



## Investigation

# Correlation between chemical composition and sealing ability of various gutta-percha brands using different filling techniques

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## ABSTRACT

The purpose of this in vitro study was to determine the apical seal of three different obturation techniques and correlated to the chemical composition of five gutta-percha cone brands. Five brands were used: Dentsply; Tanari; Konne; Obtura Spartan and Analytic Endodontics. One hundred and twenty human upper central incisors were instrumented using a pressureless crown-down technique and irrigated with 0.9% saline solution. The experimental groups were obturated using the Continuous Wave of Condensation and with a shaped single cone technique. The control group was obturated using the lateral condensation. All specimens were stored in 100% humidity for 1 week, coated with nail varnish, except for the apical 2 mm, and suspended in India ink for 10 days. Teeth were decalcified, rendered transparent, and linear dye penetration was measured. The results showed significantly greater dye penetration between lateral condensation and shaped single cone and wave of condensation. Could be concluded that the best technique was the wave of condensation and the brands Obtura and Tanari had the best results.

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## Correlação entre composição química e selamento de varias marcas de gutta-percha utilizando diferentes técnicas obturadoras

### R E S U M O

O objetivo do presente estudo foi determinar o selamento apical de três diferentes técnicas de obturação na qual foram utilizadas 5 diferentes marcas de cone de gutta-percha. As marcas utilizadas foram: Dentsply, Tanari, Konne, Obtura Spartan e Analytics Endodontics.

### Palavras chave:

Endodontia

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Guta-percha  
Obturação do canal radicular

Cento e vinte incisivos centrais superiores foram instrumentados utilizando uma técnica crown-down sob irrigação constante de solução salina 0.9%. Os grupos foram obturados utilizando duas diferentes técnicas: a) técnica da onda contínua de condensação com auxílio do aparelho System B ou b) técnica do cone único. No grupo controle foi utilizada condensação lateral. Todos os espécimes foram armazenados por 7 dias em 100% de umidade. Decorridos os 7 dias os espécimes foram cobertos com esmalte de unha, deixando livre os 2 mm apicais, e colocados em tinta nanquim por mais 7 dias. Os dentes foram então descalcificados, diafanizados e a penetração do corante foi mensurada. Os resultados mostraram uma maior penetração do corante nas técnicas de condensação lateral e na técnica do cone único do que na onda contínua de condensação.

Pode ser concluído que a melhor técnica de obturação foi a onde contínua de condensação associada aos cones da marca Obtura e Tanari.

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## Introduction

The hermetic sealing of the root canal system is one of the major objectives in successful endodontic therapy. Recently, a number of filling techniques based on heated gutta-percha have been introduced with the aim of enhancing three-dimensional filling of the root canal. These include warm vertical condensation, low-temperature and high-temperature thermoplasticized gutta-percha, thermoplasticized gutta-percha as a coating on a flexible carrier, thermal compaction and warm lateral condensation.<sup>1-4</sup>

The concept of thermoplastic compaction is based entirely on the heat softening of gutta-percha combined primarily with the vertical compaction.<sup>4</sup> The shape of nonstandardized cones provides the necessary bulk of the gutta-percha for the vertical compaction.<sup>4</sup> Clinicians have noticed that cones of various brands may have a different behaviour during compaction. There are also differences in the flow and in the quality of seal with gutta-percha from different manufactures.<sup>5,6</sup>

These differences could be explained by the great chemical heterogeneity that is found among gutta-percha cones. Brittleness, stiffness, tensile strength, and radiopacity have been shown to depend primarily on the organic and inorganic components.<sup>7</sup> The composition of gutta-percha points is approximately 14.5–22% gutta-percha polymer and 37–84.3% zinc oxide.<sup>8,9</sup> The particular percentages of components vary with manufacturer. Previous studies reported that different brands may have quite different chemical compositions.<sup>7-9</sup> It is evident that since the cones differ in their composition, they may differ in their physical properties, which could interfere in the apical sealing. These differences may be related to errors and misinterpretations in root canal filling studies. This is evident since different brands cones may provide different results in several tests, as they have different chemical composition. Thus the aim of this study was to correlate the chemical composition of five gutta-percha cone brands with apical sealing ability using different obturation techniques and also to correlate chemical composition with the manufacturer. The null hypothesis tested was that there were no differences in the apical sealing ability in canals filled with different gutta-percha cones brands and endodontic filling techniques.

## Materials and methods

120 permanent maxillary incisors with straight root were used for this study. The apical foramen was breached with a size 20 K-file. Working length was determined by subtracting 1 mm from the length when the top of the K-file appeared at the apical foramen. The canals were instrumented using Flexofiles (Dentsply-Maillefer, Ballaigues, Switzerland) until a size #50 reached the working length. The coronal part of each canal was widened with Gates-Glidden. Finally a stepback preparation was executed with circumferential filling. After each file the canal was irrigated with 2 ml of 2% chlorhexidine gel and final irrigation with 5 ml of distilled water.<sup>10</sup> Before obturation the canals were dried with absorbent paper points and the foramen was breached with a size 20 K-file.

Thirteen groups were randomly formed, eleven experimental groups with ten teeth each, and two control groups with five teeth each. The positive control group was instrumented and not obturated. In the negative control group the whole root was covered with two full nail varnish layers. The endodontic sealer used was the Endomethasone (Septodont, Saint-Maur, France). In all tested groups the sealer was taken to the canal with the main gutta-percha cone.

Groups (1–5) were obturated with Continuous Wave of Condensation with System B and five commercially available gutta-percha cones. The brands used are listed in Table 1. A medium nonstandardized gutta-percha cone was properly fitted. A medium plugger was selected to within 5–7 mm from the canal terminus. The heat source was set to 200 °C, the canal was thoroughly dried, and the medium cone was selected using a calibration ruler, corresponding to a #50 file. The plug tip was driven through the master cone with a single motion to a point 5 mm short the working length. While pressure on the plug was maintained, the button on the heating system was released and the plug was slowed in its binding position, pressure was maintained on the plug until the apical mass of the gutta-percha has set (5–10 s). Then the switch was reactivated for a short burst of heat (1 s) to release the plug and the surplus of gutta-percha. Then, the coronal portion of the canal was backfilled. This was done with the same system with modified temperatures (100 °C).

Groups (6–10) were obturated with Shaped Single Cone and five commercially available gutta-percha cones. The medium

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