

Do denture teeth dimensions match natural anterior teeth?

As dimensões dos dentes artificiais correspondem aos dentes anteriores naturais?

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ABSTRACT

Objective: To compare dimensions of natural maxillary anterior teeth and several denture teeth molds and also address differences between genders. **Methods:** A single examiner with a digital caliper measured dental casts of 41 males and 55 females in order to determine CIW (central incisor width), CIL (central incisor length) and WS (width of anterior teeth on a straight line). In addition, WC (width of anterior teeth on a curve) was measured with a flexible ruler. These parameters were also observed on three denture teeth mold charts: Premium Pala, Vivodent and Trilux. The comparison between genders was analyzed using Student's t-test ($\alpha=.05$), while absolute frequencies within several ranges were used to compare natural and denture teeth. **Results:** CIW, CIL, WS and WC obtained from males were significantly higher than those found for females ($p<0.05$). CIW of nearly half of natural and denture teeth were within 8.0–8.5 mm. Almost half of natural teeth presented CIL values within 10.6–11 mm, while the highest frequency of denture teeth was observed within 9.6–10 mm. The majority of natural and denture teeth presented WS values within 42 to 49 mm. Only one denture teeth chart described WC values, which were mainly observed within 44–51 mm, while the majority of WC values obtained from natural teeth ranged from 48 to 55 mm. **Conclusion:** Some commercially available denture teeth present dimensions not observed in natural teeth. Teeth dimensions in function of gender differences must be considered when selecting denture teeth.

Indexing terms: Dental prosthesis. Esthetics. Tooth, artificial.

RESUMO

Objetivo: Comparar as dimensões dos dentes anteriores superiores naturais e de diversos dentes artificiais para próteses e também abordar as diferenças entre os gêneros. **Métodos:** Um único examinador mediu com um paquímetro digital dentes naturais de 41 homens e 55 mulheres para determinar CIW (largura do incisivo central), CIL (comprimento do incisivo central) e WS (largura dos dentes anteriores superiores em linha reta). Adicionalmente, CC (largura dos dentes anteriores em uma curva) foi aferida com uma régua flexível. Esses parâmetros também foram observados em três cartas moldes de dentes artificiais para prótese: Premium Pala, Vivodent e Trilux. A comparação entre os sexos foi analisada pelo teste t de Student ($\alpha=0,05$), enquanto frequências absolutas foram usadas para comparar medidas dos dentes naturais e artificiais. **Resultados:** CIW, CIL, WS e WC obtidos de homens foram significativamente

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How to cite this article

Neves RG, Souza DR, Daher MRG, Lima VHR, Torres EM. Do denture teeth dimensions match natural anterior teeth?. RGO, Rev Gaúch Odontol. 2020;68: e20200056. <http://dx.doi.org/10.1590/1981-863720200005520190085>

maiores do que aqueles encontrados para mulheres ($p < 0,05$). CIW de quase metade de dentes naturais e artificiais estavam entre 8,0-8,5 mm. Quase metade dos dentes naturais apresentaram valores CIL entre 10,6-11 mm, enquanto a maior frequência de dentes artificiais foi observada entre 9,6-10 mm. A maioria dos dentes naturais e artificiais apresentaram valores WS entre 42-49 mm. Apenas uma carta molde de dentes artificiais descreveu os valores de WC, que foram observados principalmente entre 44-51 mm, enquanto a maioria dos valores de WC obtidos em dentes naturais variaram de 48 a 55 mm. **Conclusão:** Alguns dentes artificiais para próteses disponíveis comercialmente apresentam dimensões não observadas nos dentes naturais. As dimensões dos dentes em função das diferenças de gênero devem ser consideradas na seleção dos dentes artificiais.

Termos de indexação: Prótese dentária. Estética. Dente artificial.

INTRODUCTION

People that suffered tooth loss usually seek prosthetic rehabilitation; however, its success also results from the harmonious relationship between facial components and oral cavity [1-4]. The reestablishment of orofacial esthetics and function is more difficult to achieve in the absence of preextraction records or previous prosthesis that would guide the selection of denture teeth with appropriate dimensions [5].

The successful selection of anterior teeth sizes relies on dentist's proper scientific knowledge, patient's realistic expectations and commercial availability of assorted sets of denture teeth; therefore, any failure to meet these aspects may even lead to the rejection of comfortable and efficient prostheses manufactured in accordance with functional principles [2].

Whilst the length of the upper lip and the smile line can be used as reliable references to estimate teeth heights, the mesiodistal width figures as a determinant factor for harmony and is more difficult to determine [6,7]. Denture tooth width is usually determined by marking the canine locations on the maxillary wax occlusal rim; then, the distance between canines around the rim determines the curve of the six anterior teeth. Nevertheless, several manufacturers of denture teeth provide mold charts with only the measurement of anterior teeth arranged in a straight line [8].

Considering that selecting denture teeth with correct size may be particularly difficult, very few studies investigated the match between natural and commercially available denture in terms of dimensions in order to provide a major support for dentists [9,10]. Therefore, the objectives of this study were (1) to compare the dimensions of natural maxillary anterior teeth and several molds of denture teeth and (2) to address differences between genders.

METHODS

After receiving approval of the study by the Ethics Committee of the Federal University of Goiás (#248/12), maxillary dental casts of 41 males and 55 females (mean ages of 22.5 and 21.8 years, respectively) were selected in accordance with the inclusion criteria: sound maxillary anterior teeth, Angle Class I occlusion, no crowding or rotations.

A single examiner used a 0.01 mm digital caliper (ZAAS Precision) to determine the following parameters: mean of the widest mesiodistal portion of central incisors (CIW; figure 1); distance between the most apical point of the cemento-enamel junction and the most incisal point of the anatomic crown (CIL; figure 2) [11]; combined width of the six anterior teeth on a straight line (WS; figure 3) [12]; the curve distance between the distal surfaces of canines measured with a 1-mm-grading flexible ruler (RPF-0585, JON, Brazil) placed at the greatest curvature of the arch (WC; figure 4) [2,10,13]. These parameters were also observed on three different denture teeth mold charts: Premium Pala (Heraeus Kulzer, Hanau, Germany), SR Vivodent PE (Ivoclar Vivadent, Schaan, Liechtenstein) and Trilux (VIPI, Pirassununga, Brazil).

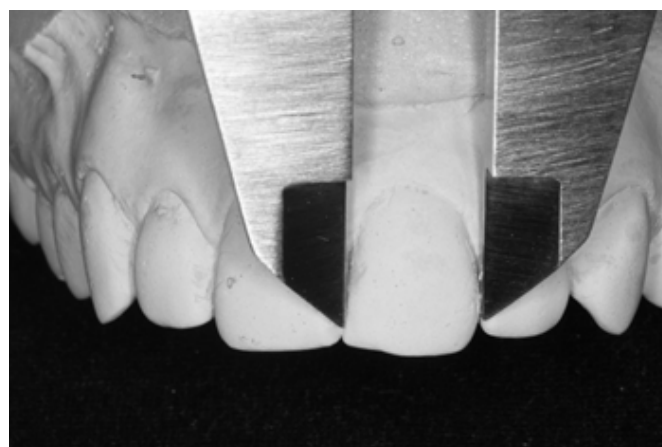


Figure 1. CIW measurement.

The same examiner repeated all cast measurements after 21 days in order to address intra-examiner reproducibility by means of intraclass correlation coefficient (ICC). The Kolmogorov-Smirnov and Levene's test were used to assess normal distribution of data and homogeneity of variances, respectively. The comparison between genders

was analyzed using Student's t-test ($\alpha=0.05$). Descriptive analysis of absolute frequencies within several parameter ranges was used to compare natural and denture teeth. All analyses were performed with statistical software (SPSS 21.0, IBM, Armonk, USA).

RESULTS

The intraclass correlation coefficient indicated excellent intra-examiner reproducibility for all parameters ($ICC > 0.92$). All parameters (CIW, CIL, WS and WC) obtained from dental casts of males were significantly higher than those found for females ($p < 0.05$).

CIW values within the ranges 8.0–8.5 mm for females (49%) and 8.6–8.9 mm for males (46%) accounted for nearly half of the individuals; in addition, the majority of denture teeth molds were also found within the same ranges 8.0–8.5 mm (42%) and 8.6–8.9 mm (25%), although 52% of Trilux molds presented CIW within 8.6–8.9 mm (table 1).

Regardless of gender, almost half (43%) of natural teeth presented CIL values within 10.6–11 mm, followed by 10.1–10.5 mm (33%) and 9.6–10 mm (14%); however, the frequencies of denture teeth molds with CIL values within the same ranges were more similar (19%, 21% and 31%, respectively). Differently from denture teeth molds, natural teeth with CIL smaller than 8.6 mm and greater than 12 mm were not found (table 2).

The majority (85%) of denture teeth molds also presented WS values within 42 to 49 mm. Similarly, 90% of natural teeth presented WS values ranging from 42 to 49 mm; however, 81% of the values obtained from males were concentrated between 46 and 51 mm while females presented 53% of the WS values in the same range and 41% between 42 and 45 mm (table 3), which suggests that a greater variety of denture teeth molds is more compatible with female teeth dimensions.

Overall, 90% of WC values obtained from natural teeth ranged from 48 to 55 mm; however, males presented only 17% of the values ranging from 48 to 55 mm and 66% concentrated between 52 and 55 mm (table 4). On the other hand, females presented 45% and 50% of WC values ranging from 48 to 55 mm and 52 to 55 mm, respectively. WC values were only observed in one mold chart and the majority of molds (70%) were found

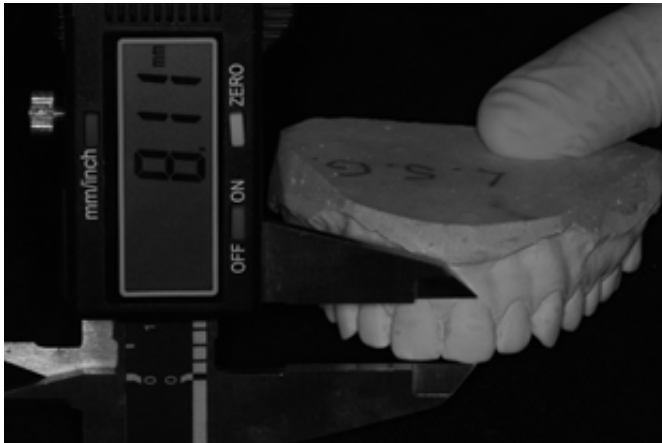


Figure 2. CIL measurement.

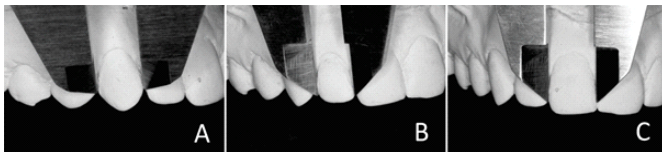


Figure 3. Measurement of all-canine (A), lateral incisor (B) and central incisor (C) in order to determine WS.



Figure 4. WC measurement.

between 44 and 51 mm, which also better match to female teeth dimensions. Although Trilux also presented molds for

WC ranges of 44–45 mm and 60–61 mm, no natural teeth were observed in these ranges.

Table 1. Absolute frequencies of natural and denture teeth within CIW ranges.

| CIW (mm) | Natural teeth | | | Denture teeth | | | |
|-----------|---------------|--------|-------|---------------|----------|--------|-------|
| | Male | Female | Total | Pala | Vivodent | Trilux | Total |
| 7.0 – 7.4 | 0 | 1 | 1 | 0 | 0 | 1 | 1 |
| 7.5 – 7.9 | 1 | 4 | 5 | 1 | 4 | 3 | 8 |
| 8.0 – 8.5 | 8 | 27 | 35 | 5 | 6 | 12 | 23 |
| 8.6 – 8.9 | 19 | 11 | 30 | 3 | 7 | 4 | 14 |
| 9.0 – 9.5 | 10 | 10 | 20 | 2 | 2 | 2 | 6 |
| 9.6 – 9.9 | 3 | 2 | 5 | 1 | 1 | 1 | 3 |

Table 2. Absolute frequencies of natural and denture teeth within CIL ranges.

| CIL (mm) | Natural teeth | | | Denture teeth | | | |
|-------------|---------------|--------|-------|---------------|----------|--------|-------|
| | Male | Female | Total | Pala | Vivodent | Trilux | Total |
| 8.0 – 8.5 | 0 | 0 | 0 | 0 | 1 | 2 | 3 |
| 8.6 – 9.0 | 0 | 1 | 1 | 0 | 1 | 1 | 2 |
| 9.1 – 9.5 | 0 | 1 | 1 | 0 | 2 | 3 | 5 |
| 9.6 – 10.0 | 3 | 11 | 14 | 3 | 6 | 7 | 16 |
| 10.1 – 10.5 | 13 | 19 | 32 | 1 | 4 | 6 | 11 |
| 10.6 – 11.0 | 21 | 20 | 41 | 3 | 5 | 2 | 10 |
| 11.1 – 11.5 | 3 | 3 | 6 | 1 | 0 | 1 | 2 |
| 11.6 – 12.0 | 1 | 0 | 1 | 3 | 0 | 0 | 3 |
| 12.1 – 12.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12.6 – 13.0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 |
| 13.1 – 13.5 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |

Table 3. Absolute frequencies of natural and denture teeth within WS ranges.

| WS (mm) | Natural teeth | | | Denture teeth | | | |
|---------|---------------|--------|-------|---------------|----------|--------|-------|
| | Male | Female | Total | Pala | Vivodent | Trilux | Total |
| 40 – 41 | 0 | 2 | 2 | 1 | 1 | 1 | 3 |
| 42 – 43 | 3 | 8 | 11 | 1 | 5 | 7 | 13 |
| 44 – 45 | 4 | 15 | 19 | 3 | 4 | 6 | 13 |
| 46 – 47 | 14 | 19 | 33 | 4 | 3 | 7 | 14 |
| 48 – 49 | 13 | 10 | 23 | 1 | 3 | 0 | 4 |
| 50 – 51 | 6 | 1 | 7 | 2 | 0 | 1 | 3 |
| 52 – 53 | 1 | 0 | 1 | 0 | 1 | 1 | 2 |

Table 4. Absolute frequencies of natural and denture teeth within WC ranges.

| WC (mm) | Natural teeth | | | Denture teeth |
|------------|---------------|--------|-------|---------------|
| | Male | Female | Total | Trilux |
| 44 – 45 | 0 | 0 | 0 | 3 |
| 46 – 47 | 0 | 1 | 1 | 2 |
| 48 – 49 | 1 | 8 | 9 | 7 |
| 50 – 51 | 6 | 16 | 22 | 9 |
| 52 – 53 | 11 | 15 | 26 | 0 |
| 54 – 55 | 16 | 13 | 29 | 0 |
| 56 – 57 | 4 | 1 | 5 | 1 |
| 58 – 59 | 3 | 1 | 4 | 0 |
| 60 – 61 | 0 | 0 | 0 | 1 |

Table 5. Mean and standard deviation of each parameter, 95% confidence interval and P-values for gender comparison.

| Parameter | Gender | Mean (\pm SD) | 95% CI | P-value |
|-----------|--------|-------------------|-------------|---------|
| CIW | Male | 8.8 (\pm 0.4) | 8.7 – 8.9 | 0.007 |
| | Female | 8.5 (\pm 0.5) | 8.4 – 8.7 | |
| CIL | Male | 10.7 (\pm 0.4) | 10.6 – 10.8 | 0.006 |
| | Female | 10.4 (\pm 0.6) | 10.3 – 10.6 | |
| WS | Male | 47.6 (\pm 2.1) | 46.9 – 48.3 | 0.001 |
| | Female | 45.6 (\pm 2.1) | 45.1 – 46.2 | |
| WC | Male | 53.8 (\pm 2.3) | 53.1 – 54.5 | 0.001 |
| | Female | 51.9 (\pm 2.3) | 51.3 – 52.5 | |

DISCUSSION

This study confirmed that CIW, CIL, WS and WC values obtained from dental casts of males are significantly higher from those observed for females ($p < 0.05$). Among several investigations that corroborate the findings of our study [12-15], Owens et al. [16] reported that natural central incisors of African, American and Hispanic males are significantly larger than those of females. After measuring the width of central and lateral incisors and the anterior teeth combined width of Serbian adults, Strajni et al. [4] also reported significant differences between genders (males > females). However, Condon et al. [17] evaluated the dimensions and ratios of maxillary anterior teeth of dental casts obtained from 109 Irish students aged between 18 and 25 years and found no significant differences between genders. In the same line, Gomes et al. [2] measured WC on dental casts obtained from 81 Brazilian students and found no significant difference between genders.

In this study, CIW mean values registered for males (8.8 mm) and females (8.5 mm) were significantly different ($p = 0.007$) (table 5). On the contrary, Gillen et al. [18], measured CIW values on dental casts of 54 individuals and found no significant difference between genders. Moreover, a good match between natural and denture teeth dimensions (three manufacturers and total of 55 molds) was indicated since the majority of CIW values (68% and 67%, respectively) were observed between 8 to 8.9 mm. Similarly to our findings, Srivastava [1] reported that CIW values of 150 individuals ranged from 7.3 to 10 mm, while denture teeth molds ranged between 7.3 to 9.1 mm.

CIL mean values observed in this study for males (10.7 mm) and females (10.4 mm) were significantly different ($p = 0.006$) (table 5). Gillen et al. [18] also observed significantly different CIL values between males and females for both white and African-American individuals; therefore, population characteristics seem to be also

important when determining dental dimensions.

A significant difference was found between WS mean values of males (47.6 mm) and females (45.6 mm) ($p=0.001$). Al Wazzan [12] also observed lower WS values for 204 Saudi Arabian females in comparison to 203 males; teeth were intraorally measured with Boley gauge and mean WS values (males 46.1 mm and females 44.5 mm) were similar to our findings. The highest WS frequency for denture teeth was registered for the 46–47 mm range, followed by 44–45 and 42–43 mm, which are found more often for females that have lower WS than males. Srivastava [1] also reported WS values after measuring all anterior teeth: 46.25 mm (41.4 to 52.4 mm) for males and 45.1 mm (39.4 to 51.6 mm) for females. Four brands of denture teeth were also evaluated in that study that reported WS mean value of 42.8 mm (38.4 to 47.6 mm) and 39–42 mm as the most frequent range. Finally, the author concluded that denture anterior teeth is predominantly narrower than natural teeth, which presents WS higher than 45 mm; however, a large number of denture teeth molds presents WS lower than 41 mm [1].

Males and females presented significant difference regarding WC mean values ($p=0.0001$) (table 5). WC of anterior teeth is rarely used in dental practice since most manufacturers of denture teeth only indicate WS values [8]; WC was only found on Trilux mold chart. The measurement method with the aid of a 1-mm-grading flexible ruler has also been used by dentists and reported by other studies [2,10,13]. After demonstrating a strong correlation between WS and WC, Varjão & Nogueira [8] used WS values to calculate WC values, which are closer to mean values found in our study (53.8 mm for males and 51.9 mm for females). Baer & Reynolds [13] obtained WC values from 451 dental casts (55.6 mm for males and 53.6 for females) and compared with Bioblend (Dentsply, USA) mold chart; they observed that WC of females match with the most frequent denture teeth molds that were found within 50–54 and 44–49 mm. Mahmood et al. [10] measured WC of 280 dental casts and compared with those values found on 98 denture teeth molds of five different brands; WC mean values for both males (54.1 mm) and females (52.1 mm) were higher than the most frequent molds of denture teeth that were observed within 46–49 mm and followed by 42–45 mm. In our study, most denture teeth molds were found within 50–51 mm and followed by 48–49 mm, which are more in line with female teeth ratios.

Although this study emphasized the variation of teeth dimensions in function of gender and different denture teeth molds, particular ethnic/demographic characteristics and denture molds commercially available in different locations must be taken into account for distinct clinical situations. In addition, some denture teeth molds presented widths and lengths not observed in the population under study and thus are found to be useless. These findings may help dentists to better select denture teeth for oral rehabilitations with dimensions similar to natural teeth.

CONCLUSION

Dentists must assume that males present wider and longer maxillary anterior teeth than females. All denture teeth presented dimensions compatible with natural teeth; however, the widest variety of molds is better matched to females. Denture central incisors are usually 0.5 to 1.5 mm shorter than the majority of natural teeth; in addition, some commercially available denture teeth present dimensions not observed in natural teeth (shorter than 8.6 mm and longer than 12 mm).

Acknowledgments

The authors do not have any financial interest in the companies/products discussed in this study. This investigation was conducted at the Federal University of Goiás and supported by the Brazilian Agency for Support and Evaluation of Graduate Education – CAPES (grant #DS1212378).

Collaborators

TORRES ÉM and NEVES RG, advised, designed, revised the theoretical assumptions and wrote the paper and documentation, preparation of figures. SOUZA DR, DAHER MRG, LIMA VHR participated in study design, data collection, analysis and writing of the manuscript. All authors reviewed the text and approved its final version.

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Received on: 24/5/2019
Approved on: 23/9/2019