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A NEW TECHNIQUE OF CLOSURE OF ORO-ANTRAL FISTULA BY USING PLATELET RICH FIBRIN MEMBRANE IN COMPARISON WITH BUCCAL ADVANCEMENT FLAP

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ABSTRACT

Background: Platelet rich fibrin (PRF), a concentrate of platelets and leucocytes embedded in a fibrin matrix has many applications in the field of oral and maxillofacial surgery. However, its use in the closure of oroantral fistula (OAF) has not been reported.

Purpose: This study aimed to compare the efficacy of using PRF membrane with acrylic splint versus the traditional buccal advancement flap for closure of OAF.

Patients and methods: 20 patients with OAFs were included in this study. Patients were randomly divided into two equal groups. Closure of OAF for (group I) with the buccal advancement flap, while for (group II) with the PRF membranes was done. Patients were clinically evaluated for primary closure, pain, edema, and depth of the sulcus postsurgically.

Results: Patients were 14 males and 6 females, with a mean age of 42.6 years. 19 cases of OAFs occurred after extraction of upper posterior teeth and 1 case occurred after cyst enucleation. Uneventful healing occurred in 18 patients; 9 in each group. Postoperative pain and postoperative edema were significantly less in group II than in group I.

Conclusion: PRF membrane is an appropriate alternative technique for closure of OAF, with less postoperative pain and edema than buccal advancement flap technique.

INTRODUCTION

Oroantral communication (OAC) is an abnormal opening between maxillary sinus and oral cavity. If left untreated, the opening becomes lined by antral and oral epithelium forming oroantral fistula (OAF).[1]

The most common cause of OAC is the extraction of upper posterior teeth (80%), mainly the first and second maxillary molars, as a result of close anatomic relation between their root apices and the maxillary sinus floor, which may be separated from each other by 0 to 7mm of bone.[2,3] OAC can also occur as a result of cysts, trauma, infection, and tumors.[4]

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OAC less than 2mm can heal spontaneously, provided that there is no sinus inflammation, while more than 3mm, or even smaller with sinusitis, mostly needs surgical closure.[5] Small perforations can heal spontaneously within 2 to 14 days. Surgical closure of OAF -even in small perforations- is highly recommended after 2 weeks, as the possibility of spontaneous healing declines after that period.[6]

Different methods have been used for closure of OAF including autogenous soft tissue flaps, autogenous hard tissue grafts, allografts, xenografts, and alloplastic materials.[7]

Buccal, palatal, buccal bad of fat, and tongue flaps are the most commonly used autogenous soft tissue flaps.[4,8]Hard tissue autografts including bone,[9] cartilage grafts,[10] and third molar auto-transplantation[11] have been used successfully for closure of OAF. Buccal advancement flap was designed by Rehrmann in 1936.[12] It is the most common surgical technique used for closure of OAF, as it has a high success rate because it is easy, simple and it also ensures an adequate blood supply from its wide base.[13]

Many allogenic and xenogenic grafts have been used successfully in closure of OAF such as lyophilized fibrin glue[14], lyophilized dura of human origin[15]and Bio-Oss(bovine bone)& Bio-Gide(porcine collagen membrane) Sandwich technique[16].

Various alloplastic materials have been used for closure of OAF. Though alloplastic materials have the advantages of simple use, some disadvantages like time consuming, high expense, and increase incidence of infection limit their use as a usual surgical technique for closure of OAF.[16,17]

Platelet rich fibrin (PRF) has been considered as the second generation of platelet concentrate, and it was first described in France by Choukroun et al.[18] PRF has many advantages over the first generation of platelet rich plasma(PRP) including ease of preparation and handling, minimal cost, and lack of biochemical additives (i.e., no need for anticoagulant, bovine thrombin or calcium chloride), and can be prepared as a membrane.[19] PRF consists of a huge quantity of platelet and leukocytes (97% of platelets and 60% of leukocytes of the centrifuged blood volume) embedded in a matrix of autogenous fibrin. This concentrate contains a large amount of many growth factors that play an important role in healing of both soft and hard tissues.[20,21]

PRF has many applications in the field of oral and maxillofacial surgery. It can be used for sinus lift augmentation, horizontal and vertical ridge augmentations, ridge preservation grafting, periodontal defects, alveolar cleft repair, reconstruction of defects after cyst enucleation or tumor excision, healing of extraction wounds, endodontic surgeries and to treat gingival recession.[22-28]

This study aimed to compare the efficacy of using PRF membrane with acrylic splint versus buccal advancement flap for closure of OAF. Null hypothesis: no difference; relative hypothesis: PRF membrane would be an appropriate alternative technique than buccal advancement flap for soft tissue closure the OAF.

PATIENTS AND METHODS

This study was approved by the ethical committee of Mansoura University. The guidelines of the Helsinki Declaration were followed. Twenty patients with OAF were included in this study(fig1). Patients were presenting to the outpatient clinic of the Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Mansoura University between 2014 -2016. Patients were informed about the line of treatment and the expected postoperative complications. Every patient signed an informed consent prior to treatment.

According to the method of OAF closure, patients were randomly divided into two equal groups:

Group I: OAFs were closed using buccal advancement flap.

Group II: OAFs were closed using PRF membranes with occlusal splints.

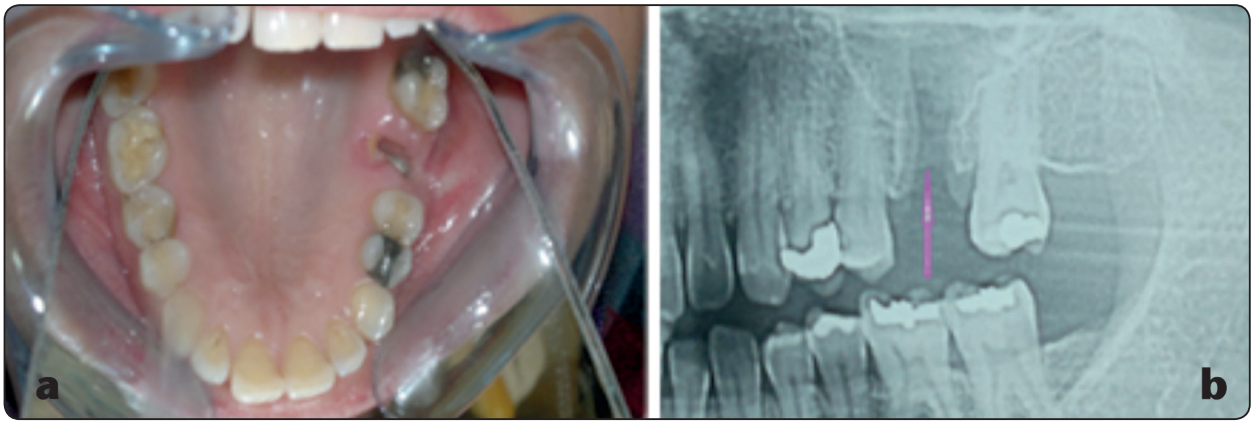

Fig. (1) a) OAF, b) Preoperative panoramic X-ray showing OAF (arrow).

All patients with sinusitis were prepared 3 to 5 days before surgical closure of OAF, with oral administration of Sultamicillin (Unictam, MUP, Egypt) 375 mg 3 times/day, or erythromycin (Erythromycin, Pharco, Egypt) 500 mg 3 times/day if the patient was allergic to penicillin, and maxillary sinus lavage by using 1 % povidone-iodine (Betadine, Nile/MundiPh, Egypt) through OAF.

Surgical procedures:

After induction of local anesthesia, 3-4 mm of the soft tissue around the orifice of OAF was incised, as the soft tissue opening is usually smaller than the bony opening. Then the unhealthy soft and osseous tissues were removed.

Group I: closure of OAFs using buccal advancement (Rehrmann) flap[12]:

Trapezoidal mucoperiosteal flap was made with wide base at the buccal sulcus to ensure sufficient blood supply. After elevation of the flap from the alveolar bone, horizontal releasing incisions were made through the periosteum at the base of the flap for its extension if necessary (fig 2a). Water tight closure was achieved by suturing the apex of the flap with palatal mucosa without tension and then the vertical incisions using 3/0 silk sutures (fig 2b).

Group II: closure of OAFs using PRF membranes

For each patient in this group, alginate impression was taken for the upper jaw and poured with dental stone. A model was made where a simple acrylic splint was fabricated to cover PRF membrane after closure of the OAF.

Preparation of PRF membrane:

A 10 ml of blood was withdrawn from the patient's antecubital vein. The blood sample was collected in glass-coated plastic tube without anticoagulant, then immediately centrifuged at 3,000 rpm for 10 minutes.[18] After centrifugation, the resultant product consisted of three layers: acellular plasma forming uppermost layer, PRF in the middle, and RBCs forming the basal layer (fig 3a).

The PRF clot was separated from RBCs layer and packed tightly in between 2 sterile gauzes to form PRF membrane (fig 3b). The PRF membrane was immediately used to cover the OAF. The PRF membrane was tucked below the buccal and palatal mucoperiosteum (fig 3c) and secured with them using 3/0 silk suture. The fitting surface of the acrylic splint was then relieved and inserted intraorally to cover PRF membrane (fig 3d).

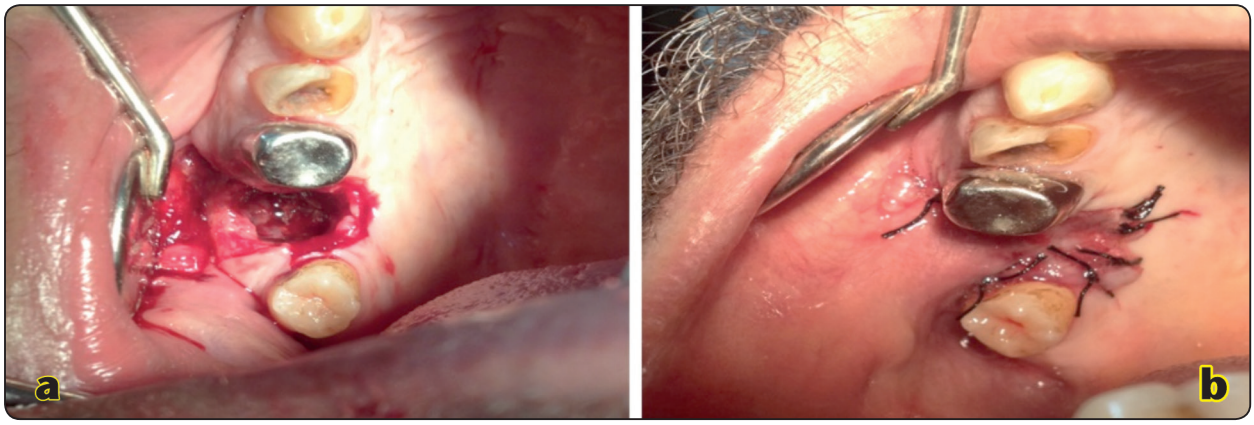

Fig. (2) a) Elevation of the buccal trapezoidal mucoperiosteal flap, b) Water tight closure of the buccal advancement flap.

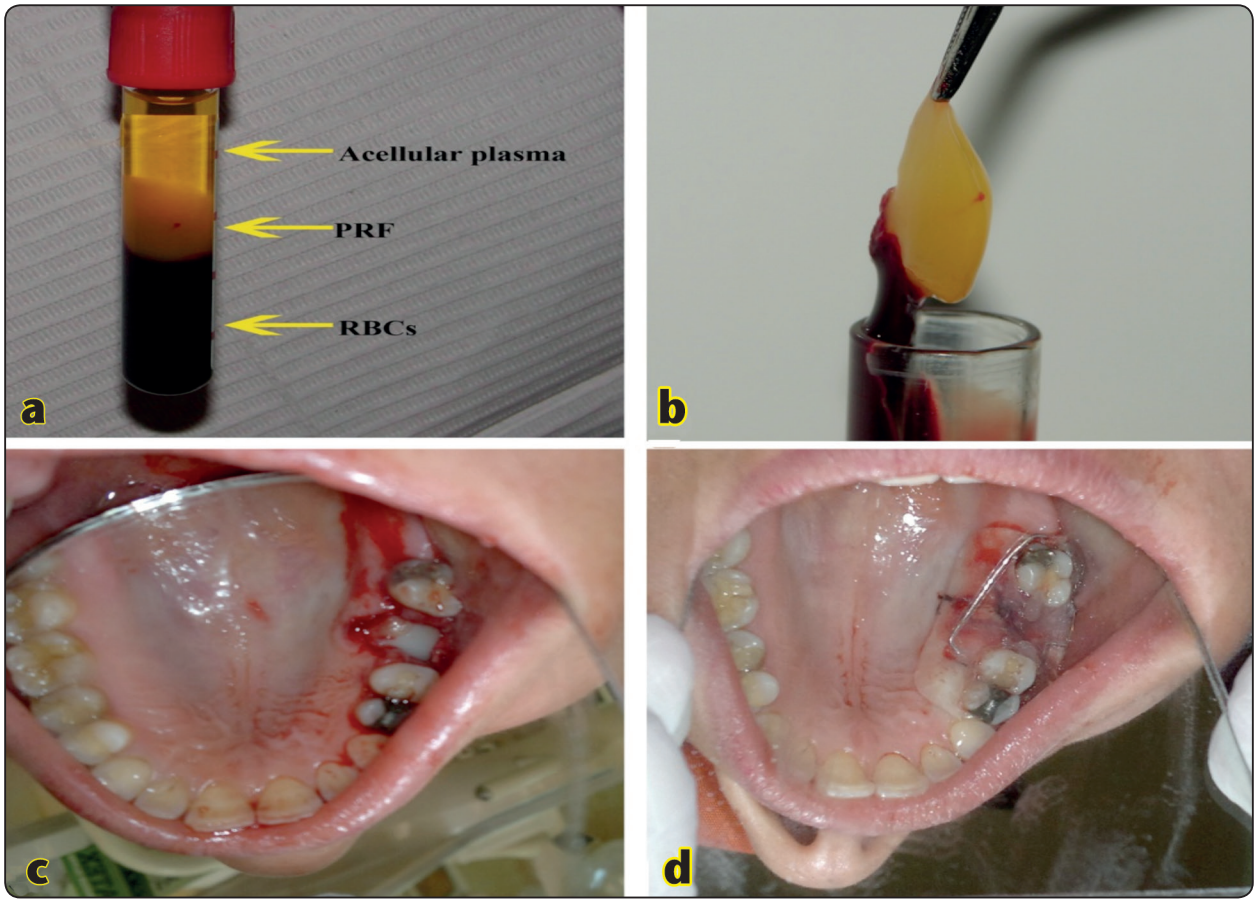

Fig. (3) a) The resultant product after blood centrifugation: acellular plasma in the top, PRF in the middle and RBCs in the base, b) PRF clot attached to RBCs layer, c) Tucking of the PRF membrane below the buccal and palatal mucoperiosteum, d) Intraoral insertion of the acrylic splint to cover PRF membrane.

Postoperative instruction:

Every patient was given sultamicillin 375 mg 3times/day or erythromycin 500 mg 3 times/day if the patient was allergic to penicillin and xylometazoline HCL (Otrivin, Novartis, Switzerland) nasal decongestant drops 4 times/day for 5 days after surgery. Diclofenac potassium (Oflam, mepha, Switzerland) 50 mg was prescribed to be taken when required. Patients were instructed to use 2 % chlorhexidine mouth wash (Hexitol, Adco, Egypt) 3 times daily for 2 weeks postsurgically. Patients in group II were instructed to wear the splint continuously for the next 2 weeks and to remove it only during the use of mouth wash and for its cleansing. Patients were advised not to blow their cheeks or nose, avoid smoking, and avoid sneezing with closed mouth during the first month after surgery. After 2 weeks postsurgically, sutures were removed.

Evaluation: Clinical examinations were scheduled at 3 days, 2, 4 and 12 weeks postoperatively for evaluation primary closure, pain, edema, and depth of the sulcus outcomes.

- Success of surgery was considered when there was complete closure of the OAF with oral mucosa.
- Postoperative pain and edema were assessed after 3 days postsurgically. Postoperative pain was assessed using visual analogue scale (VAS) of 10 units: 0; no pain, 1-2; mild pain, 3-6; moderate pain, 7-9; severe pain, and 10; inconsolable pain.
- Postoperative edema was assessed by measuring the difference between preoperative and postoperative measurements of the following lines: line A; from the outer canthus of the eye to the angle of the mandible, and line B; from the tragus to the corner of the mouth.

Statistical analysis:

Data were analyzed using Statistical Package for Social Science software computer program version 17 (SPSS, Inc., Chicago, IL, USA). Quantitative data for parametric data were presented in mean and standard deviation and median and IQR (interquartile range) for non-parametric data. Qualitative data were presented in number and percentage. Student's t-test was used for comparing quantitative parametric data. Mann Whitney U test was used for comparing quantitative non-parametric data. Chi-square "$\chi 2$" or Fischer's exact tests, as indicated, were used to compare the qualitative data. P value less than 0.05 was considered statistically significant.

RESULTS

This study included 14 males and 6 females with no significant difference between the 2 groups regarding sex (P=1). The mean age of patients was 42.6 years (group I; 40.9, group II; and 44.2) with no significant difference between the 2 groups regarding age (P=0.49). 19 cases of OAF occurred after extraction of upper posterior teeth; 2, 13,3, and 1 cases after extraction of 2nd premolar, 1st molar, 2nd molar, and 3rd molar respectively. One case occurred after cyst enucleation from right posterior maxilla in group II. There was no significant difference between the 2 groups regarding cause (P=0.66). The incidence of OAF was equal in both sides (P=1). (tabl.1)

TABLE (1) Age, gender of the patients, site and causes of OAFs in group I and group II:

		Treatment				P
		Group I		Group II		
Age		40.90±9.43		44.20±11.80		0.49
Sex	F	3	30.0%	3	30.0%	1.00
	M	7	70.0%	7	70.0%	
Side	Left	5	50.0%	5	50.0%	1.00
	Right	5	50.0%	5	50.0%	
Cause	Cyst	0	0.0%	1	10.0%	0.66
	Ext. 5	1	10.0%	1	10.0%	
	Ext. 6	7	70.0%	6	60.0%	
	Ext. 7	1	10.0%	2	20.0%	
	Ext. 8	1	10.0%	0	0.0%	

Data expressed either as mean±SD or as frequency

P significance <0.05

Primary outcome (success /failure) (tab.2):

- In group I: uneventful healing occurred in 9 patients (fig 3a), and closure failure occurred in one patient. With this patient there was a dehiscence of the buccal flap with persistence OAF.
- In group II: uneventful healing with complete closure and rapid epithelization of the OAF occurred in 9 patients(fig 3b). Failure occurred in one patient where the PRF membrane detached from the surrounding mucosa with persistence of OAF.

TABLE (2) Postoperative primary closure outcomes for group I and group II:

		Treatment				P
		Group I		Group II		
Success or failure	Failure	1	10.0%	1	10.0%	1.00
	Success	9	90.0%	9	90.0%	

Data expressed as frequency

P significance <0.05

Pain, edema & sulcus depth outcomes:

Evaluation of postoperative pain (tab.3):

- In group I: pain score ranged from 2.0 to 6.0, with median 3.50, and IQR (3.00-5.00). In group II: pain score ranged from 0.0 to 4.0, with median 2.0, and IQR (1.00-3.00). There was significant difference between group I and group II regarding pain (P=0.015).

Evaluation of postoperative edema(tab.3):

Postoperative edema (line A):

- In group I, the difference between preoperative and postoperative measurements of line A ranged from 0.2 to 2 cm, with median 1.15 cm and IQR (0.90-1.50). In group II; the difference ranged from 0.1 to 0.7 cm, with median 0.35 cm, and IQR (0.30-0.50). These line A measurements of postoperative edema were significantly different between group I and group II (P<0.001).

Postoperative edema (line B):

- In group I, the difference between preoperative and postoperative measurements of line B ranged from 0.6 to 2.3 cm, with median 1.35cm and IQR (1.00-1.70). In group II; the difference ranged from 0.2 to 0.8 cm, with median 0.35cm, and IQR (0.30-0.70). These line B

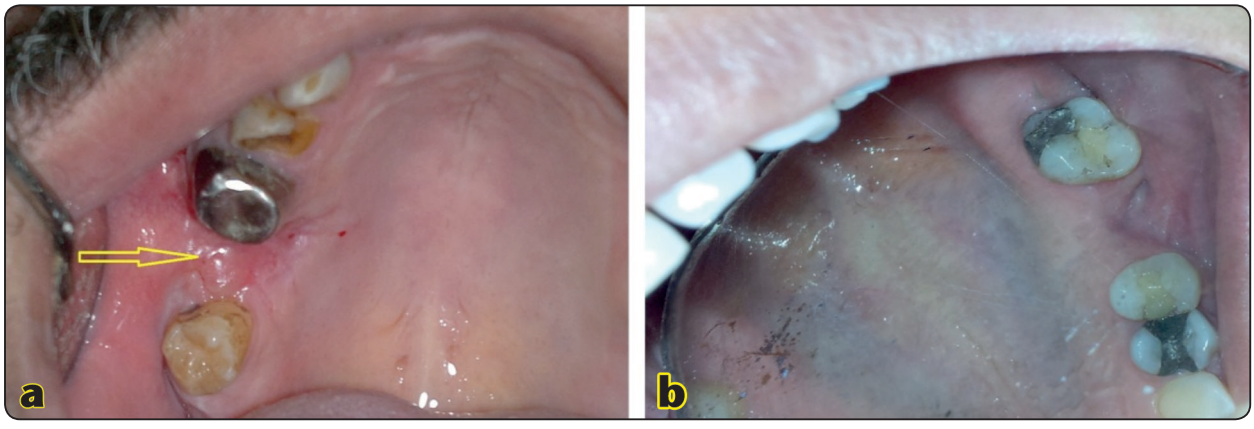

Fig. (3) a) Complete closure of the OAC in group I, after 1 month postsurgically with decrease in the depth of the buccal sulcus (arrow), b) Healed OAC after 1 months postsurgically in group II.

measurements of postoperative edema were also significantly different between group I and group II (P<0.001).

Table (3): Postoperative pain and edema outcomes:

	Treatment				P
	Group I		Group II		
	Median	IQR	Median	IQR	
Pain score	3.50	3.00-5.00	2.00	1.00-3.00	0.015
Line A(cm)	1.15	.90-1.50	.35	.30-.50	<0.001
Line B(cm)	1.35	1.00-1.70	.35	.30-.70	<0.001

Data expressed as median – IQR

P significance <0.05

Evaluation of the depth of the buccal sulcus:

Depth of the buccal sulcus decreased and did not return to normal even after 3 months in all cases of group I. While in group II there was no change in the buccal sulcus depth in all cases.

DISCUSSION

Ideally, treatment of OAF is simple, easy, safe, and it has a low cost. Also, it provides adequate healing of both osseous and soft tissues, and with minimal complications. However, such a treatment actually does not seem to exist.[7]

Several surgical techniques have been proposed for treatment of OAFs. These techniques have their advantages and disadvantages with only a few having gained wide acceptance. However, the most frequently used techniques are the buccal and palatal flaps.

Control of sinusitis prior to surgery was mandatory in success of OAF closure. von Wowern[29] documented 98% closure success of OAF in patients with preoperative control of sinusitis that was decreased to 79 % in patients with sinusitis.

In group I, uneventful closure of OAFs occurred in 9 patients (90%), this may be attributed to the design of buccal flap as it has a wide base which ensures good blood supply to the flap. Decrease of the depth of the sulcus- which can interfere with prosthetic rehabilitation and maintenance of oral hygiene- occurred in all patients. von Wowern[29] found permanent decrease of vestibular depth in half (16 cases) of the buccal flap cases. He considered flattening of vestibule for 2 months results in a permanent condition. Currently, due to the wide use of implant-retained prosthesis, reduction in the buccal sulcus depth becomes less problematic.

In group II, the success of PRF in closure of OAF occurred in 9 cases (90%), this may be attributed to: first, PRF membrane acts as a fibrin bandage that accelerates the healing of the wound edges, permits a rapid epithelization of the surface of OAC and form an effective mechanical barrier against epithelial cell, oral bacteria, and irritants to penetrate the OAC.[22,30]

Second, fibrin acts as a scaffold in which cells may proliferate, organize, and perform their functions.[31] Fibrin provides a matrix for migration of fibroblasts and endothelial cells, which are involved in the angiogenesis process and are responsible in the healing of new tissues.[32]

Third, the platelet growth factors such as platelet-derived growth factor, transforming growth factor β, fibroblast growth factor, and vascular endothelial growth factor are slowly released as the fibrin matrix is resorbed especially during the first 7-14 days, but if fibers are cross-linked as by tight compression it could provide resistance to enzymatic degradation and could be more stable during the healing time.[33,34] Zumstein et al.[35] reported that the release of platelet growth factors can be continued up to 28 days.

Fourth, occlusal splint was used to cover and protect the PRF membrane during the healing time. It was used also to overcome the main drawbacks of PRF membrane, which are its lack of rigidity, and can only be prepared in thin thicknesses.[36]

Pain and postoperative edema were significantly less in group II than group I, this may be attributed to first; less surgical steps in group II as it needed only slight reflection of buccal and palatal flaps rather than trapezoidal mucoperiosteal flap and horizontal relaxing incisions in group I.

Second; the presence of cytokines and leukocytes that are concentrated in PRF membrane can play an important rule as anti-inflammatory and anti-infectious materials, respectively.[33] Kumar et al.[37] and Singh et al.[38] concluded decrease in postoperative pain and swelling after surgical extraction of lower third molars when using PRF. Also, Dohan et al.[39] reported that PRF has immunological, antibacterial, and anti-inflammatory properties.

Therefore, based on the findings of this study, it was concluded that PRF membrane is an appropriate alternative technique for closure of OAF. Compared with the buccal advancement flap technique, the PRF membrane and acrylic splint technique showed less postoperative pain and edema and no decrease in the depth of the buccal sulcus.

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