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Tip diameter of 0.04 and 0.06 tapered gutta-percha points from different commercial brands

Diâmetro da ponta (d0) de cones de guta-percha de conicidades 0,04 e 0,06 de diferentes marcas comerciais

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Abstract

Objective: The aim of this study was to determine the correlation between the diameter D0 of gutta-percha points from three different commercial brands (Tanari Man, Cone Tech and Dentsply) and their original respective values. **Materials and methods**: A high precision micrometer was used by a single calibrated operator to evaluate if the gutta-percha points are in aggrement with the n. 57 ANSI/ADA specification. **Results**: For the 0.04 tapered points, Cone Tech showed lower percentage of inadequate points (52%), followed by Dentsply (56%) and Tanari (80%). For the 0.06 tapered points, Cone Tech showed lower percentage of inadequate points (50%), followed by manufacturers Dentsply (53%) and Tanari (81%). **Conclusions**: It can be concluded that there is no standardization in the diameter D0 of the gutta-percha points of different commercial brands.

Keywords: Gutta-percha points. Taper. Filling material.

Resumo

***Objetivo**: O objetivo deste estudo foi determinar a correlação entre o diâmetro D0 dos cones de guta-percha de três diferentes marcas comerciais (Tanari Man, Cone Tech e Dentsply) com seus respectivos valores originais.*

***Materiais e métodos**: Um micrômetro de alta precisão foi utilizado por um único operador devidamente calibrado para avaliar se os cones de guta-percha estavam de acordo com a norma n. 57 da ANSI/ADA. **Resultados**: Para a conicidade 0.04, Cone Tech apresentou menor percentual de cones inadequados (52%), seguido de Dentsply (56%) e Tanari (80%). Para a conicidade 0.06, Cone Tech apresentou menor percentual de cones inadequados (50%), seguido de Dentsply (53%) e Tanari (81%). **Conclusões**: Pôde-se concluir que não há padronização no diâmetro D0 dos cones de guta-percha das diferentes marcas comerciais.*

Palavras-chave: *Cones de guta-percha. Taper. Material para obturação.*

Introduction

The success of endodontic treatment depends on a sequence of stages starting from diagnosis, access surgery and odontometry to biomechanical preparation and root canal obturation (1). However, it would be worthless to perform all the stages adequately before obturation if the main goal is not achieved, that is, the sealing of the root canals systems to enable the periapical repair process (1).

After cleaning and disinfection, the root canal filling must seal the apical foramen completely, for empty spaces would be occupied by periapical tissue exudates causing decomposition and recontamination, which would lead to inflammation in the region. To obtain adequate apical sealing after shaping the root canal (1, 2), the master gutta-percha point must closely fit the apical portion of the debrided canal space (1, 2).

There is a tendency to perform root canal debridement using NiTi instruments (3). There are variations in taper of NiTi instruments and, for this reason, gutta-percha points are being manufactured in different sizes (0.04 and 0.06), which correspond to the taper of the NiTi instruments (3). Therefore, the master gutta-percha point must have a similar diameter to the size and taper of the instruments, facilitating and reducing time of the obturation stage (2).

The fabrication of gutta-percha points follows the specification n. 57 (ANSI/ADA) (4) that establishes norms and minimal standards for filling materials (3). Clinical observation has shown that, due to difficulties in handling gutta-percha points, which is commonly hand rolled, considering the tapers are not often uniform, correspondence of the diameters of points with standardized instruments from several manufacturers of gutta-percha points does not occur (5, 6).

Thus, the aim of this study was to evaluate the tip diameter (D_0) of 0.04 and 0.06 tapered gutta-percha points from different commercial brands, since endodontic treatment success depends on adequate apical sealing.

Materials and methods

To conduct this study, gutta-percha points of the following manufacturers were used: Tanari Man (Manacapuru, AM, Brazil), Cone Tech (Manaus, AM, Brazil) and Dentsply (Dentsply/Maillefer, Tulsa, OK, USA), being three boxes of 0.04 tapered points and three boxes of 0.06 tapered points from different lots of each manufacturer, totaling 1,080 points. The diameter D_0 of each gutta-percha cone was measured with the aid of a high precision micrometer by a single and trained operator, under the same conditions. To verify the standardization of tapers regarding to the n. 57 ANSI/ADA specification, a sample mean with known standard deviation and level of confidence of 95% for each diameters (15, 20, 25, 30, 35 and 40) was prepared for each manufacturer evaluated in this study. After obtaining the sample mean, the results were considered inappropriate if the value specified were outside the tolerance established by n. 57 ANSI/ADA specification. The values were recorded in millimeters and submitted to statistical analysis (Student's-t test, $p < .05$) to compare the correlation of the diameter of the gutta-percha points with the standardization of nickel-titanium instruments.

Results

The data are shown in Table 1.

Table 1 - Comparison of the mean values of the tip diameter of gutta-percha points in relation to the standar values for diameter D_0

Standard		Manufacturer/taper					
		Dentsply (0.04)	Dentsply (0.06)	Tanari (0.04)	Tanari (0.06)	Cone tech (0.04)	Cone tech (0.06)
	n	Mean + SD	Mean + SD	Mean + SD	Mean + SD	Mean + SD	Mean + SD
0.15	30	0.14 ± 0.01	0.15 ± 0.02	0.17 ± 0.02	0.17 ± 0.02	0.17 ± 0.02	0.17 ± 0.03
0.20	30	0.20 ± 0.01	0.20 ± 0.01	0.25 ± 0.03	0.20 ± 0.03	0.25 ± 0.05	0.22 ± 0.03
0.25	30	0.26 ± 0.01	0.25 ± 0.01	0.26 ± 0.02	0.30 ± 0.04	0.28 ± 0.04	0.28 ± 0.04
0.30	30	0.32 ± 0.03	0.31 ± 0.02	0.27 ± 0.03	0.28 ± 0.03	0.30 ± 0.03	0.28 ± 0.02
0.35	30	0.36 ± 0.01	0.33 ± 0.02	0.29 ± 0.04	0.32 ± 0.05	0.35 ± 0.02	0.34 ± 0.01
0.40	30	0.41 ± 0.01	0.42 ± 0.02	0.39 ± 0.04	0.37 ± 0.03	0.41 ± 0.02	0.41 ± 0.01
Inadequate		56%	53%	80%	81%	52%	50%

Source: Research data.

The Dentsply gutta-percha points showed 56% of inadequacies in the 0.04 tapered points with statistically significant difference for diameters 15, 25, 30, 35 and 40 ($p < .05$). For the 0.06 tapered points, inadequacies were of 53% with statistically significant difference for diameters 35 and 40 ($p < .05$).

The gutta-percha points of the manufacturer Tanari Man presented 80% and 81% of inadequacy for the 0.04 tapered points, with significant results for 15, 20, 25, 30 and 35 diameters ($p < .05$). The 0.06 tapered points presented statistically significant difference for 15, 25, 30, 35 and 40 diameters ($p < .05$). With regard to the Cone Tech points, they presented 52% of inadequacy for 0.04 tapered points, with significant results for 15, 20 and 25 diameters ($p < .05$) and 50% of inadequacy for all the 0.06 tapered points ($p < .05$).

Discussion

It is unanimous in several studies that the obturation stage is important for the success of endodontic therapy because when the canal system is hermetically sealed, it prevents the penetration of microorganisms and fluids (1, 2). Several authors affirm that unsatisfactory obturation is largely responsible for the failure of endodontic treatment (1-3, 7). The mistaken choice of the gutta-percha point can often lead to treatment failure either because the point exceeds the limit established in odontometry or locks short of the working length (5, 6).

It is important to evaluate the diameter D_0 of the gutta-percha points because it is a critical region and it is responsible for the fitting or locking in the apical filling limit of the prepared root canal (1-3). Ideally, the gutta-percha points should have the same diameter as the last file used at the working length (8, 9). Thus, the correlation between the diameter of the master gutta-percha points and the endodontic instruments facilitates and improves the obturation quality of the root canal systems (8).

The high percentage of the number of inadequacies of the diameter D_0 among the points of the same taper found in this study showed a great variation in the initial diameter of the gutta-percha points. This shows that despite standardization, some manufacturers fabricate points that are below expectations, which may lead to an increase in working time and cause clinical failures during treatment (1, 5, 6).

In this study, the gutta-percha points fabricated by Tanari presented the largest number of inadequate points, which is in disagreement with the mentioned studies. This shows that the results may depend on the lots studied, manufacturing system (manual or mechanical) and the quality control inside and outside the company (8).

The manufacturers Cone Tech and Dentsply presented less inadequate points whereas Tanari Man presented the highest number of inadequate ones. Therefore, long-term follow-up of the quality of these points is imperative, as well as a providing feedback of search results to the company in order for the manufacturers to be informed of the quality of their products and the need to improve them and maintain long-term quality (7, 9).

As observed, the results obtained corroborate the several findings in the literature, showing that there is an inaccuracy or large variation in the diameter D_0 of the gutta-percha points, which reinforces the importance of using filling cements and thermoplasticized techniques to correct defects and failures in the obturation procedure (7, 9). With the lack of precision in the diameter of the master gutta-percha points, the professional is required to seek for resources to approximate the tip diameter of the cone with the diameter of the last instrument used to prepare the apical stop.

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