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The Thermo-hydraulic condensation technique

Yosef Nahmias, Terence Mah and Joseph Dovgan follow the progress of obturation procedures and discuss the advantages and disadvantages of the THC technique

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The quest for technological advances and improvement on existing techniques is actively sought after in dentistry. Who does not want to do things better, faster, and more effectively? For decades, we have sought to improve obturation concepts, instruments and procedures to make them simpler and better.

Dr Herbert Schilder in 1967 gave birth to a predictable means of obturating the canals three-dimensionally using thermosoftened gutta percha and sealer. He showed how his technique could generate hydraulic forces that could fill lateral canals, fins, cul-de-sacs, and many of the complex anatomical irregularities within a root canal system. However, the Schilder Technique has proven to be a difficult procedure to master and time consuming. His original approach involved the use of a heat carrier that was flamed over a torch until it burned cherry red. This instrument was then quickly stabbed into the fitted gutta percha cone and withdrawn to leave thermosoftened material that is condensed apically with a plugger. This sequence is repeated several times with various fitted pluggers until the gutta percha is down packed to within 5-7mm of the radiographic terminus. The canal is then backfilled using several pieces of gutta percha and again in cycles of heating and condensing until the canal is obturated.

Over the years, technological improvements have been made which significantly improve the clinician's ability to perform warm vertical condensation. In 1982, the Touch'n Heat electric heat carrier (Figure 1) was introduced which eliminated the need for a flaming torch. Patients preferred this innovation because it decreased the incidence of burnt lips as the heat carrier is only activated prior to the tip entering into the canal instead of being transferred to the area when it is flaming red.

Figure 1: Touch n' Heat device (Analytic Technology, California)

Figure 2: System B heat source for war m gutta percha obturation techniques (Analytic Technology, California)

With this technology, the canals could be obturated efficiently and quickly.

In 1987, Dr Stephen Buchanan developed the Continuous Wave of Obturation Technique that further improved on the Schilder Technique. It eliminated the need to fit multiple pluggers and allows for condensation of the gutta percha in one downward compaction movement. This technique allows a single tapered plugger to capture a wave of condensation at the orifice of a canal and 'ride it', without release to the apical extent of down

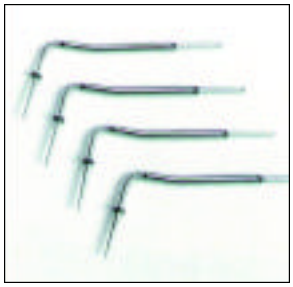
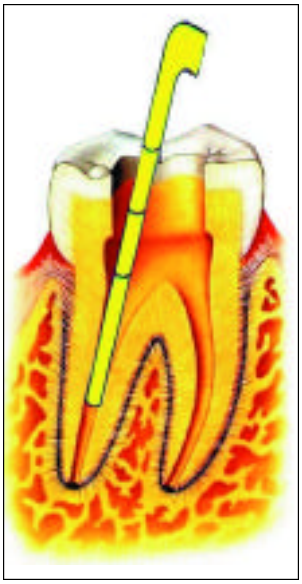


Figure 3: Buchanan pluggers designed for use with the System B heat source

Figure 4: Lateral canals filled with sealer and/or gutta percha is evident with the THC technique can be seen in the obturation of a plastic tooth (a) and clinically (b)

Figure 5: To determine that the canal has been adequately prepared for obturation using the THC technique, a Dovgan plugger must fit to within 3-5mm from the working length

packing in a single continuous movement. This builds a continuous wave of hydraulic forces that can push warm gutta percha and sealer into anatomical irregularities and lateral canals. With Schilder's technique, this wave is interrupted several times, thus the pressure wave, and heat is lost each time condensation stops and the gutta percha cools. This technique uses a modification of the Touch'n heat machine called the System B (Figure 2). The System B heat source can monitor the temperature at the tip of its heat carrier device, delivering a precise amount of heat for a long period of time. The heat carriers or Buchanan pluggers (Figure 3) were designed with geometries that closely approximate the shapes of tapered root canal preparations. These pluggers come in four sizes; fine, fine-medium, medium and medium-large which resemble the taper of non-standardised master cones. In addition, these soft stainless steel heat pluggers are fairly flexible, allowing for deeper condensation especially in narrow, curved canals. They are designed to soften the gutta percha and at the same time condense it. The System B has temperature settings of up to 600°C. Hand 1976, showed that quick bursts of heat to temperatures as high as 360°C will cause short and mild inflammation of the periodontal tissues that is not visible after 12 hours. Therefore, high temperatures of up to 350°C for short periods of time will not cause irreversible periradicular damage.



Thermo-hydrolic condensation

Recently, a new obturation technique has been developed that utilises the System-B device. This technique has been named the Thermo-Hydrolic Condensation (THC) Technique. THC takes advantage of the System-B while modifying Dr Buchanan's original obturating procedure resulting in improved hydraulics during the downpack. The improved thermal-hydraulics from the THC technique result in obturation of more lateral canals (Figure 4). It is believed the process works by increasing the time for the gutta percha to flow along with pressures obtained during the procedure. Traditional System B techniques use high temperatures which result in the tip melting the gutta percha quickly like a hot knife through butter. This in turn does not provide enough time for the 'cementopercha' to flow properly.

In order to obturate the root canal system

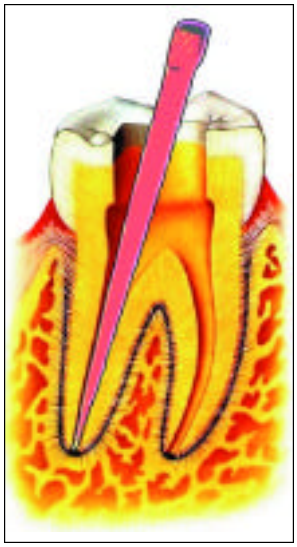
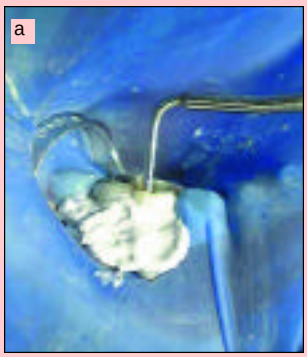
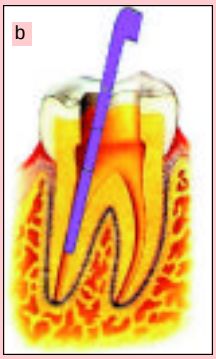


Figure 6: A non-standardised gutta percha cone is fitted 1mm short of the working length

Figure 7: A Buchanan plugger is prefitted in the prepared canal (a) and verified to bind within 4-7mm from the apical terminus (b)





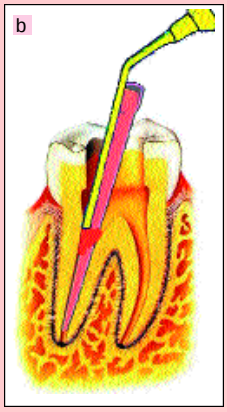


Figure 8: a) Obtura II heated gutta percha delivery system (Obtura Corp, Fenton, Missouri). b) The head of the gutta percha cone is seared off at the orifice using the tip of the Obtura gun while injecting thermoplasticized gutta percha into the canal

with the THC technique, the following objectives must be met:

- Maintain the apical constriction as small as practical
- The pre-fitted gutta percha cone must have a snug fit to within 0.5mm of radiographic terminus used
- Have a gradual taper
- Allow a Dovgan 04 tapered Niti Plugger (Thompson, Moyco, size 35/45, size 60/80) (Figure 5), and a preselected System B plugger to fit within 3-5mm from the working length.

Materials

- Non-standardised gutta percha cones (FM, M, ML)
- Kerr Pulp Canal Sealer
- System B with Buchanan pluggers (F, FM, M, ML)
- Dovgan Plugger(s) as needed
- Obtura II with 23 gauge tip

Technique

- A non-standardised (FM, M, ML) gutta percha cone is fitted to within 1mm of the working length (Figure 6)
- A Buchanan Plugger is chosen according to the gutta percha size. If a size medium cone was fit, a medium plugger should be used. The tips of all the pluggers are 0.5mm in diameter and should fit to within 4-7mm from the apical terminus. Prefit the plugger to verify that its binding point in the canal is between 4-7mm (Figures 7a and b). Place a silicone stopper to mark the plugger
- Dry the canal and cement the cone in place
- Set the Obtura II at 200°C (Figure 8a). Place the heated tip at the orifice and sear off the coronal portion of the cone while injecting the thermoplasticised gutta percha into the canal (Figure 8b). Inject

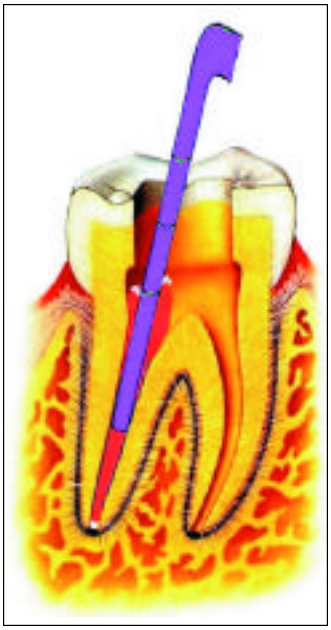


Figure 10: The System-B temperature is turned up to 300°C and apical pressure is applied to the plugger until binding resistance is felt. The plugger is then immediately withdrawn

Figure 9: The Buchanan plugger is pre-heated to 100°C and driven into the gutta percha until resistance is felt

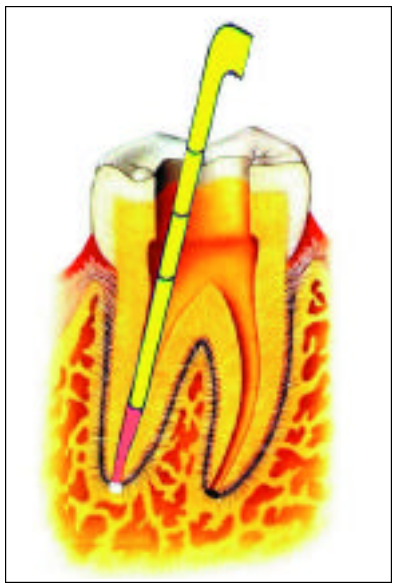


Figure 11: A prefitted Dovgan plugger is used to condense the thermosoftened gutta percha in an up/down motion and then firm pressure is applied for 10 seconds as the material cools

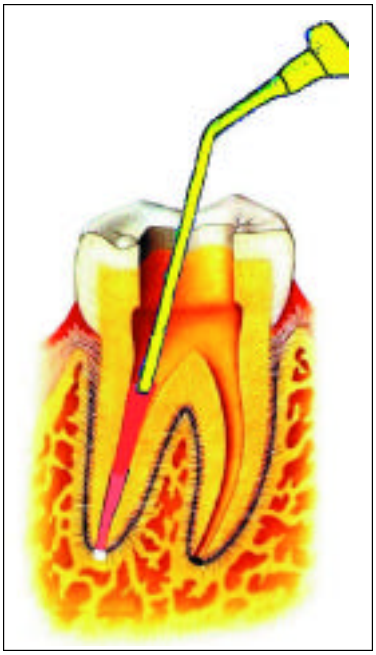


Figure 12: Obturation is completed by backfilling the canal using the Obtura gun

approximately 2-3mm of the material. Condense the gutta percha with a Schilder plugger (choose a plugger sized slightly smaller than the orifice). This will create an orifice plug that will maximise the hydraulic pressure during the downpack

• Turn the System B heat source on to 'use' and place it in the 'touch' mode. Set the heat at 100°C and the power on maximum. This low temperature setting will allow the gutta percha to thermoplasticise without burning. Hold the button on, drive the preheated plugger smoothly through the gutta percha until you reach within 3-4mm of the binding point. You will feel an increase in resistance to your downward push or the tip may even stop (Figure 9). This will take approximately two seconds. Release the activation ring.

• At this point, have your assistant immediately turn up the temperature to 300°C. Activate the heat and apply pressure to push the plugger to the binding point. Then quickly withdraw the plugger. This 'separation burst' will take about 1.5 seconds (Figure 10). The heat is turned up to 300°C to plastize the gutta percha in the most apical portion of the canal

• Using a Dovgan plugger that fits within 3-5mm of working length, apply pressure while tapping (up-down packing motion) and condense the gutta percha for a few seconds. As the material cools, stop condensing and apply apical pressure for about 10 seconds. This will prevent the material from shrinking (Figure 11)

• The canal is now ready for the backfill. The authors recommend backfilling using the Obtura II thermoplasticized gutta percha injection system. This can be accomplished by injecting small aliquots of gutta percha (2-3mm) into the canal and vertically compacting with a plugger (Figure 12). This is repeated until the whole canal is obturated. If Obtura II is not available, any other technique can be used.

Figure 14a: One canal was originally found, prepared and obturated using the THC technique. Note the extra untreated canal that was filled by sealer from the hydraulics generated by this obturation technique

Advantages of the THC technique

• Excellent apical control

• Thorough condensation of the main and

Figure 14b: Under the surgical operating microscope this extra canal can be viewed

Figure 13: Upper premolar showing lateral canals filled with the THC technique

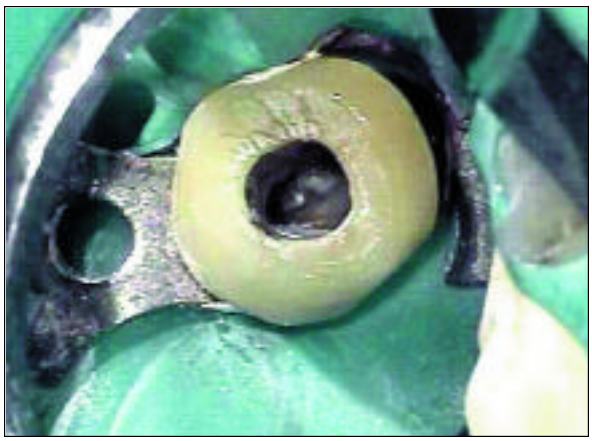


Figure 14c: The extra canal was subsequently prepared and obturated

lateral canals
• Less technique sensitive than the classic Schilder technique
• Downpack in one motion
• Fast, easy and predictable.

Disadvantages of the THC Technique

• Must have good shape and apical resistance form
• Initial purchase of System-B unit, pluggers and Obtura II.

The use of this technique is advantageous in the three dimensional obturation of the root canal system regardless of the complexity of the case (Figures 13 and 14).

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