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Quantifying the Effects of Bichectomy on the Middle and Lower Thirds of the Face: A Two-Dimensional Assessment

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Abstract

Background

Bichat's fat pad (BFP) contributes significantly to the volume of the middle third of the face and shapes its contour. Its removal can enhance zygomatic prominence, resulting in a more aesthetically pleasing face. This study aimed to assess the results of bichectomy surgery (BS) using distance and area measurements in photographs.

Methods

The variables body mass index (BMI), distance from the sagittal line- gonion, distance from the sagittal line–zygomatic region, and face selection area were measured from pre- and postoperative photographs. The data were analyzed using descriptive statistics (mean and standard deviation) and inferential statistics (Bootstrap and ANOVA one-way with Tukey post hoc).

Results

The results demonstrated that there was a statistically significant difference in the variables: sagittal line distance - gonion ($p = 0.013$), sagittal line distance – zygomatic region ($p = 0.005$), and area ($p = 0.000$) between the before and after photographs. There was a reduction in the total facial area, with 4.10 ml (average) of fat removed from each side. Importantly, no relationship was found between the volume removed from BFP and the patient's BMI, a key finding of this study.

Conclusions

The middle third of the face's volume can be reduced, eliminating the BFP, which can be visualized and measured on photographs.

Level of Evidence

Level III, retrospective cohort study using standardized and reproducible metrics in pixelbased digital photographs.

INTRODUCTION

Beyond holistic perception, the aesthetic concept of the face permeates its anatomical structure. Its volumetric appearance is defined by the complex relationship between the facial skeleton (bone tissue) and the soft tissues (fat pads, muscles, ligaments, and skin). In this context, the Bichat's fat pad (BFP) contributes significantly to the volume of the middle third of the face, and its relationship with the attached structures shapes and contours the face [1].

Although previously considered a non-functional structure, the BFP has several significant function[2], in the sucking movement in newborns during breastfeeding and the separation of the masticatory muscles and bony structures [2].

The BFP comprises encapsulated fatty tissue consisting of a central body and four extensions: buccal, pterygoid, pterygopalatine, and temporal. Lateral to the BFP are the buccal branches of the facial nerve related to the parotid duct, which permeates its central portion, penetrates the buccinator muscles, and reaches the buccal mucosa at the level of the second molar. Regarding vascularization, the BFP has a rich blood supply, which consists of a subcapsular plexus formed by a free anastomosis of arteries from each lobe [1].

Before its recent popularity in aesthetic procedures, the BFP has been an advantageous structure for reconstructive surgery, used as a graft or pedicled flap to reconstruct intraoral defects such as buccal and palatal fistulas, as well as to smooth bone contours in maxillary deformities [2, 3]. The indications for performing bichectomy surgery (BS) are aesthetic and functional, comprising a reduction in the volume of the cheeks at rest and when mimicking a smile, highlighting of the facial bone structures (the transition and more defined contour between the zygomatic region and the mandible), improvement in appearance and weight in hyper volumetric faces, improvement in facial asymmetry and reduction in repetitive trauma to the buccal mucosa [2–6].

The surgical procedure can be performed via extraoral or intraoral access, with intraoral being the safest and most aesthetic method, under local anesthesia and incision in the buccal mucosa [7]. The buccinator muscle is dissected, and the BFP is exposed, clamped, and excised. The suture is made with absorbable thread [7].

Anatomical knowledge is essential to avoid iatrogenesis in surgical procedures, which can result in temporary or permanent sequelae [8, 9]. There are reports of complications related to the procedure, mainly due to the close relationship between the BFP and other anatomical structures, such as injury to the parotid gland, nerve injuries, severe arterial bleeding [10], laceration of the parotid duct, laceration of the buccal branches of the facial nerve, infection, hematoma, asymmetry, jaw dislocation, and postoperative edema lasting up to two months [11].

The present study aims to evaluate the BS results (before and after) in an experimental, cross-sectional, retrospective manner with comparative statistical analysis and a method for measuring results using photographs. Its goal is to determine whether there was a reduction in area in the middle and lower thirds

of the face, as well as in linear measurements. The null hypothesis (H0) was that there was no difference between the BFP volumes removed and the variable's distances and area measured before and after surgery.

MATERIALS AND METHODS

Sample

The photos from the dental records analyzed were of patients treated in a private office in the last three years (2021-23). A prior selection was made to identify patients with aesthetic complaints who underwent BS.

Figure 1 illustrates the sample selection process. Of the 36 dental records initially screened, 19 were excluded due to incomplete records (n = 6), absence of postoperative follow-up at 90 days (n = 5), non-standardized photographs (n = 4), or non-standardized head position (n = 4). The final sample consisted of 17 patients with complete clinical records and standardized pre- and postoperative photographs.

The sample consisted of individuals of both sexes, ages 24 to 60, body mass ranging from 49 kg to 84 kg, height ranging from 150 cm to 182 cm, who underwent BS with removal procedures of 3.00-6.65 cm^3 of BFP, on which side.

The inclusion criteria were medical records containing photographs taken before and after the procedure, with similar focal lengths, the same lens, sensor, and camera set, similar lighting conditions, and patients looking directly at the camera with their eyes open. The total sample was 17 before/after photographic pairs from medical records. Standardized photographic protocols were used to ensure that pre- and post-procedure images of each patient were directly comparable. All photographs were obtained under identical lighting conditions using a fixed light source with constant intensity and angulation to minimize shadows and reflections. The camera was mounted on a tripod at a fixed distance and height, and patients were positioned using anatomical reference markers to maintain consistent head orientation and facial alignment. Manual focus was used to ensure optimal sharpness of the entire face, and the ISO setting was kept constant (ISO 100) to minimize image noise. A fixed focal length (105 mm) was used to avoid perspective distortion and maintain uniform facial proportions. The aperture was standardized at f/8 to provide adequate depth of field for full-face clarity, and the shutter speed was fixed at 1/125 s to prevent motion blur. These parameters were selected to ensure reproducibility, follow best photographic practices, and reduce potential sources of bias in image acquisition and subsequent analysis.

Clinical Assessment

The same dentist performed all patient procedures, pre- and postoperative evaluations, BS procedures, and photographs.

All procedures were performed in a clinical setting under local anesthesia. The technique removed a defined BFP volume through intraoral access in all cases.

Surgical Technique

1. Administration of two Dexamethasone® 4mg tablets and one sublingual Toragesic® 10mg tablet one hour before the procedure;

2. Antisepsis of the face and neck: removal of makeup with a moistened tissue, rubbing the skin with gauze soaked in 70% alcohol, 2% chlorhexidine soap, and 1% hydrogen peroxide;

3. Placement of surgical fields;

4. Marking of the initial incision point: 1) superior-inferior (identification of the carotid papilla and Stensen's duct, 1cm below these anatomical structures); 2) anteroposterior (identification of the vestibular central groove of the upper second molar to mark the point on the buccal mucosa); with the aid of a dermal pen, the incision point is determined.

5. Infiltrative local anesthesia of the superior, middle, and posterior alveolar nerve with one 4% articaine 1:100,000 (for each side of the face) and infiltrative local anesthesia of the buccal nerve with another 4% articaine 1:100,000 (anteroposterior);

6. Sensitivity test with tweezers at the incision site so that the patient can indicate whether the anesthetic effect is already satisfactory after four minutes;

7. Point incision at the marking target with insertion of the entire active tip of the scalpel blade no 15, transfixing the buccal mucosa and buccinator muscle to reach the buccal space;

8. Tissue divulsion with Kelly forceps, inserting the instrument with the active tip closed and exiting with the active tip open so as not to pinch any noble structure. Through divulsion, there is a separation between muscle and fat tissue, so this surgical movement superficializes the encapsulated fat of the BFP.

9. With the aid of a second Kelly clamp, the buccal portion of the BFP is grasped to stabilize the adipose tissue.

10. Through continuous and repetitive circumferential movement, the encapsulated fat is separated from the buccal portion.

11. Upon visualizing the union of the end of the fat capsule with the muscle, the connection is broken with delicate divulsion movements with Kelly clamps.

12. The excised structure (the buccal portion of the BFP) is inserted into a 5 mL syringe to measure the final volume removed on each side;

13. Extraoral manual compression is performed below the zygomatic bone to drain any possible mild emphysema that may have occurred due to tissue divulsion.

14. Simple suture with Viril® 4-0 thread in the incision area (usually three individual sutures);

15. Postoperative medication prescription: Tylex® 30mg every 6 hours for five days; Amoxicillin 500mg every 8 hours for seven days; Dexamethasone 4mg every 8 hours for two days; Periogard® 0.12% mouthwash twice a day for 10 days;

16. Verbal and written guidance on postoperative care;

Collected Variables

Distance data between the centers of the eyes (standard to normalize scale) – WHITE - were collected on a scale measured by pixel quantity in each image before and after the procedure. The smallest orthogonal distances were also collected in pixels: 1) sagittal line to the gonion – RED – and 2) sagittal line to the zygomatic region - GREEN. An area in the patients' faces was selected by separating only the face, its bordering silhouettes, and the line between the centers of the eyes. The area (the middle and lower third of the face) – YELLOW - of this selection was compared as a measure of change (pixels²) in the region between the gonion and zygomatic region (Figure 2).

The patient's body mass index (BMI) was also collected from the anamnesis.

Equipment and Software

The images were processed in GIMP®, and the pixels were collected at 2300% zoom to obtain measurement points—the selection of the facial area below the eye line in Adobe Photoshop®. The selected area was calculated using ImageJ®, by manually transforming the selected portion of each facial image to 8 bits and adjusting the color threshold.

Statistical Analysis

A robustness test was performed by using the same patient's image and testing the analyst's (author's) mouse 10 times (10x). In theory, the analyst's manual skill was checked. If the method were not robust, our result would differ from those of others who tried to apply this methodology. In this specific case, the test proved strong; that is, it did not depend on the analyst who performed the data collection with GIMP to obtain the results. So, distances were collected repeatedly, in this case, 10 times (n=10), to confirm the examiner's calibration when collecting the points (Online Resource 1).

The inferential analysis was conducted using the computationally intensive nonparametric bootstrap resampling test (n=300) to assess the association between measurement variation and area variation before and after the procedure. The volumes of fat removed (H0 = there is no difference between the volumes of material removed and the distances and areas measured). The ANOVA Way test was used to analyze variance and test the null hypothesis that the means are equal, identifying significant differences between groups; Tukey's post hoc test was used to determine which volumes showed a statistically significant difference. The margin of error used in the statistical tests was 5%.

The data was processed using statistics. The descriptive analysis used absolute frequencies and percentages for the categorical variables and mean ± SD for the numerical variables (distances and area measured in pixels) at each point reported for each patient (Tables 1 and 2).

RESULTS

Table 1 shows the average values collected in the photographs before and after the procedure and demonstrated that all patients in the sample had a reduced area demarcated for this research after BS, except for patient no. 13.

Table 2 shows the results for the differences in distance (sagittal line to the gonion and sagittal line to the zygomatic region) and area, along with other data collected on age, weight, height, BMI, right and left BFP volumes, and average BFP volume. It was observed that despite there was an increase in distance - sagittal line to the gonion - in some patients (no 1/2/8/9/10/11/16) of the sample and in distance - sagittal line to the zygomatic region (no 1/2/7/9/10/11/13) when compared to the initial one. It was noted that this variation was statistically significant across the entire sample. The age distribution of the sample ranged from 24 to 60 years, with a greater concentration in the 20-29 years age group. The weight ranged from 49-84 kg; the height from 150-182 cm; the BMI from 19.4-28.4; and the maximum and minimum value of the excised volume of BFP was 3.00-6.65 cm³, respectively.

Table 3 describes the means and standard deviations of the distances analyzed for the entire sample, before and after the procedure, already corrected for the distance between eyes. It presents a set of results showing a reduction in the average facial area of the treated patients (by approximately 10,000 pixels) and an average removal of facial fat on both sides of 4.10 ± 1.04 ml.

In turn, after confirming the distribution's normality using the Bootstrap test (n=300), One-way ANOVA tests with Tukey's Post Hoc were carried out using the mean values and standard deviations of the analyzed measurements (Online Resource 2). And shows that H0 was rejected based on the p values: sagittal line distance - gonion (p=0.013), sagittal line distance – zygomatic region (p=0.005), and area (p=0.000). That is, there is an association between the volumes of BFP removed and the variables' distances and area measured before and after surgery. In other words, the volume removed from BFP affected the facial distances and area collected for this sample.

Finally, the BMI (calculated from height and weight), the average volume removed from BFP, and the variation in facial area after the procedure were also compared. The results are shown in Table 3 and Figure 3, which present each patient analyzed in one of the pyramids. They show that it is impossible to

correlate BFP volume with BMI globally to obtain greater or lesser variation in the facial area. In other words, BMI does not affect the volume removed. Therefore, even with smaller volumes removed, patients with lower BMI tend to exhibit greater variation in the reduced facial area.

DISCUSSION

The analysis of the present study revealed significant associations between the average volume of 4.10ml of fat removed from the BFPs and the reduction in sagittal distances, precisely the sagittal line-gonion distance, reduced in percentage by 2.95% if we compare before and after the procedure surgery and the sagittal - zygomatic region line distance, reduced in percentage by 1.76% (Table 1). These distances are fundamental measurements in the evaluation of facial structure and the proportions between the different regions of the face, especially the sagittal-gonion distance, which is highly desirable to be reduced with BS to highlight the Triangle of Yarbus [12] or Triangle of beauty [13] and thus avoid "squareness of the face" [13].

Reducing the sagittal line-gonion distance by an average of 2.95% is particularly important for determining mandibular projection and angulation, which play a crucial role in defining the lower facial contour. As stated by Paul [14], the results reveal a statistically significant association ($p = 0.013$) between the volume of fat removed from the BFP and this measure relating to the jaw angle. Therefore, it suggests that excess fat in the cheeks can directly influence the adequate projection of the jaw angle and thus affect the harmony of the face.

Likewise, the low reduction in the sagittal-zygomatic region line distance, averaging 1.76%, is related to the more excellent projection and contour of the zygomatic region of the face, which play a central role in defining the facial structure and general aesthetics. A statistically significant association was found ($p = 0.005$) between the average volume of fat removed (4.10ml). This measure highlights the importance of projecting the zygomatic region in facial rejuvenation. This projection (zygomatic arches highlighted) can be enhanced with bichectomy without facial prostheses or dermal fillers.

The present study analyzed the results and revealed a highly significant association between the average fat volume removed from the cheeks (4.10 ± 1.04 ml; Table 3) and a 5.47% reduction in the middle third of the face (approximately 10,000 pixels). This relationship suggests that the amount of fat in the BFP has a determining role in the definition and proportion of the midface [2–6].

The current concept of beauty emphasizes adequate projections in the zygomatic region and chin, contributing to a more defined facial contour [2, 15], and postulates that displacement of the BFP (ptosis) and its herniation contribute to the appearance of an aged face [6]. Therefore, the relationship observed between the volume of fat removed and the reduction in the lower and middle third of the face highlights the importance of a personalized approach when performing facial aesthetic procedures. As a result, the average excised volume 2,3 is 2.74 ± 0.69 ml, which differs from that reported in the present study. The average volume removed was 3.2 ml [5], which differs from ours, too. The present research removed much larger average volumes of BFP, 4.10 ml (average on both sides of the face).

Regarding the surgical technique of choice [3], the intraoral approach is the safest option compared to the extraoral approach. Paul [14] supports that, when indicated, excision of the BFP should be performed during the facial lifting procedure. New techniques, such as the hydro section [11], the direct surgical approach to a superficial muscular aponeurotic system [14], general anesthesia [16], and laser high-power diode [17], are still proposed. It should be noted that the main pitfall in the extraoral approach is the inadvertent surgical manipulation of facial nerve branches [3].

The parotid duct [7, 18] is the most relevant anatomical structure related to the intraoral approach. The literature [17], in the form of systematic reviews, reports a low rate of postoperative surgical complications [3, 7], which agrees with the present study, which found no serious surgical complications in a sample of 60 patients. However, it should be noted that long-term longitudinal studies are scarce [3, 4, 7]. Preoperative ultrasound examination [10] is used to avoid possible complications. This consideration is specific; there is a consensus that anatomical knowledge and minimally invasive surgical techniques reduce risks.

In addition to the associations discussed, it is vital to consider the impact of BMI on BFP volume removal and its aesthetic implications. BMI is a measurement that reflects the relationship between an individual's weight and height and is a helpful indicator of overall body composition. Facial fat removal can have different effects on patients with different BMIs. Patients with a higher BMI tend to have more subcutaneous fat, including in the facial region. In these cases, removing larger volumes of fat may be necessary to achieve desirable aesthetic results [1].

On the other hand, in patients with a lower BMI, fat removal should be carried out with greater caution to avoid excessive volume loss and the resulting aged or skeletal appearance [3]. Previous studies indicate that patients with higher BMI may be at greater risk of sagging skin after fat removal due to reduced skin elasticity [4]. Therefore, the surgical approach must be tailored to account for skin quality and retraction capacity after fat removal. In patients with lower BMI, the priority should be to preserve adequate volume to maintain the fullness and youth of the face. The present study had no association between BMI, the volume of BFP removed, and variation in the facial area.

The results of this research have significant implications for clinical practice in facial aesthetic surgery. They highlight the importance of a personalized, careful approach when performing aesthetic procedures involving the removal of facial fat. When considering BS, practitioners must consider the patient's aesthetic desires, individual facial features, and ideal proportions. Excessive fat removal can result in a tapered, aged appearance. Therefore, the results of this study reinforce the need for a personalized approach when indicating BS.

Furthermore, the results of this research can inform the development of clinical guidelines for facial fat removal, helping professionals systematize an effective, minimally invasive surgical technique. In other words, the average removal of 4.10 ml of BFP volume generated results with statistical significance ($p = 0.013$) when related to an average reduction of 2.95% of the sagittal-gonion line and an average reduction of 1.76% of the sagittal-zygomatic region eyeline distance ($p = 0.05$). Furthermore, a statistically significant reduction ($p = 0.000$) in the middle and lower third of the face must be considered after

removing the average BFP value. A deeper understanding of the relationship between the fat volume removed and facial measurements can lead to more satisfying, natural aesthetic results, helping avoid post-treatment complications and dissatisfaction.

For future research, it would be interesting to further explore the influence of different BFP removal techniques and specific areas of facial fat on facial aesthetics, and to expand the sample size. Furthermore, investigating the relationship [19] between BFP removal and patient satisfaction with their appearance could provide valuable insights to improve clinical outcomes and patient experience. Also, the 90-day follow-up period was selected to allow resolution of postoperative edema while minimizing the influence of subsequent aesthetic procedures that could confound the isolated effect of bichectomy. Therefore, the present findings reflect early postoperative changes rather than long-term aging-related outcomes. Future longitudinal studies are needed to investigate the stability of these results and the potential impact of bichectomy on facial aging.

This study concludes that results achieved with BS (reduction of the middle and lower thirds of the face) can be quantified in digital photographs (in pixels). The subtle changes the patient perceives in their photos after surgery can be demonstrated by reducing the number of pixels in specific areas and measuring them in digital photographs.

Declarations

FUNDING

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COMPETING INTERESTS

The authors have no relevant financial or non-financial interests to disclose**.**

ETHICAL APPROVAL

This study was performed in line with the principles of the Declaration of Helsinki. The research was previously submitted for analysis by the São Leopoldo Mandic Research Ethics Committee. The response was given through a Consubstantiated Opinion from the Ethics Committee with approval of the research project (Protocol number 6670 3522.0.0000.5374).

CONSENT TO PARTICIPATE

Informed consent was obtained from all individual participants included in the study and was presented to the São Leopoldo Mandic Research Ethics Committee before ethical approval

CONSENT TO PUBLISH

No individual person's data in any form (including any individual details, images or videos).

Author Contribution

All authors contributed to the study conception and design. J.M.J.: Data curation; Formal analysis; Investigation; Methodology; Project management; Writing - original draft. M.C.S.M.: Methodology; Writing - revision and editing. M.O.C.D.L.: Supervision; Validation; Visualization; Methodology; Project management. T.E.P.B.: Methodology; Software. C.R.P.J.: Supervision; Validation; Methodology. All authors read and approved of the final manuscript.

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Tables

Table 1 - Before and after surgery (measurements 1 and 2 and area) pixels, collected from the 17 patients (n=17).

	Before			**After**		
	Sagittal gonion *	**Sagittal zygomatic ***	**Area ****	**Sagittal gonion ***	**Sagittal zygomatic ***	**Area ****
1	241	302	289334	263,7007	327,8441	275773,9
2	165	204	138804	170,8071	224,9137	119256,2
3	160	177	83148	149,8448	167,784	77393,79
4	217	244	152440	198,7281	225,9649	146001,6
5	173	198	114598	164,3051	188,2436	105575,3
6	246	313	292706	230,7317	298,3415	280181,3
7	235	246	182483	211,7301	265,9091	169615,7
8	311	353	371111	315,2908	344,6202	348319,9
9	301	367	369404	304,5339	341,4151	362524,9
10	218	264	177985	241,6471	271,8529	175750,6
11	113	152	70859	137,0014	166,7381	67714,79
12	312	364	372108	274,8234	356,5277	328797
13	135	155	75820	133,492	161,9572	76462,43
14	212	257	188840	189,409	248,9092	175922,3
15	246	287	234288	218,8564	260,0175	231244,9
16	185	224	137974	185,6843	215,1753	126493,6
17	230	257	184764	214,8522	245,113	174903,8

Table 2 - Difference before vs. after distances 2 and 3 and area, associated with other data collected on age, weight, height, BMI, right and left BFP volume, and average BFP volume of patients.

	Diference sagittal gonion (pixel)	Diference sagittal zygomatic (pixel)	Diference area (pixel²)	Age	Weight (kg)	Height (m)	BMI	Right BFP (cm³)	L
01	9,42	8,56	-4,69	31	68	1,72	22,9	3,5	3
02	3,52	10,25	-14,08	32	49	1,55	20,3	3	3
03	-6,35	-5,21	-6,92	24	57	1,7	19,7	3	3
04	-8,42	-7,39	-4,22	26	43	1,57	17,4	3	3
05	-5,03	-4,93	-7,87	27	60	1,62	22,8	3	3
06	-6,21	-4,68	-4,28	29	68	1,57	27,5	3,1	3
07	-9,90	8,09	-7,05	23	65	1,61	25,0	3,5	4
08	1,38	-2,37	-6,14	41	90	1,78	28,4	4	4
09	1,17	-6,97	-1,86	23	55	1,68	19,4	4	4
10	10,85	2,97	-1,26	32	53	1,62	20,2	4,2	4
11	21,24	9,70	-4,44	28	84	1,82	25,3	4,9	5
12	-11,92	-2,05	-11,64	30	60	1,5	26,6	4,1	4
13	-1,12	4,49	0,85	60	66	1,59	26,1	4,2	4
14	-10,66	-3,15	-6,84	32	60	1,6	23,4	4	4
15	-11,03	-9,40	-1,30	31	60	1,62	22,8	5,3	5
16	0,37	-3,94	-8,32	36	68	1,65	24,9	6,1	7
17	-6,59	-4,63	-5,34	27	68	1,64	25,2	6	5

Table 3 - Preoperative and postoperative facial area averages, with average fat volume removed (n=17).

Facial area (pixel^2)		Volume removed (ml)	
Preoperative	**Postoperative**	**Left side**	**Right side**
205597 ± 66757	194359 ± 65276	4,1 ± 1,1	4,05 ± 1,0

Distance sagittal gonium (pixel)		Distance sagittal zygomatic (pixel)	
Preoperative	**Postoperative**	**Preoperative**	**Postoperative**
221 ± 37	214 ± 35	260 ± 42	255 ± 39

Figures

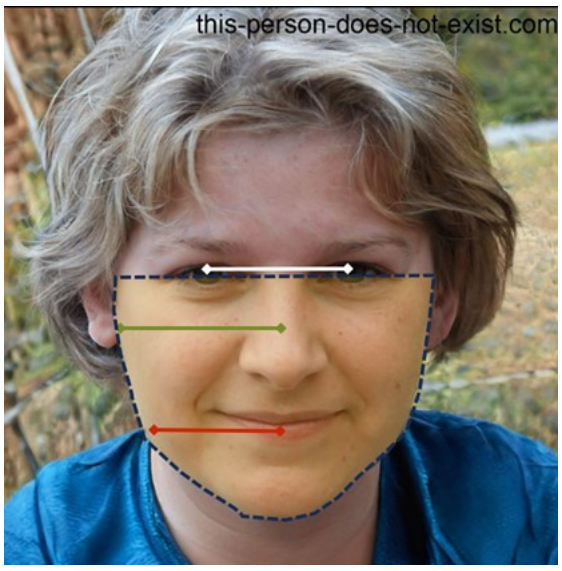


Figure 1

Example of measurements taken on a random face of an individual that does not exist, generated by artificial intelligence. Source: Own authorship, adapted from https://this-person-does-not-exist.com/en

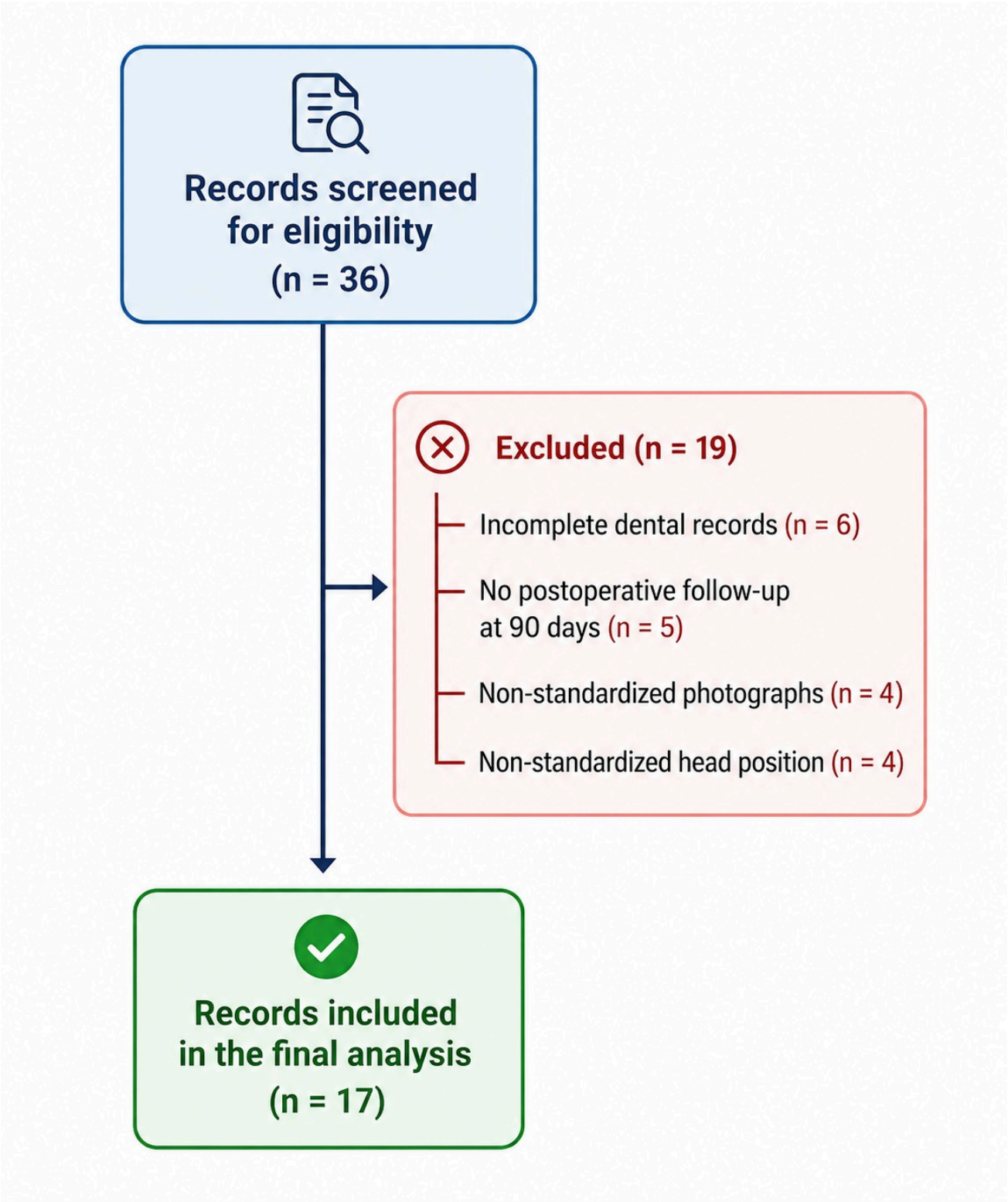


Figure 2

Flowchart of sample selection.

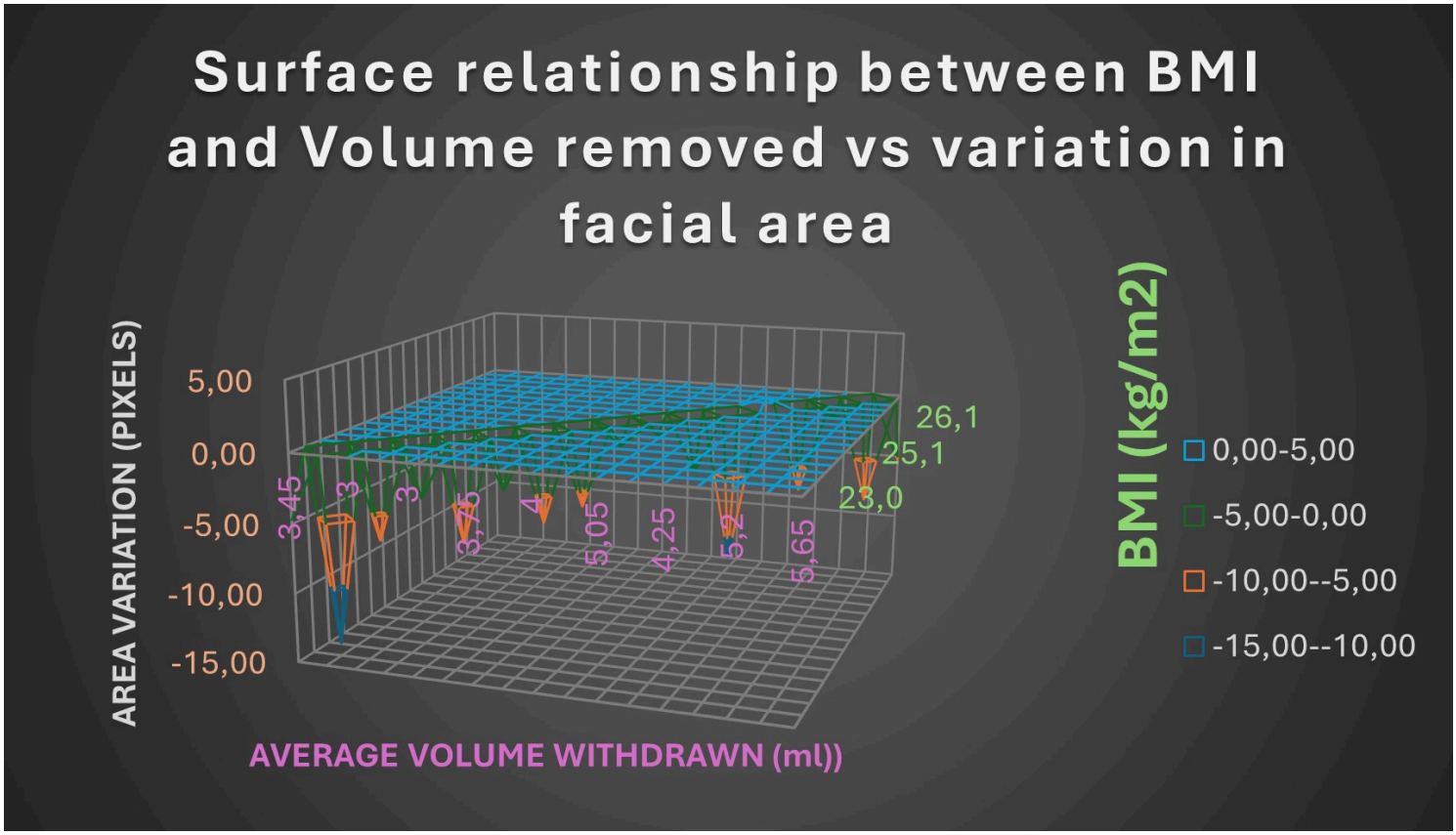


Figure 3

Relationship between each patient's BMI and the average volume removed from BFP, with the variation in the facial area before and after the procedure.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- OnlineResource1.docx
- OnlineResource2.docx