

The Buccal Fat Pad Technique an Option to Prevent Complications in Zygomatic Implants Surgery: 5 -13 Years Follow Up

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Abstract

Background: The extrasinus approach is a technique, with an implant placement of zygomatic implants with approach outside of the maxillary sinus. The technique reduces the risk of sinusitis and favors prosthetic rehabilitation, but there is a risk of soft tissue recession, exposure of the implant threads and contamination of the implant surface.

Purpose: The objective of this retrospective clinical study is to prove and present the benefits of the use of the Buccal Fat pad flap technique and its feasibility in preventing soft tissue complications in rehabilitations with zygomatic implants.

Materials and Methods: Patients from authors clinics in Brazil (IDM - Clinic - Rio de Janeiro) and Chile (Universidad de Los Andes - Santiago and Universidad de La Frontera - Temuco) with severe maxillary atrophy rehabilitated by maxillary full fixed prosthesis with zygomatic implants. Were installed two implants one in each side associated to conventional implants and in more critical conditions of bone atrophy, four zygomatic implants, two in each side were used. In cases with risk of an oroantral communication and were used extrasinusal approach (ZAGA concept), the buccal fat pad flap technique was used. The peri-implant soft tissue recession (PISTR) was evaluated by clinical examination and recession was scored on an ordinal scale: I = no recession; II = slight recession (implant head visible); III = recession with up to seven exposed threads.

Results: In the period from May 2005 to January 2013, a total of 147 zygomatic implants were installed in 52 patients (Men = 22 and Women = 30) with mean age of 56,9 years old, were submitted to surgery of zygomatic implants. In all cases, the buccal fat pad flap technique was used to prevent complications such as: mucosal resection or fenestration and exposure of the implants or oroantral communication, depending on the positioning of these implants. The patients were followed over the years and in 5 cases (3,4%) there was tissue retraction and exposure of the threads of an implant.

Conclusion: It can be concluded that the use of the buccal fat pad flap proved to be a simple and effective technique in the prevention of complications of soft tissue recession associated with the surgery of zygomatic implants installed with the extrasinusal technique.

Keywords: Zygomatic implants, buccal fat pad technique, extrasinusal approach, ZAGA concept.

Introduction

The regenerative treatment in Medicine and Dentistry, had an evolution through the times with the emergence of grafting techniques that enable the treatment of defects of difficult solution in the past. The new technologies enabled the development of implants and biomaterials of grafting, which are used successfully in reconstructive and restorative surgeries.

However, autogenous grafts are still considered by the scientific literature as the materials of first choice, since they present the best results. The adipose tissue has been used in medicine for aesthetic treatment during several years, however there are controversies in the literature regarding the success indexes of this technique.¹

In dentistry the adipose body named Buccal Fat Pad (BFP), also known as “Bichat’s Ball” has been used with treatment of defects in the oral cavity. The fatty body is a round mass, encapsulated by a thin layer of connective tissue, located between the buccinator muscle and in front of the anterior margin of the masseter muscle and that it gives to the cheeks of its rounded outline, particularly in infants.^{2,3}

In 1732, Heister⁴ had only described the presence, in the region, of a glandular structure, known as the molar gland. In 1802, Bichat⁴ was the first to recognize this anatomic structure as having an adipose nature. Shattock⁵, in 1909 confirmed the fatty nature of this body as being completely distinct from the subcutaneous adipose tissue, although no correlation was found between the size of the individual and the volume of the buccal adipose.

Egyedi (1977)⁶ was the first to describe the use of the BFP for oral reconstruction using it as a pedicled graft for the closure of postoperative maxillary defects (oroantral communications) in four cases. In 1983 Neder⁷ use as free graft to reconstruct oral defects in two patients and the use of the BFP in oral cavity surgeries, that was corroborated by other authors including bisphosphonate-related osteonecrosis.⁸⁻¹⁰

Some authors have demonstrated that the use of BFP in oral implantology is a viable technique during regenerative procedures of the autogenous bone block graft, post-extraction sites regeneration, soft tissue defects and as a membrane in guided bone regeneration (GBR).^{11,12} Other authors proposed as an option in sinus lift surgeries to bone graft protection or after rupture of the Schneiderian membrane.^{13-15.}

In this context, the use of the pedicled BFP flap in the prevention and treatment of complications in zygomatic implant surgeries is pertinent. Mainly to avoid oroantral communications and mucosal fenestration with exposure of the implant.^{16,17} The simplicity of the technique and the ability of a blood supply to the flap are factors that favor better tissue healing.^{16,17} Others authors have corroborated this proposal using in clinical studies with good results and used in zygomatic implant surgeries as a protocol to prevent complications.¹⁸⁻²⁰

The ZAGA concept (Zygomatic Anatomy-Guided Approach) introduced a new vision enables better results for zygomatic implants in the rehabilitation of cases with severe bone atrophy of the maxilla.²¹ The concept presents the surgeon with a protocol for surgical planning and adapts the procedure to the anatomy of each patient.²²

Different approaches aim to reduce and prevent soft tissue complications with zygomatic implants. Techniques such as scarf graft and Bichat's buccal fat pad together with the ZAGA concept can help in this proposal.²¹ A careful preoperative analysis, followed by proper implant placement and the prevention of complications demonstrated that it is an excellent resource for oral implantology.

Recently, Hernandez-Alfaro et al²⁰ presented a study carried out to describe the benefits of a pedicled buccal fat flap in extramaxillary approach of zygomatic implants. In this study, variables and measures were proposed for peri-implant soft tissue recession (PISTR)²⁰

The objective of this a long-term retrospective clinical study is to prove and present the benefits of the use of the BFP flap technique and its feasibility in preventing soft tissue complications in rehabilitations with zygomatic implants.

Anatomical Aspects

The BFP can be divided into three segments (anterior, intermediate and posterior) and has four extensions (buccal, pterygoid, pterygopalatine or superficial temporal and temporal or deep temporal). The adipose body would be encapsulated in the cheek by a fascial envelope derived from the parotid-masseteric fascia.³ It is fixed by 6 ligaments the maxilla, posterior zygoma, infraorbital fissure, temporal tendon and buccinator membrane.³

The buccal extension is the most superficial and gives volume to the cheek. Penetrates the cheek below the parotid duct, passes in front of the anterior border of the masseter muscle and descends to the retromolar region of the mandible, superficially to the main portion of the buccinator muscle. The anterior border is marked by the facial vessels, which are located in the same plane of the buccal adipose. The parotid duct transits superficially to the adipose body until it penetrates this and the buccinator muscle to enter the oral cavity in the region of the upper second molar.³

The structures in the buccal adipose include the duct of the parotid gland, the accessory duct of the parotid salivary glands, the facial artery, facial veins, buccal artery (one of the pterygoid branches of the maxillary artery), lymphatic chain, and branches of nerves facial and mandibular.

The mean volume in men is 10.2 ml (ranging from 7.8 to 11.2 ml) while in women the mean volume varies from 8.9 ml (ranging from 7.2 ml to 10.8 ml). The average thickness is 6mm and the average weight is 9.7g.³ Other authors² such as Moore (1990) attribute this development to the act of sucking the nipple during breastfeeding, preventing the cheeks from collapsing. In addition, this structure has a purely mechanical function, serving as a cushion to facilitate movement of one muscle relative to another, working in a slippery and loose medium and also contributing to the external morphology of the face.⁴

Tissue Bioengineering Potential of Adipose Cells

The regenerative medicine has found that multipotent stem cells can differentiate into cells of various tissues. It was observed that a large number of multipotent stem cells with high differentiation potential are present in human adipose tissue. A number of in vitro and in vivo experimental studies have been carried out to prove the viability of differentiation of adipose tissue into bone and cartilaginous tissue.^{23,24} Other studies have been also shown that BFP is a source of multipotent cells in a very similar way to adipose cells in other parts of the body.^{25,26} It was related to the presence of mesenchymal cells in the adipose tissue that makes the use of this tissue in oral reconstruction, even more interesting and advantageous.^{25,27} Other authors²⁴ affirmed based on experimental studies in animals that the adipose tissue presents / displays great quantity of multipotent stem cells with high capacity of differentiation, favoring its use in the treatment of the bone defects and soft tissues in oral maxillofacial surgery. On the other hand, the use of autogenous transplants of diverse tissues is considered as "gold standard" in the regenerative treatments, especially by the capacity of immunomodulation and regeneration induction.²⁸ The immunomodulation generated by these cells is related to the ability to interfere in the inflammatory response of the reconstructed site stimulating the production of anti-inflammatory cytokines that favor the differentiation and migration of endothelial and mesenchymal cells compatible with the regenerative process of each region.²⁸

Pediced Buccal Fat Pad Flap Technique

The buccal fat pad pedicled flap provides a large supply of tissue that helps in the closure of oronasal communications. This technique associated with implants it allows the coverage of implant threads with the purpose of increasing tissue thickness and reducing the possibility of fenestration of the mucosa and subsequent exposure of the implant. An incision of approximately 1 cm in length was performed through the buccinators muscle behind the zygomatic buttress. A blunt dissection was performed with a Metzemaum scissors to penetrate in BFP capsule. The fatty tissue must be stretched with a gentle and gradual way to avoid rupture and maintain its integrity. After that the pedicle must be positioned over the threads of the zygomatic implants or the oroantral communication and sutured with resorbable material.

Material and Methods

Patients

Patients from authors clinics in Brazil (IDM - Clinic – Rio de Janeiro - Brazil) and Chile (Universidad de Los Andes – Santiago- Chile and Universidad de La Frontera – Temuco - Chile) with severe maxillary atrophy rehabilitated by maxillary full fixed prosthesis with zygomatic implants and conventional implants were included.

ASA I or ASA II patients with full maxillary edentulism, presence of residual alveolar bone crest with a minimum of 4 mm in thickness and height in the posterior maxilla, anterior residual bone to install two implants (right and left) and with no possibility to perform bone graft were included..

Exclusion criteria for the study were:

1. Patients unable to give informed consent to participate in treatment.
2. Health conditions that did not allow the surgical procedure.
3. Patients with systemic conditions and contraindications for surgery.
4. Uncontrolled diabetics;
5. Patients who were treated with bone anti-resorptive drugs in the long term.
6. Patients who abused alcohol and drugs.
7. Patient with psychiatric illnesses.
8. Irradiated patients.

The included patients signed a inform consent and the study was conducted in accordance with Helsinki guidelines.

Surgical Technique and Prosthetic Rehabilitation

Before the surgery, panoramic radiography and computerized tomography were obtained. Surgical technique included classical technique, sinus slot technique,²⁹ extrasinus technique³⁰ for two or four zygomatic implants.³¹ All cases were performed under general anesthesia and infiltration with local anesthesia. Three experienced maxillofacial surgeons from different centers followed the same surgical protocol to perform the procedures. A supracrestal incision was performed from one side of the maxillary tuberosity to the opposite side, with two bilateral posterior buccal releasing incisions and a vertical mesiobuccal releasing incision.¹⁷

The zygomatic implants were installed according to the selected technique and the conventional implants in the maxillary area between 13 and 23 using a palatal approach related to the residual bone. In more critical conditions of bone atrophy, four zygomatic implants, two in each side were used. In cases with risk of an oroantral communication or more exteriorization of zygomatic implants, the buccal fat pad flap technique was used, using a pedicled flap.^{16,17} The pedicled flap was positioned over the site of the implants and bone defects, and sutured with resorbable thread (vycril 4-0) or mononylon 5-0, and the suture was removed 1 week after surgery.

The implants were anchored with a minimum torque of 30 Ncm. and submitted to immediate loading. For surgery, antibiotic therapy was administrated, and the postoperative pain managed by the use of antiinflammatory and analgesic medication with recommendation of oral hygiene and Mouthwash (Chlorexidine Digluconate 0.12%, 1 minute, 3 times daily) was included for 3 weeks.^{16,17,32}

A multifunctional guide was used for inter maxillary registers based on patient's previous dental prosthesis. The cast model was prepared to manufacture a fixed prosthesis and installed 48 hours to 1 week after surgery.^{17,32} (Figs. 1A-D)

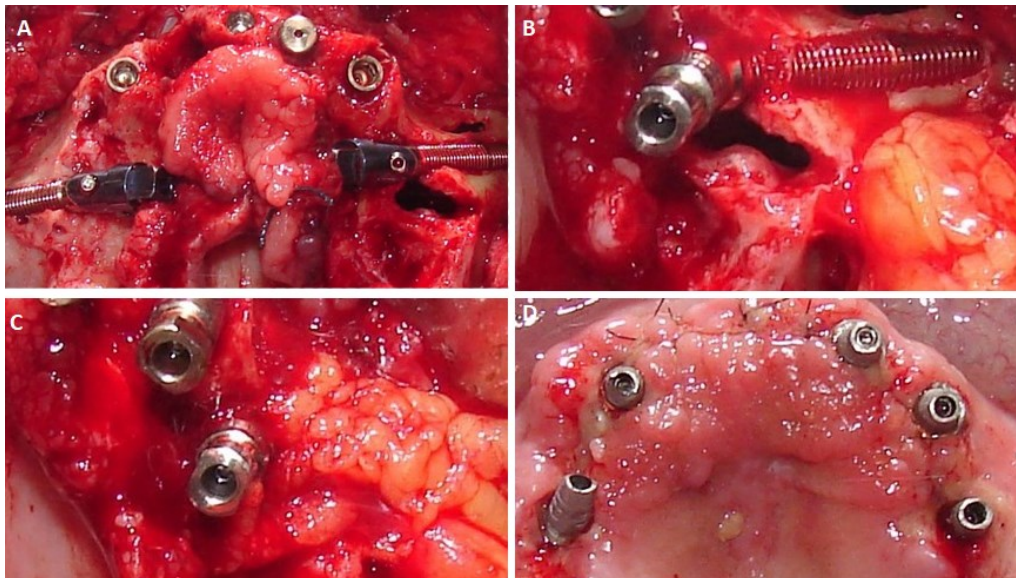


Figure 1: *A – Zygomatic implants installed with extrasinus approach (ZAGA concept); B – Zygomatic implant installed with oroantral communication; C – BFP flap to cover implant and closure of OAC to prevent soft tissue recession; D – Healing after 1 week.*

Post-Operative Follow-up and Success Criteria

The patients were recalled for clinical and radiographic follow-up annually after prosthesis installation. During the clinical exam, implants stability, prostheses conditions and peri-implant tissues were evaluated using panoramic and periapical radiographs to control the bone level in the peri-implant regions.³² The success criteria for osseointegration were according with the proposed by Albrektsson et al³³ and Buser et al³⁴ associated with a reverse torque test (10 Ncm) which is an indicator of clinical stability followed by percussion on abutment.^{17,32} (Figs.3A-C and 4A-E)

Peri-implant soft tissue recessions (PISTR) were assessed by clinical examination and scored on an ordinal scale: I = no recession; II = mild recession (implant head visible); III = recession with up to seven threads exposed.²⁰

Variables as age, sex, general conditions, number of installed zygomatic implants, length of implants, number of standard implants installed, type of prosthesis installed, type of antagonist and complications were included in the analysis. Data analysis was performed by ANOVA, t test and chi square using value $p < 5\%$ to obtain statistical significance.

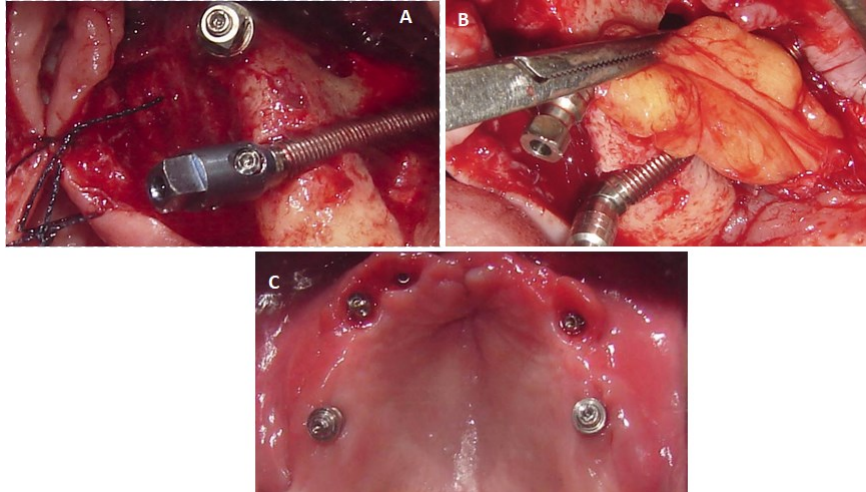


Figure 2: *A – Zygomatic implant installed with extrasinus approach (ZAGA concept); B – BFP flap to cover implant to prevent soft tissue recession; C – Clinical control after 10 years.*

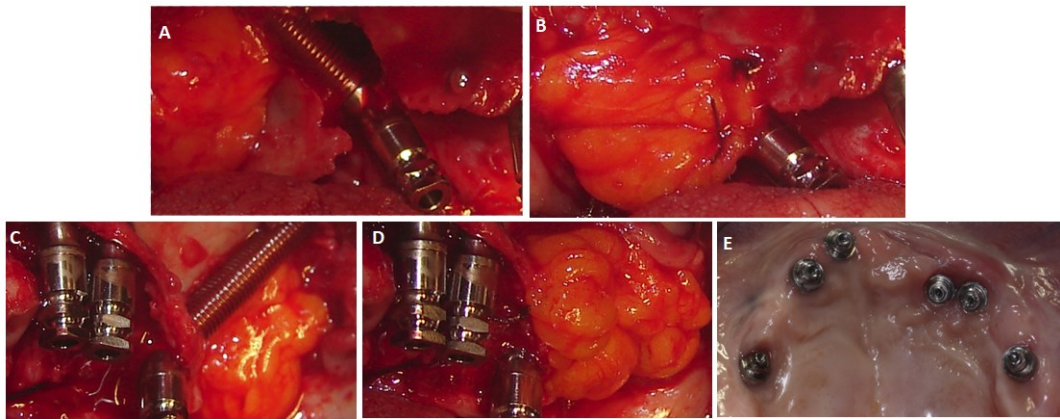


Figure 3: *A – Zygomatic implant installed with extrasinus approach with OAC (ZAGA concept); B – BFP flap to cover implant and closure of OAC to prevent soft tissue recession; C – Zygomatic implant installed with extrasinus approach (ZAGA concept); D – BFP flap to cover implant to prevent soft tissue recession, E- Clinical control after 8 years.*

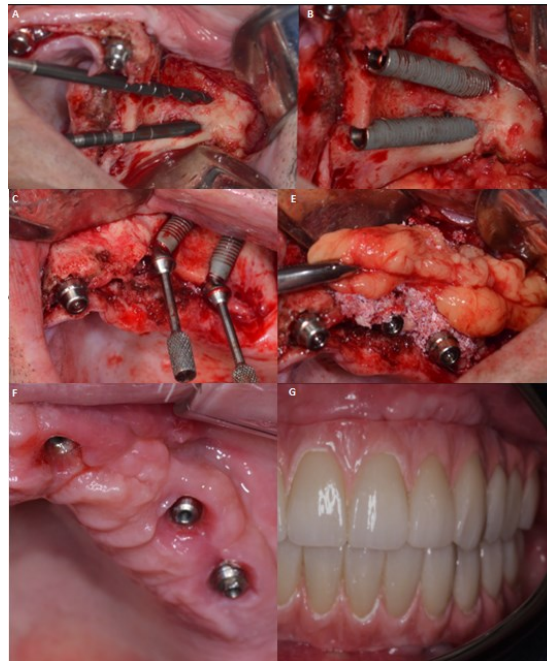


Figure 4: *A and B – Extrasinus approach, C – Abutment placement, D – BFP flap covering implants and graft, E – Control after 5 years, F- Prosthetic result.*

Results

In the period from May 2005 to January 2013, a total of 147 zygomatic implants were installed in 52 patients (Men = 22 and Women = 30) with mean age of 56,9 years old, were submitted to surgery of zygomatic implants. In 28 patients, two zygomatic implants were installed, one on each side and conventional implants in the anterior and maxillary tuberosity region. In 19 patients, four zygomatic implants were installed with two implants installed on each side. In 3 patients two zygomatic implants were installed in one side and 1 zygomatic implant in the other side. In all cases, the BFP flap technique was used to prevent complications such as: mucosal resection or fenestration and exposure of the implants or oroantral communication, depending on the positioning of these implants. The patients were followed annually in a minimum period of 5 the years and in 5 cases there was tissue retraction and exposure of the threads of an implant. (Table 1)

Table 1–Clinical Data of the Patients.

Patient number	Age	Sex	Number ZI	Length ZI (mm)	Follow-up (Mo)	Perimplant Soft tissue recession Score
1	50	M	2	35/40	173	I
2	55	M	2	45/50	170	I
3	75	M	4	30/30/30/30	166	I
4	50	F	2	35/30	162	I
5	69	M	2	40/40	161	I
6	54	M	4	45/50/40/42.5	160	I
7	51	M	4	50/50/ 42.5/45	158	I
8	54	M	2	35/40	158	I
9	68	M	2	42/47.5	151	I
10	69	F	2	45/47.5	151	I
11	54	M	4	45/50/35/40	146	I
12	55	F	2	45/50	140	I
13	58	F	2	40/42.5	126	I
14	55	F	2	45/45	108	I
15	62	M	2	45/45	105	I
16	53	M	2	40/40	101	I
17	63	M	4	55/55/35/35	96	I
18	71	M	2	55/55	96	I
19	52	F	2	40/45	96	I
20	56	F	2	42.5/45	95	II (Left)
21	57	F	2	35/35	93	I
22	48	M	2	45/45	84	II (Left)
23	51	F	2	40/40	84	I
24	76	F	2	40/40	84	II (Left)
25	35	F	2	40/42.5	78	I
26	62	M	4	55/55/35/40	72	I
27	67	F	2	55/50	72	I
28	58	F	4	60/60/40/35	72	I
29	53	F	3	55/55/45	72	I
30	74	F	4	55/55/40/40	72	I
31	58	M	4	55/55/40/45	72	I
32	57	M	4	60/60/45/45	72	II (Left)
33	51	M	4	60/60/45/45	72	I
34	66	F	4	55/55/40/40	72	I
35	53	F	2	40/42.5	71	I
36	59	F	4	50/50/ 42.5/45	71	I
37	64	F	2	47.5/50	65	I
38	56	M	4	42.5/45/50/50	63	I

39	48	F	2	55/55	60	I
40	71	F	2	55/55	60	I
41	52	F	4	55/55/40/40	60	I
42	67	F	2	55/55/40	60	I
43	65	F	4	60/60/45/45	60	I
44	49	F	4	60/60/40/40	60	I
45	63	F	4	60/60/45/45	60	I
46	62	F	4	60/60/35/35	60	I
47	62	M	4	55/55/40/40	60	II (Left)
48	49	M	2	60/60/40	60	I
49	70	F	4	60/60/35/40	60	I
50	49	F	2	45/50	60	I
51	65	M	2	52.5/50	60	I
52	67	F	2	45/50	60	I
	57,66		147			

Discussion

The zygomatic implant is part of a group of techniques that obtained good results in the complex maxillary cases. The rehabilitation of atrophic maxillae with this technique has been shown to be a reliable option, with high survival rates between 92.3% and 100%.³⁵ However many variables are included in the success of this therapy, including baseline, surgical and prostheses.³⁶⁻³⁹

The use of four implants has presented as a predictable resource in the treatment of critical cases with bone atrophy in the anterior region of the maxilla and also enables successful patient rehabilitation.^{31,40} However, biological complications, such as maxillary sinusitis and buccal mucosal recession, have been reported.³⁵

Initially, an important aspect cited by the literature in relation to the extrasinus technique was the long-term effect of the contact of the threads of the zygomatic implants with soft tissues.³⁰ The ZAGA concept proposes the use of zygomatic implants with the extramaxillary positioning to reduce postoperative complications such as maxillary sinusitis and enable better prosthetic rehabilitation.^{21,22} Although the extrasinus technique offers many advantages, there is a risk of peri-implant soft tissue recession with implant exposure.²⁰

The literature suggests using bone regeneration with biomaterials associated with zygomatic implants to reduce the risk of complications such as maxillary sinusitis and soft tissue recession, but there are no documented data available.⁴²

On the other hand the scientific literature has demonstrated the effectiveness of using the BFP flap in several situations in the treatment of complications, especially in oroantral communications and in the prevention of flap dehiscence.⁸⁻¹⁰

Others authors demonstrate the regenerative potential of adipose tissue due to its angiogenic capacity and have been also shown that BFP is a source of multipotent cells in a very similar way to adipose cells in other parts of the body.²³⁻²⁷ The immunomodulation generated by these cells is related to the ability to interfere in the inflammatory response of the reconstructed site stimulating the production of anti-inflammatory cytokines that favor the differentiation and migration of endothelial and mesenchymal cells compatible with the regenerative process of each region.²⁸

Hernandez- Alfaro et al²⁰ presented a result of 17.5% of soft tissue recession in their study in rehabilitations with 4 zygomatic implants. Contrasting with other authors who presented a high rate of complications from soft tissue recession.³⁸ In the present study, in a period of 5 to 13 years of follow-up, only 5 cases (3.4%) presented soft tissue recession with exposure of implant threads. It can be demonstrated the effectiveness of the technique's long-term in preserving soft tissue stability and in fact preventing complications of this type.

Another important aspect is that it is an easy-to-perform and minimally invasive technique, as the anatomical location of the BFP favors access during the surgical procedure with low risk of causing sequelae to the patient, as demonstrated in the literature.¹⁶⁻²⁰ However a limitation of the technique is related to the amount of adipose tissue present in the patient. Due to the fact that it reduces with age and in elderly patients, this amount may be insufficient to cover the implants.

Conclusions

Within the limitations of the work, it can be concluded that the use of the buccal fat pad (BFP) flap proved to be a simple and effective technique in the prevention of complications of soft tissue recession associated with the surgery of zygomatic implants installed with the extramaxillary technique.

Conflict of Interest

The authors declare no conflict of interest.

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