3 Dimensional ObturationTechniques : Paving Way for Endodontic Treatment & Its Modalities - Review Article

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Abstract:

Virtually all dentists are intrigued when endodontic post-treatment radiographs exhibit filled accessory canals. Filling root canal systems represents the culmination and successful fulfillment of a series of procedural steps that comprise start-to-finish endodontics (figure 1). Moving heat softened obturation materials into all aspects of the anatomy is dependent on eliminating pulpal tissue, the smear layer and related debris, and bacteria and their by-products, when present. To maximize obturation potential, clinicians would be wise to direct treatment efforts toward shaping canals and cleaning root canal systems. Shaping facilitates three-dimensional cleaning by removing restrictive dentin, allowing a more effective volume of irrigant to penetrate, circulate, and potentially clean into all aspects of the root canal system . Well-shaped canals result in a tapered preparation that serves to control and limit the movement of warm gutta percha during obturation procedures. Importantly, shaping also facilitates 3D obturation by allowing pre-fit pluggers to work deep and unrestricted by dentinal walls and move thermosoftened obturation materials into all aspects of the root canal system.

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Figure No. 1

Vertical Condensation Technique

The objective of the vertical condensation technique is to continuously and progressively carry a wave of warm gutta- percha along the length of the master cone, starting coronally and ending in apical. The physical and thermo-molecular properties of gutta-percha are well understood and its importance in filling of the radicular portion of the tooth structure carrying its flow from coronal orifice to the the dimensions just before the apical foramen.

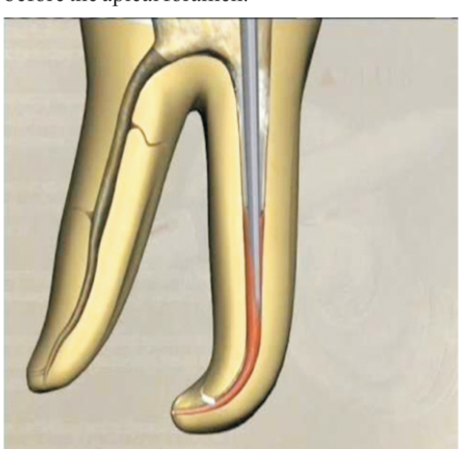

Figure No.2: vertical condensation technique

Cone Fit & Plugger Selection

Traditionally, a size medium non-standardized gutta percha master cone was selected and apically trimmed to fit snugly into the terminus of the prepared canal. The 6% taper of these master cones, as compared to the 2% taper of standardized gutta percha, ensured more effective hydraulics during obturation. Today, the selection of the correct master cone has been simplified because of the rediscovery of system-based endodontics. System-based master cones streamline treatment in that they are intended to have an apical diameter the same as and a rate of taper slightly less than the largest sized manual or mechanically driven file that was carried to the full working length. The master cone is fit in a fluid-filled canal to more closely simulate the lubrication effect that sealer will provide when sliding the buttered master cone into the prepared canal.

Figure No .3

Further, the master cone should be able to be inserted to the full working length and exhibit apical tugback upon removal. This master cone can be apically trimmed and further customized with glass slabs or a spatula utilizing either cold or heat rolling techniques. It is simple to fit a master cone into a patent, smoothly tapered, and well-prepared canal.

A diagnostic working film should confirm the desired position of the master cone and verify all the previous operative steps. The master cone is typically cut back about 1.0 mm from the radiographic terminus (RT) so that its most apical end is just short of the “apical constriction” or the actual position of the physiologic terminus (PT).Specifically, the final length of any given prepared and finished canal is the reproducible distance from the reference point to the PT.the position of the most apically instrumented foramen can be consistently located utilizing the paper point drying technique.

These animations demonstrate the master cone fit to length and the master cone apically cut back based on the paper point drying technique.

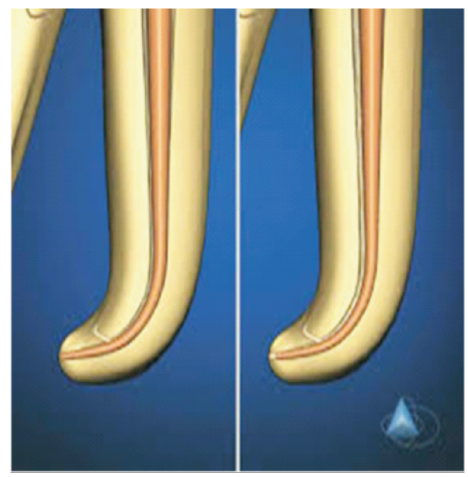

Figure No .4

Four manual pluggers, utilized to compact heat-softened gutta percha, provide working end diameters of 0.5 mm, 0.7 mm, 0.9 mm, and 1.3 mm. Generally, a larger size plugger is selected that will work loosely, yet efficiently, over a range of a few millimeters in the coronal one-third of the canal. A medium size plugger is selected that will work passively and effectively over a range of a few millimeters in the middle one-third of the canal. In longer roots, a smaller size plugger may be required to work deeper and safely to within 5 mm of the canal terminus. Prefitting pluggers is essential and guarantees that when a plugger meets resistance, the plugger is on thermosoftened gutta percha and not binding against unyielding dentinal walls.

Sealer & Master Cone Placement

Kerr Pulp Canal Sealer EWT (Extended Working Time) has been specifically formulated for the warm gutta-percha with vertical condensation technique and affords several advantages. These include:

1) Superior lubrication and flow
2) Adjustable viscosity
3) Dimensionally inert
4) Essentially non-resorbable
5) Sets in the presence of heat
6) Inhibits prostaglandins
7) Biocompatible

A fresh mix of Kerr Pulp Canal Sealer EWT completely sets extraorally within 30 minutes.

Intraorally, this sealer sets even more rapidly, which advantageously serves to reduce an inflammatory post-obturation response directly related to a sealer puff or surplus material after filling. The amount of sealer used in this obturation technique should be minimal.

The radicular portion of the master cone is lightly applied with sealer and gently aligned as it is slowly slid to length. Placing the master cone in this manner will serve to more evenly distribute sealer along the walls of the preparation, and importantly, allow surplus sealer to harmlessly vent coronally. To be confident that there is sufficient sealer, the master cone is removed and its radicular surfaces inspected to ensure it is evenly coated with sealer. If the master cone is devoid of sealer, then simply re-align and re-insert this cone to ensure there is sufficient sealer present. When the master cone is evenly coated with sealer and fully seated, obturation can commence.

Calamus Dual 3DObturation System

The Calamus Dual 3D Obturation System is one unit that conveniently combines both Calamus "Pack" and Calamus "Flow" handpieces (Figure 3). The Calamus Pack handpiece is the heat source that, in conjunction with an appropriately sized Electric Heat Plugger (EHP), is utilized to thermosoften, remove, and condense gutta percha during the downpacking phase of obturation. There are three variably sized EHPs and the one selected is based on the apical size, taper, and curvature of the finished preparation. The EHPs are available in ISO colors black, yellow, and blue, corresponding to working end diameters and tapers of 40/03, 50/05, and 60/06, respectively. The Calamus Pack handpiece also accepts a "thermal response tip" for conducting a diagnostic "hot test" on heat-sensitive pulps.

Figure No. 5 : Electrical Heat Pluggers

Calamus Downpack

In preparation for initiating the downpack, the clinician should select the Calamus EHP that fits passively through the straightaway portion of the preparation and optimally to within 5 mm from the terminus of the canal. When the EHP cannot reach this desired level, in a well-shaped canal, the Calamus bending tool may be utilized to place a suitable curvature on the more apical portion of the 40/03 EHP that matches the curvature of the prepared canal. A silicone stop may be placed on the EHP to safely monitor its maximum depth of insertion. Because of the thermomolecular properties of gutta percha, the Calamus EHP will generate about a 5 mm heat wave through gutta percha, apical to its actual depth of placement. Following the placement of the sealer-aligned master cone in a canal with an irregular cross-section, it is beneficial to inject heat-softened gutta percha lateral to the master cone. This method will advantageously serve to initially thermosoften the master cone, maximize the volume of gutta percha , effectively filling root canal and increase hydraulics when commencing with the downpacking phase of obturation.

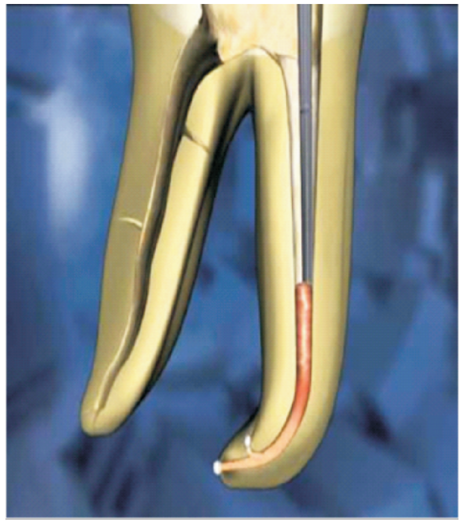

Figure No. 6

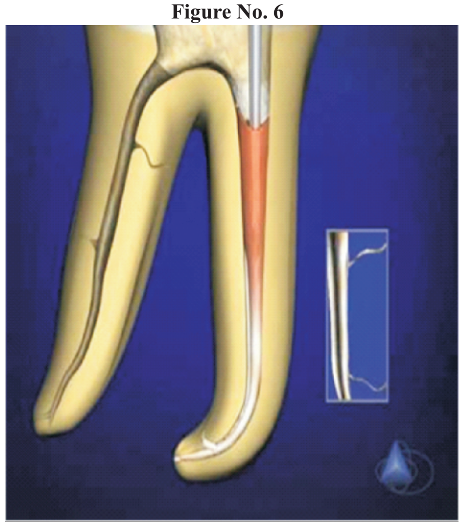

Figure No. 7

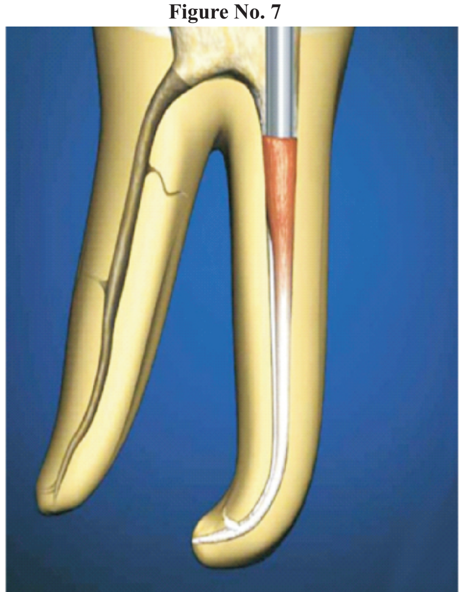

Figure No. 8

Calamus Backpack

When the downpack has been completed and the apical one-third corked, reverse filling the canal is important to eliminate radicular dead space. The Calamus Flow reverse filling technique, or what is termed the backpack, is easy, fast, and three-dimension. Thermo-softened gutta percha is readily dispensed into a shaped canal utilizing the Calamus Flow handpiece in conjunction with a 20 or 23 gauge cartridge. A new cartridge is selected and inserted into the heating chamber and secured by tightening the cartridge nut. A protective heat shield may be used to prevent inadvertent thermal injury and is inserted over the canula and the heating chamber portion of the handpiece prior to backfilling the canal. When the Calamus Flow handpiece is activated, an internal plunger travels toward the heating chamber and the cartridge, which is filled with gutta percha. In this manner, the plunger serves to push thermosoftened material out of the heated cartridge, through the canula, and into the canal.

The tip of the warm canula is positioned against the downpacked gutta percha for 5 seconds to re-thermosoften its most coronal extent.This procedural nuance promotes cohesion between each injected segment of warm gutta percha. The Calamus Flow handpiece is activated and a short 2 to 3 mm segment of warm gutta percha is dispensed into the most apical region of the empty canal. Injecting or dispensing too much gutta percha invites shrinkage and/or voids which result in poorly obturated canals judged radiographically. The Calamus Flow handpiece should be held lightly so it will "back-out" of the canal when injecting thermosoftened gutta percha into the canal.

Conclusion

The Calamus Dual 3D Obturation System is innovative technology that may be utilized to fill root canal systems. As the health of the attachment apparatus associated with endodontically treated teeth becomes fully understood and completely appreciated, the naturally retained root will be recognized as the "ultimate dental implant". When properly performed, endodontic treatment is the cornerstone of restorative and reconstructive dentistry.

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