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Research Article

Evaluation of Root-End Resections Perfc Cr: YSGG Laser with and without Place Root-End Filling Material

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Abstract

Microleakage following root-end resections has a direct influence
This study compared the microleakage after root-end resections pe
with or without the placement of MTA, and evaluated the pres
GP/MTA and the canal walls. Ninety single-rooted teeth were ins
and divided into 3 experimental groups: (I) root-end resectio
(parameters: 4.5 w, 30 pps, 20% water and 50% air); (II) Li
MTA; (III) the burs were used followed by root-end fillings with M
resected with the burs. The samples were prepared for microleal
immersed in 1% methylene blue, decalcified, cleared, and evalu
software. Epoxy-resin replicas of the root-ends were analyzed by
results were 0.518±1.059, 0.172±0.223, and 0.158±0.253, for
samples, respectively, (ANOVA P=.02). The laser (7831.7±2329.2
presented gaps. Whereas, none was found in the MTA (ANOVA
group demonstrated statistically less leakage and better adaptati
groups. There was no correlation between the size of the gaps and

1. Introduction

Root-end resection may be the treatment of choice for teeth in wh
eliminate existing periapical pathosis [1, 2]. Thus, following the
ends and prevent apical microleakage, improving the outcome of s

The surgical procedures target the elimination of the etiological fac
the root canal system apically, promoting healing of the perira
millimeters of the root eliminate most of the apical deltas, isthmus
that specific area of the root canal system. Consequently, the mic
preventing the seepage of their byproducts to the periapical tissue

Carbide burs mounted on high-speed hand-pieces provide ade
However, little is known if the type of bur used or the degree of
significant impact on the clinical outcome of surgical endodontics [

Root-end resection performed with laser result in ablation of the
microleakage, and increase the resistance to root resorption [9].
resection with lasers may also prevent loss of adaptation between

Elimination of microorganism is another important component of t
YSGG lasers have been shown to be effective against *E. faeca*
periapical lesions [11, 12].

Different root-end filling materials have been utilized in surgical p
in an attempt to prevent microleakage and promote bone healin
feasible in certain clinical situations where excessive bleeding or
Accordingly, searching for alternative techniques that may provide
be of clinical relevance.

The hypothesis of the present study is that root-end resections p
the placement of retrofilling material result in leakage similar to th
surgical carbide burs and the mineral trioxide aggregate (MTA) is
of this study was twofold. ( ) To compare microleakage in root-e
laser or surgical carbide burs with and without the placement of
adaptation of the gutta-percha and the MTA to the root canal wa
filling materials and the dentinal walls, and the presence of cracks

2. Material and Methods

The sample of this study consisted of ninety-five maxillary and m
samples were decoronated prior to cleaning and shaping. The cer
with Gates-Gliddens drills (Moyco Union Broach, York, PA) num
(Dentsply-Maillefer, Tulsa, OK) ISO rotary instruments were lubr
Plymouth Meeting, PA) and used to prepare the canals to a maste
with a fine-medium (FM) nonstandardized gutta-percha cone and
OK). Downpack was performed with System B unit (SybronEndo,
Fenton, MO) was used for incrementally backfilling the middle a
(Dentsply, Tulsa, OK) were used to aid the adaptation of the filling

After obturation, the samples were maintained in 100% humidity
one of the three experimental groups, containing 30 samples each
resections were performed with the Er, Cr: YSGG laser (Waterlas
using hard tissue mode and a G6 tip with the following paramete
laser tip was placed perpendicularly to the long axis of the roots, 3
end resection without a bevel. After resection, the gutta-percha v
San Diego, CA). This group did not receive the root-end filling
performed with Lindeman carbide burs (Brasseler, Savanna, GA), a
root to prevent beveling. The gutta-percha was cold burnished the
no root-end filling was used in this group. Group III, the root-end
bevel), followed by root-end preparation with the MiniEndo ultr
KiS 1D tip (Obtura/Spartan, Fenton, MO). Mineral trioxide aggrega
was used as the root-end filling material. The MTA was placed into
MAP system (Produits Dentaires, Vevey, Switzerland) and condens
IV (positive control), five instrumented but unobturated roots
preparation was performed and no root-end filling material w
penetration into the canals. The teeth from all groups were left in 1
leakage or SEM analysis. Out of the 30 samples from each group
analysis and 10 were used for SEM gap measurements.

2.1. Microleakage Samples

The samples were coated with nail polish (Procter & Gumble D
resected surfaces and placed in suspension overnight (18 hours) in
PA) at room temperature. Before clearing procedures, the roots
removed with the aid of periodontal curettes and nail polish remo
two days in decalcifying solution (Richard-Allan Scientific, Kalama
ethyl alcohol (Fisher Chemicals, Fair Lawn, NJ). The samples were
hour submersion in 90%, and finally one hour in 100% ethyl alcoh
soaking in methyl salicylate (Fisher Chemicals, Fair Lawn, NJ) for
the mesial and distal aspects of each sample. The images' sizes
(Figures 1(a) and 1(b)). Two evaluators, unaware from which grou
dye penetration with the aid of ImageJ software (National Institute

Figure 1: Digital photographs of cleared sam
penetration with the aid of the ImageJ softwar

2.2. Gap Measurement (SEM) Samples

The scanning electron microscope (SEM) samples were pre
polyvinylsiloxane impressions of the resected root-ends. The re
eliminate artifacts linked to SEM processing [15]. The ability of
placing microscratches in the resected root-end of a natural too
replica and test specimen were placed on an SEM mounting stub
corresponding areas was compared under high-power magnificati
adjacent to the natural specimen. This was done to ensure the ac
able to reproduce surface details present in corresponding areas o
resin processing artifacts were present, then that natural tooth
them to set for 24 hours, the resin replicas were kept overnigh
platinum, and analyzed under the SEM (JOEL JSM 6400, J

Photomicrographs were obtained for the evaluation of the gutta-
using the ImageJ software (Figure 2). The presence of microcrack

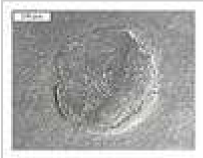

Figure 2: Scanning Electron Microscope pictur
measurement between the gutta-percha and tl

The leakage and gap measurements from the two evaluators wer
and Scheffe post hoc test for any significant differences between tl

3. Results

Interevaluators comparisons are demonstrated in Figures 3 and 4.
group are shown in Figures 5 and 6, respectively. The leakage
whereas, the gap measurements are presented in micrometer squa
leakage were , and , fo
and MTA (group III) samples, respectively, (ANOVA). The
entire length of the root canal. SEM analysis demonstrated measu
resection without root-end filling ( ) groups. A sum
MTA group (group III) demonstrated statistically less microleakage
the best marginal adaptation, with no measurable gaps at the M
other two groups. There was no significant difference between tl
(group II) for both the microleakage and gap measurements, wher

Table 1: Comparison of mean dye leakage
resected groups.

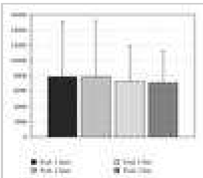

Figure 3: Comparative analysis of average a
between evaluators. The MTA group is not sho

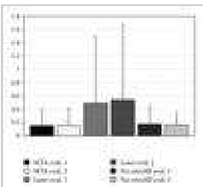

Figure 4: Comparative analysis of avera
measurements between evaluators.

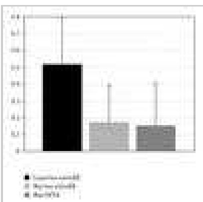

Figure 5: Mean leakage and standard deviatio

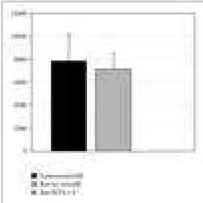

Figure 6: Mean and standard deviation from
groups.

Microcracks were not observed in any of the specimens analyzed u

4. Discussion

The study results do not support the hypothesis. Root-end resecti
the placement of a root-end filling material demonstrated greater
performed with carbide bur and MTA was used as root-end filli
observed, between the gutta-percha and the root canal walls, in th

Comparison of the root-end resected surface topography when
remarkable differences. The laser device provided a much roug
because it increases the resected root-end surface area and the
smooth flat resected surface. It is possible that the laser does obli
area counteracts the obliteration. Thus, it may also make more d
for vertical root fractures and burnish the retrofill material smooth

The placement of a root-end filling material may not play an esse
the etiological factor (i.e., microorganism at the apical third)
Nonetheless, some investigators [17] had supported that the pro
end filling material is used.

The laser setting may also have an effect on the ability of the las
pulse rates will either obliterate or open dentinal tubules [18, 19
from another study (unpublished data) by our group. However, fu
effect of the different Er, Cr: YSGG laser settings.

Currently, the mineral trioxide aggregate (MTA) seems to be the
mechanical and biological properties [13, 20, 21]. MTA has sho
responses when compared to other commonly used root-end filling
[20, 24]. The group that received MTA as the root-end filli
microleakage, which is in agreement with previous reports [25,
100% humidity for 72 hours prior to the leakage study, and it may
MTA has long setting time and could be partially or totally washed
set, impairing it’s sealing ability. In contrastthough, it should be
stimulates the formation of hydroxyapatite filling in the microscopi

The resin replica proved to be representative of the natural tooth b
to be beneficial in differentiating lack of marginal adaptation versu
the natural teeth were most likely caused from the vacuum and c
None of the replicas demonstrated the presence of cracks.

The present study also showed no correlation between the presenc
in agreement with previously published reports [28 – 30]. Even tho
to evaluate the sealing ability of endodontic filling materials [31]

analyzed carefully and not directly extrapolated to the clinical sit
margins of the root-end filling material, which may render unreli
eliminate this problem, rather than providing linear measuremen
from both mesial and distal aspects of the root.

The other problem with dye studies may be related to the molecul
design and to the fact that dye solutions cannot duplicate the bact

In summary, based on the parameter of this in vitro study, we ca
bur and MTA used as the root-end filling material demonstrated s
canal wall adaptation when compared to root-end resection perforr

References

1. S. Lin, O. Platner, Z. Metzger, and I. Tsesis, "Residual bact resection: a histopathological evaluation," *International En* 2008.
2. I. Abramovitz, H. Better, A. Shacham, B. Shlomi, and Z. Met retrospective evaluation of associated factors and rational," 530, 2002.
3. M. Torabinejad, C.-U. Hong, S.-J. Lee, M. Monsef, and T. R. aggregate for root-end filling in dogs," *Journal of Endodont*
4. A. M. Montellano, S. A. Schwartz, and T. J. Beeson, "Conta aggregate used as a root-end filling material: a bacterial lea 5, pp. 452–455, 2006.
5. P. N. R. Nair, U. Sjögren, D. Figdor, and G. Sundqvist, "Per human teeth, failed endodontic treatments, and periapical s *Oral Radiology, and Endodontics*, vol. 87, no. 5, pp. 617–62
6. S. Kim and S. Kratchman, "Modern endodontic surgery con *Endodontics*, vol. 32, no. 7, pp. 601–623, 2006.
7. L. A. Morgan and J. G. Marshall, "The topography of root er types of finishing burs," *Oral Surgery, Oral Medicine, Oral F* no. 5, pp. 585–591, 1998.
8. Y. Kimura, P. Wilder-Smith, and K. Matsumoto, "Lasers in e *Journal*, vol. 33, no. 3, pp. 173–185, 2000.
9. A. F. Paghdiwala, T. K. Vaidyanathan, and M. F. Paghdiwala, dental tissues: analysis of temperature changes, depth of cu vol. 7, no. 3, pp. 989–997, 1993.
10. T. Komori, K. Yokoyama, T. Takato, and K. Matsumoto, "Cl apicoectomy," *Journal of Endodontics*, vol. 23, no. 12, pp.
11. U. Schoop, W. Kluger, A. Moritz, N. Nedjelik, A. Georgopoul laser systems in the deep layers of dentin," *Lasers in Surge* 2004.
12. Q. Wang, C. Zhang, and X. Yin, "Evaluation of the bacterici experimentally infected root canals," *Journal of Endodontic*

13. M. Torabinejad and N. Chivian, "Clinical applications of min
vol. 25, no. 3, pp. 197–205, 1999.

14. R. Niederman and J. N. Theodosopoulou, "A systematic rev
International Endodontic Journal, vol. 36, no. 9, pp. 577–5{

15. R. F. E. Crang and K. L. Klomparens, "Artifacts in biological
1988.

16. B. R. Johnson, "Considerations in the selection of a root-en
Oral Pathology, Oral Radiology, and Endodontics, vol. 87, nc

17. M. Altonen and K. Mattila, "Follow up study of apicoectomiz
vol. 5, no. 1, pp. 33–40, 1976.

18. S. A. M. Corona, A. E. de Souza, M. A. Chinelatti, M. C. Bors
of energy and pulse repetition rate of Er: YAG laser on denti
laser-irradiated substrate," *Photomedicine and Laser Surge*

19. Z. Zapletalová, J. Perina Jr., R. Novotný, and H. Chmelíckov
tubules using a pulsed Nd:YAG laser," *Photomedicine and L*

20. P. F. E. Bernabé, R. Holland, R. Morandi, et al., "Comparati
of pulpless dogs' teeth," *Brazilian Dental Journal*, vol. 16, n

21. Y. Yoshimine, M. Ono, and A. Akamine, "In vitro compariso
aggregate, 4META/MMA-TBB resin, and intermediate restora
Journal of Endodontics, vol. 33, no. 9, pp. 1066–1069, 200

22. G. A. Pelliccioni, C. P. Vellani, M. R. A. Gatto, M. G. Gandolfi
trioxide aggregate cement used as a retrograde filling witho
microleakage," *Journal of Endodontics*, vol. 33, no. 9, pp. 1

23. B. Storm, F. C. Eichmiller, P. A. Tordik, and G. G. Goodell, "
trioxide aggregate and Portland cement," *Journal of Endod*

24. S. Sarris, J. F. Tahmassebi, M. S. Duggal, and I. A. Cross, "
for root-end closure of non-vital immature permanent inciso
vol. 24, no. 1, pp. 79–85, 2008.

25. E. J. Fischer, D. E. Arens, and C. H. Miller, "Bacterial leakaç
zinc-free amalgam, intermediate restorative material, and S
Endodontics, vol. 24, no. 3, pp. 176–179, 1998.

26. C. Mangin, C. Yesilsoy, R. Nissan, and R. Stevens, "The cor
mineral trioxide aggregate, and super ethoxybenzoic acid as
Endodontics, vol. 29, no. 4, pp. 261–264, 2003.

27. N. K. Sarkar, R. Caicedo, P. Ritwik, R. Moiseyeva, and I. Kav
properties of mineral trioxide aggregate," *Journal of Endod*

28. A. K. Abdal, D. H. Retie, and H. C. Jamison, "The apical sea
of retrofilling materials," *Oral Surgery, Oral Medicine, Oral*

29. M. Yoshimura, F. J. Marshall, and J. S. Tinkle, "In vitro qua
amalgam fillings," *Journal of Endodontics*, vol. 16, no. 1, pp

30. C. B. Xavier, R. Weismann, M. G. de Oliveira, F. F. Demarco
apical microleakage and marginal adaptation," *Journal of E*

31. C. R. Barthel, J. Moshonov, G. Shuping, and D. Orstavik, "E
root canals," *International Endodontic Journal*, vol. 32, no.

32. J. Camps and D. Pashley, "Reliability of the dye penetratior
pp. 592–594, 2003.