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Seleção do tamanho e da forma dos dentes anteriores
superiores de próteses totais em quatro grupos
raciais da população brasileira

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Introdução geral

A seleção dos dentes artificiais de próteses totais pode se tornar um procedimento complexo quando não existem dentes anteriores remanescentes ou registros pré-extração. Muitos autores^{1,6,12,21,23,27,29,31,33,34} comentam a respeito das dificuldades na escolha de dentes artificiais que sejam aceitáveis para os pacientes desdentados. Erros nesta etapa do tratamento freqüentemente resultam na rejeição das próteses pelos pacientes, mesmo que elas tenham sido bem confeccionadas e estejam confortáveis e eficientes^{12,14,23}. Assim, inúmeros métodos e orientações estéticas têm sido sugeridos para o processo de seleção dos dentes artificiais¹⁴.

A partir de estudos antropométricos, surgiram os métodos baseados em proporções biométricas, que correlacionam o tamanho dos dentes anteriores superiores ao tamanho da face. House & Loop⁷ (1937) preconizaram uma proporção de 1:16 entre a largura e altura do incisivo central superior e a largura e altura da face, respectivamente. Sears³⁰ (1938) sugeriu que a largura da face fosse dividida por 3,3 para obter-se a largura combinada dos seis dentes anteriores superiores. Muitos trabalhos^{4,13,17,18,28,29,35} procuraram associar as mensurações faciais com as dimensões dos dentes naturais. No entanto, não foram constatadas relações significativas que pudessem confirmar a validade dos métodos da forma com que foram propostos.

No que diz respeito à forma dos dentes, Williams⁴⁰ (1914) preconizou que a forma do incisivo central natural corresponderia à forma da

face, quando invertida. Nelson²⁴ (1922) complementou essa teoria e propôs ainda que houvesse correspondência entre a forma dos dentes anteriores e a forma do arco dentário maxilar. Os estudos^{1-3,8,23,31-33,41,43} que avaliaram as teorias de Williams e Nelson não confirmam haver uma relação consistente entre a forma do incisivo central e a forma da face ou do arco dentário.

A literatura odontológica relacionada à prótese dentária é vasta, porém, um detalhe importante é a falta de dados a respeito de outros grupos raciais que não o de brancos. A grande maioria dos estudos^{1,3,6,23,28,29,31,32,35,41} utilizou amostras compostas apenas por indivíduos brancos ou, então, “predominantemente” brancos. Este fato foi criticado por alguns autores^{5,10,25,26,36}, pois, raros são os trabalhos^{12,15,16,20,22} relacionados à seleção dos dentes artificiais que utilizaram outros grupos raciais. Muitas são as características físicas que diferem um grupo racial de outro e várias das mesmas devem ser levadas em consideração nos planejamentos protéticos.

Estudos recentes realizados por Varjão & Nogueira^{36,38} (2005) e Varjão et al.³⁷ (2005) avaliaram diversos métodos utilizados para seleção do tamanho dos seis dentes anteriores em indivíduos brancos, pardos, negros e amarelos. Os resultados demonstraram haver diferenças significativas entre algumas mensurações dentárias e no que diz respeito ao comportamento de alguns métodos de seleção entre as quatro raças. Alguns métodos não deveriam ser utilizados para determinados grupos raciais, como, por exemplo, o método da largura nasal para indivíduos negros e método das comissuras bucais para indivíduos amarelos, por fornecerem informações completamente fora de propósito para esses indivíduos.

Além da carência de informações a respeito de outras raças, um agravante é o fato de os fabricantes de dentes artificiais aparentemente se basearem em estudos realizados com populações brancas para a produção dos dentes artificiais. Trabalhos^{4,11} realizados no Brasil demonstraram que a maioria dos modelos de dentes artificiais disponíveis no mercado possui dimensões menores do que as dimensões dos dentes naturais de brasileiros. Estudos internacionais^{5,19,39,42} também constataram que os dentes artificiais disponíveis comercialmente possuem dimensões menores do que as dos dentes naturais das populações que poderiam necessitá-los.

De acordo com a Pesquisa Nacional por Amostra de Domicílios de 2002 (Web Site do IBGE⁹), a população brasileira está constituída por 53,4% de brancos, 40% de pardos (mulatos, cafuzos, caboclos, mamelucos e mestiços de negros com outra pessoa), 5,6% de negros e 0,6 % de outras etnias (incluindo amarelos e indígenas).

Mediante este quadro, o objetivo deste trabalho, composto por sete estudos clínicos, foi avaliar e discutir alguns parâmetros relacionados à seleção do tamanho e da forma dos dentes artificiais anteriores para próteses totais em quatro grupos raciais da população brasileira.

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* Vancouver Style. "Uniform Requirements for Manuscripts Submitted to Biomedical Journals" (Ann Intern Med 1997;126:36-47)

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Mesiodistal widths of maxillary anterior teeth in four racial groups

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Abstract

Purpose: This study was undertaken to evaluate the mesiodistal dimensions of the maxillary anterior teeth in four racial groups of the Brazilian population and to compare them with the data found in the dental literature.

Methods: 160 dentate subjects (G1- 40 Whites, G2- 40 Blacks G3- 40 Mulattos and G4- 40 Asians) of mixed sex aged from 18 to 33 years were selected. Stone casts were obtained from impressions of the maxillary arch. On the casts, the width of each anterior tooth was measured at the contact points using a sliding caliper. The measurements were made at three different occasions and the mean value was used on the analysis. ANOVA was used to determine whether the widths of each anterior tooth and the combined width of the 6 anterior teeth were different among races. The Tukey test compared means where statistically significant differences were found ($P < .05$).

Results: The combined widths of the 6 anterior teeth were: G1- 45.65mm, G2- 49.08mm, G3- 46.54mm and G4- 46.55mm. Blacks showed all mesiodistal crown widths statistically different from the other groups. The differences between right central incisor width and left central incisor width were: G1- 0.11mm, G2- 0.04mm, G3- 0.04mm and G4- 0.03mm.

Conclusion: The Black race presented all maxillary anterior teeth larger than the other racial groups. The White group showed the greatest difference between the widths of the right and left central incisors. The miscegenation of White and Black individuals resulted in teeth which widths are slightly larger than the teeth widths observed in the White group and narrower than the teeth widths of the Black group. In general, the results obtained are in agreement with the data found in dental literature.

Introduction

One of the primary concerns in denture esthetics is the selection of artificial teeth¹. The size, form and color of the teeth must be in harmony with the surrounding oral and facial structures². The width of the teeth is considered by some to be more critical than length³. However, selecting the proper anterior teeth width for edentulous patients may be difficult when pre-extraction records are not available⁴⁻⁶. Errors at this stage can often result in patient rejection of otherwise well constructed, comfortable, and efficient dentures⁵.

Several studies⁵⁻¹⁰ attempted to evaluate the mesiodistal dimensions of natural maxillary anterior teeth. However, most of them were conducted in Caucasian population samples with little noted about other races. Consequently, manufactures tend to use standard guides based on Caucasian populations to produce artificial teeth moulds⁵. This may pose certain problems for populations with different racial groups. Grave⁹ (1987) measured the central incisors widths of 100 Black individuals and compared them to the molds of artificial teeth selected for a group of denture wearers of the same race. The author concluded that the dentists tend to select artificial teeth that are noticeably narrower than the natural teeth and that this might be detrimental to appearance if the discrepancy is large.

In 1992, Johnson¹¹ reported how the knowledge of racial norms for facial appearance might aid dentists, since the treatment given would then be in harmony with the facial appearance for patients of different races.

The American continent constitutes a diverse mix of races, with some of the ethnic groups remaining racially pure while others have mixed with other races. The purpose of this study was to evaluate the mesiodistal dimensions of

the maxillary anterior teeth in four racial groups of the Brazilian population and to compare it with previous studies of the dental literature.

Materials and Methods

The research plan was prepared in accordance with the guidelines appropriate to research involving human subjects, as set down in Resolution 196/96 of the National Health Council and approved by the Research Ethics Committee of Sao Paulo State University, Brazil.

One hundred and sixty Brazilian subjects (40 Whites, 40 Blacks, 40 Mulattos – descendents of the miscegenation of White and Black, and 40 Asians – Japanese and Chinese) of mixed sex and age (ranging from 18 to 33 years) were selected for this study. The criteria for selecting the subjects were: they had all natural permanent maxillary teeth in good alignment, all teeth assessed to be morphologically normal, the anterior teeth did not have proximal restorations and there was no history of orthodontic treatment.

Before carrying out any procedures, all subjects received detailed information about the research and were then asked to sign a Free and Clarified Consent Form.

Artificial stone casts (Rock Plus, Polidental Ind Co Ltd, Sao Paulo, SP, Brazil) of the maxillary arch were made from irreversible hydrocolloid (Jeltrate, Dentsply Ind Co Ltd, Petropolis, RJ, Brazil) impressions made in perforated stock trays.

The widths of each maxillary anterior tooth were measured on the casts at the contact points with a digital sliding caliper (Mitutoyo Sul Americana Ltda., São Paulo - SP, Brazil) to the nearest tenth of a millimeter. Two blades were adapted

on the internal edges of the caliper beaks to facilitate proper fit in the embrasures (Figure 1).



Figure 1 – Measurement of the mesiodistal width of right central incisor.

A total of 960 teeth were measured. For each tooth, three measurements were made on three separate occasions. The average of the three measurements was calculated and used on the analysis.

One-way analysis of variance (ANOVA) was used to determine whether the mesiodistal width of each anterior tooth and the combined width of the 6 anterior teeth were different among races. The Tukey test compared means where statistically significant differences were found ($P < .05$).

Results

The descriptive statistics of the recorded measurements in the four racial groups are listed in Tables 1 to 4, in which RCI= right central incisor; LCI= left central incisor; RLI= right lateral incisor; LLI= of left lateral incisor; RC= right canine; LC= left canine; CAW= combined width of the 6 anterior teeth.

Table 1 –Values (mm) for the 6 anterior teeth widths in White race.

	Mean $\pm$ SD	Minimum	Maximum
RCI	8.51 $\pm$ 0.53	7.50	9.7
LCI	8.62 $\pm$ 0.58	7.05	9.77
RLI	6.57 $\pm$ 0.58	5.62	7.95
LLI	6.65 $\pm$ 0.63	5.56	8.07
RC	7.65 $\pm$ 0.48	6.68	8.97
LC	7.66 $\pm$ 0.47	6.77	8.74
CAW	45.65 $\pm$ 2.72	39.70	51.09

Table 2 – Values (mm) for the 6 anterior teeth widths in Black race.

	Mean $\pm$ SD	Minimum	Maximum
RCI	9.16 $\pm$ 0.53	7.98	10.22
LCI	9.12 $\pm$ 0.56	7.86	10.19
RLI	7.20 $\pm$ 0.53	6.12	8.34
LLI	7.16 $\pm$ 0.56	5.83	8.23
RC	8.23 $\pm$ 0.36	7.29	8.97
LC	8.22 $\pm$ 0.39	7.53	9.22
CAW	49.08 $\pm$ 2.26	44.19	53.60

Table 3 – Values (mm) for the 6 anterior teeth widths in Mulatto race.

	Mean±SD	Minimum	Maximum
RCI	8.69±0.55	7.48	9.79
LCI	8.73±0.56	7.61	9.76
RLI	6.77±0.63	5.54	8.12
LLI	6.69±0.65	4.87	7.97
RC	7.83±0.51	6.63	9.01
LC	7.83±0.52	6.61	9.42
CAW	46.54±2.88	40.78	51.90

Table 4 – Values (mm) for the 6 anterior teeth widths in Asian race.

	Mean±SD	Minimum	Maximum
RCI	8.62±0.48	7.03	9.78
LCI	8.59±0.43	7.07	9.4
RLI	6.86±0.47	5.88	7.91
LLI	6.93±0.56	5.41	7.91
RC	7.81±0.49	6.79	8.8
LC	7.74±0.43	6.91	8.62
CAW	46.55±2.12	40.96	51.73

The Tukey test showed that the Black group was statistically different from the White, Mulatto and Asian groups for the individual tooth widths and for the combined width of the 6 anterior teeth (ANOVA *P* values <0.001).

Figures 2 and 3 show the mean values for the combined width of the 6 anterior teeth and for the central incisors widths (mean of right and left) in the four racial groups.

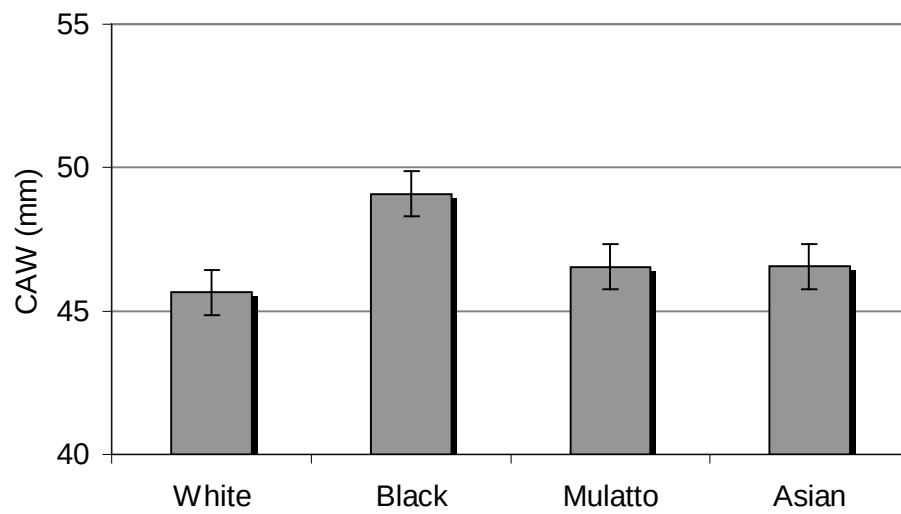


Figure 2 – Mean values for the combined width of the 6 anterior teeth (CAW) in the four racial groups.

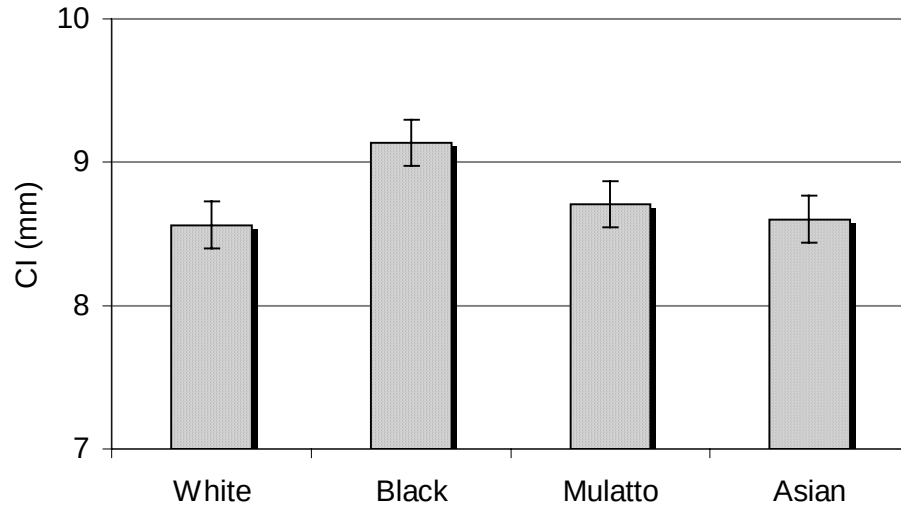


Figure 3 – Mean values for the central incisors (CI) in the four racial groups (mean between left central incisor and right central incisor).

Discussion

The Black group showed all maxillary anterior teeth larger than the other groups. The Mulatto subjects presented larger teeth than the White and Asian subjects, although no statistically difference was found among them.

Observing Tables 1 to 4, the differences between the mean widths of the right central incisors and the left central incisors, although they were small in the four races, they were greater in the White group (0.11 mm). Mavroskoufis and Ritchie⁶ (1980), while studying subjects predominantly White, found a smaller value of 0.04 mm. This value is very close to the values obtained for the differences between right and left central incisors in Black, Mulatto and Asian groups (0.04 mm, 0.04 mm and 0.03 mm, respectively). Otherwise, Bishara *et al.*⁷ (1986) found identical central incisors.

The mean widths of the maxillary central incisors in the White group are in agreement with the values found by Lavelle¹⁰ (1972): 8.66 mm (mean between men and women); Cesario and Latta Jr.⁸ (1984): 8.52 mm (women) and Bishara *et al.*⁷ (1986): 8.61 mm. Otherwise, the values found for the central incisors widths are lower than the values found by Mavroskoufis and Ritchie⁶ (1980): 8.86 mm (left central incisor) and 8.90 mm (right central incisor); Mack¹² (1981): 8.8 mm, Cesario and Latta Jr.⁸ (1984): 8.92 mm (men) and Woodhead¹³ (1977): 9.0 mm.

In the Black group, the mean widths of the central incisors are different from the values found by Mack¹² (1981): 9.9 mm and Grave⁹ (1987): 8.4 mm. However, the results are in agreement with those of the studies of Lavelle¹⁰ (1972): 9.27 mm (mean between men and women) and Cesario and Latta Jr.⁸ (1984): 9.07 mm (mean between men and women).

The mean widths of the central incisors in the Asian group are very close to the results obtained in Lavelle's study¹⁰ (1972): 8.62 mm, and close to the results of Keng and Foong⁵ (1996): 8.85 mm, while studying Asian subjects.

An interesting finding in this study is the mean widths of all anterior teeth in the Mulatto group. The Mulatto individuals are descendents of the miscegenation of Whites and Blacks. Although there is no data available in the dental literature regarding Mulatto teeth dimensions, the values obtained are larger than the values obtained for White subjects and narrower than the values obtained for Black subjects in this study and others^{8,10}.

The mean values obtained for the lateral incisors in the White group are very close to the values found by Bishara *et al.*⁷ (1986): 6.55 mm (left) and 6.65 mm (right) and somewhat higher than the values found by Lavelle¹⁰ (1972): 6.26 mm. In the Black race, the lateral incisors mean widths are in agreement with the values obtained in Lavelle's study¹⁰ (1972): 7.54 mm. In the Asian race, the lateral incisors values are also too close of the results found by Lavelle¹⁰ (1972): 6.92 mm.

It is interesting to note that in the Asian group, although there were no statistically significant differences, the lateral incisors were larger than the lateral incisors of White and Mulatto groups. This confirms the results found in Lavelle's study¹⁰ (1972), in which the subjects of Asian origin also presented larger lateral incisors than White subjects.

The mean values obtained for the canine's widths are in agreement with the mean values between men and women found by Lavelle¹⁰ (1972) for Whites (7.44 mm), Blacks (8.26 mm) and Asians (8.00 mm). The canines' widths of the

White group are too close to the values obtained in the study of Bishara *et al.*⁷ (1986): 7.65 mm (right canine) and 7.62 mm (left canine).

The combined width of the 6 anterior teeth obtained for the White, Black and Asian groups are in agreement with the results obtained by Lavelle¹⁰ (1972) for White Black and Asian subjects: 44.74 mm, 50.16 mm and 47.09 mm, respectively.

Although this study presents limitations, such as not evaluating the data according to gender, the results confirm that patients of different racial groups may present with varying teeth sizes and the dentists have to take account of this during the construction of complete dentures. The Black group showed wider teeth than the other groups and this deserves a special attention during the process of artificial teeth selection.

Conclusions

Within the limitations of this study, the following conclusions were drawn:

The Black race presented all maxillary anterior teeth larger than the other racial groups.

The White group showed the greatest differences between the widths of the right and left central incisors.

The miscegenation of White and Black individuals resulted in teeth which widths are slightly larger than the teeth widths observed in the White group and narrower than the teeth widths of the Black group.

In general, the results obtained are in agreement with the data found in dental literature.

Acknowledgments

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The bizygomatic width for the selection of complete denture maxillary anterior teeth width in four racial groups

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Abstract

Purpose: This study was undertaken to evaluate the use of the bizygomatic width for the selection of the width of the complete denture maxillary anterior teeth in four racial groups of the Brazilian population. **Methods:** The bizygomatic widths (BW) of 160 subjects (40 Whites, 40 Mulattos, 40 Blacks and 40 Asians) were measured with a modified face-bow. Artificial stone casts were made from impressions of the maxillary arches of the subjects. The combined width of the 6 anterior teeth (CAW) and the curve distance between the distal surfaces of the canines (CDC) were measured on the casts. The Pearson product-moment correlation coefficient was used to evaluate the relationship between BW and CAW and between BW and CDC. The numeric relationships between the measurements were calculated by dividing the values of BW by the values of CAW and CDC. **Results:** The four racial groups showed a weak linear correlation between the BW and CAW and between BW and CDC. It was not high enough to use the BW as a predictive factor for selecting the teeth width. The relationship between the BW with CAW and CDC resulted in mean quotients of 2.9 and 2.6, respectively. **Conclusion:** The bizygomatic width might not be used to predict individually the width of the anterior teeth. The quotients of 2.9 and 2.6 could be used as an initial guide for selecting the CAW and CDC from the BW, since they would generate selection errors clinically significant for the majority of the populations studied.

Introduction

One of the primary concerns in denture esthetics is the selection of artificial teeth (1). However, it is difficult to select proper anterior teeth width for edentulous patients when pre-extraction records are not available (2-4). Errors at this stage can often result in patient rejection of otherwise well constructed, comfortable, and efficient dentures (5). In an effort to solve this problem, some anthropometric parameters have been suggested for determining the width of the maxillary anterior teeth.

Sears (6), in 1938, pointed out that a correlation existed between the maxillary anterior teeth and the face. The author suggested that the combined width of the 6 anterior teeth could be determined by dividing the bizygomatic width by 3.3. Many authors (7-9) concurred with this theory and proposed the use of the bizygomatic width as a guide for the selection of artificial teeth width.

However, few studies evaluated the relationship between the bizygomatic width and the maxillary anterior teeth widths. Kern (10) found a ratio of 2.5:1 between the two measurements in 55% of 509 cases. Scandrett *et al.* (11) evaluated the linear correlation between the bizygomatic width and the curve distance between the distal surfaces of the canines of White subjects and obtained a correlation coefficient of 0.287.

Such important detail is the fact that most of the studies regarding the selection of complete denture teeth were conducted in Caucasian population samples (3,11-15). Patients of different racial groups may present with varying teeth sizes and the dentist has to take account of this during the selection process of complete denture artificial teeth.

In 1992, Johnson (16) pointed out that the prosthodontic literature seems to pertain only to the Caucasian race with little noted about other races. Furthermore, the author reported how the knowledge of racial norms for facial appearance might aid practitioners, since the treatment given would then be in harmony with the facial appearance for patients of different races.

The American continent constitutes a diverse mix of races, with some of the ethnic groups remaining racially pure while others have mixed with other races. The purpose of this study was to evaluate the use of the bizygomatic width for the selection of the width of the complete denture maxillary anterior teeth in four racial groups of the Brazilian population.

Materials and Methods

The research plan was prepared in accordance with the guidelines appropriate to research involving human subjects, as set down in Resolution 196/96 of the National Health Council and approved by the Research Ethics Committee of Sao Paulo State University, Brazil.

One hundred and sixty Brazilian subjects (40 Whites, 40 Blacks, 40 Mulattos – descendents of the miscegenation of White and Black, and 40 Asians – Japanese and Chinese) of mixed sex and age (ranging from 18 to 33 years) were selected. The following criteria were used: the subjects had no congenital or surgical facial defects; they had all natural permanent maxillary teeth with no history of orthodontic treatment; the anterior teeth were in good alignment, assessed to be morphologically normal and did not have proximal restorations that grossly affected the width of crown.

Before carrying out any procedures, all subjects received detailed information about the research and were then asked to sign a Free and Clarified Consent Form.

Artificial stone casts (Rock Plus; Polidental Ind Co Ltd, Sao Paulo, Sao Paulo, Brazil) of the maxillary arch were made from irreversible hydrocolloid (Jeltrate, Dentsply Ind Co Ltd, Petropolis, Rio de Janeiro, Brazil) impressions made in perforated stock trays. All teeth measurements were made on the casts.

To obtain the combined width of the 6 anterior teeth, the widths of each maxillary anterior tooth were measured at the contact points with a digital sliding caliper (Mitutoyo Sul Americana Ltda., São Paulo - SP, Brazil) to the nearest tenth of a millimeter. Two blades were adapted on the internal edge of the caliper beaks to facilitate proper fit in the embrasures (Figure 1).



Figure 1 – Measurement of the right central incisor width.

The combined width of the 6 anterior teeth corresponded to the sum of the individual teeth widths. The curve distance between the distal surfaces of the

canines was measured with a dental tape placed at the greatest facial curvature of the arch, sectioned with a blade at the location of the distal surfaces of the canines and then measured with the sliding caliper.

The bizygomatic width was measured using a modified face-bow positioned at the widest points of the zygomas (Figure 2). The record of the bizygomatic width was transferred to a plotting paper with a lead pencil (Figure 3) and then measured with the sliding caliper.



Figure 2 – Measurement of the bizygomatic width.

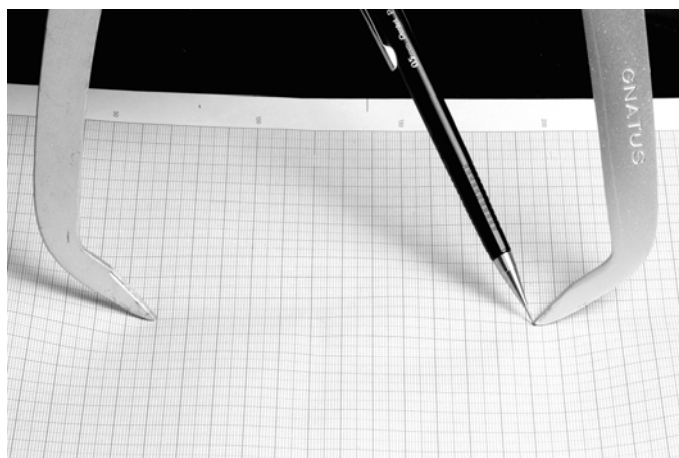


Figure 3 – Record of the bizygomatic width transferred to the plotting paper.

All measurements were made three times on three separate occasions. The average of the three measurements was used on the analysis.

One-way analysis of variance (ANOVA) was used to determine whether the bizygomatic width and the teeth measurements were significant different among races. The Tukey test compared means where statistically differences were found. The level of significance of 5% was used ($P < .05$). The Pearson product-moment correlation coefficient was used to evaluate the relationship between the bizygomatic width (BW) and the combined width of the 6 anterior teeth (CAW) and between the bizygomatic width (BW) and the curve distance between the distal surfaces of the canines (CDC). In addition, the numeric relationship between the bizygomatic width and the 6 anterior widths was evaluated dividing the values of BW by the values of CAW and CDC.

Results

The descriptive statistics of the recorded measurements and the result of the Tukey test in the four racial groups are presented in Table 1.

Table 1. Values (mm) obtained for the bizygomatic width (BW), combined width of 6 anterior teeth (CWA) and curve distance between the distal of the canines (CDC). Equal letters (a, b) indicate that the Tukey test showed no significant difference.

		White	Black	Mulatto	Asian
BW *	Minimum	121.86	123.34	121.34	125.19
	Maximum	154.70	158.66	148.94	152.27
	Mean	135.48 ^a	138.47 ^{ab}	134.58 ^a	140.04 ^b
	SD	7.73	8.31	6.84	6.59
CWA **	Minimum	39.70	44.19	40.78	42.96
	Maximum	51.09	53.60	51.90	51.73
	Mean	45.65 ^a	49.13 ^b	46.54 ^a	46.60 ^a
	SD	2.72	2.19	2.88	2.01
CDC **	Minimum	44.45	51.57	45.74	47.66
	Maximum	58.16	61.47	60.39	59.87
	Mean	52.12 ^a	56.10 ^b	53.58 ^a	53.29 ^a
	SD	3.23	2.58	3.69	2.36

* P value = 0.003 (ANOVA)

** P value < 0.001 (ANOVA)

Pearson correlation analysis showed a weak correlation between the bizygomatic width and the teeth measurements in the four racial groups studied. All coefficients (r) obtained were below 0.500 (Table 2).

Table 2. Correlations coefficients (r) for the bizygomatic width with CDC and CWA.

	White	Black	Mulatto	Asian
	r	r	r	r
CAW	0.167	0.385	0.400	0.222
CDC	0.154	0.464	0.401	0.320

The quotients obtained when dividing the values of the BW by the values of CAW and CDC were very similar in the four racial groups (about 2.9 for CAW and about 2.6 for CDC). These quotients, called q and q' (Table 3), were used to determine, in millimeters, the selection errors due to the clinical application of the bizygomatic width to predict the width of the anterior teeth. These errors (e and e') were defined as the difference between the width of the artificial teeth estimated by the bizygomatic width and the real width of the natural teeth. They were calculated using the following formulas:

$$e = BW / q - CAW$$

$$e' = BW / q' - CDC$$

Table 3 contains the descriptive statistics regarding the selection errors.

Table 3. Quotients (q , q') for the relationship of BW with CWA and CDC and values (mm) obtained for the selection errors.

		White	Black	Mulatto	Asian
CAW $q=2.9$	Minimum	*-7.25	-7.26	-6.47	-2.69
	Maximum	8.13	5.48	5.40	7.33
	Mean	1.06	-1.38	-0.13	1.69
	SD	3.48	2.86	2.90	2.68
CDC $q'=2.6$	Minimum	-9.66	-9.32	-10.23	-4.29
	Maximum	7.40	3.20	5.35	6.67
	Mean	-0.01	-2.84	-1.82	0.57
	SD	4.04	3.04	3.57	2.86

* The minus sign (-) indicate the selection of narrower teeth

Based on the normal distribution curve, a cumulative distribution was made for the values obtained for the selection errors. Tables 4 and 5 contain the percentage (0.5%, 2.5%, 12.5%, 25% and 50%) of errors previewed with the values presented for the populations of the White, Black, Mulatto and Asian races.

Table 4. Distribution of the values (mm) of the selection errors (e) when predicting the CAW from the BW.

Distribution	White	Black	Mulatto	Asian
0.5%	-7.9	-8.8	-7.6	-5.2
2.5%	-5.8	-7.0	-5.8	-3.6
12.5%	-2.9	-4.7	-3.5	-1.4
25.0%	-1.3	-3.3	-2.1	-0.1
50.0%	1.1	-1.4	-0.1	1.7
75.0%	3.4	0.5	1.8	3.5
87.5%	5.1	1.9	3.2	4.8
97.5%	7.9	4.2	5.6	6.9
99.5%	10.0	6.0	7.3	8.6

Table 5. Distribution of the values (mm) of the selection errors (e') when predicting the CDC from the BW.

Distribution	White	Black	Mulatto	Asian
0.5%	-10.4	-10.7	-11.0	-6.8
2.5%	-7.9	-8.8	-8.8	-5.0
12.5%	-4.7	-6.3	-5.9	-2.7
25.0%	-2.7	-4.9	-4.2	-1.4
50.0%	0.0	-2.8	-1.8	0.6
75.0%	2.7	0.8	0.6	2.5
87.5%	4.6	0.7	2.3	3.9
97.5%	7.9	3.1	5.2	6.2
99.5%	10.4	5.0	7.4	7.9

Discussion

In the original paper of Sears (6), it was suggested that the combined width of the 6 anterior teeth could be obtained dividing the bizygomatic width by 3.3. Some authors (8,11) considered the combined width of the 6 anterior as the curve distance between the distal surfaces of the canines. The manufacturers tooth mold charts may supply the measurements of the 6 anterior teeth like a straight line (combined width) or on a curve (from canine distal to canine distal). So that, this study also evaluated whether a relationship existed between the bizygomatic width and the curve distance between the distal surfaces of the canines.

Since there was no evidence of a linear correlation existing between the bizygomatic width and the teeth measurements as expressed by the weak correlations obtained (Table 2), it is not possible to predict individually the width of the anterior teeth from the bizygomatic width. This is in agreement with the results obtained by Scandrett *et al.* (11).

The values obtained for the BW and CDC are in agreement with the results of previous studies. Scandrett *et al.* (11), studying White subjects, obtained 136.5 mm for BW and 53.61 mm for CDC. The values found by Latta Jr *et al.* (17) for the BW were 138 mm for White and 141 mm for Black subjects.

Although there was a weak correlation between the variables, a numeric relationship could be demonstrated between the values of BW and CAW and between the values of BW and CDC. It is interesting to note that although there were cases in which statistically significant differences were found for some of the measurements among the four races (Table 1), the relationships between the values were similar in the four races, because the quotients found for each race

were almost the same. The results of this study agree with those of Kern's study (10), in which the quotients found ranged from 2.2 to 2.8.

Since these quotients represent mean values for the populations studied, the selection errors inherent to its application were also calculated for each racial group. The mean values obtained for the selection errors may be considered not clinically significant, since they were less than 2 mm for all racial groups (Table 3). However, the previewed distribution of errors presented in Tables 4 and 5 show that the majority of errors (a range of 75%) would be clinically significant (more than 4 mm), with an exception in the Mulatto group for the CAW and in the Asian group for the CDC. These results indicate that the mean quotients of 2.9 and 2.6 may be more adequate than the quotient of 3.3 proposed by Sears (6), but they should be used only as an initial guide for selecting the CAW and CDC from the BW.

When selecting artificial teeth, the size is only one factor. Other features, such as the form, color and position of the teeth should also be considered to obtain an acceptable esthetic result. The data obtained in this study could be useful indicators in helping the dentists on the selection process. However, the results might be used as an estimative for the populations studied. Other variables are needed to predict the width of the maxillary anterior teeth, such as the patient's physical size, the esthetic sensitivity of the dentist and the opinions and desires of the patients.

Conclusion

The bizygomatic width might not be used to predict individually the width of the anterior teeth in any racial group studied. In general, the application of the quotients of 2.9 and 2.6 for selecting the CAW and CDC from the BW would lead to the selection errors with mean value not clinically significant. However, since they would generate errors clinically significant for the majority of the populations studied, the quotients proposed should be used only as an initial guide.

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Correlation between the face size and the maxillary central incisor size in four racial groups

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Abstract

Purpose: This study was undertaken to evaluate the correlation between the face size with the maxillary central incisor size in four racial groups of the Brazilian population. **Methods:** The bizygomatic widths (BW) and face lengths (FL) of 160 subjects (40 Whites, 40 Mulattos, 40 Blacks and 40 Asians) were measured with a modified face-bow. Artificial stone casts were made from impressions of the maxillary arches of the subjects. The right central incisor width (CIW) and the right central incisor length (CIL) were measured on the casts. The Pearson product-moment correlation coefficient was used to evaluate the relationship between BW and CIW and between FL and CIL. The numeric relationships between the measurements were also calculated dividing the values of BW by the values of CIW and the values of FL by the values of CIL. **Results:** The four racial groups showed a weak linear correlation between the BW and CIW and between the FL and CIL. It was not high enough to use the face size as a predictive factor for selecting the central incisor size. The relationship between the BW with CIW and between FL and CIL resulted in mean quotients of 15.7 and 17.7, respectively. **Conclusion:** The bizygomatic width and the face length might not be used to predict individually the size of the central incisor. The quotients of 15.7 and 17.7 could be used only as an initial guide for selecting the CAW and CIL from the BW and FL, since they would generate selection errors clinically significant for the majority of the populations studied.

Introduction

It is difficult to select proper anterior teeth width for edentulous patients when pre-extraction records are not available¹⁻³. Errors at this stage can often result in patient rejection of otherwise well constructed, comfortable, and efficient dentures⁴. In an effort to solve this problem, some anthropometric parameters have been suggested for determining the width of the maxillary anterior teeth.

House and Loop⁵, in 1937, emphasized the harmony in the proportion of the maxillary anterior teeth and the face. The authors established a biometric ratio of 1:16 for both the length of the maxillary central incisor compared with the length of the face and also for the width of the maxillary central incisor compared with the bizygomatic width. Many authors⁶⁻¹⁰ concurred with this theory and propose the use of the face size as a guide for the selection of the artificial maxillary central incisor size.

Some studies attempted to evaluate the relationship between the face size and the central incisor size. Kern¹¹ obtained the ratio of 16:1 between the bizygomatic width and the central incisor width in 31% of cases. For the relationship between the face length with the central incisor length, this ratio was not found in any of 509 cases. La Vere *et al.*¹² verified the ratio of 16:1 between the bizygomatic width and the central incisor width and between the face length and the central incisor length in only 14.5% and 23% of cases, respectively. Scandrett *et al.*¹³ found a weak correlation between the bizygomatic width and the central incisor width.

Such important detail is the fact that most of the studies regarding the selection of complete denture teeth were conducted in Caucasian population

samples¹⁴⁻¹⁷. Patients of different racial groups may present with varying teeth sizes and the dentist has to take account of this during the selection process of complete denture artificial teeth.

In 1992, Johnson¹⁸ pointed out that the prosthodontic literature seems to pertain only to the Caucasian race with little noted about other races. Furthermore, the author reported how the knowledge of racial norms for facial appearance might aid practitioners, since the treatment given would then be in harmony with the facial appearance for patients of different races.

The American continent constitutes a diverse mix of races, with some of the ethnic groups remaining racially pure while others have mixed with other races. The purpose of this study was to evaluate the use of the face size for the selection of the complete denture maxillary central incisor size in four racial groups of the Brazilian population.

Materials and Methods

The research plan was prepared in accordance with the guidelines appropriate to research involving human subjects, as set down in Resolution 196/96 of the National Health Council and approved by the Research Ethics Committee of Sao Paulo State University, Brazil.

One hundred and sixty Brazilian subjects (40 Whites, 40 Blacks, 40 Mulattos – descendents of the miscegenation of White and Black, and 40 Asians – Japanese and Chinese) of mixed sex and age (ranging from 18 to 33 years) were selected. The following criteria were used: the subjects had no congenital or surgical facial defects or baldness and they had all maxillary anterior teeth with

no history of orthodontic treatment. The anterior teeth were in good alignment and assessed to be morphologically normal. The central incisors did not have proximal restorations, incisal wear or gingival hyperplasia.

Before carrying out any procedures, all subjects received detailed information about the research and were then asked to sign a Free and Clarified Consent Form.

Artificial stone casts (Rock Plus; Polidental Ind Com Ltd, Sao Paulo, Sao Paulo, Brazil) of the maxillary arch were made from irreversible hydrocolloid (Jeltrate, Dentsply Ind Com Ltd, Petropolis, Rio de Janeiro, Brazil) impressions made in perforated stock trays. The width of the right maxillary central incisor was measured at the contact points with a digital sliding caliper (Mitutoyo Sul Americana Ltda., São Paulo - SP, Brazil) to the nearest tenth of a millimeter. Two blades were adapted on the internal edge of the caliper beaks to facilitate proper fit in the embrasures (Figure 1).



Figure 1 – Measurement of the right central incisor width.

The length of the central incisors was also measured, from the highest point of gingival margin to the incisal edge (Figure 2).



Figure 2 – Measurement of the right central incisor length.

The bizygomatic width was measured using a modified face-bow positioned at the widest points of the zygomas (Figure 3). The record of the bizygomatic width was transferred to a plotting paper with a lead pencil (Figure 4) and then measured with the sliding caliper.



Figure 3 – Measurement of the bizygomatic width.

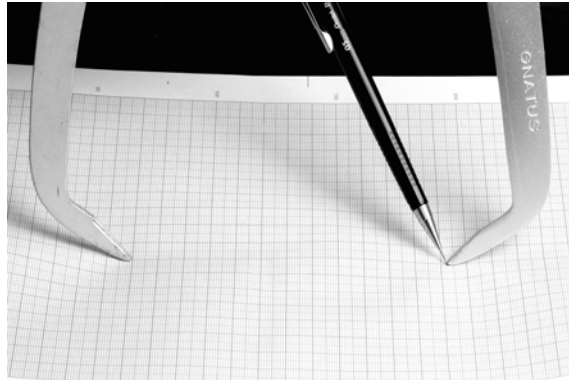


Figure 4 – Record of the bizygomatic width transferred to the plotting paper.

The face length was measured in a similar manner, from hairline to the inferior border of menton (Figure 5).



Figure 5 – Measurement of the face length.

All measurements were made three times on three separate occasions. The average of the three measurements was calculated and used on the analysis.

One-way analysis of variance (ANOVA) was used to determine whether the face measurements and the tooth measurements were significant different among races. The Tukey test compared means where statistically differences were found. The level of significance of 5% was used ($P<.05$). The Pearson product-moment correlation coefficient was used to evaluate the relationship between the bizygomatic width (BW) and the width of the central incisor (CIW) and between the face length (FL) and the length of the central incisor (CIL). In addition, the numeric relationships between the face size and the central incisor size were evaluated dividing the values of BW by the values of CAW and the values of FL by the values of CIL.

Results

The descriptive statistics of the recorded measurements and the result of the Tukey test in the four racial groups are presented in Table 1.

Table 1. Values (mm) obtained for the bizygomatic width (BW), face length (FL), central incisor width (CIW) and central incisor length (CIL). Equal letters (a, b) indicate that the Tukey test showed no significant difference.

		White	Black	Mulatto	Asian
BW *	Minimum	121.86	123.34	121.34	125.19
	Maximum	154.70	158.66	148.94	152.27
	Mean	135.48 ^a	138.47 ^{ab}	134.58 ^a	140.04 ^b
	SD	7.73	8.31	6.84	6.59
FL **	Minimum	156.54	160.28	154.66	164.61
	Maximum	202.15	200.82	199.15	204.32
	Mean	178.77 ^{ab}	182.12 ^b	176.36 ^a	181.76 ^{ab}
	SD	10.41	9.00	10.62	8.92
CIW***	Minimum	7.27	8.02	7.48	8.03
	Maximum	9.70	10.22	9.79	9.78
	Mean	8.51 ^a	9.16 ^b	8.69 ^a	8.62 ^a
	SD	0.53	0.49	0.55	0.42
CIL ****	Minimum	7.88	8.39	7.86	8.77
	Maximum	12.00	11.89	12.01	11.83
	Mean	10.20 ^a	10.34 ^a	10.23 ^a	10.21 ^a
	SD	1.00	0.96	1.07	0.69

* *P* value = 0.003; ** *P* value = 0.029; *** *P* value < 0.001; **** *P* value = 0.902 (ANOVA)

Pearson correlation analysis showed a weak correlation between the face measurements and the central incisors measurements in the four racial groups studied. All coefficients (r) obtained were below 0.400 (Table 2).

Table 2. Correlations coefficients (r) for the bizygomatic width with CIW and for the face length with CIL.

	White	Black	Mulatto	Asian
	r	r	r	r
CIW	0.278	0.134	0.225	0.136
CIL	0.160	0.333	0.336	0.243

The quotients obtained when dividing the values obtained for the BW by the values for CIW and the values obtained for FL by the values for CIL were very similar in the four racial groups (about 15.7 for CIW and about 17.7 for CIL). These quotients, called q and q' (Table 3), were used to determine, in millimeters, the selection errors due to the clinical application of the face measurements to predict the width and length of the central incisor. These errors (e and e') were defined as the difference between the size of the central incisor estimated by the face and the real size of the natural tooth. They were calculated using the following formulas:

$$e = BW / q - CIW$$

$$e' = FL / q' - CIL.$$

Table 3 contains the descriptive statistics regarding the selection errors.

Table 3. Quotients (q, q') for the relationship of BW with CIW and of FL with CIL and values (mm) obtained for the selection errors.

		White	Black	Mulatto	Asian
q= 15.7	Minimum	*-1.40	-1.56	-1.52	-0.92
	Maximum	1.78	0.92	1.02	1.26
	Mean	0.12	-0.36	-0.12	0.28
	SD	0.66	0.59	0.57	0.52
q'=17.7	Minimum	-2.18	-1.86	-2.59	-1.86
	Maximum	2.00	2.30	1.57	1.65
	Mean	-0.10	-0.05	-0.26	0.06
	SD	1.01	1.02	1.10	0.80

* The minus sign (-) indicate the selection of narrower teeth

Based on the normal distribution curve, an accumulative distribution was made for the values obtained for the selection errors. Tables 4 and 5 contain the percentage (0.5%, 2.5%, 12.5%, 25% and 50%) of errors previewed with the values presented for the populations of the White, Black, Mulatto and Asian races.

Table 4. Distribution of the values (mm) of the selection errors (e) when predicting the CIW from the BW.

Distribution	White	Black	Mulatto	Asian
0.5%	-1,6	-1,9	-1,6	-1,1
2.5%	-1,2	-1,5	-1,2	-0,7
12.5%	-0,6	-1,0	-0,8	-0,3
25.0%	-0,3	-0,8	-0,5	-0,1
50.0%	0,1	-0,4	-0,1	0,3
75.0%	0,6	0,0	0,3	0,6
87.5%	0,9	0,3	0,5	0,9
97.5%	1,4	0,8	1,0	1,3
99.5%	1,8	1,2	1,4	1,6

Table 5. Distribution of the values (mm) of the selection errors (e') when predicting the CIL from the FL.

Distribution	White	Black	Mulatto	Asian
0.5%	-2,7	-2,7	-3,1	-2,0
2.5%	-2,1	-2,1	-2,4	-1,5
12.5%	-1,3	-1,2	-1,5	-0,9
25.0%	-0,8	-0,7	-1,0	-0,5
50.0%	-0,1	0,0	-0,3	0,1
75.0%	0,6	0,6	0,5	0,6
87.5%	1,1	1,1	1,0	1,0
97.5%	1,9	2,0	1,9	1,6
99.5%	2,5	2,6	2,6	2,1

Discussion

Since there was no evidence of a linear correlation existing between the face measurements and the teeth measurements as expressed by the weak correlations obtained (Table 2), it is not possible to predict individually the width and length of the central incisor from the bizygomatic width and face length. The coefficient of 0.278 obtained for the correlation between the BW and CIW in the White group is somewhat different from those obtained by Scandrett *et al.*¹³ (0.185 for the right incisor and 0.153 for the left incisor).

Although there was a weak correlation between the variables, a numeric relationship could be demonstrated between the face size and the central incisor size. It is interesting to note that although there were cases in which statistically significant differences were found for some of the measurements among the four races (Table 1), the relationships between the values were similar in the four races, because the quotients found for each race were almost the same. The quotient of 15.7 found for the relationship between the BW and CIW is not too far from the quotient of 15 found by Kern¹¹ in the majority of cases (42%). However, the quotient of 19 (between the face length and the central incisor length) found by the author in the majority of cases (30%) is far from that of 17.7 obtained in this study.

Since the quotients (15.7 and 17.7) represent mean values for the populations studied, the selection errors inherent to its application were also calculated for each racial group. The mean values obtained for the selection errors may be considered not clinically significant, since they were less than 0.5 mm for all racial groups (Table 3). For the CIW, the artificial teeth selected would

be narrower than the natural teeth in the Black and Mulatto groups, because the mean values were negative. In White and Asian groups, the artificial teeth would be wider. For the CILC, in only Asian group the artificial teeth would be wider than natural teeth.

Although the mean values of the selection errors were small, the previewed distribution of errors presented in Table 4 show that for the CIW, the majority of errors (a range of 75%) would be higher than 0.5 mm and close to 1.0 mm and this may be clinically significant for the central incisor width. From Table 5, it can be seen that for the CIL, the majority of errors would be higher than 1.0 mm. These results indicate that the quotients of 15.7 and 17.7 could be used only as an initial guide when selecting the central incisor size based on the face size for the populations of all racial groups studied. Other variables must to be considered, such as the patient's physical size, jaw ridge size and some esthetic sensitivity.

Conclusions

The face size might not be used to predict individually the size of the central incisor in any racial group studied. In general, the application of the quotients of 15.7 and 17.7 for selecting the CIW and CIL from the BW and FL, respectively, would lead to the selection errors with mean value not clinically significant. However, since they would generate errors clinically significant for the majority of the populations studied, the quotients proposed should be used only as an initial guide.

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Short Communications

Relationship of the curve distance between the distal surfaces of the canines with the combined width of the 6 anterior teeth in four racial groups

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Introduction: Selecting the proper anterior artificial teeth width for edentulous patients may be difficult when pre-extraction records are not available. Errors at this stage can often result in patient rejection of otherwise well constructed, comfortable, and efficient dentures. In an effort to solve this problem, various guidelines have been suggested for determining the width of the maxillary anterior teeth. Some of this guidelines, such as the bizygomatic width¹, are use to obtain the combined width of the 6 anterior teeth. Other guidelines, such as the intercomissural width², are used to obtain the curve distance between the distal surfaces of the canines. The manufacturers tooth mold charts may supply the measurements of the 6 anterior teeth like a straight line (combined width) or on a curve (from canine distal to canine distal). Some studies^{3,4} suggest that about 4 to 7 mm should be added to the value obtained for the combined width of the 6 anterior teeth to convert it on a curve measurement. However, these values are based on investigations conducted in Caucasian population samples. In 1992, Johnson⁵ pointed out that the knowledge of racial norms for facial appearance might aid practitioners, since the treatment given would then be in harmony with the facial appearance for patients of different races. The purpose of this article is to evaluate if a relationship exist between the curve distance between the distal surfaces of the canines and the combined width of the 6 anterior teeth in subjects of four racial groups.

Materials and methods: 160 subjects (40 Whites, 40 Blacks, 40 Mulattos – descendents of White and Black, and 40 Asians – Japanese and Chinese) of mixed sex and ranging from 18 to 33 years were selected. They had all natural permanent maxillary teeth in good alignment; all teeth assessed to be

morphologically normal; the anterior teeth did not have proximal restorations and there was no history of orthodontic treatment. A stone cast was made from an irreversible hydrocolloid impression of the maxillary arch. The widths of each maxillary anterior tooth were measured on the casts at the contact points using a digital sliding caliper. Two blades were adapted on the internal edges of the caliper beaks to facilitate proper fit in the embrasures. The combined width of the 6 anterior teeth (CAW) corresponded to the sum of each anterior tooth width. The curve distance between the distal surfaces of the canines (CDC) was measured using a dental tape placed at the greatest curvature of the arch, sectioned with a blade at the distal surfaces location and then measured with the sliding caliper. Each measurement was repeated three times at different occasions and the average of the three measurements was used on the analysis. The Pearson correlation coefficient was used to evaluate the relationship between CDC and CAW.

Results: Pearson correlation analysis showed a strong correlation between CDC and CAW in the four racial groups studied. The following coefficients (r) were obtained: Whites=0.957; Blacks=0.803; Mulattos=0.917 and Asians=0.881. The correlation between the two measurements in the four races is showed in Figures 1 to 4. The linear regression equations obtained were: $CDC=1.1*CAW+0.3$ (Whites); $CDC=0.95*CAW+9.7$ (Blacks); $CDC=1.2*CAW-1.1$ (Mulattos) and $CDC=1.0*CAW+5.0$ (Asians).

Discussion and Conclusion: There was an explicit relationship between the CDC and the CAW in the four racial groups. The strong correlations found

indicate that it is possible to predict one measurement from the other. So that, independent on the method used for the selection of the 6 anterior teeth width, the dentists might be based on the linear regression equations obtained in this study to equate the teeth measurement predicted by the method used to the informations supplied by different manufactures of artificial teeth. The results of this study also confirm that subjects of different races may present with specifically characteristics that may be taken into account when selecting artificial teeth.

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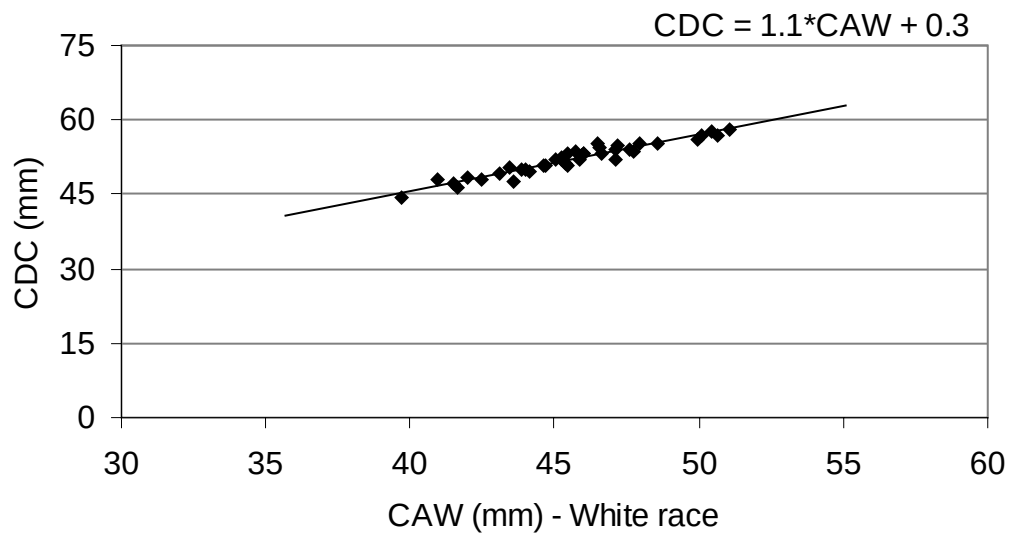
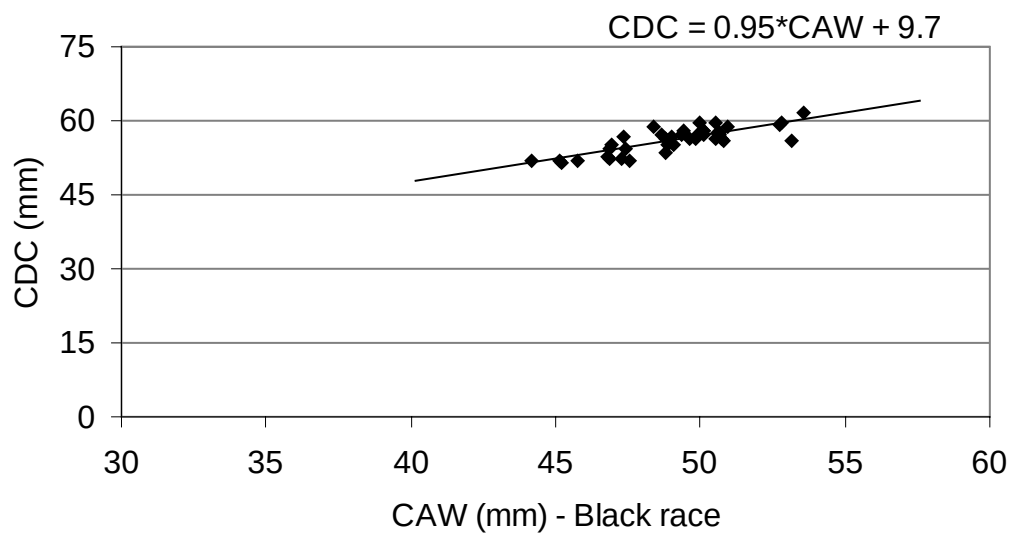
Figures legends:

Figure 1 - Correlation between the values for CDC and CAW in the White group.

Figure 2 - Correlation between the values for CDC and CAW in the Black group.

Figure 3 - Correlation between the values for CDC and CAW in the Mulatto group.

Figure 4 - Correlation between the values for CDC and CAW in the Asian group.

**Fig. 1****Fig. 2**

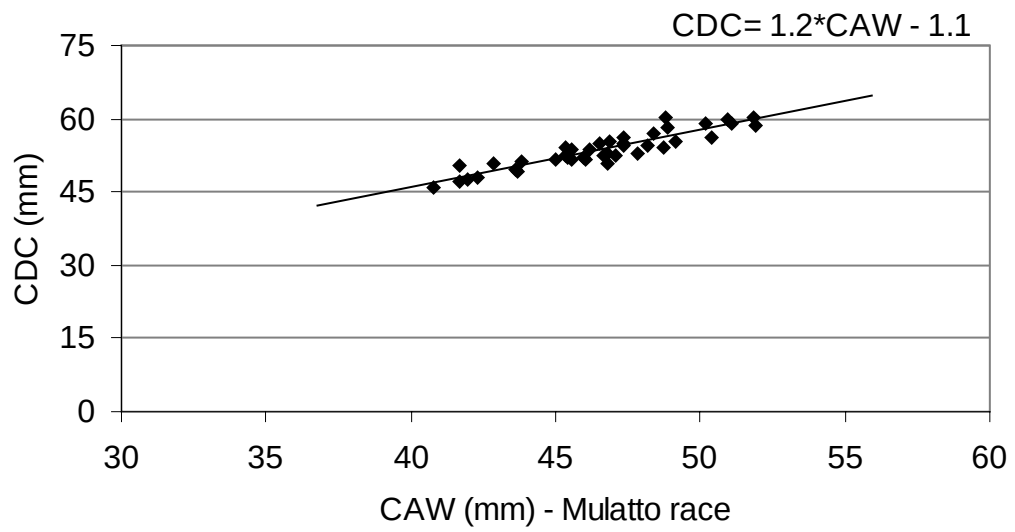


Fig. 3

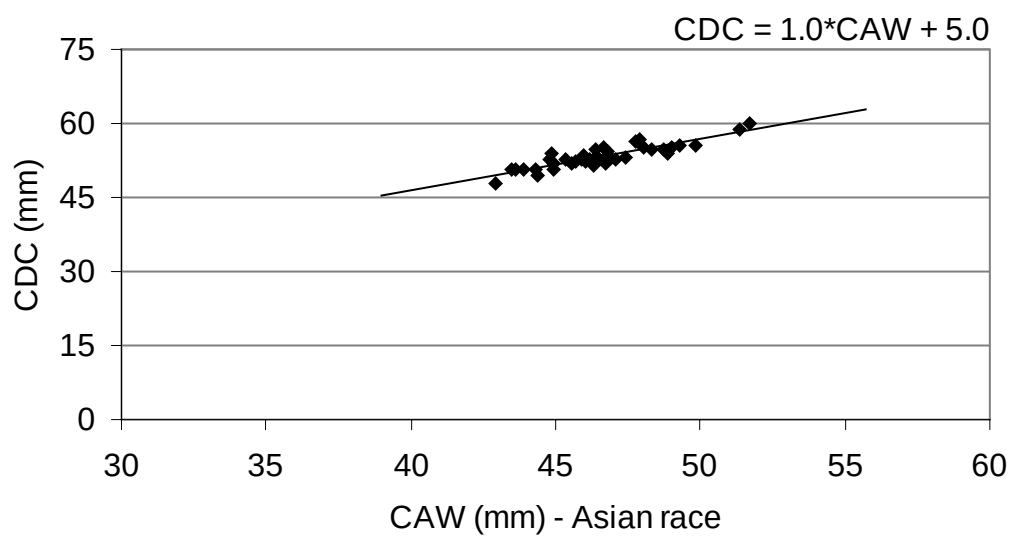


Fig. 4

Size matching of artificial teeth with the natural maxillary anterior teeth of four racial groups

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Introduction

One of the primary concerns in denture esthetics is the selection of artificial teeth¹. The width of the teeth is considered by some to be the more critical factor². A variety of guidelines are used to predict the anterior teeth width, such as the nasal width, the intercomissural width, the bizygomatic width and others. They are all intended to help the dentist find a mould similar to the missing natural teeth³.

Patients of different racial groups may present with varying teeth sizes. The studies of Grave⁴ (1987), Lavelle⁵ (1972) and Mack⁶ (1981) demonstrated that Black subjects have wider teeth than other races. However, manufactures tend to use standard guides to produce artificial teeth moulds and this may pose certain problems for populations with different racial groups⁷. Some authors^{4,8-10} reported that the artificial teeth moulds available are predominantly small in their size distribution than that of the population that will need them.

The American continent constitutes a diverse mix of races, with some of the ethnic groups remaining racially pure while others have mixed with other races. The purpose of this study was to compare the widths of the natural 6 anterior teeth of White, Black, Mulatto and Asian subjects with the widths of commercially available artificial teeth from different manufacturers.

Materials and methods

The research plan was prepared in accordance with the guidelines appropriate to research involving human subjects, as set down in Resolution 196/96 of the National Health Council and approved by the Research Ethics Committee of Sao Paulo State University, Brazil.

One hundred and sixty Brazilian subjects (40 Whites, 40 Blacks, 40 Mulattos – descendents of the miscegenation of White and Black, and 40 Asians – Japanese and Chinese) of mixed sex and age (ranging from 18 to 33 years) were selected. The following criteria were used: the subjects had all natural permanent maxillary teeth with no history of orthodontic treatment; the anterior teeth were in good alignment, assessed to be morphologically normal and did not have proximal restorations that grossly affected the width of crown.

Before carrying out any procedures, all subjects received detailed information about the research and were then asked to sign a Free and Clarified Consent Form.

Artificial stone casts (Rock Plus; Polidental Ind Co Ltd, Sao Paulo, Sao Paulo, Brazil) of the maxillary arch were made from irreversible hydrocolloid (Jeltrate, Dentsply Ind Co Ltd, Petropolis, Rio de Janeiro, Brazil) impressions made in perforated stock trays. All teeth measurements were made on the casts.

To obtain the combined width of the 6 anterior teeth, the widths of each maxillary anterior tooth were measured at the contact points with a digital sliding caliper (Mitutoyo Sul Americana Ltd, Sao Paulo, Sao Paulo, Brazil) to the nearest tenth of a millimeter. Two blades were adapted on the internal edge of the caliper beaks to facilitate proper fit in the embrasures (Figure 1).



Figure 1 – Measurement of the mesiodistal width of right central incisor.

The combined width of the 6 anterior teeth corresponded to the sum of the individual teeth widths. The curve distance between the distal surfaces of the canines was measured with a dental tape placed at the greatest facial curvature of the arch, sectioned with a blade at the location of the distal surfaces of the canines and then measured with the sliding caliper.

All measurements were made three times on three separate occasions. The average of the three measurements was used on the analysis. Based on the normal distribution of the values, a cumulative distribution was made for the values obtained on measurements of each racial group. Considering the values for a range of 75% of the individuals of each population, a comparison was made with the measurements of the 6 anterior teeth supplied by different manufacturers of acrylic resin artificial teeth.

Results

Tables 1 and 2 show the cumulative distribution of the teeth measurements for all racial groups studied.

Table 1- Cumulative distribution for the values (mm) of the combined width of the 6 anterior teeth.

Distribution	White	Black	Mulatto	Asian
0.5%	38.6	43.5	39.1	41.4
2.5%	40.3	44.8	40.9	42.7
12.5%	42.5	46.6	43.2	44.3
25.0%	43.8	47.6	44.6	45.2
50.0%	45.7	49.1	46.5	46.6
75.0%	47.5	50.6	48.5	48.0
87.5%	48.8	51.7	49.9	48.9
97.5%	51.0	53.4	52.2	50.5
99.5%	52.7	54.8	54.0	51.8

Table 2- Cumulative distribution for the values (mm) of the curve distance between the distal surfaces of the canines.

Distribution	White	Black	Mulatto	Asian
0.5%	43.8	49.4	44.1	47.2
2.5%	45.8	51.0	46.3	48.7
12.5%	48.4	53.1	49.3	50.6
25.0%	49.9	54.4	51.1	51.7
50.0%	52.1	56.1	53.6	53.3
75.0%	54.3	57.8	56.1	54.9
87.5%	55.8	59.1	57.8	56.0
97.5%	58.4	61.2	60.8	57.9
99.5%	60.4	62.8	63.1	59.4

The ranges of artificial teeth moulds of different manufacturers and the number of moulds well matched with the natural teeth are shown in Table 3.

Table 3- Ranges of artificial teeth examined and comparison with natural teeth widths.

Manufacturer	Range	Total N. of moulds	N. of moulds well matched			
			White	Black	Mulatto	Asian
Ivoclar Vivadent; Schaan, Liechtenstein	Antaris	27	18	11	19	13
Degudent GmbH; Hanau-Wolfgang, Deutschland, GE	Artiplus	10	1	0	1	0
Dentsply Ind Co; Petropolis, Rio de Janeiro, BR	Trubyte Biotone	13	8	1	6	4
Ivoclar; Ciudad del Mexico, ME	Ivostar	15	12	6	11	11
Myerson LLC; Chicago, Illinois, USA	Myerson	24	4	0	2	0
Vipi Ind; Pirassununga, Sao Paulo, BR	Trilux	17	12	3	10	6
Vipi Ind; Pirassununga, Sao Paulo, BR	Vipi-dent	16	8	2	7	5

Discussion

The widths of the 6 anterior teeth were measured as the combined width of the 6 anterior teeth and as the curve distance between the distal of the canines, because the manufacturers tooth mold charts may supply the measurements of the 6 anterior teeth like a straight line (combined width) or on a curve (from canine distal to canine distal). Among the ranges of artificial teeth studied, Artiplus, Biotone, Myerson and Vipi-Dent supply the curve distance between canines distal. Antaris, Ivostar and Trilux supply the combined width of the anterior teeth like a straight line.

The cumulative distribution of the measurements presented in Tables 1 and 2 indicate the percentage of subjects in the White, Black, Mulatto and Asian populations for whom the teeth measurements would be above and below the values presented. For an example, in the White population, 75% of subjects would present the CAW with values above 42.5 mm and below 48.8 mm (Table 1). Based on this distribution, the moulds of each artificial teeth range that presented measurements above 42.5 mm and below 48.8 mm were considered well matched with the teeth of individuals of the White population.

From Table 3 it can be seen that few moulds of artificial teeth are well matched with the natural teeth of the majority (75%) of the populations of the racial groups studied. The greatest number of moulds is well matched with the natural teeth of the White population. There are artificial teeth ranges (Artiplus and Myerson) in which any mould match the teeth dimensions of Black and Asian subjects. The Trubyte Biotone range, which is one of the most used in Brazil, present only 1 mould well matched with the teeth of the Black population.

It was verified that the majority of moulds of all manufacturers that were not well matched with the natural teeth were undersized. This confirms the findings of other studies^{4,8,10}.

As the manufactures dictate the moulds available, the clinicians are often at a disadvantage when choosing artificial teeth. The lack of alternatives would lead to the selection of artificial teeth which size may not be adequate for the individual and this might be detrimental to appearance and function if the discrepancy is large. This problem worsen for patients of Black and Asian races. So that, the manufactures should create an awareness of racial variations and adequate their productions to the characteristics of the teeth of individuals of White, Black, Mulatto and Asians populations.

Conclusion

There is a reduced number of anterior artificial teeth moulds well matched with the size of natural teeth of all racial groups studied. The greatest number of moulds is well matched with the teeth of the White population and the smallest number of moulds is well matched with the teeth of the Black and Asian populations.

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Correlation between maxillary central incisor form and face form in four racial groups

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Abstract

Purpose: This study was undertaken to evaluate the correlation between the central incisor form and the face form in four racial groups and to investigate if there were agreement among experts in categorizing the central incisors forms.

Methods: 160 subjects (40 Whites, 40 Mulattos, 40 Blacks and 40 Asians) ranging from 18 to 33 years were selected. Digital photographic records were made, one full-face and other an intraoral view of the right maxillary central incisor. The outline tracings of the tooth and face images were obtained using Adobe Photoshop 5.0 software. The outline tracings were printed in distinct transparencies and three prosthodontists determined if there was correspondence between the tooth and the face forms by superimposition of the transparencies. If there was disagreement among the prosthodontists evaluations, the prevalent decision was considered. The experts also performed the classification of the central incisor form into square, ovoid, tapering or combination form at two different sessions. At the first session, no instructions were given when classifying. At the second session, they were instructed to classify the tooth forms according to Williams method.

Results: The correspondence between tooth and face forms was found in 23.75% of all cases. The agreement on the tooth form classifications among the prosthodontists occurred in 30.62% of all cases at the first session and 24.37% at the second session.

Conclusion: The results indicate that there is not a highly defined correlation between the central incisor form and the face form in any racial group studied. In addition, the experts were not in fair agreement in categorizing tooth forms.

Introduction

Selecting and arranging artificial teeth for edentulous patients are difficult when pre-extraction records are not available. Errors at this stage can often result in patient rejection of otherwise well constructed, comfortable, and efficient dentures¹⁻⁵. In an effort to solve this problem, various esthetic guidelines have been suggested while selecting artificial teeth for edentulous patients.

Williams⁶ (1914) suggested that a correlation existed between the upside-down facial form and the form of the maxillary central incisors. The dental outlines of the incisors were classified into three categories: tapered, ovoid and square. It was called "Law of harmony". Some investigators propose additional combinations for the central incisor form, such as square tapering, square ovoid, square ovoid tapering², etc.

Many studies^{1,3,7-14} attempted to evaluate Williams theory. They have shown no significant relationships between the face form and the central incisor form. Wright¹⁴ (1942) found identical face and tooth forms in only 13% of 600 subjects. In the study of Mavroskoufis and Ritchie⁹ (1980), the forms were identical in 5.7% of cases. Sellen *et al.*¹⁰ (1998), Ibrahimagic *et al.*⁷ (2001) and Wolfart *et al.*¹³ (2004) found correspondence between forms in about 30% of cases. The greatest percentage of correspondence was 51.28% found by Berksun *et al.*² (2002).

Such important fact is that most of those studies were conducted in Caucasian population samples^{1,3,8,9-11,13}. The prosthodontic literature seems to pertain only to the Caucasian race and it is apparent that there is a lack of information regarding other races. Johnson¹⁵ (1992) reported how the knowledge of racial norms for facial appearance might aid practitioners, since the treatment

given would then be in harmony with the facial appearance for patients of different races. The dentists have to take account of this when selecting artificial teeth for complete denture.

The American continent constitutes a diverse mix of races, with some of the ethnic groups remaining racially pure while others have mixed with other races. The purpose of this study was to evaluate whether a correlation existed between the face form and the central incisor form in four racial groups of Brazilian population. In addition, it was investigated if there were agreement among experts in categorizing the central incisors forms.

Materials and methods

The research plan was prepared in accordance with the guidelines appropriate to research involving human subjects, as set down in Resolution 196/96 of the National Health Board and approved by the Committee on Ethical Issues of Sao Paulo State University, Brazil.

One hundred and sixty Brazilian subjects (40 Whites, 40 Blacks, 40 Mulattos – descendents of the miscegenation of White and Black, and 40 Asians – Japanese and Chinese) of mixed sex and age (ranging from 18 to 33 years) were selected. The following criteria were used: the subjects had no congenital or surgical facial defects; they had all natural anterior maxillary teeth in good alignment; the incisors teeth had no restorations, no incisal wear and no gingival hyperplasia.

Before carrying out any procedures, all the subjects received detailed information about the research and were then asked to sign a Free and Clarified Consent Form. A standardized photographic procedure was made to obtain the

images of the central incisors and of the face. Each subject was seated with the head supported by a headrest and with the occlusal plane of maxillary teeth parallel to the floor. Intraoral photographs of the right maxillary central incisor were made with a digital camera (MVC-FD97, Sony Corp, Shinagawa-Ku, Tokyo, Japan) mounted on a tripod. The camera was adjusted until the lens was parallel to the buccal surface of the tooth. Cheek retractors were used to obtain full exposure of the central incisors. A full-face photographic with closed lips was also obtained, with the lens positioned parallel to the face of the subjects. The hair did not cover any part of the face and the teeth were in contact.

The images of the tooth and of the face were transferred to a computer (Windows PC, Microsoft Corp, Chicago, Illinois, USA) so that they could be edited. For this purpose, the Adobe Photoshop image editing software (Photoshop 5.0, Adobe Inc, San Jose, California, USA) was used. An outline tracing was made around the buccal surface of the central incisor, which corresponded to the mesial and distal contours, the incisal edge and cervical margin (Figure 1).

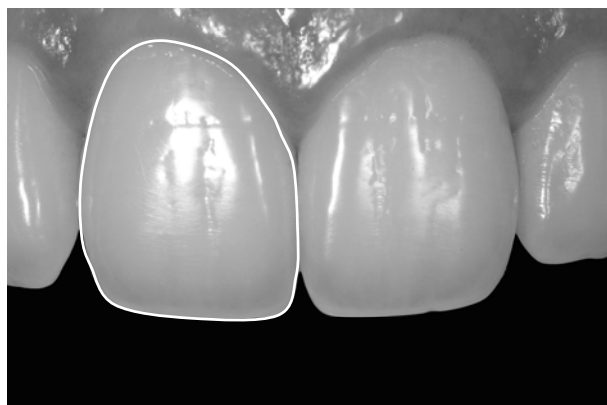


Figure 1 – Outline tracing of the form of right central incisor.

The outline form of the face was also drawn. The upper portion of the outline was drawn to follow the hairline, thus including the forehead. The line then bended downward and met the most lateral visible point of the zygomas. From there, each line continued downward by following the outer lines of the cheeks and chin, until meeting in the region of the symphysis menti (Figure 2).



Figure 2 – Outline tracing of the form of the face.

The outline tracings of the tooth and of the face forms were extracted from the images and saved as separate image files. The pairs of outline tracings (face and tooth) were enlarged until they had about the same size and were then printed on distinct transparencies. Three prosthodontists who had at least 15 years of experience determined if there was correspondence between tooth and face forms by superimposition of the transparencies. The outline tracing of the

tooth was inverted and positioned over the outline of the face aligning the cervical of the tooth with the chin (Figure 3).

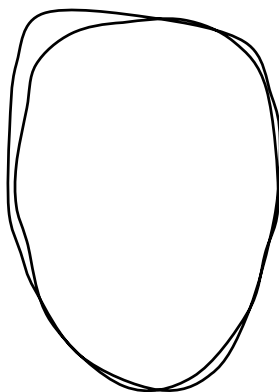


Figure 3 – Superimposition of the outline tracings of tooth and face forms.

If there was disagreement among the prosthodontists evaluations, the prevalent decision was considered. The percentage of cases of concordance between the tooth and face forms was calculated for all subjects and for each racial group.

The prosthodontists also performed an analysis of the central incisors forms. At the first survey, they were asked to classify the tooth form into square, tapering, ovoid or combination by the visual analysis of the outline tracing printed on the transparency. No further information was given. After 6 months, a second survey was carried out with the same participants. They were instructed to follow Williams method: a square incisor have the mesial and distal proximal surfaces parallel for at least half of the cervicoincisal length of the crown; in the tapering tooth the proximal surfaces converge from incisal to cervical and in the ovoid teeth the proximal surfaces are biconvex. The prosthodontists also received the

following instructions: the outline tracing prints should be placed on a diagram of perpendicular lines (Figure 4) and the proximal surfaces of the tooth should be examined in each quadrant of the diagram.

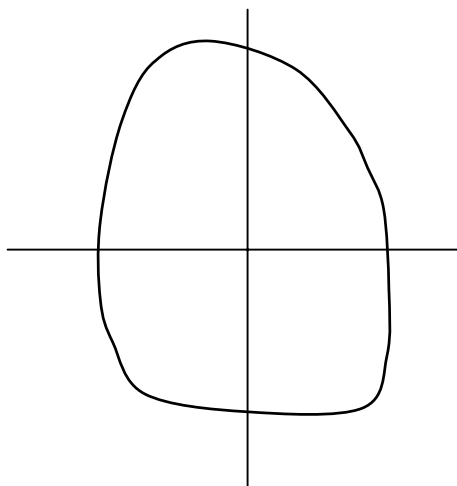


Figure 4 – Outline tracing positioned on a diagram of perpendicular lines.

One of the three basic forms (square, ovoid or tapering) should be attributed to the tooth only if it predominated in at least 75% of the outline tracing (3 quadrants). If one basic form predominated in 50% of the outline tracing (2 quadrants), the tooth form should be classified as a combination form.

A quantitative analysis was performed regarding the number of cases in which the square, ovoid, tapering or combinations forms were attributed to the central incisors in the two different evaluations. The respective percentages were calculated.

Results

The correspondence between the tooth and the face forms according to the prosthodontists' evaluations occurred in a small percentage of cases in the four racial groups studied (Figure 5).

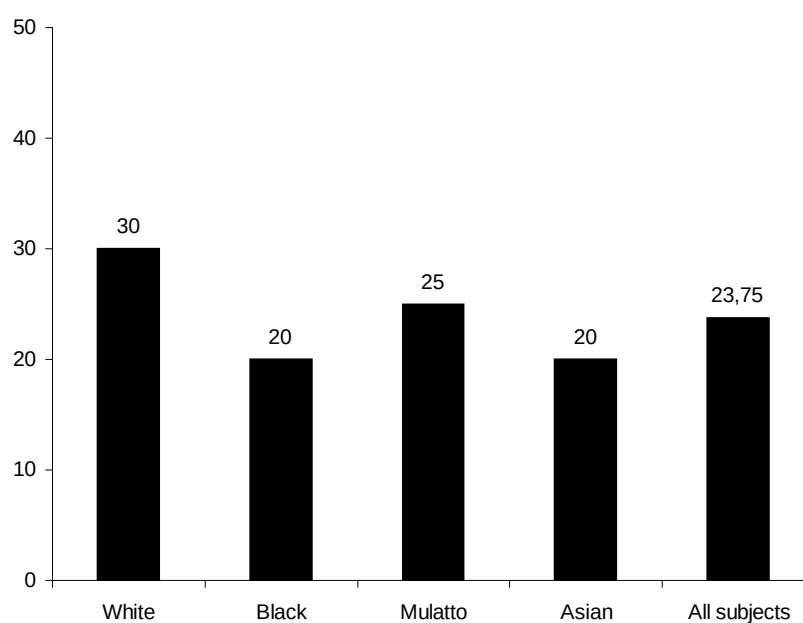


Figure 5 – Correspondence between tooth and face form according to the prosthodontists evaluations – percentage of cases.

The agreement on the tooth form classifications among the prosthodontists before instructions (first session) and after instructions (second session) is shown in Figure 6.

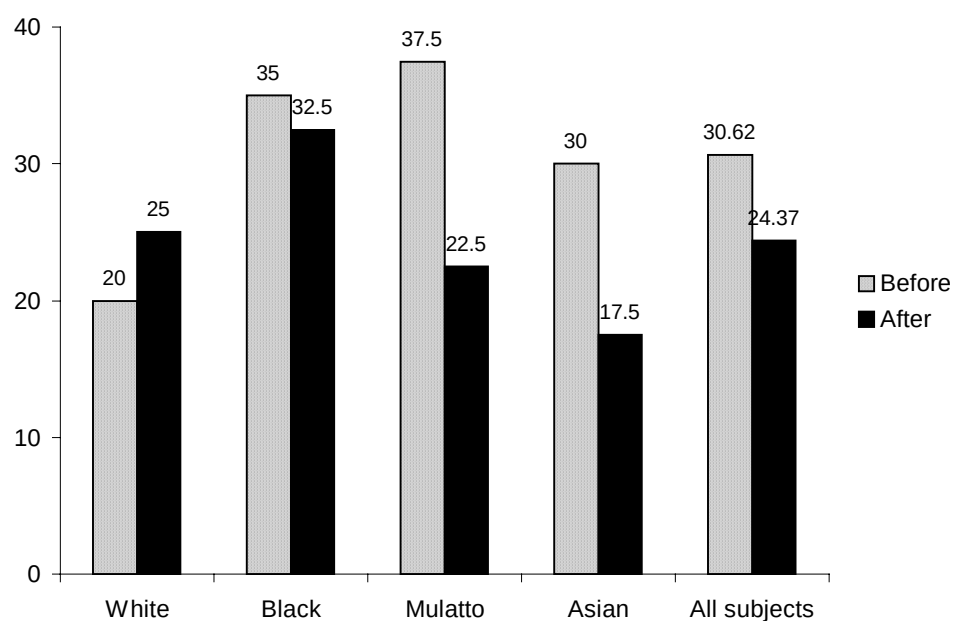


Figure 6 – Agreement among the prosthodontists in classifying tooth forms before instructions and after instructions – percentage of cases.

Discussion

Several esthetic guides have been proposed as aids for the selection of artificial teeth. Numerous methods have been devised for determining artificial teeth form. Although no universally reliable method has been found¹⁶, Williams method is the most accepted^{1,16}.

The comparison of the outline tracings of face form with the outline tracing of the central incisor form showed that the correlation found was low in the four racial groups (Figure 5). In all subjects (n=160) the correspondence occurred in only 23.75% of cases. This confirms the results of previous studies^{7,9,10,13,14} even though the percentages are somewhat different.

There were substantial variations among the participants for the evaluation of tooth forms on both first and second sessions (Figure 6). Before the instruction, they achieved the same results in 30.62% of cases for all subjects. At the second evaluation, after the instructions were given, the agreement among the classifications was lower (24.37%). This may be attributed to an infinite variety of tooth forms in nature. At the first session, the prosthodontists were not informed about the specific characteristics defined to classify the tooth form. They might have been affected by previously accepted esthetic principles that are influenced by certain doctrine and theories. As dental esthetics criteria of each individual vary according to his psychosocial profile, even though they were instructed in the second survey, the examiners failed to categorize the same forms for the central incisors. The dental literature shows similar findings^{1,2,13}.

The results indicate that although it is acceptable the existence of square, ovoid, tapering and combination teeth forms, people cannot achieve the same results when classifying the teeth forms. The findings also suggest that there is insufficient correlation to support Williams theory. Making use solely of this theory when selecting the artificial teeth form could lead to unsatisfactory results. The esthetic sensitivity of the dentist and the opinions and desires of the patients should be taken into account so that the treatment rendering would be in harmony with the facial appearance of each individual.

Conclusion

Within the limitations of this study, the results indicate that there is not a highly defined correlation between the central incisor form and the face form in any racial group studied. In addition, the three prosthodontists were not in fair agreement in categorizing tooth form.

Acknowledgments

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Prosthodontics

Correlation between maxillary central incisor and maxillary arch forms in four racial groups of the Brazilian population

Coincidência entre a forma do incisivo central superior e a forma do arco dentário superior em quatro grupos raciais da população brasileira

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Abstract

Harmony among face, arch and tooth forms is assumed as an esthetic factor to be considered while selecting artificial teeth for edentulous patients. This study was undertaken to evaluate the correlation between the central incisor form and the arch form in four racial groups of the Brazilian population. Digital photographic records of the right maxillary central incisor and maxillary stone casts were made of 160 subjects (40 Whites, 40 Mulattos, 40 Blacks and 40 Asians). To classify the central incisor form, the outline tracing of the tooth image was obtained using Adobe Photoshop 5.0 editing software. The tooth and arch forms were classified into three categories: square, ovoid or tapering. The percentage of cases in which there was coincidence of tooth form with arch form was calculated for each racial group. The coincidence between tooth and arch forms in the White, Black, Mulatto and Asian groups were 42.5%, 45%, 25% and 35%, respectively. The theory that the tooth form should correspond to the arch form could not be confirmed in any racial group studied.

Descriptors: complete denture, esthetic, artificial teeth, race

Resumo

Na ausência de registros prévios, alguns guias estéticos têm sido sugeridos para a seleção dos dentes artificiais para pacientes desdentados totais. Diversos trabalhos preconizam a harmonia entre as formas da face, dos dentes anteriores e do arco dentário. O objetivo deste estudo foi avaliar a correlação entre a forma do incisivo central superior e a forma do arco dentário em quatro grupos raciais da população brasileira. Foram obtidas fotografias digitais dos incisivos centrais

superiores direitos e modelos da arcada superior de 160 indivíduos (40 Brancos, 40 Negros, 40 Pardos e 40 Amarelos). A classificação da forma do dente foi realizada observando-se o contorno linear do dente, obtido utilizando-se o programa Adobe Photoshop 5.0. As formas dos dentes e dos arcos foram classificadas em três categorias: quadradas, ovóides ou triangulares. Para cada grupo racial, foram calculadas as porcentagens de casos nos quais houve coincidência entre ambas as formas. A coincidência entre a forma do dente e a forma do arco nos grupos dos Brancos, Negros, Pardos e Amarelos ocorreu em 42,5%; 45%; 25% e 35% dos casos, respectivamente. Os resultados obtidos demonstram que a teoria da correspondência entre a forma dos dentes anteriores e a forma do arco dentário não pôde ser confirmada em nenhum dos grupos raciais estudados.

Descritores: prótese total, estética, dente artificial, raça

Introduction

Selecting and arranging artificial teeth for edentulous patients are difficult when pre-extraction records are not available^{1,5,11,13,17}. Errors at this stage can often result in patient rejection of otherwise well constructed, comfortable, and efficient dentures¹³.

Harmony among face, arch and tooth forms is assumed as an esthetic factor to be considered while selecting artificial teeth for edentulous patients¹⁹. Williams²³ (1914) suggested that a correlation existed between the upside-down facial form and the form of the maxillary central incisors. The author classified the dental outlines of the incisors into three categories: tapered, ovoid and square.

Lowery¹² (1921) and Nelson¹⁴ (1922) concurred with this theory and proposed that there was a distinct relationship between face form, arch form, tooth form and alignment form in nature. It was termed "Nelson's Aesthetic Triangle".

Many studies^{1,2,3,6,11,13,16,17,19,22,24,25} attempted to evaluate Williams²³ theory. They have shown no significant relationships between the face form and the central incisor form. Otherwise, few studies^{2,17} evaluated the relationship between central incisor form and arch form and could not confirm a strong coincidence between them.

Such important detail is the fact that most of the studies regarding the selection of complete denture teeth were conducted in Caucasian population samples^{1,3-5,13,15,17,24} and the findings have been extrapolated to other ethnic groups. In 1992, Johnson⁸ pointed out that the prosthodontic literature seems to pertain only to the Caucasian race with little noted about other races. Furthermore, the author reported how the knowledge of racial norms for facial appearance might aid practitioners, since the treatment given would then be in harmony with the facial appearance for patients of different races.

The Brazilian society constitutes a diverse mix of races⁷, with some of the ethnic groups remaining racially pure while others have mixed with other races. Previous studies²⁰⁻²² made in Brazilian population evaluated methods used for the selection of the width and form of artificial teeth and found significant differences among subjects of different races. The dentists have to create an awareness of racial variations and take account of this when selecting artificial teeth for complete denture.

The purpose of this study was to evaluate the supposed correlation between the central incisor form and the maxillary arch form in four racial groups of the Brazilian population.

Materials and methods

The research plan was prepared in accordance with the guidelines appropriate to research involving human subjects, as set down in Resolution 196/96 of the National Health Board and approved by the Committee on Ethical Issues of Sao Paulo State University, Brazil.

One hundred and sixty Brazilian subjects (40 Whites, 40 Blacks, 40 Mulattos – descendents of the miscegenation of White and Black, and 40 Asians) of mixed sex and age (ranging from 18 to 33 years) were selected. The subjects met the following criteria: they had all natural permanent maxillary teeth in good alignment, with no history of orthodontic treatment or extraction. The incisors teeth had no restorations, no incisal wear and no gingival hyperplasia.

Before carrying out any procedures, all the subjects received detailed information about the research and were then asked to sign a Free and Clarified Consent Form.

To classify the teeth forms, intraoral photographs of the subject's right maxillary central incisor were made with a digital camera (MVC-FD97, Sony Corp, Shinagawa-Ku, Tokyo, Japan) mounted on a tripod. A fixed camera-tooth distance was employed and the camera was adjusted until the lens was parallel to the buccal surface of the central incisor. Cheek retractors were used to obtain full exposure of the tooth. The images were transferred to a computer (Windows PC, Microsoft Corp, Chicago, Illinois, USA) so that they could be edited. For this

purpose, the Adobe Photoshop image editing software (Photoshop 5.0, Adobe Inc, San Jose, California, USA) was used. An outline tracing was made around the buccal surface of the central incisor, which corresponded to the mesial and distal contours, the incisal edge and cervical margin. The outline tracing was separated from the image and printed on a paper sheet.

Examining the print of the outline tracing, the central incisor form was classified into three categories, according to Williams²³ method: If the mesial and distal proximal surfaces of the tooth were parallel for at least half of the cervicoincisal length of the crown, the tooth form was classified as square. If the proximal surfaces converged from incisal to cervical, the form was classified as tapering and if the proximal surfaces were biconvex, the tooth was classified as ovoid.

To evaluate the arch forms, artificial stone casts (Rock Plus; Polidental Ind Co Ltd, Sao Paulo, Sao Paulo, Brazil) were obtained from irreversible hydrocolloid (Jeltrate; Dentsply Ind Co Ltd, Petropolis, Rio de Janeiro, Brazil) impressions of the maxillary arch taken in perforated stock trays. The forms were classified as square, ovoid or tapering, by examining the alignment of the anterior teeth in the casts as described by Nelson¹⁴. The square arches were considered to be those in which the anterior alignment was in a segment of a large circle, approaching nearly a straight line. In the casts in which there was a defined V-shape arrangement of the anterior teeth, the arch was classified as tapering. If the arrangement of anterior teeth was in the segment of a small circle, the arch was classified as ovoid.

For each racial group, the percentage of square, ovoid and tapering forms for the central incisor and for the arch were calculated. The correlation between

tooth and arch forms was evaluated by identifying the cases in which there was coincidence between the tooth form and the arch form.

Results

The percentages of forms attributed to the central incisors and arches are shown in Figures 1 and 2.

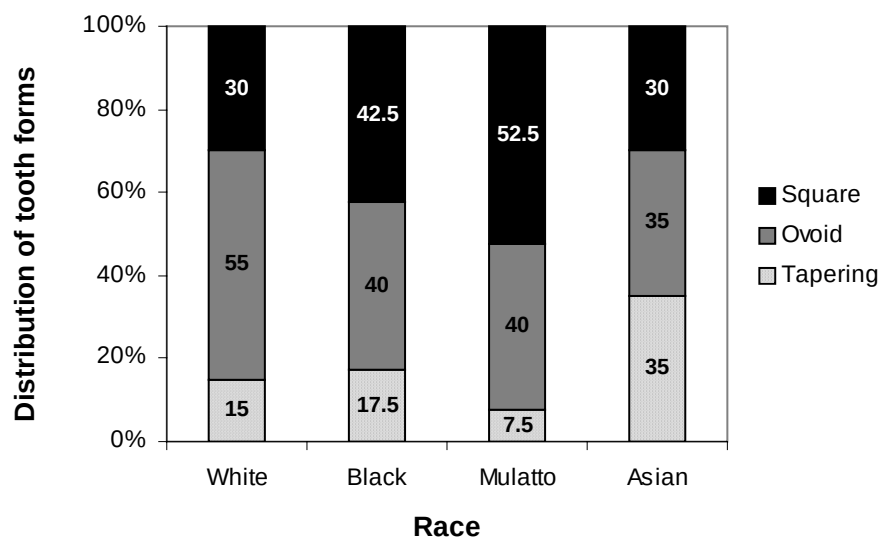


Figure 1 – Distribution of central incisors forms in the four racial groups – percentage of cases.

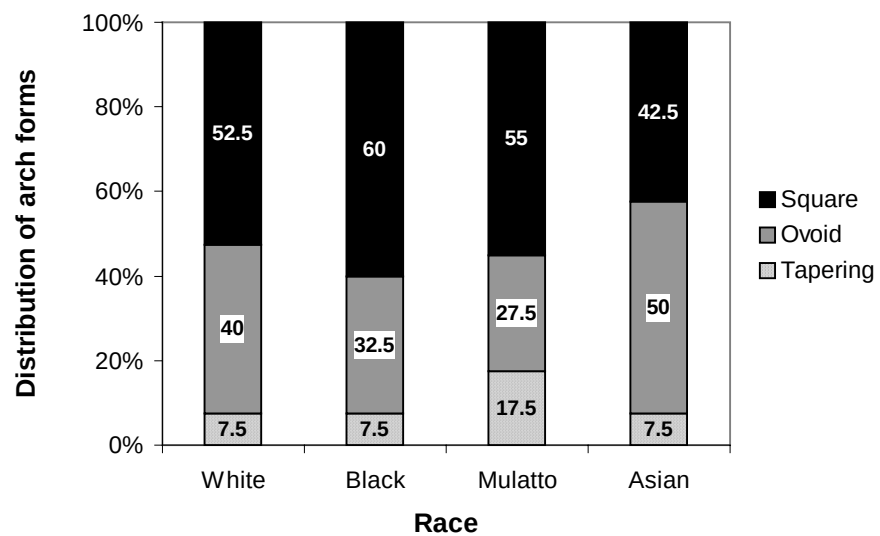


Figure 2 – Distribution of arch forms in the four racial groups – percentage of cases.

The comparison of tooth and arch forms showed that in most cases there was no coincidence of the central incisors forms with the arch forms (Table 1).

Table 1 – Correlation between tooth forms and arch forms in the four racial groups.

	White		Black		Mulatto		Asian	
Correlation	n	(%)	n	(%)	n	(%)	n	(%)
Tapering-tapering	1	2.5	1	2.5	0	0	2	5
Ovoid-ovoid	9	22.5	5	12.5	8	20	8	20
Square-square	7	17.5	12	30	2	5	4	10
Total	17	42.5	18	45	10	25	14	35

Discussion

Several guides have been proposed as aids for the selection of artificial teeth. Numerous methods have been devised for evaluation of esthetic factors in determining artificial teeth form. However, no universally reliable method has been found¹⁸ although the Williams method is the most accepted^{1,18}.

Previous studies^{9,25} classified the central incisor form observing the tooth in the cast. In this study, a standard photographic procedure was taken and the classification of tooth form was performed by examination of the outline tracing form of the right central incisors. This avoided the influence of gingival contour and adjacent teeth that could be misleading in classifying the form of the tooth¹.

The tooth form most frequently found in the literature is the square one^{1,2,9,25}. In this study, this form predominated only in the Black and Mulatto groups (Figure 1). In the White group, ovoid teeth were the majority, according to a previous study³. The small number of tapering teeth found in the White, Black and Mulatto groups is in agreement with some studies^{3,24} made with White individuals. Other studies^{1,2} did not inform the sample's race, although they reported the same findings. Wright²⁵ (1942), however, found a large percentage (38.36%) of tapering teeth, close to the percentage obtained for the Asian group (35%) in this study.

One limitation of this study is not considering combination forms for the central incisor, such as square tapering, square ovoid, square ovoid tapering, etc. The forms attributed to the tooth were the basic geometric forms based on the classification of Williams²³ (1914). If combination forms were considered when classifying, there would be a large variety of forms. This could make impossible the comparison between tooth and arch forms.

In this study and in others^{1,2,9,25} the central incisor forms were subjectively classified. The differences on the percentages of square, ovoid and tapering forms observed among these studies may be explained by the fact that the examiners have their own perceptions on dental aesthetic that are influenced by certain doctrine and theories.

In the White, Black and Mulatto groups, the arch form was classified in most cases as square (Figure 2). This is in disagreement with the percentages of square arches found by Berksun *et al.*² (2002) and Kook *et al.*¹⁰ (2004): 18.65% and 18.1%, respectively. The percentage of square arches in the Asian group (42.5%) is close to that found by Kook *et al.*¹⁰ (2004) studying Korean subjects (46.7%).

When comparing the central incisor and the arch forms, in minority of cases the coincidence occurred between tapering arches and tapering tooth in all racial groups. In general, the highest agreements between the tooth and arch forms were found in 42% of cases in the White group and 45% in the Black group (Table 1). This confirms the results of the study of Berksun *et al.*² (2002), in which the correspondence was found in 46% of cases, although the sample race has not been informed. Nevertheless, Sellen *et al.*¹⁷ (1998) studied White subjects and found correspondence in only 24% of cases.

Analyzing Figure 2 and Table 1 together, it is interesting to note that in the Mulatto group, although there were 52.5% of square teeth (21 cases), in only 2 of these cases (5%) the arches were also square. However, in the Black group, in 17 cases (42.5%) of square teeth, 12 cases (30%) presented square arches.

The findings of this study suggest that there is insufficient correlation to support “Nelson’s Aesthetic Triangle” theory. Making use solely of this theory

when selecting the artificial teeth form could lead to unsatisfactory results, mainly on the Mulatto group, which represents the larger part of the Brazilian population⁷. The esthetic sensitivity of the dentist and the opinions and desires of the patients should be taken into account so that the treatment rendering would be in harmony with the facial appearance of each individual.

Conclusions

Within the limitations of this study, the results indicate that there is not a highly defined correlation between the central incisor form and the arch form in any racial group studied. The greatest coincidence between arch and tooth form occurred in the Black group and the lowest coincidence occurred in the Mulatto group.

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Considerações gerais

Sobre a amostra

Em decorrência da alta complexidade do assunto “raças humanas”, torna-se difícil o estabelecimento de características muito detalhadas que possam classificar um indivíduo em determinada raça. Como exemplo, dentro do grupo dos negros, existem indivíduos com pele mais clara, outros com nariz mais afilado, outros com lábios menos grossos e assim por diante.

Assim, a classificação adotada no presente trabalho esteve de acordo com a classificação estabelecida pela UNESCO¹⁰ e mais aceita pela maioria dos antropólogos*, ou seja, a existência de três troncos raciais: o grupo caucasóide (brancos), o grupo negróide (negros) e o grupo mongolóide (amarelos). Dessa forma, foram adotadas características morfológicas gerais mais comuns a cada um dos grupos raciais para definir a classificação, como segue:

- Brancos*: pele de coloração variando de clara a quase chocolate; cabelos moles, ondulados ou lisos com várias colorações, desde louro ao negro; sistema piloso do corpo escasso, moderado ou intenso; testa reta, face ortognata, olhos horizontais, castanhos ou claros; nariz afilado, lábios delgados, queixo mediano, forma da cabeça muito variada: braquicéfalo, mesocéfalo e dolicocefalo.

* www.racashumanas.hpg.ig.com.br

- Negros^{*}: pele de coloração bem escura, de marrom escuro a quase negro; cabelos crespos, escuros e bem encarapinhado; sistema piloso do rosto e corpo pouco desenvolvido, bem encarapinhado; testa alta e reta; olhos grandes, de coloração castanha escura ou preta, com a conjuntiva amarelada; nariz achatado e de abas largas; lábios grossos; estatura variada.
- Pardos^{*}: características intermediárias e/ou comuns aos grupos dos brancos e negros, que apresentem história de miscigenação entre as raças até o nível de avós paternos e maternos.
- Amarelos^{*}: pele clara ou bronzeada; cabelos duros, lisos e pretos; sistema piloso corporal pouco desenvolvido; face grande e achatada; nariz de largura mediana; lábios delgados; cabeça mesocéfala na maioria dos casos; olhos oblíquos e sem prega palpável, de coloração castanha escura ou preta.

Somando-se a isto, foi realizada também uma investigação das características dos pais e avós paternos e maternos do indivíduo. Caso houvesse história de cruzamento entre a raça branca e negra, o indivíduo era considerado pardo. Portanto, a classificação final em determinada raça foi estabelecida após a observação das características físicas somada à referida investigação.

Observou-se que todas as mensurações dentárias realizadas, assim como os erros de seleção inerentes à utilização dos métodos das proporções faciais, apresentaram distribuição normal e homogeneidade de variância. Este fato, comprovado estatisticamente, demonstra que a amostra foi

^{*} www.racashumanas.hpg.ig.com.br

capaz de representar com confiabilidade as populações alvos do estudo e validou todas as análises estatísticas realizadas.

Sobre os estudos

No intuito de promover a escolha de dentes artificiais que sejam similares aos dentes naturais perdidos, muitos são os parâmetros e as orientações estéticas utilizados para auxiliar na seleção dos dentes anteriores superiores de próteses totais. Assim, os estudos a respeito de seleção de dentes artificiais são geralmente conduzidos com indivíduos dentados, para que se possa comprovar a validade das diretrizes sugeridas.

Um grande objeto de crítica na literatura odontológica é a tendência em realizarem-se pesquisas clínicas com amostras compostas apenas por indivíduos da raça branca. Com exceção de alguns trabalhos^{4-8,11-14} que estudaram separadamente os grupos raciais, parece não haver uma preocupação com as diferenças inerentes a cada raça. No Brasil, alguns estudos, como o de Kawauchi³ (2001), incluíram na amostra indivíduos brancos, negros e mulatos, porém, os grupos raciais não foram analisados separadamente.

Inúmeras são as características que diferenciam um grupo racial de outro, como posição, disposição e tamanho dos dentes. No Capítulo 1, em conformidade com os dados da literatura, comprovou-se que indivíduos negros apresentam dentes maiores que os dentes das demais raças. Constatou-se também que as larguras médias dos dentes anteriores de indivíduos pardos apresentam valores compreendidos entre os valores das larguras médias de

dentes de brancos e negros. Este fato foi também verificado em relação a outras variáveis por Varjão¹¹ (2003) que, ao mensurar as larguras nasais de indivíduos brasileiros, constatou que o valor médio obtido para indivíduos pardos encontrava-se entre os valores médios obtidos para brancos e negros. Assim, a miscigenação entre brancos e negros parece gerar indivíduos com características físicas intermediárias aos dois grupos.

Nos Capítulos 2 e 3, foram estudados os métodos das proporções faciais propostos por Sears⁹ (1938) e House & Loop² (1937). Os quocientes médios obtidos para o relacionamento entre a face e os dentes anteriores (2,9 e 2,6) e entre a face e o incisivo central (15,7 e 17,7) apresentam-se um pouco diferentes dos quocientes de 3,3 e 16 propostos. Considerando-se o fato de os quocientes encontrados serem, em média, praticamente os mesmos para todos os indivíduos estudados, é provável que os quocientes propostos pelos autores também representem valores médios para as populações por eles estudadas. Apesar de os quocientes terem sido praticamente os mesmos para todos os indivíduos, a distribuição dos erros de seleção gerados pela utilização de tais quocientes demonstra que a porcentagem de erros cujos valores poderiam ser considerados clinicamente insignificantes é baixa (Tabelas 4 e 5 dos Capítulos 2 e 3). Assim, os métodos das proporções faciais, baseados nos quocientes obtidos, deveriam ser utilizados apenas como uma orientação inicial na seleção do tamanho dos dentes artificiais.

No Capítulo 4, utilizou-se o teste de correlação de Pearson, um teste estatístico que permite avaliar o grau de relação linear entre variáveis. Segundo esse teste, quanto mais próximo de 1 for o coeficiente de correlação obtido (r), maior será a correlação entre as variáveis e, então, é possível prever

individualmente o valor de uma delas em função do valor da outra. Não há um consenso de opiniões sobre qual valor limite determinaria serem os coeficientes de correlação fortes ou fracos. Neste estudo, foi adotado que coeficientes acima de 0,80 seriam considerados fortes. Os dados obtidos no Capítulo 4, além de inéditos, são de extrema utilidade na prática clínica. Foi constatada forte correlação entre a largura em curva e a largura em linha reta dos seis dentes anteriores. Portanto, quando se dispuser, por exemplo, da largura em linha reta dos seis dentes anteriores superiores e desejar-se utilizar uma marca comercial de dente artificial cuja largura dos seis dentes é fornecida em curva, pode-se prever uma medida em função de outra com base nas equações obtidas. Neste estudo foi demonstrada, mais uma vez, a importância da diferenciação entre diversas raças, uma vez que as equações de regressão linear obtidas são diferentes para cada raça, devendo ser utilizadas especificamente para a raça em questão.

No Capítulo 5, foi verificado que os modelos de dentes artificiais disponíveis no mercado não atendem amplamente às necessidades da população brasileira. Para uma faixa de 75% das populações branca, negra, parda e amarela, poucos são os modelos compatíveis com as larguras dos dentes naturais, principalmente em relação às raças negra e amarela. Como exemplo, pode-se citar os dentes Trubyte Biotone. Para indivíduos da população negra, apenas um modelo (266), cuja largura dos dentes anteriores em curva é 55 mm, estaria de acordo com as características das populações. Os doze modelos restantes atenderiam somente aos 12,5% restantes de indivíduos que possuem dentes com larguras menores que 53,1 mm (Tabela 2 do Capítulo 5).

Nenhum modelo de dente atenderia aos demais 12,5% com dentes maiores que 59,1 mm.

No que diz respeito à forma do incisivo central superior (Capítulos 6 e 7), em nenhum grupo racial estudado foi possível serem confirmadas as teorias de correspondência entre a forma do dente e a forma da face ou do arco. Embora a avaliação da correspondência entre as formas tenha sido conduzida de maneiras diferentes nos dois estudos, pôde-se observar que, no grupo dos pardos, a porcentagem de correspondência foi a mesma para o arco e para a face (25%). Já nos grupos dos brancos, negros e amarelos, a forma do incisivo central esteve relacionada à forma do arco em um maior número de casos (42,5%, 45% e 35%, respectivamente) do que à forma da face (30%, 20% e 20%, respectivamente). No trabalho realizado por Berksun¹ (2002), foi encontrada uma maior correspondência entre a forma do incisivo com a face (51%) do que com a forma do arco (46%). No Capítulo 6 ficou também demonstrado que, embora se aceite a existência de formas geométricas básicas (quadradas, ovóides e triangulares) e possíveis combinações, os profissionais não são capazes de chegar a um mesmo resultado na classificação da forma de um dente, mesmo quando a classificação for conduzida de maneira padronizada. Isso reflete o forte componente subjetivo da classificação da forma de um dente anterior. Assim, a subjetividade da interpretação das formas, aliada à incapacidade de comprovação de correlação entre a forma do dente e a forma da face ou do arco, acabam por determinar que a decisão final sobre a forma do dente artificial a ser selecionado dependa muito mais da experiência clínica do profissional do que qualquer técnica proposta.

Por fim, os parâmetros apresentados e discutidos neste trabalho devem ser utilizados como orientações e não como regras rígidas. O senso estético e a experiência clínica do profissional, assim como os desejos e expectativas do paciente em relação ao tratamento, devem também ser levados em consideração no momento da seleção dos dentes artificiais de próteses totais.

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VARJÃO, F. M. Seleção do tamanho e da forma dos dentes anteriores superiores de próteses totais em quatro grupos raciais da população brasileira. Araraquara, 2005. 133f. Tese (Doutorado em Reabilitação Oral) – Faculdade de Odontologia de Araraquara, Universidade Estadual Paulista.

Resumo

O objetivo deste trabalho, composto por sete estudos clínicos, foi avaliar e discutir alguns parâmetros relacionados à seleção do tamanho e da forma dos dentes artificiais anteriores de próteses totais em quatro diferentes grupos raciais. A amostra constituiu-se de 160 indivíduos dentados naturais entre 18 e 33 anos, de ambos os sexos, sendo 40 brancos; 40 negros 40 pardos (descendentes de brancos e negros) e 40 amarelos (japoneses e chineses). A partir de mensurações faciais, mensurações em modelos de gesso do arco superior ou análise de fotografias intra e extra-orais, os seguintes dados foram obtidos: largura individual de cada dente anterior; largura e altura do incisivo central (IC) direito; largura combinada dos seis dentes anteriores (largura em linha reta); largura em curva dos seis dentes anteriores; largura bizigomática (LB); altura da face (AF); forma do arco dentário; forma da face; forma do IC direito. Por meio da análise dos dados obtidos, métodos de seleção do tamanho dos dentes artificiais baseados em proporções antropométricas foram avaliados, assim como o relacionamento entre algumas mensurações dentárias. O tamanho dos dentes naturais foi comparado ao tamanho de dentes artificiais disponíveis no mercado. Foram também avaliados métodos utilizados para a seleção da forma dos dentes artificiais. Os resultados obtidos em todos os estudos demonstraram que: (1) indivíduos da raça negra apresentam dentes

predominantemente maiores que indivíduos das demais raças; (2) não há evidência de correlação linear entre a LB e a largura dos seis dentes anteriores (em reta ou curva); (3) a relação entre a LB com a largura em reta e em curva dos dentes anteriores resultou em quocientes médios de 2,9 e 2,6, respectivamente. Esses quocientes poderiam ser utilizados como uma orientação inicial para a seleção da largura dos dentes anteriores, uma vez que eles levariam a erros de seleção clinicamente significantes na maioria (75%) das populações de cada raça estudada; (4) não há evidência de correlação linear entre a LB e largura do IC e entre a AF e a altura do IC; (5) as relações entre a LB e a largura do IC e entre a AF e a altura do IC resultaram em quocientes médios de 15,7 e 17,7, respectivamente. Esses quocientes poderiam ser utilizados como uma orientação inicial para a seleção do tamanho do IC; (6) existem poucos modelos de dentes artificiais cujas larguras são compatíveis com as larguras dos dentes naturais de indivíduos brasileiros, especialmente da raça negra; (7) há uma forte correlação linear entre a largura em reta e a largura em curva dos dentes anteriores, sendo possível prever individualmente uma medida a partir da outra; (8) não há relação consistente entre a forma do incisivo central e a forma da face ou do arco dentário.

Palavras-chave: prótese total; dente artificial; estética; raças.

VARJÃO, F. M. Selecting the size and form of artificial teeth in four racial groups of the Brazilian population. Araraquara, 2005. 133f. Tese (Doutorado em Reabilitação Oral) – Faculdade de Odontologia de Araraquara, Universidade Estadual Paulista.

Abstract

This study evaluated some esthetic guidelines used for the selection of artificial teeth size and form in four racial groups. One hundred and sixty subjects aged from 18 to 33 years (40 Whites, 40 Blacks, 40 Mulattos and 40 Asians) were selected. From measurements made on dental casts, facial measurements and photographic records, the following data were obtained: individual width of each anterior tooth; right central incisor length (CIL); right central incisor width (CIW); combined width of the 6 anterior teeth (CAW); curve distance between the distal surfaces of the canines (CDC); bizygomatic width (BW); face length (FL); maxillary arch form; face form; right central incisor form. Some methods used for the selection of artificial teeth based on anthropometric measurements and the relationship among teeth measurements were evaluated. The width of artificial teeth ranges was compared with the natural teeth widths. Methods suggested for the selection of anterior teeth form were also evaluated. The results indicated that: (1) Black subjects present wider teeth than subjects of other races; (2) no linear correlation could be demonstrated between the BW and CAW and between the BW and CDC; (3) the numeric relationship between BW and CAW and CDC was demonstrated by quotients of 2.9 and 2.6, respectively. These quotients could be used as initial guides for the selection of the 6 anterior teeth width, since they would lead to selection errors clinically significant in the majority (75%) of

the populations of each race studied; (4) no linear correlation could be demonstrated between BW and CIW and between FL and CIL; (5) the numeric relationship between BW and CIW and between FL and CIL was demonstrated by quotients of 15.7 and 17.7, respectively. These quotients could be used as initial guides for the selection of the central incisors size; (6) there are few moulds of artificial teeth well matched with the teeth widths of Brazilian individuals, specially of the Black race; (7) there was a strong linear correlation between CAW and CDC, indicating that one measurement may be predict from the other; (8) there was no consistent correlation between the central incisor form and face form or arch form.

Key words: complete denture; artificial teeth; aesthetics; race.

Os trabalhos apresentados em cada Capítulo foram submetidos para publicação, conforme apresentado a seguir:

1. Varjão FM, Nogueira SS. Mesiodistal widths of maxillary anterior teeth in four racial groups. J Dent – Enviado para publicação.
2. Varjão FM, Nogueira SS. The bizygomatic width for the selection of complete denture maxillary anterior teeth in four racial groups. J Prosthet Dent – Enviado para publicação.
3. Varjão FM, Nogueira SS. Correlation between the face size and the maxillary central incisor size in four racial groups. J Oral Rehabil – Enviado para publicação.
4. Varjão FM, Nogueira SS. Relationship of the curve distance between the distal surfaces of the canines with the combined width of the 6 anterior teeth in four racial groups. Int J Prosthodont – Enviado para publicação.
5. Varjão FM, Nogueira SS. Size matching of artificial teeth with the natural maxillary anterior teeth of four racial groups. Braz Dent J – Enviado para publicação.
6. Varjão FM, Nogueira SS, Russi S, Arioli Filho JN. Correlation between maxillary central incisor form and face form in four racial groups. Quintessence Int – Enviado para publicação.
7. Varjão FM, Nogueira SS. Correlation between maxillary central incisor and maxillary arch forms in four racial groups of the Brazilian population. Braz Oral Res – Enviado para publicação.