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Research Article

ORO ANTRAL FISTULA CLOSURE USING SANDWICH TECHNIQUE

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ABSTRACT

Background: This paper describes a new surgical technique for Oro Antral Fistula closure using guided tissue regeneration membrane & bone substitute sandwich technique.

Method: 24 patients with oro antral fistula were selected. BIOOSS granules were sandwiched between collagen sheets thus creating a closed sandwich. Following fistulectomy mucoperiosteal flap was raised & the sandwich was then tucked in the sinus with smooth surface facing the sinus & rough surface facing oral mucosa. The mucoperiosteal flap was then sutured over the defect. Patients were followed up for swelling, infection, graft failure & healing, by clinical & radiographic methods.

Results: Out of 24 patients objective healing as well as radiological evidence of healing was observed in 18 (100%) subjects. 6 cases of graft rejection was seen due to patients negligence, however overall success rate of the study was 75 %, statistically.

Conclusion: This technique yields a more promising closure of oroantral communication by providing a biologically apt base with bone structure at the floor of the maxillary sinus. The reconstructed bony tissue regenerated from this technique is also capable to receive an endosseous implant in the future.

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INTRODUCTION

The oroantral fistula is a pathological connection between the maxillary sinus and the oral cavity. Despite the fact that extraction of maxillary posterior teeth happens to be the most common cause of development of oro-antral communication, varied etiology has been proposed by numerous researchers that includes dehiscence of floor of the sinus secondary to periapical lesions, forcing a tooth/ tooth root into the sinus cavity during attempted removal, facial trauma, chronic osteomyelitis, gumma, infected maxillary implant dentures etc. Following extraction Incidence of this complication may vary from 0.31% to 3.8%. Hanazawa *Yet al* (1952) [1] reported that Oro Antral Fistula commonly occur after third decade of life. It is more frequent in males and occurs mostly in the second and first molars followed by second premolar teeth. Usual radiologic findings include sinus floor discontinuity, opacification of sinus, focal alveolar atrophy and associated periodontal disease. Small fistulae tend to heal spontaneously,

whereas larger fistulae rarely heal. Surgery is indicated if a fistula does not heal within three weeks.

Various treatment modalities are available for management of Oro Antral Communication or Oro AntralFistula like Buccal flaps, Palatal flaps, Dorsal lingual flaps, Temporo-parietal myofascial flaps Martenson *et al* (1957) [2]. These techniques have the following shortfalls: Buccal sliding flap reduces the depth of the vestibular sulcus, hence need for a vestibuloplasty procedure arises. Palatal flaps causes pain and scarring, the vascular pedicle is vulnerable to trauma and the palatal denuded area takes too long to heal. Dorsal lingual flaps causes difficulty in mobility and articulations. Recently a variety of grafts, including autogenous bone, allogeneous materials, xenografts and synthetic materials have been used with a varying success in the management of OAF. Consequently, after reviewing an array of such procedures, our present study focussed on a technique using the BIOOSS-SKINTEMP II (Sandwich technique). This is particularly unique because it has the advantage of concurrent bone tissue regeneration in the

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Oro Antral Communication/Oro AntralFistula site, which will enable the placement of an endosseous implant in future without the need for complex maxillary sinus lift procedure.

MATERIALS & METHODS

24 Patients reporting to us between 2009 - 2011 for treatment of oro-antral fistulas were included in this study. Patients were selected on random basis avoiding favouring sex, caste and race. Selection criteria included patients with oro-antral fistula (Figure 1) & willing to undergo surgery for closure of oro-antral fistula. They were free from any serious systemic illness which contraindicates the procedure. Patients were excluded from the study group if they were suffering from any renal or hepatic disease, blood dyscrasia, previous or present gastric ulcers, heart disease, hypersensitivities, allergies, or idiosyncratic reactions to any study medications, Pregnant or lactating females & those who were not consenting to participate in the study In all patients irrigation of sinus was done with normal saline, betadine & hydrogen peroxide for 7 days & the sinus was rendered disease free before surgery. 7 days course of antibiotics such as amoxicillin & metronidazole was given. All patients were previously informed that they would be a part of this study & a written informed consent was taken from all the patients. The subjects were screened for any local or systemic contraindications for the surgery under local anesthesia by detailed history, systemic and local examination and investigation. In all patients, complete haemogram & routine urine examination was done. The patients were laid semi supine on the dental chair. Test for sensitivity to lignocaine was done. Extra oral skin preparation was done with 5% standard betadine solution & Intraoral preparation was done with mixture of betadine solution and normal saline and the patient was draped with sterile drapes. Local anesthesia (2% lignocaine hydrochloride with 1:200,000 adrenaline) was administered to block the Posterior Superior Alveolar nerve, Middle Superior Alveolar nerve & Greater Palatine nerve.



Figure 1- Pre op

Surgical Procedure

A circular incision with a 2-mm margin was made around the Oro-Antral Fistula, and the epithelial tract and any inflammatory tissue within the opening was completely excised. Two divergent cuts were then made from each end of the circular incision extending into the vestibule & trapezoidal buccal mucoperiosteal flap on buccal side was then reflected from the alveolar process and the lateral wall of the maxilla. The Resorbable Guided Tissue Regeneration Membrane - Bone Substitute Sandwich Technique using Biooss & Skintemp II, was followed for all cases. Biooss granules were sandwiched

between sheaths of approximately trimmed Skintemp II which were previously sutured together on three sides using 3-0 vicryl suture. The fourth side was then adequately closed using the same suture after the BIOOSS granules were inserted, thus creating a closed sandwich (Figure 2).

The sandwich was prepared in such a way that it has a smooth surface & a rough surface & tucked into the Oro-Antral Fistula in such a way that it forms a convexity towards the sinus & rough surface facing towards the alveolar bone and additional BIOOSS was filled in the concavity (Figure 3).



Figure 2 Prepared sandwich



Figure 3 Graft in position (arrow)



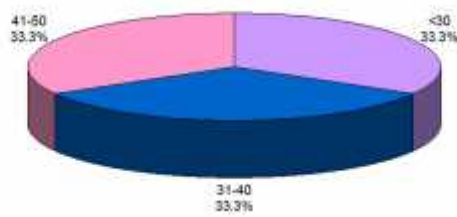
Figure 4 Post op OPG with graft (arrow)

Marginal alveolectomy was performed and flap was repositioned and sutured in place whilst achieving primary closure. After the completion of procedure an Immediate Postoperative Orthopantomogram was taken to evaluate the position of the sandwich graft & another Orthopantomogram was taken after 16 weeks & Subsequently between 24th week to 36th week to evaluate radiographic evidence of healing (Figure 4). Postoperatively patients were asked not to blow out air or suck in air through mouth, not to vigorously blow air from nose & were also asked to open their mouth while

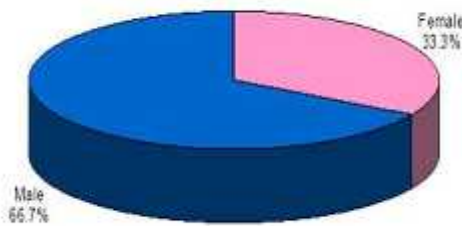
sneezing. Pre-operative medicines were continued for one more week along with analgesics. Patients were recalled after 7 days for suture removal. Assessment of patients was done at the end of 1 week, 2 weeks, 8 weeks, 16 week & 24 week under following parameters like swelling, infection, healing & graft status were assessed.

RESULTS

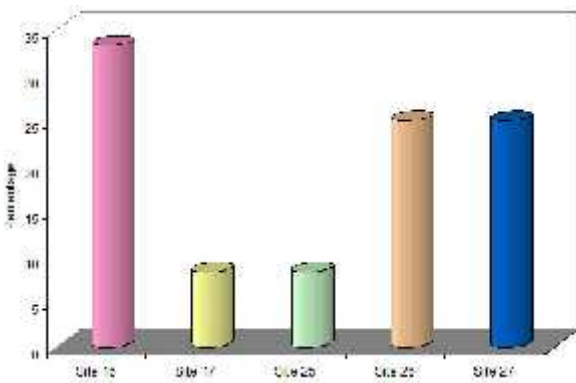
Age of patients ranged from 27 to 50 years. A total of 8 (33.3%) patients each were in age groups ≤ 30 years, 31-40 years and 41-50 years respectively (Graph 1). Mean age of subjects was 37.83 ± 7.81 years. Majority of subjects were males (66.7%). There were only 8 (33.3%) females. Male to female ratio of study subjects was 2:1 (Graph 2). Maximum number of subjects had involvement of site 16 (33.3%) followed by site 26 and 27 (25% each). Involvement of site 17 and 25 was observed in 1 (8.3%) subject each (Graph 3).



Graph 1- Age

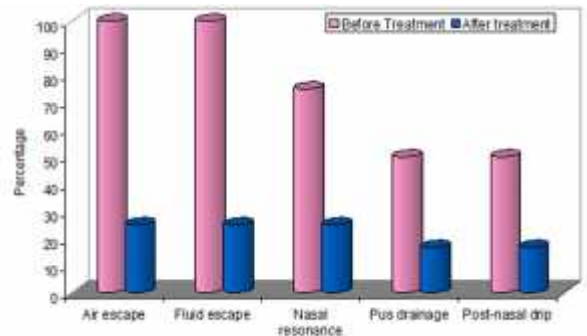


Graph 2- Sex wise distribution



Graph 3- Site wise distribution

The size of defect was observed to be ≤ 5 mm in one-quarter (25%) of subjects while three-quarter (75%) of subjects had size of defect > 5 mm. The size of defect ranged from 4 to 11 mm. Mean size of defect was 6.92 ± 2.11 mm. All the cases had air escape and fluid escape problems before intervention. Nasal resonance was observed in three-fourth (75%) of patients while pus drainage and post-nasal drip was noticed in half (50%) of subjects (Graph 4)



Graph 4 Changes in signs

Post-Operative Assessment

After carrying out the procedure as detailed in Materials and Methods section, the post-operative assessment was done at 1 week (Table 1), 2 week (Table 2), 8 week (Table 3), 16 week (Table 4) and 24-32 week (Table 5) intervals.

Table 1 Outcome at First Post-operative Follow up (At Week 1) (n=24)

S.No.	Variable	No. of subjects	Percentage
1.	Swelling	10	41.7
2.	Infection	0	0
3.	Healing	14	58.3
4.	Graft rejection	2	8.3

Table 2 Outcome at Second Post-operative Follow up (At Week 2) (n=22)

S.No.	Variable	No. of subjects	Percentage
1.	Swelling	4	18.2
2.	Infection	0	0
3.	Healing	18	81.8
4.	Graft rejection	2	9.1

Table 3 Outcome at Third Post-operative Follow up (At Week 8) (n=20)

S.No.	Variable	No. of subjects	Percentage
1.	Swelling	0	0
2.	Infection	0	0
3.	Healing	18	90
4.	Graft rejection	2	10

Table 4 Outcome at Fourth Post-operative Follow up (At Week 16) (n=18)

S.No.	Variable	No. of subjects	Percentage
1.	Swelling	0	0
2.	Infection	0	0
3.	Healing	18	100
4.	Radiological evidence of healing	18	100
5.	Graft rejection	0	0

Table 5 Outcome at Final Post-operative Follow up (Between 24-32 weeks) (n=18)

S.No.	Variable	No. of subjects	Percentage
1.	Swelling	0	0
2.	Infection	0	0
3.	Healing	18	100
4.	Radiological evidence of healing	18	100
5.	Graft rejection	0	0

On first follow up out of 24 patients swelling was observed in 10 (41.7%) patients. Infection was observed in 0 patients. Objective healing was observed in 14 (58.3%) subjects out of

total 24 patients (Table 1). In 2 subjects graft rejection was seen (Figure 5).



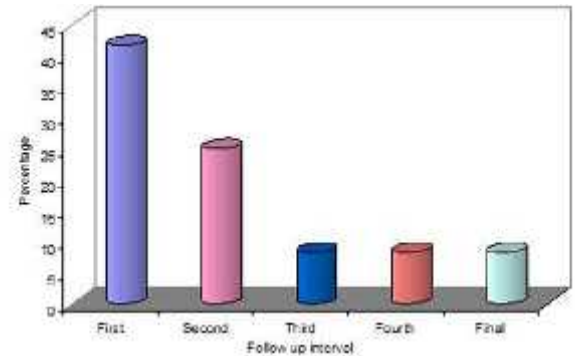
Figure 5 Graft rejected (arrow)

Second follow was carried out in 22 patients only because two cases of graft rejection observed during the 1st follow up were excluded from the study. During this follow up swelling was observed in 4 (18.2%) patients only. Infection was observed in 0 (0%). Out of 22 Objective healing was observed in 18 (81.8%) subjects. In 2 (9.1%) more subject graft was rejected leading to revision thus making total cases of graft rejection as 4 patients by the end of 2nd follow up (Table 2). Third follow up could be carried out in 20 subjects only because 4 patients had graft rejection and were excluded from the study. On third follow up, swelling and infection was observed in 0 patients. Out of total 20 patients in 18 (90%) cases there was evidence of objective healing (Table 3) and 2 (10%) more cases of graft rejection was observed thus making a total of 6 patients with graft rejection out of 24 included in the study. Fourth follow up could be carried out in 18 patients as 2 more new patients of graft rejection were removed from the study. On fourth follow there was no event of swelling or infection in all the 18 subjects. Objective healing as well as radiological evidence of healing was observed in all the 18 (100%) subjects. There was no new case of graft rejection (0%) reported (Table 4). Final follow up was carried out in 18 patients. On final follow no event of swelling or infection was noticed in any subject. Objective healing as well as radiological evidence of healing was observed in all the 18 (100%) subjects. Again there was 0 case of graft rejection reported during last follow up (Table 5). Results showed a significant change in complaints like air escape, fluid escape and nasal resonance after treatment. However, the change in pus drainage and post-nasal drip was not significant statistically ($p=0.193$) (Graph 4). All the cases which are having persisting complaints were cases of graft rejection (Table 6).

Table 6 Change in preoperative Findings

S.No.	Variable	Before treatment		After treatment		Significance of change (Fisher exact test)	
		No.	%	No.	%	t ²	p
1.	Air escape	24	100	6	25	14.400	<0.001
2.	Fluid escape	24	100	6	25	14.400	<0.001
3.	Nasal resonance	18	75	6	25	6.000	0.039
4.	Pus drainage	12	50	4	16.7	3.000	0.193
5.	Post-nasal drip	12	50	4	16.7	3.000	0.193

There was a gradual fall in incidence of swelling from first till third follow-up, however, no change was observed from third to final follow up intervals (Graph 5).



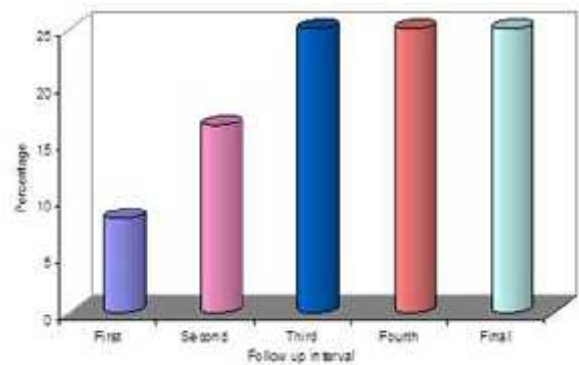
Graph 5 Changes in swelling

On comparing the change from baseline, no significant difference was observed at any time interval ($p>0.05$). At first follow up, none of the patients showed evidence of infection, however, from second follow up till the final follow up, infection was observed in 2 (8.3%) patient (Table 7).

Table 7 Comparison of Infection at different time intervals as compared to first follow up visit

S.No.	Time interval	No. of patients with swelling	Percentage	Significance of difference from first follow-up interval	
				t ²	p (Fisher exact test)
1.	First follow up	0	0	–	–
2.	Second follow up	2	8.3	1.043	1
3.	Third follow up	2	8.3	1.043	1
4.	Fourth follow up	2	8.3	1.043	1
5.	Fifth follow up	2	8.3	1.043	1

Statistically, at none of the time intervals, the change was significant statistically. Comparison of healing (Graph 6) at different time interval as compared to first follow up visit has been shown.



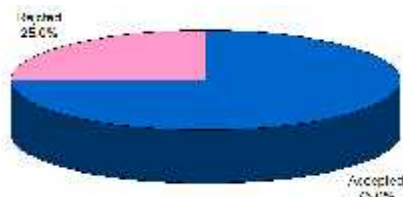
Graph 6 changes in healing

A first follow up interval, 14 (58.3%) patients had evidence of healing while the same was evident in 18 (75%) patients from second follow up till final follow up. On comparing the data statistically, no significant change from first follow up findings was observed ($p=0.667$). At first follow up interval, 2 (8.3%) patients had evidence of graft rejection while the same was evident in 4 (8.3%) subjects at second follow up and 6 (25%) patients from third follow up onwards (Table 8).

Table 8 Comparison of Evidence of Graft Rejection at different time intervals as compared to first follow up visit

S.No.	Time interval	No. of patients with rejection	Percentage	Significance of difference from first follow-up interval	
				t ²	p (Fisher exact test)
1.	First follow up	2	8.3	–	–
2.	Second follow up	4	16.5	0.381	1
3.	Third follow up	6	25	1.200	0.591
4.	Fourth follow up	6	25	0.750	0.591
5.	Fifth follow up	6	25	0.750	0.591

On comparing the data statistically, no significant change from first follow up findings was observed ($p > 0.05$). The graft was accepted in 18 (75%) subjects and rejected in 6 (25%) subjects. Thus the overall success rate was 75% (Graph 7).



Graph 7- Success rate

DISCUSSION

The volume of the maxillary sinus is the result of functional development of the maxilla and its pneumatisation, and it therefore increases at the same rate as the growth of the jaws and eruption of permanent teeth. Because of the smaller volume of the sinus the risk of occurrence of oroantral communication in children and adolescents is less. However in adults the volume of the sinus amounts to 20-25 ml. Because of the anatomic position of the maxillary sinus and its intimate connection with the teeth, oroantral communication and subsequent formation of an oroantral fistula is relatively common complication of dental extractions.

Hanazawe *et al* [1] (1995), reported that an oroantral fistula of less than 2 mm diameter has the possibility of spontaneous healing, while in the cases of diameter of more than 3 mm spontaneous healing is hampered because of the possibility of inflammation of the sinus or periodontal region. Martensson *et al* (1957) [2], in contrast to Hanazawe, reported that there is less possibility of spontaneous healing when the oroantral fistula has been present for 3 to 4 weeks, or when its diameter is greater than 5 mm.

Many techniques have been proposed for the closure of oroantral fistula, including buccal or palatal alveolar flaps and their modifications. Use of some alloplastic materials have also been proposed. Materials range from autogenous bone grafts to gold foil (Goldman *et al* 1969) [3].

With advancing technology, allotrasplants like dura mater and fascia lata, have also been used for closing oro-antral fistula. In recent years, the use of a pedicled buccal fat pad in closure of large oroantral openings has become popular (Hanazawa *et al*. 1995) [1]. Distant flaps like temporalis or forehead or tongue flaps have also been described earlier but all these technique provide only soft tissue closure.

Recently an innovative Sandwich Technique, which was followed in our study also, was described by Ogansalu *et al* (2005) [4] have been introduced. In this technique collagen membrane & Biooss (deminerlized bovine bone matrix) sandwich graft was used for OAF closure, this sandwich technique not only led to a proper anatomical closure, but also aided in the built up of a more biological base i.e. the reformation of lost bone structure.

Our study comprised of 24 patients between age range of 27 to 50 years. 50yrs was considered as upper limit because maximum degree of pneumatization takes place upto this age & also it happens to be the prevalence age for maximum posterior teeth extraction. A total of 8 (33.3%) patients each were in age groups ≤ 30 years, 31-40 years and 41-50 years respectively. Mean age of subjects was 37.83 ± 7.81 years.

In our study majority of subjects were males 22 (66.7%) & 8 (33.3%) females. Maximum number of subjects had involvement of site 16 (33.3%) followed by site 26 and 27 (25% each). Involvement of site 17 and 25 was observed in 1 (8.3%) subject each. the most common site for OAF formation followed by upper 2nd molar. Killey and Kay *et al* (1978) [5] concluded that more than half of the oroantral fistula occurred after extraction of the first molar, and approximately 25% as a result of second molar extraction.

In our study the size of defect was observed to be ≤ 5 mm in (25%) of subjects while (75%) of subjects had defect size > 5 mm. The size of defect ranged from 4 to 11 mm. Mean size of defect was 6.92 ± 2.11 mm.

All the cases had air and fluid escape problems before intervention. Nasal resonance was observed in three-fourth (75%) of patients while pus drainage and post-nasal drip was noticed in (50%) of subjects. All these signs & symptoms are classical for the existence of oroantral fistula with pus drainage & post nasal drip suggesting chronic sinusitis.

In our study swelling was observed in 10 patients (41.7%) at first week follow up which reduced to 4 patients (18.2%) during second week follow up. Third week and subsequent follow up showed no evidence of swelling in all subjects. This was in accordance with statistics provided by Baumann A *et al*. (2000) [6].

Infection was observed in one of the patients from second week onwards (8.3%) but it was statically not significant. This implies that carefully incised tissues with carefully applied peri-operative surgical procedures leads to least post-operative morbidity. Further, Ronald *et al*. (2008) [7] also implicated that hydroxyapatite collagen meshwork was resorbable under in vivo conditions and shows good biocompatibility. The properties shown by the applied hydroxyapatite - collagen sandwich graft describes a bone replacement substance that was stable in volume, biodegradable, and osteoconductive.

In present study Healing was observed under objective & radiographic parameter results showed that during first week follow up Objective healing was observed in only 14 (58.3%) subjects & no healing was observed in 10 (41.66%) patients but at the third week follow up healing was observed in 18 (90%) cases, After 16th week & at final follow up evidence of both radiographic & objective healing was observed in all the 18

(100%) subjects. All Subjects showed highly statistically significant radiological evidence of bone formation at 6th week and in between 24th to 32nd week interval which was in accordance with the study of Ogunsalu et al. (2005)⁴, Ibrahim mohammed et al (2000) [8] & kayathoma et al (2006) [9] confirmed radiographic evidence of bone formation in oroantral fistula closure at 12th & 16th week.

In our study at first week follow up evidence of graft rejection was seen in 2 patients, subsequently at second & third follow visit there were graft rejection in 4 other patients. After third follow up visit no further evidence of graft rejection was observed in any of the patients. A significant change in complaints like air escape, fluid escape and nasal resonance was observed after treatment. However, the change in pus drainage and post-nasal drip was not significant statistically. All the cases had persisting complaints following graft rejection.

In the present study it was observed that there was a gradual fall in incidence of swelling from first till third week follow-up but no change was observed from third to final follow up intervals. The findings were similar to the finding of study of (Hariram, U S Pal et al 2010) [10] No evidence of infection was seen in any patients at first week but infection was observed in 2 (8.3%) patients from second follow up till the final follow up visit. Statistically, at none of the time intervals, the change was significant statistically. When healing was considered results showed that 14 (58.3%) patients had evidence of healing at first follow up interval, while from second follow up onwards healing was evident in 18 (75%) patients. On comparing the data statistically, no significant change from first follow up findings were observed (p=0.667).

When graft survival was taken into account, results showed that at first follow up week 2 patients showed evidence of graft rejection and at second follow up there was evidence of graft rejection in 2 more patients thus graft rejection was present in 4 (16.6 %) subjects. At third follow up 2 more patients showed signs of graft rejection thus a final total of 6 (25%) patients showed graft rejection.

On comparing the data statistically, no significant change from first follow up findings was observed (p>0.05). This was also elucidated in the works of Adeyemo et al. (2004) [11]. Out of 6 patients with graft rejection, 4 were males with the age range from 30 to 40 yrs of age. The 1st patient who showed evidence of graft rejection was 35yrs/m and rejection took place at 1st follow up week. 2nd patient was of age 30 yrs/M and graft rejection took place at 2nd follow up week. At 3rd follow up week 2 more male patients showed evidence of graft rejection with age 38 & 30 yrs respectively. All these Patients had a history of being a chronic smokers & graft rejection was attributed to smoking, as all of them continued to smoke during post op week which subsequently resulted in wound breakdown and graft rejection.

A 50 yr old female patient also showed evidence of graft rejection during first follow up week with a defect of size 3.5mm after graft failure. This was due to poor oral hygiene and patient compliance as the patient didn't follow the post op instruction and was regularly creating negative pressure by drinking with straw & spitting which as mentioned in the literature has a poor outcome on healing of oroantral fistula.

During second follow up, again 1 more female patients who was again 50yr with defect size of about 3.5mm showed evidence of graft rejection, graft failed at about 8th week post op because of poor oral hygiene and oral tobacco abuse, thus making a grand total of 6 patients with graft rejection.

Post nasal drip & pus discharge along with nasal resonance of voice, nasal regurgitation of fluid persisted in all the three patient suggesting that failure of graft can also be due to persistent infection in maxillary sinus this bears close relation with finding of Von wovern et al (1982) [12] suggesting failure of oroantral fistula to heal in cases where sinus infection persisted.

Finally, patients with graft rejection were treated using buccal fat pad graft in 4 patients with defects sizes of 2mm & 3mm and in 1 patient with defect of size 3.5mm, palatal pedicled flap was used to close the residual defect. In 1 patient buccal advancement flap was used for closure. From the foregoing discussion, we in our study, found that new bone formation was evident in sandwich graft technique. However, to prove statistically significant result, a larger sample size as well as larger follow up is required for establishment of the same.

CONCLUSION

The Sandwich graft technique yields a more promising closure of oroantral communication by providing a biologically apt base with bone structure at the floor of the maxillary sinus. No donor site surgery is necessary & this is an advantageous technique in terms of time saving, cost and more importantly, less discomfort to the patient during and after surgery. Furthermore, both bony (hard tissue) and soft tissue closure is achieved for oro-antral communication in contrast to only soft tissue closure obtained by buccal sliding flaps or palatal flaps. The reconstructed bony tissue regenerated from this technique are also capable to receive an endosseous implant

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