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# Experimental assessment of sealer bio ceramic wall matching in first and third apical areas by scanning electron microscope

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## ABSTRACT

This study was aimed at investigating experimental assessment of sealer bio ceramic wall matching in 1th and third apical area by Scanning Electron Microscope (SEM).In this experimental study, thirty single root and single channel human teeth extracted were prepared by file rotary (FKG/Switzerland) connected to electric endodontic (Dentsply, Maillefer, Swiss). Teeth were divided into two groups including 15 teeth: group A were obdurate with sealer bio ceramic (BRASSELER USA Total Fill BC Sealer). Group B were filled by sealer AH-26. Root channels were filed by lateral compaction. All samples placed in 37 centigrade degrees and in 100 percent humidity. Sample was cut 3 millimeters from apical end of root channel. Finally, SEM images were taken and wall matching level was measured. Data were tested by one-way ANOVA and after LCD experiment they were analyzed. Results indicated that considering wall matching, there is no significant relation between similar section of two sealer section namely first section of AH-26 sealer with first section of sealer bio ceramic, second section of AH-26 sealer with second section of bio ceramic and between third sections of AH-26 sealer with third section of sealer bio ceramic while wall matching of both sealer is similar. In sealer bio ceramic first section has better seal and wall matching than third section. Wall matching of sealer bio ceramic was similar to AH-26 sealer.

**KEY WORDS:** WALL MATCHING, SEALER BIO CERAMIC, AH-26, SCANNING ELECTRON MICROSCOPE (SEM)

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## INTRODUCTION

In the past, success in endodontic treatment was identified by three factors including debridement, sterilization, and channel obturation with equal importance for each one. In one primitive radiography study about success and failure, Ingle indicated that 58% of treatment failure is due to defected obturation (Ingle et al, 1994). Forming and cleaning trend determines decontaminated level and ability of filling root channel space; thus channel obturation is reflection of forming and cleaning. Main reason of pulp and pre apical diseases is bacterial (Kakehashi et al, 1965). Evidence show that root channel system cannot completely be cleaned and disinfected and it is necessary to fill root channel space in order to elimination of leaking (Heard and Walton 1997). Obturation of channel prevents coronary leaking and bacterial contamination and seals apex against pre apical tissue liquids and remained drivers in the channel (Delivanis et al.1983 and Silva Almeida et al. 2017).

Different endo dentin materials have been recommended for filling root space. Most methods use a central material and sealer. Sealer is necessary for core material in all methods and it provides stiff sealing against liquids. Root channel sealers are necessary things for sealing space of crown wall and main cone. Sealers also fill voids and root channel irregularity, secondary, lateral channels and space between applied gutta-percha cones and also they act as tripper during filling. Some standards of an ideal sealer include: providing real connection between main material of obturation and crown, not solving with tissue liquid during connection, being bacteriostatic, and finally creates an apical and lateral and crown seal and maintains it (Grossman and Oliet 1988 and Setia et al 2014).

Sealer can be reason of root treatment failure due to micro leakage that happens in the space between sealer, crown, sealer and core. Chemical connection of sealer to channel wall on one side and on the other side obturation material of gutta-percha creates a mixture of mono block by which there is minimum channel micro leakage (Pawar et al 2014 ).Most popular sealers are zinc oxide and eugenol mixtures, hydroxide calcium sealers, glass ionomer and resins. Resin sealers are AH-26 sealers (Dentsply, Maillefer and Swiss) that are used for a long time, they have adhesion property, they don't have eugenol and slowly stiffens (De Moor and De Bruyne 2004; Al-Haddad and Che Ab Aziz 2016; Savadkouhi and Fazlyab 2016; Ahuja et al. 2016).

It is stated that when this combination is in the tooth it has ability of hydroxide apatite and chemical connection. Bioceramic sealers are the most important biocermics which have best role in reducing micro leakage and increasing prognosis of root treatment by forming mono block and chemical connection to channel wall. One popular bio ceramic sealer is Total Fill BC Sealer produced by BRASSELER USA factory. This sealer is accessible as injectable mixed paste which is based on combination of silicate calcium which is unsolvable. It does not need water for being stiffened. It does not need to be mixed. Working time and setting time is 4 hours in room temperature. When channel is dry, setting time reaches to 10 hours. Most bubble and most complexity are in first and third apical area of channel which has effect on treatment prognosis (Vertucci 1984). Micro leakage is main reason of endodentic failure which can happen between gutta-percha and sealer, sealer and crown and also in micro bubbles which exist in sealer. Edge match indirectly reflects ability of sealing filler material of root end which is very important. Assessment of edge match of root end fillers by scanning electron microscopy can give information about ability of this material sealing (Shokouhinejad et al. 2014; Ghorbanzadeh et al. 2014). Bio ceramics of ceramic combinations are the best ecofriendly mixtures which have been recently produced and its contents include zirconium oxide, calcium silicate, calcium phosphate, hydroxide and filler and other, (Pawar et al., 2014, Utneja et al. 2015; Jitaru et al. 2016 and Silva Almeida et al. 2017).

Bioceramic sealers can increase wall matching and can reduce microleakage specially in apical area due to formation of mono block mixture and chemical connection to channel wall thus, in this study we aimed at assessing wall matching of bioceramic sealer in first and third apical areas of tooth root channel.

## MATERIALS AND METHODS

### PREPARATION OF SAMPLES

In this experimental laboratorial study, thirty single root and single channel were extracted from upper jaw and lower jaw of people due to hopeless prognise periodontal. For this study double blind and teeth randomly divided into two groups. In all groups, radiology images were taken and they were studied considering lack of crack, breaking, curvature, and calcification of channel. Then teeth were floated for 5 minutes in 5/25% sodium hypochlorite. Consequently, remained tissues and clean mass were washed from teeth and were kept in normal saline. Teeth crow were cut by hand piece with high speed under water spray. Working length was measured by entering 15 file K file (Dentsply, Maillefer, Swiss) into root channel until file top then one millimeter was reduced. Channels of all roots were prepared to 35,36% taper by rotary file connected to electric endodential hand piece (Dentsply, Maillefer, Swiss) in all

teeth, number 40 race was used as widener of channel crown area while 6% race number 40 was used for middle area of channel. Then 35,6% transferred to working length. Tooth crack must not be observed in applied rotary files. Washing was made by 10 millimeter sodium hypochlorite solvent, 5/25% disposable plastic syringe with gauge 27 (BD. plastipak, India). After preparation, root channels were washed by one-mile litter EDTA17% and then with 5 milliliter 2/5% sodium hypochlorite for elimination of smear layer. Finally root channels were washed with 3 milliliters saline strilled and dried with paper point (Dentsply, Maillefer, Swiss).

## SEALING ROOT CHANNELS

Teeth are divided into two 15 teeth groups:

Group A included 15 teeth and were obturated with 35-6% gutta and sealer bioceramic ( BRASSELER USA Total Fill BC Sealer) while their master apical gutta was 35-6% which impregnated to bioceramic sealer and transferred to working length. Then spreader 25 (Dentsply, Maillefer, Swiss) was transferred until it penetrates. Then secondary gutta were transferred to length of spreader influence; this process was performed until maximum penetration was continued to 3 to 4 millimeter. Then accessible gutta were extracted by hot chisel and remained gutta were condensed vertically in channel span and then the hole was filled and dressing. Group B including 15 teeth were filled by lateral compaction and with gutta 35-6% and sealer AH-26. While their master apical gutta was 35-6 percent which impregnated by AH-26 sealer and it transferred to working length. Then spreader 25 was transferred until it penetrated, and then secondary gutta was transferred to 25% length of spreader penetration; this was continued until maximum penetration of spreader reached 3-4 millimeter. Next, accessible gutta was extracted by hot chisel while remained gutta was condensed vertically in channel span and the hole was wound dressed and filled.

All samples were kept in $37^0$ degrees and 100% humidity for one week in order to facilitate completion of sealer setting. Sample were placed in blocks and marked from 1 to 30. these sample were taken to cutting place then three 1 millimeter sections were provided from three millimeter root apical (first and third apical).

### Assessment by Scanning Electron Microscope (SEM) SEM

For observing by SEM, cut parts were dehydrated. Then samples were mounted, and sputter covered with gold then they observed under scanning electron microscope.

In order to assess wall matching following process was performed:

Width of marginal gap was filled as maximum distance of material and root channel crown directly was measured in thousandth scale by another researcher for preventing bias.

Data were analyzed by SPSS software $20^{th}$ version. In order to compare wall matching in experimental groups we used ANOVA test and for pairwise comparison after experiment of LCD was applied. Level of significance was p<0/05.

## RESULTS

Level of wall matching of sealer in lateral compaction in first and third apical area is shown in table 1:

Results of ANOVA test showed that there is significant difference wall matching among groups (p=0/005).

Results of LSD test illusterated that considering wall matching, there is no significant difference between similar section of both sealer that is mean first section of AH-26 sealer(figure1) with first section of sealer bioceramic(figure4), second section of AH-26 (figure2)

Table 1. Level of wall matching of sealer in lateral compaction in first and third apical area is shown

| Maximum | Minimum | Standard deviation | mean | number | | |
|---|---|---|---|---|---|---|
| 0/0620 | 0/0200 | 0/0109 | 0/034 | 15 | First section | Sealer AH-26 |
| 0/0920 | 0/0101 | 0/0320 | 0/037 | 15 | Second section | |
| 0/0920 | 0/0110 | 0/0186 | 0/06 | 15 | Third section | |
| 0/0750 | 0/0200 | 0/0168 | 0/038 | 15 | First section | Bioceramic sealer |
| 0/0900 | 0/0200 | 0/0219 | 0/044 | 15 | Second section | |
| 0/0800 | 0/0210 | 0/0185 | 0/054 | 15 | Third section | |

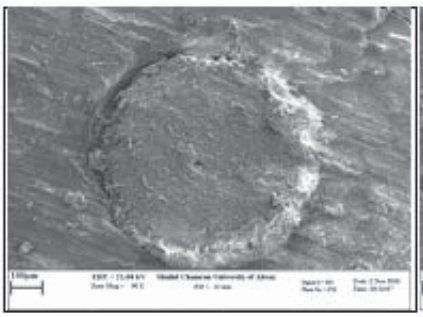

FIGURE 1.

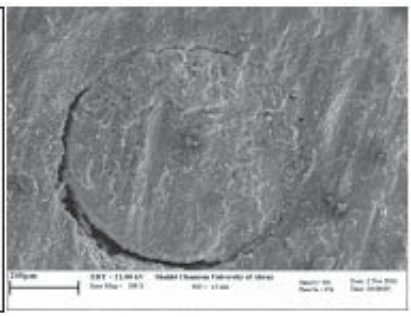

FIGURE 2.

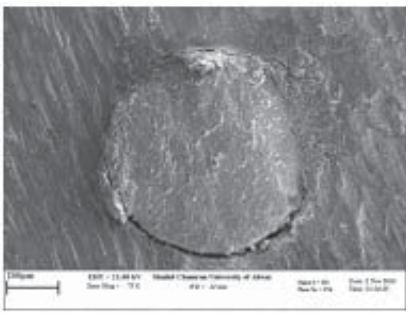

FIGURE 3.

with second section of bioceramic (figure5) and third section of AH-26 sealer (figure3) with third section of sealer bioceramic(figure6) (p>0/05).

In AH-26 sealer, third section significantly enjoys more microscopic sapce level than first section (p=0/001) and second section (p=0/004) so it has less wall matching. Thus first section had significantly better seal and wall matching than than third section. Second section has significantly better seal and wall matching than third section.

Cross sections: three millimeters at the end of channel apical in AH26 sealer group from left to right includes figure one to figure three

Figure one: first one millimeter figure two: second one millimeter, figure three third one millimeter

Cross sections: three millimeters at the end of channel apical in bioceramic sealer group from left to right includes figure four to figure six

Figure four: first one millimeter, figure five: second one millimeter, figure six third one millimeter

In sealer bioceramic, third section significantly enjoys more microscopic space than first section (p=0/04) so there is less wall matching. And first section has significantly better seal and wall matching than third section.

Third section of sealer bioceramic has significantly microscopic space and less wall matching than first section (p=0/012) and second AH-26 sealer (P=0/29). In addition, third section of AH-26 sealer has significantly more microscopic space and less wall matching than first section (p=0/006) and second sealer bioceramic (p=0/039).

## DISCUSSION

Sealing tooth channel has main importance for prevention from micro leakage and penetration bakeries into pre apical and it is very crucial for determining prediognosis of root treatment. Coronal micro leakage is considered as a vital factor in failure of root treatments. Main factor for avoiding microleakage is applying sealers and elimination of smear layer. For this reason, clinical assessment of different kinds of sealers ability against coronal penetration of bacteria's and effect of cleaner solvents sounds rational for purification of smear layer (Farhad et al. 2007). Using sealers with appropriate properties including connection, matchless, and tubule penetration has two positive consequences: First, creating seal in channel due to higher interface f sealer with crown wall; second burial of remained batteries in crown tubules which in fact it is anti-bacterial effect of sealers (Mohammadian et al. 2017).

Aim of this study was to investigate experimental assessment of sealer bioceramic wall matching in 1th and third apical area by Scanning Electron Microscope (SEM). Gutta percha is in connection with sealers and it is most common applied filler in root channel (Mohammadian et al. 2017). So in this study, in order

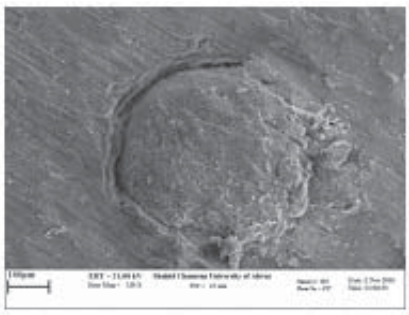

FIGURE 4.

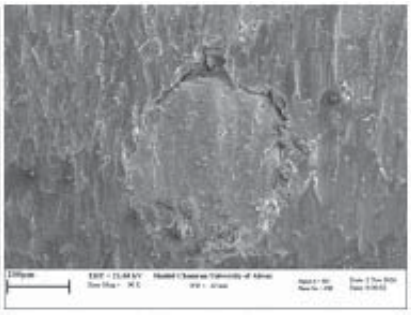

FIGURE 5.

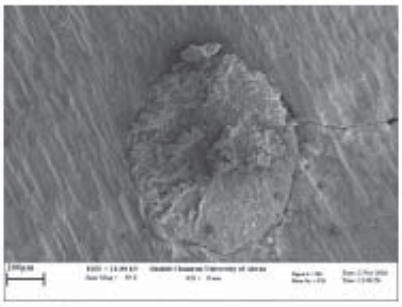

FIGURE 6.

to fill root channel, gutta percha has been used.In this study, cold lateral compaction method was used because this method is the most common place method for oburation of channel. This method is able to be used in most clinical conditions and it provides controlling during obturation (Cailleteau and Mullaney 1997; Anantula and Ganta 2011; Kumar et al. 2012). In addition, cold lateral compaction method is golden standard in endo dentic (Anantula and Ganta 2011; Kumar et al. 2012).

Existence and nonexistence of smear layer has main role in apical seal created by different method of obturation. Studies indicated that smear layer can act as a way for leakage of micro-organism and it can be as a source for growth and activities of different bacteria's in crown tubules (Kumar et al. 2012). Hence, in this study root with 5/25% sodium hypoclorit solvent and 17% EDTA were disinfected for elimination of smear layer.

In this study for assessing wall matching, SEM was used. Because it has higher accuracy and ability of better magnification in interface. SEM uses electromagents insteade of lenzes so it provides chance of more control on level of magnification for the reseearche and at results images are provided more transparent (Punitha P and Shashikala K. 2011).

Results indicated that considering wall matching, there is no significant relation between similar section of two sealer section namely first section of AH-26 sealer with first section of sealer bioseramic, second section of AH-26 sealer with second section of bioceramic and between third sections of AH-26 sealer with third section of sealer bioceramic while wall matching of both sealer is similar. In sealer bioceramic first secton has better seal and wall matching than third section. Producers claim that hydrophilic characteristic of endodentic points of polymeric use remained humidity and form self-sealing on setting radially and without developing in axial orientation. While alkaline nature of most bioceramic products change crown collagen fibers and facilitates sealers penetration to crown tubules.

In this study, it was observed that penetration of sealer bioceramic Total Fill BC is similar to resin sealer AH-26. Mohammadian et al (2017) reported that in root apical area ,considering sealer interface with crown, there is no significant difference between two sealer bioceramic BC and resine sealer AH-plus.

In another study, by Pawar et al (2014) have indicated that sealer bioceramic endosequence and resin sealer resilon epiphany enjoys better apical seal in compare to AH-Plus resin sealer. However in this study in order to measure seal they used color penetration method.In study of SEM by Polineni et al (2016) considering wall matching MM-Seal resin sealer has the least gap level byt there was no difference between MM-Seal resin sealer with Endosequence sealer bioceramic.Interface of sealer-crown is a crucial area in sealed root channels. Sealers with epoxy resin and bioceramic are not shrinked during setting and it can be the reason of appropriate matching in gap between crown and sealer in compare to sealers based on eugenol, (Mohammadian et al. 2017).

In this study in AH-26 sealer third section significantly enjoyes more microscopical space than first section (p-0/001) and second (p-0/004) so has less wall matching. Thus, first section has better wall matching than third section. Second section has signifcantly beteer seal and wall matching than third section. In sealer bioceramic, third section significantly has more microscopic space level than first section (p-0/04) so has less wall matching. Hence, first section significantly has better seal and wall matching than third section.

Results ilusterated that third section of Total Fill BC bioceramic sealer has significantly more microscopial space and less wall matching than first and second sections of AH-26 sealer. In addition, third section of AH-26 sealer has significantly more microscopial space and less wall matching than first and second sections of Total Fill BC bioceramic sealer. These results can be due to difference of different sections of root in apical area. Polineni et al (2016), using SEM, coronal sections showed that it enjoys more wall matching as compared to apical sections.

This difference between coronal and apical level can be due to less compaction and more diameter of crown tubule in apical level which cause less perpetration of sealer. Moreover, elimination of smear later in one third apical area is problematic and it may act as physical obstacle which is interference of sealer to root channel crown (Polineni et al. 2016).

Generally, it must be considered that leakage totally cannot be eliminated from treated root channels; lateral and additional channels and other anatomic differences along with periapical pressure have main role as progressive factor.

Considering that the areas which are commonly unaffected by instrumentation and irrigation during root canal preparation, where a more viscous material like sealer can't reach, can open up spaces for leakage and decrease the chances of success.

## CONCLUSION

Results indicated that there is no significant difference between similar sections of both sealer it means that considering wall matching, first section of AH-26 sealer with first section of bioceramic sealer Total Fill BC, second section of AH-26 sealer with second section of sealer bioceramic sealer Total Fill BC and third section of AH-26 sealer with third section of sealer bioceramic

total Fill BC. In sealer bioceramic total Fill BC first section has significantly better seal and wall matching than third section.

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