



Size accuracy of the greater taper gutta-percha points – preliminary report

Klaudia Gałań^{1,B-D,F}, Sebastian Bobryk^{1,B-D,F}, Joanna Bagińska^{2,A,C,E-F}

¹ Student Research Group 'StuDentio', Department of Dentistry Propaedeutics, Medical University of Białystok, Białystok, Poland

² Department of Dentistry Propaedeutics, Medical University of Białystok, Białystok, Poland

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Abstract

Introduction and Objective. When filling root canals with gutta-percha points (GP), good adaptation of the point to the apical diameter must be achieved through the use of a point corresponding to the size of the master apical file (MAF). GP points with a greater taper, designed to fit into root canals shaped with files with a greater taper, are currently in common use. The study was performed to evaluate the ISO compliance of GP greater taper points (4% and 6%).

Materials and Method. Two boxes of GP in sizes 20, 30 and 40 (Dentsply Maillefer, Switzerland) with a taper of 4% (GP 4% group) and 6% (GP 6% group) were used. The percentage of GPs conforming to the ISO size and those not conforming to the ISO size was determined by assessing the fit of the GP apex diameter (D0) with an endodontic gauge (Dentsply Maillefer, Switzerland). Data were analysed using the chi2 test with a significance level of 0.05.

Results. Overall, 58.9% of the GP points assessed were in accordance with the ISO size. Depending on the size (20, 30, 40 according to ISO), compliance was 75%, 52.5% and 44.4% in the group GP 4%, and 87.5%, 32.5% and 60% in the group GP 6%, respectively. The results were statistically significant in the GP 4% ($p < 0.0001$) and GP 6% ($p < 0.05$) groups. In both groups, standardisation of greater taper GP was most accurate at size 20. There were no statistically significant differences between the number of GP points with correct diameter between groups GP 4% and GP 6%.

Conclusions. The study demonstrated the presence of differences between the ISO size and the actual size of the greater taper GP points. Therefore, the calibration of greater taper GP points before root canal filling should be a routine procedure.

Key words

ISO standards, gutta-percha points, greater taper points, endodontic gauge, root canal obturation

INTRODUCTION

Various possible endodontic errors and endodontic malpractices can be committed by dentists during clinical procedures [1–3]. Apart from pre-operative errors, such as improper diagnosis, and post-operative failures, such as prolonged pain, there are also complications resulting from treatment courses [3]. One of the most critical components of the root canal treatment (RCT) is the filling of the root canal. The hermetic sealing of a root canal is achieved by a combination of endodontic sealer and gutta-percha (GP) point [4]. Regardless of the root canal filling technique, unfilled spaces are often left between the points, sealer and walls of the root canal, which can lead to complications due to remaining pathogens [3, 5–7].

Gutta-percha should be the basic root canal filling material, considering that endodontic sealers can cause a microleakage, leading to an infection of the root canals [8, 9]. There are also reports that confirm sealer's cytotoxic influence on the periapical tissues [10, 11]. Good adaptation of the master point to the apical diameter must be achieved through the use of a GP point corresponding to the size and taper of the master apical file (MAF). Currently, the rotary instrumentation techniques are the preferable approach during chemo-mechanical canal preparation, mainly because they are time-saving [12, 13]. If the dentist shapes the canal

with rotary or reciprocal instruments with a greater taper, the use of standard (2% taper) GP points will be inadequate as a condensation of multiple accessory points is time-consuming and fraught with the risk of voids [14]. In order to avoid those complications, dental practitioners may choose a greater taper master point which is designed to match root canals shaped with greater taper files [5]. In practice, the master point is matched to the last instrument used at the working length; therefore, the ISO standardisation of the GP point is very important. Even though producers guarantee compliance with ISO standards, the dimensions of gutta-percha points may differ. There are reports in the literature on the wide variability in diameter and taper of commercially available gutta-percha points [15–17]. However, only a few papers address the accuracy of the greater taper GP points [18–22]. This study was performed to evaluate the ISO size compliance of GP greater taper points.

MATERIALS AND METHOD

Two calibrated examiners evaluated the commercially available gutta-percha points (Dentsply Maillefer, Switzerland) with 2 degrees of taper, 4% (Group GP 4%) and 6% (Group GP 6%). The diameter at D0 of each GP point was assessed using an endodontic gauge (Dentsply Maillefer, Switzerland) dedicated to greater taper points. Due to the construction of the gauge, only GP points of 20, 30 and 40 ISO sizes were assessed. For each size and taper 2 factory sealed packages were used. Measurements were conducted

✉ Address for correspondence: Joanna Bagińska, Department of Dentistry Propaedeutic, Medical University of Białystok, Poland
E-mail: joanna.baginska@umb.edu.pl

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by placing the point in the hole of appropriate size to verify its locking while it is assessed during a clinical procedure (Fig. 1). Points that were damaged were not evaluated.

The number and percentage of GPs conforming to the ISO size and those not conforming to the ISO size was calculated. Data were analysed with the chi2 test (<https://www.socscistatistics.com/tests/chisquare2/default2.aspx>), with the level of significance at 0.05.

RESULTS

A total of 236 points were measured and the percentage of points of each size conforming with the ISO standard was calculated. One factory-sealed packet of 4% GP points of the size 40 was found to contain 36 cones instead of 40 declared by the manufacturer. One hundred and thirty-nine points (58.5%) met the ISO size requirements. In the GP 4% group, the accuracy was 75%, 52.5%, 44.4% for sizes 20, 30 and 40, respectively, and in the GP 6% group it was 87.5%, 32.5% and 60%. Figures 2 and 3 show the percentage of points with the correct ISO size. Statistically significant differences in the number of GP points corresponding to the ISO standard were found in both groups (Tab. 1). In the comparison of the groups GP 4% and GP 6%, there were no statistically significant differences between the number of GP points of each size with the correct diameter.

Table 1. Distribution of numbers of GP points compliant and non-compliant with ISO size in group GP 4% and group GP 6% (chi² test; p<0.05)

| Size of GP point | No. of points compliant with ISO size | No. of points noncompliant with ISO size | p |
|------------------|---------------------------------------|--|--------|
| group GP 4% | | | |
| 20 | 30 | 10 | <0.05 |
| 30 | 21 | 19 | |
| 40 | 16 | 20 | |
| group GP 6% | | | |
| 20 | 35 | 5 | <0.001 |
| 30 | 13 | 27 | |
| 40 | 24 | 16 | |

DISCUSSION

Successful endodontic treatment is determined by following the standard guidelines and continually improving the technical skills of the operator [1]. One of the principles of endodontic treatment is that the master GP point should have a good adaptation to the apical diameter. The cone not only has to fill the canal to the apical foramen, but also obliterate the canal space laterally. This requirement could not be met without following the ISO standardisation of GP points. However, it is undoubtedly a challenge for dental manufacturers to achieve a proper standardisation of GP points. GP points are also susceptible to storage conditions due to their elasticity at room temperature and thermoplasticity [23].

The present study showed that the tip dimensions (D0) of greater taper GP points may differ from the ISO standard. During measurement of points with the endodontic gauge, differences were found between ISO and actual sizes,

regardless of the point's size and taper. The results obtained in the current study are in line with those obtained by Ivanyj et al. [17], Cunha et al. [19] and Cunningham et al. [20]. The study by Cunha et al. [19] showed discrepancies in terms of accuracy of standardised diameters with respect to GP points of 3 different brands, including those manufactured by Dentsply Maillefer. Cunningham et al. [20] also confirmed variation in greater taper point's diameter and taper for 5 brands, although the differences were lower than the acceptable deviation (± 0.07 mm) set for GP points in size 30 by the ANSI/ADA Standard No. 78 [24]. It has to be emphasised that according to the ISO standard, the tolerance of the cone's diameter is not applicable to D0 [25]. In contrast, Castilho et al. [21] found that most of the Dentsply Maillefer points of the size 25–40, F2 and F3, and of the taper 02, 04 and 06, were properly calibrated or close to the required diameter.

A difference in the actual dimension of the endodontic rotary/reciprocating instruments and GP points dedicated to them was also observed [4, 18, 26, 27]. Salles et al. [4] compared the MTwo[®] system and found that for almost all size/taper combinations (except 25/0.7) there were no statistically significant differences at D1 and D3. However, a comparison of other 2 brands of instrument/point systems revealed that the cones were statistically significantly greater than corresponding files at D1, D3 and D11 for ProTaper Next and D3 and D11 for WaveOne GP [18]. This factor may go unnoticed by dental practitioners and lead to under-obturation of root canal causing a failure at long term [19]. This shows the need of verification of the point's diameter, and not only at the D0 point. There are reports in the literature indicating that the gutta-percha gauges can also exhibit variability with regard to the size and shape of the gauge holes, which affects the ability to properly calibrate the points. The endodontic calibrator may also exhibit dimension changes due to high temperature during the sterilization process [28].

Limitation of the study. In this study, the accuracy of the GP point size was measured at the tip of the point (D0). Such a procedure corresponds to the management during endodontic treatment. The endodontic gauge was capable of measuring only selected point sizes (20, 30, 40); therefore, it was not possible to determine the actual point size. The practical aspect of the conducted study is that it demonstrates the necessity to calibrate greater taper GP points before root canal filling. Further analyses should be carried out to determine whether the size differences between the claimed and actual diameters are significant enough to affect the sealability of the root canal filling.

CONCLUSIONS

The study demonstrated the presence of differences between the ISO size and the actual size of the greater taper GP points. Therefore, the calibration of greater taper GP points before root canal filling should be a routine procedure.

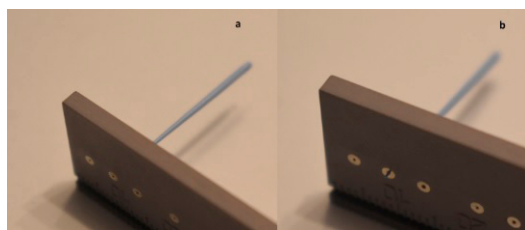


Figure 1. Endodontic gauge with gutta-percha point: a) accurate point dimension, b) incorrect point dimension

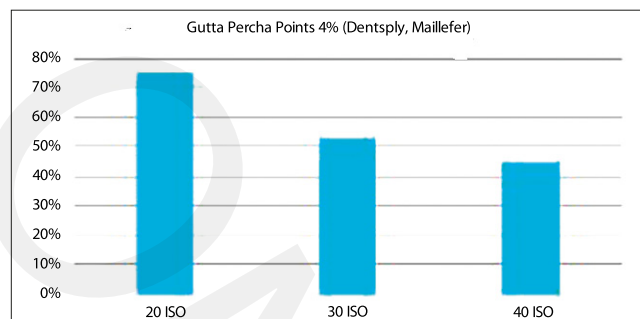


Figure 2. Distribution of percentage of 4% taper GP points with correct diameters

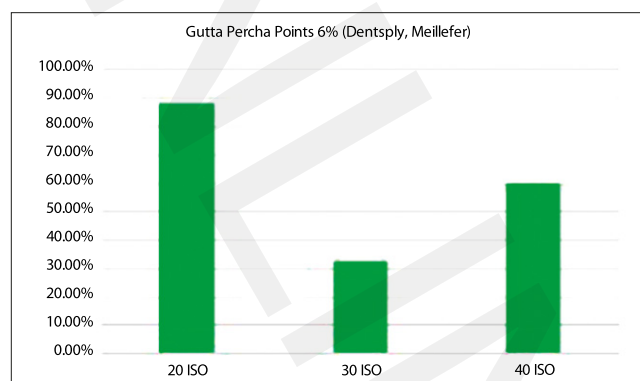


Figure 3. Distribution of percentage of 6% taper GP points with correct diameters

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