International Journal of Oral Care & Research

Volume 2 Issue 5 (Jul - Sep 2014) ISSN 2347-6249

An Official Publication of
"Ivano-Frankivsk National Medical University, Ukraine"
Officially Associated with
"The Egyptian Society of Oral Implantology"
"International Group for Oral Rehabilitation, France"

Review Article

Received : 03-06-14
Review completed : 27-07-14
Accepted : 02-08-14

COLD LATERAL CONDENSATION VERSUS OTHER ROOT CANAL OBTURATION TECHNIQUES - A REVIEW

PR Aravendh Kumar, * D Pradeep Kumar, ** Nagaraju Bachu, *** Bala Kasi Reddy Kaipa †

* Professor, Department of Conservative Dentistry & Endodontics, RVS Dental Collage, Coimbatore, Tamilnadu, India
** Reader, Department of Orthodontics, Sri Ramakrishna Dental College, Coimbatore, Tamilnadu, India
*** Reader, Department of Conservative Dentistry & Endodontics, Aditya Dental College, Beed, Maharashtra, India
† Senior Lecturer, Department of Conservative Dentistry and Endodontics, MNR Dental College, Hyderabad, Telangana, India

ABSTRACT

To increase endodontic treatment success, the root canal system (RCS) must be effectively sealed coronally and apically. The apical seal is the principal barrier to leakage; however, loss of the coronal seal also allows bacterial recontamination of endodontically treated teeth leading to failure. There are many different RCS obturation techniques but no one technique has been identified which is clearly superior. The purpose of this review was to compare the cold lateral condensation (CLC) technique with other RCS obturation techniques.

KEYWORDS: Cold lateral condensation; obturation; root canal system

INTRODUCTION

The clinical success of endodontic therapy depends on diagnosis, treatment planning, knowledge of tooth anatomy, and the traditional concepts of debridement, sterilization, and obturation.[1] However complete obliteration of the root canal space from canal orifice to apical constriction has been shown to be very critical to achieve success. Adequate access and a straight-line path to the canal system allow complete irrigation, shaping, cleaning, and quality obturation.[2] Despite being one of the most technically demanding procedures in restorative dentistry,[2] conventional root canal treatment completed in dental schools or by specialists has been shown to be highly successful.[3-7] Molven and Halse[6] examined root canal treatment performed by dental students and found success rates of 68% for teeth with pre-existing periapical radiolucencies, and 91% in teeth without pre-existing periapical radiolucencies. Heling and Tamshe[4] reported an overall success rate of 70% in 213 teeth that were also treated by dental undergraduates. Smith *et al.*,[7] reported an overall success rate of 84% in 821 teeth that had root fillings placed by postgraduate students and staff in a dental hospital. There are, however, few studies of the outcome of conventional root canal treatment performed by general dental practitioners. Barbakow *et al.*,[8,9] evaluated root canal treatments performed in general practice in patients aged 10 to 80 years over a nine-year period. Out of a total of 566 teeth, almost one quarter were maxillary incisors and one fifth were maxillary premolars; the majority of teeth were root-filled with GP and sealer. Teeth that were root-filled to the radiographic apex of the tooth were more successful than teeth that were filled short of the apex; the overall success rate was 87%. Inferior technical quality of root fillings is considered to be the main cause of clinical failure.[10,11] Incomplete obturation of the root canal leaves residual space for microbial colonization and proliferation and may also imply that cleaning was incomplete. Grieve and McAndrew[12] reported that the majority of root fillings in their study of teeth with post retained crowns were unsatisfactory. Saunders *et al.*,[13] found that 39% of root fillings were greater than 2 mm from the radiographic apex and stressed the need to improve quality of root canal treatment in general dental practice. They confirmed that root fillings judged to be adequate radiographically were associated with a reduced incidence of periapical radiolucency. In a radiographic assessment of root fillings performed in general dental practice Dummer[14] showed that only 10% of cases fulfilled technical criteria for standards of care as defined by the European Society of Endodontology.[15] The difficulties involved in

totally obliterating the root canal space has led to innovations of variety of techniques and filling materials. Numerous materials and techniques have been developed for filling root canals. GP and biocompatible sealer cement, used with cold lateral condensation method, although not ideal, is at present the most universally accepted means to obturate the root canal space.[16] It is compressible, inert, dimensionally stable, tissue tolerant, radiopaque, and becomes plastic when heated.[3] Its physical properties have made possible several obturation techniques. This root filling method is not without its drawbacks. It produces a root filling that is not a homogeneous mass of GP but rather a number of separate cones tightly pressed together and held with a root canal sealer. This technique is relatively time consuming, causes vertical root fracture, Irregularities in taper and morphology, encourage voids or pooling of sealer[17] and micro leakage between individual GP cones and the canal walls contribute tofailure.[18]
recovery.

COLD LATERAL CONDENSATION OBTURATION TECHNIQUE

Cold lateral condensation (CLC) as an obturation technique (Fig. 1) is widely applied by dental practitioners throughout the world because of its advantages of controlled placement of gutta-percha (GP) in the root canal and low cost.[17-19] The final filling is composed of a large number of GP cones tightly pressed together and joined by frictional grip and cementing substance, rather than a homogeneous mass of GP.[20] Voids because of spaces between individual GP cones and the root canal walls can be seen with poor root canal preparation, curved canals, inadequate lateral pressure during condensation, or mismatches between GP cones and the prepared root canal. The resulting fill in such cases would lack homogeneity and have to rely on sealer to fill the voids, and thus would have a poorer prognosis since voids may provide a niche for bacteria to thrive.[21,22] Heat or solvents have been recommended as a means of improving the adaptation of GP without the need for excessive forces. Warm lateral condensation has been reported to produce a root filling with less dye leakage than cold lateral condensation. The heat may be carried to the GP in the canal in a variety of ways including flame or electrically heated carriers. The warm lateral condensation produces excellent canal seal laterally and apically; however it has certain disadvantages like risk of vertical root fracture and periodic overfilling of GP and cement that cannot be retrieved from the periradicular tissues.[23]

COLD LATERAL CONDENSATION OBTURATION TECHNIQUE VERSUS OTHER ROOT CANAL SYSTEM OBTURATION TECHNIQUES

Compared with CLC, warm vertical condensation of GP can provide a high-density filling and better sealing at all portals of entry between the root canal and the periodontium.[24] This technique allows the placement of a homogeneous mass of GP into the canal system with the carrier as a means of compaction.[25] This technique can be more effective in filling lateral canals than CLC.[26] In clinical practice, the disadvantage of this technique is that the filling length is hard to control. Rapid insertion is related to overextension, whereas slow insertion tends to result in underfilling.[19] On the basis of microscopic analysis and clinical tests, it has been concluded that optimum filling is achieved when canals are instrumented and filled 0.5 to 2.0 mm short of the root apex.[27-30] CLC of GP is the most widely used method for root canal obturation,[31] but techniques based on the pre-heating of the GP were introduced in order to improve the three-dimensional filling of curved and straight root canals.[32] Varied results have been published by studies comparing the use of warm GP and CLC techniques in the three-dimensional filling of root canals prepared with hand instrumentation. De Moor & De Boever,[33] achieved a better apical sealing with CLC and a hybrid GP condensation technique than with techniques using thermo plasticized GP. However, Wu *et al*.,[34] found no significant differences between the CLC method and vertical compaction of warm GP and Vizgir-da *et al*.,[35] found no significant differences between the CLC method and the high-temperature thermo plasticized GP technique. Most authors[36-38] have reported that the injection of low-temperature thermo plasticized GP achieves a similar level of canal sealing to that obtained with CLC. Al-Dewani *et al*.,[39] observed lower apical leakage in straight and curved root canals filled with the Ultrafil® system compared with the cold lateral condensation method.

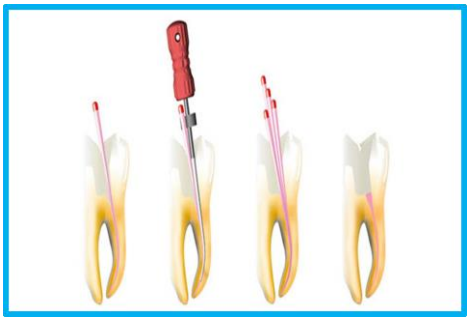

Fig. 1: Cold lateral condensation obturation technique

Hembrough *et al*.,[40] studied the efficacy of the CLC of GPin single-rooted teeth using three tapered master cones: an ISO-standardized GP cone, a Dia-ISOGT.06 GP cone and a size medium GPcone, and found no significant differences in the quality of the obturation. Gordon *et al*.,[41] compared the area filled by GP, sealer and voids in standardized simulated curved canals and in mesio-buccal canals of extracted maxillary first molars filled with a .06 taper single cone technique or with CLC of multiple .02 GP points. They found no differences between the techniques in the amount of GP occupying a prepared .06 tapered canal. A study by Lea CS[42] showed that warm vertical compaction using the continuous wave of condensation technique in acrylic blocks resulted in a greater GP fill by weight compared with standard cold lateral compaction. Though a great number of in vitro studies were conducted to compare the outcome of root canal obturation by warm GP with that by CLC, conclusions were inconsistent or contradictory, and less pertinent than clinical studies. Root fillings placed using cold lateral condensation of GP to within 2 mm of the radiographic apex of the tooth were associated with the best outcome.[43] A Comparison of CLC and a warm multiphase GP technique for obturating curved root canals was done by RMP Gilhooly *et al*.,[44] which showed that Root canals filled by multiphase obturation had significantly more extrusion of sealer ($p < 0.001$) and GP ($p < 0.001$) than canals filled by lateral condensation. Canals filled by multiphase GP obturation had significantly less apical dye leakage than those obturated by lateral condensation ($p < 0.05$). Lateral condensation achieved significantly better scores for radiographic quality than multiphase obturation from the bucco-lingual view ($p < 0.01$). A study done by Gulabivala K,[45] showed that CLC had a higher proportion of specimens with leakage in canals with curvature greater than 20′ than in canals with curvatures less than 20 ($p<0.05$). The curvature of canals had no effect on the sealing ability of the other techniques. The method of canal preparation had no effect on the sealing ability of Alpha Seal. Alpha Seal, Thermafil and JS Quick Fill were significantly quicker to perform than cold lateral condensation.

CONCLUSION

Cold lateral condensation is most widely used method of obturating root canals. Advantages of this technique are its predictability, ease of use, conservative preparation and controlled placement of materials. However, the final filling lack homogeneity of gutta-percha mass, less adaptation to canal walls, irregularities and increased number of voids. So clinicians rely on sealers to fill the voids, which may resorb with time. This might decrease the effectiveness of root canal obturation. In conclusion, CLC technique is still the most widely used technique in the world but more retrospective studies should be done to see its obturation quality, long-term outcome, and postoperative pain prevalence.

CONFLICT OF INTEREST & SOURCE OF FUNDING

The author declares that there is no source of funding and there is no conflict of interest among all authors.

BIBLIOGRAPHY

1. Schilder H. Cleaning and shaping the root canal. Dent Clin North Am 1974;18:269-96.
2. Schilder H. Filling root canals in three dimensions. Dent Clin North Am 1967;11:723-44.
3. Grossman LI, Shepard LI, Pearson LA. Roentgenologic and clinical evaluation of endodontically treated teeth. Oral Surg Oral Med Oral Path 1964;17:368-74.
4. Heling B, Tamshe A. Evaluation of the success of endodontically treated teeth. Oral Surg 1970;30:533-6.
5. Swartz DB, Skidmore AE, Griffin JA. Twenty years of endodontic success and failure. J Endod 1983;9:198-202.
6. Molven O, Halse A. Success rates for gutta-percha and Kloroperka N-O root fillings made by undergraduate students:

radiographic findings after 10-17 years. Int Endod J 1988;21:243-50.
7. Smith CS, Setchell D, Harty FJ. Factors influencing the success of conventional root canal therapy - a five-year retrospective study. Int Endod J 1993;26:321-33.
8. Barbakow FH, Cleaton-Jones PE, Friedman D. An evaluation of 566 cases of root canal therapy in general dental practice. 1. Diagnostic criteria and treatment details. J Endod 1980;6:456-60.
9. Barbakow FH, Cleaton-Jones PE, Friedman D. An evaluation of 566 cases of root canal therapy in general dental practice. 2. Postoperative observations. J Endod 1980;6:485-9.
10. Eckerbom M, Andersson JE, Magnusson T. A longitudinal study of changes in frequency and technical standard of endodontic treatment in a Swedish population. Endod Dent Traumatol 1989;5:27-31.
11. DeCleen MJH, Schuurs AHB, Wesselink PR, Wu MK. Periapical status and prevalence of endodontic treatment in an adult Dutch population. Int Endod J 1993;26:112-9.
12. Grieve AR, McAndrew R. A radiographic study of post-retained crowns in patients attending a dental hospital. Br Dent J 1993;174:197-201.
13. Saunders WP, Saunders EM, Sadiq J, Cruickshank E. Technical standard of root canal treatment in an adult Scottish sub-population. Br Dent J 1997;182:382-6.
14. Dummer PMH. The quality of root canal treatment provided by general dental practitioners working within the general dental services of England and Wales. Part 2. Dental Profile. J Dent Pract Board Eng Wales. 1998;19:8-10.
15. Consensus report of the European Society of Endodontology on quality guidelines for endodontic treatment. Int Endod J 1994;27:115-24.
16. Weine FS. Endodontic therapy. 5th ed. St. Louis: Mosby; 1996.
17. Brayton SM, Davis SR, Goldman M. Gutta percha root canal fillings. An in vitro analysis. Oral Surg Oral Med Oral Pathol Endod 1973;35:226-31.
18. Kerkes K, Tronstad L. Long term results of endodontic treatment performed with a standardized technique. Journal of Endodontics 1979;5:83-90.
19. Levitan ME, Himel VT, Luckey JB. The effect of insertion rates on fill length and adaptation of a thermoplasticized gutta-percha technique. J Endod 2003;29:505-8.
20. Leduc J, Fishelberg G. Endodontic obturation: a review. General Dentistry 2003;51:232-3.
21. Peters DD. Two-year in vitro solubility evaluation of four gutta-percha sealer obturation techniques. J Endod 1986;12:139-45.
22. Wollard RR, Brough SO, Maggio J, Seltzer S. Scanning electron microscopic examination of root canal filling materials. J Endod 1976;2:98-110.
23. Kersten HW. Evaluation of three thermo plasticized gutta percha filling techniques using a leakage model in vitro. Int Endod J 1988;21:353-60.
24. Gilbert SD, Witherspoon DE, Berry CW. Coronal leakage following three obturation techniques. Int Endod J 2001;34:293-9.
25. Becker TA, Donnelly JC. Thermafil obturation: a literature review. General Dentistry 1997;45:46-55, quiz 59–60.
26. Clinton K, Van Himel T. Comparison of a warm gutta-percha obturation technique and lateral condensation. J Endod 2001;27:692-5.
27. Kuttler Y. Microscopic investigation of root apexes. J Am Dent Assoc 1955;50:544-52.
28. Ricucci D. Apical limit of root canal instrumentation and obturation, part 1 literature review. Int Endod J 1998;31:384-93.
29. Stein T. Radiographic "Working length" revisited. Oral Surg Oral Med Oral Path 1992;74:796-9.
30. Schaeffer MA, White RR, Walton RE. Determining the optimal obturation length: a meta-analysis of literature. J Endod 2005;31:271-4.
31. Gutmann JL, Witherspoon DE. Obturation of the cleaned and shaped root canal system. In: Cohen S, Burns RC eds. Pathways of the pulp. 7th edn. St. Louis, USA: Mosby; 1998. p. 258-361.

32. Canalda-Sahli C, Berastegui-Jimeno E, Brau-Aguade E. Apical sealing using two thermoplasticized gutta-percha techniques compared with lateral condensation. J Endod 1997;23:636-8.
33. De Moor RJ, De Boever JG. The sealing ability of an epoxy resin root canal sealer used with five gutta-percha obturation techniques. Endod Dent Traumatol 2000;16:291-7.
34. Wu MK, Kastakova A, Wesselink PR. Quality of cold and warm gutta-percha fillings in oval canals in mandibular premolars. Int Endod J 2001;34:485-91.
35. Vizgirda PJ, Liewehr FR, Patton WR, McPherson JC, Buxton TB. A comparison of laterally condensed gutta-percha, thermoplasticized gutta-percha, and mineral trioxide aggregate as root canal filling materials. J Endod 2004;30:103-6.
36. Budd CS, Weller RN, Kulild JC. A comparison of thermoplasticized injectable gutta-percha obturation techniques. J Endod 1991;17:260-4.
37. Dalat DM, Spangberg LS. Comparison of apical leakage in root canals obturated with various gutta-percha techniques using a dye vacuum tracing method. J Endod 1994;20:315-9.
38. Goldberg F, Massone EJ, Artaza LP. Comparison of the sealing capacity of three endodontic filling techniques. J Endod 1995;21:1-3.
39. Al-Dewani N, Hayes SJ, Dummer PM. Comparison of laterally condensed and low-temperature thermoplasticized gutta-percha root fillings. J Endod 2000;26:733-8.
40. Hembrough MW, Steiman HR, Belanger KK. Lateral condensation in canals prepared with nickel titanium rotary instruments: an evaluation of the use of three different master cones. J Endod 2002;28:516-9.
41. Gordon MP, Love RM, Chandler NP. An evaluation of .06 tapered gutta-percha cones for filling of .06 taper prepared curved root canals. Int Endod J 2005;38:87-96.
42. Lea CS, Apicella MJ, Mines P, Yancicg PP, Parker. Comparison of the obturation density of cold lateral compaction versus warm vertical compaction using the continuous wave of condensation technique, MH. J Endod 2005;31(1):37-9.
43. Peak JD, Hayes SJ, Bryant ST, Dummer PMH. The outcome of root canal treatment. A retrospective study within the armed forces (Royal Air Force). British Dental Journal 2001;190:140-4.
44. Gilhooly RMP, Hayes SJ, Bryant ST, Dummer PMH. Comparison of cold lateral condensation and a warm multiphase gutta-percha technique for obturating curved root canals. International Endodontic Journal;33:415-20.
45. Gulabivala K., Holt R, Long B. An *in vitro* comparison of thermoplasticised gutta-percha obturation techniques with cold lateral condensation. Dental Traumatology 1998;14:262-9.

Editorial Office
426/427, S. V. Road
B/30, 4th Floor
Roop Kamal Society
Kandivali (West)
Mumbai, Maharashtra
India (400067)

Volume 2 Issue 5 (Jul - Sep 2014) **ISSN 2347-6249**

International Journal of Oral Care & Research