

# Analysis of accuracy of endodontic millimeter rulers of different commercial brands

Análise da precisão das réguas endodônticas milimetradas de diferentes marcas comerciais

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## ABSTRACT

### Objective

Evaluate the accuracy of the Brazilian market of endodontic millimeter rulers.

### Methods

The endodontic millimeter rulers were divided into four experimental groups of 10 rulers each, according to the commercial brand: Group 1 - Jon (Comércio de Produtos Odontológicos Ltda., São Paulo, Brazil), Group 2 - Microdont (Microsinagem de Precisão Ltda., Socorro, Brazil), Group 3 - Angelus (Angelus Soluções Odontológicas, Londrina, Brazil) e Group 4 - ICE (Instrumentos Cirúrgicos Esmeralda Ltda., São Paulo, Brazil). In each endodontic ruler the measure of 20.00 mm was verified with an electronic digital caliper. The results were statistically tested using variance analysis ANOVA followed by Turkey test with  $p < 0.05$ .

### Results

The results showed that the average measures of the rulers are not exact, ranging from 19.80 mm to 20.27 mm for the brand ICE (Instrumentos Cirúrgicos Esmeralda Ltda., São Paulo, Brazil). The brand Angelus (Angelus Soluções Odontológicas, Londrina, Brazil) had the lowest variation and exact measurement in 60% of rulers examined. There was no significant difference between brands.

### Conclusion

The endodontic millimeter rulers analyzed were not standardized and accurate, so the professional should use the same ruler from the beginning to the end of the treatment.

**Indexing terms:** Dental instruments. Endodontics. Odontometry.

## RESUMO

### Objetivo

Avaliar a precisão de réguas endodônticas milimetradas comercializadas no Brasil.

### Métodos

As réguas endodônticas milimetradas foram divididas em 4 grupos experimentais de 10 réguas cada, de acordo com a marca comercial: Grupo 1 - Jon (Comércio de Produtos Odontológicos Ltda., São Paulo, Brasil), Grupo 2 - Microdont (Microsinagem de Precisão Ltda., Socorro, Brasil), Grupo 3 - Angelus (Angelus Soluções Odontológicas, Londrina, Brasil) e Grupo 4 - ICE (Instrumentos Cirúrgicos Esmeralda Ltda., São Paulo, Brasil). Em cada régua foi aferida a medida de 20,00mm por meio de um paquímetro digital eletrônico. Os resultados obtidos foram submetidos à análise estatística utilizando Análise de Variância ANOVA, seguido do teste de Turkey com  $p < 0,05$ .

### Resultados

Os resultados demonstraram que a média das medidas das réguas não são exatas, variando desde 19,80mm até 20,27mm para a marca ICE (Instrumentos Cirúrgicos Esmeralda Ltda., São Paulo, Brasil). A marca Angelus (Angelus Soluções Odontológicas, Londrina, Brasil) apresentou a menor variação e a medida exata em 60% das réguas examinadas. Não houve diferença significante entre as marcas.

### Conclusão

As réguas endodônticas milimetradas analisadas, não se mostraram padronizadas e precisas, devendo o profissional utilizar a mesma régua do início ao fim do tratamento.

**Termos de indexação:** Instrumentos odontológicos. Endodontia. Odontometria.

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## **INTRODUCTION**

Endodontic treatment consists of interdependent and sequential operative procedures, which must be performed carefully, because negligence on any one of them will negatively influence the next stage.

Considering that successful endodontic treatment depends on the correct chemical-mechanical preparation of the entire root canal and correct filling, Odontometry is of fundamental importance, since it is used to determine the working length and consequently, the apical limit for debridement and obturation.

Several Odontometry techniques have been described in the literature. Among them, digital tactile sensitivity<sup>1</sup>, radiographic<sup>2-4</sup> and electronic methods<sup>5-6</sup> can be used alone or in conjunction with one another with the purpose of increasing safety in determining the apical limit of debridement<sup>7-8</sup>.

Irrespective of the technique, the use of an endodontic millimeter ruler is necessary as the operator uses it to record the value of the working length, which is later transferred to the endodontic instruments during root canal debridement and to the gutta-percha cones during the obturation stage.

However, it is clear that the endodontic millimeter ruler must be precise and standardized not only within the same commercial brand but also among different brands with the objective of providing more safety during the different stages of endodontic treatment that depend on it.

Therefore, the aim of this study was to assess endodontic millimeter rulers of different commercial brands in Brazil with regard to their measurement precision.

## **METHODS**

To conduct this study, 40 endodontic millimeter rulers were used and were divided into 4 experimental groups of 10 rulers each, according to the commercial brand and distributed as follows: Group 1 - Jon (Comércio de Produtos Odontológicos Ltda., São Paulo, Brazil); Group 2 - Microdont (Microusinagem de Precisão Ltda., Socorro, Brazil); Group 3 - Angelus (Angelus Soluções Odontológicas, Londrina, Brazil); Group 4 - ICE (Instrumentos Cirúrgicos Esmeralda Ltda., São Paulo, Brazil).

The measurement of 20.00 mm was pre-established for all the rulers and the measurement was verified with an electronic digital caliper (Digimess Instrumentos de Precisão Ltda., São Paulo, Brazil) to check the precision of the pre-established measurement for each ruler.

After obtaining the measurements, the results were submitted to statistical analysis using the Analysis of Variance, followed by Tukey's test at a level of significance of  $p < 0.05$ .

## **RESULTS**

The results obtained after the verification of all the rulers using the electronic digital caliper with the pre-established measurement of 20.00 mm are shown in Table 1.

The measurement of the rulers of the brand Jon (Comércio de Produtos Odontológicos Ltda., São Paulo, Brazil) ranged from 19.85mm to 20.16mm with a variation of 0.31mm. Those of the brand Microdont (Microusinagem de Precisão Ltda., Socorro, Brazil) ranged from 19.85mm to 20.20mm with a variation of 0.35mm. Neither of the rulers showed an exact measurement (20mm). Those of the brand Angelus (Angelus Soluções Odontológicas, Londrina, Brazil) ranged from 18.85mm to 20.05mm with a smaller variation: 0.20mm. Lastly, those of the brand ICE (Instrumentos Cirúrgicos Esmeralda Ltda., São Paulo, Brazil) showed values that ranged from 19.58mm to 20.27mm with a greater variation, 0.67 mm.

Neither of the rulers of the ICE (Instrumentos Cirúrgicos Esmeralda Ltda., São Paulo, Brazil) brand showed an exact measurement.

Considering a variation of plus or minus 0.05 mm in 20.00 mm, the rulers of the brand Jon (Comércio de Produtos Odontológicos Ltda., São Paulo, Brazil) showed a frequency of 50%; Microdont (Microusinagem de Precisão Ltda., Socorro, Brazil), 20%; Angelus (Angelus Soluções Odontológicas, Londrina, Brazil), 60%; and ICE (Instrumentos Cirúrgicos Esmeralda Ltda., São Paulo, Brazil), 20% (Table 2).

The results of the statistical analysis of the measurements observed in the endodontic rulers are shown in Table 3, in which no significant difference among the brands could be observed.

**Table 1.** Individual values obtained after the verification of the different brands of endodontic millimeter rulers with the electronic digital caliper with the pre-established measurement of 20.00 mm.

Group 1 - Jon	Group 2 - Microdont	Group 3 - Angelus	Group 4 - ICE
20.05mm	20.20mm	19.87mm	20.15mm
20.00mm	20.08mm	19.85mm	20.05mm
19.95mm	20.20mm	20.04mm	19.58mm
19.87mm	20.16mm	19.92mm	20.27mm
20.04mm	20.03mm	19.98mm	20.06mm
19.85mm	19.85mm	19.98mm	20.16mm
20.10mm	20.04mm	20.04mm	19.81mm
20.16mm	20.17mm	20.04mm	20.09mm
20.10mm	20.18mm	19.98mm	20.15mm
20.00mm	20.16mm	19.87mm	19.80mm

**Table 2.** Frequency distribution of the values obtained in the different brands of endodontic.

Length	Jon		Microdont		Angelus		ICE	
	n	%	n	%	n	%	n	%
19.80 to 19.90	2	20	1	10	4	40	3	30
20.00*	5	50	2	20	6	60	2	20
20.10 to 20.20	3	30	7	70	0	0	4	40
20.25	0	0	0	0	0	0	1	10
	10	100	10	100	10	100	10	100

\*A difference of 0.05 mm above or below the pre-established measurement (20.00 mm).

**Table 3.** Mean and standard deviation of measurements observed in the endodontic rulers.

	Jon	Microdont	Angelus	ICE
n	10	10	10	10
Mínimo	19.85	19.85	19.85	19.80
Máximo	20.16	20.20	20.04	20.27
Média	20.01*	20.11*	19.96*	20.01*
Desvio padrão	0.1001	0.1103	0.07469	0.2131
Erro	0.03165	0.03487	0.02362	0.06739

\* No significant difference,  $p > 0.05$ .

## DISCUSSION

Odontometry is an extremely important stage of endodontic treatment, because from it, the apical limit of debridement is established and consequently, the obturation limit<sup>9</sup>.

Both in the radiographic method and with the use of apical locators, the so called endodontic rulers are indispensable for verifying the measurements necessary for endodontic treatment.

Several rulers with special designs have been released on the market, but few studies have been conducted to assess the precision of endodontic millimeter rulers<sup>10-11</sup>. Andrade & Pinheiro<sup>11</sup> found a lack of standardization of endodontic millimeter rulers in the commercial brands Kerr, Bioart and Jon (Comércio de Produtos Odontológicos Ltda., São Paulo, Brazil).

Alencar et al.<sup>10</sup> assessed 80 endodontic millimeter rulers of four different commercial brands (Imagem, Jon, Comércio de Produtos Odontológicos Ltda., São Paulo, Brazil; Maillefer and no brand) and concluded that irrespective of the commercial brand, all the measurements of the rulers were imprecise. Analyzing them together, the no brand rulers were the most precise, followed by the rulers of the brands Imagem, Jon (Comércio de Produtos Odontológicos Ltda., São Paulo, Brazil) and Maillefer.

Corroborating previous studies, the results of the present study showed that although there was no statistically significant difference among the rulers of the same commercial brand, and among the rulers of different brands, variation was observed among the measurements. The exact measurement of 20.00 mm was only obtained for the brand Jon (Comércio de Produtos Odontológicos Ltda., São Paulo, Brazil) (20%) and no occurrence measure was recorded for the brands Angelus (Angelus Soluções Odontológicas, Londrina, Brazil), Microdont (Microusinagem de Precisão Ltda., Socorro, Brazil) and ICE (Instrumentos Cirúrgicos Esmeralda Ltda., São Paulo, Brazil) (Table 1).

Considering a deviation of plus or minus 0.05 mm from the reference measurement (20.00 mm), the ruler of the brand Jon (Comércio de Produtos Odontológicos Ltda., São Paulo, Brazil), Angelus, (Angelus Soluções Odontológicas, Londrina, Brazil) showed higher agreement (60%), followed by Jon (Comércio de Produtos Odontológicos Ltda., São Paulo, Brazil) (50%) and Microdont (Microusinagem de Precisão Ltda., Socorro, Brazil) and ICE (Instrumentos Cirúrgicos Esmeralda Ltda., São Paulo, Brazil) (20%), as shown in Table 2.

In view of these results, it is important for professionals who perform endodontic treatments to be aware of the precision of endodontic rulers, particularly when performing treatments in multiple sessions. In these cases, the same ruler must always be used in the different treatment sessions in order to prevent errors in establishing the apical limit of debridement and obturation. The purpose of taking care is to ensure that the success of endodontic treatment is not compromised.

Alencar et al.<sup>10</sup> pointed out how important it is for manufacturers of endodontic millimeter rulers to comply with the norms of standardization of these instruments so that the quality of endodontic treatment is not compromised.

## CONCLUSION

According to the methodology used, it was concluded that the endodontic millimeter rulers analyzed were not precise and standardized and the professional

should use the same ruler from the beginning of treatment to the end in order to prevent error when determining the apical limit of debridement and obturation.

## Collaborators

FR VICTORINO and A LUSTOSA-PEREIRA participated in all the stages of the study, from its conception to the development and writing of article. N BERNARDINELLI, RB GARCIA, IG de MORAES and CM BRAMANTE help with the statistical analysis and correction of the final version of the article.

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