

## SIMULTANEOUS OROANTRAL FISTULA CLOSURE AND SINUS LINING REPAIR USING CORE CHIN BONE GRAFTING

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### ABSTRACT

**Background:** oroantral fistulas (OAFs) are pathological communications between the oral cavity and maxillary sinus. This complication occurs most commonly during extraction of upper molar and premolar teeth. Different surgical techniques were introduced to close OAFs, however most of these techniques depend on soft tissue closure only without grafting the bony defect of the OAF. With increasing demand for Implant rehabilitation, bony closure of the OAF is required.

**Purpose:** the aim of this study was to assess simultaneous closure of oroantral fistula with sinus lining repair using chin bone graft as a single surgical procedure.

**Patients and methods:** this study was carried out on twelve patients complaining from oroantral fistula (OAF) following extraction of maxillary posterior teeth. The patients were collected from the department of Oral and Maxillofacial surgery, Faculty of Dentistry, Tanta University. The sinus lining was repaired using the fistulous tract which dissected and rotated into the sinus membrane, then the bony defect was grafted with autogenous corticocancellous chin graft and platelet- rich fibrin (PRF) membrane and the graft was covered with buccal advancement flap. The patients were followed up clinically after 1, 2 weeks, 1,3 and 6 months to evaluate closure of the fistula and any signs of infection, wound dehiscence or graft exposure. Radiographic evaluation was performed immediate and 6 months postoperatively using C.B.C.T to evaluate the fate of bone graft.

**Results:** Successful closure of the OAF was achieved in 11 cases with no signs of wound dehiscence, infection, ulceration or exposure of the graft. Only one case (case no. 3) showed wound dehiscence and graft exposure immediate postoperatively and the wound not healed so, by the end of the 1st month we removed the graft and the wound was closed with buccal advancement flap.

**Radiographically:** except for case no. 3, radiographic evaluation using C.B.C.T after 6 months when compared to immediately after surgery showed complete healing of the bone defect with non-significant increase in both bone density and alveolar bone height.

**Conclusion:** This study suggested that epithelialized fistulas could be used for repairing of the sinus membrane and press- fitted closure of the OAF using autogenous chin bone graft combined with PRF covered with buccal advancement flap provided three- layered closure of the OAF and bony base for subsequent Implant placement.

**KEY WORDS:** Oroantral fistula (OAF)- Autogenous bone grafts- Platelet rich fibrin (PRF).

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## INTRODUCTION

An oroantral fistula (OAF) is a diseased connection between the oral cavity and maxillary sinus that is epithelialized. It may occur as a result of extraction of maxillary molars or premolars owing to their root apices' closeness to the antrum. Additionally, oroantral fistulas may develop as a result of the excision of maxillary cysts or tumours, face trauma, dentoalveolar or implant surgery, infection, or may be iatrogenic in nature. Between the ages of 30 and 60, oroantral fistulas are rather prevalent.<sup>1,2</sup>

Clinically, the patient may present with one or more symptoms indicating the presence of an oroantral fistula. Complications include discomfort, a bad or salty taste in the mouth, a change in the resonance of the voice, an inability to blow out the cheeks, air shooting from the fistula into the mouth while blowing the nose, and liquids escaping from the mouth via the nose.<sup>3</sup>

If left untreated, a fistula often develops into a chronic oroantral fistula, which results in severe chronic inflammatory thickening of the sinus membrane. Closure of the defect is intended to keep oral germs and food debris out of the sinus.<sup>2</sup>

Numerous experts assert that minor fistulae often heal spontaneously, but bigger fistulae seldom do. If a fistula does not heal within three weeks, surgery is necessary.<sup>2,4,5</sup>

To close oroantral fistulas, various surgical techniques have been introduced, including advancing or rotating intraoral local soft tissue flaps such as buccal or palatal mucosa, buccal fat pad, submucosal connective tissue, tongue tissue, double flap (palatal flap covered by a semi-thick vestibular flap), and endoscopically pedicled nasoseptal flap.<sup>6-10</sup>

Due to the high recurrence rate of oroantral fistulas with soft tissue coverage techniques, particularly in large bone defects, and the ongoing need for implant rehabilitation and pre-implant surgery,

such as sinus floor elevation and ridge augmentation, routine soft tissue closure of oroantral fistulas has become a major issue, as it results in matting of the oral mucosa and schneiderian membrane, which makes sinus membrane elevation impossible without tear.<sup>11</sup>

While there are several bone replacements, autogenous bone transplants remain the gold standard for repair. Autogenous bone has been shown to be superior in terms of shape, function, and adaptation than allogeneic bone, xenogeneic bone, bone substitutes, and alloplasts. Additionally, autogenous bone is osteoinductive, osteoconductive, and immune-compatible.<sup>12</sup>

The surgeon has a variety of donor locations accessible for autogenous bone harvesting. The maxillary tuberosity, mandibular symphysis, ramus, and retromolar regions are the most often utilised intraoral locations, whereas the ilium, costochondral area, calvarium, and tibia are the most frequently used extraoral sites.<sup>17-18</sup>

The primary benefits of intraoral harvesting sites are that harvesting may be performed as an outpatient surgery under local anaesthetic agent, that local donor sites provide straightforward surgical access, and that the ischaemic duration of the bone transplant is brief. Additionally, since both the donor and recipient sites are intraoral, there is no risk of morbidity associated with a secondary surgical site, such as an extraoral scar. However, the primary drawback of intraoral harvesting is the scarcity of accessible bone, which may be inadequate to treat moderate to large abnormalities.<sup>19-20</sup>

Mandibular symphyseal bone has been effectively grafted in secondary alveolar clefts, maxillary sinus grafting, alveolar defects prior to dental implant insertion, orbital floor reconstruction, and with Le Fort I osteotomy. The anterior mandible is the most abundant intraoral donor location. The typical amount of bone harvested from the symphysis is between 1.7 and 4.7 ml, with a maximum block

size of around 21 x10 x7 mm. This quantity of bone would allow for an increase in ridge width of 7 mm across a mesiodistal distance of 21 mm.<sup>19-27</sup>

The addition of PRF to autogenous bone transplants may promote new bone growth and aid in sinus floor mucosal closure.<sup>28</sup>

## MATERIALS AND METHODS

This is a prospective single-arm study in which twelve patients with a significant oroantral fistula who were clinically and radiographically recommended for surgical closure were enrolled according to one of the following criteria ;1-Patients had oroantral fistulas without having previously undergone surgery. 2-Patients developed oroantral fistulas with a width more than 5 mm. 3-Patients were found to have an oroantral fistula and were scheduled for subsequent implant.

Patients having previously treated oroantral fistulas that failed, fistulas smaller than 5 mm in diameter, or systemic diseases that impair healing were excluded from the research.

### Preoperative evaluation:

#### *Clinical evaluation:*

All patients had a comprehensive medical history, demographic data collection, and clinical examination to ascertain signs and symptoms of sinusitis, nasal and fistulous discharge, prior surgical intervention, and location of oral communication.

Patients who presented to our clinic complaining of fluid regurgitation from the nose on the afflicted side after teeth extraction were examined intra-orally and a nasal blowing test was done to establish the existence of the fistula. The patient was instructed to use his hand to shut his nostrils and blow down his nose while his mouth remained open. Air bubbles or fluid secretions surrounding the orifice, cloudiness of the mirror, or hearing a whistling sound all suggest the existence of the oroantral Fistula.

### *Radiographic evaluation:*

A panoramic x-ray and C.B.C.T scan were obtained to corroborate clinical findings about the existence of the fistula and to assess the status of the maxillary sinus in terms of foreign bodies, remaining roots, and the extent of the bony defect at the fistula site.

### Preoperative preparation:

1. All patients received preoperative therapy consisting of an antibiotic tablet (Augmentin 1 gm)\* taken once every 12 hours for one week and an analgesic tablet (ketoprek 75mg)\*\* taken once every 8 hours for one week to remove any remaining infection or inflammation and to reduce discomfort.
2. Through the fistula, the afflicted sinus was irrigated daily with antimicrobial alkaline mouth & nasal wash (Alka-Misr) \*\*\* the contents of one sachet (5mg) mixed in half a glass of warm water to treat and control infection until surgery.

### Surgical technique

#### *Surgical exposure of the OAF:*

Eleven patients had general anaesthesia by nasotracheal intubation; one patient underwent local anaesthesia with a local anaesthetic agent (e.g., 1% lidocaine\*\*\*\* with epinephrine 1:100,000).

A horizontal incision was made on the buccal aspect, one mesial and one distal to the field of surgery, with a scalpel fitted with a number 15 Bard Parker blade, including one tooth on each side (mesial, distal) of the OAF. Two vertical releasing incisions were made on the buccal aspect, one mesial and one distal to the field of surgery. Then, a circular crestal incision was performed 1-2 mm from the fistula's edges.

The buccal mucoperiosteal flap was reflected with a periosteal elevator to expose the buccal maxillary alveolar bone surrounding the fistula; the fistula margins were elevated from the alveolus

bony walls and rotated into the OAF to maintain continuity with the residual sinus membrane; the fistulous tract was dissected and rotated into the sinus membrane; and finally, the fistulous tract was tension-free sutured together with 5.

#### ***Autogenous bone harvesting and grafting:***

From the symphyseal bone, a cortico-cancellous block graft was extracted. To expose the anterior aspect of the mandibular symphysis, an intraoral incision was made below the mucogingival junction and extended between the mandibular canines. Corticocancellous block was obtained using a trephine bur of appropriate size for the extent of the bone defect at the OAF, while keeping the lingual cortex intact.

#### ***Preparation of platelet-rich fibrin for repairing sinus-lining***

A 10 ml venous blood sample was obtained from the patient using a 20 ml plastic graduated syringe, and the blood was divided into two equal dry glass test tubes without anticoagulant. The tubes were placed symmetrically around the centrifuge's motor axis for proper balancing and centrifuged for 20 minutes at 3000 rpm. Three layers comprised the final product; the intermediate layer is a non-transparent platelet-rich fibrin gel. This gel was removed from the tube, trimmed out using scissors, and compressed into a thin membrane that was put in the fistulous tract after rotation to seal the sinus lining.

#### ***Repair and grafting of OAF***

A corticocancellous block was press-fit into the bone defect at the location of the fistula. Between the alveolar walls and the sinus floor, residual bony gaps were filled with cancellous bone particles acquired from the donor site. The graft was then covered with a platelet-rich fibrin membrane.

#### ***Wound care:***

Soft tissues were restored and sutured at the operative and donor sites utilising a watertight suture method and 3/0 suture materials.

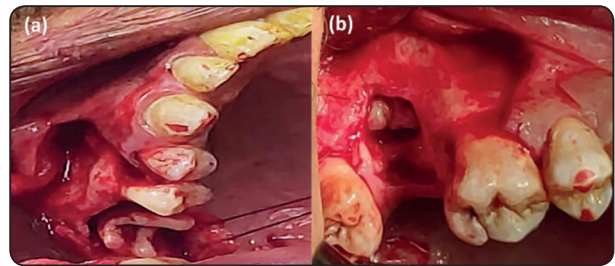


Fig. (1) (a) (case no.1): Intraoperative photograph showing crestal incision 1-2 mm from the margins of the fistula. (b) (case no.4) Intraoperative photograph showing dissection of the fistulous tract.

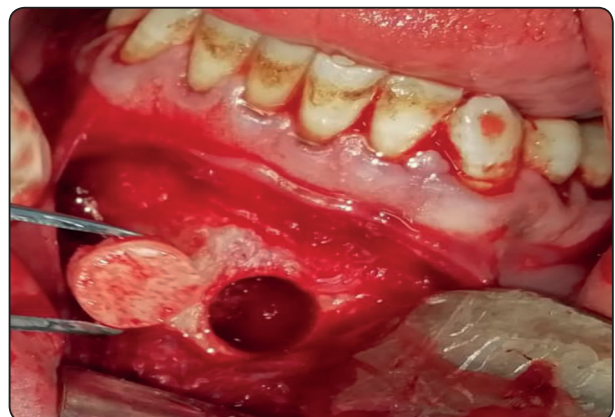


Fig. (2) (case No.1) Intraoperative photograph showing harvesting autogenous chin bone graft

#### **Postoperative care and evaluation:**

##### ***Postoperative care:***

- 1- Postoperative treatment in all cases included the following: broad spectrum antibiotic (Cefotax 1gm. Vial) given I.V. every 12 hours, anti-inflammatory medication (Adolor 30 mg. Ampule) given I.M. every 12 hours, anti-edematous medication ( $\alpha$ - chemotrypsin Vial) given I.M. every 12 hours, and nasal decongestant (Otrivin nasal drops) 2-3 drops given for each nostril 3-4 times daily. Patients were provided the prior drugs for one week after surgery.
- 2- Patients were encouraged to abstain from intense physical activity (sneezing, nose blowing) that might result in an increase in pressure inside the para nasal sinuses until the sutures were removed 10-14 days after surgery.



### Postoperative evaluation

For six months after surgery, all patients were monitored clinically and radiographically.

### Clinical evaluation

All patients were followed closely immediately after surgery, for the first and second weeks, and then for the first, third, and sixth months postoperatively to assess fistula closure and any signs of infection or dehiscence.

### Radiographic evaluation:

C.B.C.T scans were collected immediately after surgery and six months later to assess the destiny of the bone transplant, the healing process, and the height of the bone.

## RESULTS

This study was conducted on twelve adult patients with oroantral fistula (OAF) who underwent surgical closure of the fistula with autogenous chin bone graft.

All patients were followed up for six months postoperatively both clinically and radiographically.

Patients' ages ranged from 23 to 55 years with a mean of 34.83 years as shown in (Table 1). OAF of all 12 patients was caused by extraction of maxillary posterior teeth.

The male to female ratio of the total of patients' material was 3:1 (9 men (75%) and 3 women (25%))

### Clinical results:

#### *1<sup>st</sup> week postoperatively:*

11 patients (91.7%) showed no signs of wound dehiscence, infection, ulceration, exposure of the graft or fluid regurgitation from the nose after drinking. Only one case (case no. 3) (8.3%) showed wound dehiscence and exposure of the graft 1st week postoperatively, we removed the graft and the wound was irrigated and sutured using 3/0 suture material.

#### *2<sup>nd</sup> week postoperatively:*

The wound was healed in the 11 patients without fluid regurgitation from the nose after drinking, so, we removed the stitches.

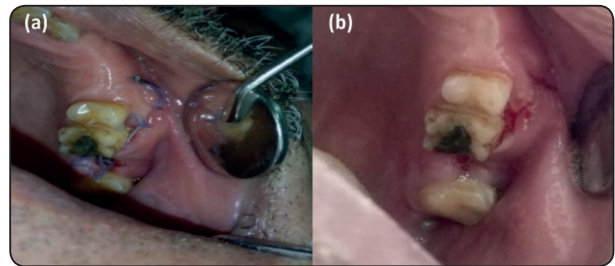


Fig. (3): (a) One week postoperative clinical photograph showing wound healing (case no.5) (b): 2 weeks postoperative clinical photograph showing wound healing (case no. 5)

#### *1<sup>st</sup> month postoperatively*

The wound showed optimum healing in the 11 patients and the patients showed no signs of maxillary sinusitis (no nasal congestion or discharge, on facial pain or tenderness, no change in the ability of smell, no headache or bad breath).

#### *3<sup>rd</sup> and 6<sup>th</sup> month postoperatively*

The covering mucosa returned to normal color and texture. The wound was completely healed.

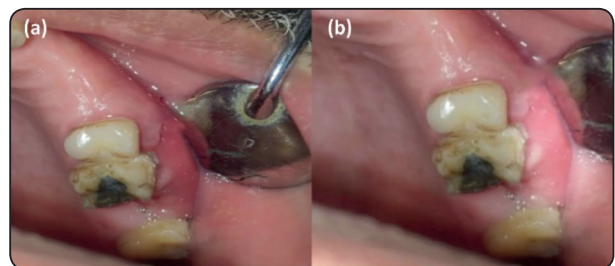


Fig. (4): (a) one-month postoperative clinical photograph showing wound healing (case no.5) (b) 6 months postoperative clinical photograph showing wound healing (case no.5)

TABLE (1): Showing percentage of wound dehiscence, infection

Wound dehiscence, infection	N	%
No	11	91.7
Yes	1	8.3
Total	12	100

**Radiographic results**

C.B.C.T scan was obtained for all 12 patients immediately and six months postoperatively to evaluate alveolar bone height and bone density.

**Alveolar bone height**

The mean of alveolar bone height immediately after grafting was  $11.24 \pm 0.68$  with standard deviation 0.68. Six months after grafting was  $10.91 \pm 0.70$  with standard deviation 0.70. There was statistically insignificant decrease in alveolar bone height 6 months after grafting when compared to immediate postoperatively.

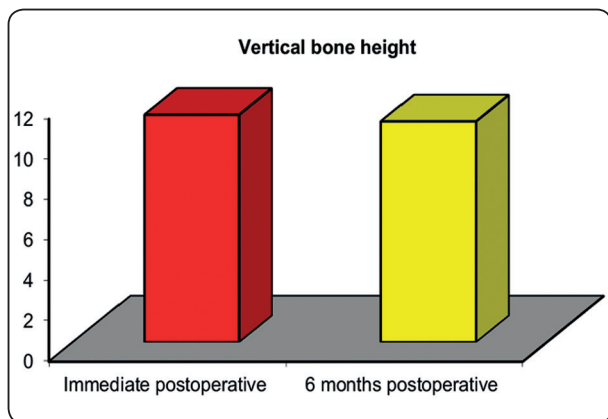


Fig. (5): Column chart showing changes in alveolar bone height immediately after grafting and six months after grafting.

**Bone density:**

The mean bone density immediately after grafting was  $614.82 \pm 101.87$  with standard deviation 101.87. Six months after grafting was  $622.82 \pm 104.12$  with

standard deviation 104.12. There was statistically insignificant increase in bone density 6 months postoperative when compared to immediate postoperatively. Table (V-5): showing changes in bone density immediately and six months after graftin

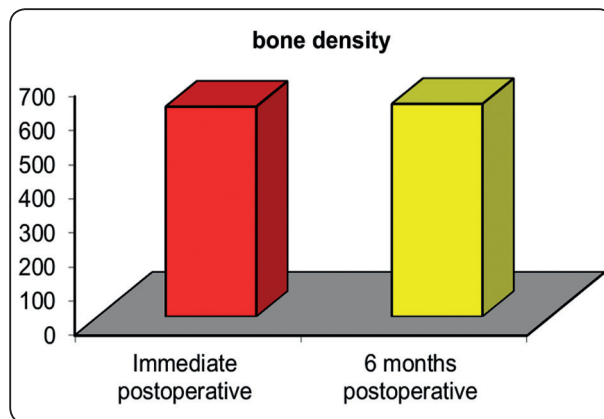


Fig. (6): (a) column chart showing changes in bone density.

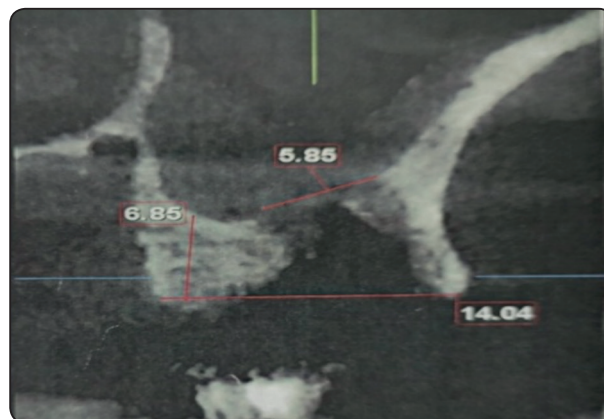


Fig. (7): preoperative C.B.C.T showing OAF related to upper Lt. 7 (case no. 5)

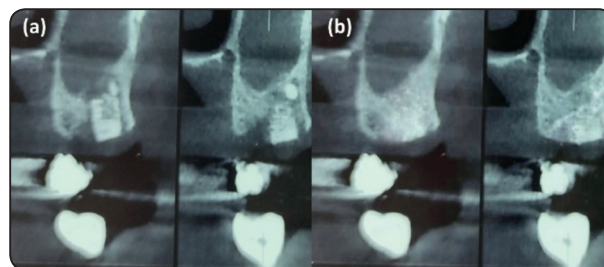


Fig.(8): (a) immediate postoperative C.B.C.T showing grafting of OAF related to upper Lt. 7(case no.5) (b): 6 months postoperative C.B.C.T showing graft healing (case no.5)

## DISCUSSION

Our study's gender distribution demonstrates a significant male preponderance, with a male (75%) to female (25%) ratio of 3:1. This is consistent with Yilmaz et al. 1's finding that male patients had double the rate of female patients in terms of fistulas. According to Delgado Galindez et al. <sup>29</sup>, the male to female ratio was 1.4:1. Hirata et al. <sup>30</sup> discovered that men had a much greater incidence of oroantral fistula, with a male to female ratio of 1.7:1. According to another research conducted by Arbi <sup>31</sup>, the male to female ratio was 2.4:1. This discrepancy may be explained by men's overall greater rate of traumatic tooth extraction. <sup>3</sup> However, a research conducted by Yabroudi and Dannan <sup>32</sup> discovered that men and females had an equal incidence of oroantral fistulae.

Our studied patients had a mean age of 34 years at the time of surgery, ranging from 23 to 55 years, which is consistent with Yilmaz et al. 1's finding that fistulas are prevalent between the ages of 30 and 60. It is believed that the loss of teeth associated with ageing increases the probability of developing fistulas. Additionally, the maxillary sinus achieves its maximum size during the third decade of life, increasing the likelihood of oroantral communications. Oroantral communications are less likely to arise in children and adolescents due to the sinus's comparatively modest size in this age group. <sup>2</sup> None of the patients in this research were under the age of twenty.

We employed the Rehrman buccal advancement flap to expose the buccal maxillary bone around the OAF in our research, the buccal advancement flap is one of the most frequently used procedures for OAC closure. This is due to the fact that it is a straightforward and secure procedure. <sup>33-34</sup> This is consistent with Killey <sup>3</sup> who studied 362 cases using this technique for OAF closure and reported success in 336 (93 %) of them. It is also consistent with Elmaradny et al. <sup>35</sup> who reported excellent success

with minimal scarring and minimal reduction of the buccal sulcus 3 months postoperatively, which did not interfere with any prosthetic rehabilitation when the flap was used to cover buccal anrostomy as bone graft for closure.

We collected autogenous corticocancellous block from mandibular symphyseal bone in our investigation, closing the OAF using a trephine bur. Following that, to assure primary stability, the harvested corticocancellous block was force fitted into the bone defect. In all instances, a solid press-fit of the grafts into the bony maxillary defect was accomplished without the requirement for extra internal fixation with micro plates or bone screws. This is congruent with the findings of G Watzak et al. <sup>36</sup>, who found that Press-fit closure was adequate to reconstruct the bony sinus floor in 17 of 21 individuals.

Bony closure of OAF has the benefit of promoting spontaneous postoperative healing of the soft tissue that is supported by the bony basis in this investigation. This is congruent with Minoru et al. <sup>37</sup>, who reported this benefit during interseptal alveolotomy for bone closure of OAF.

Another benefit of the press-fit fistula closure is that the roots of adjoining teeth are protected. After solo soft tissue closure, the positioning of OAFs along the roots of adjoining teeth may provide a concern; although mucoperiosteal flaps may reattach to exposed cervices, relapses are relatively frequent. Restoring the bone sheath surrounding the exposed root surfaces allows for the preservation of teeth next to the fistula. <sup>38</sup>

Proctor <sup>11</sup> first described the use of an iliac crest graft to close large OAFs in 1969, but his approach had considerable intrinsic donor site morbidity, protracted postoperative discomfort, and the possibility of sensory disruption. <sup>11,39</sup>

Alternative intra-oral donor locations include the chin region, retromolar area, tuberosity, ramus of

mandible, and zygomatic bone.<sup>40</sup> Harvesting bone from intra-oral donor locations has many benefits, including the ability to do the surgery under local anaesthetic as an outpatient treatment, easy surgical access to the local donor sites, and a short ischemic period for the bone transplant. Additionally, since both the donor and recipient sites are intraoral, there is no risk of morbidity associated with a secondary surgical site, such as an extraoral scar.<sup>19-20</sup>

In four patients, Watzak et al.<sup>36</sup> extracted retromolar bone for press-fit closure of oroantral connections. Following the placement of the bone transplant, the soft tissue was closed using a Rehrmann buccal advancement flap. There was no re-opening of the sinus.<sup>41</sup> However, removing retromolar bone is sometimes paired with third molar extraction, which may alter patient acceptability of the treatment<sup>42</sup>. When compared to chin bone transplants, the retromolar donor location has a considerable disadvantage due to the limited volume of accessible bone.<sup>43</sup>

In this research, we selected symphyseal bone to close the OAF because to its major benefits over alternative intraoral locations, including less graft resorption, closeness to the recipient site, lack of hospitalisation, ease of surgical access, and lack of cutaneous scar development.<sup>44</sup> Additionally, grafts from various sources have varying rates of mineralization. Schlegel et al. discovered that chin bone grafts were better in terms of mineralization during a 6-month period.<sup>45</sup> This is consistent with the findings of our investigation. Similarly, Haas et al. demonstrated success with chin transplants in their exploratory investigation.<sup>46</sup>

In our work, we choose corticocancellous block because it has a high concentration of bone and marrow cells with osteogenic potential and a large osteoconductive surface area but lacks rigidity and support. Thus, corticocancellous blocks are preferable because they promote cancellous revascularization while providing mechanical support and stiffness to the cortical region.<sup>47</sup>

The autogenous bone graft was covered with a platelet-rich fibrin (PRF) membrane and subsequently with a buccal advancement flap to complete a three-layered closure of the OAF in this research. Shiv Prasad Sharma<sup>48</sup> introduced the concept of three-layered closure when he conducted three-layered closure of chronic OAF utilising a chin graft, buccal fat pad, and buccal advancement flap. Additionally, our research is supported by Er et al.<sup>49</sup> and Weinstock et al.<sup>50</sup>. Er et al. reported wound dehiscence in 20% of instances after two-layer closure, demonstrating the advantages of three-layered closure. The two layers above the graft offer additional support and also create a well-vascularized bed for the graft's success.

George coined the term "triple-layered."<sup>51</sup> He combined the buccal advancement flap and buccal fat pad with a leucocyte-platelet-rich fibrin (L-PRF) membrane.

Platelet rich fibrin (PRF) was initially characterised in France by Choukroun et al. as the second generation of platelet concentrate. PRF has a number of advantages over the first generation of platelet rich plasma (PRP), including ease of preparation and handling, low cost, and lack of biochemical additives (i.e., no need for anticoagulant, bovine thrombin, or calcium chloride), as well as the ability to be prepared as a membrane.<sup>52-53</sup>

PRF provides considerable postoperative protection for the surgical site and seems to expedite integration, maturation, and remodelling while increasing the density of the bone transplant.<sup>54</sup>

PRF may be thought of as both an autologous biomaterial and a membrane. Due to the osteoconductive and/or osteoinductive qualities of PRF, its use as a membrane and grafting material accelerates the production of mineralized tissue.<sup>55</sup> We employed PRF as a membrane to cover the autogenous chin transplant in our investigation.

In our investigation, 11 patients had satisfactory



closure, with no wound dehiscence at the donor or recipient sites and no graft exposure. By the end of the first month, the covering mucosa had restored to its usual colour and texture.

We employed C.B.C.T to evaluate the graft radiographically, which is consistent with Elmaradny et al.<sup>35</sup> C.B.C.T. overcomes the drawbacks of panoramic radiography, including fluctuating magnification, distortion, superimposition of structures, and inadequate imaging of structures not situated inside the focus trough.<sup>56</sup>

Eleven individuals had a statistically insignificant increase in alveolar bone height and density. Only one example (case no. 3) in our research had wound dehiscence one week after surgery, and despite the patient receiving antibiotics and anti-inflammatory medications, we ultimately removed the exposed graft. The graft failure might be attributed to two things. First, there was a residual root pushed into the sinus that we were unable to remove during the procedure; thus, we planned to remove it by endoscopic surgery. The second cause was that the patient was a habitual smoker and had disregarded our postoperative recommendations to avoid vigorous activities such as nose blowing, sneezing, and smoking, all of which raise pressure inside the paranasal sinuses, resulting in the flap dehiscence.

## CONCLUSION

In conclusion, it is advised that the OAF be closed bony to give a bone basis for eventual implant insertion.

A dissected and rotated epithelialized fistulous tract may be utilised to restore the sinus membrane.

The combination of a press-fit closure of the OAF with an autogenous chin graft and a PRF membrane covered by a buccal advancement flap results in a successful three-layered closure of the OAF and promotes soft tissue flap recovery.

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