Treatment of Oroantral Fistulas Using Bony Press-Fit Technique

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Purpose: The objective of this study was to determine the effectiveness of the bony press-fit technique in closing oroantral communications (OACs) and oroantral fistulas (OAFs) and in identifying potential intraoral donor sites.

Patients and Methods: Ten patients, 4 with OACs and 6 with OAFs, were treated with autogenous bone grafts using the bony press-fit technique. In 9 patients, dental extractions caused OACs or OAFs; in 1 patient, an OAC appeared after cyst enucleation. Donor sites included the chin (3 patients), buccal exostosis (1 patient), maxillary tuberosity (2 patients), ramus (1 patient), and the lateral wall of the maxillary sinus (3 patients). The preoperative evaluation of the patients, surgical technique, and postoperative management were examined.

Results: In all 10 patients, a stable press fit of the graft was achieved. Additional fixation methods were not needed. In 2 patients, mucosal dehiscence developed, but healed spontaneously. In 2 patients, dental implant surgery was performed in the grafted area.

Conclusion: Treatment of 10 patients with OACs or OAFs was performed, with a 100% success rate. The bony press-fit technique can be used to safely close OACs or OAFs, and it presents some advantages compared with other techniques.

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An oroantral communication (OAC) is an open connection between the oral cavity and the maxillary sinus and is caused by the extraction of maxillary posterior teeth, implant surgery, cyst and tumor enucleation, orthognathic surgery, osteomyelitis, and trauma.[1] If the communication remains patent, an oroantral fistula (OAF) develops.[2] The immediate closure of OACs must be performed within 24 to 48 hours to prevent chronic maxillary sinusitis and the development of a fistula.[1,3,4] It is generally accepted that OACs may close spontaneously, especially when the defect size is 1 to 2 mm in diameter.[5,6] However, determining the size of the OAC is difficult clinically and the healing process may vary from patient to patient.

Surgical repair of the OAF is one of the most challenging problems that confront oral surgeons. Numerous surgical techniques have been described for the closure of OAFs, including the use of autogenous soft tissue flaps, autogenous bone grafts, allogenic and xenogenic grafts, synthetic materials such as hydroxylapatite, and metals.[7] All these surgical techniques have some advantages and disadvantages, and the best treatment method for OACs is still debated in the literature.[3]

Although the buccal advancement flap procedure is the most widely used, use of the palatal flap for closure is recommended when an OAC is larger than 10 mm, with a reported success rate of 76%.[8,9] Therefore, if the defect is larger than 10 mm, using bone grafts for the closure of OACs may increase the success rate. In addition, there is an increased need for implant rehabilitation and peri-implant surgical procedures, such as sinus floor elevation in the posterior maxilla. When placement of an endosseous implant is desired in this situation, bone grafting for the closure of an OAC may be the best option.

Bone grafts for the closure of OACs are often harvested from the iliac crest, chin, retromolar area, or zygoma.[10-14] Intraoral bone harvesting is the current strategy of choice, yielding decreased patient

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morbidity and shorter surgery compared with extraoral harvesting techniques.

In this study, 10 patients with OACs or OAFs were treated with autogenous bone grafts using the press-fit closure technique, with a success rate of 100%. The aim of this study was to analyze the effectiveness of intraoral bone grafts for the closure of OACs or OAFs and to review the potential intraoral donor sites for this procedure.

Patients and Methods

Ten patients (7 male, 3 female) were treated using the bony press-fit technique from 2010 through 2012 at the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Hacettepe University. The mean age of the patients was 37.9 years (range, 13 to 62 yr). Demographic data of the patients and characteristics of the observed OACs and OAFs are presented in Table 1.

Nine OACs or OAFs were caused by tooth extractions. One patient (number 4) presented with a mucocele in the left maxillary sinus, and a Caldwell-Luc operation was performed simultaneously with extraction of the first molar. Another patient, a 13-year-old boy, (number 9; 13-yr-old boy) presented with an odontogenic cyst on the left posterior maxilla that expanded into the left maxillary sinus. After enucleation of the cystic lesion and removal of the impacted teeth, an OAC was discovered. The greatest incidence of OACs was found after the extraction of the first molar (6 patients, 60%). In 2 other patients, OACs formed after the removal of impacted teeth. One of these patients (number 8) was a 20-year-old woman who had an impacted deciduous second molar and an impacted permanent second premolar in the right maxilla (Fig 1). Surgery was performed in the authors' department. After the impacted teeth were removed, an OAC developed (Fig 2) and was closed with a monocortical block graft harvested from the chin at the time of dental extraction (Fig 3). Postoperative orthopantogram showed graft stability of the floor of the antrum (Fig 4). The other patient (number 5) was a 40-year-old man who was referred to the authors' department with the complaint of extraoral swelling in the right maxillary region and pain during the previous year. His history disclosed that an impacted right maxillary third molar was surgically removed, and his complaints of pain and swelling began after that extraction. During his intraoral examination, an OAF was visualized at the vestibular sulcus. The authors located the OAF on computed tomographic scans, which depicted the OAF as 1 mm in diameter. In 4 patients, OACs occurred during surgeries conducted in the authors' department, and the authors chose to use the press-fit technique for closure of the communication at the first appointment. Six patients were referred to the authors' department with an OAF, with durations that ranged from 15 days to 15 years. Before referral, some attempts had been made to close the OACs or OAFs using the buccal advancement flap procedure, but these procedures had failed. Therefore, the authors elected to perform the press-fit technique to close the persistent OAFs in these patients.

Chronic maxillary sinusitis was diagnosed clinically and radiographically in 6 patients whose symptoms included postnasal drainage, pain and swelling in the maxillary region, and intraoral pus formation. Patients with chronic sinusitis were prescribed intramuscular antibiotics for 7 to 15 days before closure of the OAFs. One patient (number 7) with purulent sinusitis received the placement of a drain combined with antibiotic therapy for 1 week.

In 3 patients (numbers 1, 2, and 5), the size of the bony defect was evaluated from computed

Table 1. DEMOGRAPHIC DATA OF PATIENTS AND CHARACTERISTICS OF OACS AND OAFS

Patient Number	Age (yr)/Gender	Cause of OAC/OAF	Region of OAC/OAF	Duration of OAF
1	56/M	extraction	right first molar	15 yr
2	45/F	extraction	right first molar	15 days
3	62/M	extraction	left maxillar posterior	unknown
4	36/M	extraction + mucocele	left first molar	OAC
5	40/M	extraction	right third molar	1 yr
6	24/F	extraction	left first molar	15 days
7	43/M	extraction	right first molar	1 yr
8	20/F	extraction	right second premolar	OAC
9	13/M	cyst enucleation	left maxillary posterior	OAC
10	40/M	extraction	left first molar	OAC

Abbreviations: F, female; M, male; OAC, oroantral communication; OAF, oroantral fistula.

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FIGURE 1. Orthopantogram shows an impacted right maxillary second premolar and a deciduous second molar in close contact with the right maxillary sinus.

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tomographic scans; in the other 7 patients, the size was evaluated at the time of surgery.

Surgical Method

In this study, indications for using the press-fit technique for the closure of OACs and OAFs included *1)* a persistent, large OAF with multiple unsuccessful attempts at closure; *2)* an OAC or OAF and planned implant surgery; and *3)* an OAC or OAF along a neighboring root surface that extended into the maxillary sinus.

This research was exempt from Hacettepe University institutional review board approval and all patients signed an informed consent form. Surgery was performed under local anesthesia. Donor sites

FIGURE 2. After removing the impacted teeth, an oroantral communication formed.

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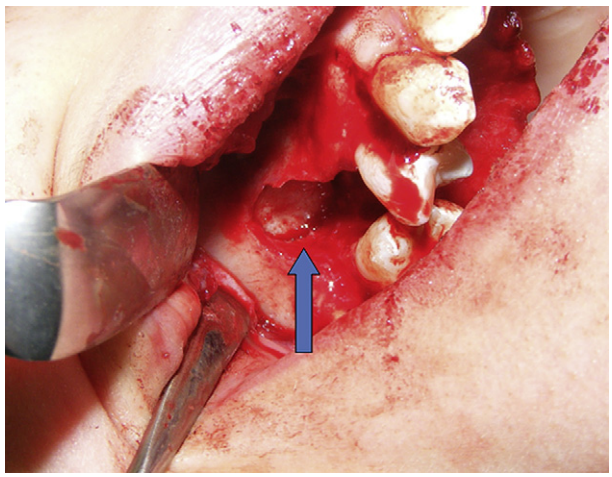

FIGURE 3. A monocortical block graft (*arrow*) was pressed into the oroantral communication.

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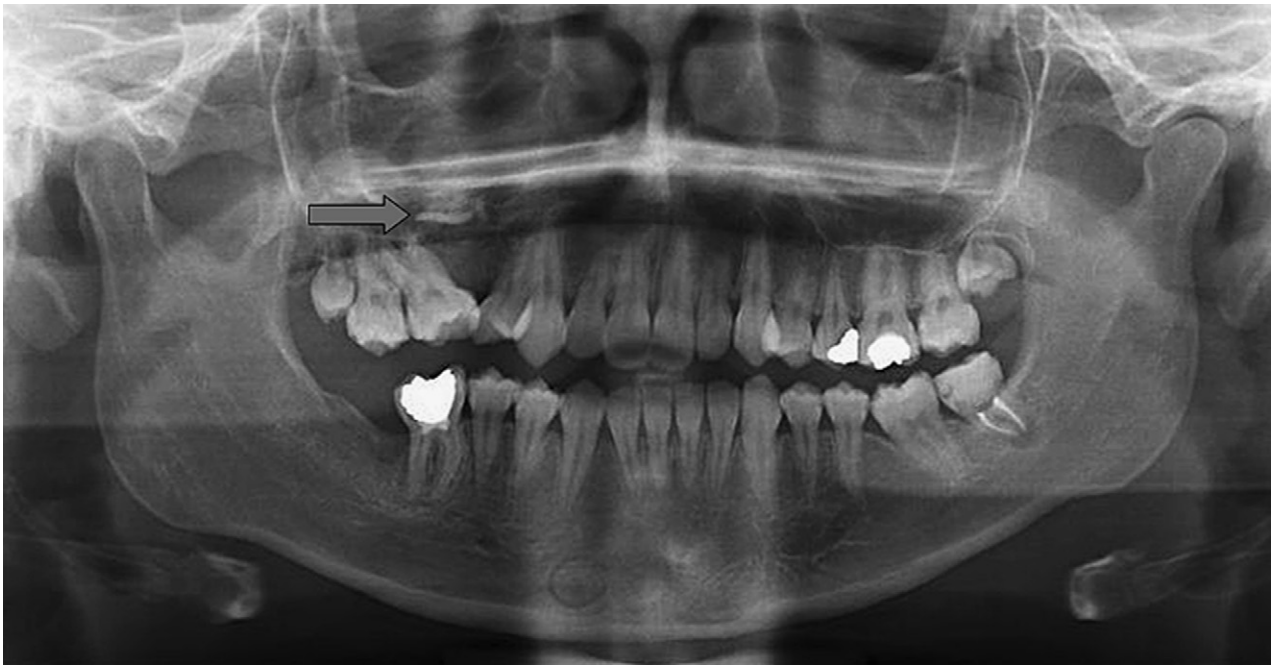

FIGURE 4. Postoperative orthopantogram displays the monocortical block graft (*arrow*).

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included the chin (3 patients), buccal exostosis (1 patient), maxillary tuberosity (2 patients), ramus (1 patient), and the lateral wall of the maxillary sinus (3 patients). In 2 patients with chronic maxillary sinusitis (numbers 1 and 7), bone grafts were harvested from the lateral wall of the sinus. Therefore, the Caldwell-Luc operation was performed in these patients, allowing the authors to access and clean the infected sinus (Figs 5, 6). Surgical procedures were performed using a technique similar to that described by Haas et al[11] and Watzak et al.[12] In the surgical procedure, it was essential that the block graft be press fitted into the bony defect to ensure primary stability. In the 5 patients whose defects were circular (numbers 1, 6, 7, 8, and 10), monocortical bone blocks were harvested with a trephine bur (Fig 5). In 1 patient (number 5), a quadrangular bone block was harvested from the ramus owing to the localization and shape of the defect. In the other 4 patients, bone grafts were harvested with a chisel to accommodate the defect size. Care was taken to not force the grafts into the sinus during graft placement. In 9 patients, soft tissue closure was

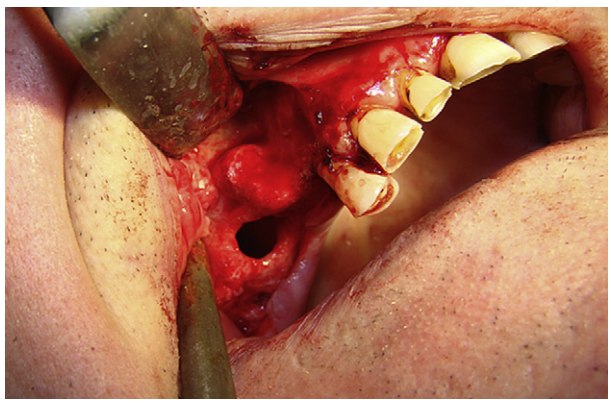

FIGURE 5. Perioperative view of an oroantral fistula and a buccal exostosis on the lateral wall of the sinus.

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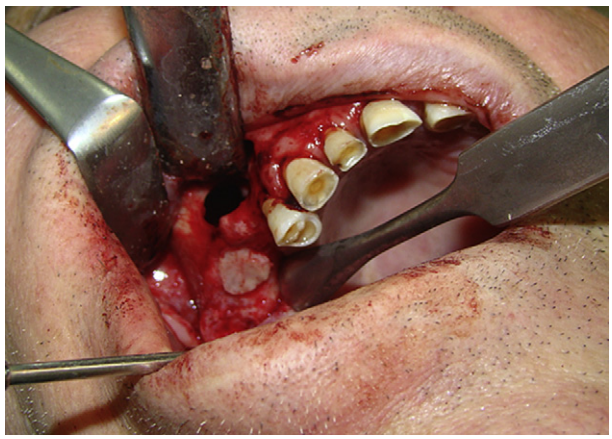

FIGURE 6. A monocortical bone graft that included the buccal exostosis was pressed into the oroantral fistula.

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obtained after press fitting the graft with buccal flap advancement. Only 1 patient who had had an OAF for 15 years (number 1; Figs 7, 8) underwent the palatal pedicle flap technique after press fitting of the graft. This technique was used because this patient had a recurrent OAF and because he had undergone 2 unsuccessful attempts at sinus closure with the buccal advancement flap technique before receiving treatment in the authors' department. Therefore, he presented with a severe decrease in buccal sulcus depth and it was necessary to use the palatal flap technique for primary closure of the graft (Fig 9).

All patients were administered intramuscular metilprednisolon 40 mg immediately after surgery to decrease postoperative edema and to avoid wound dehiscence. Also, they were prescribed oral antibiotics, a nasal decongestant, an antihistamine, an anti-inflammatory analgesic, and an oral antiseptic mouthwash after the operation. All were given sinus precautions (no forceful nasal blowing and opening the mouth while sneezing). The sutures were removed 10 to 14 days after the surgical procedure.

Results

For the bony press-fit technique, pressing the autogenous bone into the defect is essential. If the primary stability is insufficient, additional fixation methods are needed. Otherwise, bone grafts may resorb or be transported to the sinus, and closure of the OAC or OAF may fail in cases with large communications. In addition, complete osseous healing may not be achieved in the floor of the antrum, and at the time of sinus lifting before implant placement, membrane elevation may be problematic. In this study, a stable press fit of the graft was achieved in all 10 patients. In 2 patients (numbers 1 and 6), mucosal dehiscence developed 10 days after surgery; however, the bone graft was not exposed and closure occurred spontaneously. Figures 10 and 11 show the healing of the 15-year-old OAF in patient number 1. In the other patients, healing was uneventful. The bony closure of the OACs or OAFs was evaluated by orthopantography in all patients.

To minimize morbidity, grafts were harvested from areas that were in close proximity to the defect. Most defect sizes varied from 9 to 11 mm in diameter. Therefore, use of a trephine bur with an external diameter of 10 mm maintained sufficient stability of the

FIGURE 7. Intraoral view of a 15-year-old oroantral fistula.

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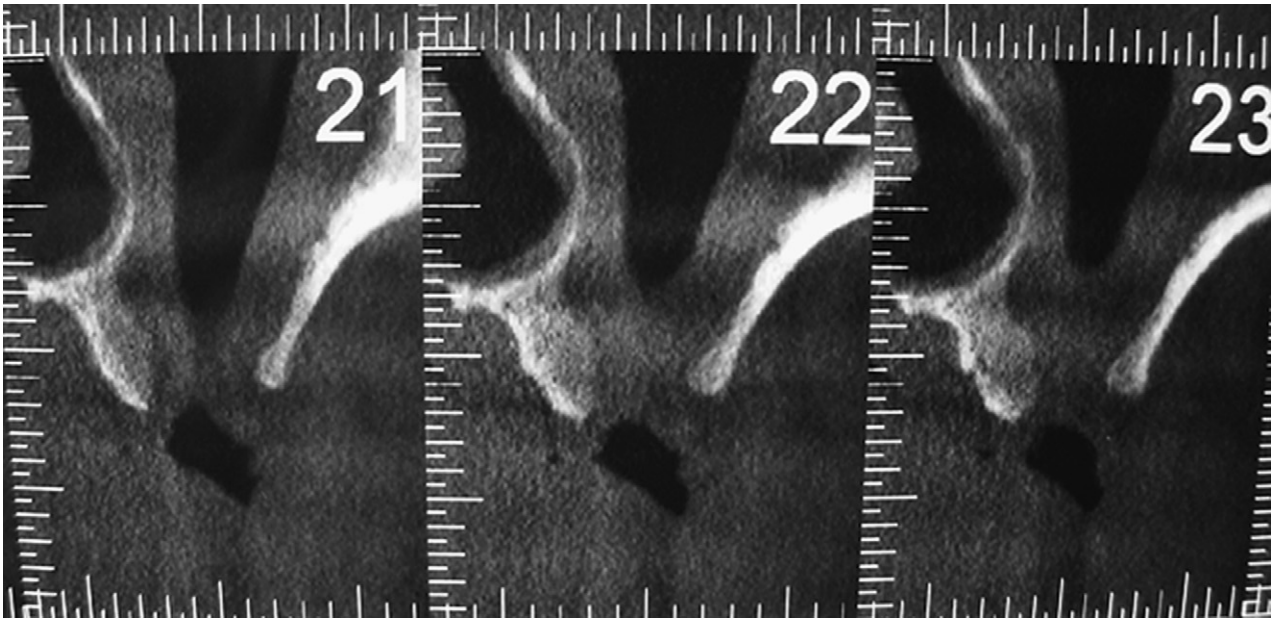

FIGURE 8. Sagittal computed tomographic section shows an oroantral fistula 10 mm in diameter.

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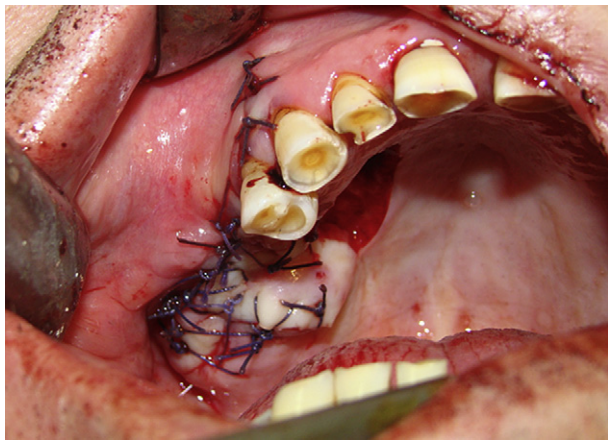

FIGURE 9. Primary closure of the graft using palatal flap advancement.

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graft. In 2 patients (numbers 3 and 5), the defect sizes were 1 to 2 mm in diameter. In one of these patients (number 3), the implant surgery had been planned so the osseous healing of the floor of the antrum was achieved using the bony press-fit technique. In this patient, the graft was harvested from the maxillary tuberosity, which was adequate for bony closure. In the other patient (number 5), the graft was harvested from the ramus owing to the localization of the defect.

FIGURE 10. Intraoral view after 1 month.

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Discussion

Various techniques for the closure of OACs or OAFs have been described in the literature and these techniques present some advantages and disadvantages.[11,12,15-18] When deciding which technique to use to treat an OAC, several factors should be taken into account, such as the size of the defect, time of diagnosis, presence of infection, presence of foreign bodies in the sinus, and possible future placement of dental implants.[7,19]

Local flap procedures (buccal advancement flap and palatal flap) are used widely to close OACs. However, aside from the decrease of the sulcus depth and palatal side morbidity, there are 2 main disadvantages of flap techniques: *1)* if the defect size is large, soft tissue coverage may fail, even if a palatal flap is used; and *2)* flap techniques cause fusion of the mucosa and the Schneiderian membrane, which can give rise to sinus membrane perforation during secondary sinus floor augmentation. The success rate of buccal advancement flap has been reported to range from 84% to 93%.[2,3,6,20,21] Conversely, although a palatal flap is chosen to close larger defects, the reported success rate for the palatal flap is 76%.[9] In recent years, buccal fat pads have been used widely, with high success rates.[18,22] However, closure of large defects with a buccal fat pad can result in graft necrosis or new fistulas.[23] Despite their high success rates, local flap procedures (buccal advancement flap, palatal flap, and buccal fat pad) cannot achieve osseous healing of the floor of the antrum.

The closure of OAFs with bone grafts harvested from the iliac crest was first performed by Proctor.[10] Haas et al[11] recently introduced an OAF closure technique that uses press-fitted monocortical block grafts that are harvested intraorally. Compared with Proctor's technique, the advantages of this technique include decreases in surgical time and morbidity and its potential application in common practice with different indications. Considering the increased demand for implant rehabilitation, osseous healing of the sinus floor must be achieved with these procedures. In this study, the bony press-fit technique was used in patients who would receive future implant rehabilitation, those who required closure of persistent OAFs or closure of OACs that occurred after cyst enucleation, and those who received treatment for a mucocele or dental extractions for the prevention of OAFs.

In this study, all OACs or OAFs were closed using only autogenous bone block grafts harvested from intraoral donor sites. Particulate graft materials, such as xenografts and allografts, were not preferred because *1)* the bony press-fit technique is based on pressing the graft into the defect, but it cannot be achieved using particulate graft materials; and *2)* unless the sinus

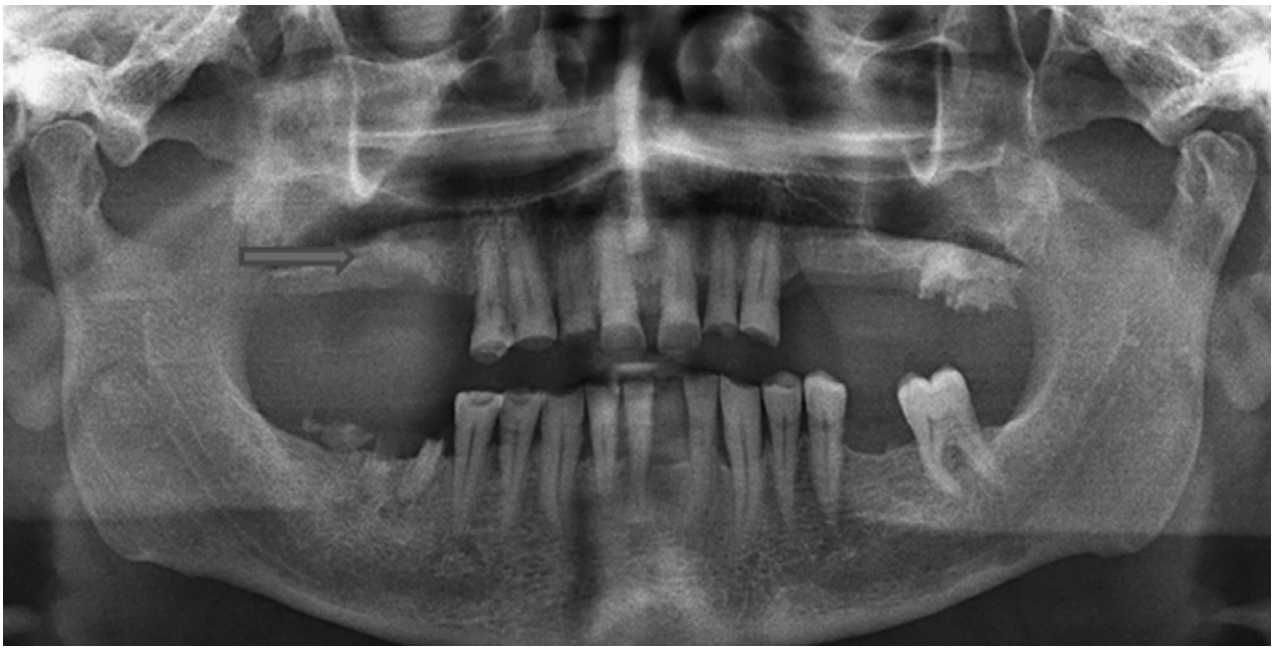

FIGURE 11. Postoperative orthopantogram after 1 month displays the monocortical bone graft (*arrow*).

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membrane is intact, diffusion of the particulate graft into the sinus and the development of foreign body reaction are usually critical in such a procedure. Ogunsalu[24] used xenografts with guided bone regeneration to close OAFs, so that bony healing was provided. However, bony regeneration was not objectively quantified in that study. Block allografts can be used for this purpose, but the main disadvantage of the allograft is a small risk of transmitting viral hepatitis. The expense of these materials is another problem. In this study, bone grafts were harvested from sites that were in close proximity to the defects, with the goal of decreasing the patients' postsurgical discomfort and shortening surgery time. Also, there was no additional cost for the patients.

In the bony press-fit technique, it is important to prevent infection in the sinus to achieve successful osseointegration of the bone graft. Thus, all patients in this study who presented with chronic sinusitis were prescribed intramuscular antibiotics for 7 to 15 days before surgery. During surgery, curettage of the infected tissue in the sinus was performed to facilitate healthy drainage of the sinus, if necessary. This procedure was required in 3 of the 6 patients with an OAF (numbers 1, 2, and 7) in this study, as determined by thickening of the sinus membrane (as recognized on computed tomographic scans) and the inspection of the sinus during surgery. In addition, in 2 patients (numbers 1 and 7), bone grafts were harvested from the lateral wall of the sinus, so that the opening of the lateral wall of the sinus could assist in the cleaning of the sinus. The other important aspect of the bony press-fit technique is to ensure that the graft is pressed firmly into the defect. If the autogenous bone graft is harvested smaller than the defect size, it can fall into the sinus while attempting to press fit the graft. In this situation, additional fixation methods can be used or a larger bone graft can be harvested. In this study, all bone grafts were pressed firmly into the defect and no additional fixation methods, such as screws or plates, were used. Primary closure of the bone graft is also important. In this study, after primary closure of the defect, mucosal dehiscence developed in 2 patients (numbers 1 and 6), but these closed spontaneously. Spontaneous closure of minor mucosal dehiscence in the press-fit technique is easier than in local flap procedures because, in the bony press-fit technique, the autogenous bone graft acts as a supportive plug between the sinus cavity and the local flap, facilitating the healing process and preventing the formation of secondary fistulas. In contrast, the viability of the autogenous bone graft is provided primarily by the periosteum; thus, the presence of a large mucosal dehiscence may expose the graft and cause a partial or complete loss of the bone graft or the formation of secondary fistulas.

In conclusion, the closure of 10 OACs or OAFs with a 100% success rate is reported in this study. Therefore, the bony press-fit technique can be used to safely close OACs or OAFs because it provides some advantages over other techniques. However, a large series of case studies is required to confirm this success rate.

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