

Anatomy of the buccal fat pad for structures at risk during bichatectomy

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SUMMARY

The buccal fat pad (BFP), is an adipose tissue located in the cheek, with complex morphology. Oral bichatectomy is a frequent aesthetic procedure with possible complications. Our objective was to determine the volume and its relationship with the upper 2nd molar and the facial artery (FA). A cross-sectional, observational study was performed. Computed tomography was used to obtain 3D images to determine volume, length, and width. Distances from the 2nd molar to each extension, and the nearest distance to the FA were measured. A total of 106 BFP (70 male) were included. The mean age was 51±21. The mean volume, length, and width were 13.8±5.4 ml, 72.9±10.7 mm, and 21.4±5.6 mm, respectively. The BFP extends mainly cephalically and caudally from the second molar, reaching upto 8.5 cm and 32 ml. The mean distance between the second molar and FA was 12.9 mm, but as close as 3 mm. The FA

had a mean distance of 2.1mm to the nearest BFP extension, with 42.5% in intimate contact, and another 9.4% crossing the center of the masseter extension. There were no statistically significant differences between sexes. The BFP has a dynamic shape with highly variable size and volume. The FA is often at risk of damage during procedures due to proximity.

Key words: Buccal fat pad – Bichatectomy – Anatomy – Facial artery

INTRODUCTION

The buccal fat pad (BFP) or Bichat bag, was first described by Marie François Xavier Bichat as a trigone-shaped adipose tissue located on the cheek. It has a complex morphology and is made

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up of a main pad or body (that is crossed by the parotid gland duct), from which several extensions arise (Kahn et al., 2000). It is wrapped within a thin fascia that is located in the masticatory space between the buccinator and the masseter muscles (Bither et al., 2013). It differs from subcutaneous fat, as it is made up of univacuolar, white fat adult adipose cells with very few fibrous trabeculae through which the vessels pass. It is not subject to lipid metabolism, making it independent of total body weight. It has an approximate mean volume of 10 ml (Kahn et al., 2000; Bither et al., 2013).

BFP constitutes an important point of reference in the aesthetics of the face through its shape, location, and right-left symmetry. A prominent BFP causing a rounded or wide face has been a common indication for a bichatectomy (bichectomy or facial lipectomy) which involves its excision (De La Lima Stevaeo, 2015; Moura et al., 2018; Roman-Torres et al., 2020). This provides a masculinization of the face, reducing the prominence of the cheeks, with improved facial aesthetic results (Lee and Park, 2017; De La Lima Stevaeo, 2015; Matarasso, 1991; Rohrich et al., 2009). Clinical evaluation has been the primary method to indicate the surgical procedure (Dubin et al., 1989; De La Lima Stevaeo, 2015; Matarasso, 1991). The procedure may be done with local anesthetics and an intraoral incision near the level of the second superior molar, identifying the Stensen's duct (De La Lima Stevaeo, 2015; Moura et al., 2018), or during more complex procedures such as facelift surgery (Surek et al., 2021). However, the procedure is not without risk. Complications include damage to the buccal branch of the facial nerve, to the parotid ducts, uncontrolled bleeding, pathological scarring, among others (Hwang et al., 2005; Pimentel et al., 2021; Rácz et al., 1989). In some cases, surgeons may overestimate the amount of buccal fat, due to a lack of parameters and indications for the procedure (Jaeger et al., 2016). Anatomical knowledge of the area, familiarity with BFP morphology, and adequate surgical training are fundamental for safer patient management (Fernández-Reyes et al., 2022; Kahn et al., 2000; Quiroga-Garza et al., 2020; Tapia-Nañez et al., 2022; Yousuf et al., 2010). Our objective was to determine the volume parameters in different age groups, the size of ex-

tensions of the BFP, as well as its relation to the second superior molar and facial artery.

MATERIALS AND METHODS

A descriptive cross-sectional, observational, and retrospective study was designed. Imaging studies (computed tomography (CT)) were obtained from the database of the Radiology and Diagnostic Imaging Department of the University Hospital "Dr. José Eleuterio González", Monterrey, Mexico. All studies were performed using a 64-slice CT scanner (General Electric CT99 Light Speed VCT, Software 2978195VCT). CT parameters were: rotation 0.4s helicoidal acquisition, 20 mm detector covering, 120 Kv, 400+, 0.625 mm width slices, 0.53:1 mm/rot Pitch, and 22 to 23 cm FOV.

Measurements were made using the Volume Viewer program to process DICOM images (General Electric Healthcare V8.7.4a). Through multiplanar sections and with the selection of specific densities, a 3D image of each BFP was obtained (Fig. 1) and distances of points located in the same plane were measured. The maximum volume (ml), length (mm), and width (mm), were registered, as well as the distance from the second molar to each of its extensions, and the distance between the segment of the facial artery that was closest to an extension of each BFP. Measurements were performed by two observers with a kappa coefficient of 0.83 for intra-observer, and 0.78 for interobserver comparison. Each study was evaluated by 2 non-blinded observers with experience in radiology and anatomy.

Inclusion criteria were CTs from adult patients (age range 18 to 75 years), without gender distinction, and with adequate BFP visualization. Those with a history of surgical procedures on the facial or neck regions, structural alterations, tumors, or artifacts, were excluded. Those with low image quality or unidentifiable BFP were eliminated.

Statistical analysis

Descriptive statistics were performed, reporting the quantitative variables with measures of central tendency and dispersion, and absolute and relative frequencies for qualitative variables.

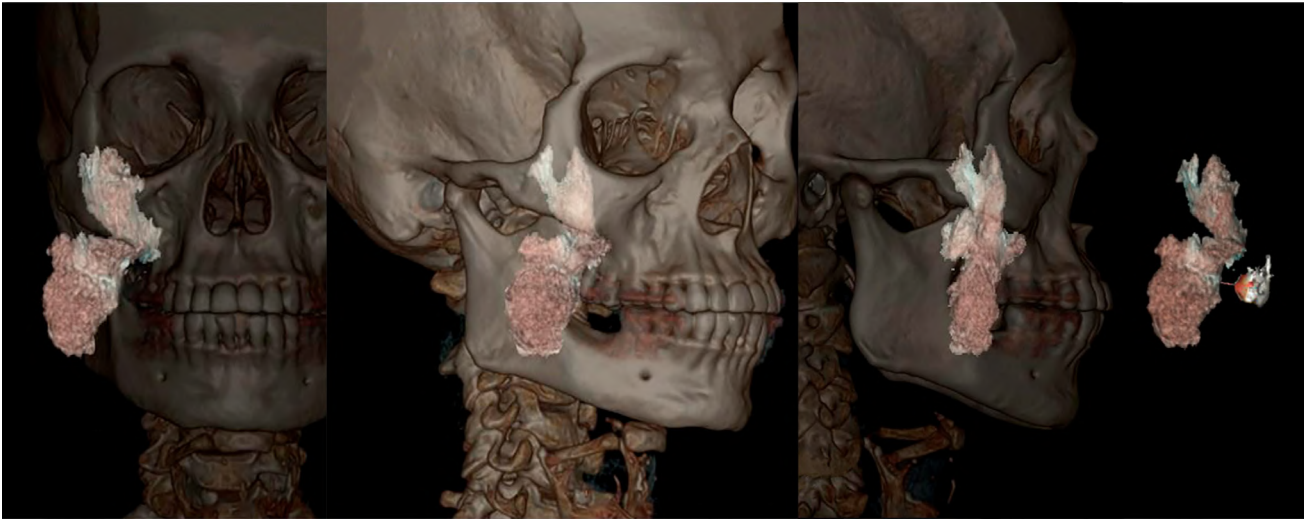


Fig. 1.- Frontal, oblique, and lateral 3D reconstruction views of the buccal fat pad. The reconstruction allows adequate visualization for plane selection for measurements in relation to structures such as the 2nd molar and the facial artery.

Quantitative variables are presented in means and standard deviations or median. Inferential statistics were also carried out by performing a normality test, resulting in a normal distribution with specific parametric tests for each variable; this was done with the SPSS IBM 24.0 program for Windows 10. The sample size was previously calculated based on the variability reported in the literature and a confidence of 95%. This resulted in a sample size of 106 BFP.

Ethical considerations

This study was previously reviewed and approved by the University's Ethics and Research Committees with the registration number AH18-00010, certifying it adheres to the guidelines of the General Health Law on Health Research in Human Beings of our country and the Declaration of Helsinki.

RESULTS

A total of 106 BFP (53 CT) were measured (66% males and 34% females). The mean age was 51 ± 20.6 years. The morphometry measurements are shown in Table 1. The BFP extends primarily superiorly and inferiorly from the second molar, reaching ranges of up to 8.5cm and volumes of up to 32 ml. The mean distance between the 2nd molar and the facial artery was 12.9 mm but was reported as close as 3 mm. Anterior-inferior extensions of the BFP had a mean distance of 2.1 mm from

the facial artery. Almost half (42.5%, $n=45$) of BFP were in intimate contact (less than 2 mm) with the facial artery, and another 9.4% ($n=10$) crossed the center of the masseteric extension. It was found at a distance from the closest portion of the BFP, a minimum of 1.6 mm, a maximum of 27.0 mm, and a mean of 10.4 (SD 5.9). The difference between genders was not statistically significant. Variables are stratified by age groups in Table 2. BFP volume did not change with age, although the age group 15 to 18 years of age had a significantly smaller size and standard deviation. There was a tendency to have a statistically longer BFP length with age, most notable in the masseteric, deep temporal, and pterygopalatine extensions.

DISCUSSION

With a mean volume of 14 ml, but ranging between 4.4 and 32.3 ml, the BFP is frequently close to or in contact with the facial artery. The FA is also 0.3 to 3 cm away from the second molar, the anatomical reference used to make the incision of the aesthetic procedure, BFP resection. This leaves the FA at risk of bleeding during surgical excision, when not considered.

Face and head aesthetic procedures are the most frequent (35.7%) worldwide, followed by breast (32.0%), and the body/extremities (32.2%) according to the 2019 survey by the International Society of Aesthetic Plastic Surgery (ISAPS, 2020). In Mexico, 580,659 aesthetic procedures

Table 1. Morphometric variables of the buccal fat pad.

	Mean (± SD)	Range	Males	Females	p	
Volume (ml)	13.8 ± 5.4	4.4 – 32.3	14.5 ± 5.9	12.4 ± 3.8	0.533	
Length (mm)	72.9 ± 10.7	46.7 – 96.3	74.0 ± 10.4	70.4 ± 11.2	0.481	
Width (mm)	21.4 ± 5.6	6.0 – 37.4	21.2 ± 5.5	21.7 ± 5.2	0.881	
Distance (mm)						
2° molar to	BFP Extension					
	Masseteric	32.3 ± 6.0	20.7 – 47.6	32.5 ± 6.0	31.6 ± 3.9	0.888
	Superficial temporal	59.3 ± 8.8	43.1 – 84.9	59.9 ± 8.9	56.4 ± 6.2	0.384
	Deep temporal	46.2 ± 7.3	17.6 – 76.9	46.5 ± 7.7	45.0 ± 7.5	0.228
	Pterygomandibular	30.9 ± 6.3	16.2 – 42.4	31.6 ± 5.9	28.5 ± 6.4	0.127
	Pterygopalatine	43.9 ± 7.8	25.7 – 62.6	43.8 ± 7.15	43.0 ± 9.4	0.767
	Lower orbital	39.4 ± 4.2	24.1 – 51.2	39.8 ± 3.7	37.3 ± 3.6	0.051
	Facial artery (FA)	12.9 ± 7.7	3.3 – 32.9	14.6 ± 8.5	11.9 ± 6.5	0.241
FA	Nearest	2.1 ± 1.0	1.0 – 3.0	1.84 ± 1.0	2.5 ± 0.8	

SD: standard deviation; FA: Facial artery; ml: milliliter; mm: millimeter. Statistical analysis was performed with the Kruskal-Wallis test for independent variables. *: statistical significance (p < 0.05).

were registered of which 38.9% were in the face and head area. A common procedure includes the bichatectomy, to improve facial contour. The procedure may be well under-reported, as it is performed by different surgical professionals ranging from dentists, maxilo-facial surgeons, and aesthetic plastic surgeons (Quiroga-Garza et al., 2022). The procedure, although simple and

managed as out-patient, should be performed by trained personnel, as it can present important complications (Moura et al., 2018; Quiroga-Garza et al., 2020; Roman-Torres et al., 2020).

Hemorrhage is the most feared complication, due to the risk of hemorrhagic shock from lesions to the facial artery or other vessels derived from

Table 2. Variables measured by categorical age group division.

Age Group	Mean (± SD)							p	
	15-18	19-30	31-40	41-50	51-60	61-70	>71		
Volume (ml)	11.1 ± 2.5	14.0 ± 2.9	13.2 ± 3.4	13.8 ± 5.1	15.7 ± 7.4	12.3 ± 2.5	14.6 ± 6.6	0.273	
Length (mm)	65.5 ± 12.0	71.6 ± 18.3	66.8 ± 9.3	74.2 ± 7.4	76.2 ± 9.2	73.8 ± 7.2	75.6 ± 10.1	0.028*	
Width (mm)	21.3 ± 5.4	23.2 ± 8.1	19.9 ± 5.1	23.1 ± 3.5	21.5 ± 7.2	21.7 ± 6.2	20.8 ± 4.0	0.800	
Distance (mm)									
2° molar to	BFP Extension								
	Masseteric	32.9 ± 4.1	33.7 ± 10.0	28.7 ± 4.8	28.0 ± 5.1	33.7 ± 5.9	32.2 ± 6.0	34.1 ± 4.9	0.019*
	Superficial temporal	55.0 ± 9.6	53.8 ± 5.1	57.9 ± 7.0	63.6 ± 12.6	60.0 ± 10.8	58.3 ± 4.0	61.4 ± 7.0	0.092
	Deep temporal	43.6 ± 3.3	51.1 ± 13.5	48.4 ± 4.0	44.0 ± 5.4	45.1 ± 7.2	42.6 ± 8.4	48.7 ± 6.2	0.024*
	Pterygomandibular	27.6 ± 4.6	33.2 ± 3.3	29.5 ± 9.1	30.1 ± 6.7	30.8 ± 7.4	31.7 ± 5.7	32.6 ± 4.7	0.282
	Pterygopalatine	45.3 ± 8.5	45.0 ± 5.0	46.2 ± 8.6	45.8 ± 7.9	38.9 ± 7.6	41.8 ± 8.3	46.3 ± 5.9	0.016*
	Lower orbital	36.1 ± 6.3	39.9 ± 1.4	39.0 ± 3.7	40.9 ± 4.6	39.6 ± 3.6	40.0 ± 3.7	40.0 ± 3.9	0.109
	Facial artery (FA)	12.7 ± 7.1	9.8 ± 3.6	18.8 ± 9.6	16.2 ± 8.1	14.9 ± 8.9	9.4 ± 7.2	9.9 ± 4.0	0.003*
FA	Nearest	2.31 ± 0.9	1.25 ± 0.5	1.92 ± 1.0	2.0 ± 1.04	2.1 ± 1.0	2.0 ± 0.9	2.1 ± 1.0	

All values are expressed as mean ± standard deviation. Statistical analysis was performed with a one-way ANOVA test with Turkey adjustment. SD: standard deviation; ml: milliliter; mm: millimeter; *: statistical significance (p < 0.05).

the external carotid artery (Cepeda et al., 2019; Herrera-Nuñez et al., 2020; Roman-Torres et al., 2020; Vieira et al., 2019). Other complications include infection (Pimentel et al., 2021), lesions to the salivary parotid duct or fistula (De La Lima Stevao, 2015; Vieira et al., 2019), loss of nerve function (De La Lima Stevao, 2015), and incomplete removal (Dubin et al., 1989).

A pre-surgical imaging assessment of the BFP size should be recommended. With important anatomical structures in close proximity, a patient with a 34 ml BFP may be at risk of lesion, or incomplete removal. Procedures should be performed by highly trained medical professionals with an anatomical understanding of its morphometry and variability.

Jaeger et al. (2016) suggest the use of ultrasound to evaluate the BFP volume, although this method is operator-dependent, and may be difficult for untrained personnel. CT provided an objective and reproducible method of evaluating the BFP. This is also helpful not only in aesthetic procedure safety, but also in reconstructive surgery.

Knowledge of morphometric characteristics of the BFP is also useful in reconstructive procedures. Its vascularization and easy access make it a reliable tissue graft/flap for reconstruction of maxillofacial and oral defects (congenital, pathological, or neoplastic), as well as interpositioning material for temporomandibular joint reconstruction (Baumann and Ewers, 2000; Colella et al., 2004; Kim et al., 2017; Lucchetti et al., 2019; Mohan et al., 2012; Yang et al., 2018).

Limitations

The imaging technique selected allowed for precise morphometric measurements, but did not allow identification of nerve structures, so these could not be evaluated for risk of damage. Due to the retrospective design, BMI and patient characteristics can not be correlated with BFP.

CONCLUSIONS

The BFP has a dynamic shape with highly variable size and volume, extending primarily superiorly and inferiorly from the second molar, without statistical difference between sexes. The facial ar-

tery is frequently at risk of being damaged during the procedures due to its proximity as close as 3 mm.

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