

Apical Leakage Using Various Sealers and Root Canal Filling Techniques

Carlos ESTRELA¹
Hildeberto Francisco PESCE²
Gilson Blitzkow SIDNEY³
José Antonio Poli de FIGUEIREDO⁴

¹*Faculdade de Odontologia, Universidade Federal de Goiás,
Goiânia, GO, Brasil*

²*Faculdade de Odontologia, Universidade de São Paulo,
São Paulo, SP, Brasil*

³*Faculdade de Odontologia, Universidade Federal do Paraná,
Curitiba, PR, Brasil*

⁴*Faculdade de Odontologia, Universidade Federal do Rio Grande do Sul,
Porto Alegre, RS, Brasil*

The aim of this study was to compare the apical leakage associated with several sealers and root canal filling techniques. Eighty maxillary central incisors were included in the study. Following cleaning and shaping, the root canals were filled by an active or a passive lateral condensation technique with the following endodontic sealers: Fillicanal (Grossman sealer), N-Rickert, Sealapex and AH-26. The teeth were immersed in a 0.5% methylene blue solution, pH 7.2, for 72 hours at 37°C and then cut longitudinally to reveal the canal walls. Apical leakage along the canal was measured using 20X magnification. The results are as follows: 1. All four sealers allowed apical leakage; 2. No statistically significant difference was observed between the sealers with the techniques studied; 3. When comparing active and passive lateral condensation techniques, Fillicanal, Sealapex and AH-26 showed statistically significant differences among themselves, with a lower extent to the active lateral condensation technique. N-Rickert sealer showed no significant differences between the techniques.

Key Words: root filling, sealers, apical leakage, lateral condensation.

Introduction

The success of root canal therapy depends directly on the correct cleaning, decontamination and shaping of the canal, in order to facilitate the insertion of the filling material into a clean and bacteria-free cavity. In order to reach these goals, several root filling techniques have been proposed (Yee et al., 1977; Nguyen, 1982; Tagger, 1984; Paiva and Antoniazzi, 1988).

Most techniques have as their main objective the adaptation of gutta-percha and a thin film of sealer to the root canal walls, making the canal system waterproof. However,

apical leakage associated with root filling is a serious problem, which is responsible for countless failures in root canal therapy.

Active lateral condensation is employed with the use of finger spreaders, aiming to offer more space between the master cone and the canal walls, permitting filling with a greater number of secondary cones, which would be better adapted within the canal.

Sampaio (1972) suggests the use of lateral condensation through the introduction of secondary cones following the master one, but without the use of finger spreaders. The objective is to avoid deformation of gutta-percha's original conical form.

Root canal sealers can have zinc oxide and eugenol, calcium hydroxide, epoxy resins or glass ionomer as a basic component. All of them are claimed, by the different manufacturers, to have good biological and physical properties.

The aim of this study was to evaluate the sealing ability of four different sealers: Fillcanal, N-Rickert, Sealapex and AH-26. The active and passive lateral condensation techniques were used.

Material and Methods

Eighty human maxillary central incisors that had neither internal resorption nor previous root filling were selected. The teeth were washed under running water and stored in saline solution for 24 hours. The pulp chambers were opened and the contents emptied with the aid of 1% sodium hypochlorite and a #15 k-type file. The teeth were stored individually in flasks containing saline solution.

The working length of each tooth was determined radiographically and corresponded to an apical limit of 1 mm short of the apex. The root canals were prepared at the cervical third with Gates-Glidden burs and at the apical third up to a k-type file #60. Sodium hypochlorite (1%) was used for thorough irrigation.

Following preparation, trisodic EDTA, pH 7.2, was used for five min, and the foramen was penetrated by a #15 file passed 2 mm beyond the foramen, in order to remove any residual apical plug of dentine. The teeth were then randomly assigned to four groups of twenty each.

For group 1, root canals were filled with gutta-percha cones and Fillcanal (Grossman sealer, Instituto de Química e Biologia S.A., São Paulo). An active lateral condensation technique, with the help of a finger spreader, was employed in 10 teeth, while the other 10 were filled by passive lateral condensation. The sealer used for group 2 was N-Rickert (Botica Veado D'Ouro Ltda., SP), and the twenty teeth were filled with the same techniques as above. Sealapex (Sybron-Kerr) was used for group 3, and AH-26 (Prodonto, SP) for group 4, using both the active and passive lateral condensation techniques.

The sealers were manipulated according to the manufacturers' instructions and were inserted into the root canal with the help of the master cone. Once the master cone was inserted, the root canal was filled until it was completely full of accessory cones, using the finger spreader or not, according to the protocol.

When filling was completed, the outer surface of the tooth was covered with quick polymerization epoxic resin (Brascola, SP), according to Robazza (1973), leaving the apical foramen region exposed. The teeth were then immersed in 0.5% methylene blue solution, pH 7.2, where they were kept for 72 hours at 37°C.

After this period, all teeth were washed in running water and embedded in hard gypsum blocks. Later, the teeth were longitudinally cut in a buccal-lingual direction, until the root canals were visible; the final sectioning was completed with sandpaper disc number 0.6.

The maximum leakage of methylene blue areas in the apical region was measured using a Carl Zeiss microscope (Model #40166) adjusted to a 20X magnification. Results were submitted to statistical analysis.

Results

Table 1 shows the results of the Tukey test applied to the type of sealer related to the filling technique, and to the filling technique related to the type of sealer.

Table 1 - Tukey test according to the mean values of the type of sealer and the lateral condensation (L.C.) technique.

| Sealer x Technique | Fillcanal | N-Rickert | Sealapex | AH-26 |
|--------------------|-----------|-----------|----------|--------|
| Active L.C. | 0.731 | 0.806 | 0.877 | 0.745 |
| Passive L.C. | 1.054* | 0.990 | 1.053* | 0.997* |

Significant minimum difference = 0.992.

*Significant at P = 0.01.

When active lateral condensation was used, the sealers had similar values, with discrete leakage, when compared to passive lateral condensation.

Among the sealers, only N-Rickert reacted similarly for the two filling techniques. Fillcanal, Sealapex and AH-26 showed significant differences for the techniques, with higher scores of apical leakage for the passive lateral condensation technique.

Discussion

One of the primary objectives of root canal filling is to achieve hermetic apical seal in order to prevent the infiltration of exudate and microorganisms between the dentine walls and the filling material, giving the apical and periapical tissues some rest, which will allow the organism to repair. The importance of the physico-chemical and biological properties of filling sealers as well as the filling technique applied are critical to successful outcome.

When comparing the sealing ability of some endodontic sealers using an active lateral condensation technique, Leal et al. (1979) noted that N-Rickert sealer showed the least leakage, followed by Fillcanal and Alfa Canal. On the other hand, Bonetti Filho et al. (1987) evaluated the sealing ability of different filling techniques for root canals using Fillcanal and found that the active lateral condensation technique was the most effective, showing the least average leakage. Hovland and Dumsha (1985) compared the apical leakage associated with two calcium hydroxide-based sealers and Grossman sealer, while using the lateral condensation technique. They found no differences between the sealers. According to Leal et al. (1987), Sealapex and AH-26 without silver showed less average leakages when compared to Fillcanal, but were similar statistically among themselves.

The results obtained from the present study showed no statistically significant differences (Tukey test) in apical leakage among the sealers with any of the filling techniques used. However, when comparing active and passive lateral condensation, Fillcanal, Sealapex and AH-26 showed significant differences in leakage values. N-Rickert was the only sealer that showed no difference between the techniques.

Some factors responsible for filling quality are sealer adhesiveness, dimensional stability and tissue tolerance (Holland et al., 1971; Grossman, 1976; Sampaio and Sato, 1984).

It should be kept in mind that no filling technique will accomplish the desired success if any of the previous procedures in endodontic therapy, such as access opening, cleaning and shaping, are not well performed.

Conclusions

1. All four sealers allowed apical leakage.
2. No statistically significant difference in apical leakage was observed between the sealers with the techniques studied.
3. When comparing apical leakage between the active and passive lateral condensation techniques, Fillcanal, Sealapex and AH-26 showed significant differences for each sealer, with lower values for the active lateral condensation technique. N-Rickert sealer did not show significant differences between the techniques.

References

- Bonetti Filho I, Leal JM, Dias AJM: Avaliação *in vitro* da capacidade seladora de diferentes técnicas de obtenção dos canais radiculares através da infiltração do corantes Rodamina B a 0,2%. Rev Odontol Clínica 2: 17-21, 1987
- Grossman LI: Physical properties of root canal cements. J Endod 2: 166-175, 1976
- Holland R, Souza V, Holland JRC, Nery MJ: Estudo histológico do comportamento do tecido conjuntivo subcutâneo do rato ao implante de alguns materiais obturadores de canais radiculares. Influência da proporção pó/líquido. Rev Ass Paul Cirurg Dent 25: 101-110, 1971

- Hovland EJ, Dumsha TC: Leakage evaluation *in vitro* of the root canal sealer cement Scalapex. *Int Endod J* 18: 179-182, 1985
- Leal JM, Carneiro SMA, Tedesco ADF, Mendes AJM: Avaliação comparativa da impermeabilidade de alguns cimentos de uso endodôntico, frente à penetração de radioisótopos. Influência do tempo de armazenagem. *Rev Bras Odont* 3: 27-32, 1979
- Leal JM, Bonetti Filho I, Leonardo MR, Simões Filho AP: Scalapex, AH-26 silver free e FillCanal. Avaliação *in vitro* do selamento apical através da infiltração do corante Rodamina B a 2%. Influência do tempo de armazenagem. *Rev Bras Odont* 19: 8-14, 1987
- Nguyen NT: Obturação dos canais radiculares. In: Caminhos da Polpa. Cohen S, Burns RC ed. 2 edn. 126-186, Guanabara Koogan, Rio de Janeiro, 1982
- Paiva JG, Antoniazzi JH: *Endodontia. Bases para a prática clínica*. 2 edn. Artes Médicas, São Paulo, 1988
- Robazza CRC: Contribuição para o estudo *in vitro* da permeabilidade da dentina radicular, quando do emprego de algumas substâncias de uso endodôntico. Ribeirão Preto, SP, Doctoral thesis, 1973
- Sampaio JMP: Contribuição ao estudo do processo reparador do tecido conjuntivo de ratos, quando da introdução de tubos de polietileno contendo dois materiais empregados na obturação de condutos radiculares nas suas fórmulas originais e acrescidas de delta-hidrocortizona. São Paulo, Doctoral thesis, 1972
- Sampaio JMP, Sato EFL: Avaliação da fluidez de vários materiais obturadores de canais radiculares. *Rev Inst Odont Paul* 2: 1-5, 1984
- Tagger M, Tanse A, Kats A, Korsen BM: Evaluation of the apical seal produced by a hybrid root canal filling method, combining lateral condensation and thermatic compaction. *J Endod* 10: 199-202, 1984
- Yee FS, Martin J, Krabron AA, Gran P: Three-dimensional obturation of the root canal using injection-molded thermoplasticized dental gutta-percha. *J Endod* 3: 168-174, 1977

Correspondence: Professor Carlos Estrela, Departamento de Cirurgia e Medicina Oral, Faculdade de Odontologia, Universidade Federal de Goiás, Praça Universitária s/n, Caixa Postal 35, 74001-970 Goiânia, GO, Brasil.

Accepted January 10, 1994