MEDWIN PUBLISHERS
Committed to create value for Researchers

International Journal of Forensic Sciences
ISSN: 2573-1734

Soft Tissue Thickness Assessment for Forensic Facial Reconstruction Purposes - Evaluation of Brazilian Children's Data

Baccarin LS[1]*, Beaini TL[2], Nigro Mazzilli LE[1] and Haltenhoff Melani RF[1]

[1]Department of Social Dentistry, Faculty of Dentistry, University of São Paulo, Brazil

[2]Department of Preventive and Social Dentistry, Federal University of Uberlândia, Brazil

Review article

Volume 4 Issue 2

Received Date: June 10, 2019

Published Date: June 26, 2019

DOI: 10.23880/ijfsc-16000162

***Corresponding author:** Leandro Stocco Baccarin, Laboratory of Forensic Anthropology and Odontology (OFLAB), Department of Social Dentistry, Faculty of Dentistry, University of São Paulo, São Paulo, SP, Brazil, Email: lestocco@usp.br

Abstract

The knowledge of data regarding children's facial soft tissue thicknesses can contribute to performing improved forensic facial approximations in the process of identification of missing children by Forensic Medicine Institutes, thus contributing to a swifter recognition of these individuals. The aim of this study was to conduct an integrative review and a critical analysis on data regarding Brazilian children's facial soft tissue thickness, available in 2019 for forensic facial reconstruction purposes. The initial search for documents related to the forensic facial reconstruction of Brazilians was carried out in the electronic databases of the Brazilian Bibliography of Dentistry (BBO) and the Latin American and Caribbean Literature in Health Sciences (LILACS). Extended research included US National Library of Medicine (PubMed) database and University of São Paulo (USP), São Paulo State University (UNESP) and University of Campinas (UNICAMP) digital libraries. The terms searched were "forensic facial approximation," "forensic facial reconstruction", “facial reconstruction” and "forensic facial reconstitution", and the period surveyed was 1999 to 2019. Initially, the selected studies included data on facial soft tissue thicknesses of Brazilians in general. Only one study involving a child population was identified, specifically children from northeastern Brazil. Once there is a lack of other studies, a critical analysis was carried out at this one available. When comparing the data from this study with those from a study with a similar methodology on Japanese children, large discrepancies were observed among these ethnic groups regarding facial soft tissue thickness data. Because the only study available did not include the facial data of children from all regions of Brazil, its results cannot be extrapolated to the Brazilian child population as a whole. Considering the lack of other studies in the literature on the thicknesses of facial soft tissues of Brazilian children, it is important that further research on this subject be carried out, and includes data from the different Brazilian regions.

Keywords: Facial reconstruction; Children; Human identification; Forensic science; Forensic anthropology

Abbreviations: BBO: Brazilian Bibliography of Dentistry; LILACS: Latin American and Caribbean Literature in Health Sciences; USP: University of São Paulo; UNICAMP: University of Campinas; CBCT: Cone Beam Computed Tomography.

Introduction

Forensic facial reconstruction or forensic facial approximation stands out among the auxiliary techniques used to perform human identification, and is an important resource that can be used when the ante-mortem data of the individual to be identified is unavailable [1].

The dry skull of an individual without a presumed identity can be used as a reference for performing a scientific-based facial soft tissue reconstitution, both by manual and digital methods. This process allows a facial image to be obtained and disclosed, thus helping relatives and close friends recognize the individual in question [2]. Once recognition is made possible by offering an image of the reconstituted face, the primary methods of human identification [3] can then be performed using the ante-mortem data of the individual to be identified, made available by the police authorities and official institutions.

Currently, the search for statistical records on missing children in Brazil yields inconsistent data, since the information on these disappearances lacks integration [4]. According to Vinegar [4], it is estimated that circa 250,000 people disappear each year, and that at least 40,000 are under the age of 19. It is also believed that this number is underestimated, suggesting that this is a far-reaching social problem in Brazil, which has not received the proper monitoring and attention by the authorities. Officially, there were 82.684 missing people on record in 2017 and 81.176 in 2016, considering the data published in the Brazilian Public Security Yearbook [5]. Of these people, 53.525 were found in 2017 and 28.121, in 2016. However, there are no data specifically on the disappearance of children and adolescents. When forensic medicine institutes are called upon to identify missing victims, knowledge of the facial soft tissue thickness data pertaining to this age group can help obtain improved facial approximations, thereby enabling a timelier recognition of these individuals.

Thus, this study conducted an integrative review, followed by a critical analysis with the aim of evaluating the data currently available on the facial thicknesses of Brazilian children's soft tissue, for forensic facial reconstruction purposes.

Methods

Our initial search for documents related to the forensic facial reconstruction of Brazilians was carried out in the electronic databases of the Brazilian Bibliography of Dentistry (BBO) and the Latin American and Caribbean Literature in Health Sciences (LILACS), following the same procedure adopted by Herrera et al. [3]. The terms searched were "forensic facial approximation," "forensic facial reconstruction", "facial reconstruction" and "forensic facial reconstitution." Extended research included US National Library of Medicine (PubMed) database and University of São Paulo (USP), São Paulo State University (UNESP) and University of Campinas (UNICAMP) digital libraries and the period surveyed was 1999 to 2019.

Author	Year	Measurement method	Ancestry	N	Age	Anatomical landmarks
Tedeschi-Oliveira et al., 2009 [1]	2009	Needle (corpses)	Brazilians (Male and Female)	40	Adults 17 - 90	10 Midline 11 Bilateral -32
Santos, 2008 [6]	2008	Nuclear Magnetic Resonance (live subjects)	Brazilians (Male and Female)	186	Adults	11 Midline 11 Bilateral -22
de Almeida et al., 2013 [7]	2013	Needle (corpses)	Brazilians (Male and Female)	100	Adults 41 -60	13 Midline 18 Bilateral -49
Beaini, 2013 [8]	2013	Cone-Beam CT (live subjects)	Brazilians (Male and Female)	100	Adults 18 - 65	10 Midline 11 Bilateral -32
Pithon et al., 2014 [9]	2014	Teleradiography (live subjects)	Brazilians (Male and Female)	300	Children 08-12	10 Midline -10

Table 1: Studies on facial soft tissue thicknesses for forensic facial reconstruction purposes available in 2019 on Brazilian individuals.

Four studies on facial soft tissue thickness data from Brazilians adults [1,6-8] and one study on data from Brazilian children [9] were selected.

Table 1 shows the studies that have been made available in 2019 on the mean facial soft tissue thickness measurements taken for forensic facial reconstruction purposes, and that contain tables of data from Brazilian individuals, both adults and children.

Discussion

In a literature review conducted in 2013, Herrera, et al. [3] tabulated data from 3 studies [1,6-7] on facial soft tissue thickness data from Brazilians adults, two of which were performed using needle punctures in corpses [1,7] and one, using measurements of facial soft tissue thicknesses on magnetic resonance imaging scans [6]. When Herrera's survey [3] was published, there were no other publications available containing tables of mean facial soft tissue thickness data on Brazilian children.

After the survey conducted by Herrera, et al. [3] came out, other contributions were made to forensic facial reconstruction, particularly tables of facial thicknesses of the soft tissue of Brazilians. In the same year of 2013, Beaini [8] added consistent results by supplying a new table with data on Brazilian adults, and proposed that standardized measurements of soft tissue thicknesses be performed using cone-beam computed tomography (CBCT) scans. This study examined the hypothesis that there would be differences in soft tissue thickness among individuals having different horizontal facial types, but no significant differences were found between facial types regarding the anatomical landmarks studied. The results also indicated that stratification of the tables on facial types for facial reconstruction purposes was inappropriate, even though the soft tissue thicknesses at the mandibular landmarks proved thinner in Class III profile adults than in individuals with other profiles.

As for the methodology used, the measurement technique proposed by Beaini [8] had the advantage of using CBCT scans performed on live individuals in a sitting position. In this position, the effects of gravity on the facial tissues during image acquisition are not as strong as those on the tissues of corpses positioned in dorsal decubitus, or than those obtained by helicoidal computed tomography examinations on live patients. Regarding the bilateral parasagittal points, this method also allows correct standardization of the radial direction of the measurement taken from the anatomical landmark to the soft tissue surface. Regarding the sagittal points, it allows taking measurements in a direction perpendicular to the bone surface. In his study with adult individuals, Beaini[8] considered 32 anatomical craniometric points, comprising 10 sagittal points and 11 pairs of bilateral parasagittal points.

Our search found that the only study available on facial soft tissues thicknesses, performed for forensic purposes and with Brazilian children, was the research by Pithon, et al. [9], published in 2014. Once there is a lack of other studies, a critical analysis was carried out at this one available. These authors [9] studied facial soft tissue measurements on 10 sagittal facial landmarks of 300 children from northeastern Brazil, aged 8-12 years. The measurements were made on cephalograms of the individuals, divided according to the observed skeletal profile pattern (normal, concave or convex), determined on the basis of an assessment of the ANB angle. No significant differences were found between the skeletal classes of Brazilian children of both sexes; i. e., the observed thicknesses were similar for most of the points studied. However, differences between Classes II and III were found for the stomion, bottom lip and pogonion points, suggesting that these measurements are related to a facial compensation for mandibular protrusion [9]. The measurements observed in Class III individuals were higher for the stomion point in both sexes, and lower for the bottom lip point in females. Measurements for the pogonion point in Class III individuals were larger in males; the authors attributed this to a greater genetic tendency of boys toward prognathism. The measurements observed in Class I individuals were smaller in females, but these differences were only significant for the rhinion, subnasale and upper lip landmarks [9].

Critical Analysis

The results of the measurements taken on the sagittal points by Pithon, et al. [9] were compared with those obtained by Utsuno, et al. [10] in Japanese children aged 9–18 years. The averages of the linear measurements of the tissue thicknesses obtained for Brazilians were found to be significantly higher than those obtained for the Japanese, at each sagittal point studied, even considering that absolute averages were used, with an appropriate 10% compensation for teleradiographic imaging. Table 2 displays the results of a simple linear analysis of the differences found among Class I children of different ancestry, at each of the landmark points studied [9,10].

	Pithon, et al. [9]		Utsuno, et al. [10]		Difference (mm)	
	Class I - Means (mm)					
Landmark	Male (n = 48)	Female (n = 52)	Male (n = 131)	Female (n = 84)	Male	Female
1. Glabella	14.71	13.86	5.4	5.4	9.31	8.46
2. Nasion	13.16	13.04	6.3	5.9	6.86	7.14
3. Rhinion	8.67	6.93	3,00	2.6	5.67	4.33
4. Subnasale	32.96	27.36	14.2	13.3	18.76	14.06
5. Upper lip	30.02	27.27	16.1	14.9	13.92	12.37
6. Stomion	13.17	12.82	4.2	4.3	8.97	8.52
7. Bottom lip	28.29	27.19	15.5	15.1	12.79	12.09
8. Labiomental region	26.26	24.43	13.5	14.1	12.76	10.33
9. Pogonion	24.68	22.59	13.6	13.1	11.08	9.49
10. Gnathion	17.54	16.17	6.8	6.7	10.74	9.47

Table 2: Average linear measurement differences in facial soft tissue thicknesses (in mm) between subjects evaluated in the studies conducted by Pithon, et al. [9] and Utsuno, et al. [10].

Pithon et al. [9] used software-rendered, automated digital measurements taken on digital lateral teleradiographs, whereas Utsuno et al. [10] used manual measurements of facial soft tissues taken on manual cephalometric tracings, using an acetate sheet applied to the cephalograms placed on a light box. Table 2 contains a parallel comparison between the two studies [9,10], regarding measurements taken on 10 coinciding anatomical landmarks along the midsagittal line. Utsuno, et al. [10] also took facial soft tissue thickness measurements at the right and left gonion points, on frontal teleradiographs.

Regarding the sagittal points selected in common in both studies, measurements of facial soft tissue thicknesses were, on average, 11.09 mm larger in Brazilian versus Japanese boys, and 9.63 mm larger in Brazilian versus Japanese girls [9,10]. Substantial differences were observed between the average linear measurements on all the anatomical points considered, for both males and females. These differences between the stated averages are significant and may have an impact on the outcome of a facial reconstruction, since the visual appearance of a reconstructed face with an unduly increased volume may impair the recognition process.

As for the methodologies applied, Pithon, et al. [9] performed digital soft tissue thickness measurements on lateral teleradiographs using software to determine the distance between two previously demarcated points-one on the bone surface and the other on the soft tissue surface of the face. On the other hand, Utsuno et al. [10] performed sagittal measurements manually to determine soft tissue thicknesses [10]; this method probably made the landmark definitions and the measurement directions more accurate. It is also noteworthy that the measurement directions used by Pithon, et al. [9] for the midsagittal points were different from those used by Utsuno et al. [10], thus yielding different results.

Another factor relevant to the comparison between both studies is the different criteria they used to classify facial skeletal patterns. Pithon, et al. [9] selected 100 images from each profile, considering Class I as individuals with an ANB angle of 2° ± 2°, Class II as individuals with an ANB angle > 4°, and Class III as individuals with an ANB angle < 0°. Utsuno, et al. [10] considered different values in their classification: Class I for ANB between 2° and 5°, Class II for ANB > 5°, and Class III for ANB < 2°.

Even taking these differences into account, the results obtained for Class I individuals were discrepant. Although the sagittal data were obtained from lateral cephalograms in both studies, caution is recommended in interpreting the results of the comparison. Although the 10% magnification related to taking the cephalograms was corrected in both studies to obtain absolute linear values [9,10], the existence of methodological differences still precludes standardization between the forensic facial approximation studies performed in different populations.

In a later study also carried out with Japanese children, Utsuno, et al. [11] analyzed the data without taking into account skeletal facial patterns. According to the authors, the goal was to facilitate facial reconstruction by establishing a table that had standardized data from a

population, assumed to be normal, and that was designed to serve as a future reference for other studies conducted with the same population.

Utsuno, et al. [10] also compared their results with those of studies performed with other populations-such as British [12] and American [13-15] white children, and black American and Hispanic children [15] and concluded that the facial tissue thicknesses of Japanese children were greater than those measured in other populations, in the lower face region [10].

A comparison of the results of Pithon, et al. [9] with those of Dumont [14] regarding American white children showed that Brazilian females had significantly greater soft tissue thicknesses for the bottom lip, labiomental region, and pogonion anatomic landmarks. Although the differences between the results found by Pithon, et al. [9] and Utsuno, et al. [10] were smaller, it cannot be said that the populations studied were similar.

In an important systematic review, Stephan and Simpson [16] and Stephan [17] compiled soft tissue thickness data from studies conducted with individuals aged 1–18 years, and reported that facial soft tissue thicknesses increased by less than 3 mm with age, on most of the landmark points considered [16]. These authors [16] reported that the highest observed increase was 7 mm on the mid-philtrum landmark, albeit noting that some measurements increased, whereas others decreased with growth [16].

Stephan and Simpson [16] also reported that the nasion point is an exception, since the thickness measured on this point tends to decrease with growth in the 1–10 year age group, but remains relatively constant from there on, with only a small increase. Only the rhinion and mid-nasal points showed no variation with increasing age [16].

Conclusion

Large discrepancies were observed between the measurements of Brazilian children's facial soft tissue thicknesses, as reported in one study [9], compared with those reported for Japanese children in another study [10] available in the literature. This observation could be considered grounds for questioning the authors' conclusion [9] that the facial soft tissue profiles of Brazilians are closer to those of Japanese, based a comparison of the data of children from the Brazilian Northeast with data from other ethnic groups. The magnitude of the discrepancies also indicates that there is significant methodological variation regarding the measurement direction and the measurement-taking method (digital versus manual); these discrepancies call for the definition of more accurate and reproducible parameters. Considering the lack of other studies in the literature on the thicknesses of facial soft tissues of Brazilian children, it is important that further research on this subject be carried out, and include data from the different Brazilian regions. The only study available [9] does not include the facial data of children from all regions of Brazil; therefore, its results cannot be extrapolated to the Brazilian child population as a whole.

Acknowledgements

Author LSB[1] would like to express gratitude to Ph.D. Raíssa Ananda Paim Strapasson and Ph.D. Marta Regina Pinheiro Flores (Laboratory of Forensic Anthropology and Odontology – OFLAB, Faculty of Dentistry, University of São Paulo), for proof reading the article.

References

1. Tedeschi-Oliveira SV, Melani RF, de Almeida NH, de Paiva LA (2009) Facial soft tissue thickness of Brazilian adults. Forensic Sci Int 193(1-3): 127.e1-7.

2. Fernandes CM, Serra MC, da Silva JV, Noritomi PY, Pereira FD, et al. (2012) Tests of one Brazilian facial reconstruction method using three soft tissue depth sets and familiar assessors. Forensic Sci Int 214(1-3): 211.e1-7.

3. Herrera LM, Tedeschi-Oliveira SV, Melani RFH (2013) Forensic Facial Reconstruction: Review and Analysis of Scientific Research in Brazil. Br J Forensic Sciences, Medical Law and Bioethics 2(4): 365-375.

4. Vinagre JFM (2017) O desaparecimento de crianças e adolescentes. Brasília: Conselho Federal de Medicina – CFM.

5. Lima RS, Bueno S, Marques D, Neme C, Sobral I, et al.(2018) Anuário Brasileiro de Segurança Pública. São Paulo: Fórum Brasileiro de Segurança Pública pp: 1-90.

6. Santos WDF, Diniz PRB, Santos AC, Martin CCS, Guimarães MA (2008) Craniometric landmarks definitions from multiplanar Magnetic Resonance

Images (MRI) regarding forensic facial reconstruction. Medicina (Ribeirão Preto) 41(1): 17-23.

7. de Almeida NH, Michel-Crosato E, de Paiva LA, Biazevic MG (2013) Facial soft tissue thickness in the Brazilian population: new reference data and anatomical landmarks. Forensic Sci Int 231(1-3): 404.e1-e7.

8. Beaini TL (2013) Espessura de tecidos moles nos diferentes tipos faciais: estudo em tomografias computadorizadas cone-beam (Thesys). Faculdade de Odontologia de São Paulo, sSão Paulo pp: 1-145.

9. Pithon MM, Rodrigues Ribeiro DL, Lacerda dos Santos R, Leite de Santana C, Pedrosa Cruz JP (2014) Soft tissue thickness in young north eastern Brazilian individuals with different skeletal classes. J Forensic Leg Med 22: 115-120.

10. Utsuno H, Kageyama T, Deguchi T, Umemura Y, Yoshino M, et al. (2007) Facial soft tissue thickness in skeletal type I Japanese children. Forensic Sci Int 172(2-3): 137-143.

11. Utsuno H, Kageyama T, Uchida K, Yoshino M, Miyazawa H, et al. (2010) Facial soft tissue thickness in Japanese children. Forensic Sci Int 199(1-3): 109.e1-e6.

12. Wilkinson CM (2002) In vivo facial tissue depth measurements for White British children. J Forensic Sci 47(3): 459-465.

13. Hodson G, Lieberman LS, Wright P (1985) In vivo measurements of facial tissue thickness in American Caucasoid children. J Forensic Sci 30(4): 1100–1112.

14. Dumont ER (1986) Mid-facial tissue depth of white children: an aid in facial feature reconstruction. J Forensic Sci 31(4): 1463-1469.

15. Manhein MH, Listi GA, Barsley RE, MusselmanR, Barrow NE, et al. (2000) In vivo facial tissue depth measurements for children and adults. J Forensic Sci 45(1): 48-60.

16. Stephan CN, Simpson EK (2008) Facial soft tissue depths in craniofacial identification (part II): An analytical review of the published sub-adult data. J Forensic Sci 53(6): 1273-1279.

17. Stephan CN (2017) 2018 tallied facial soft tissue thicknesses for adults and sub-adults. Forensic Sci Int 280: 113-123.