UNIVERSIDADE DE SÃO PAULO
FACULDADE DE ODONTOLOGIA DE BAURU

CAROLINE MARTINS GAMBARDELA TKACZ

Comparative study of the dental arch shape in young Brazilians with normal occlusion

Estudo comparativo da forma dos arcos dentais de jovens brasileiros leucodermas, melanodermas, feodermas, xantodermas e nipo – brasileiros com oclusão normal

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Orientador: Prof. Dr. Arnaldo Pinzan

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DEDICATÓRIA

Dedico este trabalho

Ao meu marido, Alexandre e aos meus queridos pais

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"Eu queria escrever luxuoso. Usar palavras que rebrilhassem molhadas e fossem peregrinas. Às vezes solenes em púrpura, às vezes abismais esmeraldas, às vezes leves na mais fina macia seda rendilhada."

Clarice Lispector

ABSTRACT

Comparative study of the dental arch shape in young Brazilians with normal occlusion

Aim: This study was to determine the normative values of dental arch length and width measures; to identify the shapes of the dental arches of Brazilians with normal occlusion**. Methods**: The sample included 100 dental casts from untreated subjects with normal occlusion divided by ethnic groups. It was digitized using a 3D scanner. The measures and the shapes of the dental arches from both arches were determined and compared. **Results**: Japanese women had the highest distances in the lower and upper posterior variables among all groups. White men presented the lowest values for transversal measurements. The Black men had the highest maxillary measures except for the intermolar width. The arch shape of the Japanese-Brazilian women presented the narrowest at the molar area. The Mulatto men had the highest dental arches in the anterior area. **Conclusions**: According to the results obtained, there was a slight variation in the shapes of dental arches between ethnic groups. Individual and ethnic characteristics in treatment should be considered**.**

Key words: Dental Arch. Ethnic Groups. Dental Occlusion.

RESUMO

Introdução: A forma do arco dentário está relacionado a vários fatores, incluindo o tamanho dos ossos maxilares, a influência da musculatura oral sobre a posição dos dentes, o desenvolvimento do processo alveolar e variações individuais de crescimento, raça e sexo. **Proposição:** Determinar os valores médios das medidas longitudinais e transversais, identificar e comparar as formas dos arcos dentários de brasileiros com oclusão normal. **Métodos**: A amostra incluiu os modelos de gesso de 100 indivíduos não tratados e com oclusão normal e divididos por grupos étnicos. Estes foram digitalizados utilizando um scanner 3D. As distâncias intercaninos, interpremolares, intermolares, comprimento, perímetro e as formas dos arcos foram analisadas e comparadas. **Resultados**: As mulheres japonesas tiveram as maiores distâncias nas variáveis posteriores dos arcos inferior e superior entre todos os grupos. Os valores mais baixos para as medições transversais foram apresentados por homens brancos. Os homens negros tiveram as maiores medidas para o arco superior, exceto para a distância intermolares. As mulheres nipo-brasileiras apresentaram as formas dos arcos mais estreitas nas regiões de molares. Os homens mulatos apresentaram os maiores arcos dentários na região anterior. **Conclusões**: De acordo com os resultados obtidos, houve uma pequena variação nas formas dos arcos dentais entre os grupos étnicos e que as características individuais e étnicas devem ser consideradas no planejamento ortodôntico.

Palavras-chave: Arco dental. Grupos étnicos. Oclusão dentária.

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1 INTRODUCTION

The shape of dental arch showed individual variations as to its configuration and it is related by the configuration of the supporting bone, the musculature and the intraoral functional forces, craniofacial skeleton, malocclusion type, ethnicity, sex. (BRAUN et al., 1998; SLAJ et al., 2011).

Triviño et al (TRIVIÑO; SIQUEIRA; SCANAVINI, 2007; TRIVIÑO; SIQUEIRA; SCANAVINI, 2008) analyzed mandibular dental casts from Brazilian subjects with normal occlusion and found eight mandibular dental arches forms in three sizes. Lee et al (LEE et al., 2011) studied young Korean adults and identified three arch forms in the maxilla and the mandible. They concluded that there was no ideal or representative shape for the normal occlusion.

Rijal et al (RIJAL et al., 2012) investigated a probability distribution of maxillary dental arch shape using digital images. They used a sample of dental casts of 47 adults from Malaysia and China aged between 19 and 32 years with well-aligned maxillary anterior teeth. The authors found three types of arches and concluded that this information will help orthodontists about the variation of arch shape which is useful for diagnosis and treatment plan.

In a recent study Sousa et al (SOUSA et al., 2012) had the intention to determine the accuracy and reproducibility of arch widths and lengths obtained with the surface laser scanner 3Shape D-250 3-dimensional and scanner. The authors concluded that the points on the digital casts were easy to identify. A simple click on two points is enough for the program to generate a linear measurement automatically. The reproducibility of digital measurements of arch on digital casts was similar to direct measurements on the dental casts with a caliper. Digital casts can be used for storing dental casts and for research with satisfactory degrees of accuracy and reproducibility of linear measurements of arch width and length.

According to Fleming et al (FLEMING; MARINHO; JOHAL, 2011), casts for orthodontic diagnosis and treatment planning have traditionally been kept in the form of physical plaster casts, which are subject to loss, fracture and degradation. The

replacement of plaster orthodontic casts by virtual information has further potential benefits including: instant accessibility of 3D information without need for the retrieval of plaster casts from a storage area; the ability to perform accurate and simple diagnostic set-ups of various extraction patterns; virtual images which may be transferred anywhere in the world for instant reference or consultation. In a systematic review, the authors noticed the agreement between transverse dimensional readings obtained using digital and plaster casts. The differences between the mandibular and maxillary intercanine, inter-premolar, inter-molar dimensions in digital and plaster casts were small and unlikely to be of clinical significance. They suggested a significant time saving with digital techniques although a significant learning curve and period of adjustment were likely to be required. This review confirmed that digital casts offer a valid alternative to plaster casts and the validity of digital casts as an alternative to the plaster ones is getting increasingly evident.

After reading about it. This study aims to determine and compare the dimensions and shape of the dental arch among different Brazilians ethnic groups.

2 ARTICLE

2 ARTICLE

The article below was written according to the American Journal of Orthodontics and Dentofacial Orthopedics instructions and guideline for article submission.

Comparative study of the dental arch shape in young Brazilians with normal occlusion

Caroline Martins Gambardela – Tkacz
Supervisor: Arnaldo Pinzan

Introduction

The shape of the dental arch was related to several factors including the size of the jaws, the influence of the oral musculature on the position of the teeth,[1] the development of the alveolar process[2,3] and individual variations of growth, ethnic,[4,5] occlusion, tooth size[6] and sex.

The interest in studying the normal arch form in patients has existed for almost a century.[4,5] There is a link between the cusps and incisal edges that compose both dental arches. This pattern of normal occlusion provides a method of determining the degree of individual variation in case of malocclusion. Since Scott,[2,3] there has been no standard form of dental arch and a difficulty in selecting a nomenclature to describe the types of normal dental arches. Geometric forms, such as parabola, ellipse, hyperbola and mathematical formulas like catenary curve,[2] beta function,[7,8] cubic splines and polynomial equations[9-11] were methods used to classify and evaluate the shape of dental arches. AlHarbi[12] concluded that a polynomial function of the fourth degree is a reasonable analysis when the objective is to describe the curvature of the normal dental arch. Pepe[13] said the polynomial curves were much more accurate than catenary curves in describing arch form.

Almeida et al[11] have evaluated the variations of the shape of the dental arch from dental casts of young Whites, Black and Japanese using the fourth degree polynomial equation. They concluded that the arches of Whites and Blacks in both sexes, show the same posterior width, but the anterior area of the Black group is

wider and with a squarer aspect, namely the posterior segment of the arch of the Black group are slightly less divergent than the Whites'. Japanese presented wider dental arch in the posterior region.

Studies compare the clinical forms of the mandibular dental arch of Caucasians, Japanese[14], Koreans[15], Israelis[16] and Egyptians[17]. The aim of these studies was to identify the distribution of the shape of the dental arch with malocclusion and normal occlusion to clarify morphological differences among these populations. All groups were classified as square, ovoid or tapered to determine and compare the frequency among the ethnic groups. The Caucasian group 43.8% had tapered shaped arch and the Japanese, ovoid and square shapes were the most prevalent. The Korean group showed higher prevalence of square arches (46.7%) while the Israeli group showed that the ovoid form appeared more frequent. The distribution of arch forms in Egyptians showed similar frequencies among tapered, ovoid, and square.

Othman et al[18] investigated the morphological differences of arch forms between two ethnic groups from Malaysia. The arch dimensions were measured to determinate the arch shapes. The authors overlaid templates of square, ovoid, and tapered arch forms (Orthoform; 3M Unitek, Monrovia, CA, USA) on printed scans of the models to determine the best fit. They concluded that the ovoid shape had the highest prevalence in the maxillary arch and for the mandibular arch; the most frequent shape was tapered in both ethnic Malay and Orang Asli groups, whereas square arch shape had the lowest frequency in all groups.

Some authors[10,19] found more than one type of arches. This information will help orthodontists about the variation of arch shape which is useful for diagnosis and treatment plan, also permit the fabrication of preformed archwires with the most common dental arch forms or templates to help in the manual contouring of archwires, eliminating the use of dental casts during orthodontic treatment and thus reducing the possibility of breaking them.

In the literature, there are authors who compared the dental arches of untreated subjects with preformed archwires commercially available. One of them is Oda et al[20] who concluded that the mean width of preformed archwires is narrower

than the mean width of the normal dental arch form. Therefore, according to their studies, for today's orthodontic needs, there might be required preformed archwires that are approximately 1 to 3 mm wider at the canine level and 2 to 5 mm wider at the first-molar level. Earlier, Felton et al[21] had found no predominance of any particular arch form in the commercially available arches of that time.

Thus, considering high variability of the previous results and the potentiality of the new technologies, the aim of this study was: To determine the mean values for the intercanine, inter1stpremolar, inter2ndpremolar intermolar widths, length and perimeter of the arch of young Brazilians; to determine the shapes of the maxillary and mandibular dental arches using the fourth-degree polynomial; to evaluate and compare the different characteristics of these arches among the ethnic groups; to identify the presence or absence of differences between sexes.

Material and Methods

Material

In order to calculate the sample size for the minimum difference to be detected among the means of 5% of the five groups, the analysis of variance was applied. The reference values for the mean and standard deviation of intercanine width compared in groups divided by ethnic as well as the estimated minimum difference to be detected, were taken from the results of the Nojima et al.[14]

The sample began to be collected after the approval of Ethics Committee on Human Research of Bauru Dental School, University of São Paulo under process nº 18931913.0.0000.5217.

The sample consisted of 100 pairs of dental casts from young untreated subjects with normal occlusion from the files of the Discipline of Orthodontics, Bauru Dental School, University of São Paulo and divided into five groups: Mulatto, Black, White, Japanese and Japanese-Brazilians with 20 subjects (10 of each sex). **Group 1: Mulattos**, the descendants of Whites with Blacks or between Brazilian Mulattos, at a mean age of 20.85 years (SD 3.66; range, 17 – 30 years); **Group 2: Blacks** from Africa coast where the Bantu population and their descendents are prevalent, at a

mean age of 14.13 years (SD 1.52; range, 12 – 18 years); **Group 3:** This group was composed of **Whites** from Portugal, Spain or Italy and their descendants, at a mean age of 13.35 years (SD 0.88; range, 11.9 – 14.9 years); **Group 4: Japanese** and their descendants, except for those from the Okinawa Island because there the colonization was done by the Chinese, at a mean age of 15.78 years (SD 1.75; range, 12.18 – 18.46 years); **Group 5: Japanese-Brazilians:** children or grandchildren of individual Japanese ancestry with Brazilians, at a mean age of 13.94 years (SD 1.05; range, 12.28 – 16.04 years). The selected sample subjects were from the same geographic area, Bauru - SP – Brazil and the standardization groups were divided by ethnic.

The following inclusion criteria have been adopted: Full permanent dentition excluding the third molars; normal molar and canine relationship; Mild or no crowding; Absence of crossbite; Normal overbite and overjet; No history of orthodontic treatment.

Methods

The dental casts were scanned through the 3Shape R700 3D (3Shape A/S, Copenhagen, Denmark) scanner. The maxillary and mandibular casts were scanned separately and in occlusion. On the computer connected to the scanner, the image was saved in (.STL) format, compatible with Windows™ and specific software for three-dimensional images. The images from the dental casts were acquired through the software Scan It (3Shape A/S, Copenhagen, Denmark). After scanning, the maxillary and mandibular dental casts were measured in two different programs: Ortho Analyzer 3D (3Shape A/S, Copenhagen, Denmark) and Geomagic Studio 5 software (Raindrop Geomagic, Inc, Morrisville, NC) by one operator.

Transversal and longitudinal measurements from maxillary and mandibular arches were performed according to figure 1.[11,22] The points were marked according to Table 1 and Figure 2 for both arches.

TRANSVERSAL: **Intercanine width:** distance between the cusp tips of crowns of permanent canines; **Inter 1st premolar width:** distance between the buccal cusps tips on the occlusal surface of the first premolars; **Inter 2nd premolar width:** distance between the buccal cusps tips on the occlusal surface of the second premolars;

Intermolar width: distance between the mesiobuccal cusp tips of the first molars. LONGITUDINAL: **Arch length:** the distance from the lingual contact point between the central incisors until a line connecting the mesial contact points of the first molar from one side to the other; **Arch perimeter or circumference:** measured from the mesial surface of the first molar from the right side to the left, through the sulcus of premolars, cusp tips of canine and incisal edges of incisors. These variables were measured in millimeters.

To determine the shape of the arches, the three-dimensional images in (.STL) format were imported into the software Geomagic Studio 5. The relations of the 14 points in the X, Y and Z axis were obtained. (Table 1 and Figure 2) The mean value of these points for each ethnic group was calculated, with this information the graphics were defined. The mean curve was built using trendline functions available in Microsoft Excel worksheet. The Y-axis values were not used because they refer to depth of the cast. The mean values for each point for each ethnic group were obtained from the curves that were made by the scatter chart. To compare the graphics were overlaid through the axis. The Geomagic Studio was used because the Ortho Analyzer did not relate the cast to the Cartesian plane.

Statistical analyses

In order to determine the error involved in the method as well as the reliability of the results, 30% of the sample were randomly selected and subjected to a new measurement. The same methods and previous criteria were used. The random error was calculated according to Dahlberg's formula. The systematic error was calculated with dependent *t* tests, at $P< 0.05$. Values greater than 1 mm for linear measurements were considered errors.

The differences between the sexes were evaluated with independent *t* test. The normal distribution was verified by the Kolmogorov-Smirnov test. The data were analyzed by 1-Way ANOVA followed by the Tukey test. All statistical analyses were calculated by Statistica software (Statistica for Windows, version 10, Statsoft, Tulsa, Okla, USA), and the results were considered significant at $P <0.05$.

Results

Table 2 presented the dependent *t* test and Dahlberg´s formula results applied to the variables evaluated to estimate the random and systematic errors, respectively. The values of random errors varied from 0.19 to 2.46 according the Dahlberg's formula and just the lower intermolar width presented systematic error between the first and second measurement ($p < 0.05$ in all measures). Based on these data, the method employed in this study was considered acceptable and reliable.

According to the independent *t* test, four variables studied had statistically significant differences, so the results were presented separately by sex. All the variables fit normal distribution as well as Kolgomorov-Smirnov test, so a parametric test was used. The parametric test One – Way ANOVA was used to analyze the mean differences among the five groups followed by the Tukey test when the variables had statistically significance. The superscript different letters indicate presence of statistically significant differences among the mean values determined by the Tukey test.

Table 3 showed a statistically significant difference in relationship to age between both groups separated by sexes. There was no compatibility between White, Black, Japanese and Japanese-Brazilian towards Mulattos, but this did not interfere in the results, since all groups fulfill the same inclusion criteria of complete permanent dentition.

Tables 4 e 5 showed the results of One-Way ANOVA test for comparison among groups separated by female and male respectively.

Table 4 showed that Japanese female had the greater distances in the mandible and maxillary posterior variables among all groups. The Black women had the highest values for the two upper longitudinal measures. The two maxillary longitudinal variables presented identical values for all the five groups, the Black women showed the highest values. Concerning the mandibular intercanine width, the White female showed the lowest values While the Japanese-Brazilian showed the highest, and the values were also different in the Tukey's test. The White and Japanese female groups presented different values regarding the lower inter 2nd premolar width. The Mulattos presented the lowest values and the Japanese the highest values for the arch length, being different from the others. The Black female

showed the highest values for the lower arch perimeter. The White female presented the lowest values for all variables except for the arch length.

Table 5 showed that the Black male had the highest maxillary measures except for the intermolar width. The White male showed the lowest maxillary values for transversal measures. The Japanese were those who presented the lowest maxillary values for the longitudinal measures. The Back group had the highest mandibular values for variables and the Mulattos group had the lowest mandibular values for inter 1st and 2nd premolars widths. The mandible variables: intercanine width, intermolar width, arch length and arch perimeter were similar among the five ethnic groups.

The mean shape of dental arches for each sex and ethnic group were shown in pictures 3 and 4. Picture 5 showed the superimposition of the maxillary and mandibular mean curves of the arches.

In the anterior area, the Japanese and Japanese-Brazilian females showed similar maxillary arch forms, but they were smaller than the other three groups. The arches of the Japanese-Brazilian females were the narrowest ones at the posterior area. The Mulattos males had the greatest dental arch shape in the anterior area.

Discussion

The sample was selected according to racial and occlusion characteristics in order to standardize the results. Untreated dentitions are often used as reference, against which the dental changes are produced by orthodontic treatment.[23]

The method applied in this study analyzed all data digitally, without the need for printed documents. The traditional dental casts were scanned and the measurements obtained through 3D images in specific software, as previously tested by Sousa et al[24] and reasoned by Fleming et al.[25] In the literature the authors use different ways to obtain the measurements, directly over the dental casts using a caliper,[26-28] with photographic techniques,[29,30] photocopies or digitalized images,[6,10,19,21,31] and 3D digital casts.[20,23,32-34]

In order to determine the dental arches dimensions and shapes, some authors have chosen either one of the arches, the maxillary[19] or the mandibular, [14] and

sometimes both of them. [28,30] In addition, several landmarks have been used such as clinical bracket points, [10,14-17] facial axis points, [20,33] center on the occlusal surface. [23] However, the anatomic structure chosen in this study was the incisal edge and cusp tip[11,12,18,32,34-37] because it studied the dental not the alveolar arch characteristics and the sample consisted only of subjects with normal occlusion. The subjects of this study will not be submitted to orthodontic treatment.

The arch shape varies according to the landmarks chosen to represent the teeth; each setting generates a different shape. General comparisons among the various studies of the arch shape should be done as a precaution. The validity of each arch type is related to the purpose of its use.[6,30]

The choice of the polynomial equation to determine the shape of the arch was based on Almeida,[11] Diop Ba,[9] Triviño et al,[10] AlHarbi et al[12] and Tsai[29] because it was reported to be the best way to described the dental arch. According to Arai and Will[36] it is an objective analysis and might be a reliable tool for quantitative analysis of shape of dental arch in orthodontic patients, but the lack of simplicity of the fourth order polynomial equation is a disadvantage for the clinical daily use, while the subjective clinical assessments are generally easier to use and they are also in agreement with the dental arch forms. The subjective classification is also described in the literature.[14-18,32]

In order to observe whether there were any differences between the sexes, this sample was divided by sex. There was a statistically significant difference between the sexes; therefore, the results were compared separately. Tsai[29] studied Taiwanese children and concluded that arch length and width were larger in boys than in girls and the mean curves of both the anterior and posterior segments of the upper and lower arches were similar in both sexes, but the mean curve of the girls were smaller than those of the boys.

Bishara et al[35] indicated the decrease in arch length during adolescence and early adulthood for both males as females. Carter and McNamara Jr[23] showed that there was a decrease in the values of arch width, depth, and perimeter for the untreated group. The fact that one group from this sample has a mean age higher than the others did not affect the fidelity of the research, because the Mulattoes do not presented extreme numerical values.

The results showed differences according to sex for the transverse and longitudinal arch dimensions. Females have smaller values than males. The female

Japanese from this sample showed lower values for mandibular intercanine and intermolar width than Oda et al[20].

Forster et al[26] research has lower values than the results of this study for all variables even when using the same landmarks and White subjects from USA. The values of the White subjects found in this sample are higher than the results of Carter and McNamara Jr[23], perhaps this can be explained by the fact that they used different landmarks to measure the variables. (Table 4)

The male Mulattos in this sample had higher values for maxillary and mandibular intercanine, inter 1st premolar and intermolar width than the Colombian mestizos with normal occlusion,[27] because the authors did not separate their sample by sex or age. The maxillary anterior arch width of the boys from Tsai[29] were very similar to the values found with the Japanese group in this study. Alvaran et al[27] values tended to be smaller than the results found in this study. It demonstrated that the Colombian mestizos have narrower dental arches in the posterior area than the male Brazilian Mulattos. (Table 5)

Rastegar – Lari et al[38] used the same references for measuring the arch length whereas Hasegawa et al[28] included the first molar and both results are greater than all groups in this study.

The results of this study showed that there were slight differences among the dental arch shapes among the groups. They agree with Raberin et al[37], Triviño et al[10], Bayome et al,[33] Lee et al[6] and Felton et al[21] that there is not a single dental arch form for the groups with normal occlusion. (Figure 5) Their study also found differences in the arch shapes even though they were very few.

This study compared the shape of interethnic groups of dental arches whereas Raberin[37] and Tsai[29] compared the dental arch shape between boys and girls and Nie and Lin[34] and Kook et al 2004 compared the shape of the dental arches between subjects with malocclusions and normal occlusions. In the researched literature there has been no comparison among interethnic groups, only Diop Ba et al[9] determined the shape of the Senegalese's dental arches.

Clinical Implications

All studies about the normal occlusion seek to improve the way of implementing malocclusion treatment plans. There were differences in the arch shapes among normal occlusion and malocclusions may be explained by compensatory mechanisms.[7]

The maintenance of the original arch shape and mandibular intercanine width in clinical orthodontics are essential for long-term occlusal stability,[1,21] thus, the understanding the shape of the arch is an important factor for a successful orthodontic treatment.

It is widely acknowledged that each individual has your own arch form.[9] The objective is not to create new templates, because these curves may describe arch form, but they are not accurate enough to serve as a template for an archwire,[13] however, the choice of the preformed archwire, among the ones available commercially, has to be careful for patients from different ethnic groups.

Conclusions

According to the method employed and the results obtained it may be concluded that there was a slight variation in the dimensions and shapes of the dental arches among the ethnic groups due to biological variability.

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Fig 1A: Longitudinal and transversal measurements in the maxillary arch using Ortho Analyzer

Fig 1B: Longitudinal and transversal measurements in the lower arch using Ortho Analyzer

Figure 2A: Points selected on the maxillary cast related to the Cartesian plane with Geomagic Studio

Figure 2B: Points selected on the mandibular cast related to the Cartesian plane with Geomagic Studio

Figure 3A: Mean dental arches of mulatto female

Figure 3B: Mean dental arches of black female

Figure 3C: Mean dental arches of white female

Figure 3D: Mean dental arches of Japanese female

Figure 3E: Mean dental arches of Japanese - Brazilian female

Figure 4A: Mean dental arches of Mulattos male

Figure 4B: Mean dental arches of Black male

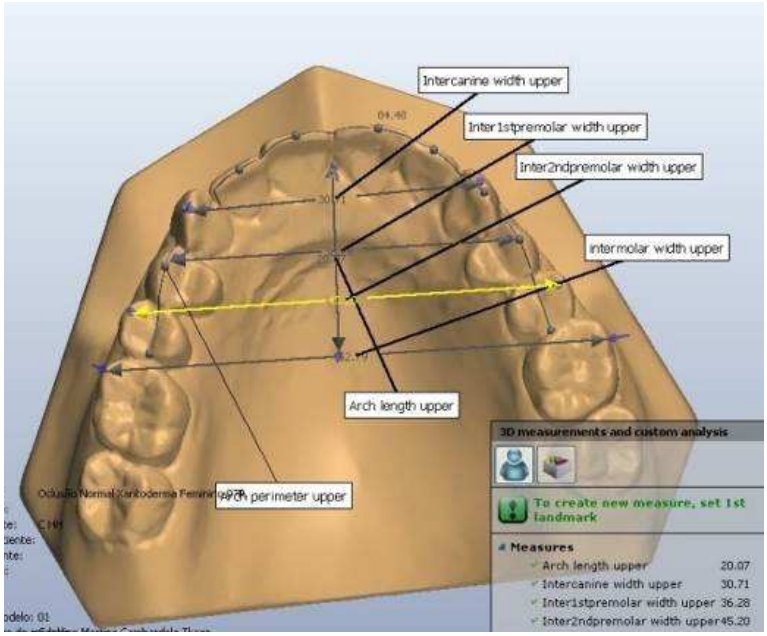
Figure 4C: Mean dental arches of White male

Figure 4D: Mean dental arches of Japanese male

Figure 4E: Mean dental arches of Japanese - Brazilian male

Figure 5A: Superimposition of female dental arch forms of all ethnical groups

Figure 5B: Superimposition of male dental arch forms of all ethnical groups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intermolar width upper
Arch length upper
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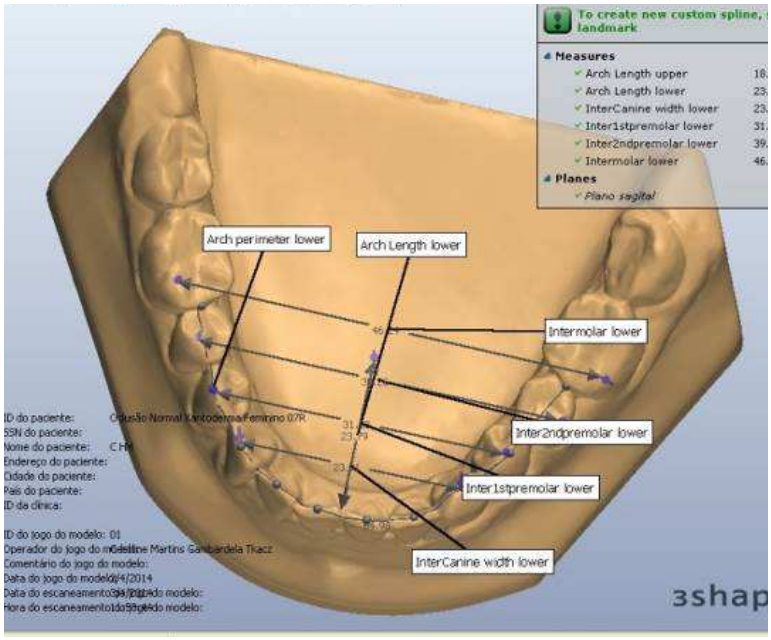
Fig 1A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Arch Length lower
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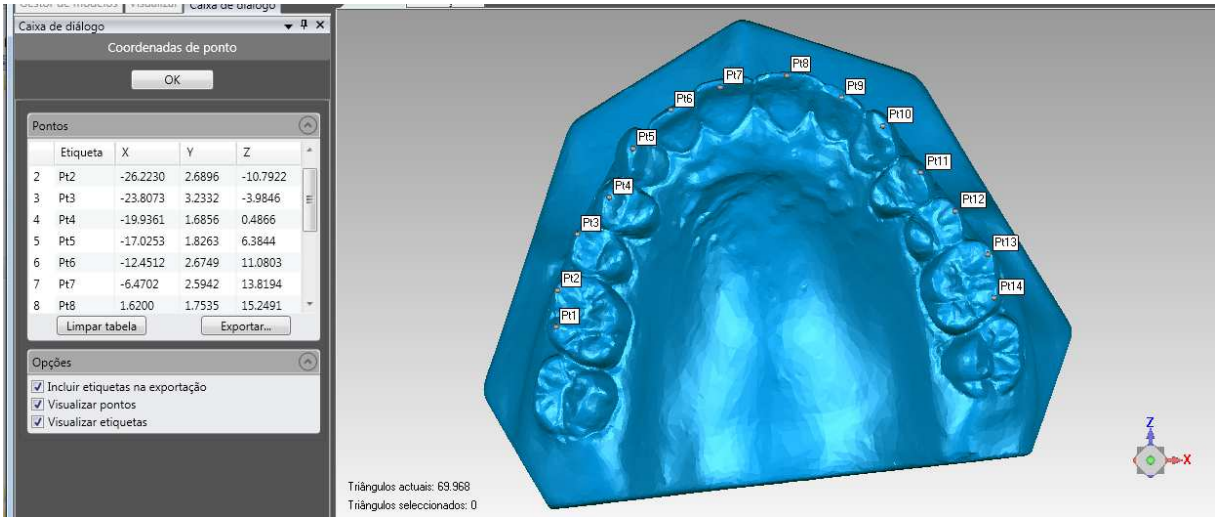
Fig 1B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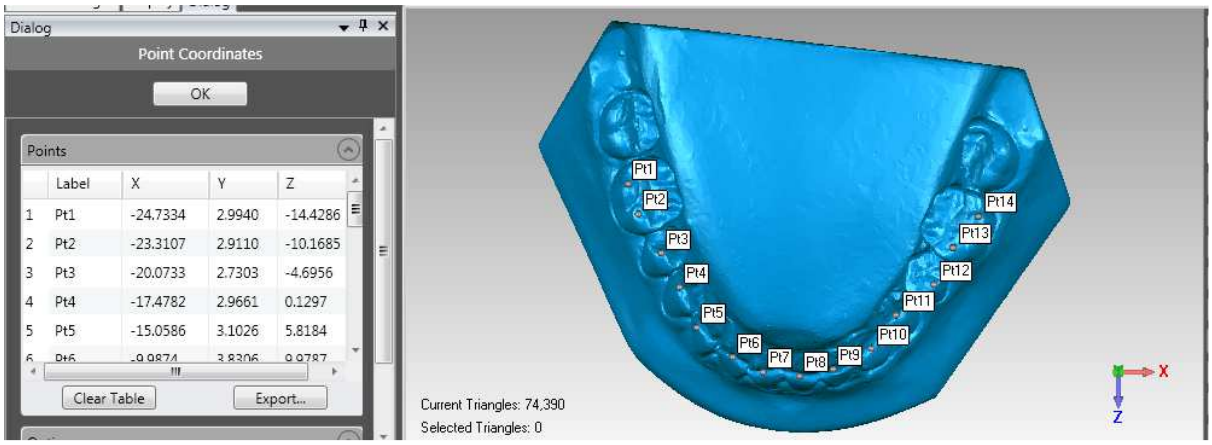
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Fig 2B

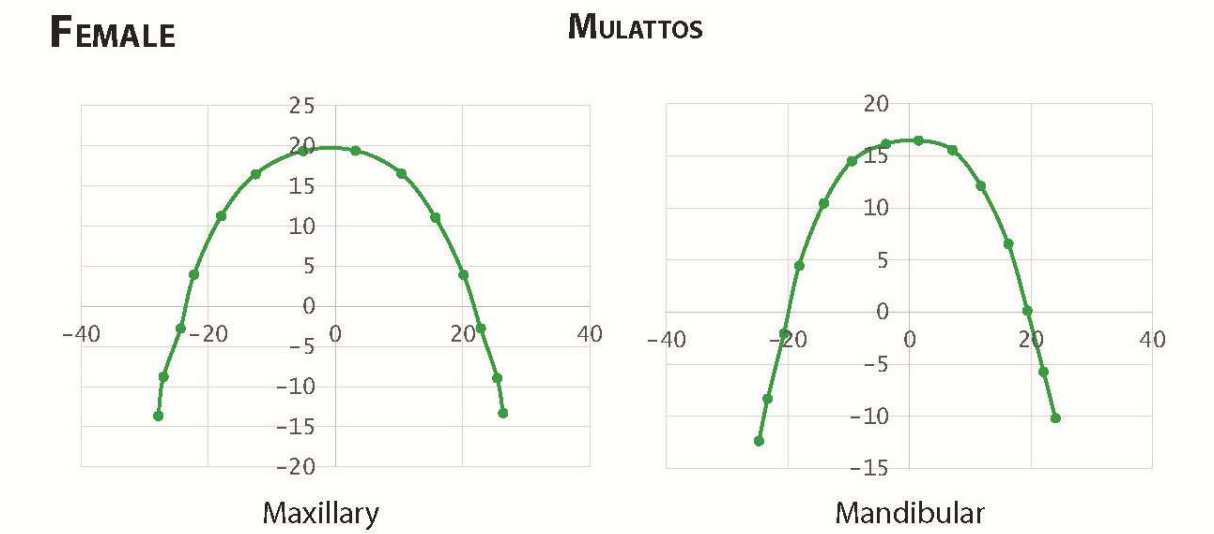
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Figure 3A

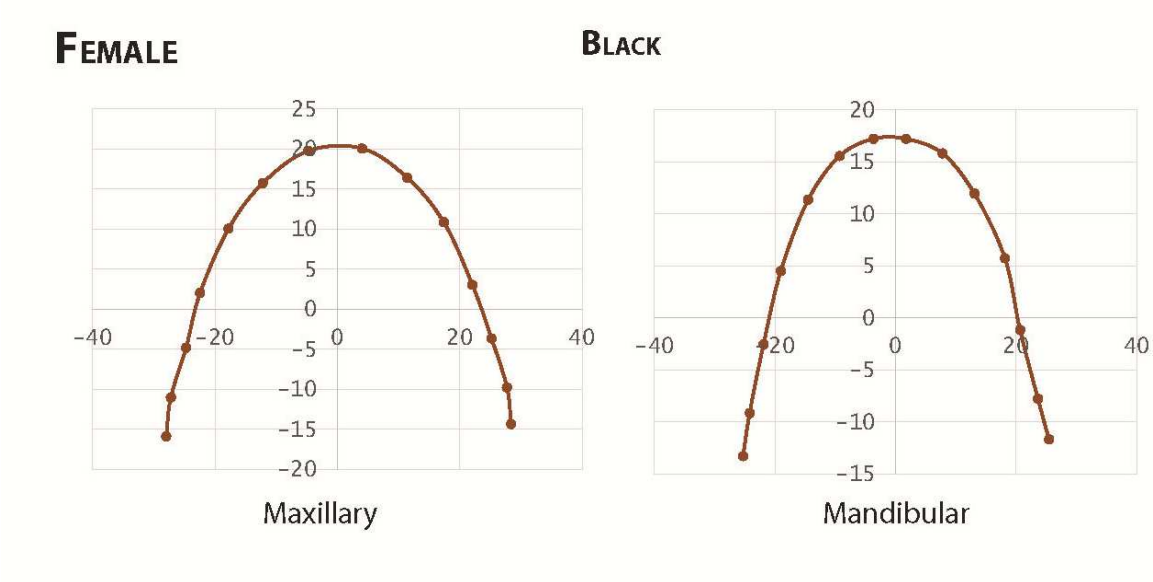
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Figure 3B

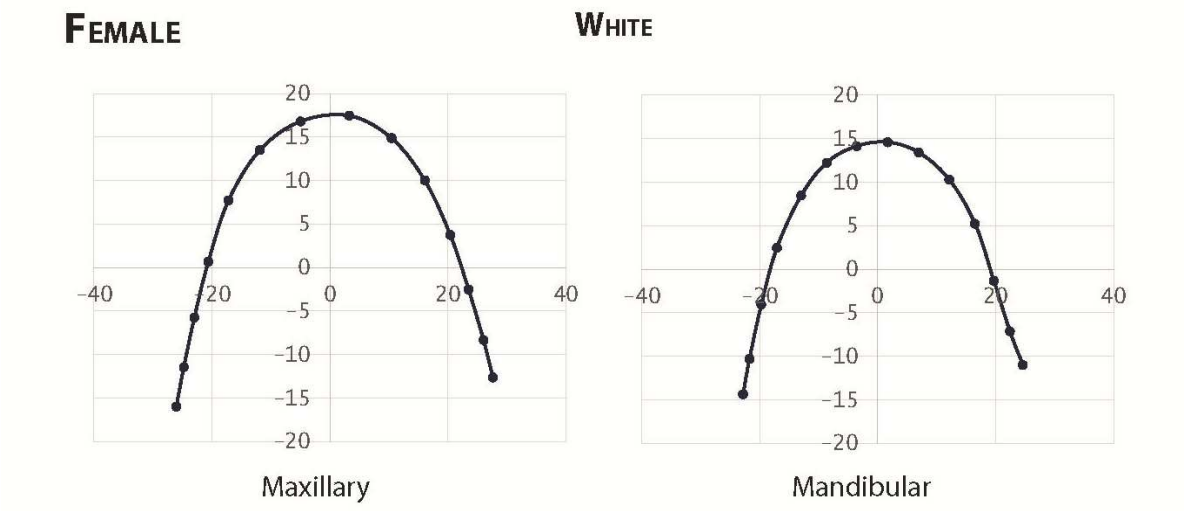
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Figure 3C

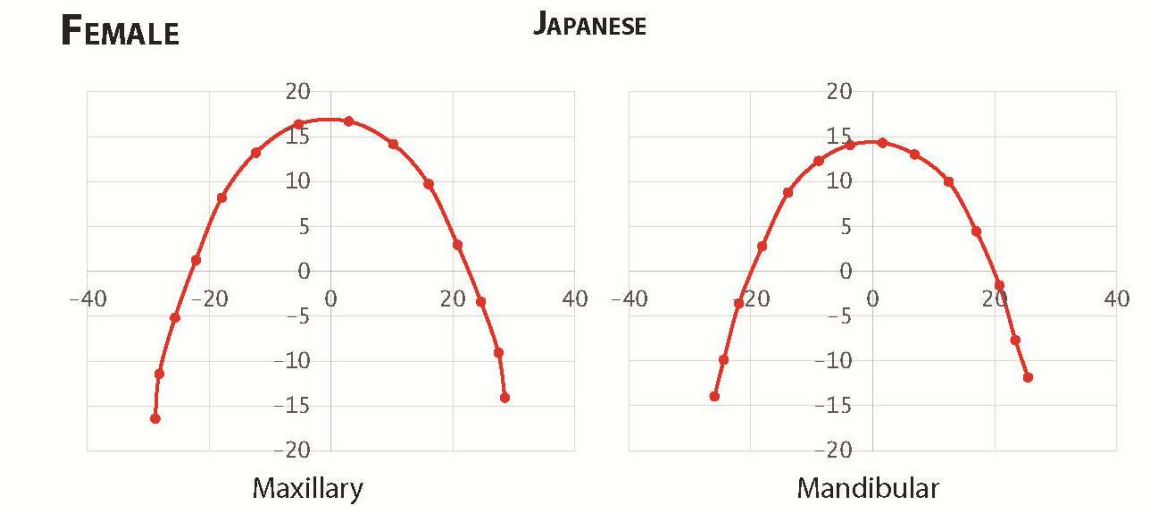
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Figure 3D

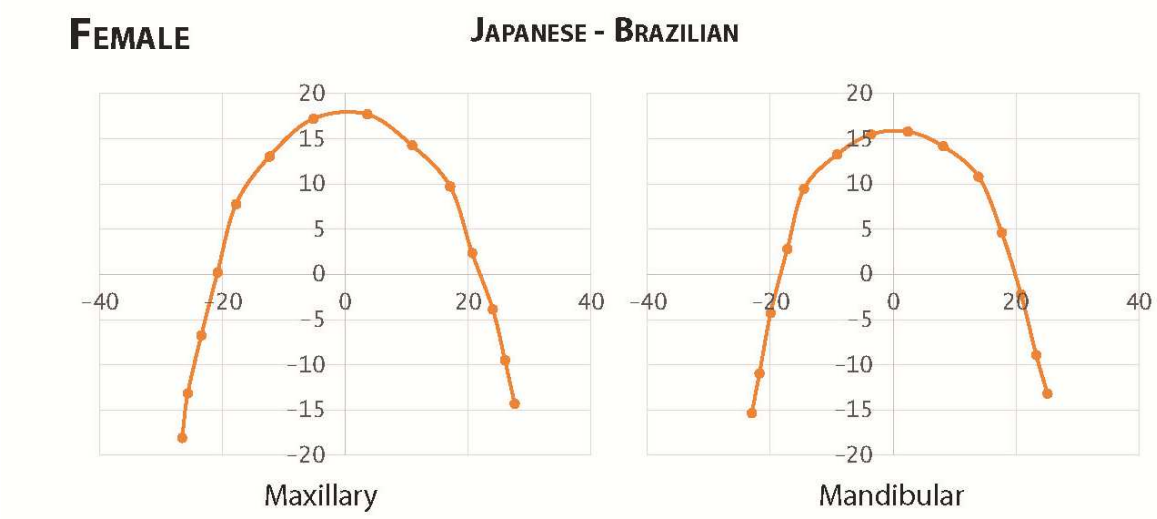
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Figure 3E

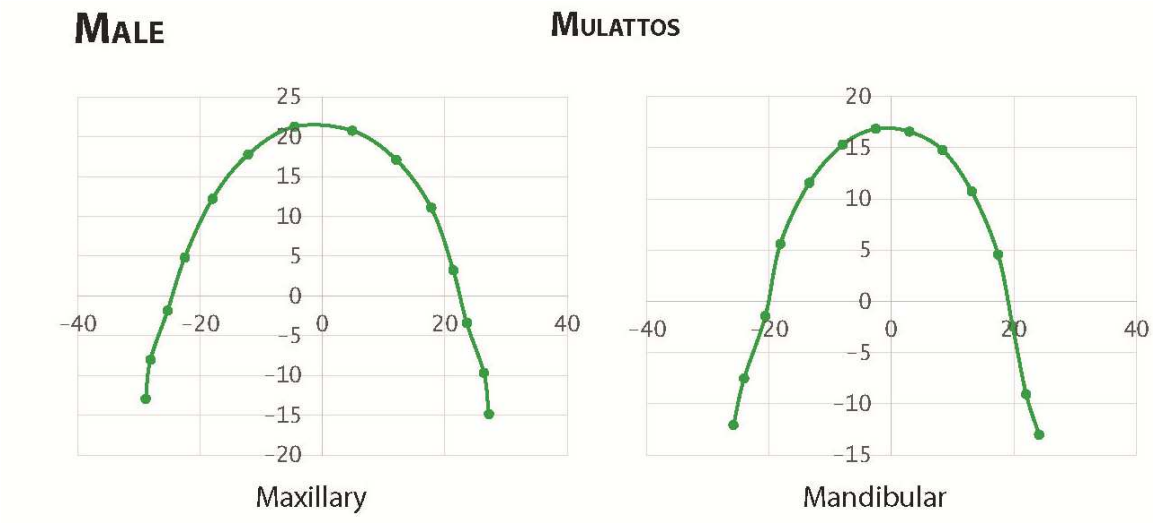
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Figure 4A

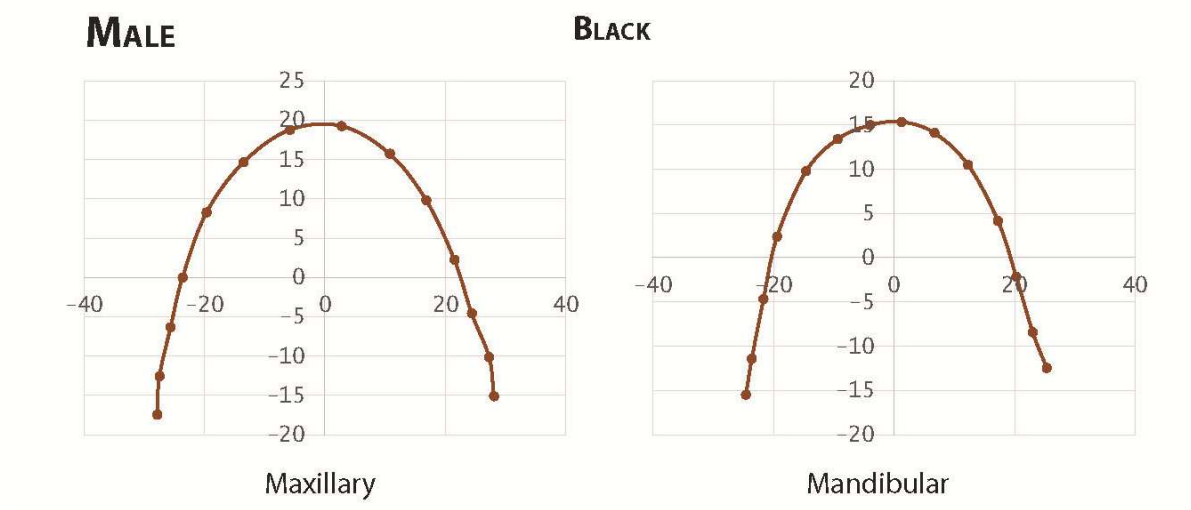
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Figure 4B

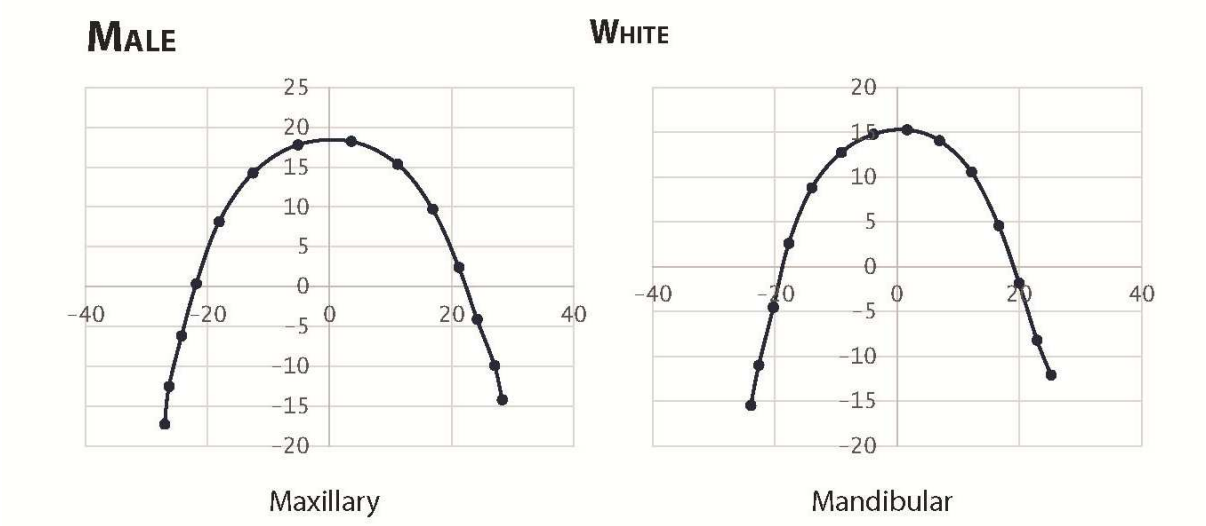
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Figure 4C

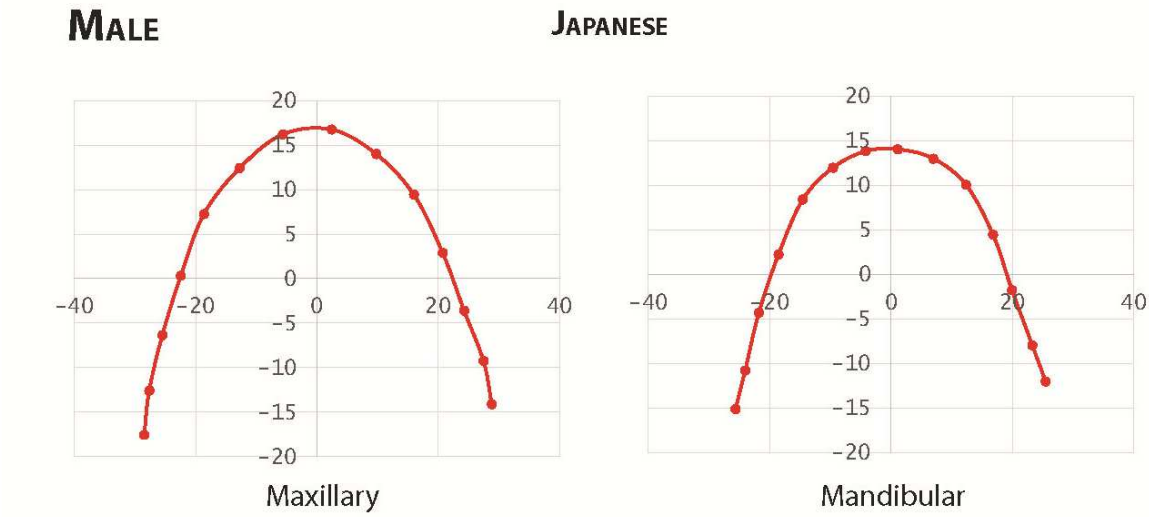
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Figure 4D

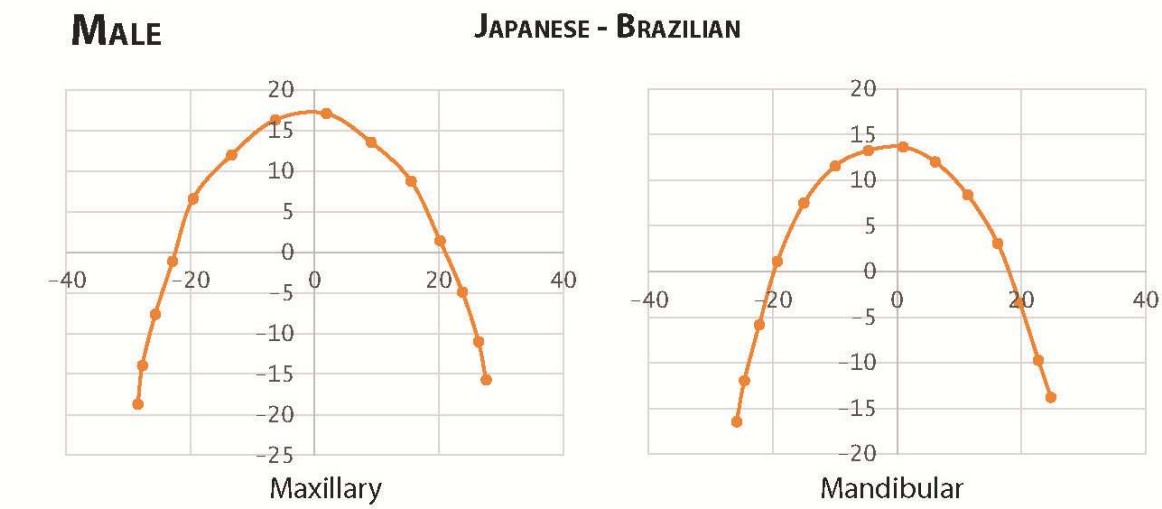
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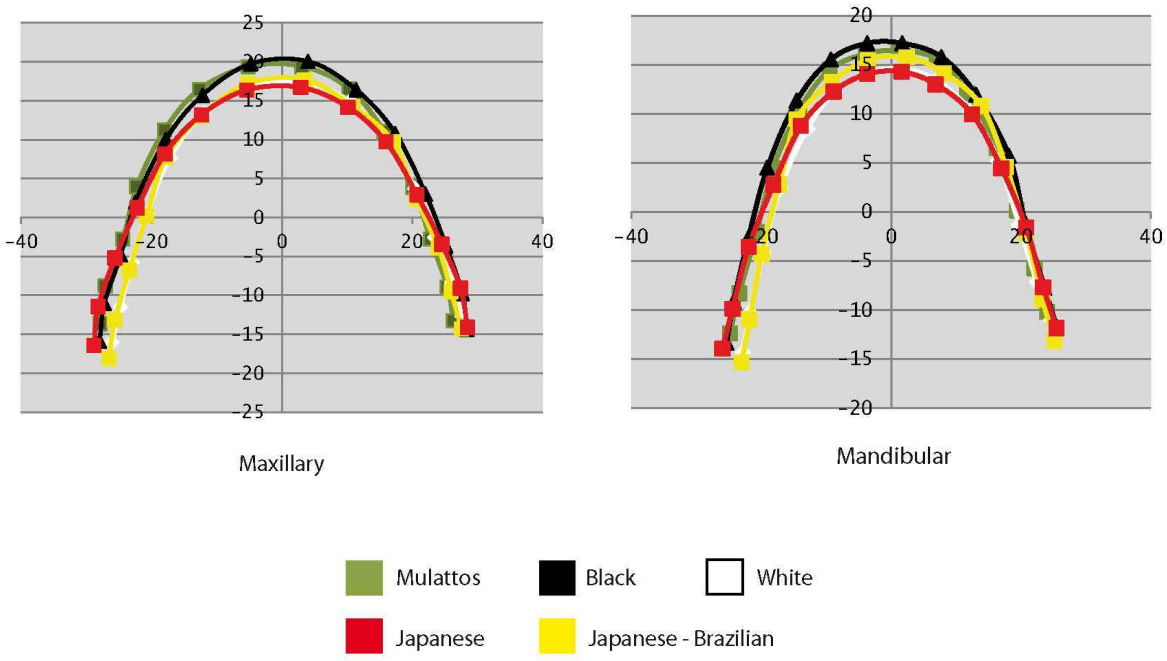
Figure 4E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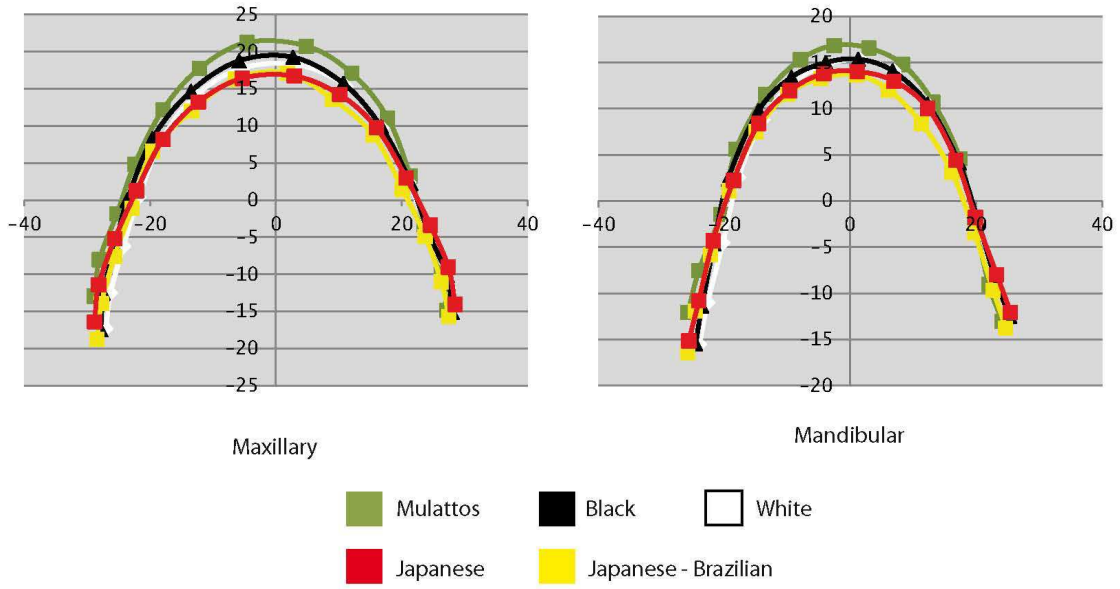
Japanese - Brazilian

Figure 5A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Japanese - Brazilian

Figure 5B

Table 1: Description of landmarks used to the measures

Point	Description
1	Distobuccal cusp of the right first molar
2	Mesiobuccal cusp of the right first molar
3	Buccal cusp of the right second premolar
4	Buccal cusp of the right first premolar
5	Cusp tip of the right canine
6	Midpoint of the incisal edge of the right lateral incisors
7	Midpoint of the incisal edge of the right central incisors
8	Midpoint of the incisal edge of the left central incisors
9	Midpoint of the incisal edge of the left lateral incisors
10	Cusp tip of the left canine
11	Buccal cusp of the left first premolar
12	Buccal cusp of the left second premolar
13	Mesiobuccal cusp of left the first molar
14	Distobuccal cusp of left the first molar

Table 2: Evaluation of random and systematics errors intra-investigator *(n=30)*

	1st. measurement		2nd. measurement		Dahlberg	P
	Mean	s. d.	Mean	s. d.		
Maxillary Intercanines width	34.94	2.35	34.88	2.24	0.45	0.62
Maxillary Inter 1st premolar width	43.66	3.02	43.64	3.04	0.43	0.85
Maxillary Inter 2nd premolar width	49.10	3.16	49.10	3,16	0.19	1.00
Maxillary Intermolar width	53.94	3.18	53.87	3.11	0.32	0.42
Maxillary Arch length	24.22	1.85	23.95	1.40	0.94	0.26
Maxillary Arch perimeter	86.06	5.11	85.56	4.76	2.08	0.35
Mandibular Intercanines width	26.77	2.26	27.07	1.81	0.75	0.12
Mandibular Inter 1st premolar width	35.49	2.51	34.94	3.56	2.11	0.32
Mandibular Inter 2nd premolar width	41.13	2.93	41.05	2.66	0.59	0.58
Mandibular Intermolar width	46.44	2.69	46.24	2.50	0.36	**0.02***
Mandibular Arch length	21.21	2.30	20.63	1.28	1.38	0.09
Mandibular Arch perimeter	75.81	5.64	74.88	4.52	2.46	0.14

Statistically significant at P<0.05

Table 3: The intergroup comparison of age (n = 100)

	Mulattos	Black	White	Japanese	Japanese-brazilian	p
	Mean (S.d.)	Mean (S.d.)	Mean (S.d.)	Mean (S.d.)	Mean (S.d.)	
Female	20.40 ^{A} (2.54)	14.64 ^{BC} (1.68)	13.26 ^{B} (1.05)	16.43 ^{C} (1.47)	13.51 ^{B} (1.07)	**0.000***
Male	21.30 ^{A} (4.62)	13.62 ^{B} (1.23)	13.44 ^{B} (0.71)	15.13 ^{B} (1.83)	14.37 ^{B} (0.89)	**0,000***
Total sample	20.85 ^{A} (3.66)	14.13 ^{BC} (1.52)	13.35 ^{B} (0.88)	15.78 ^{C} (1.75)	13.94 ^{B} (1.05)	**0.000***

Statistically significant at P<0.05

Table 4: Mean values and standard deviation of the transverse and longitudinal measures of upper and lower dental arches for females (n=50)

	Mulattos	Black	White	Japanese	Japanese -brazilian	p
	Mean (s.d.)	Mean (s.d.)	Mean (s.d.)	Mean (s.d.)	Mean (s.d.)	
Maxillary Intercanines width	33.74 (1.92)	35.22 (1.99)	32.69 (1.80)	33.9 (2.31)	34.93 (2.18)	0,061
Maxillary Inter 1st premolar width	42.70 (2.96)	44.31 (3.15)	41.22 (2.67)	42.94 (3.34)	41.89 (2.75)	0,213
Maxillary Inter 2nd premolar width	47.35 ^{AB} (2.85)	49.72 ^{A} (3.05)	46.33 ^{B} (1.83)	50.13 ^{A} (2.92)	47.45 ^{AB} (1.69)	**0.005***
Maxillary Intermolar width	52.27 ^{AB} (2.13)	54.59 ^{AC} (2.78)	50.58 ^{B} (1.59)	55.62 ^{C} (2.88)	52.14 ^{AB} (1.89)	**0.000***
Maxillary Arch length	22.98 ^{A} (1.01)	25.5 ^{B} (1.31)	22.64 ^{A} (0.96)	24.08 ^{AB} (3.51)	24.07 ^{AB} (1.49)	**0.015***
Maxillary Arch perimeter	82.90 ^{AB} (4.45)	89.08 ^{B} (4.57)	80.92 ^{A} (3.37)	86.87 ^{AB} (5.48)	86.53 ^{AB} (6.32)	**0.004***
Mandibular Intercanines width	26.00 ^{AB} (2.19)	27.21 ^{AB} (2.55)	25.01 ^{A} (1.86)	26.28 ^{AB} (1.57)	27.52 ^{B} (1.50)	**0.049***
Mandibular Inter 1st premolar width	34.60 (1.65)	36.01 (2.58)	33.60 (1.91)	35.49 (2.42)	34.67 (2.17)	0.145
Mandibular Inter 2nd premolar width	39.95 ^{AB} (2.38)	41.31 ^{AB} (3.71)	39.26 ^{A} (1.78)	43.06 ^{B} (2.89)	39.87 ^{AB} (2.28)	**0.021***
Mandibular Intermolar width	45.31 ^{AB} (1.56)	47.13 ^{AC} (2.71)	44.28 ^{B} (1.60)	48.33 ^{C} (2.66)	44.76 ^{AB} (2.10)	**0.000***
Mandibular Arch length	18.62 ^{A} (2.20)	21.92 ^{AB} (1.67)	20.73 ^{AB} (3.98)	23.09 ^{B} (4.86)	22.56 ^{AB} (2.76)	**0.030***
Mandibular Arch perimeter	72.57 ^{A} (3.05)	79.50 ^{B} (5.07)	70.70 ^{A} (5.46)	71.75 ^{A} (6.22)	74.96 ^{AB} (5.07)	**0.002***

Statistically significant at P<0.05

Table 5: Mean values and standard deviation of the transverse and longitudinal measures of upper and lower dental arches for males (n=50)

	Mulattos	Black	White	Japanese	Japanese-brazilian	p
	Mean (s.d.)	Mean (s.d.)	Mean (s.d.)	Mean (s.d.)	Mean (s.d.)	
Maxillary Intercanines width	35.94 ^{AB} (1.80)	37.42 ^{A} (1.38)	34.32 ^{B} (2.49)	35.38 ^{AB} (1.86)	34.77 ^{B} (2.16)	**0.010***
Maxillary Inter 1st premolar width	43.47 ^{AB} (2.49)	46.10 ^{A} (1.89)	42.67 ^{B} (2.23)	43.81 ^{AB} (2.67)	43.03 ^{AB} (2.77)	**0.025***
Maxillary Inter 2nd premolar width	48.84 (2.44)	51.13 (2.26)	48.02 (2.43)	50.43 (2.71)	49.32 (2.90)	0.068
Maxillary Intermolar width	53.81 ^{AB} (2.97)	55.67 ^{AB} (2.60)	52.90 ^{A} (1.64)	56.36 ^{B} (2.38)	53.80 ^{AB} (2.89)	**0.033***
Maxillary Arch length	25.01 ^{A} (1.75)	25.46 ^{A} (1.16)	24.82 ^{A} (1.22)	22.77 ^{B} (1.77)	23.79 ^{AB} (1.59)	**0.001***
Maxillary Arch perimeter	87.53 ^{AB} (4.2)	90.76 ^{A} (4.27)	85.86 ^{B} (3.45)	85.71 ^{B} (4.81)	85.93 ^{B} (3.67)	**0.042***
Mandibular Intercanines width	26.72 (1.53)	28.19 (2.06)	26.17 (1.62)	26.88 (1.69)	26.36 (1.14)	0.069
Mandibular Inter 1st premolar width	35.14 ^{AB} (1.40)	37.32 ^{A} (1.53)	35.54 ^{B} (2.44)	35.62 ^{AB} (2.06)	35.28 ^{AB} (2.51)	**0.046***
Mandibular Inter 2nd premolar width	39.84 ^{A} (2.41)	43.03 ^{B} (1.67)	40.65 ^{AB} (2.42)	41.44 ^{AB} (2.62)	41.42 ^{AB} (1.96)	**0.038***
Mandibular Intermolar width	46.04 (3.03)	47.41 (2.47)	45.72 (2.51)	48.02 (3.01)	46.99 (2.74)	0.327
Mandibular Arch length	20.62 (1.92)	21.69 (1.14)	20.56 (1.48)	19.87 (2.84)	20.89 (1.01)	0.278
Mandibular Arch perimeter	75.91 (3.16)	77.22 (6.64)	76.65 (5.50)	72.89 (5.37)	76.55 (5.04)	0.388

Statistically significant at P<0.05

3 DISCUSSION

3 DISCUSSION

The values recommended in studies of normal occlusion do not show what occurs in the general population because there are different types of malocclusions. Can be used as parameters to guide professionals in the planning and performance of orthodontic treatment (PINZAN; PINZAN-VERCELINO; PINZAN, 2010). In a classic article, Lawrence F. Andrews (ANDREWS, 1972) compared the best results of cases treated with the best of nature. Six characteristics present in the dental casts of patients with normal occlusion were described. Since that publication, the normal occlusion success parameters were redefined. Up to Edward H. Angle, the only concept was the molar ratio of Class I, however the inclusion criteria were based on the earlier author, because it constitutes just a few cases in the population. According to Silva Filho et al (SILVA FILHO; FREITAS; CAVASSAN, 1990) the percentage of children with normal occlusion represented 11.47% of a other sample from Bauru. Almeida et al (ALMEIDA; LOPES; MARTINS, 1983), studied the shape of the dental arch and not bother to select only cases of normal occlusion.

Identification of the shape of the dental arch of the patient and the preservation of the balance between muscle, bone and teeth is a key for the stability of the results, in other words, the success of orthodontic treatment (TRIVIÑO; SIQUEIRA; SCANAVINI, 2007; GAFNI et al., 2011).
Future work should explore:

- The shape of dental arch x pattern of craniofacial growth
- To identify the dental arch shape in different malocclusions before start orthodontic treatment
- The relationship between the shape of dental arch with the preformed archwires available in Brazilian industry.

4 CONCLUSION

4 CONCLUSION

According to the method employed and the results obtained it may be concluded that there was a slight variation in the dimensions shape of the dental arches among the ethnic groups due to biological variability. Small differences are always present suggesting that the plan for treatment has to be individualized.

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ANNEXES

ANNEXES

FACULDADE DE ODONTOLOGIA DE BAURU-USP

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: ESTUDO COMPARATIVO DA FORMA DOS ARCOS DENTÁRIOS DE JOVENS BRASILEIROS LEUCODERMAS, MELANODERMAS, FEODERMAS, XANTODERMAS E NIPO - BRASILEIROS COM OCLUSÃO NORMAL

Pesquisador: Caroline Martins Gambardela Tkacz

Área Temática:

Versão: 2

CAAE: 18931913.0.0000.5417

Instituição Proponente: Universidade de Sao Paulo

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 556.271

Data da Relatoria: 26/02/2014

Apresentação do Projeto:

Este é um projeto da área de Ortodontia que será realizada por uma mestranda da área. O presente trabalho tem por objetivo determinar a forma dos arcos dentários de jovens brasileiros com oclusão normal. Para a realização dessa pesquisa serão utilizados modelos de gesso de jovens leucodermas,melanodermas, feodermas, xantodermas e nipo-brasileiros, disponíveis no arquivo da FOB (dados secundários), área de Ortodontia. Está inserido em uma das linhas de pesquisa centrais de seu orientador.

Objetivo da Pesquisa:

Claro e definido: "O presente trabalho justifica - se pelo fato da necessidade de investigação científica sobre a forma dos arcos dentários das diversas raças e sua miscigenação, frente ao emprego indiscriminado dos arcos pré - contornados utilizados durante o tratamento ortodôntico e a tendência atual de individualização dos tratamentos ortodônticos.

Avaliação dos Riscos e Benefícios:

-Riscos: está de acordo, já que nao há riscos por se trabalhar com arquivos

-Benefícios: conduzirão os tratamentos de forma direcionada individual ou por etnias

O texto está coerente no TCLE e no projeto.

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FACULDADE DE ODONTOLOGIA DE BAURU-USP

Comentários e Considerações sobre a Pesquisa:

A verificação da influência do tipo étnico e, principalmente com as miscigenações cada vez mais frequentes, tem despertado grande interesse para que se estabeleça os diversos padrões de normalidade da arcada dentária, bem como da oclusão, respeitando-se este fator. Dessa forma, tratamento individualizado poderia ser favorável quando da necessidade. Dessa forma, o estudo traria contribuições no diagnóstico e tratamento ortodôntico.

Considerações sobre os Termos de apresentação obrigatória:

Os termos foram todos adequados de acordo com as recomendações.

Recomendações:

Todas as recomendações apontadas foram adequadamente efetuadas

Conclusões ou Pendências e Lista de Inadequações:

Não há pendências ou recomendações de ordem ética.

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

Considerações Finais a critério do CEP:

Esse projeto foi considerado APROVADO na reunião extraordinária do CEP de 10.3.2014, com base nas normas éticas da Resolução CNS 466/12. Ao término da pesquisa o CEP-FOB/USP exige a apresentação de relatório final. Os relatórios parciais deverão estar de acordo com o cronograma e/ou parecer emitido pelo CEP. Alterações na metodologia, título, inclusão ou exclusão de autores, cronograma e quaisquer outras mudanças que sejam significativas deverão ser previamente comunicadas a este CEP sob risco de não aprovação do relatório final. Quando da apresentação deste, deverão ser incluídos todos os TCLEs e/ou termos de doação assinados e rubricados.

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FACULDADE DE ODONTOLOGIA DE BAURU-USP

Continuação do Parecer: 556.271

BAURU, 13 de Março de 2014

Assinador por:
Flaviana Bombarda de Andrade
(Coordenador)

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