



A COMBINED STAGED NOVEL APPROACH FOR RECONSTRUCTION OF PERSISTING ORO-ANTRAL FISTULAE DEFECTS UTILIZING TRIPLED LAYER CLOSURE AND OPEN SINUS LIFTING

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ABSTRACT

This study aimed to assess the clinical outcome of a designated approach purpose to reconstruct large oro-antral fistulae combining tripled layer soft tissue closure along with later sinus lifting and bone grafting. The study constituted of three non-smokers male patients, which were subjected to failed previous surgical closures of large oro-antral fistulae, with a subsequent maxillary sinus infection and morbid vascular bed. After definite eradication of the persisting infection, the large communications were planned to be restored by three soft tissue flaps, the first of which based on utilizing the dense epithelial fistulous sinus tract, which was crafted, instead of being eliminated and adapted to the underlying bony defect to represent a shield that sealed the defect, obliterated the dead space, withstood the postoperative fluid overload and supported the overlying pedicled fat pad and the buccal advancement flap, which represented the second and third layers of closure. Three months later, open sinus lifting and bone grafting of the defects were carried out. Although two patients complained significant postoperative pain, limitation of mouth opening and swelling, all the reconstructed defects healed uneventfully, none of them revealed postoperative infection, wound dehiscence or relapse throughout the investigation period, and the patients neither exhibited any sign of recurrent maxillary sinusitis nor graft failure, furthermore, C.B.C.T. six months postoperatively, demonstrated that the reconstructed defects are well organized to receive proper sized dental implants. The authors recommend implementing this study over a broadened sample size, as this study was restrained by the small number of participants.

KEYWORDS: Chronic, persistent, reconstruction of, oro-antral fistula, oro-antral communication, layered closure, epithelial sinus tract, buccal fat pad flap, buccal advancement flap, open sinus lift, bone graft.

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INTRODUCTION

Oro-antral fistulae represent untreated communications between the oral cavity and the maxillary sinus, forming connecting epithelial tracts, most commonly derived as a post-operative complication of unplanned extraction of maxillary molars. The maxillary sinus occupies the body of the maxilla and extends to the alveolar process adjoining the roots of the maxillary molars with a thin bony floor ranging from 1 to 7 mm. Despite the low risk, the countless number of maxillary molars extractions explains the immense prevalence. ⁽¹⁾

The epithelial tract represents a pathologic pathway from the oral cavity to the antrum, through which bacterial invasion and consequent sinusitis occur which in turn complicates the healing of the violated membrane, surgical removal of the epithelial tract always considered the standard setup after confirmation of irradiation of the persisting infection. ⁽²⁾

Although most of the Oro-antral fistulae are usually treated with high success rates with local flaps such as buccal or palatal advancement flaps, the persistent chronic fistula as well as those with failed previous surgical closure; with subsequent morbidity and deficient vascular state are difficult to manage and usually requires more advanced surgical maneuvers. ^(3,4) Several surgical modalities have been postulated for closure of chronic fistulas; counting transposition of local soft tissue flaps, utilizing autogenous bones, xenografts and various alloplastic and synthetic materials, aiming to improve the vascular state of the compromised bed, to obliterate the dead space and to support the transpositioned soft tissue flaps looking forward to secure intimate soft tissue closure intending to provide long term sealing of the maxillary sinus. ⁽⁴⁻⁸⁾

Since it was first described by Egyedi ⁽⁹⁾ in 1977, the buccal fat pad pedicled flap had obtained wide acceptance for coverage of large and resisting Oro-antral fistulae as both the perfusion and the capacity

of the fat pad is adequate consistency, ensuring a stable double layered soft tissue closure. ⁽¹⁰⁾

Unfortunately, large oro-antral communications are usually accompanied by massive buccal alveolar bone deficiency and post-surgical reduction of the buccal vestibular depth, hence the future prosthetic rehabilitation of the defect would be time-consuming as it demands sinus lifting as well as bone grafting before implants insertion. ⁽¹¹⁾

In this clinical study, the authors aim to assess the clinical outcome of a combined approach utilized tripled layer soft tissue closure, followed by open sinus lifting and bone grafting objecting the reconstruction of large oro-antral fistulae. The triple-layered closure implemented fine dissection, right on adaptation and meticulous suturing of the epithelial sinus tract after absolute eradication of the infection ; which represented the first layer of closure, followed by careful exploration and retrieval of the buccal fat pad to serve as the second layer of closure and finally suturing back the advanced buccal flap. Looking forward that the firm layer created by crafting the dense epithelium would obliterate the dead space and support the buccal advanced flap, sandwiching the transported buccal fat pad and building up a sound based soft tissue closure that would support the later graft induction.

PATIENTS AND METHODS

Criteria of patient selection:

Three male patients aging 38, 47 and 60 years were involved in this study, all were presented with large chronic oro-antral fistulae with the persistence of 5 months, 3 months and 4 months respectively. None of them is a smoker. (Figure: 1)

All of the patients were exposed to complicated extraction of the maxillary molars, followed by failed surgical closures, two of them were subjected to failed buccal advancement flaps and the third to a breakdown of a palatal rotational flap. All of the

patients were presented with maxillary sinusitis, nasal congestion, and discharge, fluid leak to the nasal cavity while drinking and pain enclosing the previous extraction site; which was recognized by the second patient as neighboring toothache and radiated to the orbit of the third patient. The diagnosis was assured by clinical and radiographic examination.

Eradication of the persisting infection was targeted for one week prior to surgery; daily saline irrigation was performed and evacuation of the pus was regularly attempted, the patients administrated amoxicillin/clavulanic acid, **625 mg q8h** (Augmentin; GlaxoSmithKline) and metronidazole, **500 mg q8h** (Flagyl; Sanofi Aventis), NSAID (Brufen, **400 mg q8h**), nasal decongestant; Xylometazoline hydrochloride (Otrivin 0.1% Nasal Drops; Dawaya) for one week prior to surgery and Fluconazole; (Diflucan; Pfizer :150 mg single oral dose) three days preoperatively.

Operative procedure:

Nasal intubations were carried out and the surgical fields were scrubbed and draped in a regular manner, a horizontal incision was sculptured along the alveolar crest combined with two vertical incisions to border the buccal flap, which was elevated to an upraised position. (Figure: 2)



Fig. (1) Photograph showing large chronic Oro-antral fistula.

The epithelial sinus tract opening of the large fistulae was first tested for vitality; **by probing the epithelial tract and inspecting the bleeding pattern**, then it was carefully dilated using a fine straight artery forceps establishing a pathway to the diseased sinus membrane, which was utilized for separating the base of the epithelial sinus tract from the surrounding bony floor of the maxillary sinus and the attached sinus membrane, through which, a small bone curette was introduced to extirpate the friable segments of the membrane as well as to debride the necrotic bone, nasal antrostomy was then performed by wedging a fine sharp bone awl through the lateral nasal bones to open into the antro lateral wall of the maxillary sinus by which copious saline irrigation was flushed through and through and the patent access antrostomy was drained by inserting a betadine soaked gauze drain inside.

The base of the epithelial tracts was dissected free, mobilized and approximated to allow for watertight suturing with biodegradable 4/0 Vicryl sutures in an elevated position, adapting to the underlying defects and obliterating the dead spaces, while leaving the peripheral edges of the tracts undisturbed; attached to the peripheral bony margins of the communications. (Figure 3)

The buccal fat pads of the patients were palpated demarcating their exact locations, then the

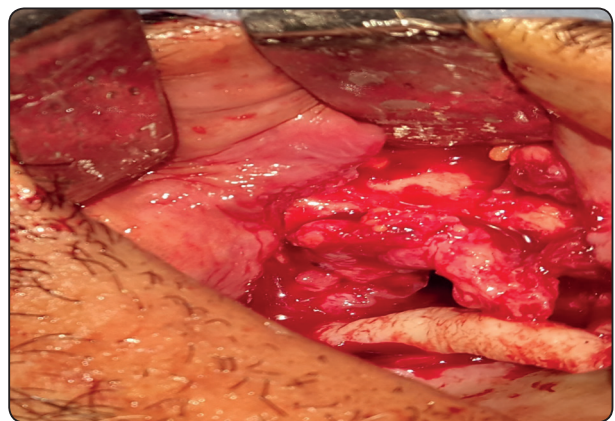


Fig. (2) Photograph showing the elevated buccal flap and the epithelial sinus tract.

periosteum in the extent of the zygomatic buttress, was approached via the elevated buccal flaps and incised horizontally to unveil the soft yellow colored fat, which was detached from the buccinator muscle and the surrounding tissues utilizing small curved artery forceps with caution, the elastic pads of fat were retrieved and protracted to adapt over the circumference of the defects, then sutured along the mesial, distal and palatal extents of the original gingival incisions using biodegradable 4/0 Vicryl sutures. (Figures: 4 and 5)

The periosteum on the underside of the elevated buccal flaps was scored horizontally and the extent of coverage of the stretched flaps was inspected, further scoring was necessary in two cases to ensure

adequate passive closure of the broadened buccal flaps wrapping the buccal fat pads and overlying the tailored epithelial tracts which were adapted to the underlying bone defects, then the expanded buccal flaps were sutured back using biodegradable 3/0 Vicryl suture. (Figure: 6)

Postoperatively, the patients administered Corticosteroids; (Dexamethasone **8 mg; IM single dose injection**, Sigmatec) and continued the preoperative medication regimen for additional 5 days, instructed for fair oral hygiene, soft diet, nasal precautions (avoiding nose blowing violent sneezing) and restraining exerting negative oral pressure. The nasal gauze drains were removed after three days, the superficial mucosal sutures were

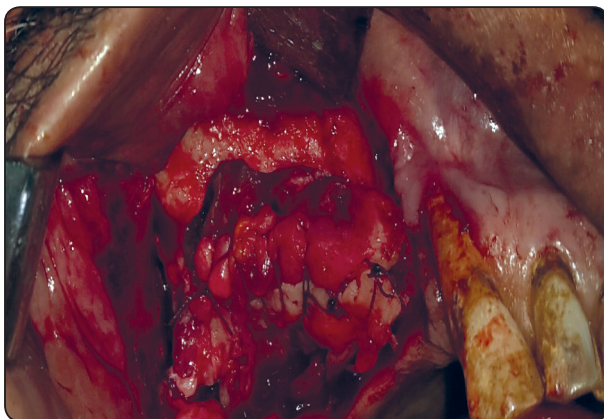


Fig. (3) Photograph showing crafting of the epithelial tract to seal a watertight layer adapted to the bony defect.



Fig. (4) Photograph showing dissection and retrieval of the buccal fat pad.

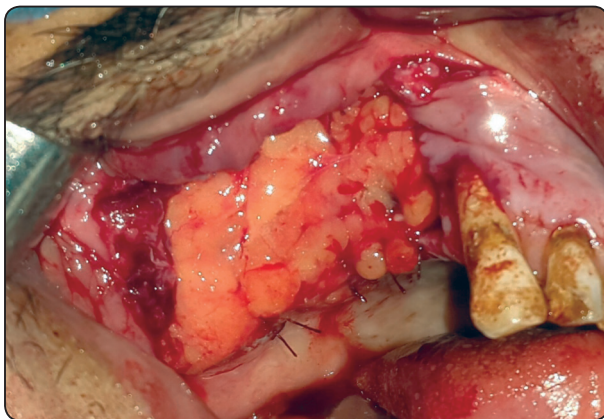


Fig. (5) Photograph showing adaptation and suturing of the fat pad overlying the epithelial tract.



Fig. (6) Photograph showing suturing back the elevated buccal advancement flap.

removed and the wounds were inspected for initial healing after 10 days.

Three months later, the patients were subjected to a second surgery under general anesthesia aimed to reconstruct the bony defects to accommodate future implant insertions. A trapezoidal buccal mucoperiosteal flaps were sculptured, where the margins all around relied on sound bone, the flaps were elevated superiorly exposing the bony defects, which were widened using large blunt round burs (Komet Sinus Window Opening Bur) under profuse saline irrigation to constitute buccal windows, through which the sinus membranes were freely demarcated and carefully elevated aided by fine sinus elevators. Granular bone xenograft (Geistlich Bio-OSS, Switzerland) was mixed with saline and compacted into the bony windows underlying the elevated sinus membranes (Figure : 7), followed by restorable membrane coverage (Geistlich Bio-Gide, Switzerland), which were adapted to overlay the bone graft and sutured to the fixed margins of the elevated flaps using 3/0 Vicryl suture, then the periosteum of the elevated flaps was gently scored, and the flaps were adjusted to adapt and sutured back in place with 3/0 Vicryl. The same previous postoperative medication regimen was repeated and the sutures were removed after seven days.

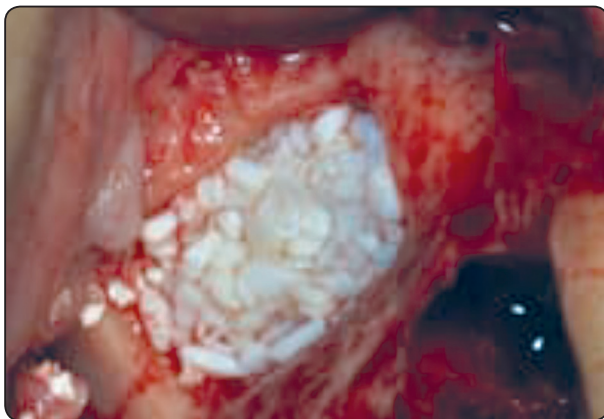


Fig. (7) Photograph showing packing the bone graft into the created bone window.

The patients were subjected to Cone Beam C.T. scans six months postoperatively, to allocate the persistence of the sinus lifting and bone grafting and to analyze the quality and quantity of the reconstructed alveolar bone defect.

RESULTS

This clinical study constituted on three nonsmokers male patients experimented failed surgical closure of oro-antral communications with neglected treatment for at least three months after the failed surgical interventions and hence, presented with advanced maxillary sinus infection as well as huge persistence oro-antral fistulae with oversized dead space and inconsistent vascular bed that would not preserve the integrity of advancing buccal or palatal flaps.

The authors postulated that the dense epithelial sinus tract, although its elimination is considered a routine, could be crafted in a manner that obliterates the huge dead space and support both of the pedicled buccal fat pad and the overlying buccal advancement flap, regarding that more than optimum eradication of the present maxillary sinus infection is established. Before adapting the epithelial tract to the underlying defect, the vitality of the three epithelial tracts was verified by gentle probing, which revealed three bleeder epithelial tracts.

After removal of the buccal advancement flap sutures, the patients were scheduled for three months of regular weekly following ups, through which strict measures of oral hygiene were executed.

All the defects healed uneventfully, although two patients complained significant postoperative pain, swelling and limitation of mouth opening, none of the reconstructed defects revealed postoperative infection, wound dehiscence or relapse throughout the investigation period, moreover, after the

resolution of the post-operative pain and edema, none of the patient exhibited any sign of maxillary sinusitis; hemifacial pain, tenderness over the previously affected maxillary sinus or nasal discharge.

Three months postoperatively, the patients were planned to undergo regular sinus lifting and bone grafting of the defects to prepare for future implant installations, which was preceded by inspection of the reconstructed defect that revealed superb healing, the color, and texture of the generated mucosa were comprehensively natural, however, the depth of the buccal vestibule seemed insufficient, which limited the prosthetic rehabilitation to a later implant-supported prosthesis. Palpation of the healed communications expressed dense, condensed, impenetrable painless cushion of tissues. (Figure: 8). On the other hand, the authors encountered intraoperative problematic elevation of the sinus membrane, the previously chronically infected membrane, and the former epithelial and mucosal surgical repair yielded the sinus membrane adherent to the underlying tissues, with sequential difficult separation, through which two sinus membranes were perforated, the integrity of the perforated membranes was restored by adapting a resorbable collagen membrane (Geistlich Bio-Gide, Switzerland) beneath, separating the violated lining from the underlying bone graft and bounding the roof of the bone graft.

The coronal and axial cuts of the C.B.C.T.; six months following sinus lifting and bone grafting revealed that all the reconstructed defects exhibited bone remodeling with convenient bone length, width, and quality to accommodate unrestrained suitable size implant insertions. (Figures 9, 10) The clinical evaluation as well revealed uncomplicated healing, the patients with disrupted sinus membranes neither demonstrated sinusitis nor graft rejection.



Fig. (8) Photograph showing soft tissue healing of the defects three months postoperatively.

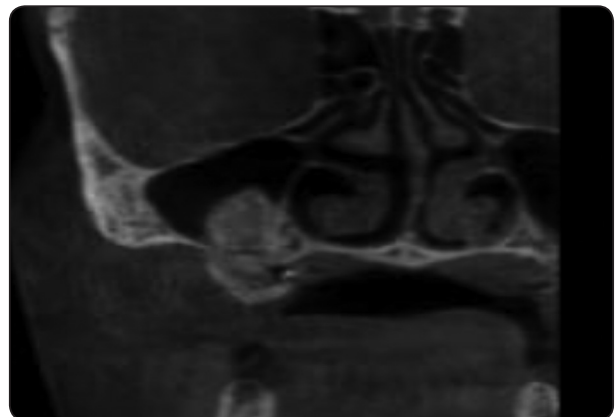


Fig. (9) Photograph showing coronal cut C.B.C.T illustrating bony reconstruction of the alveolar defect.

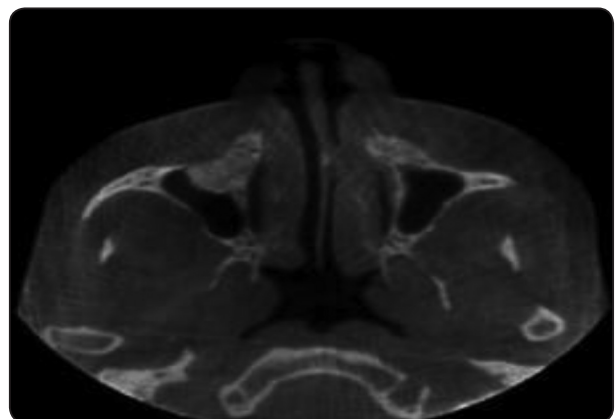


Fig. (10) Photograph showing axial cut C.B.C.T illustrating bony reconstruction of the alveolar defect.

DISCUSSION

Oro-antral communication is a pathologic transmission connecting the oral cavity with the maxillary sinus, most commonly attributed to creating an apical bone defect during extraction of the maxillary molars which are separated from the maxillary sinus with delicate layer of bone roofed by the hollow sinus, defects larger than half a centimeter and persisting for more than three months are usually epithelialized forming an oro-antral fistulae, ⁽¹²⁾ which usually appears after the third decade as increasing age is associated with propagation of dental caries and compromising of the periodontium with subsequent loss of teeth as well as increasing the size of the maxillary sinus along with its approximation to the apices of the accused teeth. ⁽¹³⁾

Yalcin et al ⁽¹³⁾ reported a male/female ratio of 17:6 of occurrence of oro-antral fistulae, the authors referred that to the more common tooth extractions in males and the much denser bone and the more difficult extraction, which was noticed in this study as all the patients with large failed previous treatment were males.

Yalcin et al ⁽¹³⁾ also denoted that the success rates of advancing the surrounding buccal mucosa for closing small fistulae and rotating the neighboring dense palatal flap to obliterate moderate size defects are very high, however, large buccal defects; situated away from the palate, usually requires more advanced surgical maneuvers, which was observed by the authors of this study, as all the cases presented with post-surgical recurrence of oro-antral fistulae were at least 1.5 Cms defects simply intervened with the standard techniques, who are referring the previously failed surgical treatments to that the tension-free closure, utilizing broad-based and good vascularized soft tissue flap supported by intact bone as well as modification of the surgical technique to obliterate the dead space and provide support for the mucosal flap deemed necessary.

Saleh and Issa ⁽⁸⁾ considered that broad trapezoidal buccal flap had the privilege of providing adequate perfusion and enclosed direct access to the defect allowing for proper eradication of the infection and debridement of the necrotic tissues, moreover, the horizontal scoring of the periosteum as well as the mesial and the distal vertical incisions facilitated expanding and adjusting the pedicle to properly fit the defect passively, which is agreed by the authors, as we refer to part of the uneventful healing among the cases as well as the normal texture of the formed mucosa to the vascularity, malleability and wide coverage of the buccal advancement flap to both of the fat pad and the modified epithelium.

Despite the popularity, wide acceptance and high success rate of transporting the buccal fat pad pedicled flap to cover the nearby intraoral defects, Nezafati et al ⁽¹⁴⁾ reported hematoma formation, severe limitation of mouth opening, postoperative edema and infection and most importantly: scarring, pedicle perforation, and breakdown as potential complications, which explained the excessive pain, swelling and trismus encountered in two cases postoperatively, furthermore, the marked reduction in vestibular depth was attributed to the extirpation of the buccal fat pads, however, the translated pedicle showed intimate epithelization around four weeks postoperatively.

Saleh and Issa ⁽⁸⁾ determined soft tissue grafting alone may not be appropriate to restore large and persistent fistulae, since the discontinuity of the bony floor of the maxillary sinus and violating the overlying sinus membrane is gravity sensitive, as the organized surgical hematoma and the accumulated secretions from the engorgement membrane during the primary healing stage would induce a state of weight overload exerting downward pressure on the underlying transported soft tissue graft; only secured in place by fine sutures, which would endanger its stability, leading to break down and failure of the pedicle, hence the authors of this study designated

a triple layered closure of large persisting fistulae, by crafting the dense epithelial sinus tract looking forward to representing a shield that obliterates the dead space and supports the pedicled buccal fat pad; decreasing the extent of the formed hematoma and creating a firm layer beneath that would withstand the fluid weight overload.

Abuabara et al ⁽¹⁵⁾ considered the epithelial tract is a necrotic tissue that should be eliminated to establish uncomplicated healing and to avoid sinusitis and subsequent graft rejection, however, the authors believe that the epithelial tract has gained some sort of vitality through its integration to vital portions of the surrounding bones, preserving the vascularity of the bleeding epithelial tract was maintained by persisting its integrity to the margins of the bone defect. The epithelial tract supported the overlying pedicled fat pad and the buccal flap, furthermore, all the defects healed uneventfully and none of the patients showed any sign of recurrent sinusitis or graft rejection.

Although delaying the elevation of the sinus floor membrane after complete healing allowed for complete eradication of the chronic infection and restored back the function of the previously congested membrane, mucosal adhesions of the thickened membrane endangered maintaining its continuity during surgery, as attempting to separate the attached membraned violated its integrity in two cases. These findings correlate with those reported by Lee ⁽¹⁶⁾, the author relied failed sinus lifting manipulated along with concurrent closure of oro-antral fistulae to both less than ideal elimination of the coexisting chronic infection and failure to maintain the sinus floor integrity, despite simultaneous sinus lift and fistulae closure facilitated the manipulation of the relaxed membrane, a convenient control of infection deemed unpredictable.

Radiographic analysis, six months postoperatively suggested that maxillary sinus lifting with simple packing of Xenobone graft confined to suitable membranes would be sufficient for receiving an

implant qualitatively and quantitatively, that coincide with the findings demonstrated by Ogunsalu ⁽¹⁷⁾, who believed that sandwiching a compacted layer of (BIO-OSS) between two layers of biodegradable membranes yield distinguishing bone quality that reconstructed the fistulous defect and buttressed the dental implants, without disturbing a donor site.

CONCLUSION

This study demonstrates a technique that defines both soft tissue and bony reconstruction of large oro-antral fistulae through staged surgical closure, the first of which utilize modifying and crafting the fistulous dense epithelial tract to represent a shield; obliterating the dead space, sustaining the fluid overload and supporting the overlying buccal fat pad and advanced buccal flap, followed by the second stage, which incorporated both sinus lifting and bone grafting, customizing the reconstructed defect to receive dental implants. Although the staged protocol demanded two surgical settings with prolonged treatment, securing the eradication of infection, construction of optimum soft tissue envelop and convenient bony profile was accomplished; the reconstructed defects were suitable to receive dental implants and to isolate the violated maxillary sinus with minimum morbidity.

This study is restrained by the small sample size and the authors recommend repeating the study among a larger population.

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