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Forensic anthropology population data

Facial soft tissue thickness of Brazilian adults

Sílvia Virginia Tedeschi-Oliveira *, Rodolfo Francisco Haltenhoff Melani, Natalie Haddad de Almeida, Luiz Airton Saavedra de Paiva

Departamento de Odontologia Social, Faculdade de Odontologia da Universidade de São Paulo, Avenida Lineu Prestes 2227, CEP 05508-000 São Paulo, Brazil

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ABSTRACT

The auxiliary technique known as Facial Reconstruction enables one to reestablish the contours of the soft tissues over the skull, therefore producing a face and increasing the probability of a facial recognition. The reliability of this technique depends on the evaluation of the mean values of soft tissue thicknesses observed in a given population. Measurements were evaluated in autopsied corpses in "Section of Technical Verification of Deaths" in Guarulhos, São Paulo, Brazil. Thickness was measured manually by puncturing 10 midline craniometrical points and 11 bilateral points on a sample of 40 corpses of both sexes aged between 17 and 90 years, classified by skin color and the nutritional state. The results for the average thickness values are higher for males, variations related to the nutritional state are proportional to the increased fat on the face and age was not significant. The ethnic variable related to skin color when compared to studies with other populations showed differences, with the need for a reference table for a given population application of Facial Reconstruction technique in skulls of non-attributable identity.

1. Introduction

The identification of human remains is a constant challenge in forensic science. The main scientific techniques used for legal identification are based on comparing ante mortem medical or dental records with post-mortem remains. However, using previous records is not always possible [1].

Facial Reconstruction is most usefully applied in cases where human remains have no attributable identity because it allows one to recreate the face of an individual by reconstructing the contours of the skull's soft tissues; this increases the likelihood of facial recognition. Different methodologies have been developed in three-dimensional Facial Reconstruction including computer programs that can generate an image of a face using the anatomical relationship between soft tissue and the skull [2].

There have been several reports of success in identifying human remains using Facial Reconstruction as an auxiliary technique. However, its reliability can be hampered by a lack of records regarding the thickness of soft tissue of a given population. These records are based on skeletal age, biological sex, and ethnic characteristics.

Although differences between ethnic groups have been described in scientific literature [3–16], the variables used by the database were commonly obtained from isolated populations of different groups, such as populations in Central Asia [4]; European and North American Caucasians [3,10,14]; African Zulus [17]; White Australians [8,18]; Saudis [9] and Indians from Northwest India [11].

When the faces of mixed race South Africans were assessed, it was found that the thickness of soft tissues used for Facial Reconstruction was only representative of that specific population. It is therefore questionable whether data obtained in research with one population can be applied in Facial Reconstruction of people from another ethnic group. Black individuals, of either gender, have thicker soft tissue around the face than their counterparts of mixed racial origin. The faces in a group of mixed race men and women were notably different to the faces of white North Americans [19]. The soft tissue measurements of Saudi individuals differed significantly when compared to other ethnic groups, especially Caucasians [9]. These variations were also found in the soft tissue of people from Northwest India [11], especially when compared to results from other populations such as black Americans, mixed race South Africans, American Caucasians and Japanese adults.

In Brazil there is no clear racial demarcation between populations in terms of distinctive ethnic, linguistic, cultural or historical characteristics. This means that the classification of individuals according to these categories is imprecise [20]. The

* Corresponding author at: Rua Leopoldo Couto de Magalhães Júnior, 591 apto 62, Itaim Bibi, São Paulo, SP, CEP: 04542-011, BraZil. Tel.: +55 011 3078 9615; fax: +55 011 3078 9615.
E-mail address: silviatedeschi@usp.br (S.V. Tedeschi-Oliveira).

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wide variability of physical traits makes it difficult to assign individuals to a particular group, although the majority of physical characteristics are quantitative. These morphological quantitative differences between ethnic groups have been known since the 19th century. The diagnosis of racial identity by studying the skull is a controversial subject. For a coroner, however, it is useful to obtain and analyze information that will allow any of the skeleton's characteristics to be compared with predefined anthropological types [21].

Historically in Brazil, anthropological types have been classified by comparing skin pigmentation with a chromatographic scale and by morphologic characteristics, mainly skull shape. They are classified into four groups: leucoderms (whitish skin, dark and *leiotrichous* (smooth) hair, mostly dark eyes and *brachycephalic*); faioderms (descendents of interbreeding between black and white ancestors, with different skin tones, dark eyes, *cymotrichous* (wavy or curly) hair and *mesocephalic*); xantoderms (native Indians and immigrants of Asian origin with yellowish skin color, dark and smooth hair, dark eyes, oblique eyelids, a wide face and *brachycephalic*); melanoderms (dark skinned, *ulotrichous* (woolly) hair, dark eyes and *brachycephalic*).

The purpose of this study is to assess the measurements of the thickness of soft tissue that covers anatomical landmarks of the skull using a population sample of corpses at the "Seção Técnica de Verificação de Óbitos" (Department for Technical Verification of Deaths) in Guarulhos, São Paulo. Guarulhos is located in the metropolitan area of Sao Paulo (Brazil's largest city), and is made up of a highly mixed population consisting of several different racial types [23]. Thus the cadaver sample is comparable to the composition of the Brazilian population as a whole in terms of skin color [22].

2. Materials and methods

2.1. General considerations

The available sample consisted of 40 corpses from the "SVTO" (Department for Technical Verification of Death) in the city of Guarulhos, São Paulo State, Brazil that were being necropsied in order to determine cause of death or the pathology associated with the death. This sample was considered representative of this particular region, considering that there will be some variation of predominant anthropological types for given regions of the country.

The measurements carried out in this research preceded any necropsy examination, in order to avoid modifications of the facial soft tissues. The examined corpses had intact soft facial tissues and time since death was less than 12 h to minimize any tanatological effect that may compromise the tissue integrity. All corpses were assigned an examination number, and classified by biological sex, age, time of death, skin color and nutritional status.

Because Brazil has one of the most heterogeneous populations in the world [24,25], the Von Luschan chromatic scale was used to classify skin color with values of 10–19 for leucoderms, 20–23 for xantoderms, 24–29 for faioderms and 30–36 for melanoderms. The Von Luschan scale establishes different color tones that can be compared to a part of the skin unexposed to the sun. Classification was carried out by two examiners who observed both armpits of sample individuals, and considered one tone above and one below the tone determined with the help of the abovementioned scale. There was no sign of "livor mortis" in the observed area. This classification was complemented by somatometric and somatoscopic observations for Brazilian anthropological types as suggested by Roquette-Pinto [22].

Body mass index (BMI) was used to classify the sample's nutritional status. BMI was calculated using the following formula: kg/m^2. Height and weight were measured during the autopsies. The following classification was used: lean, when BMI <20 ($N = 11$); normal, when $20 < BMI < 0.9$ ($N = 13$); overweight, when $25 < BMI < 29.9$ ($N = 10$); and obese, when $BMI > 30$ ($N = 6$).

The thickness of the facial soft tissue was measured at the skull's anatomical landmarks used by Rhine and Campbell [3] on their corresponding cutaneous portions for 10 midline and 11 bilateral points, as described in Table 1 and shown in Fig. 1.

Table 1
Anatomical landmarks considered in present study.

Anatomical landmarks	Description
Midline points	
1. Supraglabella	Foremost point in the midline, above Glabella
2. Glabella	Most forward projecting point of the forehead in the midline at the level of the SupraOrbital ridges
3. Nasion	Midline of the nasofrontal suture
4. Rhinion	End of the nasal bone
5. Mid-philtrum	Midline of the intranasal depression
6. Supradentale	Center jaw, between the upper incisive
7. Infradentale	Center jaw, between the lower incisive
8. Supramentale	Most posterior midline point, above the chin in the jaw between the infradentale and the pogonion
9. Mental eminence	The most prominent point of the chin
10. Menton	Lowest point of the chin
Bilateral points	
11. Frontal eminence	Bony projection of the ectocranial surface of the frontal bone
12. SupraOrbital	Center upper part of the margin of the orbit
13. Suborbital	Center lower part of the margin of the orbit
14. Inferior malar	Lower part of the jaw
15. Lateral orbit	Line between the eye and the center of the zygomatic ach
16. Zygomatic arch	Outermost point in the zygomatic arch from a vertical plan view
17. Supraglenoid	Above and forward the acoustic meatus
18. Gonion	The outer margin of the angle of the mandibule
19. SupraM2	Above the second upper molar
20. Occlusal line	Point in the jaw in the plane of dental occlusion
21. SubM2	Bellow the second lower molar

2.2. Methodology

Measurements were taken by puncturing the skin with a thin stainless steel dental needle with a silicone marker stop. The needles were introduced in the previously located anatomical landmarks, perpendicular to the skin until they met bone resistance. The marker was then slid into touch the surface of the skin, without pressing or deforming it. A caliper was used to measure the depth from the tip of the needle to the base at the skin. Numbered needles were used for each of the points evaluated, to avoid any ambiguous results.

This methodology has been the subject of criticism [26,27] because it is typically used on corpses, and may deform the tissues due to pressure on the skin when pierced by the needle. Also it may move the soft tissue and deform the body as the corpse is in a supine position. The puncture method; however, allows for measurements to be made at any point on the head with simple instruments and does not expose the examiner to radiation.

Major changes to the tissues can be avoided by assessing the samples as soon as possible after death (which this study established as being within 12 h). Any inaccuracy caused by thanatological changes of the tissues is no different from those that occur due to lack of standardization of radiographic assessments of tissue thickness for diagnostic purposes.

Two examiners located the landmark points and took measurements, although only the first examiner's results are presented in this study; the second examiner's results were used to confirm accuracy.

Descriptive statistics were calculated using the Statistical Program for Social Sciences (SPSS) software for Windows (SPSS Inc., Chicago, version 14.0) [28]. Student's *T*-test was used to compare two groups, ANOVA was used to compare more than two groups and Tukey's test, when there was indication of a statistically significant difference—$p < 0.05$. The averages were compared to those in the studies of Rhine and Campbell [3] and Rhine and Moore [15] for individuals with the same skin color and gender.

3. Results

Forty individuals were studied, with 65% men ($N = 26$) and 35% women ($N = 14$). Mean age was 59 years with a standard deviation of 16.76. The youngest age was 17 years (female) and the oldest 90 years (male); 65% of the sample were older than 55 years. With regard to skin color, 55% were Caucasian and the majority (32.5%) had a nutritional status considered normal.

The Descriptive Statistical analysis of the 32 pairs of points showed that measurements did not differ greatly between examiners. The correlation of these measurements is considered good ($r > 0.5$), which indicates a statistically significant ($p < 0.05$) association between the two measurements (Table 2 and Fig. 2).

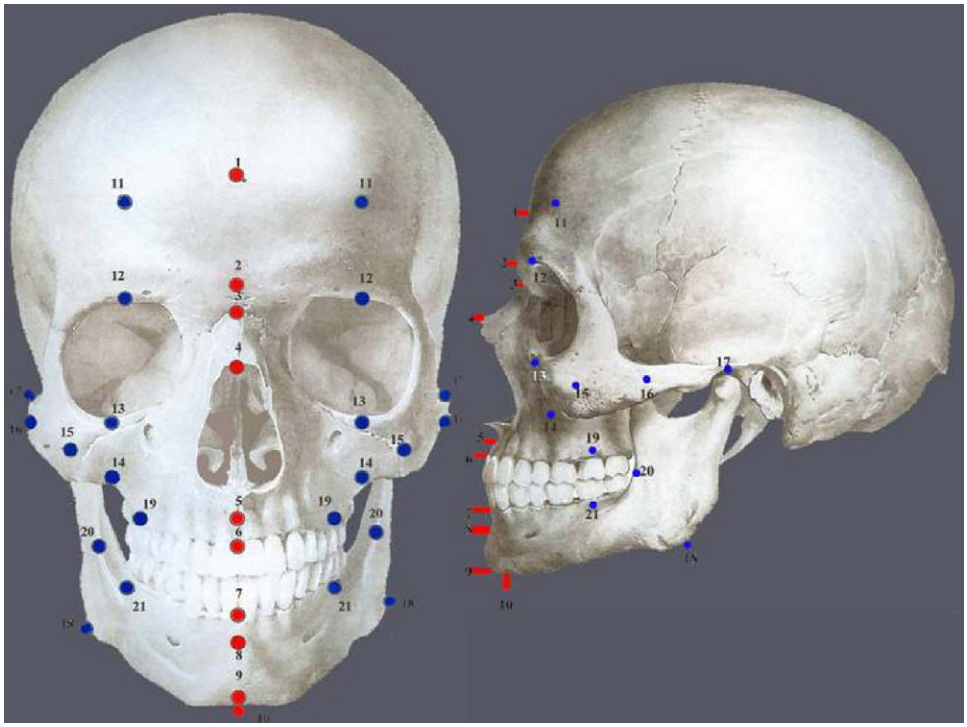

Fig. 1. Facial tissue measurements locations.

The paired *T*-test comparisons between the measurements from the left and right side of the face showed that the only significant difference ($p = 0.038$) was for the Gonion variable. The other left and right side measurements may be considered equal.

The Student's *T*-test was applied to data regarding gender. When the 32 measurements of males and females were compared, values for men were higher, and the differences compared to women were statistically significant ($p < 0.05$) for the craniometrical Glabella ($p = 0.014$), mid-philtrum ($p = 0.001$), supramentale ($p = 0.008$), right frontal eminence ($p = 0.009$), left frontal eminence ($p = 0.023$), right SupraOrbital ($p = 0.007$), SupraM2 left ($p = 0.016$), left occlusal line ($p = 0.0001$), right SubM2 ($p = 0.002$) and left SubM2 ($p = 0.013$) points.

The Analysis of Variance (ANOVA) of age variables showed significant differences only for the following anatomical variables: infradentale—lower lip margin ($p = 0.036$), SupraM2 ($p = 0.013$) and right occlusal line ($p = 0.028$) points, with higher mean values found in the age group over 55 years.

When ANOVA was applied to variables regarding nutritional status, differences were found for three midline and eleven bilateral variables. As shown in Fig. 3, the values found for the Inferior malar, Lateral orbit, Zygomatic arch and Supraglenoid,

Table 2
Analysis of paired *T*-test for measurements of two examiners and correlation of the measurements (Pearson correlation coefficient).

Landmarks	Difference average (mm)	Standard deviation the difference	Standard error the difference	Correlation (r)	p
Midline points					
1. Supraglabella	0.27	0.78	0.12	0.70	<0.0001
2. Glabella	0.21	0.72	0.11	0.82	<0.0001
3. Nasion	0.51	1.20	0.19	0.69	<0.0001
4. Rhinion	0.26	1.40	0.22	0.44	0.0360
5. Mid-philtrum	−0.89	1.74	0.27	0.81	<0.0001
6. Supradentale	0.63	3.35	0.53	0.44	0.0040
7. Infradentale	0.86	2.90	0.47	0.40	0.0090
8. Supramentale	−0.48	1.59	0.25	0.74	<0.0001
9. Mental eminence	−0.29	1.53	0.24	0.84	<0.0001
10. Menton	0.82	2.78	0.44	0.71	<0.0001
Bilateral points					
11. Frontal eminence	−0.19	0.73	0.11	0.76	<0.0001
12. SupraOrbital	0.10	0.79	0.12	0.84	<0.0001
13. Suborbital	−0.30	1.48	0.23	0.77	<0.0001
14. Inferior Malar	−1.46	2.52	0.39	0.72	<0.0001
15. Lateral orbit	0.55	2.59	0.41	0.60	<0.0001
16. Zygomatic arch	−0.78	3.70	0.58	0.55	0.0002
17. Supraglenoid	−1.42	2.97	0.47	0.69	<0.0001
18. Gonion	1.19	3.12	0.49	0.67	<0.0001
19. SupraM2	1.08	3.23	0.51	0.36	0.0213
20. Occlusal line	0.54	2.27	0.36	0.67	<0.0001
21. SubM2	0.14	2.71	0.43	0.63	<0.0001

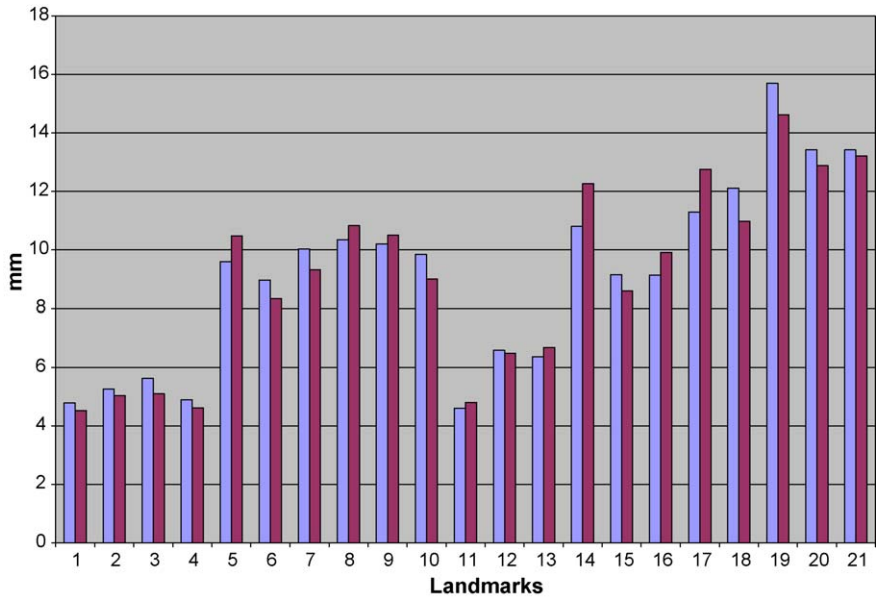

Fig. 2. Comparison of the averages of two examiners for the points measured considering the average right and left.

located in the facial region with highest fat concentration, increased proportionally, which means they vary in size but the relationship between them does not change. In practice, the nutritional status of an individual while alive cannot be determined by studying their skeleton. If articles of clothing are found near the skull, they can be regarded as an indicator of nutritional status, although their relationship with the skull will need careful assessment.

The xantoderm group was not assessed because it contained just one individual. ANOVA showed a statistically significant difference ($p < 0.05$) between skin color groups for the variable Nasion ($p = 0.008$) and Tukey's test showed that the different group was the leucoderms group ($p = 0.015$). In this case, the difference between the means of the two examiners at this measuring point was 0.9 mm, which is considered of small significance for Facial Reconstruction.

A table of mean values (Table 3) was prepared from the studied sample, taking into account only the differences due to biological sex. The mean of the bilateral points was used, because there was no statistically significant difference between sides.

When the results of this study are compared to the means obtained by Rhine and Campbell [3] for male and female melanoderms/African-Americans (Fig. 4) it can be seen that thicknesses found for the American population are greater for most landmarks studied.

In Rhine and Campbell's [3] study for male melanoderms with normal nutritional status, some measurements were 2 mm greater than in our study, especially in the central areas of the face. Differences less than 2 mm were found at the Menton point (−2.8 mm) and SupraOrbital right (−2.0 mm). For females, differences greater than 2 mm were found for the whole face, except the Zygomatic arch-left, which had a lower

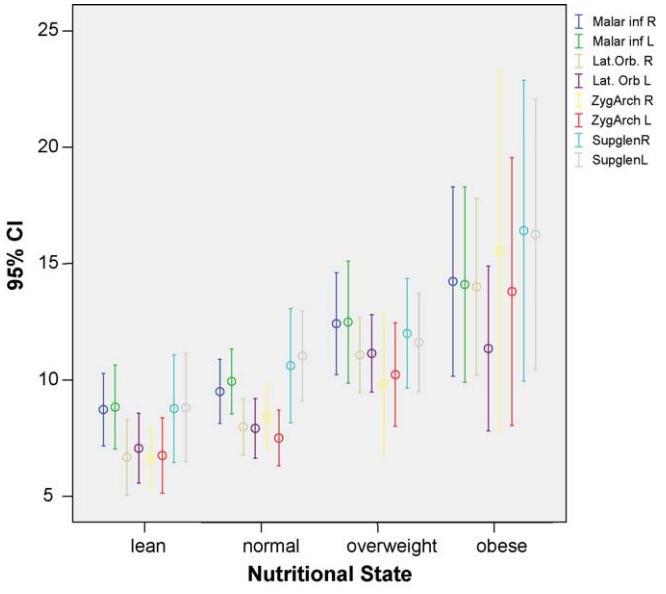

Fig. 3. Measurements variation (mm) as per nutritional state in four bilateral points.

Table 3
Facial soft tissues thickness in Brazilians (mm).

Localization	Means	
	Males ($n = 26$)	Females ($n = 14$)
Midline		
Supraglabella	5.0	4.3
Glabella	5.5	4.6
Nasion	5.9	5.0
Rhinion	5.2	4.2
Mid-philtrum	10.6	7.7
Supradentale	9.1	8.7
Infradentale	10.6	9.4
Supramentale	11.0	9.1
Mental eminence	10.6	9.4
Menton	10.4	8.7
Bilateral		
Frontal eminence	4.9	3.9
SupraOrbital	6.9	5.8
SubOrbital	6.5	6.0
Inferior malar	11.2	10.0
Lateral orbit	9.1	9.2
Zygomatic arch	9.2	8.8
Supraglenoid	11.6	10.8
Gonion	12.7	10.9
SupraM2	16.4	14.4
Occlusal line	14.4	11.7
SubM2	14.6	11.3

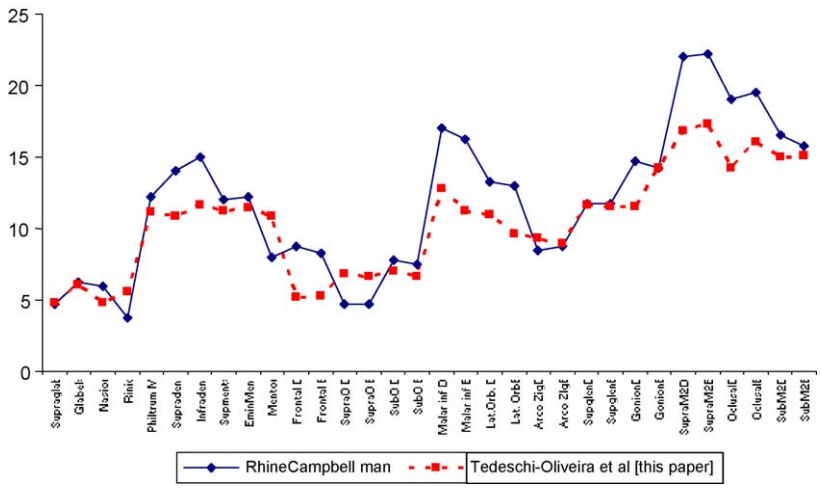

Fig. 4. Average results (mm) comparison between the present study (Brazilians melanoderms) and those of Rhine and Campbell [3]—African-Americans for male.

value (−2.4 mm). The differences in mean values can be seen in Table 4.

The results in our study also differed to the mean values found by Rhine and Moore [15], presented in Table 5. The greatest difference was for variables corresponding to bilateral points on the lower portion of the face in white individuals of both genders (Fig. 5). These authors found higher measurements in men and the differences between these mean values greater than 2 mm were found in the regions of the Inferior malar (+2.1 mm), SupraM2 (+3.6 mm) and occlusal line (+4.4 mm). However, smaller measurements than those of this study, with a difference between mean values greater than 2 mm were found at Rhinion (−2.3 mm), Menton (−3.5 mm), Zygomatic arch (−3.1 mm) and Supraglenoid (−4.4 mm). For females, these differences were recorded in SupraM2 (+5.7 mm), occlusal line (+6.5 mm), SubM2 (+6.2 mm), Menton (−2.7 mm) and Supraglenoid (−3.9 mm). Fig. 5 shows that the greatest differences between the two studies were in the bilateral variables that correspond to the lower part of the face.

Table 4
Differences found between averages from Rhine and Campbell [3] studies and in this study (Tedeschi-Oliveira et al.) for male and female with normal nutritional status.

Variables for the Brazilian melanoderms and African-Americans group	Rhine Campbell	Tedeschi-Oliveira et al. (this paper)	Differences	Rhine Campbell	Tedeschi-Oliveira et al. (this paper)	Differences
	Male			Female		
Midline						
Supraglabella	4.7	4.8	−0.1	4.5	4.2	0.3
Glabella	6.2	6.0	0.2	6.2	4.9	1.3
Nasion	6.0	4.8	1.2	5.7	4.5	1.2
Rhinion	3.7	5.5	−1.8	3.7	4.1	−0.4
Mid-philtrum	12.2	11.1	1.1	11.2	8.9	2.3
Supradentale	14.0	10.8	3.2	13.0	6.7	6.3
Infradentale	15.0	11.6	3.4	15.5	7.8	7.7
Supramentale	12.0	11.2	0.8	12.0	9.0	3.0
Mental eminence	12.2	11.4	0.8	12.2	8.9	3.3
Menton	8.0	10.8	−2.8	7.7	7.8	−0.1
Bilateral						
Frontal right	8.7	5.2	3.5	8.0	3.9	4.1
Frontal left	8.2	5.3	2.9	8.0	3.7	4.3
SupraOrbital right	4.7	6.7	−2.0	4.5	5.6	−−1.1
SupraOrbital left	4.7	6.6	−1.9	4.5	6.0	−1.5
SubOrbital right	7.7	7.0	0.7	8.2	5.8	2.4
SubOrbital left	7.5	6.6	0.9	8.5	6.2	2.3
Inferior malar right	17.0	12.7	4.3	17.7	7.6	10.1
Inferior malar left	16.2	11.2	5.0	17.2	8.0	9.2
Lateral orbit right	13.2	10.9	2.3	12.7	7.9	4.8
Lateral orbit left	13.0	9.5	3.5	14.2	7.5	6.7
Zygomatic arch right	8.5	9.3	−0.8	9.0	11.4	−2.4
Zygomatic arch left	8.7	8.9	−0.2	9.2	9.1	0.1
Supglenoid right	11.7	11.6	0.1	12.2	9.1	3.1
Supglenoid left	11.7	11.5	0.2	12.0	11.6	0.4
Gonion right	14.7	11.5	3.2	14.2	9.4	4.8
Gonion left	14.2	14.2	0.0	14.2	11.0	3.2
SupraM2 right	22.0	16.8	5.2	21.2	16.2	5.0
SupraM2 left	22.2	17.3	4.9	20.7	13.9	6.8
Occlusal line right	19.0	14.2	4.8	19.2	14.4	4.8
Occlusal line left	19.5	16.0	3.5	18.2	11.2	7.0
SubM2 right	16.5	15.0	1.5	17.2	12.0	5.2
SubM2 left	15.7	15.0	0.7	16.7	11.1	5.6

Table 5
Differences found between averages (mm) from Rhine and Moore [15] studies and in this study (Tedeschi-Oliveira et al.) for male and female with normal nutritional status.

Variables for the Brazilian leucoderms and American Caucasians group	Rhine Moore	Tedeschi-Oliveira et al. (this paper)	Differences	Rhine Moore	Tedeschi-Oliveira et al. (this paper)	Differences
	Males			Females		
Midline						
Supraglabella	4.2	5.2	−1.0	3.5	4.1	0.6
Glabella	5.2	5.7	−0.5	4.7	4.7	0.0
Nasion	6.5	6.7	−0.2	5.5	5.5	0.0
Rhinion	3.0	5.3	−2.3	2.7	4.6	−1.9
Mid-philtrum	10.0	10.7	−0.7	8.5	7.1	1.4
Supradentale	9.7	8.8	0.9	9.0	9.8	−0.8
Infradentale	11.0	10.0	1.0	10.0	9.6	0.4
Supramentale	10.7	11.1	−0.4	9.5	9.7	−0.2
Mental eminence	11.2	11.0	0.2	10.0	9.3	0.7
Menton	7.2	10.7	−3.5	5.7	8.4	−2.7
Bilateral						
Frontal	4.2	5.1	−0.9	3.5	3.7	−0.2
SupraOrbital	8.2	7.8	0.4	7.0	60	1.0
SubOrbital	5.7	6.4	−0.7	6.0	7.1	−1.1
Malar inferior	13.2	11.1	2.1	12.7	10.8	1.9
Lateral orbit	10.0	9.3	0.7	10.7	10.0	0.7
Zygomatic arch	7.2	10.3	−3.1	7.5	8.4	−0.9
Supraglenoid	8.5	12.9	−4.4	8.0	11.9	−3.9
Gonion	11.5	13.2	−1.7	12.0	108	1.2
SupraM2	19.5	15.9	3.6	19.2	13.5	5.7
Occlusal line	18.2	13.8	4.4	17.0	10.4	6.6
SubM2	16.0	14.4	1.6	15.5	9.3	6.2

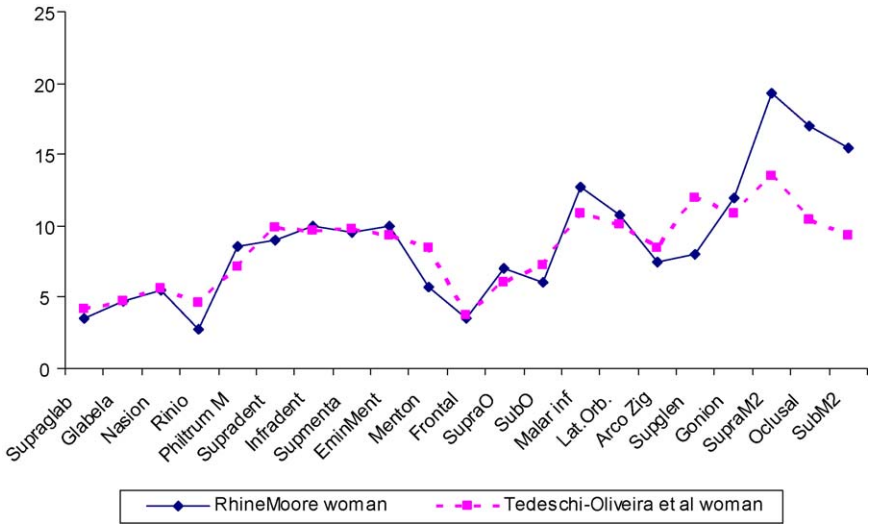

Fig. 5. Average (mm) results comparison between the present study (Brazilian leucoderm) and those of Rhine and Moore [15] American Caucasian for female.

4. Discussion

Facial Reconstruction can be of great value in forensic investigations in the absence of other data. However, it is unlikely that this technique will achieve an exact sculpture of the person as they were when alive.

Measuring the thickness of facial soft tissues has its limitations, but the ease of obtaining measurements through needle puncture has allowed this method to withstand the development of more technologically advanced methods, as can be seen in recent publications [8.18]. Non-invasive imaging diagnostic techniques will, undoubtedly, be more accurate [4,10,11,17,19,26,27]. Such exams, however, are not always free from radiation hazards and it is not possible to gather data for all necessary points for Facial Reconstruction techniques without increasing radiation exposure time on patients being examined for any pathology. It may also be difficult to locate craniometric points and corresponding tissue depth.

Differences in the thickness of facial tissues related to sex, age, ethnicity and nutritional status have been singled out as the shortcomings of the Facial Reconstruction technique and have been studied by several authors and also in this work. The results indicate that males have thicker soft tissue than women, so these differences should be taken into account when using Facial Reconstruction.

Although several authors [5–7,12,13] have shown that adult and child faces differ, it was not possible to correlate changes due to aging. In our study, only three out of 32 variables were found to be statistically different, with greatest thicknesses in the over 55 age group. We agree with Sahni et al. [11] that the increased tissue thickness may be related to skin wrinkling because, as human skin ages there is a reduced resistance to traction and thickness of

collagen structures. In the studied sample, 65% of the individuals were aged above 55 years, which means it was not possible to make a statistical analysis of aging effects. To date, studies on age related data that may be of use in Facial Reconstruction have been limited to the differences between children and adults.

The face changes according to different nutritional status because of the fat found in Infraorbital, Zygomatic and Malar regions and, when this information is needed, we agree with the suggestion by Starbuck and Ward [16], that different versions of Facial Reconstruction should be created that take nutritional status into account.

The data obtained by this study highlights that the highly mixed Brazilian population presents statistically different results from those found in other populations, with different results between leucoderms and melanoderms [2–4,8,9,11,15,17,18]. One can see that even with no significant differences related to skin color for the group studied in our population; these differences appear when compared to other population groups for the same skin color. Therefore, Brazilian leucoderms have different measurements of soft tissue thickness compared to the faces of American Caucasians [15]. Similar differences were also found between Brazilian melanoderms and African-Americans [3].

This study used the same craniometric points and measurement techniques as Rhine and Campbell [3] (the most commonly quoted and discussed study in available scientific literature). This suggests that the differences found are real. African-Americans in general have thicker soft tissues in the face when compared to Brazilian melanoderms of both genders and Caucasian Americans have a greater thickness of facial bilateral points when compared with Brazilian leucoderms.

Tables of thickness measurements for different populations will result in different faces being reconstructed over a single skull. These findings concur with current theories that there are no distinct races among humans [29], but that morphological characteristics prevail in different groups.

5. Conclusion

Men had greater thicknesses of facial soft tissues when compared to women in the sample studied. Age was not significant. The variations related to nutritional status are proportional to the increase of facial fat and do not represent a determining factor in the Facial Reconstruction technique.

In the sample studied, there was no significant difference between ethnic groups when classified by skin color. However, when compared to results obtained with other populations there were perceived differences. Our study shows that using soft tissue thicknesses found for Americans for Facial Reconstruction in Brazilians will not result in an accurate representation of the individual when alive.

Because the Brazilian population is very heterogeneous and mixed, the benchmarks for tables of facial soft tissue thickness obtained by other countries contain differences that must be considered if applied to Facial Reconstruction of Brazilian individuals. We believe that the use of the measurements in our study for Facial Reconstruction in our population will lead to more precise results that will improve the chances of identifying a corpse. This will be of benefit to forensic investigators.

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