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Buccal fat pad graft in oral and maxillofacial surgery-A review

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ABSTRACT

Buccal fat pad is much underutilized graft in oral and maxillofacial surgeries. Although, it has been recognized in early seventeenth century, but its use in different conditions as a graft was popularized after mid eighteenth. This article encompasses various aspects of buccal fat pad including its anatomy, development, clinical significance and uses as a graft in much reconstructive procedures in oral and maxillofacial surgery cases e.g. Oroantral fistula, oral sub-mucous fibrosis, resections, reconstructions cases.

Keywords: Buccal fat pad, graft, Oroantral fistula, oral sub-mucous fibrosis, resections, reconstructions.

Introduction

The buccal fat pad (BFP) has become more and more popular for closing oronasal and oroantral communications and as a versatile pedicled graft for closing post- surgical maxillary defects [1].Originally described as an anatomic structure without any obvious function, it was for a long period even considered to be a surgical nuisance [2-4] (Fig. 2).However, during the past 3 decades, the BFP has become a well established tool in oral and maxillofacial surgery for the closure of oroantral communications(OAC) [5] and reconstruction of small to medium sized acquired or congenital soft tissue and bone defects in the oral cavity [6].The following clinical uses of the BFP in the literature were observed: closure of OAC/oroantral fistula (OAF), closure of post excision defects , asa covering for mucosal defects, closure of primary clefts, midline secondary clefts, in TMJ reconstruction, postincisional fibrotomy coverage in oral sub mucous fibrosis, elongation of soft palate, vocalcord augmentation, and root coverage.

HISTORY ASPECTS

The BFP was first described by Heister (1732), who believed this structure to be glandular in nature and termed it the"glandulamolaris" [7, 8] .Bichat is credited with recognizing the true nature of the BFP.

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Therefore, it is commonly referred to as the boule de Bichat orbollegraisseusse in French; it is called wangenfettpfropf or Wangen fettpolster (Wangen Cheek fett fat, polster pad-cheek, fat,pad) in German, and the sucking pad, sucking cushion, masticatory fat pad, or buccal pad of fat in English. The fatty nature of the buccal fat pad was first described by Bichat in1802,and since then its embryology, vascularity, volume, and function have been studied in detail by several authors. It consists of a lobulated mass of specialized fatty tissue lying within the masticatory space, and located between the buccinators muscle and the mandibular ramus, separating the muscles from each other (Fig. 1). It is covered by a delicate fascial envelope with septa that divide it into a series of fibroadipose compartments. Functionally it is thought to increase intermuscular movement and to contribute to the soft tissue contours of the face. It is often encountered accidentally during maxillary orthognathic operations and there have been reports in children, of spontaneous or traumatic herniation of the buccal fat pad. The use of the buccal fat pad has increased in popularity in recent years because of its reliability, ease of harvest, and low complication rate. It has been used as a pedicled graft in facial augmentation procedures, for there pair of persistent oroantral fistulas after dental extractions and in the treatment of oral sub mucous fibrosis. There have been several reports of its successful use as a pedicled graft in reconstructing small to medium sized maxillary defects after resection of a tumor. The anatomy of the BFP was first described by Scammon, later by Goughran [9] .The BFP had

limited clinical usage for many years and was considered to be a surgical nuisance because of its accidental encounter during various surgical procedures in pterygomaxillary space and after injuries in the maxillofacial region [2,3]. Its usage has increased after Egyedi(1977) described BFP for closing oronasal and oroantral communications and as a versatile pedicled graft for closing post-surgical maxillary defects. Neder described the use of buccal pad fat as free graft to close oral defects [9]. Tideman et al. (1986) described its detailed anatomy, vascular supply and operative technique in their study [10]. Rapidis et al., Hao, and Dean et al., used pedicled BFP for reconstruction of medium-sized postsurgical oral defects of malignant lesions [9, 11,12]

Fig 1: Showing buccal fat pad in infant

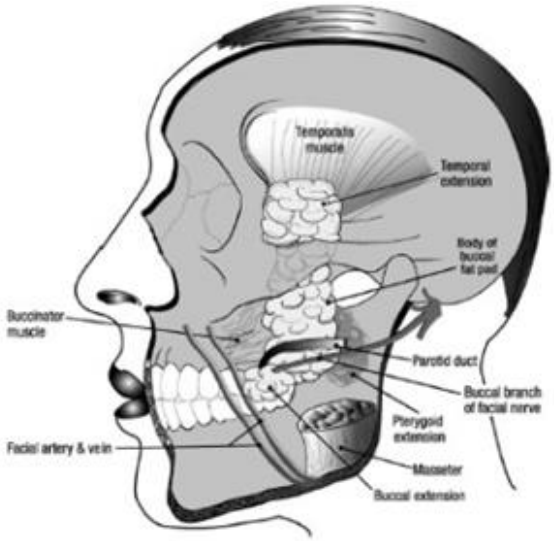

Fig 2: Showing buccal fat pad in adult

Embryology

Much of our knowledge regarding the prenatal morphogenesis of human at tissue is derived from studies conducted in the 1980s. A landmark study by Poissonnet et al [13] studied the growth and development of adipose tissue during early gestation, selecting the buccal fat pad as a model system. Light microscopy and quantitative analysis of fat lobule size were carried out on 805 human embryos and fetuses. The stages of adipose development of the buccal a t pad are summarized in Table 1. In brief Poissonnet et al [13] showed that adipose tissue differentiates during the second trimester, between weeks 14 and 16. In addition, after the23rd week of gestation, while the number of fat lobules remain approximately constant, the size of these lobules increases until the 29thweek, suggesting that weeks 14 through 23 are a sensitive period of at lobule development. Histological preparations of adipose slices showed the morphogenic link between the onset of vascularization and the firstappearance of adipose cells. The authors hypothesized that disturbances during this sensitive adipose development period may potentially play a role in the future development of obesity. After the 14th week of gestation, the cheek is the first place on the face where adipose tissue develops, doing so from deep to superficial Fat develops around the opticvesicle after the 18th week between the sclera and the wall of the orbit [13].

ANATOMY AND CHARACTERISTICS

The BFP is a simple lobulated mass described as consisting of a centralbody and 4 extensions: buccal, pterygoid, pterygopalatine, and temporal. The main body is situated deeply along the posterior maxilla and upper fibers of the buccinator, covered with a thin capsule. Thebuccal extension lies superficially within the cheek and is partially responsible for cheek contour. The buccal extension and main body together constitute 55%-70% of total weight. The pterygopalatine extension of fat tissue extends to the pterygopalatine fossa and inferiororbital fissure.

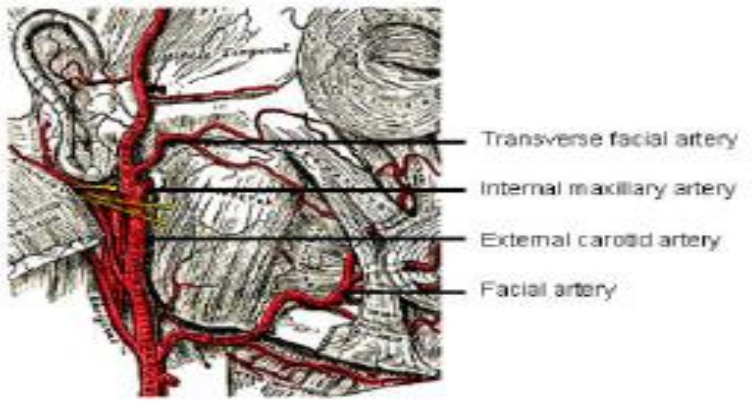

Fig 3: Blood supply of buccal fat pad

The pterygoid extension is a posterior extension that generally stays in the pterygo- mandibular space and packs the mandibular neurovascular bundle and lingual nerve. The temporal extension can be divided further into 2 parts: superficial and deep.The superficial part of the temporal process of the BFP stays between the deep temporal fascia, temporalis muscle, and tendon. The anterior endof it turns around the anterior rim of the temporalis muscle, and continues with the deep part. The deep part of the temporal process lies behind the lateral orbital wall and frontal process of the Zygoma and turns backward into the infratemporal space. Each process has its own capsuleand is anchored to the surrounding structures by ligaments. The size of the pterygoid and temporal extension is inconsistent, but is usually smaller than either body or buccal extension [11,12,14-17].

The superficial temporal fat situated between 2 layers of deep temporal fascia is a separate fat pad and differs in appearance, has a separate vascular supply, and is anatomically distinct from the BFP [17].The parotid duct courses with the buccal branches of the facial nerve anteriorly(superficial), and on the lateral surface of the BFP, it penetrates the buccinator muscles, entering the oral cavity opposite the second molar. The facial vessels are in the same plane and mark the anterior extent of the BFP [18].The BFP derives its blood supply from the buccal and deep temporal branches of the maxillary artery, transverse facial branches of the superficial temporal artery, and branches of the facial artery. The branches from different sources form the lobar sub capsular plexus by freely anatomizing with each other. Owing to its rich blood supply, it can be considered as a pedicled graft with an axial pattern. The rich blood supply may explain the high success rate with this flap. It may also be one reason for the quick epithelialization of the fat[14-17].The average volume of fat is 9.6 mL. (Range 8.33-11.9 mL.)[14,16,19,20]. The size of the BFP is fairly constant among different individuals regardless of overall body weight and fat distribution; even cachectic patients have BFPs that are of normal weight and volume (Fig. 3) (Fig. 4)[21]. The possible functions of the BFP include the prevention of negative pressure in newborns while sucking, separating the masticator muscles from one another and from the adjacent bony structures, enhancement of intermuscular motion, and the protection of neurovascular bundles [12,14,17] . Physiologically, it is a specialized type of fat termed as syssacosis [16], a fat that enhances intermuscular motion. Ranke, in 1884, recognized that its rate of lypolysis also is different compared with subcutaneous fat [5,10,14,19] . It persisted during times of severe emaciation, even after subcutaneous fat was lost. It shares this characteristic with periorbital fat. Early reports comparing neonatal fat and the BFP indicated that these were more saturated [18].The quick epithelialization of the uncovered fat is a characteristic feature of the pedicled BFP flap and is histologically proven [8,22,23]. The layer above the originally uncovered BFP consists of stratified squamous epithelium migrating from the adjacent mucosal regions.

Technique to Harvest the BFP Graft

Under either local or general anesthesia, an upper mucosal incision posterior to the area of the zygomatic buttress is made, followed by a simple incision through the periosteum and fascial envelope of the BFP. Gentle blunt dissection with a fine curved artery forceps anterior and medial to the coronoid process exposes the yellowish-colored buccal fat. Further blunt dissection with 2 vascular clamps is necessary, one to gently pull out the emergent part and the other to dissect the

tissues surrounding the BFP. Mechanical suction must be avoided once the BFP is exposed. It easily herniated into the defect with little teasing and is gently pulled out from its bed with a vascular clamp. External pressure in the temporal and lateral orbital region can be applied at this time to facilitate removal of the temporal process of fat. Depending on the amount of fat required, various processes of fat pad can be manipulated and used as either a pedicled or a random flap [5] .Perhaps the most important is the careful manipulation of the flap in order to maintain its thin capsule. Secondly, a knowledge of its size limitations. There have been reports on the closure of defects up to 60 x 50 x 30mm. Assuming the calculated BFP volume is 10 ml and its lowest thickness is 6 mm, the closure of larger defects cannot be guaranteed without producing flap necrosis or creating a new fistula. The largest defects covered in our study were a 40 x 20 mm maxillary defect and a 40x 35 mm cheek mucosa defect. Lastly, we should mention the incision and sutures used. The mucosal approach must be the smallest necessary to allow for its extraction. Larger incisions, cause an excessive exit of some BFP lobules, which afterwards, interferes in the surgical field. Furthermore, the mucoperiosteal flap, gives both support and, probably, irrigation, to the axial flap. The sutures should be tension-free, to avoid partial necrosis at the edges.

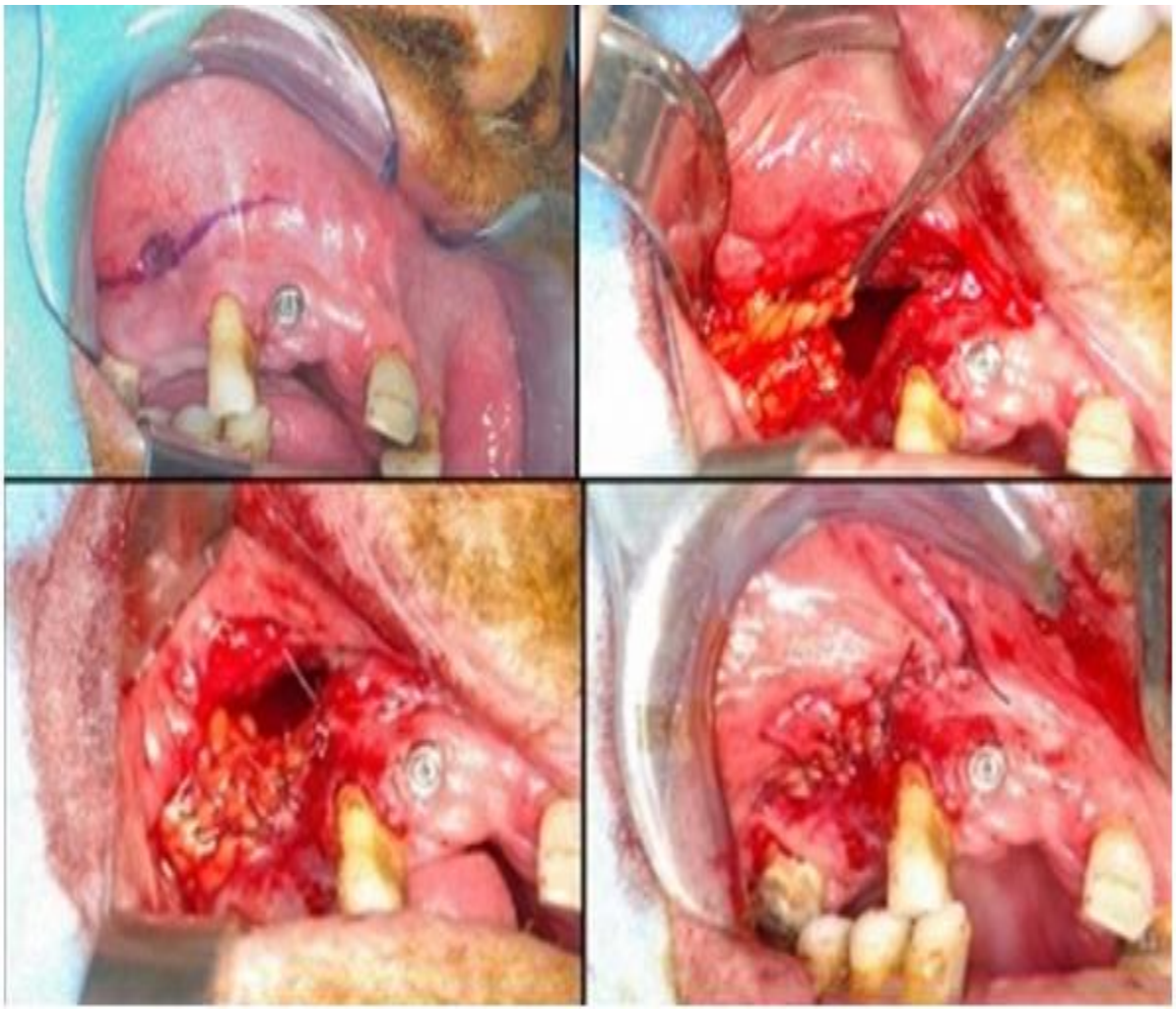

Fig 4: Showing relationship of BFP

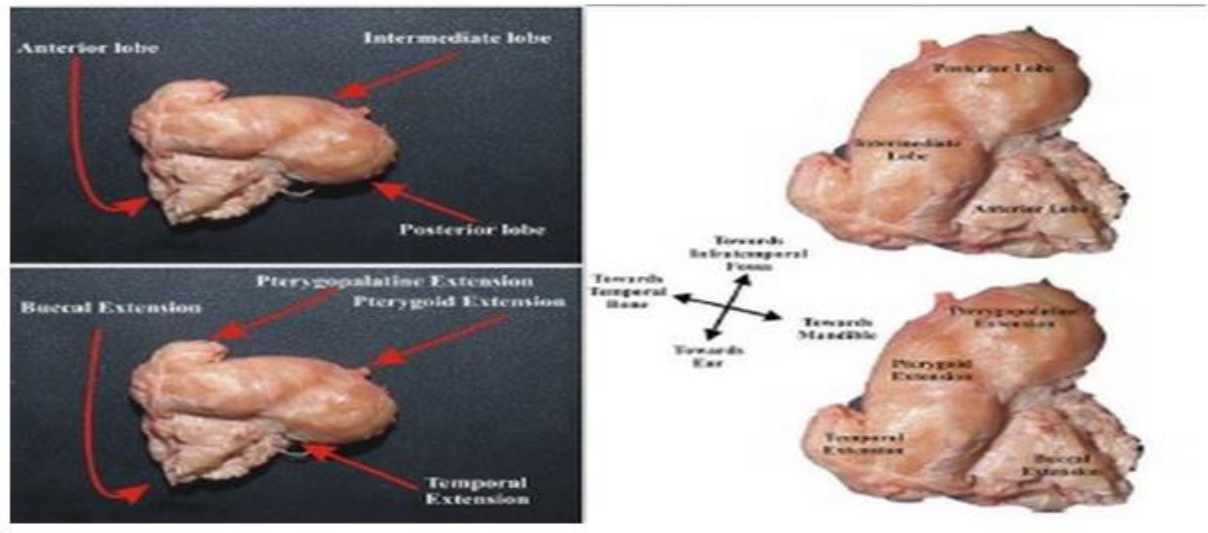

Fig 5: Techniques of harvesting buccal with surrounding structures fat pad graft

Due to its anatomical situation, the ideal defects to be reconstructed with a BFP are the maxillary defects, from the premolar area to the posterior tuberosity. Also soft and hard palate, superior alveolar rim, cheek mucosa and tonsilar fossa, are suitable places to be employed, as suggested by other authors. Excessive traction of BFP towards the medium usually causes with a vestibular sulcus loss, which requires a secondary surgical procedure. Too much traction appears to be the cause in our unfavorable results .It is also observed that there are not much benefits of its use incombination with dermal grafts, which usually are lost, epithelising afterwards by secondary healing. Neither was BFP tunneling reported to have given any better results (Fig. 5)[24]

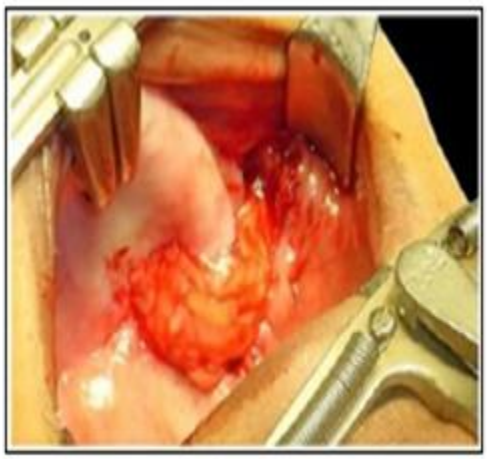

Fig 6: BFP used in OAF

Fig 7: BFP used in OSMF

HEALING OF THE BFP

Clinically, in the typical course, the surface of the orally exposed fat becomes yellowish-white in 3 days and then gradually becomes red within 1 week, which is most likely due to the formation of young granulation tissue. This changes into firmer granulation

tissue during the2nd week, and becomes completely epithelialized with a slight contraction of the wound by 3 weeks after the operation.

USES OF BFP GRAFT

BFP in closure of OAC/OAF

The BFP flap, preferably pedicled type, has been used most commonly for the closure of OAC/ OAF [1,5,6,22, 25-31]. The fact that the location of the BFP is anatomically favorable, the ease and minimal dissection with which it can be harvested and mobilized, good rate of epithelialization, and low rate of failure have made it the preferred choice [7]. Dolanmaz et al. have considered the pedicled BFP flap to be an acceptable and reliable alternative in management of acute or chronic OAC, and it seems to be best choice of treatment, especially in recurrent OAF [25].In their series of 75 cases, all of them had a favorable healing courseafter the operation, and the wounds became successfully epithelized in 3-4 weeks after surgery. Excessive granulation and hypertrophy were noticed in 9 cases. In 6 of these, the BFP near the mucosal border wasreduced with scissors to prevent the risk of dental trauma while chewing. In another 3 patients, such an operation was not needed, and no significant healing differences existed between these cases. The BFP that was left hypertrophic reached an almost normal level by completing secondary epithelialization. The difference between levels eventually disappeared completely [25]. Haraji and Zare, in a series of 13 patients, reported that OAF closed with the BFP healed without any esthetic disadvantages or disturbances of the masticatory function. There was minimal obliteration of the vestibule in the closure of OAF with the BFP as compared with closure with buccal advancement flap. They also reported that after complete healing, there were no differences in the level or color of the local mucosa25. Most studies suggest a high success rate of BFP in the closure of OAC/OAF. However, a few complications, such as mild obliteration of vestibule and recurrence of OAF, in up to 7.5% were reported in one study [5]. The vestibular depth became normal in due course of time resulting in no postoperative prosthodontic complications. Recurrent OAF needed a second operation to achieve closure5 (Fig. 6)[32]

BFP in reconstruction of post excision defects

The other major use of the BFP has been in closure of post excision defects [6,7,8,9,12,20,23,33-37]. The defects were caused by excision of pathologies, cancer involving the maxilla, etc. The BFP can be applied ranging from the angle of mouth to retromolartrigone and palate [38].Hard palate is the location in which the BFP has been most often used for reconstruction after tumor resection [34].The major consideration has been the size of defect adequate for its usage. Literature shows that defects upto 6 cm have been successfully closed, but considering the manipulation required in adapting the flap to the defect, a guideline needs to be laid down for maxillary defects: 4 cm and up to 6 cm for buccal orretromolar defects. The BFP in reconstruction of defects is highly successful; however, complications, such as postoperative infection [20,37] ,fistula formation [36],partial or complete loss of flap, limitation in mouth opening, depressed cheek [5,20,35],hematoma, and hemorrhage, have been reported [30]. Hollowness of the cheek might be because of excessive amount of fat harvested for larger defects. Hematoma and hemorrhage were suspected to be due to rupture of the pedicles and were controlled by pressure. Follow-up period for the defects in most studies was variable: from 4 weeks to 12 years in one study [36]. However, a majority of studies showed that follow-up of 3-6 months is adequate to comment on the success and failure of the flap, and no delayed postoperative complications were observed. Liu et al. used the BFP in reconstruction of post excision defects along with prefabricated titanium mesh and found it to be satisfactory, concluding that BFP is most suitable for benign tumors reconstruction [37]. BFP in closure of mucosal defects The BFP has also been used to cover the mucosal defects after ablation of buccal cancer [39]. The epithelialization of the flap has been found to be satisfactory at 4-6 weeks. The BFP has been compared with radial free forearm flap and free split-thickness graft. Results showed that it readily epithelializes but has been found to restrict the mouth opening. The dense fibrous connective tissue in the sub epithelial stroma lackinglamina propria and sub mucosa could lead to retraction of the BFP and limitation in mouth opening. Depression over the cheek has also been mentioned occasionally [35].Mucosal defects also have been closed with the combination of the BFP and buccinatormyocutaneous flap, and results have been satisfactory [39].

BFP in treatment of oral submucous fibrosis

A retrospective study of 100 patients compared the BFP with nasolabial flap, tongue flap, and split skin graft for the coverage of post fibrotic band incision in oral submucous fibrosis with 25 patients in each group [40]. The authors concluded that the BFP serves as the best substitute, providing excellent function without deteriorating esthetics. It offered ease of surgery, little postoperative morbidity, and good patient acceptance(Fig. 7)[41]

BFP in repair of primary cleft palate

Levi et al. innovated the use of pedicled BFP in conjunction with the Furlow repair and the hard palatal 2-flap procedure for closure of primary cleft palate, citing less dissection and reduced donor site morbidity of this material for their choice. They posited that an added layer of vascularized tissue (the BFP flap) functions to fill and line this open denuded space, increases vascularity to this area, and may thwart or even prevent significant wound contracture. They thought this technique may decrease scar contraction and subsequent transverse maxillary growth restriction induced by the lateral hard palatal tissue defect, as well as buttress areas where fistula formation is most common. No change in the hollowness of the child's cheeks was seen in their study [42].Other authors have used the double pedicled BFP in the closure of postosteotomymidpalatine cleft with reasonable success and no postoperative complication [43]. Pappachan and Vasant pedicled the BFP in conjunction with pedicled mucosal flaps and reported that the BFP helps to lengthen the soft palate without generating tension on the nasal side [44].

Role of BFP in temporomandibular joint reconstruction

Rattan used the BFP as a useful adjunct to autogenous or alloplastic temporomandibular joint (TMJ) reconstruction after TMJ ankylosis release and multiple operate joints [17]. The rationale for placing fat around the joint is to obliterate dead space around the joint, thus preventing the formation and organization of hematoma. It also may isolate any residual active tissue, such as periosteum, and reactive tissue from previous failedalloplastic implants to the periphery of the region, thus decreasing chances of fibrosis and bone formation. The BPF lies in close proximity to the TMJ and can be easily harvested through the same preauricular approach as used for TMJ exposure, therefore diminishing the chances of infection. Rattan concluded that the BFP can be used for TMJ reconstruction because of its local availability, but further studies are required to draw firm conclusions. In addition, the adequacy of volume and long-term fate of the BFP in TMJ reconstruction is not known [16]. BFP as membrane in sinus floor augmentation Hassani et al. used the BFP and performed sinus augmentation with a mixture of autogenous bone and natural bone mineral, covering the lateral sinus wall with the BFP [45] .They based this on the fact that the successful osseous reconstruction of small and major maxillary jaw defects by bone grafting is dependent on the early physical protection of the graft from trauma and micro motion and the establishment of ablood supply to the graft. Both of these prerequisites could be aided by judicious use of the BFP. Use of pedicled BFP provides immediate blood supply to the recipient site and promotes rapid neovascularization of the grafted material. By placing the BFP between fast-growing fibrous tissue and the defect itself, slow-growing osseo- progenitor cells canmigrate into the bone defect and lead to the reossification of this area [46].They also mentioned that it has an additional protective function of providing a multilayer wound closure over all types of maxillary bone grafts, thereby preventing graft exposure and enhancing success [47].There may be some complications, such as reduction in oral opening, partial necrosis, infection, excessive scarring, and sulcus obliteration. It is said that the BFP might be a substitute for bioresorbable collagen membranes in maxillary and sinus floor bone grafts. It is also suggested that the vascularity of this pedicled flap could be responsible for goodimplant survival in the posterior maxillary area and the validity and reliability of using the BFP could significantly increase with more comprehensive research in this field and by directly comparing BFP withdifferent types of membranes and analyzing the results statistically (Fig.8).

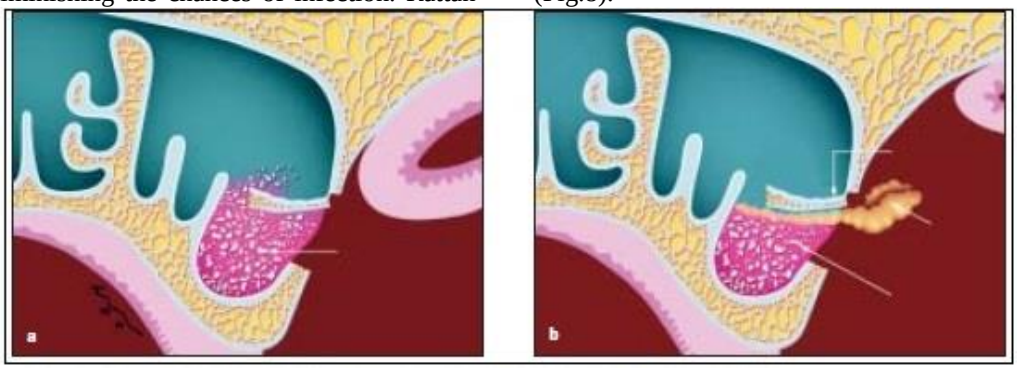

Fig 8: BFP used in repair of sinus membrane perforation

Miscellaneous uses

The BFP has also been used for vocal cord augmentation, where intracordal injection of autologous fat harvested from the buccal fat pad is administered [48]. Khouw et al. used bilateral BFP in combination with a superiorly based pharyngeal flap for palatal recontruction (to lengthen the soft palate) in rhinolaleaaperta after extensive necrotizing tonsillitis [49]. Pedicled BFP has also been used in the coverage of severe gingival recession defects (Miller class IV) and provides a considerable amount of keratinized tissue for coverage of the upper molar teeth [53].

Advantages and disadvantages

The advantages of using the buccal fat pad flap in oral reconstruction are numerous:

1. It is a simple and quick flap to use.2. The procedure can be done under local anesthesia.
3. No visible scars are left.4. Excision of contralateral buccal fat pad is often not needed because no asymmetry results from elevation of flap.5. Failure and morbidity rates are very low, and6. There is low patient morbidity

The disadvantages of the pedicled buccal fat pad include the following:

1. Only small-to-medium defects can be covered.
2. It can only be used for coverage of defects, not for adding bulk, and
3. A small depression may be caused by the procedure

Summary

The success of the BFP has been attributed to its rich vascular supply,less donor site morbidity, almost constant weight for all individuals, reliability, and ease of harvest and lower complication rate. After going through pertinent studies, we find that the BFP is versatile in terms of its location and application. It can be used as far anteriorly as the superior alveolar ridge canine tooth region and up to but not beyond the midline of the palate extending laterally to the superior buccal sulcus and buccal mucosa. Posteriorly it can be used in the hard palate, the tuberosity region, the retromolar area, the soft palate (up to mid- line), and the anterior tonsillar pillar. It can be used alone or in combination with other flaps, such as the pedicled temporalis muscle myocutaneous flap or the pectoralis major myocutaneous flap. It has been put to many uses, ranging from closure of OACs to closure of post excision maxillary defects caused because of benign and/or malignant tumors. Other uses include coverage of mucosal defects after ablative surgery or after fibrotic band incision in oral submucous fibrosis, as adjunct in closure of primary clefts or postosteotomy clefts, as membrane in sinus lift procedures, and in TMJ surgeries. The most critical factor for the success of the BFP seems to be the size; although the literature reports that defects of size 7*5 *2 cm have healed successfully, most authors recommend 5*4 cm (medium sized) defects for reconstruction with the BFP. However, if the defects are big and near the midline, bilateral flaps have been used, so that it can be distributed over a large area. The follow-up period for most of the studies was 4 weeks to 3-6 months and 1 series had a protracted follow-up of 12 years. However, that series contained the use of the BFP after excision of malignant tumors, and the prolonged duration was to detect any signs of recurrence of the lesions. The BFP healed in 2 weeks and completely epithelized in 6 weeks. Among the few complications associated with the BFP were recurrence of OAF and partial loss of flap, which was mostly seen in large-sized defects. Cheek deformity has also been reported in few series, but the change has been stated to be "subtle". Limitation in mouth opening was most commonly seen when the BFP flap was used in the retromolar region. Occasional hematoma and hemorrhage were also reported, which were found to be due to one of the pedicles of the flap and which responded to conservative treatment. Mild obliteration of the vestibule which corrects in due course of time has also been reported. To conclude, in recent years, the BFP has been used for a variety of purposes, owing to its physical and biologic properties, and the results have been encouraging clinicians to make use of its potential benefits. The most common use of the BFP has been in the closure of OACs, followed by postexcision reconstruction. The size limitation of the BFP must be known to permit successful outcome. More studies with adequate sample size and long-term follow-up are required to ascertain its use incleft palate closure, in TMJ reconstruction, and as sinus floor membrane.

References

1. Egyedi P. Utilization of the buccal fat pad for closure oro-antral and/or oro-nasal communications. J Maxillofac Surg 1977; 5:241-4.
2. Messenger KL, Cloyd W. Traumatic herniation of the buccal fat pad:report of a case. Oral Surg Oral Med Oral Pathol Oral RadiolEndod1977; 43:41.
3. Wolford DG, Stapleford RG, Forte, RA, Heath M. Traumaticherniation of the buccal fat pad: report of case. J Am Dent Assoc1981; 103:593.
4. Scott P, Fabbroni G, Mitchell DA. The buccal fat pad in the closureof oro-antral communications: an illustrated guide. Dent Update2004; 31:363-6.
5. Poeschl PW, Baumann A, Russmueller G, Poeschl E, Klug C, EwersR. Closure of oroantral

communications with Bichat's buccal fatpad. J Oral MaxillofacSurg 2009; 67:1460-6.

6. Adeyemo WL, Ogunlewe MO, Ladeinde AL, James O. Closure oforo-antral fistula with pedicled buccal fat pad. A case report andreview of literature.Afr J Oral Health 2004; 1:42-6.
7. Marzano UG. Lorenz Heister's "molar gland."Plast Reconstr Surg2005; 115:1389-93.
8. Baumann A, Ewers R. Application of the buccal fat pad in oral reconstruction. J Oral Maxillo facSurg 2000; 58:389-92
9. Rapidis AD, Alexandridis CA, Eleftberiadis E, Angelopoulos AP.The use of the buccal fat pad for reconstruction of oral defects: review of the literature and report of 15 cases. J Oral MaxillofacSurg2000; 58:158-63
10. Tideman H. Bosdnquet A, Scott J. Use of the buccal fat pad as a pedicled graft. J Oral MaxillofacSurg 1986;44:435-40
11. Hao SP. Reconstruction of oral defects with the pedicled buccal fatpad flap. Otolaryngol Head Neck Surg 2000; 122:863-7.
12. Dean A, Alamillos F, Garcia-Lopez, A, Sanchez J, Penalba M. The buccal fat pad in oral reconstruction. Head Neck 2001; 23:383-8.
13. Poissonet CM, Budi AR, Bookstein FL. Growth and development of human adipose tissue during early gestation. EarlyHum Dev1983; 8:1-11
14. Stuzin JM, Wagstrom L, Kawamoto HK, Baker TJ, Wolfe SA. Theanatomy and clinical applications of the buccal pad off at.Plast Reconstr Surg 1990; 85:29-37.
15. Dubin B, Jackson IT, Halim A, Triplett WW, Ferreira M. Anatomy of the buccal fat pad and its clinical significance. PlastReconstrSurg1989; 83:257-62.
16. Zhang HM, Yan YP, Qi KM, Wang JQ, Lui ZF. Anatomicalstructure of the buccal fat pad and its clinical adaptations. PlastReconstrSurg 2002; 109:2509-20
17. Rattan V. A simple technique for use of buccal pad of fat intemporomandibular joint reconstruction. J Oral MaxillofacSurg2006; 64:1447-51
18. Matarasso A. Buccal fat pad excision: aesthetic improvement of themidface. Ann PlastSurg 1991; 26:413-8.
19. Jackson IT. Anatomy of the buccal fat pad and its clinicalsignificance. PlastReconstrSurg 1999; 103:2059-60
20. Amin MA, Bailey BMW, Swinsona B, Witherowa H. Use of thebuccal fat pad in the reconstruction and prosthetic rehabilitation ofoncological maxillary defects. Br J Oral MaxillofacSurg 2005; 43:48-154.
21. Saad Yousuf, R. Shane Tubbs et al. A review of the gross anatomy, functions, pathology, and clinical uses of the buccal fat pad.Surg Radiol Anat 2010;32:427–436
22. Hanazawa Y, Itoh K, Mabashi T, Sato K. Closure of oroantralcommunications using a pedicledbuccal fat pad graft. J OralMaxillofacSurg 1995; 53:771-5.
23. Samman N, Cheung LK, Tideman H. The buccal fat pad in oralreconstruction.Int J Oral MaxillofacSurg 1993; 22:2-6.
24. F Yabroudi, A Dannan, closure of oroantral fistula with pedicled buccal fat pad; a case report and review of literature, JDS:8(1):5736
25. Dolanmaz D, Tuz H, Bayraktar S, Metin M, Erdem E, Baykul T. Useof pedicledbuccal fat pad in the closure of oroantral communication:analysis of 75 cases. Quintessence Int 2004; 35:241-243
26. Abuabara A, Cortez ALV, Passeri LA, Moraes M, Moreira RWF.Evaluation of different treatments for oroantral/oronasal communications: experience of 112 cases. Int J Oral MaxillofacSurg2006; 35:155-8.
27. Haraji A, Zare R. The use of buccal fat pad for oro-antralcommunication closure. J Mashhad Dent Sch Mashhad UnivMediSci2007; 31(Spec Iss):9-11.
28. Moraes EJ. Closure of oroantral communication with buccal fat padflap in zygomatic implant surgery: a case report. Int J OralMaxillofac Implants 2008; 23:143-6
29. Allais M, Maurette PE, Cortez ALV, Filho JRL, Mazzonetto R. The buccal fat pad graft in the closure of oroantral communications. RevBras Otorrinolaringol 2008; 74:799.
30. Junior JSM, Keim FS, Kreibich MS. Closure of oroantral communication using buccal fat pad graft—case report. Int Arch Otorhinolaryngol 2008; 12:450-3
31. Kim YW, Hwang JW, Yun PY. Closure of large perforation of sinus membrane using pedicledbuccal fat pad graft: a case report. Int JOralMaxillofac Implants2008; 23:1139-1142.
32. E. Meyer et al, Buccal fat pad – a simple, underutilized flap. S Afr J Surg 2012; 50(2):47-49
33. Chakrabarti J, Tekriwal R, Ganguli A, Ghosh S, Mishra PK.Pedicled buccal pad flap for intraoral malignant defects: a series of 29 cases. Indian J PlastSurg 2009; 42:36-42.

34. Colella G, Tartaro G, Giudice A. The buccal fat pad in oral reconstruction. Br AssocPlastSurg 2004; 57:326-9.
35. Chien CY, Hwang CF, Chuang HC, Jeng SF, Su CY. Comparison of radial forearm free flap, pedicled buccal fat pad flap and split thickness skin graft in reconstruction of buccal mucosal defect. Oral Oncol 2005; 41:694-7.
36. Zhong LP, Chen G, Fan L, Zhao S. Immediate reconstruction ofmaxilla with bone grafts supported by pedicledbuccal fat pad graft.OralSurg Oral Med Oral Pathol Oral RadiolEndod 2004; 97:147-54.
37. Liu YM, Chen GF, Yan JL, Zhao SF, Zhang WM, Zhao S, et al.Functional reconstruction of maxilla with pedicled buccal fat padflap, prefabricated titanium mesh and autologous bone grafts. Int J.Oral Maxillofac.Surg 2006; 35:1108-13.
38. Alkan A, Dolanmaz D, Uzun E, Erdem E. The reconstruction of oraldefects with buccal fat pad. Swiss Med Wkly 2003;133:78
39. Ferrari S, Ferri A, Bianchi B, Copelli C, Magri AS, Sesenna E. Anovel technique for cheek mucosa defect reconstruction using apedicled buccal fat pad and buccinatormyomucosal island flap. OralOncol 2009; 45:59-62
40. Mehrotra D, Pradhan R, Gupta S. Retrospective comparison of surgical treatment modalities in 100 patients with oral submucousfibrosis. Oral Surg Oral Med Oral Pathol Oral RadiolEndod2009; 107:e1-10.
41. R. Sharma et al ,use of buccal fat pad for treatment of oral submucous fibrosis, J Oral Maxillofacial Surg 2012;70:228-232
42. Levi B, Kasten SJ, Buchman SR. Utilization of the buccal fat padflap for congenital cleft palate repair. PlastReconstrSurg2009; 123:1018-21
43. Riu GD, Meloni SM, Bozzo C, Meloni F, Tullio A. A double buccalfat pad flap for middle palate defect closure—a new technique forpalate closure. Int J Oral MaxillofacSurg 2006; 35:1057-9.
44. Pappachan B, Vasant R. Application of bilateral pedicledbuccal fat pad in wide primary cleft palate. Br J Oral MaxillofacSurg2008; 46:310-2.
45. Hassani A, Khojasteh A, Alikhasi M, Vaziri H. Measurement of volume changes of sinus floor augmentation covered with buccal fatpad: a case series study. Oral Surg Oral Med Oral Pathol OralRadiol Endod 2009; 107:369-74.
46. Schelegel AK, Mohler H, Busch F, Mehl A. Preclinical and clinical studies of a collagen membrane (Bio-Gide). Biomaterials1997; 18:535-8.
47. Liversedge RL, Wong K. Use of the buccal fat pad in maxillary and sinus grafting of the severely atrophic maxilla preparatory to implant reconstruction of the partially or completely edentulous patient: technical note. Int J Oral Maxillofac Implants 2002; 17:424-8.
48. Tamura E, Fukuda H, Tabata Y, Nishimura M. Use of the buccal fad pad for vocal cord augmentation. ActaOtolaryngol 2007; 1-6.
49. Khouw YLN, van der Wal KGH, Bartels F, van der Biezen JJ. Bilateral palatal reconstruction using 2 pedicledbuccal fat pads inrhinolaleaaperta after extensive necrotizing tonsillitis: a case report. J Oral Maxillofac Surg 2004; 62:749-51.
50. Martin-Granizo R, Naval L, Costas A, Goizueta C, Rodriguez F,Monje F, et al. Use of buccal fat pad to repair intraoral defects:review of 30 cases. Br J OralMaxillofacSurg 1997; 35:81-4.
51. Sharma CB, Sharma P, Bali R, Goel V. Use of single layered buccalfat pad in the closure of maxillary sinus defects. J Maxillofacial Oral Surg 2005; 4:15-7.
52. Rattan V, Rai S, Vaiphei K. Use of buccal pad of fat to prevent heterotopic bone formation after excision of myositis ossificans of medial pterygoid muscle. J Oral MaxillofacSurg 2008; 66:1518-22
53. El Haddad SA, El Razzak MYA, El Shall M. Use of pedicled buccal fat pad in root coverage of severe gingival recession defect. JPeriodontol 2008; 79:1271-9.

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