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Original Article

Surgical Outcomes of Buccal Fat Pad Flap for Oroantral Fistula Closure: A 6-Month Prospective Follow-Up Study

Fatima Zahra Amrani[1]*, Youssef Benali[1]

[1]Department of Oral and Dental Surgical Sciences, Faculty of Medicine and Dentistry, Mohammed V University, Rabat, Morocco.

***E-mail** ✉ fatima.amrani@gmail.com

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Abstract

Oroantral fistulas (OFs) are a difficult complication encountered in oral and maxillofacial surgery, typically requiring operative management to restore sinus integrity. The Bichat buccal fat pad (BFP) has emerged as a workable solution for sealing OF. The present investigation examined the effectiveness, safety profile, and therapeutic outcomes of BFP mobilization for OF repair. Twenty individuals presenting with OF were enrolled in this prospective study. The operative protocol consisted of dissecting free and sliding the BFP forward to bridge the defect. Follow-up evaluations were conducted at 7 days, 45 days, and 6 months after the operation, including both physical examination and image-based review. The main outcome measure was confirmed fistula sealing at the 6-month mark, and additional tracked endpoints covered adverse event frequency, sinus clouding on computed tomography, pain severity, and gains in everyday well-being. A total success proportion of 85.7% was recorded, with full fistula sealing observed across 18 of the 21 treated sites (including a single patient treated on both sides). Low-grade adverse events were documented in 14.3% of the cohort. Computed tomography at the half-year point revealed complete clearing of sinus clouding in 81% of individuals treated. Marked reductions in pain ratings and meaningful gains in well-being were self-reported. Advancing the BFP stands as a potent, well-tolerated, and tissue-sparing approach for closing OF, delivering elevated success proportions alongside encouraging clinical and imaging endpoints. The data substantiate the adoption of the BFP as a trustworthy alternative in the surgical armamentarium for the treatment of OF in oral and maxillofacial practice.

Keywords: Oroantral fistula, Bichat's buccal fat pad, Oral reconstructive surgery, Odontogenic sinusitis, Oro-sinus communication

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Introduction

Oroantral fistulas (OF) amount to a serious and frequently treatment-resistant problem stemming from oral and maxillofacial operative interventions, traumatic injuries, infectious processes, or neoplastic growths [1]. Documented occurrence rates span from 0.31% to 4.7% in the wake of tooth extractions performed in the back portion of the upper jaw; these anomalous passageways linking the mouth interior to the maxillary sinus introduce a formidable therapeutic hurdle and can precipitate severe ramifications for those affected, encompassing long-standing sinus inflammation, impairments in speech and food intake, and a pronounced deterioration in day-to-day well-being [2, 3].

Approaches to handling OF have long fueled discussion and scholarly inquiry within the discipline of oral and maxillofacial surgery. Achieving swift and definitive obliteration of these communications holds utmost priority in everyday practice to forestall adverse sequelae and optimize the patient's condition. Over decades, a wide spectrum of operative strategies has been proposed and implemented for OF closure, including the use of adjacent tissue flaps of varying

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dimensions, connective tissue transplants, and manufactured substances [4]. That said, presently adopted modalities carry a series of shortcomings that persistently test real-world practice:

- Inconsistent performance: While several methods can prove useful in select scenarios, they regularly exhibit uneven performance, rendering the achievement of foreseeable and uniformly trustworthy endpoints elusive.
- Surgical after-effects: infectious episodes, persistent passageways, or the demand for subsequent procedures persist as worries tied to multiple prevailing strategies.
- Considerable procedural burden on the patient: Certain modalities, for instance, those employing bone transplants or bulkier flaps, correlate with a heavier toll on the individual, covering sensory deficits, cosmetic detriments, and drawn-out convalescence.

Notwithstanding this assortment of options, pinpointing a strategy that effectively reconciles high success rates, low procedural burden, and stable, reliable endpoints remains an enduring challenge. While several methods can demonstrate effectiveness in isolated circumstances, their performance and potential side effects often complicate the

The intricacy of tackling OF increases further when maxillary sinus infection is frequently associated with these abnormal channels. This clinical picture epitomizes an overlapping disorder that regularly calls upon the expertise of both ear, nose, and throat specialists and dental surgeons, underscoring the cross-specialty nature of its care. The reciprocal influence between mouth-based and sinus-based disease processes demands a holistic mindset toward therapy.

In prior scholarly work originating from our investigative unit, we emphasized the pivotal role of an exacting diagnostic workup in formulating appropriate treatment plans for OF and co-occurring sinus disease. The data we gathered suggested that if the sinus affliction originates solely from a dental source, a single-specialty dental surgical procedure might be sufficient for treatment. In contrast, as is common, when the underlying condition is mixed in nature—arising from both nasal and dental origins—a dual-pronged strategy is necessary for its elimination, combining mouth-based and scope-guided nasal surgical steps [5-7]. This realization carries significant weight for how treatment is mapped out and underscores the necessity of an exhaustive diagnostic process when confronting such presentations.

Surgical closure remains the standard approach for treating oroantral fistulas (OF), employing an array of methods tailored to the dimensions, position, and complexity of the opening. The two principal operative routes are:

- Intraoral route: This constitutes the most frequently utilized method, entailing entry via the mouth interior. It provides multiple benefits, such as negligible external mark formation, straightforward access to the defect site, and greater patient comfort. Interventions such as rotating adjacent tissue flaps (e.g., buccal sliding flaps or palatal swing flaps) and the application of the patient's own tissues, including the Bichat buccal fat pad (BFP), are commonly performed through this route.
- Extraoral route: Under uncommon and intricate circumstances, particularly those entailing widespread facial injury or when concurrent access to additional facial anatomy is needed, an extraoral route might be contemplated. This entails entry through cuts placed along natural skin folds or pre-existing facial wounds, yet it carries a higher risk of scarring and postsurgical burden.

Among these choices, the intraoral route using the Bichat buccal fat pad has emerged as a favored alternative owing to its tissue-conserving properties, low adverse event rates, and adaptability across reconstructive contexts. The present study aims to further appraise the performance of this method, particularly for dental sealing.

In recent years, the Bichat buccal fat pad (BFP) has attracted increasing attention as a promising treatment option for sealing OF [8]. The BFP, an enveloped accumulation of richly perfused fatty tissue strategically situated within the masticatory compartment, lends itself well to mobilization to bridge oral cavity openings. Its structural and functional traits, including suppleness and abundant blood supply, position it as a prime candidate for reconstructive mouth operations, providing a sturdy barrier between the mouth and sinus environments [9]. Relying on the patient's own tissue in this fashion yields multiple benefits relative to manufactured substances or bulkier flap procedures, including reduced procedural burden, superior tissue incorporation, and potentially better long-term results.

Structural makeup and physiological roles of BFP

The Bichat body sits at a tactically important spot within the facial framework. It rests inside the masticatory compartment, bounded on the inner side by

the buccinator muscle and on the outer side by the chewing muscles, principally the masseter and internal pterygoid **(Figure 1)** [10].

The BFP possesses a lobular architecture that may vary in size across individuals [11, 12]; it largely consists of white fatty tissue, wrapped within a slender yet well-defined fibrous envelope. This wrapping is significant because it enables relatively straightforward operative handling and displacement of the adipose body as a single entity. The core mass of the adipose body issues four projections (buccal, pterygoid, superficial temporal, and deep temporal), which can be shifted to meet the specific needs of the rebuilding effort. Among these, the buccal projection is the largest in bulk and is ordinarily the segment tapped for mouth reconstructive operations [13]. The copious and overlapping circulatory inflow and outflow—supplied through the maxillary artery, the facial artery, the superficial temporal artery, the deep facial vein termination, and the pterygoid venous network—stands as vital for preserving the viability of the adipose body when it is deployed as a flap in rebuilding operations. It enables substantial tissue shifting without compromising blood supply, a trait that proves especially beneficial for managing OF [14]. Nerve supply to the BFP comes through offshoots of the trigeminal nerve, more precisely from its maxillary (V2) and mandibular (V3) portions. Notably, speculation has arisen about the presence of sympathetic nerve fibers within the BFP, which may regulate fat breakdown. Still, this facet of its nerve supply remains under further investigation for conclusive corroboration [15]. If confirmed, this finding could have consequences for understanding the metabolic activities of the BFP and its response to various physiological and disease states.

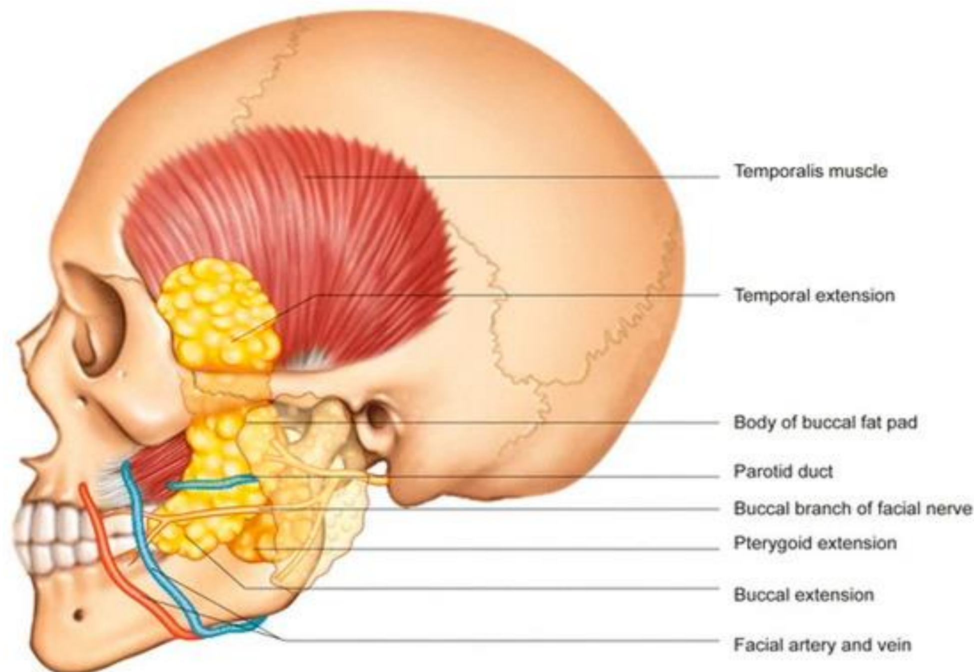


Figure 1. Structural positioning of the buccal fat pad, made up of a core mass and four projections: temporal, buccal, pterygoid, and pterygopalatine [16].

The BFP aids chewing and sucking by serving as a shock absorber, enabling the effortless sliding of the chewing musculature against one another and against the bony facial scaffold during these motions [17]. It additionally protects vital neurovascular structures in the facial territory, including the branches of the facial nerve and the parotid duct. This safeguarding role helps prevent potential physical harm to these essential elements during vigorous chewing motions [17].

Beyond its architectural and circulatory merits, the Bichat buccal fat pad (BFP) exhibits distinctive biological and cellular properties that significantly enhance its therapeutic potential. The tissue serves as a rich reservoir of mesenchymal stem cells (MSCs), which orchestrate anti-inflammatory responses, promote new vessel growth, and accelerate tissue repair, rendering the BFP an indispensable asset in regenerative therapeutics. Moreover, the BFP can be readily administered via the intraoral route, thereby reducing adverse events and preventing conspicuous marks, further bolstering its practicality in oral and maxillofacial surgery [18].

Investigations at the ultrastructural and cellular levels have revealed that the BFP houses a distinct subset of

MSCs, defined by their capacity to differentiate into multiple lineages and their resilience under stress. These traits underpin its outstanding restorative ability and its track record in regenerative and reconstructive therapeutics [19]. In addition, mesenchymal stem cells sourced from the BFP (BFP-ASCs) exhibit strong colony-forming capacity and bone-inducing properties, differentiating readily into bone-forming and fat-producing cell lines. When set side by side with adipose-derived stem cells (AdSCs) obtained from other body sites, BFP-ASCs display speedier multiplication, superior colony formation, and firm attachment to both biological and manufactured scaffolds, qualities that render them especially well-suited for bone restoration and the repair of periodontal defects [20, 21].

When viewed through a metabolic lens, the Bichat body constitutes a distinctive fat reservoir within the organism. In contrast to other adipose stores that are readily mobilized during energy shortages, BFP shows marked resistance to breakdown. Research indicates that it tends to retain its bulk even under severe dietary deprivation [8].

This trait is significant from both evolutionary and clinical standpoints. From an evolutionary perspective, it implies that BFP plays an essential role that is safeguarded even under hostile conditions. Clinically, this resistance to tissue wasting bolsters its reliability as a rebuilding material, as it is less likely to undergo significant shrinkage over time than alternative fat transplants. As a person matures, BFP undergoes shifts in mass and composition, yet it broadly maintains a meaningful presence across the lifespan. Certain investigators have proposed that BFP shapes facial features during growth, thereby contributing to the characteristic plumpness of the cheeks observed in young children [22]. This developmental dimension represents a key factor to weigh when employing BFP for rebuilding aims, especially among younger populations.

The robust blood supply and metabolic stability of the BFP, including its resistance to wasting under malnourishment, ensure its reliability for prolonged reconstructive use. These attributes have broadened its medical deployment well beyond the sealing of oroantral fistulas (OF) to include the reconstruction of soft-tissue defects, management of radiation-induced bone death, and even cosmetic interventions such as facial sculpting and volume enhancement [18, 19].

Scholarly work in recent years has sought to probe possible hormone-secreting roles of the BFP. Several investigations have shown that it may participate in the synthesis of adipokines, hormone-like agents secreted by adipose tissue. Yet, this facet of BFP activity remains at an initial inquiry stage and requires deeper exploration for full substantiation [23]. Should this be borne out, it could open new avenues for understanding the whole-body consequences of handling BFP during reconstructive operations.

Clinical relevance

The therapeutic uses of BFP have broadened markedly in recent times, demonstrating its adaptability across diverse operative disciplines. The twofold function of BFP in both rebuilding and cosmetic interventions highlights its value in contemporary oral and maxillofacial surgery. Its adaptability, paired with the comparatively low procedural burden associated with its use, has made it a progressively sought-after option among surgeons across a range of applications.

Within reconstructive surgery, it has secured uses in multiple domains:

- Sealing of oroantral and oronasal openings: The positioning of BFP and its ease of displacement render it a prime selection for blocking abnormal passages between the oral chamber and the maxillary sinus or nasal cavity. The timing of oroantral fistula (OF) repair is critical, typically performed within several weeks of the injury or tooth removal to ensure optimal healing and reduce the risk of adverse events. Operative closure should proceed once the acute inflammatory stage has resolved to reduce the risk of infection and promote better tissue fusion.
- Restoration of the orbital floor: In instances of orbital floor breaks, BFP can be employed to furnish support and plug deficits.
- Management of facial nerve palsy: The adipose body can be harnessed in select strategies directed at enhancing facial balance in those who have facial paralysis.
- Filling of soft tissue losses within the oral chamber: BFP can be used to fill voids left by tumor removal or injury [24].

In the particular setting of oral cavity defects, BFP has demonstrated special utility in:

- Closure of OF: Serving as the centerpiece of the present investigation, this use capitalizes on the nearness of BFP to the maxillary territory and its sturdy circulatory network.
- Boosting gingival bulk where recession has occurred: The adipose body can be employed to augment soft tissue in regions of gum recession, bettering both performance and appearance.

- Addressing radiation-induced bone death: In scenarios where radiotherapy has undermined local tissue vitality, the richly perfused BFP can be leveraged to bring healthy tissue into the compromised region [25].

The roles of BFP extend beyond reconstructive surgery into cosmetic surgery as well. Bichatomy, the selective excision of part of the Bichat body, has gained prominence as an intervention for facial reshaping. This method helps reduce cheek fullness, yielding a more chiseled facial profile. In the opposite direction, facial fat grafting using adipose tissue from the BFP has been used to correct facial hollows and uneven contours [26].

Operative considerations

The surgical methodology for reaching and employing BFP is a pivotal element in its effective deployment in rebuilding operations, particularly in managing OF. The most typical and favored way of reaching the BFP is via an intraoral route, generally by means of an upper vestibular cut. This route offers numerous notable benefits: minimal external marking, immediate access to the operative field, and patient comfort.

Although the intraoral route is the most common, circumstances arise in which an extraoral route may be required or preferable. Such instances are comparatively uncommon and generally encompass:

- Extensive injury to the face where intraoral entry is hindered.
- Scenarios demanding concurrent access to other facial architecture.
- Occasions where a greater amount of BFP must be shifted than can be conveniently reached via the intraoral path.

The extraoral route, when called for, is generally executed through already present facial wounds in trauma situations or through meticulously positioned cuts that track natural skin folds to keep conspicuous scarring to a minimum.

The comparatively modest risk associated with BFP operations, provided they are performed with sound technique, has markedly fueled their growing popularity within oral and maxillofacial surgery. The blend of adaptability, straightforward accessibility, and low procedural burden positions BFP as an appealing alternative for a range of reconstructive needs, particularly in the management of OF.

Study objectives

The overriding goal of this investigation centers on appraising how well Bichat's buccal fat pad (BFP) mobilization performs in securing total obliteration of odontogenic oroantral fistulas (OF). The targeted endpoints are as follows:

- Establishing the proportion of fistulas successfully sealed over a half-year surveillance period.
- Cataloging postsurgical untoward events by both their occurrence rate and degree of seriousness.
- Judging whether fistula repairs hold up durably over the long term.
- Contrasting BFP mobilization outcomes across the spectrum of OF triggers, spanning tooth removals, implant-related mishaps, and traumatic injuries.

By thoroughly evaluating these parameters, we aim to add weight to the growing body of evidence supporting the use of BFP in oral and maxillofacial reconstructive procedures. The insights we gather could have tangible consequences for bedside practice, potentially guiding therapeutic algorithms for OF and related pathologies.

Materials and Methods

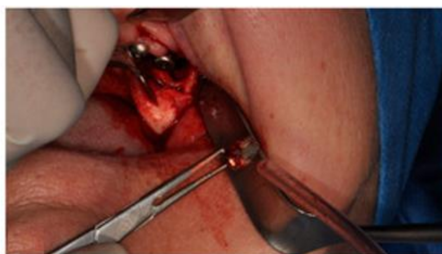
This forward-looking clinical series unfolded between January 2021 and January 2024 at the Unit of Oral Pathology and Medicine and Odontostomatological Diagnostics, Section of Clinical Dentistry, Department of Neurosciences, University of Padova, Padova, Italy. Twenty-one participants were ultimately brought on board according to the entry prerequisites and disqualification factors listed hereafter.

To meet enrollment thresholds, candidates needed to be 18 years of age or older, present with an odontogenic oroantral fistula (OF) corroborated by both bedside findings and imaging, and be able to provide informed consent and comply with follow-up schedules. Grounds for exclusion comprised the presence of a malignant process in the maxillofacial sphere, prior therapeutic irradiation targeting the head and neck, systemic disorders that were poorly governed, ongoing pregnancy or breastfeeding, earlier surgical attempts at fistula repair that had fallen short, and fistulas traceable to non-dental causes.

Each participant underwent an in-depth diagnostic sequence, including meticulous inspection of the inside and outside of the oral cavity, direct visualization and instrumental probing of the fistula, and assessment for facial lopsidedness or puffiness. Execution of the Valsalva maneuver confirmed that a patent conduit linked the oral environment to the sinus interior. Imaging investigations included orthopantomography (OPG) and computed tomography (CT) of the maxilla and paranasal air spaces, with both spiral and cone beam CT deemed admissible. The image datasets were scrutinized in sagittal, axial, and coronal

reconstructions. Whenever radiographic indications remained equivocal, ear-nose-throat specialist input, paired with nasal endoscopic visualization, was sought to exclude nasal-derived contributing factors.

A single oral surgeon, whose experience surpassed ten years of executing multifaceted oral procedures, carried out every operation. This consistency ensured uniformity in operative execution across the entire case roster. The operative intervention took place under regional anesthetic bolstered by conscious sedation, deploying articaine formulated with 1:100,000 epinephrine as the numbing agent. Prophylactic antibiotic administration—amoxicillin-clavulanic acid (2 g)—was delivered via the oral route one hour ahead of incision, and a 0.12% chlorhexidine oral rinse was applied in the moments right before commencement. An entry cut was fashioned inside the vestibular region of the upper cheek fold, spanning from the canine tooth zone to the first molar territory. The soft-tissue and periosteal covering was lifted free, exposing the lateral maxillary wall and the site of the defect. Any lingering debris attributable to dental inflammatory pathology was painstakingly cleared, and the fistula periphery was freshened back to ensure well-vascularized tissue rims. Exploration of the maxillary sinus proceeded via the fistulous opening, with hypertrophic mucosa or extraneous material extracted delicately so as not to breach the Schneiderian lining. The Bichat fat pad (BFP) was located posterior to the maxillary buttress; it was freed by gentle blunt dissection and drawn forward to blanket the defect. Sutures of resorbable material (4-0 Vicryl) anchored the BFP firmly, after which the mucosal-periosteal flap was returned to its native orientation and stitched down to produce a hermetically sealed closure **(Figure 2).**



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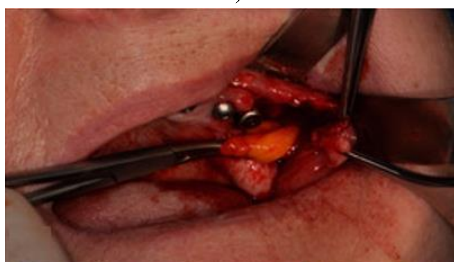

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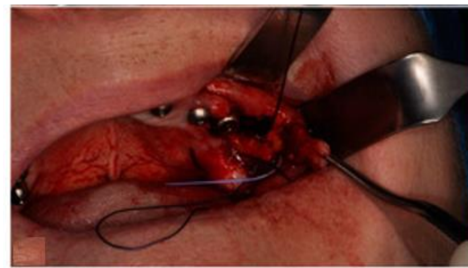

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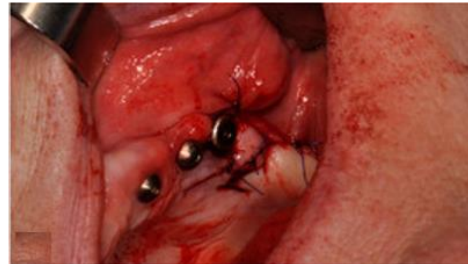

d)

Figure 2. Stepwise intraoperative depiction of oroantral fistula obliteration employing the buccal fat pad: (a) Retrieval of the dental implant from within the maxillary sinus; (b) freeing and advancing the buccal fat pad; (c) fixation of the buccal fat pad with 3-0 Vicryl sutures; (d) terminal suturing of the oral lining yielding total graft coverage.

To offset potential facial contour imbalance following buccal fat pad (BFP) removal, targeted intraoperative precautions were implemented. The volume of adipose tissue freed and advanced was deliberately constrained to limit tissue loss. Where an appreciable imbalance was foreseen due to substantial tissue shifting, the surgeon weighed the merits of compensatory strategies, such as re-equilibration via autologous fat grafting or other reconstructive fallback options [27].

Postoperative management adhered to a uniform protocol: participants were dispensed amoxicillin-clavulanic acid (875/125 mg twice daily over 7 days), ibuprofen (600 mg at 8-hour intervals on a pro re nata basis), and chlorhexidine oral rinses (0.12%, twice daily spanning 14 days). Nasal decongestant drops were ordered for 5 days, and a soft-consistency diet was advised for 2 weeks. Participants were additionally instructed to abstain from forceful nasal expiration, to sneeze without sealing the lips, and to eschew generating subatmospheric pressure within the oral chamber for a full 14 days. Return clinic visits were slated at the 7-day, 45-day, and 6-month marks following surgery, during which bedside appraisals were performed; a Valsalva challenge was administered at the 45-day visit to probe for any lingering oro-antral patency. At the half-year milestone, a CT scan was obtained to survey the status

of the maxillary sinus, the durability of fistula obliteration, and any stigmata of residual or recrudescent sinus inflammation.

All participants were likewise monitored for telltale signs of facial contour asymmetry at the 7-day, 45-day, and 6-month postoperative checks. Photographic records, coupled with clinical assessments, were used to track any shifts in facial architecture. Within the scope of the current investigation, no participant required a secondary corrective intervention to address facial imbalance, as the amount of fat pad shifted remained below thresholds that might compromise facial appearance.

Descriptive statistics were used to summarize the demographic and clinical attributes of the cohort, including age, sex, fistula causation, chronicity, and dimensions. The treatment success ratio was computed as the percentage of instances demonstrating total fistula obliteration at the 6-month endpoint. Chi-square testing was applied to probe for relationships linking treatment success to variables such as fistula diameter (< 5 mm, 5–10 mm, and > 10 mm), preoperative chronicity (1 to < 4 weeks, 1 to < 2 months, 2 to < 4 months, and 4 to 8 months), and underlying cause (dental extractions, implant displacement, and tooth/root displacement). Pain severity and well-being indices were captured using Visual Analog Scales (VAS) at four time points (preoperative baseline, 7 days, 45 days, and 6 months post-surgery). Paired t-tests were leveraged to evaluate temporal shifts across these measurement points. All statistical analyses were conducted using SPSS version 25.0, and p-values < 0.05 were considered statistically significant.

Results and Discussion

Cohort demographics and baseline characteristics

The investigation enrolled 20 individuals (12 males, 60%; 8 females, 40%). Participants' ages averaged 47 years (standard deviation ± 7 years). A single individual exhibited oroantral fistulas (OF) affecting both sides, which lifted the cumulative count of operative procedures to twenty-one **(Table 1).**

Table 1. Gender-stratified age distribution across the study population.

Gender	Patient count (%)	Average age (Years ± SD)	Age span (Years)
Male	12 (60%)	49 ± 5	40–58
Female	8 (40%)	44 ± 7	34–52
Overall	20 (100%)	47 ± 7	34–58

Causative mechanisms behind fistula formation were distributed in the following manner:

- Fifteen presentations (71.4%) could be traced back to dental extraction procedures.
- Three presentations (14.3%) were consequent to endosseous implant hardware dislodging into the maxillary sinus cavity.
- Three presentations (14.3%) followed the slippage of either a whole tooth or root fragment into the maxillary sinus space.

Fistulas had been present for a mean interval of 3.2 months before operative correction (extremes spanning a fortnight to eight months). Statistical testing detected no meaningful linkage between the length of preoperative fistula persistence and eventual closure success (P = 0.178). Defects that had persisted for widely divergent time frames all yielded high closure percentages, suggesting that BFP-based repair retains its effectiveness across the full spectrum of fistula chronicity **(Table 2).**

Table 2. Temporal intervals elapsing before surgical fistula repair.

Fistula duration	Case count (n)	Proportion (%)
1 to < 4 weeks	5	23.8
1 month to < 2 months	7	33.3
2 months to < 4 months	6	28.6
4 months to 8 months	3	14.3

Operative findings

Eighteen of the twenty-one surgical undertakings (85.7%) culminated in effective fistula obliteration accompanied by clearance of sinus inflammatory disease. Procedures consumed a mean of 45 minutes of operating theatre time (extremes: 30–70 minutes). A dedicated exploration of how fistula dimensions related to operative duration was not pursued. However, procedural uniformity was bolstered by the fact that a single, highly experienced oral surgeon performed all surgeries. This arrangement ensured the stability of the operative method and the reproducibility of endpoints across the entire case roster **(Table 3)**.

Table 3. Operative time is bracketed into predefined temporal categories.

Time range (Minutes)	Case frequency (n)	Percentage (%)
30–39	6	28.6
40–49	10	47.6
50–59	3	14.3
60–69	2	9.5

Etiological subgroups and corresponding therapeutic endpoints

Closure success diverged when the data were stratified according to the originating pathological process:

- Dental extractions: Twelve out of fifteen cases (80%) progressed to total defect sealing.
- Endosseous implant migration: three out of three cases (100%) progressed to total defect sealing.
- Tooth or root fragment migration: three out of three cases (100%) progressed to total defect sealing.

One presentation (4.8%) concerned a 52-year-old male subject whose OF did seal satisfactorily, but in whom persistent fluid retention within the sinus persisted at the half-year assessment milestone. This individual was subsequently booked for functional endoscopic sinus surgery (FESS) directed at remedying the leftover pathological burden **(Table 4)**.

Table 4. Success rates analyzed by fistula etiology.

Etiology of fistula	Case count (n)	Successful cases	Success percentage (%)
Tooth extraction	15	12	80
Endosseous implant migration	3	3	100
Tooth or root migration	3	3	100
Overall	21	18	85.7

Taken together, these patterns suggest that the BFP approach is a capable means of closing fistulas. However, lower success rates were observed in the dental extraction subgroup, a finding that may reflect more protracted disease duration or more extensive structural deficits.

Effect of defect diameter on closure success

The full set of fistulas was allocated to one of three-dimensional categories:

- Less than 5 mm in diameter
- Within the 5 mm to 10 mm band
- Exceeding 10 mm in diameter

Closure success was more frequent among defects in the smallest dimensional bracket (< 5 mm). Chi-square analysis revealed a statistically significant association between defect dimensions and therapeutic success ($P = 0.032$), with smaller-diameter communications demonstrating a stronger association with achieving total obliteration **(Table 5).**

Table 5. Therapeutic outcome juxtaposed against the fistula dimensional category.

Fistula size (mm)	Number of cases (n)	Successful closures	Unsuccessful closures	Success rate (%)
< 5	8	8	0	100
5–10	9	7	2	77.8
> 10	4	3	1	75.0
Total	21	18	3	85.7

Untoward sequelae

Mild treatment-related sequelae were encountered across three instances (14.3%):

- Self-limiting distension of the cheek that stretched beyond the fourteen-day mark in two instances (9.5%).
- Modest restriction of jaw opening that resolved within three weeks in one instance (4.8%).

The series recorded no occurrences of serious adverse sequelae—including insult to the facial nerve trunk or branches, clinically meaningful aesthetic compromise, or infectious morbidity.

Subjective endpoints elicited from participants

- 85% of the cohort recounted minimal-to-negligible discomfort once the initial seven-day postoperative window had elapsed.
- 90% registered high or very high contentment with the intervention when surveyed at the six-month milestone.
- 95% attested to a meaningful upgrade in day-to-day well-being measured against their preoperative baseline state.

Discomfort ratings, captured on a numerical scale, decreased from a mean of 6.2 before surgery to 1.8 at the one-week assessment, and then further to 0.5 by the forty-five-day follow-up.

Radiological correlates

Computed tomography datasets acquired at the six-month postoperative time point demonstrated:

- Total clearance of previously observed sinus haziness throughout seventeen cases (81%).
- Partial restitution of sinus pneumatization throughout three cases (14.3%).
- Unresolved sinus haziness remaining evident in a single case (4.8%). The affected participant ultimately underwent FESS.

Illustrative complex presentation

A 56-year-old female whose past medical history was notable for skeletal metastatic deposits secondary to

mammary carcinoma—managed with denosumab administered at escalated dosage—evolved bilateral stage 3 medication-related jaw osteonecrosis (MRONJ) following removal of the first and second maxillary premolars on both the right and left sides. This pathological cascade led to bilateral oroantral fistulas, which were initially approached via BFP repair. Notwithstanding an initial appearance of closure, fistulous recanalization materialized alongside recrudescent sinus infection. Disease resolution ultimately required an intensified, multimodal regimen combining ozonized gel preparations, antimicrobial pharmacotherapy, and hyperbaric oxygen therapy. This case vividly illustrates the compounded difficulty of fistula management when serious comorbid disease processes are operant and underscores the indispensability of tailored, individualized treatment strategies in such contexts.

Serial pain and quality-of-life metrics

A pronounced and sustained downward trajectory characterized the pain scores recorded across evaluation points, with the mean declining from 6.2 at preoperative sampling to 0.5 at the 45-day postoperative revisit ($p < 0.001$). Quality-of-life metrics traced a parallel upward trajectory, ascending from a mean of 4.0 before surgery to a mean of 9.0 at the six-month evaluation juncture ($P < 0.001$) **(Tables 6 and 7).**

Table 6. Serial pain score recordings across all assessment time points.

Time point	Average pain score ± SD	P-value
Preoperative	6.2 ± 1.3	–
7 days postoperatively	1.8 ± 0.9	< 0.001
45 days postoperatively	0.5 ± 0.7	< 0.001
6 months postoperatively	0.1 ± 0.3	< 0.001

Table 7. Serial quality-of-life score recordings across all assessment time points.

Assessment time point	Mean QoL score ± SD	P-value
Preoperative	4.0 ± 1.5	–
7 days postoperatively	6.2 ± 1.3	< 0.001
45 days postoperatively	7.8 ± 1.0	< 0.001
6 months postoperatively	9.0 ± 0.8	< 0.001

Statistical treatment of data

Chi-square analyses confirmed that fistula dimensions and therapeutic success are statistically robustly related ($P = 0.032$). In contradistinction, neither the duration of fistula persistence before repair ($P = 0.178$) nor the underlying etiological category ($P > 0.05$) displayed a meaningful influence on closure success. Paired t-test computations affirmed that the magnitude of improvement registered in both pain and quality-of-life domains—from the preoperative reference point through to the closing follow-up at half a year—carried strong statistical significance ($P < 0.001$ for each comparison).

Securing effective OF repair while safeguarding native architecture and physiological performance remains a clinical conundrum [28]. The data we present demonstrate that deploying BFP for obliteration yields remarkably strong outcomes, reflected in an 85.7% overall success proportion. This figure carries particular weight when set against the heterogeneous origins of the fistulas treated, spanning routine dental extractions, implant-related mishaps, and tooth or root fragment displacement. Defects in the smallest dimension (< 5 mm) uniformly achieved closure (100%), whereas broader dimensions showed progressively diminishing success (5–10 mm at 77.8% and > 10 mm at 75.0%), underscoring fistula diameter as a meaningful prognostic determinant. Operative sessions employing the BFP method averaged 45 minutes, with 76.2% of cases completed within the 30–49-minute range. This procedural brevity, paired with the feasibility of performing the repair under local anesthetic supplemented by conscious sedation, works to curtail both patient burden and healthcare expenditure [29].

That said, it stands to reason that defects of smaller dimensions might translate into shorter procedure times, as they may require less dissection and tissue displacement. Future investigations, drawing on expanded sample sizes, could fruitfully probe this potential interrelationship. The BFP approach combines efficiency with broad applicability across diverse patient cohorts. Operative access may be gained through either intraoral or extraoral pathways.

Though the intraoral corridor remains the predominant choice, clinical scenarios exist in which an extraoral entry is either necessary or strategically preferable. Whichever route the surgeon elects, meticulous operative execution is paramount to keeping untoward events to a minimum. Among the principal technical considerations are the following:

- Atraumatic manipulation of BFP: The adipose body should be handled with delicacy to forestall breaching its enveloping capsule. This misstep could result in fat herniation and undermine its suitability as grafting material.

- Salvaging vascular inflow: Notwithstanding the inherently generous circulatory network of the BFP, deliberate measures ought to be taken to safeguard the maximal extent of its feeding pedicle, thereby bolstering graft viability.
- Sufficient but judicious advancement: The BFP must be freed and advanced amply to permit tension-free draping across the defect, yet excessively vigorous mobilization should be steered clear of to avert compromising the blood supply.
- Secure anchorage: Dependable fixation of the BFP in its repositioned location is vital for graft incorporation and fistula sealing. The reepithelialization sequence the BFP undergoes is fundamental to its seamless integration and healing trajectory. The fat pad should be seated within the defect and stabilized beneath the mucosal layer using absorbable suture material (4-0 Vicryl). While the overlying oral lining receives primary closure, the BFP undergoes secondary reepithelialization. This tactic permits the fat pad to meld with the adjacent tissue bed and fosters physiologic restoration over time. Secondary reepithelialization also ensures that the graft does not form a purely mechanical barrier, instead encouraging a more natural pattern of mucosal renewal.

Operative misadventures of which the surgical team should retain awareness encompass the following:

- Inadvertent damage to the parotid excretory channel: The parotid duct traverses anatomy intimately related to the BFP, and deliberate caution is warranted to sidestep injuring it throughout the dissection.
- Insult to facial nerve branches: Although seldom encountered during the intraoral route, a working familiarity with the trajectory of the facial nerve is prudent, should an extraoral corridor be contemplated [30].
- Facial contour imbalance: Overly zealous resection or substantial displacement of the BFP carries the potential to engender perceptible facial lopsidedness, a concern especially germane in procedures with an aesthetic dimension.
- Restricted mouth opening: A transient curtailment of mandibular excursion may arise as a consequence of postsurgical soft-tissue swelling or cicatricial contracture.
- Bleeding or infectious complications: As holds for any operative venture, the possibility of postoperative hemorrhagic or septic sequelae persists [31].

The innate structural attributes of the BFP, encompassing its dense vascular arborization and supple texture, are instrumental to its therapeutic performance. Its ready mobilizability and the capacity to drape defects with the patient's own tissue help diminish immune rejection risks and foster superior biological integration. Published contributions, exemplified by the work of Favero *et al*. [18], highlight the role of the BFP within the reconstructive armamentarium, particularly in regenerative therapeutics and oral surgical practice [32-34].

The paucity of untoward events recorded in our series is an additional asset, with the sole issues encountered being self-limited—provisional swelling and modest trismus—neither of which detracted from the overall therapeutic success. The complete absence of consequential adverse occurrences buttresses the safety credentials of this operative strategy. The BFP proves especially valuable in complex scenarios, where its use is best reserved to safeguard its future availability for increasingly demanding reconstructive challenges. It likewise demonstrated efficacy in reducing patient-reported discomfort and elevating perceived well-being, culminating in a 90% satisfaction rate at the six-month evaluation.

Subjective endpoints gathered from participants indicate a striking improvement in day-to-day well-being, with the mean score rising from a preoperative value of 4.0 ± 1.5 to 9.0 ± 0.8 at the half-year mark. These findings echo earlier investigations that have spotlighted the dividends of curtailing postoperative morbidity. Even so, the BFP should be reserved for complex or recidivistic presentations, so that it remains an available fallback when alternative techniques have proven insufficient. It supplies a richly perfused secondary tissue plane conducive to successful rebuilding, as documented by Temistocle *et al*. [35] in a formidable instance marked by multiple antecedent failed closure attempts.

Computed tomographic imaging occupied an indispensable niche within our diagnostic algorithm. The scans yielded granular intelligence on:

- The precise spatial coordinates and dimensions of the fistulous communication.
- The state of the maxillary sinus proper, encompassing any telltale signs of sinus inflammatory disease or lining hypertrophy.
- The existence of any extraneous material lodged within the sinus cavity (such as displaced implant hardware and apical root remnants).

- Structural variants with the potential to impinge upon therapeutic strategizing or the chosen operative corridor.

Particular scrutiny was directed at the coronal image reconstructions to pinpoint any gross anatomical obstacles impeding sinus aeration, among them:

- Concha bullosa
- Clinically meaningful deflection of the nasal septum
- Paradoxically oriented turbinates

Imaging outcomes captured at the half-year juncture documented complete clearing of sinus haziness in 81% of the treated cohort, further bolstering the BFP's capacity to address both the fistulous defect itself and any concurrent sinus pathology. The presentation involving a patient who developed medication-related jaw osteonecrosis serves to foreground how vital it is to weigh patient-specific variables during therapeutic decision-making, most pointedly in those individuals who are shouldering substantial comorbid disease burdens [36].

Given that the overwhelming majority of procedures were performed on one side only, deliberate intraoperative measures were taken to prevent soft-tissue bulk depletion. Throughout the process of freeing and advancing the BFP, solely the volume deemed indispensable for draping the oroantral fistula (OF) opening was drawn forward, thereby husbanding within the cheek as great a portion of the adipose body as feasible. This tactic was deliberately pursued to maintain facial balance and reduce the risk of clinically evident contour alteration.

The repair's enduring sturdiness offers grounds for optimism, though corroborative investigations beyond the six-month observation window are required to substantiate long-term durability. While the sample in our study is modest in scale, broader, multi-institutional trials would corroborate the trends we report and help parse which subgroups might derive the greatest advantage. The forthcoming inquiry might also assess the performance of the BFP in fistulas not of dental origin, such as those resulting from traumatic injury or ablative tumor surgery.

In summary, the data we present lend weight to the BFP approach as a capable, well-tolerated, and tissue-sparing alternative for the obliteration of odontogenic OF. The elevated closure rate, low adverse-event incidence, and favorable patient-reported outcomes position it as a compelling choice for oral and maxillofacial surgeons treating this pathological entity.

Salient assets of the BFP methodology:

- Elevated closure proportion (85.7%) for fistula obliteration;
- Potent in remedying concomitant sinus pathology;
- Negligible postsurgical untoward events;
- Marked enhancement in patient-perceived well-being;
- Suited to a spectrum of fistula calibers and causative mechanisms;
- Comparatively abbreviated procedural duration, compatible with regional anesthetic delivery.

Ramifications for everyday practice:

- The BFP warrants strong consideration for odontogenic OF, above all, when bulkier flap undertakings are less than optimal.
- Its feasibility under regional anesthesia broadens patient eligibility, embracing those for whom general anesthesia is inadvisable.
- The restrained adverse-event profile and salutary patient-reported endpoints hold the potential to elevate satisfaction levels while trimming healthcare outlays.
- The dual capacity of the BFP to address both the fistulous tract and sinus pathology may curtail the necessity for additional sinus-targeted interventions.

Shortcomings of the present work and avenues for subsequent inquiry:

- Investigations with extended observation periods are called for to gauge repair longevity and to detect any late-emerging complications.
- Larger, multi-institutional trials would lend weight to the corroboration of the present data and permit exploration of endpoint divergence across heterogeneous populations.
- Subsequent research ought to put the BFP technique to the test in non-odontogenic fistula contexts and to weigh it against alternative, time-honored closure modalities.
- Scrutiny of operative refinements—such as the incorporation of supplementary materials or adaptations in flap configuration—may yield incremental gains in therapeutic endpoints.

Conclusion

The BFP mobilization method stands as an asset within the therapeutic repertoire for odontogenic OF, with pronounced effectiveness, a benign safety profile, and tissue-sparing execution. With an 85.7% closure success rate, it has proven to be a trustworthy resource for managing fistulas arising from diverse etiologies and spanning a range of sizes, with utility extending

even into complex or recidivistic scenarios. The merits of this technique—among them a relatively compact operative timeframe and the practicality of delivery under regional anesthesia—magnify its reach while lessening the procedural toll on patients. The results of this study highlight the potential for broader adoption of the BFP-based approach, especially in situations where first-line closure strategies fall short or carry contraindications. Beyond this, the enhancements documented in patient-reported metrics, including alleviation of pain and increased day-to-day well-being, underscore its constructive impact on clinical care.

That said, the present study also highlights the pressing need for continued investigative effort. Head-to-head comparative trials pitting this technique against other entrenched methods are indispensable to delineate the superior therapeutic pathway for OF management. Concurrently, deeper probing into the regenerative capabilities of the BFP, paired with incremental refinement of operative technique, is poised to reveal novel applications in oral and maxillofacial reconstruction. Through sustained commitment to refining and broadening the deployment of this approach, the field can advance toward the overarching ambition of furnishing effective, patient-anchored care that harmonizes functional restoration with aesthetic preservation while simultaneously reducing complication rates and the economic footprint of treatment.

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