturation in a 3-dimensional space with a stable, nontoxic material and the creation of a hermetic apical seal are the goals of endodontic treatments[4] .

There have been several materials and techniques developed to achieve this,however, all the materials and techniques are believed to show evidence of leakage to some degree[2]. The final objective of endodontic procedures should be the total obturation of the root canal space. Biologic necessity requires the elimination of the protein degradation products, bacteria, and bacterial toxins which emanate from necrotic and gangrenous root canalsIn the case of a coronal cavity, the space usually can be visualized easily, whereas in the case of the root canal system, the filling must be most complete in regions beyond the visibility of the dentist, deep at the apical foramen[10]

Practical Aspects of Obturation[11]

The main steps in the sequence of root canal obturation are:

- Choosing a technique and timing the obturation
- Selecting master cones
- Canal drying, sealer application
- Filling the apical portion (lateral and vertical compaction)
- Completing the fill
- Assessing the quality of the fill

Minimal amounts of root canal sealers are biologically compatible, are used in conjunction with the core filling material to establish an adequate seal". (American Association of Endodontists, 1994).Clinician should choose

a path of treatment that will result in best possible cleaning & shaping of the root canal system, coupled with an obturation technique that will provide a 3-D seal, apically, laterally, and coronally within the confines of the root canal system. We have progressed in endodontic obturation to realize that the sealer is the key to obtaining a true fluid tight seal. The challenge, more specifically, has been to find a sealer that would simultaneously bond to the canal wall as well as to the gutta-percha cone or a similar core material [12]. Nowadays, gutta-percha is still the most commonly used material for endodontic obturation As gutta-percha does not bind by itself to the root canal walls, it must be used in conjunction with sealers in order to optimize the sealing process[13]

Obturation technique:

The ability of obturation techniques to fill the prepared root canal space completely and create a hermetic seal has been questioned (Kersten 1988)[14]. There are different techniques that are used to obdurate the root‐canal system. Cold lateral (CL) condensation is the most widely used and considered to be the gold standard technique. In 1996, Buchanan created the continuous wave (CW) obturation technique, which was a modification of Schilder's warm vertical condensation technique. This obturation technique is considered less time consuming, provides less microbial coronal leakage, and adapts better to grooves and depressions of the canal walls and lateral canals than CL compaction Some studies reported that fillings created using thermal methods demonstrate better adaptation than those using cold Gutta‐percha.[15] Smear layer produced during instrumentation may interfere with adhesion and penetration in to dentinal tubules of intracanal medicament or root canal sealer during obturation. Prior to obturation smear layer should be removed and dentin interface thoroughly dried. Various experimental methods have been used to assess micro leakage fallowing obturation, including the use of radioisotopes, dyes, proteins, bacterial leakage, and endotoxin penetration, as well as the use of the electrochemical, fluometric, and scanning electron microscopic examination, and spectrophotometry[16].

In this dye leakage study, methylene blue dye was used because it shows a high sensitivity and its particles are of a similar dimension to microorganisms and their metabolites[17].

Warm vertical condensation:

Vertical condensation of gutta-percha forms the basis for many techniques, such as the master cone sectional, warm gutta-percha, and thermoplasticized techniques. A master cone is fitted short of the corrected working length with resistance to displacement. A heated plugger is inserted in to the canal and gutta-percha condenses, forcing the plasticized material apically.

The process is repeated until the apical portion has been filled. The coronal space is back filled using small segments of gutta-percha by placing in to the root 3 - 4 mm sections approximately the size of the canal, applying heat, and condensing the gutta-percha with a plugger.

It has been found that a higher percentage of the canal area is filled with gutta-percha in oval canals using the warm vertical condensation technique. Advantage of warm vertical compaction technique includes movement of the plasticized gutta-percha and filling of canal irregularities and accessory canals. It is difficult to obturate curved canals with this technique. Disadvantage include risk of vertical root fracture and extrusion of material in to the periradicular tissues[16].

Although temperature rise is a prerequisite in warm obturation techniques, it is potentially harmful[18]. Nowadays, it is generally accepted that any temperature rise on the root surface should be kept to within 10_C to avoid bone injury[19] . The temperature increase in an epoxy resin sealer in a closed system with simulated surrounding tissues at 37_C was lower than expected from published root surface temperature measurement studies. The continuous wave technique produced the highest temperature rise with a maximum increase of 9.1_C[20].

Adequate sealing of the root canal by obturation is necessary as it acts as a barrier and prevents bacterial infiltration Disturbance of the apical sealing can lead to bacterial invasion through the root canal, often resulting in reinfection and failure of the root canal treatment[21]. A new silicone-based sealer (GuttaFlow) has been introduced as one of various roots filling material. GuttaFlow is 2 in 1 cold, fluid obturation system that mixes sealer and gutta-percha together. It consists of a polymer matrix, which is filled with very finely ground gutta‐percha.GuttaFlow contains nanosilver. Nanosilver is metallic silver that is uniformly dispersed on the surface of the filling[17].

Group B- Down Pack Vertical Condensation Obturation technique is classic thermoplastic method to produce a homogenous mass of gutta percha with resin based sealer, Sealmax-R was used .This sealer is appropriate for warm compaction procedures because it is heat tolerant and that is setting reaction because it is not influenced by warm vertical compaction technique. This technique applied the

optimum apical pressure_to achieve the tight seal of root canal which encircles the wide area & closely adhere to dentinal wall which in turn minimizes the risk of micro leakage in apically[16]

In the present study, the group A– Obturation with gutta flow2 which is alpha phase flowable gutta percha is given

the second best when compared with down pack and lateral condensation. For gutta flow2, the manufacturers claim that the sealer expands 0.2% on setting. The expansion enhances the sealer flow into the dentinal tubules. However gutta flow2 also showed poor wetting on the root dentin surface because of the presence of silicone, perhaps producing a high surface tension force, making the spreading of these materials more difficult. high and low temperature inject able techniques were significantly better than the lateral condensation techniques.

Lateral condensation group/Group- C), voids, spreader tracts, incomplete fusion of gutta percha cones, and lack of surface adaptation were seen.

Macro-lens photography involves a single lens reflex (SLR) camera with its stand. In Macro-Lens Photography a camera with a single lens reflex is use. This method proved to give superior estimation of the extent of dye penetration for evaluation. The microleakage assessment was easier and quicker as the whole root could be visualized in one image[22]

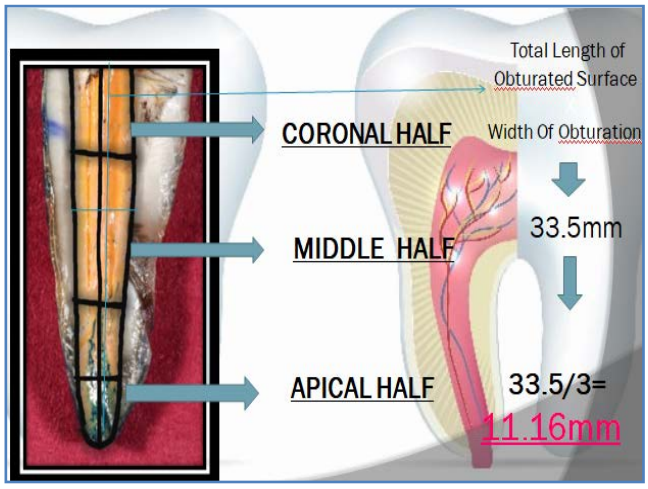

Figure 1: Showing three divisions of sectioned specimen

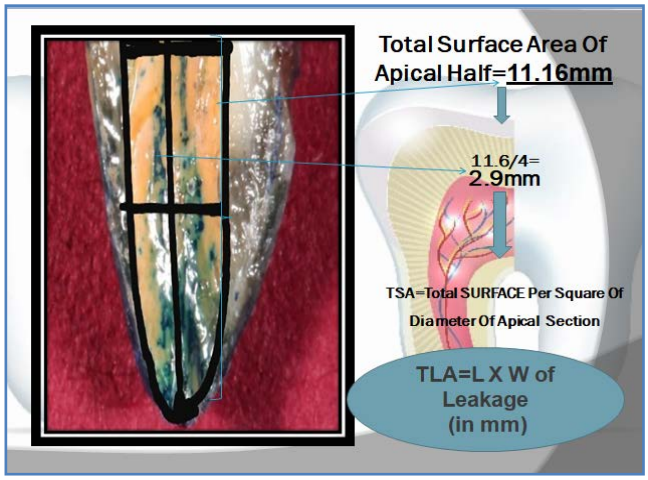

Figure 2: Showing apically leakage area

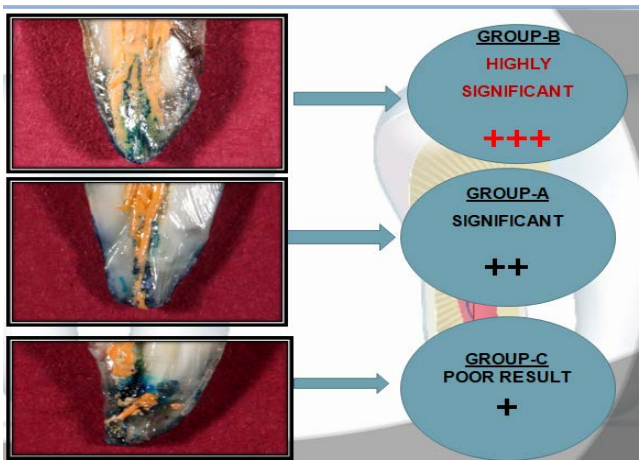

Figure 3: Comparative results of all three groups

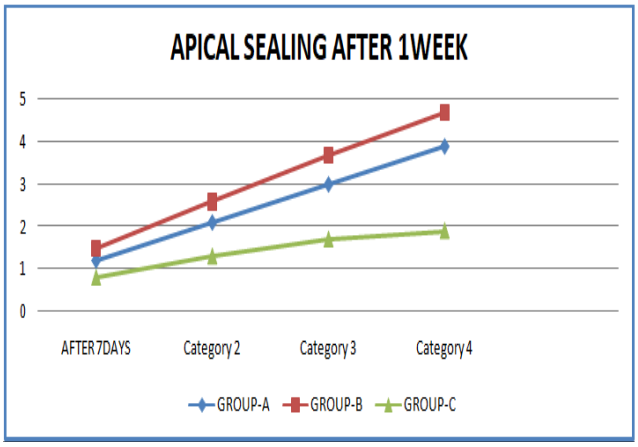

Figure 4: Graph Demonstrating Apical Sealing Ability After One Week

Conclusion

Within the parameters of the study, it can be concluded that microleakage is common finding in all the sample tested. This study proves down pack vertical obturation system with resin based sealer showed better apical sealing ability (figure.4) of the root canal as it cover the wide surface of root canal and resin based sealer is closely adhere to dentinal wall as compared to obturation with gutta flow 2 sealer.

References

1. Dr. Prandya, V. Bansode:*{ Obturating Materials present and past: A review :IOSR, Journal of Dental and Meical Science(IOSR-JDMS}:IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)(2018*
2. R. Vahid Roudsari, S.jawed *:{Modern Endodontic Principles Part5: Obturation.} (2018)*
3. A.Elizabeth :(*Clinical Outcome of Non-Surgical Root Canal Treatment Using a Single-cone Technique with Endosequence Bioceramic Sealer: A Retrospective Analysis)*: https://doi.org/10.1016/j.joen.2018.02.019 *Jounal Of Endodontics* (2018)

4. L.Antonio :{*Percentage of Gutta-percha–filled Areas in Canals Obturated by 3 Different Techniques with and without the Use of Endodontic Sealer}*: https://doi.org/10.1016/j.joen.2017.09.019 *Jounal Of Endodontics*: (2017)

5. E. Assmann *Dentin Bond Strength of Two Mineral Trioxide Aggregate–based and One Epoxy Resin–based Sealers.* , doi:10.1016/j.joen.2011.10.018 *Jounal Of Endodontics*: (2017)

6. K.Young: {*Critical Review on Methacrylate Resin–based Root Canal Sealer}* doi:{10.1016/j.joen.2009.10.023*} . Jounal Of Endodontics*: (2010)

7. Ozgun A. K.et al:{*Comparison of continuous wave and cold lateral condensation filling techniques in 3D printed simulated C-shape canals instrumented with Reciproc Blue or Hyflex EDM}:* | https://doi.org/10.1371/journal.pone.0224793 : PLOS ONE (2019)

8. Lea C.S.et al :{*Comparison of the Obturation Density of Cold Lateral Compaction Versus Warm Vertical Compaction Using the Continuous Wave of Condensation Technique*}:*VOL. 31, NO. 1, JANUARY: . Jounal Of Endodontics*: *2005*

9. Shan E.S. *:{Quality of root canal fillings using three gutta-percha obturation techniques:} dx.doi.org/10.5395/rde.2016.41.1.22* {*Korean Academy of Conservative Dentistry:* (2016)}

10. H. Schilder,(Filling Root Canals in Three Dimensions): *JOE:2006* — Volume 32.

11. American association of endodontist: Canal Preparation and Obturation: An Updated View of the Two Pillars of Nonsurgical Endodontics:*AAE:2016*

12. K. Mustajibuddin et al: (Recent Root Canal Filling Materials And Techniques - A Review): *International Journal of Recent Advances in Multidisciplinary Research: Vol. 03, Issue 12, pp.2038-2042, December, 2016.*

13. P.Machado et al**: (**Experimental Resin-Based Monoblock EndodonticObturation System): *Hindawi BioMed Research International:* Volume 2019, Article ID 3512606.

14. L. Gutmann, P. Saunders et al: (An assessment of the plastic Thermafil obturation technique Part 2Material adaptation and sealability): *Inumatiomil Endodontt Jounml: (1*991) 26,179-183.

15. A. Almohaimede, M. Almutairi Et Al:((Micro‐ Computedtomographic Analysis Filling Porosity Of Two Different Obturation Techniques) *Original Article: 2019 Saudi ournal of Oral Sciences | Published by Wolters Kluwer - MedknowOf J*49.36.30.84]

16. K. Girish :(New Root Canal Obturation Techniques: A Review) *EC Dental Science* 11.2 (2017): 68-76.

17. P.Prajakta et al:(A comparison of apical sealing ability between GuttaFlow and AH plus: An *in vitro* study): *Journal of International Society of Preventive and Community Dentistry*2020, IP: 49.36.30.84*]:*

18. F Dimopoulos, , et al (2017) :Temperature Rise on the Plugger Surface of Commercially Available Gutta-percha Heating Devices: Basic Research—Technology *JOE* — Volume3 -, - 2017.

19. C.Rong et al : (Periodontal blood flow protects the alveolar bone from thermal injury during thermoplasticized obturation: a finite elementanalysis study) *:* Basic Research—Technology:*JOE — Volume 44, Number 1, January 2018*

20. [20]D.David et al:(Real-time Intracanal Temperature Measurement During Different Obturation Techniques-Basic Research—Technology): *JOE – 2018:*

21. Nurmeisari, N Djauharie1 et al :(Comparison of Sealing Ability in the Apical Third of Tooth Root Canals after Post Preparation and Obturation with MTA Sealer and Epoxy Sealer): *IOP Conf. Series: Journal of Physics: Conf. Series 1073 (2018) 062018.*

22. A. Chawla et al, :(Assessment of apical seal obtained by three obturating techniques using dye penetration method and macro lensphotography: An in-vitro study): *Journal of Endodontics 27,692-5.*