



Stereomicroscopic Evaluation of the Adaptability Of Different Retro filling Materials (In Vitro Study)

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Abstract

The purpose of this in vitro study was to evaluate the marginal interfaces between tooth structure and the retro-filling materials.

Sixty teeth were divided into six groups of ten for each. The teeth were instrumented to a minimum of size no. 45 k-file, obturated with gutta-percha, resected perpendicular to their long axes and prepared to receive a retro-filling. The teeth were filled with amalgam, resin-modified GIC or light-cured composite resin. Each filling material was either applied with dentin adhesive or without dentin adhesive. Photomicrographs were made & examined by four evaluators.

Statistical analysis of the results revealed that the composite resin had better marginal adaptation than the amalgam & the glass ionomer cement, but the difference was non significant ($p>0.05$). In addition, the non-adhesive groups together had less marginal adaptation than the other groups and the difference was significant ($p<0.05$).

Composite resin retro-filling material had better marginal adaptation than other materials used and the dentin adhesive may have effect on the quality of the adaptation.

Introduction

When non surgical endodontic techniques are impractical or have failed to resolve peri-apical lesions of endodontic origin, peri-apical surgery with a root-end filling is the preferred type of treatment. The apical seal of a retro-filling material has been considered to be an important factor for successful peri-radicular surgery ⁽¹⁻²⁾.

Amalgam had been considered the retro-filling of choice until investigators pointed out its inadequacies for such use. Authors expressed concern over the content of free mercury in direct contact with the peri-apical tissues ^(1,3). Leakage studies ^(4,5) have shown poor results, and concern has been expressed with

electrochemical reactions ⁽⁶⁾ from amalgam . In a scanning electron microscopic study, Gartner & Dorn in 1992, ⁽⁷⁾ demonstrated interface gaps between amalgam and the prepared root ranging from 6 μ m to 150 μ m . Consequently, researchers have proposed the use of many alternative materials for retro-fillings that vary from composite resin and glass-ionomers to cavit, IRM and super EBA ^(1,7-8).

Materials and Methods

Samples preparation

Sixty extracted human single-rooted premolars were utilized in this

study. All teeth were autoclaved then stored in physiologic saline before use and throughout the experiment, because saline has been shown to preserve the morphologic and structural characteristics of the inorganic material ⁽⁹⁾.

Canal preparation

All teeth had cleaned from the caries lesions and canals were verified by passing a # 10 k-file through the apex. Working lengths were established 1.0 mm short of the anatomic apex by visually identifying the # 10 k-file at the apical foramen and subtracting 1.0 mm. All canals were instrumented to minimum # 45 k master apical file using a continuous tapered preparation ⁽⁷⁾ and flushed with 1.25% sodium hypochlorite after each file. The canals were then dried with sterile paper points and obturated using laterally condensed gutta-percha (Dia-dent, Korea) and N2 sealer. The coronal access openings were sealed with readymade ZnO/eugenol cement (Dorident, USA).

Root-end preparations

The root - ends were then resected perpendicular to the long axes of the teeth using a high speed hand-piece and air water spray with a tapered fissure bur (Komet, Germany) 2-4 mm from the anatomic apex. They were prepared for a retro-filling with the straight fissure bur (Komet, Germany) under water spray and tips. The teeth were prepared to a minimum depth of 3 mm because this is currently the accepted depth to ensure an apical seal of all resected tubules and provide enough material to prevent apical microleakage along the interface between the retro-filling material and the canal wall ⁽¹⁰⁾. The retro cavities were rinsed with saline and dried with paper points. The teeth were then

randomly divided into six groups of ten.

Root-end fillings

Teeth in group 1 were filled with resin-modified glass-ionomer cement (vitremer, USA), mixed according to manufacturer's recommendations, condensed into the preparation and the surface burnished with a ball burnisher and cured with light-cure unit according to the manufacturer's instructions. Group 2 was filled in the same manner as group 1 after application of the syntac single component adhesive and cured with light-cure unit according to the manufacturer's instructions. Group 3 was filled with light-cured composite resin (alpha-dent, USA), condensed into the preparation and surface finished with finishing bur. Group 4 was filled in the same manner as group 3 after application of the syntac adhesive. Group 5 was filled with spherical amalgam alloy (Megalloy, Dentsply, USA), triturated according to the manufacturer's recommendations, condensed into the preparation and surface burnished with a ball burnisher. Group 6 was filled in the same manner as group 5 after application of the syntac adhesive. Each sample was stored in saline until the examination.

Stereomicroscopic examination

All samples were air dried, and examined under stereoscopic microscope at 40 x of the tooth / retro-filling interface.

Evaluation

Post-operative-stereo-photo-micrographs were made of each specimen to compare the interface between the finished retro-filling material and the prepared root surface. Photo-micrographs of specimens were viewed at 40 x , because this magnification appeared to reveal the most detail while maintaining the

entire retro-filling / tooth interface . The photo-micrographs were evaluated by four independent observers, three experienced endodontists (Master of Science degree in Conservative Dentistry), and one second-year postgraduate student. An attempt was made to standardize each evaluator before viewing the photo-micrographs to reduce evaluator subjectivity. Each examiner evaluated the photo-micrographs at three different periods in an effort to test intra-judge reliability. Photographs were projected for the examiners to evaluate in a random order. The examiners were not aware of the group from which any sample was taken.

Rating scale

The interface was graded from 0 to 3, (0 =no space between the dentin wall & the retro filling material), (1 = 1-4 microns of space between the dentin wall and the retro-filling material), (2 = 4-8 microns of space present), and (3=>8 microns of gap present between the dentin and the retro-filling). The data were then statistically evaluated non-parametrically using Kruskal-Wallis one-way analysis of variance.

Results

The Retro-filling Materials

The rating scale for each group, are presented in table (1). By using Kruskal-Wallis one-way analysis of variance, the composite resin retro-filling material (group 3 and 4) had showed lower score than the amalgam and glass-ionomer cement groups and amalgam groups (group 5 and 6) had showed lower score than the glass-ionomer cement groups (group 1 and 2) , however , the difference was non significant ($p>0.05$)(Fig.1) .

The Dentin Adhesive

By using Kruskal-Wallis one-way analysis of variance , the adhesive groups together (groups 2, 4 and 6) had showed lower score than the non adhesive groups (groups 1, 3 and 5) , and the difference was significant ($p<0.05$) . For the glass-ionomer cement groups, the group 2 (with dentin adhesive) had showed lower score than the group 1 (without dentin adhesive) and the difference was significant ($p<0.05$) .

For the composite resin groups, the group 3 (without adhesive) had showed lower score than group 4 (with adhesive), however the difference was non significant ($p>0.05$). For the amalgam groups, there was no difference in the scores between group 5 and 6. (Fig. 2).

Discussion

Marginal adaptation as an indirect method of determining a retro-filling material's seal ability as has been established by Stabholz et al in 1985.⁽¹¹⁾ The criteria of our study used this indirect method along with the presence of space to evaluate the sealing ability of various materials. It appears that composite resin had excellent marginal adaptation & all the evaluators consistently rated these samples in the 0 or 1 category .These findings seem to agree with the premise of Gilheany et al in 1994.⁽¹⁰⁾ The excess material extending on to the resected root surface obscured the marginal interface in every sample to a varying degree, resulting in the evaluators making a more subjective rating of the samples. This subjectivity was amplified in these samples because the photomicrographs were only two - dimensional representations of three-dimensional object. The evaluators had trouble determining marginal adaptation from overfilling of

the preparation because only one plane was visible. One problem with the stereomicroscopic studies is that the teeth are dehydrated, which may lead to many cracks in the resected & filled root-end surfaces. When these teeth were evaluated a determination should be made between what was artifact & what was caused by the procedure itself. At higher magnification it was determined that the root fractures & large interface gaps in this study were artifact and occurred after the retro-filling was placed. We arrived at this conclusion because the retro-filling material interface & the canal walls were mirror images of one another. The large gaps were only seen along fracture lines or fracture planes. Therefore, many larger gaps that were present were not considered in the rating of the samples. This was also conveyed to the evaluators; examples were shown to clarify this problem before viewing the photomicrographs.

Conclusions

Under the circumstances of this study, the following conclusions are withdrawn:

- 1-Composite resin retro-filling material had better marginal adaptation than the other materials used.
- 2-The dentin adhesives used may have an effect on the quality of the adaptation.

References

- 1- Aqrabawi J. Sealing ability of amalgam, Super-EBA cement and MTA when used as retrograde filling materials. *Br Dent J.* 2000; 188(5):266-8.
- 2- Harty FJ, Parkins BJ, Wengraf AM. The success rate of apicoectomy. A retrospective study of 1016 cases. *Br Dent J* 1970;129:407-13.
- 3- Fisher EJ, Arens DE, Miller CH. Bacterial leakage of mineral trioxide aggregate as compared with zinc-free amalgam, intermediate restorative material, and super-EBA as a root-end filling material. *J Endodon* 1998; 24:176-9.
- 4- Vignaroli PA, Anderson RW, Pashley DH. Longitudinal evaluation of the microleakage of dentin bonding agents used to seal resected root apices. *J Endodon* 1995;21:509-12.
- 5- Thirawat J, Edmunds DH. Sealing ability of materials used as retrograde root fillings in endodontic surgery. *Int Endod J* 1989; 22:295-8.
- 6- Yatsushiro JD, Baumgartner C, Tinkle JS. Longitudinal study of two root-end filling materials using a fluid conductive system. *J Endod.* 1998;24(11):716-821.
- 7- Gartner A H, Dorn S O. Advances in endodontic surgery. *Dent Clin North Am* 1992; 36: 357-379.
- 8- Wu M-K, Kontakiotis E G, Wesselink P R. Long-term seal provided by some root end filling materials. *J Endodon* 1998; 24: 557-560.
- 9- Coviello J, Brilliant JD, Wright J. Preliminary scanning electron microscopic study of the chlororosin lateral condensation technique. *J Endodon* 1977; 3:54-62.
- 10- Gilheany PA , Figdor D , Tyas MJ : Apical dentin permeability and microleakage associated with root end resection and retrograde filling .*J Endodon* . 1994; 20: 22-6.
- 11- Stabholz A , Shani J , Friedman S. , Abed J : .Marginal adaptation of retrograde fillings and its correlation with seal ability. *J. Endodon* 1985; 11: 218-23.

Groups	Scores
1/ RM-GIC	111
2/ RM-GIC+DBA	76
3/ composite	55
4/ composite + DBA	51
5/ Amalgam	73
6/ Amalgam +DBA	72

Table (1) : Rating Scale For each sample

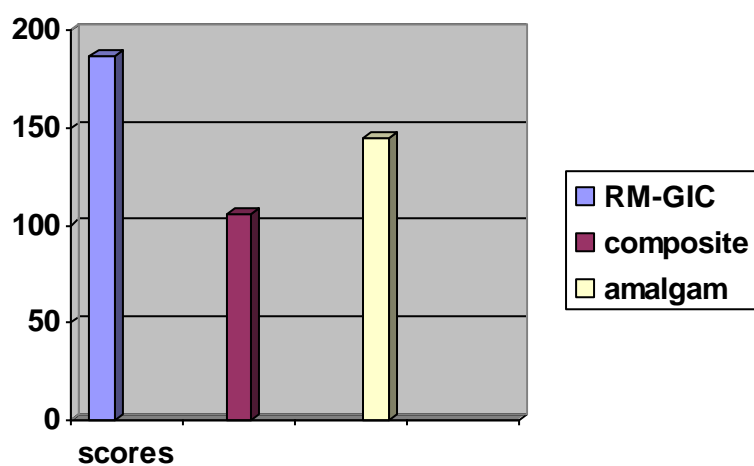


Fig.1: Differences between the retro-filling materials

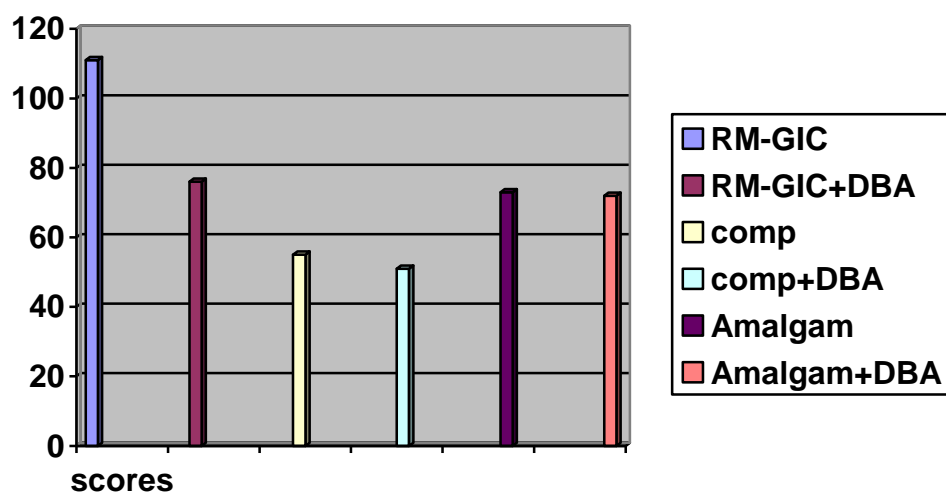


Fig. 2: Differences between the groups

