Original Article

Buccal fat pad versus sandwich graft for treatment of oroantral defects: A comparison

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ABSTRACT

Aim: To compare the efficacy of buccal fat pad (BFP) graft with sandwich graft (hydroxyapatite crystals embedded within collagen sheath) in closure of oroantral defects. **Materials and Methods:** A 2-year prospective study was conducted; 20 patients were included in the study were divided into two groups having 10 patients in each. Group I patients underwent surgical closure of oroantral fistula with sandwich graft and Group II patients with buccal pad of fat. **Results:** In Group I, the mean pain scores were 7.60 ± 0.84, 3.90 ± 1.10, 2.30 ± 1.16, 1.10 ± 0.99 and 0.40 ± 0.70 at immediate post-op., 1, 3, 6 and 12 week time intervals, respectively, whereas in Group II these were 7.30 ± 0.67, 3.50 ± 0.53, 1.70 ± 0.48, 1.00 ± 0.47 and 0.30 ± 0.48, respectively, at the corresponding time intervals. In Group I, swelling was seen to be present in 10 (100%), 7 (70%), 2 (20%) and nil (0%) patients at 1, 3, 6 and 12 weeks, respectively, whereas in Group II, it was seen to be present in 10 (100%), 10 (100%), 2 (20%) and nil (0%) patients at the corresponding time intervals. At 1 week, infection was seen to be present in 1 (10%) patient of Group I and 2 (20%) patients of Group II. At 3 and 6 weeks, infection was seen to be present in 1 (10%) patient of Group I and none of the patients of group II. No radiologic evidence of bone formation was seen in either group up to 1 week. At 3 week interval, there were 6 (60%) patients in Group I and nil (0%) in Group II showing bone formation, thus showing a statistically significant difference between the two groups. By 6 week time interval, radiologic evidence of bone formation was seen in 9 (90%) patients of Group I but in no patients of Group II, thereby showing a statistically very highly significant ($P < 0.001$) difference between the two groups. In Group I, in 1 (10%) patient, graft was rejected by first week; however, no further graft rejection took place. In Group II, no case of graft rejection was reported. **Conclusions:** The sandwich graft technique yielded a more promising closure of oroantral communication by provision of a more biologically apt base in terms of regeneration of lost bone structure at the floor of the maxillary sinus

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Introduction

It might seem intriguing how a pea-sized air space at the time of birth within the body of maxilla transforms into a full blown cavity encompassing maximum portion of the body of maxilla. This is made possible by the process of pneumatization which happens to be an evolutionary process as a functional and adaptive phenomenon.

One of the clinical complications encountered by oral and maxillofacial surgeons is oroantral communication (OAC) with progressive formation of oroantral fistula (OAF). The incidence of this complication may vary from 0.31 to 3.8% after extraction of maxillary teeth.[1]

An OAF of less than 2 mm diameter has the possibility of spontaneous healing; but in the one with a diameter of more than 3 mm spontaneous healing is hampered

because of inflammation of the sinus or periodontal region.[2] There is also less possibility of spontaneous healing when the OAF has been present for 3–4 weeks, or when its diameter is greater than 5 mm.[3] If oroantral opening remains untreated, the patients experience sinusitis.

Various techniques and treatment modalities have been described for the management of OAC or OAF. These are buccal flap, palatal flap, soft palate flap and related modifications.[4] These techniques have various advantages and disadvantages. The advantage of the buccal flap method is that it can be used when the alveolar ridge is very low and when it is impossible to apply the method of inerseptal alveotomy, but buccal flap reduces the depth of the vestibular sulcus, and therefore needs for a vestibuloplasty. A palatal flap of full thickness enables the closure of a fistula opening with the mucous membrane of the hard palate. Palatial flap contains blood vessels which enable a good blood supply, and with its thickness and width it covers the site of the fistula better and safer. An advantage of this method compared to the buccal flap method is that no lowering of the vestibule occurs and the flap is firmer and more resistant to trauma and infection.[5] Disadvantages of this method are the denudation of the palatal surface, pain, and the later appearance of roughness and deepening of this area as a result of secondary epithelization over 2–3 months. The unpleasant complication is necrosis of the palatial flap.[6]

Recently, third molar transplantation as a technique in closure of OAC has been used. This proposed modality of treatment is promising and unique but has the disadvantage of known complications of third molar extraction. OAF cannot be closed in this manner. Root canal treatment of the transplanted tooth is indicated.[7]

Different types of materials have been used to repair of the oroantral defect. Goldman[8] applied gold foil to ensure stability of the flap while closing the fistula and prevent possible recurrences. Zide and Karas[9] used blocks of hydroxyapatite for closure of OAF to fill the bone defect in the alveoli.

Other varieties of graft materials have been used in place of bone, including tantalum,[8] freeze-dried collagen[10] and fascia lata, Duramater.[11] An OAC was closed by applying a buccal fat pad (BFP)-pedicle BFP graft.[2] It is used in patients with a fistula of 8–20 mm in diameter. Over a period of 3 weeks, the fatty tissue converts into granulation tissue and epithelizes, which has been confirmed by documented histologic findings.

Bio-Gide is a synthesized collagen membrane. The porous surface facing the bone allows the in-growth of bone-forming cells. Bio-Oss is a safe and effective bone graft material, very similar to human bone, and highly successful in new bone formation. Due to high purity, no allergic reaction or infection is observed.[10]

Materials and Methods

Twenty patients of OAF, attending Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, Chhatrapati Shahuji Maharaj Medical University, Lucknow, were included in the study. The patients were taken randomly irrespective of sex, caste and creed and they were of age between 18 and 45 years. Patients suffering from renal or hepatic disease, heart disease, blood dyscrasia, previous or present gastric ulcers, known hypersensitivities, allergies, or idiosyncratic reactions to any study medications were excluded from the study. Pregnant or lactating females were excluded from the study. Patients were divided into two groups in a random manner.

Group I (n = 10 patients): Patients underwent surgical closure of OAF with sandwich graft (hydroxyapatite crystals within collagen sheaths).

Group II (n = 10 patients): Patients underwent surgical closure of OAF with BFP.

Patients of both the groups were operated under local anaesthesia. The study protocol was explained to the patients in detail and their consent was obtained. All the patients were prepared preoperatively with irrigation of sinus with normal saline for 7 days and no evidence of maxillary sinusitis was ensured before surgery. Amoxicillin, Metronidazole, decongestant nasal drops and steam inhalation were given for 7 days preoperatively.

Sandwich technique for closure of oroantral fistula

After part preparation and administration of local anesthesia, a circular incision with a 2-mm margin was made around the OAF, and the epithelial tract and inflammatory tissue within the opening were completely excised [Figure 1-3]. Two divergent cuts were made from each end of the circular incision extending into the vestibule. The trapezoidal buccal mucoperiosteal flap was reflected from the alveolar process and the lateral wall of the maxilla. Hydroxyapatite granules were sandwiched between sheaths of approximately trimmed collagen which were previously sutured together in three sides using 3-0 vicryl suture [Figure 4]. The fourth side was then adequately closed using the same suture after the hydroxyapatite granules were inserted, thus creating a closed sandwich. The

sandwich was prepared in such a way that it has a smooth side which was upward and a rough surface placed downward. The prepared sandwich was tucked into the defect in such a way that it forms a convexity toward the sinus and a concavity toward the alveolar bone [Figure 5]. Marginal alveolectomy was performed and flap repositioned and sutured in place whilst achieving primary closure [Figure 6]. No surgical splint or dressing was used. Radiological assessment was done post operatively [Figures 7 and 8].

Buccal pad of fat technique for closure of oroantral fistula

Oroantral part preparation and induction of anesthesia were done in a similar manner to that of the sandwich technique. Epithelial tract was excised and flap was raised in a similar manner as in sandwich technique [Figure 9-11]. The buccal pad of fat was exposed through a 1-cm long vertical incision in the reflected periosteum posterior to the zygomatic buttress [Figure 12]. The buccal pad of fat was gently advanced into the bony defect and secured to the palatal mucosa without tension, with 4-0 vicryl sutures. Finally, the mucoperiosteal flap was replaced in its original position and sutures were inserted between the buccal pad of fat and the buccal flap so that a part of the buccal pad of fat was exposed in the oral cavity [Figure 13].

Pre-operative medicines were continued for one more week along with analgesics. Sutures were removed after 7 days. Assessment of patients was done at the end of 1, 3, 6 weeks and 3 months [Figure 14-16] based on the following parameters:

1. Pain visual analog scale
2. Swelling present/absent
3. Infection present/absent
4. Healing period radiographic and objective
5. Graft accepted/rejected

The statistical analysis was done using Statistical Package for Social Sciences (SPSS) Version 15.0 statistical analysis software. The values were represented in number (%) and mean ± SD.

Results

Out of a total 20 patients enrolled in the study, 5 (25%) were of 18–30 years of age, 9 (45%) were 31–40 years old and the remaining 6 (30%) were 40–45 years old. The mean age of the subjects was 36.95 ± 5.70 years with a minimum age of 28 years and maximum age of 45 years [Table 1].

In Group I, four subjects (40%) were 18–30 years old and four were 31–40 years old, whereas two (20%) were 40–45 years old. In Group II, only 1 (10%) patient was 18–30 years old, 5 (50%) were between 31 and 40 years old and 4 (40%) were 40–45 years of age. Statistically no significant difference was seen between the two groups ($P = 0.276$) [Table 2].

In both the groups, 60% subjects were males and 40% subjects were females. Statistically, there was no significant difference between the two groups ($P = 1$) [Table 3].

In Group I, there were 4 (40%) subjects with size of OAF up to 5 mm^2, whereas in Group II there were 6 (60%) subjects with size of OAF up to 5 mm^2. In size 6–10 mm^2 category, there were 5 (50%) subjects in Group I and 4 (40%) subjects in Group II. In >10 mm^2 size category, there was only 1 subject in Group I. Mean size in Group I was 6.80 ± 3.16 mm^2, whereas in Group II it was 4.90 ± 1.37 mm^2. Statistically, there was no significant difference between the two groups ($P = 0.470$) [Table 4].

In Group I the mean pain scores were 7.60 ± 0.84, 3.90 ± 1.10, 2.30 ± 1.16, 1.10 ± 0.99 and 0.40 ± 0.70 at immediate post-op., 1, 3, 6 and 12 week time intervals, respectively, whereas in Group II these were 7.30 ± 0.67, 3.50 ± 0.53, 1.70 ± 0.48, 1.00 ± 0.47 and 0.30 ± 0.48, respectively at the

Table 1: Agewise distribution of cases (n = 20)

Age group (years)	No. of cases	Percent
18–30	5	25
31–40	9	45
40–45	6	30

Table 2: Comparison of age in two groups under study (n = 20)

Age group (years)	Group I (n = 10)		Group II (n = 10)	
	No.	%	No.	%
18–30	4	40	1	10
31–40	4	40	5	50
40–45	2	20	4	40

Table 3: Genderwise comparison of two groups under study (n = 20)

Gender	Group I (n = 10)		Group II (n = 10)	
	No.	%	No.	%
Male	6	60	6	60
Female	4	40	4	40

Table 4: Size of oroantral defect

Size (mm^2)	Group I (n = 10)		Group II (n = 10)	
	No.	%	No.	%
Upto 5	4	40	6	60
6–10	5	50	4	40
>10	1	10	0	0
Mean ± SD	6.80 ± 3.16		4.90 ± 1.37	

corresponding time intervals. Statistically, no significant difference was seen between two groups at any time interval [Table 5].

In Group I, swelling was seen to be present in 10 (100%), 7 (70%), 2 (20%) and nil (0%) patients at 1, 3, 6 and 12 weeks, respectively, whereas in Group II, it was seen to be present in 10 (100%), 10 (100%), 2 (20%) and nil (0%) patients at the corresponding time intervals. Statistically, no significant difference was seen between the two groups at any time interval ($P > 0.05$) [Table 6].

At 1 week, infection was seen to be present in 1 (10%) patient of Group I and 2 (20%) patients of Group II, showing no statistically significant difference ($P = 0.531$) between the two groups. At 3 and 6 weeks, infection was seen to be present in 1 (10%) patient of Group I and none of the patients of group II, showing no statistically significant difference between the two groups ($P = 0.305$). At 12 weeks, none of the patients in either group had infection [Table 7].

No radiologic evidence of bone formation was seen in either group up to 1 week. At 3 week interval, there were 6 (60%) patients in Group I and nil (0%) in Group II showing bone formation, thus showing a statistically significant difference between the two groups ($P = 0.003$). By 6 week time interval, radiologic evidence of bone formation was seen in 9 (90%) patients of Group I, but none (0%) of Group II, thereby showing a statistically very highly significant ($P < 0.001$) difference between the two groups. At 12 week time interval, the situation was similar to that at 6 weeks [Table 8].

In Group I, in 1 (10%) patient graft was rejected by first week, however no further graft rejection took place. In Group II, no case of graft rejection was reported. Statistically, no significant difference was seen between the two groups ($P = 0.305$) [Table 9].

At 1 week, 9 (90%) of Group I and 8 (80%) of Group II showed satisfactory healing ($P = 0.531$); at 3 weeks, 9 (90%) of Group I and 10 (100%) of Group II patients showed satisfactory healing ($P = 0.305$). At 6 weeks, in both groups 8 (80%) patients showed satisfactory healing. At 12 weeks, 9 (90%) of Group I and 10 (100%) of Group II patients showed satisfactory healing ($P = 0.305$). Statistically, no significant difference was seen between the two groups at any time interval ($P > 0.05$). The largest part of the upper jaw is taken up by the maxillary sinus [Table 10].

Discussion

The largest part of the upper jaw is taken up by the

Table 5: Comparison of postoperative pain at different time intervals in two groups (Visual Analouge Scale score)

Time interval	Pain score (mean ± SD)		Z	P
	Group I (*n* = 10)	Group II (*n* = 10)		
Immediate post-op.	7.60 ± 0.84	7.30 ± 0.67	0.904	0.436
1 week	3.90 ± 1.10	3.50 ± 0.53	0.621	0.579
3 weeks	2.30 ± 1.16	1.70 ± 0.48	1.149	0.315
6 weeks	1.10 ± 0.99	1.00 ± 0.47	0.043	0.971
12 weeks	0.40 ± 0.70	0.30 ± 0.48	0.141	0.912

Table 6: Comparison of postoperative swelling at different time intervals in two groups

Time interval	Patients showing swelling				χ^2	P
	Group I (n = 10)		Group II (n = 10)			
	No.	%	No.	%		
1 week	10	100	10	100	–	–
3 weeks	7	70	10	100	3.529	0.06
6 weeks	2	20	2	20	–	–
12 weeks	0	0	0	0	–	–

Table 7: Comparison of postoperative infection at different time intervals in two groups

Time interval	Patients having infection				χ^2	P
	Group I (*n* = 10)		Group II (*n* = 10)			
	No.	%	No.	%		
1 week	1	10	2	20	0.392	0.531
3 weeks	1	10	0	00	1.053	0.305
6 weeks	1	10	0	00	1.053	0.305
12 weeks	0	0	0	0	–	–

Table 8: Comparison of postoperative radiographic evidence of bone formation at different time intervals in two groups

Time interval	Patients showing bone formation				χ^2	P
	Group I (n = 10)		Group II (n = 10)			
	No.	%	No.	%		
1 week	0	0	0	0	–	–
3 weeks	6	60	0	0	8.571	0.003
6 weeks	9	90	0	0	16.364	<0.001
12 weeks	9	90	0	0	16.364	<0.001

Table 9: Comparison of graft acceptance at different time intervals in two groups

Time interval	Patients showing graft acceptance				χ^2	P
	Group I (n = 10)		Group II (n = 10)			
	No.	%	No.	%		
1 week	9	90	10	100	1.053	0.305
3 weeks	9	90	10	100	1.053	0.305
6 weeks	9	90	10	100	1.053	0.305
12 weeks	9	90	10	100	1.053	0.305

Table 10: Comparison of objective healing at different time intervals in two groups

Time interval	Satisfactory objective healing				χ^2	P
	Group I (n = 10)		Group II (n = 10)			
	No.	%	No.	%		
1 week	9	90	8	80	0.392	0.531
3 weeks	9	90	10	100	1.053	0.305
6 weeks	8	80	8	80	–	–
12 weeks	9	90	10	100	1.053	0.305

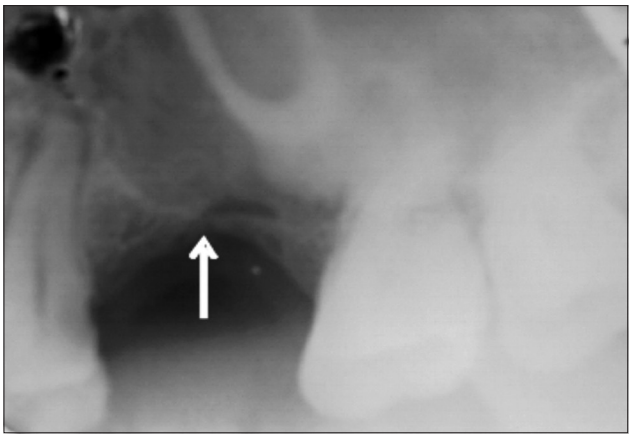

Figure 1: Intraoral periapical radiograph

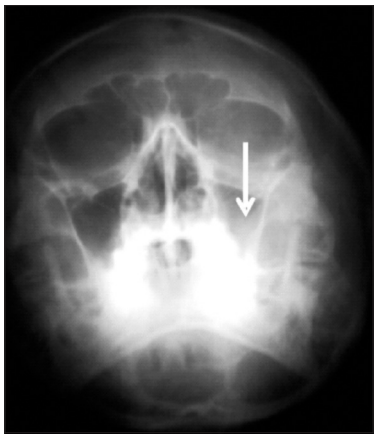

Figure 2: Occipitomental view

Figure 3: Intra oral view after removal of fistulous tract

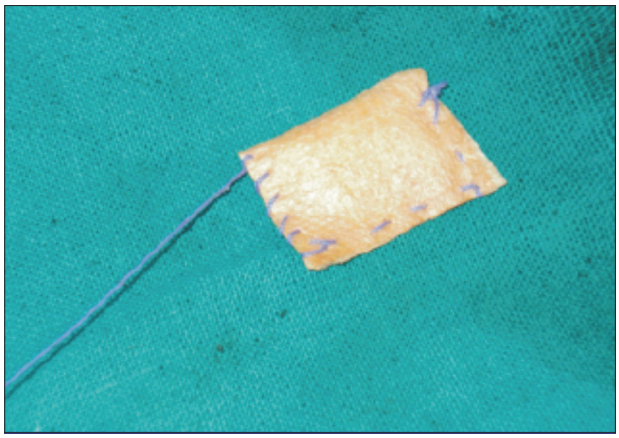

Figure 4: Sandwich graft before placement

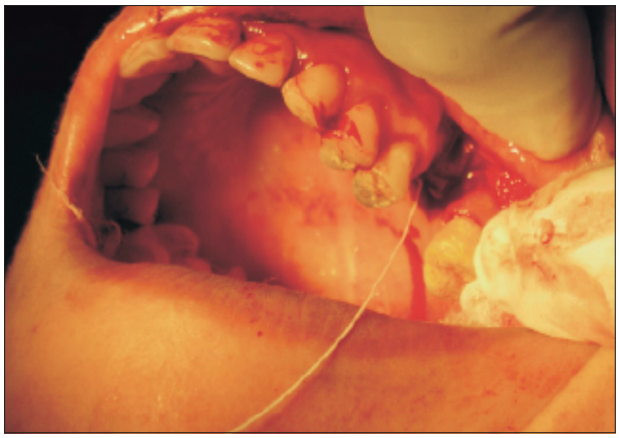

Figure 5: Sandwich graft *in situ*

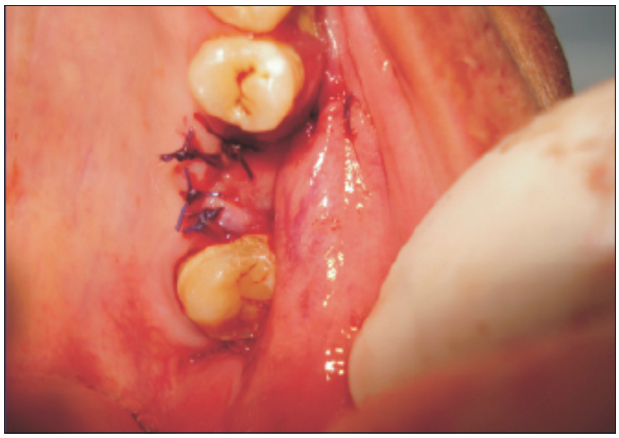

Figure 6: Primary closure

maxillary sinus known as Antrum of Highmore. At birth, the maxillary sinus is present as a small cavity. Its growth begins in the third month of foetal life, and ends between the 18th and 20th year of life. Therefore, it 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 the occurrence of OAC in children and adolescents is less. In adults, the volume of the sinus amounts to 20–25 ml.

An OAF of less than 2 mm diameter has the possibility of spontaneous healing, while in the case of an OAF of diameter of more than 3 mm, spontaneous healing is hampered because of the possibility of inflammation of the sinus or periodontal region.[2] There is less possibility of spontaneous healing when the OAF

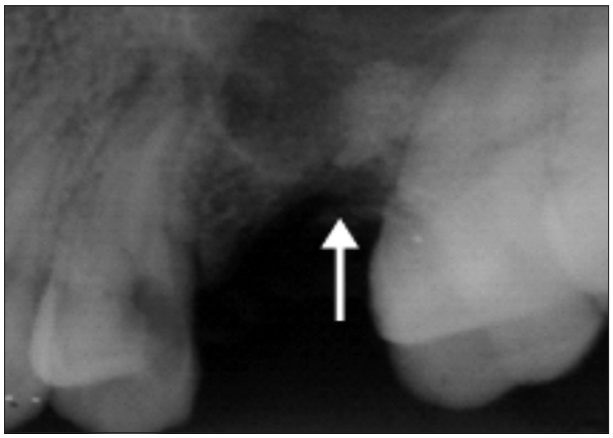

Figure 7: One week post- op

Figure 8: Twelve week post-op

Figure 9: Intraoral periapical radiograph (group II)

Figure 10: Occipitomental view (group II)

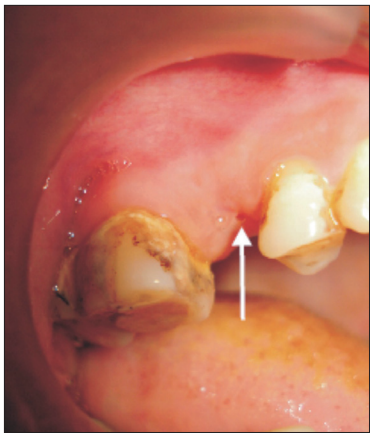

Figure 11: Intraoral view of oro-antral fistula (group II)

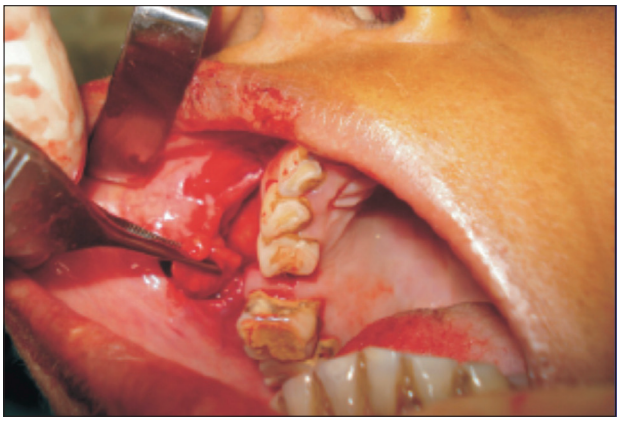

Figure 12: Buccal fat pad mobilized at the site (group II)

has been present for 3–4 weeks, or when its diameter is greater than 5 mm.[3] Many techniques have been proposed for the closure of OAF, including buccal or palatal alveolar flaps and their modifications. The preferred technique may vary from one clinician to another and case selection. In addition to the above techniques, some alloplastic materials have also been used. Materials range from autogenous bone grafts[12] to gold foil[3] for closing OAF.[11] In recent years, the use of a pedicle BFP in closure of large oroantral openings has become popular.[2] Distant flaps from the extremities or forehead or tongue flaps have been described by Edgerton and Zovickian,[13] and Guerro-Santos and Altamirano.[14]

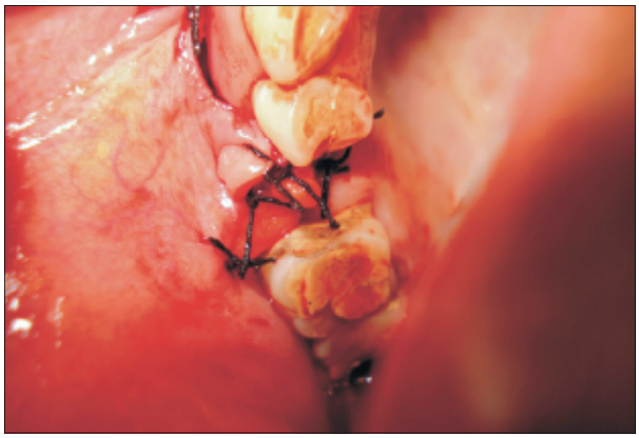

Figure 13: Buccal fat pad secured with sutures (group II)

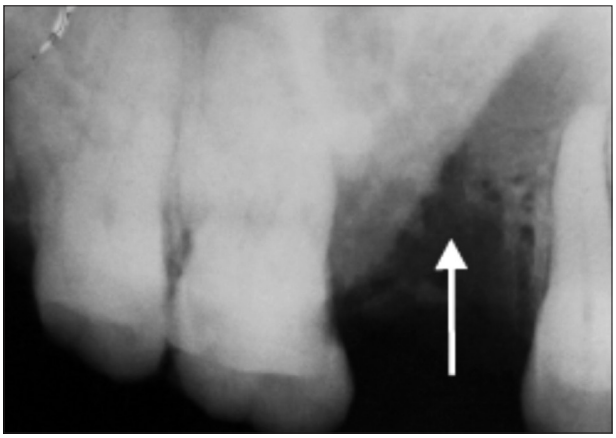

Figure 14: One week post-op (group II)

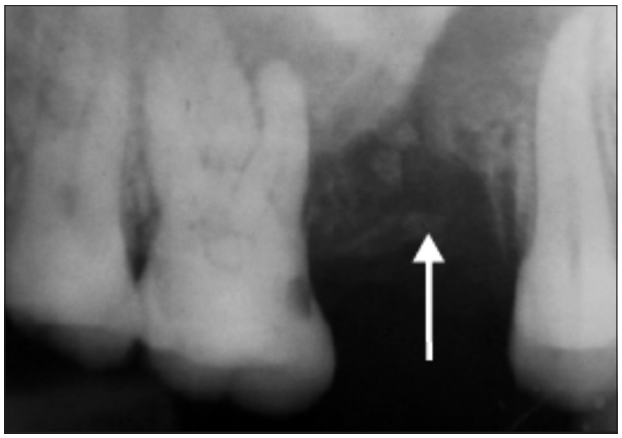

Figure 15: Six week post-op (group II)

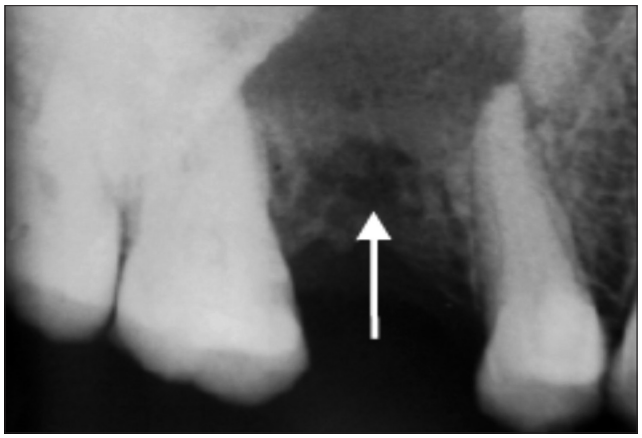

Figure 16: Twelve week post-op (group II)

Sandwich technique has not only led to a proper anatomical closure, but also aided in the build-up of a more biological base, i.e., the reformation of lost bone structure. A sandwich graft comprising hydroxyapatite crystals within a collagen network sheet in the area of OAF not only provides an adequate closure of the overlying mucosa but also is a radiologic evidence of underlying bone formation.[10]

The frequency of occurrence of OAF is nearly the same in both sexes, which correlates with the findings of Von Wowern,[15] Skoglund *et al*,[16] and Punwutikorn *et al*.[1] Females exhibit larger sinuses than males and should, therefore, be at a greater risk of OAF.[17]

Our study corresponds with the clinical evaluation by Guven[18] which indicates that OAF most frequently occurs after the third decade of life, which agrees with the results of other studies by Lin *et al*,[17] and Punwutikorn *et al*.[1]

Mean size of the OAF defect in Group I was 6.80 ± 3.16 mm^2, whereas in Group II it was 4.90 ± 1.37 mm^2. Statistically, there was no significant difference between the two groups. Patients in Group I showed a highly statistically significant radiologic evidence of bone formation at 3, 6 and 12 week interval, which was in accordance with the study of Ogunsalu *et al*.[10] On the other hand, none of the patients in group II showed radiologic evidence of any bone formation. This was in accordance with the evidences provided by Hudson *et al*,[19] Collela *et al*,[20] and Adeyemo *et al*.[21] Despite the fact that when properly dissected and mobilized, a buccal pad of fat graft provides an adequate sized pedicled graft, limitations do exist following the size of the maxillary defects. If the surgical defects measure more than 4 × 4 × 3 cm, the likelihood of partial dehiscence of the flap is high.[22] This can be attributed to the impaired vascularity of the stretched ends of the flap that are sutured to the remaining palatal mucosa. On the other hand, buccal or retromandibular defects up to 7 × 5 × 2 cm can be successfully reconstructed. In these cases, the BFP is placed over a rich vascular bed that is provided by the musculature of the recipient area. It is clearly evident from the current study that the increasing number of cases of BFPs transfer reported in the literature reflects a tendency in modern

reconstructive surgery to use simpler reconstructive techniques that, being equally effective, are technically easier and have fewer complications. Use of the BFP as a pedicled flap has so far been shown to be an easy, a well-tolerated, and an uncomplicated technique for oral reconstruction. Its sole disadvantage is that it can only be used once. However, if properly applied in selected cases, it results in complete success. During the course of treatment, the patients were also evaluated for various postoperative signs and symptoms, as performed by Pappachan and Vasant.[23]

Patients were evaluated for postoperative pain immediately on the next day and subsequently at the end of 1, 3, 6 and 12 weeks. Although the pain score seemingly decreased on subsequent check-ups, statistically no significant difference was seen between two groups at any time interval.

Postoperative swelling was also evaluated at the end of 1, 3, 6 and 12 weeks. Although swelling seemed to decrease during subsequent patient visits, statistically no significant difference was seen between the two groups at any time interval. This was in accordance with the statistics provided by Samman *et al*,[24] and Baumann *et al*.[25]

No significant postoperative infection was seen except in one patient of group I and two patients of group II, which was also not statistically significant. This implies that carefully incised tissues with carefully applied peri-operative surgical procedures lead to least postoperative morbidity. Further, hydroxyapatite-collagen meshwork is 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 is stable in volume, biodegradable, and osteoconductive. This occurs without toxic, immunologic, and thermal interactions with the bone. Hydroxyapatite also is a biocompatible substance that does not cause any chronic, inflammatory, allergenic, or toxic reactions.[26]

In Group I, in 1 (10%) patient the graft was rejected by first week; however, no further graft rejection was observed. In Group II, no case of graft rejection was reported. Statistically, no significant difference was seen between the two groups. This is consistent with works of Adeyemo *et al*,[21] Martin-Granizo[27] and Dean.[28]

Finally, postoperative healing was uneventful in both the groups. Statistically, no significant difference was seen between two groups at any time interval. This was in accordance with the results provided by Hanazawa *et al*.[2] We found that new bone formation was evident in cases where sandwich graft technique was used, as compared to buccal fat of pad where no evidence of new bone formation was seen. Rest of the parameters in the both the groups remained same.

Conclusion

It is comparatively crucial to compare an already well-accepted treatment modality (buccal pad of fat) with a more novel procedure (sandwich graft), both in terms of execution by the clinician and patient acceptance. However, in the present study, the sandwich graft technique yielded a more promising closure of OAC by provision of a more biologically apt base in terms of regeneration of lost bone structure at the floor of the maxillary sinus. More ever dental implant can be placed at the site of closure done by sandwich technique which is not possible in closure done with buccal pad of fat technique.

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