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ORIGINAL ARTICLE

Evaluation of the standardisation of gutta-percha points

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Abstract

Introduction and Objective. In order to archieve good adaptation to the apical diameter, the master gutta-percha (GP) point should match the last instrument used at the working length. The aim of this study was to determine whether the diameters of the standard gutta-percha points comply with the ISO standard.

Materials and method. The diameter at the tip (D0) of GP points (2% taper) sizes 30, 35 and 40 manufactured by Meta Biomed, South Korea (group A) and DiaDent, South Korea (group B) was assessed using an endodontic gauge (Dentsply Maillefer, Switzerland). The percentage of points larger than ISO size, compliant and smaller than ISO size, was calculated. Data were analysed using the chi2 test, with a significance level of 0.05.

Results. 71.2% of assessed points met the ISO size requirements, 16.2% were smaller and 12.6% were larger than expected. These percentages were 76%, 12.6% and 11.4% in group A, and 66.4%, 19.6% and 14% in group B, respectively. There were no statistically significant differences between the percentage of proper and incorrect sizes in groups A and B overall, or for sizes 35 and 40. Only for group A 30 the standardisation of the points was more accurate than for group B 30 ($p<0.001$).

Conclusions. This study shows that the dimensions of gutta-percha points may differ from the ISO standard. The use of an endodontic gauge can help select points with a good adaptation to the apical diameter and should be introduced as a standard procedure when obturating root canals.

Key words

ISO standard, root canal obturation, endodontic gauge, gutta-percha points

INTRODUCTION

The hermetic sealing of a root canal is one of the basic principles of root canal treatment. Such obturation is usually achieved by combining gutta-percha points (GP) with endodontic sealer [1]. Regardless of the root canal filling technique, small gaps are often left between the points, sealer and walls of the root canal, which can enable endodontic pathogens to survive [2, 3]. Sealers should be used in minimal amounts as they can cause a microleakage, leading to an infection of the root canals, and they can have a cytotoxic effect on the periapical tissues [3, 4, 5].

In order to reduce the amount of sealer and prevent extrusion of the filling material into the periapical tissues, the master gutta-percha point should have a good adaptation to the apical diameter. This can be archived by matching the master point to the size and taper to which the root canal has been prepared in the apical region [6]. In practice, the master point is matched to the last instrument used at the working length, therefore the standardization of the point is very important. The compatibility of GP point dimension with the ISO standard is important in both single GP point and lateral condensation techniques [7]. However, due to variations in the diameter of the tip of the point, the procedure of point selection can be time-consuming. [8]. Hence, the calibration of the diameter of the tip of GP point using a special gutta-percha point gauge should be a standard procedure prior to the master point adaptation in the root canal.

The first attempt to standardise GP points was made by Ingle and Levine [8]. The dimensions of endodontic obturating materials is specified in ISO Standard No. 877:2022 [9] which states that for polymer points the accepted tolerance is ±0.05 for sizes 008–025, and ±0.07 for the sizes 030–140. However, the dimensional tolerance does not apply to the tip of the point (D_0). A number of studies have reported the lack of standardisation of commercially available gutta-percha points with a wide variation in diameter and taper [1, 7, 8, 10–13].

The aim of the study was to determine whether the diameters of the standard gutta-percha points comply with the current ISO standard.

MATERIALS AND METHOD

Two commercially available brands of GP points (2% taper): Meta Biomed, South Korea (group A) and DiaDent, South Korea (group B) were selected for the study. One hundred points were randomly selected from each pack of ISO sizes 30, 35 and 40, and their diameter at D_0 was assessed using an endodontic gauge (Dentsply Maillefer, Switzerland). Within each size, measurements were taken by two calibrated examiners, each assessing 50 points, by placing the point in the hole of appropriate size. Visually bent, damaged or irregular points were rejected from the analysis. In cases where a point did not match the hole size, further measurements were taken to determine the actual point's size at D_0 (Fig. 1).

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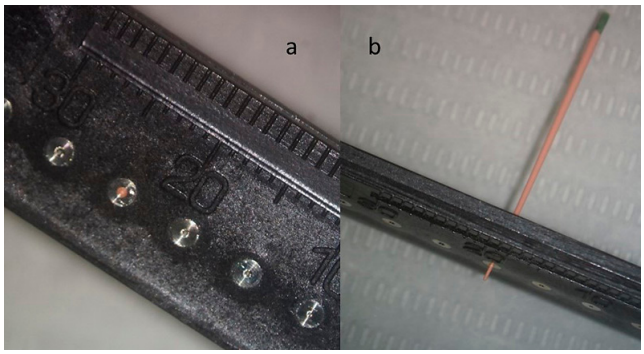

Figure 1. Endodontic gauge with gutta-percha point a. accurate point dimension b. incorrect point dimension

The percentages of points larger than the ISO size, complying with the ISO standard and smaller than the ISO size, were calculated. Data were analysed with the chi^2 test, with the level of significance at 0.05.

RESULTS

A total of 600 points were measured and the percentage of points of each size was calculated. It was found that 71.2% met the ISO size requirements, 16.2%were smaller than they should have been and 12.6% were larger. In group A (Meta Biomed), these percentages were 76%, 12.6% and 11.4%, respectively, and in group B (DiaDent) – 66.4%, 19.6% and 14%.

Figures 2–4 show the distribution of actual point sizes by brand and declared ISO size. The percentage of proper points ranged from 92% (group A 30) to 58% (group B 35). In all evaluated groups except group A 30, larger and smaller points than the declared ISO size were found.

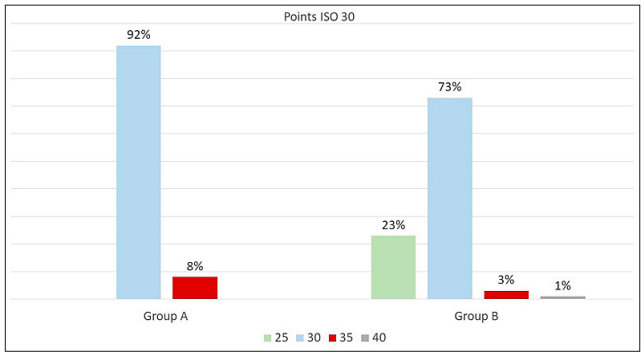

Figure 2. Distribution of actual diameters of ISO 30 points

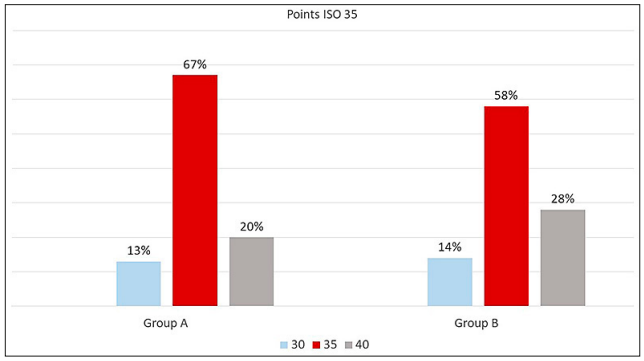

Figure 3. Distribution of actual diameters of ISO 35 points

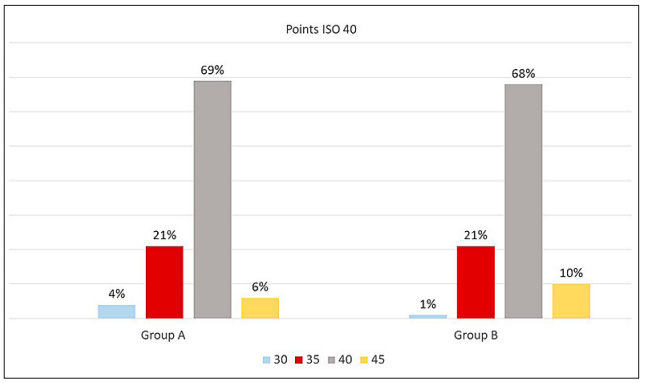

Figure 4. Distribution of actual diameters of ISO 40 points

Table 1 shows the statistical analysis of data from group A and B. There were no statistically significant differences between the percentage of proper and incorrect sizes in groups A and B overall, and for sizes 35 and 40. Only for group A 30 the standardisation of the points was more accurate than for group B 30 ($p<0.001$).

Table 1. Distribution of percentage of valid and incorrect point sizes in group A and B (chi^2 test, $p<0.05$)

Point ISO size	Group A		Group B		p
	proper	incorrect	proper	incorrect	
30	92%	8%	73%	27%	<0.001
35	67%	33%	58%	42%	NS
40	69%	31%	68%	32%	NS
30–40	76%	24%	66%	34%	NS

NS – not significant

DISCUSSION

The selection of an accurate master point is important for the proper obturation of the root canal during endodontic treatment. The lack of standardisation of GP points can increase the time needed to fill the root canal and lead to some treatment failures due to incomplete filling of the canal, or pushing the point beyond the apical foramen [8].

There are no reports on the assessment of standardisation of 2% taper GP points at the D_0 point. Such an assessment is important because dentists measure the diameter of the point directly at its tip. Moulle et al. [8] evaluated standardised GP points from six different manufacturers and found that some of them did not comply with the ISO standard. There are reports that bigger taper gutta-percha points dedicated to continuous rotational motion instrumentation, as well as for reciprocated systems, had larger diameters in relation to the corresponding endodontic instruments [1, 7, 10, 11]. In another study, most of the bigger taper points of two different brands had larger dimensions than they should have been [13]. Haupt et al. [12] observed that in endodontic systems designed for conventional continuous rotary movement, file diameters were larger than the diameters of the corresponding GP points, whereas in reciprocating systems, point diameters at the apex approached ISO size.

It was not the aim of this study to compare different brands with one another, but to assess whether the gutta-percha points available on the market are well standardised. It was

shown that for both brands and all ISO sizes assessed, in a certain percentage of the points there are variations from the specified diameter. However, it is worth noting that for sizes 35 and 40, the distribution of points with diameters smaller and larger than the ISO standard was very similar in groups A and B. Only for size 30 there were differences between the brands assessed.

A proper standardisation of gutta-percha points is undoubtedly a challenge for their manufacturers. Scanning microscopy studies have shown that the tips of GP points from different manufacturers vary in shape, and may also have artefacts such as gross protuberances or deeply cratered areas containing numerous free or entrapped crystal-like particles [14]. GP points may undergo dimensional changes under storage conditions [13]. This is due to the properties of gutta-percha, such as the elasticity of the points at room temperature and the thermo-plasticity of the material [6]. In addition, the measurement of GP points may be affected by the accuracy of the gutta-percha gauge [13]. Kozun at al. [6] found that some of the holes in the endodontic gauge had an elliptical shape visible under magnification. Such deviations can adversely affect the final shape and dimension of the tested hole and make it difficult to measure the GP point. Therefore, it seems advisable to check a newly-purchased gauge under a microscope.

Limitation of the study. Only a point's diameter at D_0 was evaluated. The taper of GP points should be constant throughout, however, according to the ISO standard [9], slight deviations in the expected diameter are acceptable. In order to assess the accuracy of various brands available on the market, the diameter of the points needs to be measured at a larger number of points, and equipment such as a calibrated digital calliper should be used. During endodontic treatment, dentists have no devices other than endodontic gauge at their disposal, hence our study reflected clinical conditions.

CONCLUSIONS

This study shows that the dimensions of gutta-percha points may differ from the ISO standard. The use of an endodontic gauge can help select points with a good adaptation to the apical diameter and should be introduced as a standard procedure when obturating root canals.

REFERENCES

1. Salles AA, Cord CB, Sonnemann TS, at al. Comparative analysis of the diameter of MTwo® system gutta-percha points in relation to their corresponding instruments. RSBO (Online). 2013;10(1):49–55.
2. Kalantar Motamedi MR, Mortaheb A, Zare Jahromi M, Gilbert BE. Micro-CT evaluation of four root canal obturation techniques. Scanning. 2021;25;2021:6632822. doi:10.1155/2021/6632822
3. Hirai VHG, Machado R, Budziak MCL, et al. Percentage of gutta-percha-, sealer-, and void-filled areas in oval-shaped root canals obturated with different filling techniques: a confocal laser scanning microscopy study. Eur J Dent. 2020;14(1):8–12. doi:10.1055/s-0040-1701543.067832
4. Pawińska M, Szczurko G, Łuczaj-Cepowicz E, et al. Cytotoxicity and oxidative stress induction by root canal sealers in human periodontal ligament fibroblasts: an in vitro study. Iran Endod J. 2021;16(3):164–175.
5. Collado-González M, Tomás-Catalá CJ, Oñate-Sánchez RE, et al. Cytotoxicity of GuttaFlow Bioseal, GuttaFlow2, MTA Fillapex, and AH Plus on human periodontal ligament stem cells. J Endod. 2017;43(5):816–822. doi:10.1016/j.joen.2017.01.001
6. Kozuń A, Banaszek K, Sawicki J. Evaluation of endodontic gauge used for measurement of gutta-percha cones – preliminary report. Dent Med Probl. 2009;46(4):450–453.
7. Bajaj N, Monga P, Mahajan P. Assessment of consistency in the dimension of gutta-percha cones of ProTaper Next and WaveOne with their corresponding number files. Eur J Dent. 2017;11(2):201–205. doi:10.4103/ejd.ejd_167_16
8. Moule AJ, Kellaway R, Clarkson R, et al. Variability of master gutta-percha cones. Aust Endod J. 2002;28(1):38–43. doi:10.1111/j.1747-4477.2002.tb00365.x
9. Polski Komitet Normalizacyjny. PN-ENG ISO 6877:2021 (ang.). Dentistry. Endodontic Obturating materials. (access 2013.01.24).
10. Mirmohammadi H, Sitarz M, Shemesh H. Intra-manufacture diameter variability of rotary files and their corresponding gutta-percha cones using laser scan micrometre. Iran Endod J. 2018;13(2):159–162. doi:10.22037/iej.v13i2.14710. PMID:29707008; PMCID: PMC5911287.
11. Martínez I, Lozano A, Sanz JL, et al. Diameter and taper variability of gutta-percha cones adapted to TruNatomyTM and RotateTM rotary file systems. J Clin Exp Dent. 2023;15(1):e17-e22. doi:10.4317/jced.59992
12. Haupt F, Seidel M, Rizk M, et al. Diameter and taper variability of single-file instrumentation systems and their corresponding gutta-percha cones. J Endod. 2018;44(9):1436–1441. doi:10.1016/j.joen.2018.06.005
13. Silva AVT, Freitas BE, Faclao CAM, et al. Evaluation of gutta-percha points standardization. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS). 2019;18(9):45–47.
14. Goldberg F, Massone EJ, Pruskin E, et al. SEM study of surface architecture of gutta–percha cones. Endod Dent Traumatol. 1991;7(1):15–18.