

A Comparative *in vitro* Study to Evaluate Sealer Distribution using Bidirectional Spiral and Traditional Sealer Placement Techniques

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ABSTRACT

The success of endodontic treatment depends on the apical seal. Root canal sealer placement plays an important role in achieving hermetic apical seal. The effectiveness of sealer placement depends on placement technique, viscosity of sealer, canal configuration, quality of canal debridement, and size of instrumentation. In this study, efficacy of traditional sealer placement techniques is compared with bidirectional sealer using resin-based sealer. Forty-four human anterior teeth with straight canals were selected and prepared with step back method. These specimens were divided into four groups of 10 specimens each and obturated by using four different methods of sealer placement techniques with single master cone and access cavity sealed with amalgam. Results of the study suggest that best sealer coverage was provided by lentulospiral and bidirectional spiral. Bidirectional spiral prevents the apical extrusion of the sealer and thus periapical irritation, which commonly occurs with the other three methods. Bidirectional spiral has more success in filling of the lateral canal than the other techniques.

Keywords: Bidirectional spiral, Endodontic, Epoxy resin sealer.

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INTRODUCTION

The ultimate goal of endodontic therapy is the total obturation of the root canal system and creation of a hermetic apical seal. It is sealing off the complex root canal system from the periodontal ligament and bone, which ensures the health of the attachment apparatus against breakdown of endodontic origin.

In all accepted obturation techniques, gutta-percha is the preferred core-filling material, but it has the disadvantage of being nonadherent to canal walls.¹ Thus, a sealer is used to fill the space between gutta-percha and the canal walls. Root canal sealer is important to the integrity of the obturation of the root canal space, but it has been suggested that the effective distribution of root canal system is very essential to obtain the best possible apical seal.²

The proper sealer placement is very essential for obtaining adequate seal as inadequate sealer placement may result in voids in the root canal filling and permit bacterial microleakage from the canal into the periapical tissues.^{3,4} This leakage has been identified as a potential cause of endodontic failure. Excess sealer in the canal space can result in its extrusion beyond the periapical foramen, resulting in a foreign body reaction in the periapical tissues, which can prevent or delay healing.⁵

A variety of sealer placement techniques have been described in the literature.⁶ These include the use of file, reamer, lentulospiral, absorbent paper point, gutta-percha cone, and an ultrasonic file. Still, there are queries regarding the sealer placement and its dispersal during the lateral condensation of gutta-percha and about the efficacy of traditional placement techniques in placing the sealer throughout the apical and coronal extent of root canal.

Bidirectional spiral is another instrument for sealer placement. It is made up of coronal grooved spirals traveling in an apical direction, which carry the cement apically, and reverse spirals on the apical end rotate in an unwinding direction out of canal, and thus, they never bind and carry the cement coronally. It produces the apical and coronal cement flow simultaneously. When these opposite flows of cement meet, they are forced to travel laterally, thoroughly coating the walls and filling any lateral canals or other invaginations that may exist.^{7,8}

MATERIALS AND METHODS

Forty-four freshly extracted human maxillary anterior teeth were taken and stored in 10% formalin before use. All selected teeth were radiographed to check for internal resorption and obliterated canal space. All teeth had single unobliterated straight root canal. Crowns of teeth were removed at the cemento-enamel junction.

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All teeth were prepared using K-files and Gates Glidden Drills using step-back method of instrumentation. The apical portion of all teeth was enlarged to No. 40 K-file.

These prepared specimens were then divided into four groups of 10 specimens each and a control group of four specimens.

The prepared root canals were thoroughly dried with absorbent paper points. Master cone was selected for each specimen, which exhibited tug back at working length.

EZ-fill epoxy resin sealer (EDS, USA) was used. Two drops of epoxy gel and one scoop of powder were mixed to a creamy consistency as per the manufacturer’s instruction and were used to coat the canal walls of all specimens.

Experimental Groups

- *Group I:* Specimens in this group were obturated using a No. 35 absorbent paper point for sealer placement.
- *Group II:* Specimens in this group were obturated using No. 35 K-reamer for placement of sealer.
- *Group III:* Specimens in this group were obturated using a lentulospiral, which would not bind in the canal at slow speed on a micromotor hand piece. The sealer was placed on a spiral and then placed into the canal and engaged for 5 seconds.
- *Group IV:* Specimens in this group were obturated using bidirectional spiral at a speed of 250 rpm for 5 seconds.

After obturating, all the access cavities were sealed with silver amalgam. All the specimens were then stored in physiological saline for 1 week at room temperature to ensure that sealer had set.

Control Group

Two specimens were prepared, but not obturated, while two specimens were obturated using only master gutta-percha without sealer.

These specimens were then cleared and examined under the microscope. The raw data of sealer coverage was tabulated and subjected to statistical analysis, which was done using Statistical Package for the Social Sciences (SPSS) for MS Windows release 6.1. Student’s unpaired t test was done to evaluate statistical significance between various groups at 18° of freedom.

RESULTS

The highest sealer coverage score in the apical third was found in group IV and lowest in groups I and II.

The highest sealer coverage score in the middle third was found in group III and lowest in group I.

The highest sealer coverage score in the coronal third was found in groups III and IV and lowest in group II.

Table 1: Statistical analysis of the groups

Region	Groups compared	p-value
Apical	I and II	1.00
Apical	I and III	0.039*
Apical	I and IV	0.002**
Apical	II and III	0.039*
Apical	II and IV	0.002**
Apical	III and IV	0.255
Middle	I and II	0.503
Middle	I and III	0.098
Middle	I and IV	0.159
Middle	II and III	0.247
Middle	II and IV	0.391
Middle	III and IV	0.736
Coronal	I and II	0.605
Coronal	I and III	0.492
Coronal	I and IV	0.464
Coronal	II and III	0.210
Coronal	II and IV	0.175
Coronal	III and IV	1.00

*0.01 < p < 0.05 – Significant at 5%; **p < 0.01 – Significant at 1%.

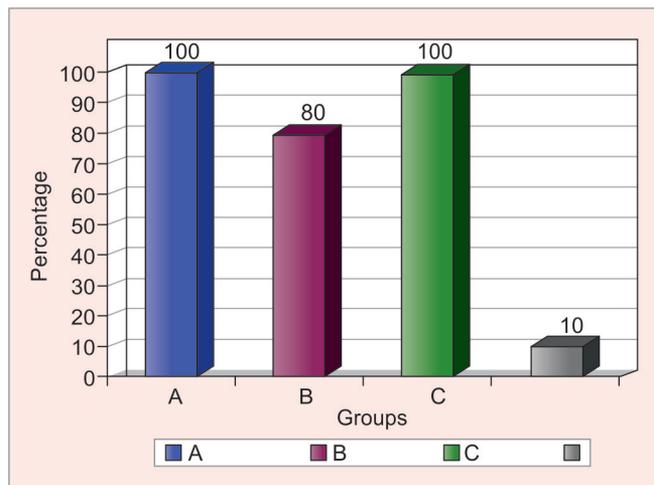
Table 2: Profile of sealer coverage

Groups	Mean sealer coverage		
	Apical third	Middle third	Coronal third
I	2.2 ± 0.789	2.1 ± 1.101	2.3 ± 0.949
II	2.2 ± 0.789	2.4 ± 0.843	2.1 ± 0.738
III	3.0 ± 0.816	2.8 ± 0.632	2.6 ± 0.966
IV	3.4 ± 0.699	2.7 ± 0.675	2.6 ± 0.843

Tables 1 and 2 show the statistical analysis. The calculated p values were compared at 5% level of significance and 1% level of significance at 18° of freedom.

Graph 1 shows the percentage of sealer extrusion in the four groups.

- Group I shows 100% sealer extrusion
- Group II shows 80% sealer extrusion
- Group III shows 100% sealer extrusion
- Group IV shows 10% sealer extrusion.



Graph 1: Percentage of sealer extrusion in the four groups

CONCLUSION

Within the design and constraints of this *in vitro* study, it was observed that

- Among four sealer placement techniques, the best sealer coverage was provided by the lentulospiral group and bidirectional group, while paper point showed least coverage.
- Bidirectional spiral prevents the apical extrusion of sealer and thus, the periapical irritation, which commonly occurs with the other three methods.
- In filling of lateral and accessory canals, the bidirectional spiral has better success than the other three methods.

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