ORIGINAL RESEARCH

Comparison of Resilon and Gutta-Percha filling materials on root canal fracture resistance following restoring with Quartz fiber posts

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ABSTRACT
Background: To study and compare resilon and gutta-percha filling materials on root canal fracture resistance and restoring with quartz fibre posts. **Materials & Methods:** A total of 20 root canals of maxillary incisors underwent chemo-mechanical preparation before being divided into two distinct groups. Statistical analysis of the collected data was performed using the T-test. The results were analysed using SPSS Software. **Results:** The average compressive strength in the experimental Resilon group was 633.76 N, whereas in the control group with gutta-percha, it was 505.26 N. **Conclusion:** Root canals that were filled with Resilon demonstrated a notably higher level of resistance compared to those filled with gutta-percha, particularly after the application of quartz fiber posts for restoration.
Keywords: Resilon, Gutta percha, Fracture resistance.

INTRODUCTION

Endodontically treated teeth (ETT) are potentially weaker than vital teeth against chewing forces and may fracture more easily. For many years, post and core systems have been used as foundational materials for final restoration of ETT that have lost most of their coronal tooth structure. Posts and cores can be custom-made or prefabricated. [1,2] In the early 1990s, prefabricated, finally polymerized fiber-reinforced composite (FRC) root canal posts were introduced to the market. FRC posts have been suggested to have certain advantages over metal posts. [3] The elasticity modulus of an FRC post is closer to that of dentin when compared with rigid metal posts. Lower stress concentrations are therefore transmitted to the root, diminishing the risk of root fractures. [4] However, FRC root canal posts have been criticized on grounds of their flexural properties as well as for undesirable adhesion to luting cements and core build-up composites.[3,4] On the other hand, many investigators have suggested that these materials boast the advantage of reducing the risk of root fracture thanks to their modulus of elasticity (16-40 GPa) being comparable with that of composite resins (5.7-25 GPa) and dentin (18.6 GPa). [5,6] Despite these advantages, bonding to radicular dentin offers less favorable conditions than coronal dentin, and thus it is still considered the frailest bond in terms of restoration.[3] The success of the root-dentin adhesive-restorative system is directly linked with the hybridization quality created through the infiltration of adhesive system into the demineralized dentin substrate. [7]

Bacterial leakage and root fractures are the two most important causes for root canal treatment failure.[8] Gutta-percha and resin sealer AH26 are commonly used for canal obturation, but they have drawbacks due to their lack of adhesion to the canal walls. [9] In fact, the root is not strengthened owing to the lack of chemical bonding of gutta-percha and sealer to the dentinal wall; therefore, the incidence of fracture may rise.[8]Resilon (Pentron, Wallingford, CT, USA) is a new resin material used for filling root canals that can be handled similar to gutta-percha. It may be laterally

condensed, as well as heat softened and injected into the root canal system. It is used in conjunction with a dual cure, resin based sealer, Epiphany (Pentron), which bonds to the dentin walls and Resilon core.[9] Some studies have shown higher compressive strength in teeth that had been obturated with Resilon compared to that of filled with gutta-percha.[9,10]A relatively newer adhesive obturation system named Resilon and Epiphany has also been used to improve resistance to fracture of endodontically treated teeth. [11]Resilon used for root canal system obturation is handled similarly to gutta-percha. This material can be laterally condensed, as well as heat softened and injected into the root canal system.[12] A dual cure, resin based sealer (Epiphany), is used in conjunction with Resilon. It has been shown that Epiphany bonds to the dentin walls and Resilon core.[13]Resilon/Epiphany system is able to penetrate into dentine tubules and provides a monoblock state obturation. [14] Hence, this study was conducted to study and compare resilon and gutta-percha filling materials on root canal fracture resistance and restoring with quartz fibre posts.

MATERIALS & METHODS

A total of 20 root canals of maxillary incisors underwent chemo-mechanical preparation before being divided into two distinct groups: Group 1, the Control group (n=10); and Group 2, the Experimental group (n=10). Following root canal treatment, the teeth were reinforced with quartz fiber posts and composite resin cores. Subsequently, the specimens were subjected to clinical simulation and loaded onto a Universal Testing Machine for assessing compressive strength. Statistical analysis of the collected data was performed using the T-test. The results were analysed using SPSS Software.

RESULTS

The average compressive strength in the experimental Resilon group was 633.76 N, whereas in the control group with gutta-percha, it was 505.26 N. This distinction proved to be statistically significant.In all cases, the roots were fractured horizontally at the cervical level, but only in one specimen the post was fractured.

Table 1: mean compressive strength for resilon and gutta-percha

Group	N	P –value	Mean
Resilon	10	0.7	633.76
Gutta- percha	10	0.9	505.26
P- value	0.04		

P- value less than 0.05= significant

DISCUSSION

Management of endodontically treated tooth (ETT) with severe destruction of crown's buildings has always been an challengeable issue. To repair these teeth, patients and dentists have invariably been looking for a method with greater stability and survival rate, one which does not impose high costs or complicated procedures. [15] Nowadays, most dentists tend to utilize prefabricated posts due to their functional, cost-effective, and conservative properties.[16] In the process of this commonly-practiced treatment, a massive amount of gutta-percha is fitted to create the right space for the post and to make possible certain accessory canals. Thus sealing using post, core, and adhesive materials becomes a mandatory part of the treatment. [17] Hence, this study was conducted to study and compare resilon and gutta-percha filling materials on root canal fracture resistance and restoring with quartz fibre posts.

In the present study, the average compressive strength in the experimental Resilon group was 633.76 N, whereas in the control group with gutta-percha, it was 505.26 N. A study byMehrvarzfar P et al, the mean compressive strengths for group 1 was 535.8 ± 155.23 N and 645.93 ± 182.98N for group 2, which were statistically significant (p-value= 0.047).Root canals filled with Resilon were significantly more resistant than that of gutta-percha, following restoration with quartz fiber posts.[18]

In the present study, this distinction proved to be statistically significant.In all cases, the roots were fractured horizontally at the cervical level, but only in one specimen the post was fractured. Another study by Ashraf H et al, no statistically significant differences were observed between different preparation techniques. The intact roots showed significantly greater fracture resistance compared to both instrumented groups (P<0.01). Resilon Group showed significantly higher resistance than gutta-percha Group (P<0.01); however the difference between Resilon and intact teeth was not statistically significant. Root canal filling using Resilon may increase the fracture resistance of treated teeth.[19] Punjabi M et al, examined one hundred and twenty single-rooted teeth were selected and decoronated at cementoenamel junction. Instrumentation of teeth (except control group) was done with Mtwo rotary files up to size 25/0.06 using a step-back technique. All teeth were divided into four experimental groups (n = 25) and two control groups (n = 10). In Group I (negative control), teeth were neither instrumented nor obturated, in Group II (positive control), instrumentation was done, but no obturation was performed, in Group III, obturation was done with cold lateral compaction technique, in Group IV, obturation was done with cold free-flow compaction technique, in Group V, obturation was done with warm vertical compaction technique, and in Group VI, obturation was done with injection-molded thermoplasticized technique. Negative control Group I showed highest fracture resistance and positive control Group II had lowest fracture resistance. Among experimental groups, cold free-flow compaction technique with GuttaFlow2 (Group IV) showed higher fracture resistance as compared to the Group III, Group V, and Group VI. GuttaFlow2 has

the potential to strengthen the endodontically treated roots to a level that is similar to that of intact teeth.[20]In a study by Teixeira et al. on compressive strength of endodontically treated teeth, canals filled with Resilon showed a significantly higher compressive strength compared with that of gutta-percha which is in agreement with our findings. [21]Monteiro et al. in an in vitro study regarding the resistance of roots filled with Resilon or gutta-percha against fracture found the same results. [22]Accordingly, quartz fiber posts were used in the present study to enhance the fracture resistance of the specimens. In this research all fractures happened in the cervical third of the roots (1–2 mm from the canal orifice), as was expected because of the similarity of MOE (modulus of elasticity) of fiber posts to dentin. In the present study, we did not use full coverage crowns over the core material and the compressive load was applied directly on the core. In this way, the interfering factors such as the size, shape, thickness and material of the crowns were omitted from the study and more precise evaluation of the effect of Resilon and gutta-percha on compressive strength of roots became more promising.[23] One of the limitations of such in-vitro studies is to provide the complicated occlusion. However we were trying to simulate the situation by fixing the specimens in a jig where a gradually increasing compressive load was delivered at 130° to the long axis of the tooth in a lingual-labial direction just above the cingulum with a ball-shaped tip. Our favorable finding in the Resilon group may be attributed to the fact that the combination of resin filling material and adhesive resin sealers may provide the condition called “Monoblock” (dentin/adhesive sealer/obturating material/quartz fiber post), resulting in strengthening of the root walls. [24]

CONCLUSION

Root canals that were filled with Resilon demonstrated a notably higher level of resistance compared to those filled with gutta-percha, particularly after the application of quartz fiber posts for restoration.

REFERENCES

1. Qing H, Chao Y, Zhang W. In vitro evaluation of the fracture resistance of anterior endodontically treated teeth restored with glass fiber and zircon posts. J Prosthet Dent. 2007;97:93–8.
2. Moosavi H, Moazzami SM, Loh S, Salari S. Microleakage evaluation of core buildup composite resins with total-etch and self-etch adhesive systems. J Contemp Dent Pract. 2010;11:009–16.
3. Ferrari M, Vichi A, Mannocci F, Mason PN. Retrospective study of the clinical performance of fiber posts. Am J Dent. 2000;13:9B–13B.
4. Le Bell AM, Tanner J, Lassila LV, Kangasniemi I, Vallittu P. Bonding of composite resin luting cement to fiber-reinforced composite root canal posts. J Adhes Dent. 2004;6:319–25.
5. Schwartz RS, Robbins JW. Post placement and restoration of endodontically treated teeth: a literature review. J Endod. 2004;30:289–301.
6. Gomes GM, Gomes OM, Reis A, Gomes JC, Loguercio AD, Calixto AL. Regional bond strengths to root canal dentin of fiber posts luted with three cementation systems. Braz Dent J. 2011;22:460–7.
7. Ferrari M, Vichi A, Grandini S. Efficacy of different adhesive techniques on bonding to root canal walls: an SEM investigation. Dent Mater. 2001;17:422–9.
8. Williams C, Loushine RJ, Weller RN, Pashley DH, Tay FR. A comparison of cohesive strength and stiffness of Resilon and Gutta-percha. J Endod. 2006 Jun;32(6):553–5.
9. Skidmore LJ, Berzins DW, Bahcall JK. An in vitro comparison at the intra radicular Dentin bond Strength of resilon and gutta percha. J Endod. 2006 Oct;32(10):963–6.
10. Stuart CH, Schwartz SA, Beeson TI. Reinforcement of immature roots with a new resin filling material. J Endod. 2006 Apr;32(4):350–3.
11. Hanada T, Quevedo CG, Okitsu M, Yoshioka T, Iwasaki N, Takahashi H, et al. Effects of new adhesive resin root canal filling materials on vertical root fractures. Aust Endod J. 2010;36(1):19–23.
12. Mehrvarzfar P, Rezvani Y, Jalalian E. Comparison of resilon and gutta-percha filling materials on root canal fracture resistance following restoring with quartz fiber posts. J Dent (Tehran). 2012;9(2):156–61.
13. Skidmore LJ, Berzins DW, Bahcall JK. An in vitro comparison of the intraradicular dentin bond strength of Resilon and gutta-percha. J Endod. 2006;32(10):963–6.
14. Teixeira FB, Teixeira EC, Thompson J, Leinfelder KF, Trope M. Dentinal bonding reaches the root canal system. J EsthetRestor Dent. 2004;16(6):348–54. discussion 54.
15. Purton DG, Chandler NP, Qualtrough AJ. Effect of thermocycling on the retention of glass-fiber root canal posts. Quintessence Int. 2003;34:366–9.
16. Newman MP, Yaman P, Dennison J, Rafter M, Billy E. Fracture resistance of endodontically treated teeth restored with composite posts. J Prosthet Dent. 2003;89:360–7.
17. Sritharan A. Discuss that the coronal seal is more important than the apical seal for endodontic success. Aust Endod J. 2002;28:112–5.
18. Mehrvarzfar P, Rezvani Y, Jalalian E. Comparison of resilon and gutta-percha filling materials on root canal fracture resistance following restoring with quartz fiber posts. J Dent (Tehran). 2012 Spring;9(2):156-61.
19. Ashraf H, Momeni G, Moradi Majd N, Homayouni H. Fracture Resistance of Root Canals Obturated with Gutta-Percha versus Resilon with Two Different Techniques. Iran Endod J. 2013 Summer;8(3):136-9.
20. Punjabi M, Dewan RG, Kochhar R. Comparative evaluation of fracture resistance of root canals obturated with four different obturating systems. J Conserv Dent 2017;20:445-50
21. Teixeira FB, Teixeira EC, Thompson JY, Trope M. Fracture resistance of roots endodontically treated with a new resin filling material. *J Am Dent Assoc.* 2004 May;135(5):646–52.
22. Monteiro J, de Ataide Ide N, Chalakkal P, Chandra PK. In vitro resistance to fracture of roots obturated with Resilon or gutta-percha. *J Endod.* 2011 Jun;37(6):828–31. Epub 2011 Apr 2.

23. Aksoy G, Cotert HS, Korkut L. Effect of an adhesive resin luting agent on the dowel head retention of three different core materials. *J Prosthet Dent.* 2005 May;93(5):439–45.

24. de Souza Filho FJ, Gallina G, Gallottini L, Russo R, Cumbo EM. Innovations in endodontic filling materials: guttapercha vs resilon. *Curr Pharm Des.* 2012 May 25.