Closure of Oroantral Fistula Using Titanium Plate with Transalveolar Wiring

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Abstract

Background Alloplastic materials such as tantalum, gold plates and foils, hydroxyapatite blocks have been used for closure of oroantral fistula (OAF). However, these materials are not widely accepted in routine surgical closure of OAF due to cost, difficult handling, increased rate of infection, and exfoliation.

Purpose To overcome the above drawbacks this study aimed to use titanium plates (0.3 mm) with transalveolar wiring fixation for closure of OAF.

Patients and Methods Ten patients with OAFs who consented to undergo this trial were selected and treated under an outpatient basis in the Oral Surgery Department, Faculty of Dentistry, Mansoura University, Egypt.

Results All OAFs were successfully treated with no eventful complications.

Conclusion This study concludes that titanium plates with transalveolar wiring fixation is an excellent technique for closure of OAF. The high success rate with this technique warrants its use for closure of OAF.

Keywords Oroantral fistula · Titanium plates · Transalveolar wiring

Introduction

Oroantral communication (OAC) is a connection between oral cavity and maxillary sinus. If not treated, the connection becomes lined by epithelium from the sinus

membrane and oral mucosa forming a fistulous tract, hence its name becomes OAF, which may or may not be filled with granulation tissue [1].

Oroantral communication may arise from posterior teeth extraction, cyst, tumor, dental infection and trauma. Upper posterior teeth extraction is the main cause of OAC, mostly the first and the second molars [2–4]. This can be explained by the close relation between the root apices of the posterior teeth and the maxillary sinus, which may be separated only by a thin layer of bone varying from 1 to 7 mm, or even by the antral membrane only [5].

In small perforations of the sinus i.e. less than 3 to 5 mm with no sinus inflammation, spontaneous healing can occur. Larger perforations or perforations with sinus inflammation have less chance to heal spontaneously [6, 7].

Spontaneous healing of small perforations can occur within 48 h to 2 weeks. By the time the incidence of sinusitis increases, the chance of spontaneous healing decreases even in small perforations. Therefore, surgical closure of OAC is recommended if there is no sign of spontaneous healing after approximately 2 weeks [8].

Many techniques have been described for closure of OAF including local flaps, distant flaps, and grafts [9]. Buccal and palatal flaps are the most commonly used local flaps. The most commonly used distant flaps are tongue and temporalis flaps [10].

Grafts that have been used ranged from autogenous bone [11–14] and cartilage grafts [15, 16] to alloplastic materials including tantalum plates [17], gold foils [18–20], gold plates [21, 22], aluminum plates [23], soft polymethyl-methacrylate [24], hydroxyapatite blocks [25], and Bio-Oss-Bio-Gide Sandwich technique [26].

Although alloplastic materials have the advantages of easy use and simplicity, some drawbacks like time consuming, high cost, infection and exfoliation limit their

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application as a routine surgical method for closure of OAF when compared to the standard surgical techniques [24–27].

Titanium is considered the most biocompatible of all metals due to its corrosion resistance, being stable in most media, especially under physiological conditions, compatible with bone growth and stays strong and flexible during use [28, 29].

This study was tried to overcome the drawbacks of the previously used alloplastic materials by using titanium plates fixed in position by transalveolar wiring for closure of OAF.

Patients and Methods

This study included 10 patients with OAF (Fig. 1) who consented to undergo treatment on an outpatient basis in the Oral Surgery Department, Faculty of Dentistry, Mansoura University, Egypt.

If sinusitis was present, it was first treated before surgical closure, with amoxicillin/clavulanate (E-Moxclav, EPICO, Egypt) 1gm twice daily, or clindamycin (Clindam, Sigma, Egypt) 150 mg 3 times daily if the patient was allergic to penicillin, combined with antral irrigation with 1 % povidone-iodine (Betadine, Nile/MundiPh, Egypt) through the fistula.

After inducing local anesthesia, about 3 mm of the soft tissue around the orifice of OAF was incised, as the bony opening is usually larger than the soft tissue opening. Then the fistulous tract, any inflammatory tissues within the opening, and the necrotic bone margins were excised (Fig. 2).

An envelope incision with no vertical releasing incisions, was made around the OAF extending anteroposteriorly on the crest of the alveolar ridge or buccopalatally if

Fig. 1 Preoperative panoramic X-ray showing OAF (arrow)

Fig. 2 Removal of the fistulous tract

the teeth were present. The mucoperiosteal flap was then elevated buccopalatally (Fig. 3).

A suitable piece of 0.3 mm titanium plate was cut and adapted to the alveolar bone to cover the OAF all around and extended 10 mm buccopalatally. Two vertical grooves were made in the titanium plate one on the buccal flange and the other on the palatal flange (Fig. 4). Two holes were made in the alveolar bone buccally and palatally and 0.5 mm from the margins of the OAF.

A 0.5 mm soft stainless steel wire was used to secure the titanium plate over the OAF. First the wire was introduced through the buccal and palatal holes of the alveolar bone to pass through the buccal and palatal grooves of the pre-adapted titanium plate respectively. The 2 ends of the wire were twisted to each other until the plate was completely adapted to the alveolar bone covering the OAF (Fig. 5). Buccal and palatal flaps were approximated using 3/0 black silk sutures with no need for watertight (primary) closure (Fig. 6).

Every patient was given amoxicillin/clavulanate 1gm twice daily or clindamycin 150 mg 3 times daily if allergic to penicillin, diclofenac potassium (Cataflam, Novartis, Switzerland) 25 mg 3 times daily, oxymetazoline HCL spray (Afrin, MUP/Schering, Egypt) nasal decongestant 4 times daily, and 2 % chlorhexidine (hexitol, Adco, Egypt)

Fig. 3 Buccal and palatal incisions

Fig. 4 Pre-adapted titanium plate with two *vertical grooves*

Fig. 5 Insertion of titanium plate with transalveolar wiring

Fig. 6 Soft tissue suturing without water tight closure

mouth wash 3 times daily for 1 week after surgery. Patients were instructed not to blow their nose or cheeks, not to smoke, and sneeze with their mouths open during the first 2 weeks after surgery. Sutures were removed 2 weeks after surgery, and after another 4 weeks the transalveolar wire was cut and the titanium plate was simply retrieved.

Results

This study involved 8 men and 2 women, ranging in age from 29 to 52 years. The average age was 35.4 years. All of OAFs occurred after extraction of upper molar teeth; 6 cases in the 1st molar region, 3 cases in the 2nd molar region, and 1 case in 3rd molar region. OAFs were more common on the right side of the maxilla (8 cases).

Patients had no complaints or distaste due to galvanic current as two dissimilar materials—titanium plates and stainless steel wires—were used.

There were no failure of treatment and OAFs in all patients healed uneventfully. After removal of the titanium plate, 6 weeks postoperatively, all OAFs were completely closed and filled with healthy tissues (Fig. 7), and finally epithelialized, with no signs and symptoms of sinusitis (Fig. 8).

Discussion

Oroantral communication and subsequent OAF are relatively common complication with an incidence rate of 0.31 to 5.1 % after extraction of upper posterior teeth [30, 31].

Many surgical techniques have been described for closure of OAF. All such techniques have their advantages and disadvantages with only a few having gained wide

Fig. 7 Immediately after titanium plate removal

Fig. 8 Complete epithelialization

acceptance. The most commonly used techniques; however, are the buccal and palatal flaps.

Although the buccal flap is simple and ensures good blood supply from its wide base with 93 % success rate [32, 33], it has some drawbacks including decrease of the depth of the sulcus, and limited use only in small to moderate size buccal or midalveolar perforations [5, 7, 34, 35].

In 1939 Ashely [36] described a palatal flap based on the greater palatine artery, giving the flap its main advantage which is rich blood supply. In addition this flap is thicker than the buccal flap and does not decrease the sulcus depth. The main disadvantage of this palatal flap is the denudation of the palatal bone causing pain. Yet, the most severe and rare complication is necrosis of palatal bone and flap [3, 5, 37, 38].

Many alloplastic materials have been used with the presumed advantages of simplicity of use, prevention of breakdown which may occur with the soft tissue alone, usage in closure of large OAF, no decrease in the sulcus depth, might also result in adequate bone formation for implant rehabilitation, and prosthetic construction can be performed before, during, or immediately after surgery [25, 28, 39].

Zide and Karas [25] used non-porous hydroxyapatite blocks for closure of OAF and concluded that it is a simple method for closing OAFs with different sizes, shapes, and locations with minimal disruption of the surrounding tissues, high patient compliance, and no need for perfect soft tissue closure to completely cover the blocks. However, high cost of the blocks, time needed for carving the blocks, and size limitations were mentioned as relevant drawbacks.

Bio-Oss-Bio-Gide Sandwich technique has been used to close OAF with the advantage of achieving both bony and soft tissue closure, in contrast to only soft tissue closure obtained by buccal and palatal flaps. However this technique needs watertight flap closure to completely cover the Bio-Gide membrane [26].

Although gold foils, gold plates, and polymethylmethacrylate have been used for closure of OAF, high cost, increased rate of infection and spontaneous exfoliation limit their wide use. In addition polymethylmethacrylate needed more steps in preparation, e.g. mixing the powder and liquid, allowing it to set, and sterilizing it for 24 h [27, 28, 39].

That patients had no complaints or distaste as a result of galvanic current was in agreement with the studies of Ravnholt [40, 41] who concluded that no currents or changes in PH were registered when gold, cobalt chromium, stainless steel, carbon composite or silver palladium alloys were in metallic contact with titanium. In addition the titanium plates and stainless steel wires were temporarily placed for a relatively short time (6 weeks).

Ideally, treatment of OACs is quick, safe, straightforward, well tolerated by patients, has low cost [40 Egyptian pounds or about 6 dollars for each 1Cm2], and results in good bony and soft tissue healing with a low complication rate [39].

In this study, titanium plates fixed in position by transalveolar wiring were successfully used for closure of OAF in 10 patients. This success may be attributed to the biocompatibility of titanium and the use of transalveolar wiring with vertical grooving in the titanium plate giving fixation and adequate adaptation of the plate to the alveolar ridge. Vertical rather than holes or horizontal grooves made on the titanium plates allowed free apical movement of the plate on tightening of the wire, making the plate more adapted to the alveolar ridge. This adaptation prevents plate movement and halts irritation to the underlining tissues and subsequent infection. In addition, control and prevention of sinus infection before surgery was instrumental in success. Von Wowern [42] reported 21 % failure of closure of OAF in patients without preoperative treatment that was reduced to 2 % in patients with preoperative control of antral infection.

Therefore, based on these findings, this study concludes that titanium plates with transalveolar wiring is an excellent technique for closure of OAF as it is quick, safe, straightforward, well tolerated by patients, has low costs, and results in good bony and soft tissue healing with a low complication rate. The high success rate with this technique warrants its use for closure of OAF.

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