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

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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 [8] 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 [9] 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

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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. It is compressible, inert, dimensionally stable, tissue tolerant, radiopaque, and becomes plastic when heated. 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 and micro leakage between individual GP cones and the canal walls contribute toofailure.

**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. 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. 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. 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.

**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. This technique allows the placement of a homogeneous mass of GP into the canal system with the carrier as a means of compaction. This technique can be more effective in filling lateral canals than CLC. 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. 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. CLC of GP is the most widely used method for root canal obturation, 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. 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 achieved a better apical sealing with CLC and a hybrid GP condensation technique than with techniques using thermo plasticized GP. However, Wu et al. found no significant differences between the CLC method and vertical compaction of warm GP and Vizgirda et al. found no significant differences between the CLC method and the high-temperature thermo plasticized GP technique. Most authors 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. observed lower apical leakage in straight and curved root canals filled with the Ultrafil® system compared with the cold lateral condensation method.
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Hembrough et al.,[40] studied the efficacy of the CLC of GP in single-rooted teeth using three tapered master cones: an ISO-standardized GP cone, a Dia-ISOGT.06 GP cone and a size medium GP cone, 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 Gilhoofly 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

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