Protection of Endodontic Filling Remaining After Post Space Preparation.

Martha Siragusa*; María Julia Spoleti**; Pablo Spoleti ***

* DDS, PhD. Professor and Chair, Endodontics Department, Faculty of Dentistry, National University of Rosario, ARGENTINA. E-mail: msiragus@arnet.com.ar

** Bioch. Chief Bacteriology Service , Zona Norte Children's Hospital, Rosario, ARGENTINA

*** DDS, PhD. Assistant Professor, Endodontics Department, Faculty of Dentistry, National University of Rosario, ARGENTINA. E-mail: pspoleti@unr.edu.ar

INTRODUCTION

The ultimate aim of endodontic treatment is the complete obturation of the root canal system and the creation of an impermeable seal.

Many factors have been reported to play a central role in the failure of endodontic treatment. Microleakage has been described as the movement of ions, molecules, fluids or bacteria between the cavity wall and the restoration material.[1]

If apical microleakage is, in fact, a cause of failure in endodontic treatment, the loss of coronal seal should be considered an adverse factor.[2]

Bacterial microleakage on the cavity wall-restoration interface was first described by Mitchell (1959) and have been corroborated by different research groups /Hansen & Bruun 1971, Bränstrom & Nyborg 1972, Bergenholtz et al 1982, Browne & Tobias 1986).[3] Hovland and Dumsha observed that most of the leakage took place at the cement-canal wall interface or the gutta-percha-cement interface, implicating the sealer as the weak link in long-term successful obturation of the root canal. Because no sealer-cement or obturation technique consistently prevents percolation through the canal, it is critical to maintain a coronal seal to prevent microleakage into the canal space.[4]
The restoration of endodontically treated teeth is central to success. The final restoration creates a permanent coronal seal and protects the remaining dental structure, shape and function. The need for a meticulous restoration is evidenced by the fact that many endodontic treatments fail due to restoration flaws rather than as a result of a faulty endodontic treatment.[5,6]

Endodontically treated teeth exhibit somewhat particular problems at the time of restoration. Most teeth are so mutilated by caries, previous restorations and endodontic access that there is hardly any clinical crown to retain the final restoration. Frequently, only the roots are left to retain the prosthetic crown. The retention that is usually provided by the coronal walls must be sought elsewhere. Intraradicular anchorage is one of the possibilities.[7]

Many endodontically treated teeth are rehabilitated with post, core and crown.[8] Concern about the effect of post space preparation on apical seal have been expressed, due to the amount of remaining material that could be minimal.[9]
When the coronal portion of the root canal filling is exposed to oral flora, it may allow the contact of bacteria with the periapical tissues.[10] Coronal leakage after post space preparation may be more significant because there is less root canal filling material remaining.[11]

Post space preparation involves elimination of gutta percha up to the required length after canal conformation for post placement. Excess elimination of gutta percha may lead to a faulty apical seal. Thus, whichever elimination technique is selected, it must be applied cautiously to preserve sufficient gutta percha to guarantee an adequate apical seal. At least 4 mm of gutta percha are required.[12] It is noteworthy that the cemented post, regardless of its design or preparation technique, does not seal along its interface with the canal wall. The post does not fit tightly at the end of the preparation and thus does not come into intimate contact with the canal wall. The cement does not fully cover the interface. Saliva and bacteria can easily leak apically once they come into contact with the post.[13]

On Restorative Dentistry have been introduced recently many materials with combinations that allow a better bonding to enamel and/or dentin; to replace amalgam with composites as a major restorative material for posterior restorations condensable or packable composites have been developed, which have demonstrated fluoride release and a good bonding that diminish microleakage.[14]

Physical properties of packable composites such as a reduced initial polymerization shrinkage, a coeffi cient of thermal expansion close to that of the tooth structure, and a modulus of elasticity similar to that of amalgam have been reported.[15]

The purpose of this study were to assess the sealing capacity of the remaining endodontic obturation after un-filling the root canal; and to evaluate the sealing ability of endodontic filling after post space preparation.

METHODOLOGY

Twenty two extracted upper central incisors were selected and stored in saline until their use. They were sterilized for biosafety reasons in keeping with Tate and White[16] and according to the recommended infection control practices of the Center for Disease Control and Prevention (CDC, Atlanta, USA).[17]

The external surface of the teeth was cleaned with a gauze and the aid of an ultrasonic handpiece employed in periodontics. The crown was sectioned at the enamel-cement level to yield roots of equal length. The length of the root canal was measured passing through the apex a # 10 K file and subtracting 1 mm from that length. Each root was identified and each root length was recorded. The roots were treated endodontically using standardized technique with a # 50 K file as master apical file. The roots were obturated with gutta percha cones, Sealer 26 (Dentsply, Brazil), and lateral condensation technique.

The root canal was un-filled and shaped 48 hs or more after endodontic obturation using Largo drills (Maillefer, Switzerland) and leaving 5 mm of remaining obturation. The canals were cleaned with files tipped with cotton wool.

The teeth were divided at random into two groups of ten:

- GROUP A: following the prosthetic preparation described, no further treatment was applied, leaving the 5 mm of remaining endodontic obturation.

- GROUP B: after un-filling the root canal, the remaining residual obturation was protected with a coating of condensable packable, photocurable composite Sure Fil (Dentsply, USA).

Following un-filling of the root canals of Group B teeth, a layer of the adhesive system universal Prime & Bond 2.1 (Dentsply, Brazil) was applied within the canal and photopolymerized. The composite was then placed in the root canal, condensed with digital pluggers (Uniflex, Germany) and photopolymerized for 40 seconds.

One tooth was kept intact and used as a negative control. Another root was endodontically prepared with no obturation whatsoever and used as a positive control.

The technique described by Torabinejad,[18] Siqueira,[19] and Friedman.[20] was used to evaluate bacterial leakage. A hole in the bottom of an Eppendorf tube was made and the root fitted into the orifice. The tube around the root was sealed with a cyanoacryclate cement (La gotita, Akapol, Argentina). The external surface of the root and the tip of the tube were coated with nail varnish, with exception of a 3mm surface surrounding the root apex. (Figures 1, 2)

The Eppendorf tube was adapted to a test tube containing thioglycolate culture medium with an indicator in such a way that the root apex was suspended in it. The interface of both tubes was sealed with the same cyanoacrylate cement. The device was sterilized. (Figure 3)

To verify the sterility of the device, it was incubated at 37º C for 2 days to confirm no microbial growth. Once sterility had been confirmed, an innoculum of *Escherichia coli* was placed daily in the Eppendorf tube and kept at 37º C. Changes in the indicator of bacterial growth in the culture medium in the inferior tube were monitored daily.

When color changes were observed, the device was opened and the culture medium was cultured to identify the flora and confirm if it corresponded to the same strain employed in the innoculum.

RESULTS

After a forty days follow up all the teeth of the groups, except the negative control, showed bacteriological leakage. On the group A (no further treatment) leakage occurred on day 5, and on the group B (were a protective layer was placed) it was on day 15; the positive control has showed leakage since day one.

The day on which microleakage was observed for each of the specimens is presented in Table 1.

The recovered bacterial flora of each tube was identified to check that it was the same of the innoculum one.

Applying Bonferroni's t test, differences between the experimental groups were statistically significant ($p<0.05$).

DISCUSSION

The importance of obturation in endodontics is confirmed by the fact that in the first 24 hours there was microleakage in the positive control in keeping with previous studies and regardless of the method used to detect this phenomenon.[21,22,23]

Post space preparation should maintain an endodontic obturation that provides an adequate seal. This seal deserves evaluation.[24]

The use of bacterial innoculi to evaluate microleakages is considered more relevant in clinical and biological terms than the tests that employ dyes.[25,26,27] This method was developed to solve some constraints in studies with dye leakage.[28,29] Kersten and Moorer [30] showed that dyes are low molecular weight molecules and can enter sites that would be inaccessible to bacteria.

Wu et al.[31] proved that once the post-core has been constructed, there is no difference between a group with a remaining obturation smaller than 4 mm and a group with an intact obturation. However, we must conclude, accordingly with Barbosa et al.[11] that coronal microleakage is a fact (observed in both experimental groups) and must be avoided or controlled better, particularly when it is necessary to partially un-fill the canal to prepare the space for post placement.

We may conclude, as Metzger et al.[32] in a previous study, that the bacterial contamination of the space prepared for the post may lead to failure of the endodontic treatment. Three levels of prevention procedures should be considered: a) during post space preparation, b) between appointments if the treatment is not concluded in one session and c) during the functional life of the rehabilitated tooth.

Protection of the remaining endodontic obturation increased the number of days until the bacteria reached the root apex, what resembles the findings in animals of Barbosa et al.[11] although, in our case, leakage was not totally impeded.

Although placing an even layer of a dentin bonding agent in the canal walls of the post space is difficult and the procedure involved in applying the packable composite is somewhat cumbersome it does lead to a reduction in the risk of microleakage.

REFERENCES

1- Kidd EAM. Microleakage in relation to amalgam and composite restoration. British Dent J 1976;141:305-10.

2- Barriesi KM, Wlaton RE, Johnson WT, Drake DR. Coronal leakage of mixed anaerobic bacteria after obturation and post space preparation. Oral Surg Oral Med Oral Pathol 1997;84:310-4.

3- Matharu S, Spratt DA, PrattenJ, Ng Y-L, Mordan N, Wilson M, Gulabivala K. A new in vitro model for the study of microbial microleakage around dental restorations: a preliminary qualitative evaluation. Int End J 2001;34:547-53.

4- Galvan Jr RR, West LA, Liewehr FR, Pashley DH. Coronal microleakage of five materials used to create an intracoronal seal in endodontically treated teeth. J Endodon 2002;28:59-61.

5- Sjögren U, Hägglund B, Sundqvist G, Wing K. Factors affecting the long-term results of endodontic treatment. J Endodon 1990;16:498.

6- Vire DE. Failure of endodontically treated teeth: Classification and evaluation. J Endodon 1991; 17:338.

7- Restauración de dientes muy destruídos. En Fundamentos de Prostodoncia Fija. HT Shillingburg Jr, S Hobo, LD Whitsett. La Prensa Médica Mexicana S.A., cap. 7, pág. 130-1.

8- Baraban DJ. Restoration of endodontically treated teeth: an update. J Prosthet Dent 1988;59:553-8.

9- Ricci ER, Kessler JR. Apical seal of teeth obturated by laterally condensed gutta-percha, the Thermafil Plastic and Thermafil Metal Obturator techniques after post space preparation. J Endodon 1994;20:123-6.

10- Holland R, Cruz A, Souza V, Nery MJ, Bernabé PFE, Otoboni Filho JA, Dezan Junior E. Comportamiento de los tejidos periapicales frente a la exposición de la obturación endodóntica al medio oral. Estudio histológico en dientes de perros. Endodoncia 2000;54:99-108.

11- Barbosa HG, Holland R, de Souza V, Dezan Junior E, Bernabé PFE, Otoboni Filho JA, Nery MJ. Healing process of dog teeth after post space preparation and exposition of the filling material to the oral enviroment. Braz Dent J 2003;14(2):103-8.

12- Madison S, Zakariasen KL. Linear and volumetric analiysis of apical leakage in teeth prepared for posts. J Endodon 1984;10:422.

13- Messer HH, Wilson PR. Preparación para restauración y colocación de cemento temporal. En Endodoncia Principios y práctica. Walton – Torabinejad. Segunda Edidicón . Mc Graw-Hill Interamericana, 1999, cap. 15, pág. 288.

14- Staninec M, Kawakami M: Adhesión and microleakage tests of a new dentin bonding system. Dent Mater 1993;9(3):204-8.

15- Tung FF, Estafan D, Scherer W. Microleakage of a condensable resin composite: an in vitro investigation.Quintessence Int. 2000 Jun;31(6):430-4.

16- Tate WH, White RR. Disinfection of human teeth for educational purposes. J of Dent Educ 1991;55:583.

17- Recommended Infection Control Practices for Dentistry. Center for Disease Control and Prevention (CDC) Atlanta Estados Unidos. MMWR May 28,1993;42 Nº RR-8.

18- Torabinejad M, Rastegar AF, Kettering JD, Pitt Ford JR. Bacterial leakage of mineraltrioxide aggregate as a root-end filling material. J Endodon 1995;21:109-12.

19- Siquiera Jr JF, Rocas IN, Lopez HP, de Uzeda M. Coronal leakage of two root canal sealers containing calcium hydroxide after exposure to human saliva. J Endodon 1999;25:14-16.

20- Padachey N, Patel V, Santerre P, Cvitkovitch D, Lawrence HP, Friedman S. Resistance of a novel root canal sealer to bacterial ingress in vitro. J Endodon 2000;26:656-9.

21- Trope M, Chow E, Nissan R. In vitro endotoxin penetration of coronally unsealed endodontically treated teeth. Endod Dent Traumatol 1995;11:90-4.

22- Simons J, Ibanez B, Friedman S, Trope M. Leakage after lateral condensation with finger spreaders and D-11-T spreaders. J Endodon 1991;17:101-4.

23- Shipper G, Trope M. In vitro microbial leakage of endodontically treated teeth using new and standard obturation techniques. J Endodon 2004;30:154-8.

24- Abramovitz I, Lev R, Fuss Z, Metzger Z. The unpredictability of seal after post space preparation: a fluid transport study. J Endodon 2001;27:292-5.

25- Chailertvanitkul P, Saunders WP, MacKenzie D, Weeman DA. An in vitro study of the coronal leakage of two root canal sealers using an obligate anaerobe in microbial marker. Int Endod J 1996;29:249-55.

26- Behrend GD, Cutler CW, Gutmann JL. An in vitro study of smear layer removal and microbial leakage along root-canal fillings. Int Endod J 1996;29:99-107.
27- Siqueira J, Rocas I, Loper H, Uzeda M. Coronal leakage of two root canal sealers containing calcium hydroxide alter exposure to human saliva. J Endodon 1999;25:14-6.
28- Torabinejad M, Borasmy U, Kettering JD. In vitro bacterial penetration of coronally unsealed obturated root canals. J Endodon 1993;16:566-9.
29- Malone KH, Donnelly JC. An in vitro evaluation of coronal microlekage in obturated root canals without coronal restorations. J Endodon 1997;23:35-8.
30- Kersten HW, Moorer WR. Particles and molecules in endodontic leakage. Int Endod J 1989;22:118/24.
31- Wu M-K, Pehlivan Y, Kontakiotis EG, Wesselink PR. Microleakage along apical root fillings and cemented posts. J Prosth Dent 1994;79:264-9.
32- Metzger Z, Abramovitz R, Abramovitz I, Tagger M. Correlation between remaining length of root canal fillings after immediate post space preparation and coronal leakage. J Endodon 2000;26:724-8.

Received: December 2006
Submitted: March 2007

TABLES

		DAYS									MEAN	STAND
GROUP	n	1	5	10	15	20	25	30	35	40		DEV.
GROUP A	10	0	1	4	7	10	10	10	10	10	12.50	4.58
GROUP B	10	0	0	0	1	2	4	9	9	10	26.40	5.82
+ CONTROL	1	1	1	1	1	1	1	1	1	1		
- CONTROL	1	0	0	0	0	0	0	0	0	0		

Table 1. Day in which leakage was observed in each group.

FIGURES

Fig. 1 Root fitted on the Eppendorf tube and it adapted into a test tube lid.

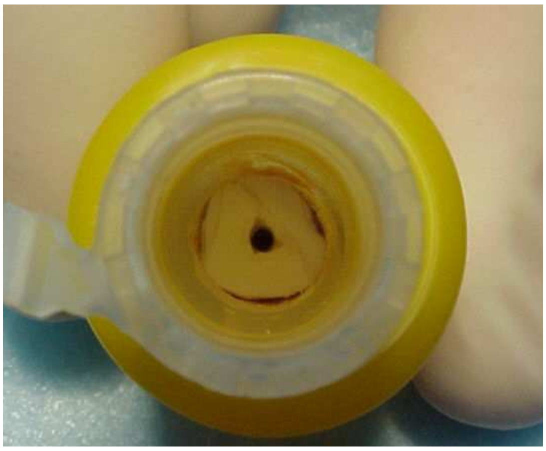

Fig 2. Top view of the device

Fig. 3. Device for leakage evaluation