

Buccal Fat Pad Flap and Buccal Advancement Flap for Closure of Oroantral Fistula: A Systematic Review and a Case Report

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Abstract

Purpose: This study aimed to evaluate the success rates of two surgical techniques used for the closure of the oroantral fistula.

Materials and Methods: A systematic review was conducted following the PRISMA guidelines. Relevant studies were identified from electronic databases (PubMed, LILACS, Semantic Scholar, Cochrane Library, Rutgers University Library, and Europe PMC) from 1959 to 2021. The inclusion criteria were recent studies in English, studies involving human subjects, and studies comparing the buccal fat pad (BFP) and buccal advancement flap (BAF) techniques.

A total of 1455 records were initially identified. After screening, only 4 studies were included in the final analysis: 1 retrospective study and 3 comparative studies.

Results: The pooled relative risk (RR) indicated a significant difference, with the Buccal Advancement Flap showing a slightly lower probability of success compared to the Buccal Fat Pad Flap for oroantral fistula closure (RR 0.914, 95% CI: 0.836 - 0.998). No heterogeneity was detected among the included studies ($I^2 = 0.0\%$, $P = 0.452$).

Conclusion: Both techniques are safe and simple and demonstrate high success rates. The BFP technique is particularly advantageous for closing oroantral fistulas larger than 5 mm when preserving the depth of the vestibular sulcus is required or in cases where the BAF technique has failed.

Keywords: Agenesis; Oroantral fistula; Buccal fat pad (BFP)

Introduction

Oroantral communications (OACs) can occasionally occur during oral and maxillofacial surgery. While OACs smaller than 2 mm in diameter often close spontaneously, defects more significant than 3 mm, particularly in the presence of inflammation in the antrum or periodontal region, frequently persist and necessitate surgical intervention for closure. (1,2) Timely closure of OACs, ideally within 24 to 48 hours, is recommended to reduce the risk of maxillary sinusitis and prevent the development of a fistula. (3).

Oroantral fistula (OAF) refers to a persistent epithelialized communication between the oral cavity and the maxillary sinus, most commonly resulting from the extraction of upper molars, with an incidence ranging between 0.31% and 4.7%. Other etiological factors include cysts, tumors, trauma, osteonecrosis, implant failure, dehiscence following procedures in the atrophied posterior maxilla, and other pathological conditions. (4,5). Various surgical techniques for OAC repair have been documented. According to Visscher's classification (6), these methods are grouped into the following categories: autogenous soft tissue grafts, autogenous bone grafts, allogeneous materials, xenografts, synthetic/metal closure, and other techniques. In 2018, Parvini et al. added new techniques to this classification (7,8).

The buccal advancement flap (BAF), the Rehrmann flap, is the most commonly used technique for closing minor OAFs. Its widespread use is due to its reliable blood supply, simplicity, versatility, and high success rate. (9,10).

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Another frequently used technique for OAF closure is the buccal fat pad (BFP) flap. The BFP, first identified by Heister in 1732 as the “molar gland”¹⁰, was later described in detail by Bichat in 1801 as an adipose structure and has since been referred to as “Bichat’s fat pad.” (11,12).

Egyedi first described the use of the BFP for the closure of medium-sized OAFs in 1977, citing its advantages, including a simple surgical procedure, high success rate, good mobility, favorable epithelialization, potential stem cell reservoir, and rich vascular supply. The BFP receives blood flow from multiple sources: the buccal and deep temporal branches of the maxillary artery, transverse facial branches of the superficial temporal artery, and small branches of the facial artery (1,7,14,15).

Materials And Methods

Focused question

The study aims to answer the question, “Which technique between Buccal Fat Pad Flap and Buccal Advancement Flap is best for closing the Oroantral Fistula?”

Methodology

This systematic review was conducted according to the PRISMA Statement (16).

Literature search strategies

The study’s strategy involves searching the following electronic databases: PubMed, LILACS, Semantic Scholar, Cochrane Library, Rutgers University Library, and Europe PMC, using keywords contained in Table 1. Research Algorithms.

At first, all publications from 1959 to 2021 were included. After the removal of duplicates, 1455 records were identified. After the application of inclusion/exclusion criteria, 4 studies were included in the review (Fig. 1. PRISMA flowchart. Flow diagram of study Inclusion).

Inclusion criteria

The studies included in this review adhered to the criteria established by the PICO framework. This

encompassed (P) Population: patients with oroantral fistulae, without age restrictions; (I) Intervention: closure of oroantral fistulae; (C) Comparison: between Buccal Fat Pad and Buccal Advancement Flap techniques; and (O) Outcomes: success rates for the closure of oroantral fistulae using the different approaches (17).

Additional inclusion criteria were studies published in English, recent publications within the last five years, and a minimum follow-up period of two months, during which the absence of oroantral communication recurrence could be considered indicative of a successful closure (18).

Exclusion criteria

The exclusion criteria were animal studies, case reports, and articles that did not present relevant data for this study.

Data extraction

The following data were extracted from each study: authors, year of publication, study title, study design, average patient age, male-to-female ratio, number of patients, range of oroantral defect size, study protocol, follow-up duration, and success rate (refer to Table 2 for general data collected from the studies).

Risk of bias

The selected articles were critically assessed based on the following criteria: randomization in population selection, clearly defined inclusion and exclusion criteria, detailed description of the surgical technique, information regarding the use of medications, and the thoroughness of statistical analysis.

Quality assessment

All potential biases were evaluated for each study included in the review.

Criteria were marked as follows:

- “Yes” if the criterion was present
- “No” if the criterion was absent

The validity of the studies was assessed and classified:

Table 1. Research Algorithms

Database	Web Address	Algorithm
Pubmed	https://pubmed.ncbi.nlm.nih.gov/	[(oroantral) OR (oroantral communication) OR (oroantral fstula) OR (orosinusal) OR (oro-sinusal) OR (OAF)]
LILACS	https://lilacs.bvsalud.org/en/	Title, abstract, subject; [((oroantral) OR (oro-antral) OR (orosinusal) OR (oro-sinusal) OR (OAF)) AND ((communication) OR (fstula))]
Semantic Scholar	https://www.semanticscholar.org/	[(oroantral) OR (oro-antral) OR (orosinusal) OR (oro-sinusal) OR (OAF)] AND (communication) OR (fstula)
Cochrane Library	https://www.cochranelibrary.com/	[(oroantral) OR (oroantral communication) OR (oroantral fstula) OR (orosinusal) OR (oro-sinusal) OR (OAF)]
Rutgers University Library	https://www.libraries.rutgers.edu/	(oroantral OR oroantral communication OR oroantral fstula OR oro-antral OR orosinusal OR oro-sinusal OR OAF)
Europe PMC	https://europepmc.org/	[((oroantral) OR (oro-antral) OR (orosinusal) OR (oro-sinusal)) AND ((communication) AND (fstula))]

At first, all publications from 1959 to 2021 were included. After the removal of duplicates, 1455 records were identified. After the application of inclusion/exclusion criteria, 4 studies were included in the review (Fig. 1. PRISMA flowchart. Flow diagram of study Inclusion).

Table 2. General Data Collected from the study

Author	Title	Study Design	N° of partici- pant	Male/Female	Age/Range (Years)	Inclusion/Exclusion criteria	Size of oroantral defect (range)	Success Rate
Gheisari et al ¹⁸ (2019)	Oro-antral fistula repair with different surgical methods: a retrospective analysis of 147 cases	Retrospective Study	147	116 Males and 31 Females - BFPF: 42 Males and 18 Females - BAF: 55 Males and 4 Females - PF: 19 Males and 9 Females	Range from 17 to 75 Mean age 41	NOT MENTIONED Note - "All patients undergone surgery during the past ten years by an experienced surgeon to repair communication..." 2009–2019	Range from 5 mm to 10 mm	BFPF: 98,3% BAF: 89,8% PF: 85,7%
Bhatt et al ¹⁹ (2018)	Comparison between pedicled buccal fat pad flap and buccal advancement flap for closure of oroantral communication	Comparative Study	20	NOT MENTIONED - BFP: 11 patients - BAF: 9 patients	Range from 35 to 75	Inclusion: - Patients free of any systemic disease - No special consideration was given to any particular socio-economic group, age and sex - Patients with OAC following the extraction of the maxillary antral teeth, sinus lift procedure, while harvesting tuberosity bone graft & OAF were selected for the study. - Patient who understood the nature of the study and who were willing for regular follow up were selected. Exclusion: - OAC/F occurring due to the destruction of the floor of the antrum secondary to the pre existing infections - Patients had the preexisting antral pathology were not selected.	Range from 3 mm to > 10 mm - BFP >3 mm (6 patients) 6–10 mm (1 patient) - BAF >3 mm (6 patients) 6–10 mm (1 patient) 10 mm (2 patients)	BFP: 100% BAF: 78%

To be continued

Rashid et al ²⁰ (2018)	Closure of oroantral fistula comparison of buccal advancement flap and buccal fat pad	Comparative Study	40	28 Males and 12 Females - BFPF: 13 Males and 7 Females - BAF: 15 Males and 5 Females	Range from 23 to 46	Inclusion: - All patients irrespective of age and gender - Long standing fistula - Failure of primary closure - Defect greater than 5 mm Exclusion: - Immunocompromised patients - Previously operated patients - Patients with chronic infections - Presence of sinusitis	Range from 3 mm to 13 mm Mean size 5,4 mm - BFPF: >5 mm - BAF <5 mm	BFPF: 85% BAF: 90%
Al Nashar et al ²¹ (2016)	Closure of oroantral fistula by using buccal fat pad or buccal advancement flap: comparative study.	Comparative Study	20	11 Males and 9 Females - BFPF: 5 Males and 5 Females - BAF: 6 Males and 4 Females	BFPF: Mean age 46.3 BAF: Mean age 45.5	Inclusion: - ASA1 - ASA2 Exclusion: - Sings of sinusitis - ASA3 - ASA4	NOT MENTIONED	BFPF: 100% BAF: 80%
Author	Title	N° of participant	Test used before surgery	Pre-operative protocol	Intra-operative protocol	Post-operative protocol	Follow up	
Gheisari et al ¹⁸ (2019)	Oro-antral fistula repair with different surgical methods: a retrospective analysis of 147 cases	147	Radiological: - Panoramic radiograph Clinical: - Periodontal Probe (to measure the diameter)	- Mouthwash with chlorhexidine 0,2% - 2g Amoxicillin - 400mg Ibuprofen	NOT MENTIONED Local anesthesia: - 2% lidocaine with 1/100000 or 1/80000 epinephrine	- Mouthwash with chlorhexidine 0,2% - 2g Amoxicillin - 400mg Ibuprofen (for 7 days after surgery) Essential advise like "reverting oral suction and cleaning the area was given to patients."	3 months	

To be continued

Bhatt et al ¹⁹ (2018)	Comparison between pedicled buccal fat pad flap and buccal advancement flap for closure of oroantral communication	20	<p>Radiological:</p> <ul style="list-style-type: none"> - Panoramic radiograph - Intraoral periapical radiograph - Paranasal sinus view <p>Clinical:</p> <ul style="list-style-type: none"> - Visibility - Nose <p>Blowing Test</p> <ul style="list-style-type: none"> - Cotton wisp test - Valsalva Maneuver - Caliper (to measure the diameter) 	<ul style="list-style-type: none"> - Saline solution (for 7 days before surgery) <p>- Irrigation with Povidine iodine</p> <ul style="list-style-type: none"> - Irrigation with Saline solution <p>Local anesthesia:</p> <ul style="list-style-type: none"> - 2% lidocaine with 1/80000 epinephrine 	NOT MENTIONED	3 months
Rashid et al ²⁰ (2018)	Closure of oroantral fistula by using buccal fat pad or buccal advancement flap: comparative study.	40	<p>Radiological:</p> <ul style="list-style-type: none"> - Panoramic radiograph - Computed tomography <p>Clinical:</p> <ul style="list-style-type: none"> - Nose <p>Blowing Test</p> <ul style="list-style-type: none"> - Probing (introduction of a probe into the antrum through the fistula) 	<ul style="list-style-type: none"> - Pre-operative mouth wash with antiseptic <p>-Antimicrobial treatment</p> <ul style="list-style-type: none"> - Non-steroidal anti-inflammatory drugs (NSAIDS) <p>Local anesthesia: NOT MENTIONED</p>	<ul style="list-style-type: none"> - Antimicrobial treatment (for 10 days) - Non-steroidal anti-inflammatory drugs (NSAIDS) <p>Essential advise like "not chew or swallow hard food and to drink a fluid away from the operative side.</p> <p>Nose blowing and sneezing with a closed mouth were prohibited for 2 weeks and not to roll the tongue over the suture line or the flap for the 1st week".</p>	1 year
Al Nashar et al ²¹ (2016)	Closure of oroantral fistula by using buccal fat pad or buccal advancement flap: comparative study.	20	<p>Radiological:</p> <ul style="list-style-type: none"> - Panoramic radiograph <p>Clinical: NOT MENTIONED</p>	<ul style="list-style-type: none"> - Saline solution (for 7 days before surgery, 3 time a day) <p>Local anesthesia: NOT MENTIONED</p> <ul style="list-style-type: none"> - 2% lidocaine 1/80000 epinephrine 	<ul style="list-style-type: none"> - Amoxicillin clavulanate 1g (twice daily) - Ibuprofen 600mg (3 times a day) - Nasal spray containing a vasoconstrictor (2% ephedrine or 25% phenylephrine, 3 times a day) - Antihistamine (pseudoephedrine, 3 times a day) <p>Essential advise like "sucking on a straw, blowing the nose and sneezing with a closed mouth for 2 weeks"</p>	3 months

Table 3. Critical appraisal of the included studies

Author	Title	Study Design	Random selection in population	Defined inclusion/exclusion criteria	Description of the surgical technique	Information on the drugs	Statistical analysis	Estimated risk of bias
Gheisari et al ¹⁸ (2019)	Oro-antral fistula repair with different surgical methods: a retrospective analysis of 147 cases	Retrospective Study	NO	NO	YES	YES	YES	HIGH
Bhatt et al ¹⁹ (2018)	Comparison between pedicled buccal fat pad flap and buccal advancement flap for closure of oroantral communication	Comparative Study	YES	YES	YES	NO	YES	Moderate
Rashid et al ²⁰ (2018)	Closure of oroantral fistula comparison of buccal advancement flap and buccal fat pad	Comparative Study	NO	YES	NO	YES	NO	HIGH
Al Nashar et al ²¹ (2016)	Closure of oroantral fistula by using buccal fat pad or buccal advancement flap: Comparative Study.	Comparative Study	NO	YES	YES	YES	YES	Moderate

1. **Low risk of bias:** A study that satisfies all criteria is considered to have a low risk of bias.
2. **Moderate risk of bias:** A study that fails to meet one of the criteria is classified as having a moderate risk of bias.
3. **High risk of bias:** A study that does not meet two or more criteria is deemed to have a high risk of bias.

A critical evaluation of the included studies and the estimated risk of bias is summarized in Table 3.

Statistical analysis

Risk ratios (RRs) were utilized to quantify effect size. A forest plot was created to visually compare study-specific and pooled relative risks, along with the corresponding 95% confidence intervals (CIs) for the success of treatment, explicitly contrasting treatments BAF and BFP. The area of each square in the plot is proportional to the weight of the study in the pooled analysis. The pooled random effects estimate and its 95% CI are indicated by a dashed vertical line and a diamond shape, respectively. A vertical line at 1.0 signifies no treatment effect. Heterogeneity among the studies was evaluated using the chi-squared test and the I^2 statistic. The I^2 statistic reflects the proportion of total variation attributable to heterogeneity, with 0% indicating no heterogeneity and 100% indicating maximal heterogeneity among the included studies. Refer to Figure 2 for details.

Discussion

Oroantral communications (OACs) and oroantral fistulas (OAFs) are potential complications associated with oral and maxillofacial surgical procedures.

The primary cause of OACs is tooth extraction, which accounts for approximately 92.63–95% of cases, with a nearly even distribution between the right (49%) and left (51%) sides. (19,20) Most studies indicate that the first molar region is the most common site for OACs (21,22). However, some authors, such as Güven (36), have reported that the second molar region is the most frequent site. Pourmand et al. (37) and Franco-Carro et al. (27) noted that OAFs are the most common complications following wisdom tooth extraction, with the risk of OAF increasing with patient age. (23,24)

According to Punwutikorn et al. (2), the size of the maxillary sinus is largest during the third decade of life, making this age group particularly susceptible to OACs. Their study found the highest incidence of OACs in individuals aged 60 and over.

Over the years, various techniques for managing these complications have been proposed. Among the earliest described methods are the buccal advancement flap and the buccal fat pad, which continue to be among surgeons' most commonly used solutions. (25,26)

When selecting a technique for OAF closure, the most critical factors to consider include the size and location of the defect, as well as the condition of the available tissue. (28) Additional criteria for determining the appropriate technique involve assessing the quantity and quality of tissue at the affected site and the surgeon's experience level. (29,30)

Many surgeons opt for a buccal advancement flap (BAF) as the first-line treatment for the closure of small oroantral communications or minor fistulas due to its

relative simplicity, adequate blood supply, and effective mobilization capabilities. Flap mobility is enhanced by making parallel incisions in the periosteum at the base of the flap (31,32,33).

The use of the buccal fat pad (BFP) for closing medium-sized oroantral fistulas (with diameters between 1 and 4 cm) was first described by Egyedi in 1977. (15) This straightforward and reliable surgical technique offers several advantages, including excellent blood supply, which is particularly beneficial when the recipient site is poorly vascularized; ease of mobilization; effective epithelialization of the exposed fat within 2 to 4 weeks post-surgery (1,34); minimal visible scarring at the donor site (30,36); a high success rate; and low patient morbidity (35). The Bichat fat pad also possesses regenerative potential due to its pluripotent cells³⁷. Notably, the volume of Bichat's fat pad is larger during childhood, remains relatively consistent across sexes, and persists even with weight loss or subcutaneous fat reduction. (38,39)

The primary disadvantages of the BFP include the limitation of being harvested only once (19) and the potential for creating a minor depression in the cheek area. However, the contralateral fat pad typically does not require excision, as the resulting asymmetry is often minimal (36). Notably, Egyedi (15) reported that significant depression in the cheek area was not observable.

When properly dissected and mobilized, the BFP can yield a pedicle graft measuring up to 7 x 4 x 3 cm. Egydi (15) was the first to suggest the feasibility of closing oroantral fistulas up to 4 cm in diameter. Subsequently, Tiedeman et al. (48) observed that defects up to 3 x 5 cm could be effectively covered without compromising vascularity. In a study by Fujimura et al. (49), the authors successfully closed a defect measuring 6 x 5 x 3 cm. (50,51)

According to findings by Bhatt et al. (22) and Al Nashar et al. (25), as well as other researchers, there was a statistically significant loss of sulcus depth following immediate surgical closure with Rehrmann's buccal advancement flap compared to BAF. Additionally, Von Wowern (20) demonstrated that in 50% of cases, the reduction in vestibular height was permanent, correlating with the extent of flap advancement. Therefore, using BFP is particularly recommended when sulcus depth preservation is critical (52,53,54), especially in cases where the site needs preparation for prosthetic placement. (55,56)

Several authors advocate for using BFP when the buccal advancement flap or other techniques have failed and in situations involving damage to the buccal or palatal mucoperiosteum (9,38,45,59).

In a meta-analytic study by Franco-Carro et al. (27), complications related to buccal flaps were noted in 15.58% of cases. In comparison, complications associated with Bichat fat pad treatment occurred in 16.68% of cases.

The research conducted by Alonso-González et al. (57) indicated that patients reported high satisfaction (9.1/10) six months post-treatment with the BFP, particularly regarding aesthetic, phonetic, and chewing outcomes.

Shukla et al. (58) observed that postoperative pain was higher with BFP than BAF during the initial post-surgery days. However, by the 14th day, pain levels significantly decreased, and by the 21st day, no pain was reported by any patient. Additionally, postoperative edema was

more significant with BFP than BAF, though it resolved ultimately in all patients by the 21st day.

Results

Three studies indicated a lower probability of success for the buccal advancement flap (BAF) than the buccal fat pad (BFP). In contrast, only the study by Rashid et al. (24) reported results that favored BAF. Nevertheless, the study-specific relative risks were not statistically significant. However, the pooled risk ratio (RR) was substantial, demonstrating a slightly lower probability of success for BAF in closing oroantral fistulas compared to BFP (RR 0.914, 95% CI: 0.836–0.998). No heterogeneity was observed among the studies (I^2 0.0%, $P = 0.452$).

Case report

A 31-year-old male patient presented for evaluation due to persistent pain in the first quadrant of his maxilla, specifically in the area corresponding to teeth 1.7 and 1.4. Upon examination, it was noted that the roots of tooth 1.7 had been involved in a recent extraction, which unfortunately resulted in a perforation of the Schneiderian membrane. This perforation led to an oroantral communication, a common complication following tooth extractions in the maxillary region, particularly in cases where the roots extend into the sinus cavity. (68,69)

A dental implant fixture was successfully placed to address tooth 1.4, which was previously extracted. However, the surgical site presented challenges due to a lack of sufficient vestibular bone volume, which is critical for the stability and integration of the implant⁵⁵.A

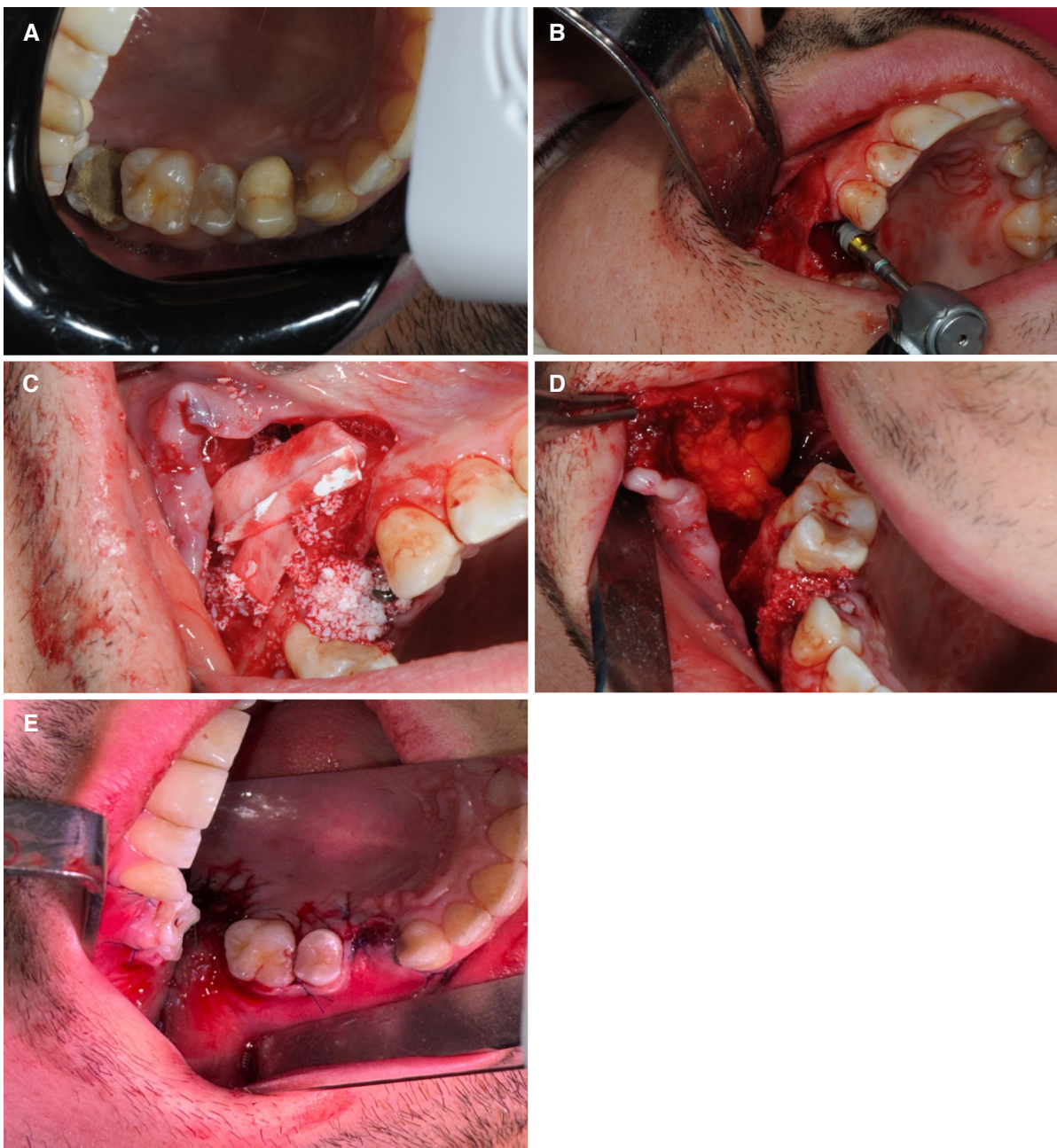


Figure 1 (A- baseline; B- implant fixture insertion; C- GBR; D- buccal fat pad flap; E- flap closure and sutures.)

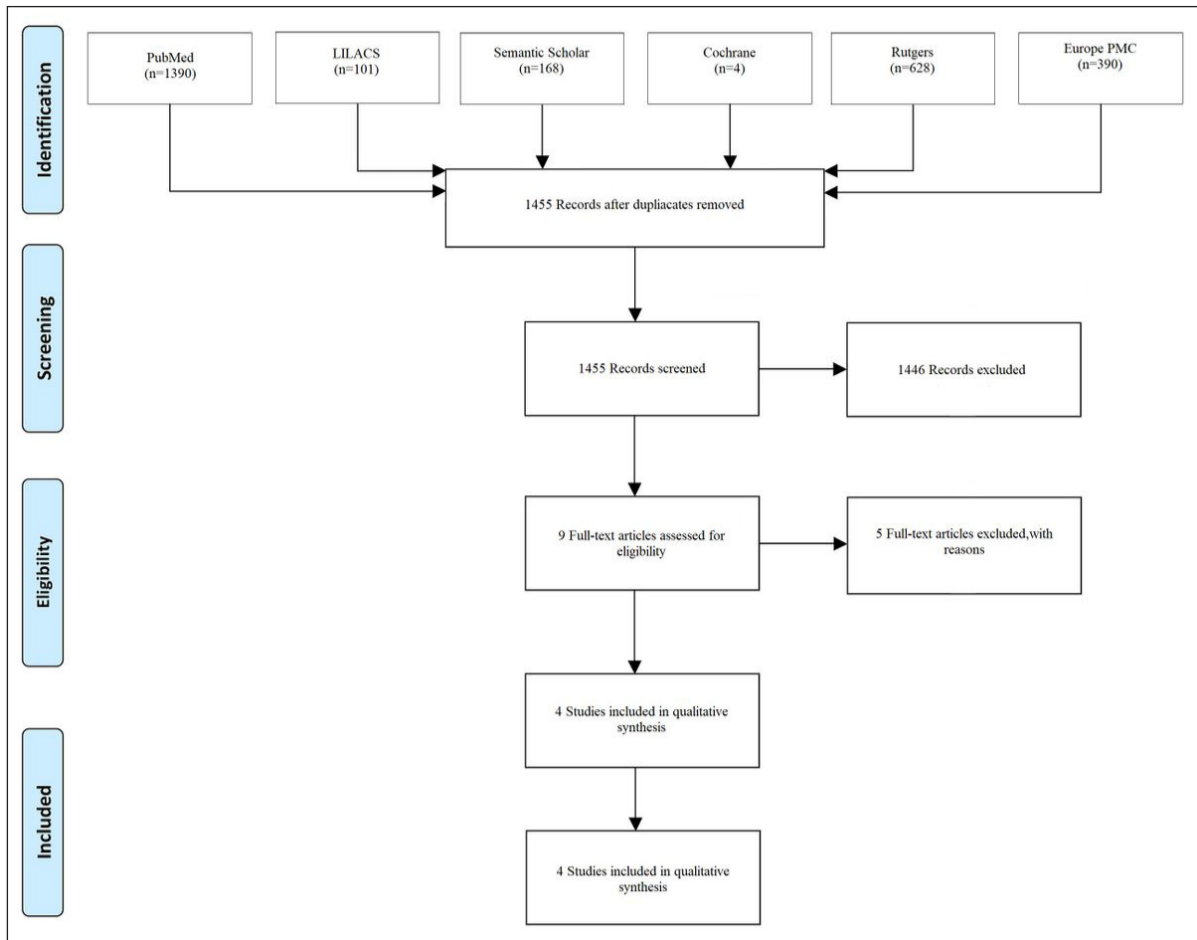


Figure 1. PRISMA flowchart. Flow diagram of study Inclusion

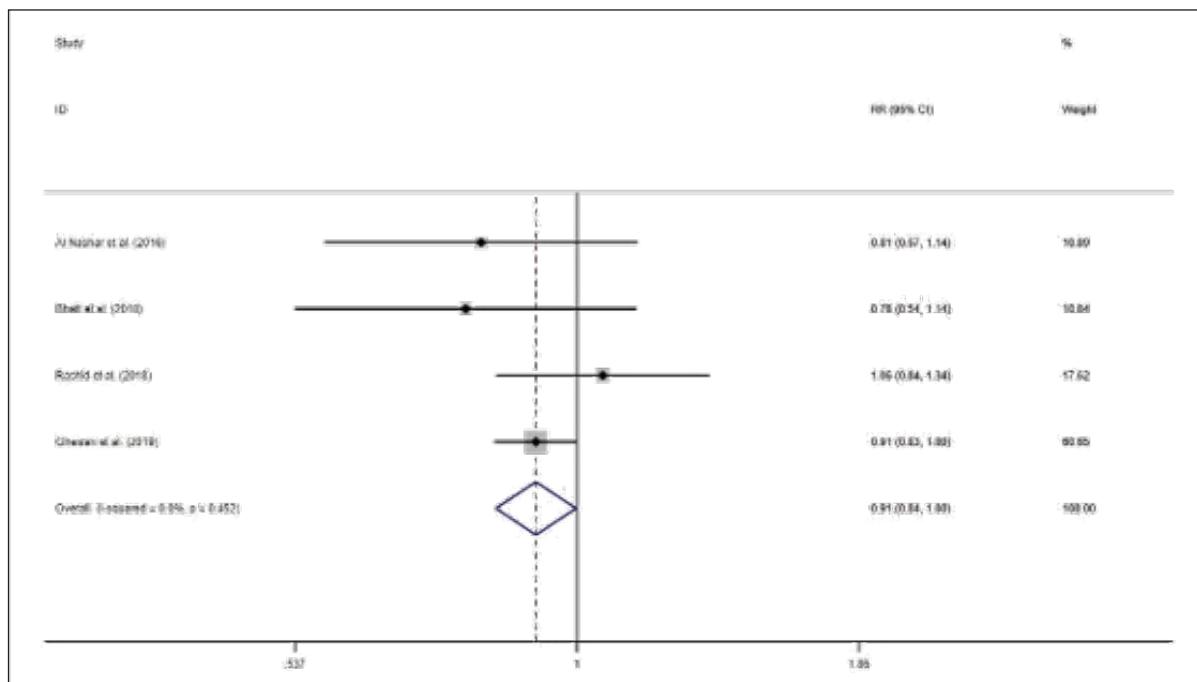


Figure 2. Forest Plot; Comparison Between Buccal Fat Pad Flap and Buccal Advancement Flap

guided bone regeneration (GBR) procedure was performed to rectify this deficiency. This technique involved deproteinized bovine bone, which serves as a scaffold for new bone growth, and a resorbable collagen membrane to facilitate healing and prevent soft tissue infiltration into the grafted area. (67)

Given the oroantral communication resulting from the extraction, careful management was necessary to prevent complications such as sinusitis or chronic infection (63). The Bichat fat pad was employed as a vascularized soft tissue graft in this case. The Bichat fat pad in the buccal region provides an excellent blood supply and promotes healing. (65) It was carefully mobilized and sutured directly to the palatal mucosa at the extraction site to effectively close the communication. This technique not only aids in closure but also enhances the healing of the surrounding tissues. (62)

Following the management of the oroantral communication, a cover screw was placed on the implant fixture to protect the healing site and facilitate proper integration of the implant (70). The surgical flap was then sutured with the primary intention using 4-0 nylon sutures, ensuring optimal tissue approximation and minimizing the risk of dehiscence. (60,61) Postoperative instructions were provided to the patient, emphasizing the importance of maintaining oral hygiene and attending follow-up appointments to monitor healing and implant stability. Overall, this comprehensive approach aimed to ensure a successful outcome, with the dual objectives of restoring dental function and maintaining the integrity of the maxillary sinus. (71,72)

Conclusion

This systematic review did not identify any randomized clinical trials (RCTs) that met the specified inclusion criteria. Additionally, the sample sizes across the studies were relatively small, and no further investigations involving a larger cohort of patients were conducted.

Given that the estimated risk of bias in the studies was moderate to high, caution is warranted when interpreting the results.

The choice of technique should be assessed based on factors such as the surgeon's clinical experience, the patient's specific conditions, and the advantages and disadvantages of each method.

Both techniques are considered safe and straightforward and exhibit high success rates. The BFP is particularly suitable for closing oroantral fistulas larger than 5 mm, especially when preserving the depth of the vestibular sulcus is essential or when the buccal advancement flap is unsuccessful.

Declarations

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Conflicts of interest

The authors declare no conflicts of interest

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