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REVIEW

A review of the gross anatomy, functions, pathology, and clinical uses of the buccal fat pad

Saad Yousuf · R. Shane Tubbs · Christopher T. Wartmann · Theodoros Kapos · Aaron A. Cohen-Gadol · Marios Loukas

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Abstract The buccal fat pad is a trigone-shaped adipose tissue located in the cheek that assumes numerous functional and aesthetic clinical uses. It has been studied extensively within the past four decades, and its use in repairing common and debilitating oral defects is the motive for continued research on this topic. It is vital to understand the etiology of any oral defect or of a lesion of the buccal fat pad, for a misdiagnosis can prevent effective treatment of the underlying problem. In this review, we describe the embryology and anatomy of the buccal fat and its association with clinical condition and clinical procedures.

Keywords Buccal fat pad · Cleft palate · Buccal fat pad lipoma · Buccal fat pad herniation

S. Yousuf · M. Loukas (✉)
Department of Anatomical Sciences,
School of Medicine, St. George's University,
Grenada, West Indies
e-mail: mloukas@sgu.edu; edsg2000@yahoo.com

R. Shane Tubbs
Pediatric Neurosurgery, Children's Hospital,
Birmingham, AL, USA

C. T. Wartmann
Department of Otolaryngology/Head and Neck Surgery,
University of Maryland Medical Center, Baltimore, MD, USA

T. Kapos
Department of Biomaterials and Advanced Prosthodontics,
Harvard School of Dental Medicine, Boston, MA, USA

A. A. Cohen-Gadol
Clarian Neurosurgical Group and Department of Neurosurgery,
Indianapolis, IN, USA

Introduction

For centuries, many anatomists, physicians and pathologists have been studying the fat pads of the face. The complex nature of the buccal fat pad concerning both anatomy and function has sparked recent interest. These adipose structures play an important role in facial aesthetics of people of all ages, from neonates to adults. Because of the location of the buccal fat pad, it is prone to undergo clinically significant pathologies such as lipoma, herniation, and pseudoherniation. The location, however, also allows for easy access to cover a myriad of oral defects and lesions including congenital palatal defects and numerous neoplastic lesions, among others. This paper will review the embryology, gross anatomy, function and pathologic processes of the buccal fat pad.

Embryology

Much of our knowledge regarding the prenatal morphogenesis of human fat tissue is derived from studies conducted in the 1980s. A landmark study by Poissonnet et al. [24] 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 fat pad are summarized in Table 1. In brief, Poissonnet et al. [24] showed that adipose tissue differentiates during the second trimester, between weeks 14 and 16. In addition, after the 23rd week of gestation, while the number of fat lobules remain approximately constant, the size of these lobules increases until the 29th week, suggesting that weeks 14 through 23 are a sensitive period of fat lobule

Table 1 Five morphogenic phases of fat formation (Poissonnet et al.)

Stages	Events	
1	Undifferentiated fat tissue without condensation	Fat is composed of an amorphous ground substance and fibers organized into loose connective tissue; mesenchymal cells aggregate
2	Vascular invasion/angiogenesis	Primitive blood vessels proliferate (emergence of the characteristic fat tissue); a rich capillary network develops from each small blood vessel. Surrounding mesenchymal cells differentiate into stellate preadipocytes. Blood vessels signal areas where fat cells will organize into groups
3	Development of mesenchymal lobules	These lobules contain stellate mesenchymal cells or pre-adipocytes without lipid droplets
4	Appearance of primitive fat lobules	Fat storage becomes visible
5	Definitive fat lobules	Fat lobules are well separated from each other via connective tissue septa

development. Histological preparations of adipose slices showed the morphogenic link between the onset of vascularization and the first appearance 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 optic vesicle after the 18th week between the sclera and the wall of the orbit [24].

The buccal fat pad plays a large role in the cheek prominence of newborns and infants. The fat pad is well developed in the premature fetus and is one of the earliest sites of well developed fetal adipose deposition. A profile of the lipid content is imperative in understanding the development of the buccal fat pad in the face throughout gestational and early infantile years. Through gas–liquid chromatography and thin-layer chromatography, Bagdade and Hirsch [2] measured and tabulated the fatty acid composition of adipose tissue from both the buccal fat pad and abdominal subcutaneous tissue from the same subject for comparison. The authors found that preterm infants showed similar adipose tissue stores to that of maternal subjects. However, during the third trimester of pregnancy, there were marked changes in fatty acid composition in the buccal fat pad compared to that of the mother, and these differences were consistent with lipogenesis resulting from a high carbohydrate diet [2]. There is a large (12-fold) increase in body fat during the final trimester.

Gross anatomy of the buccal fat pad

The buccal space is the compartment in which the buccal fat pad is confined. The boundaries of this compartment include the buccinator muscle medially, the deep cervical fascia and muscles of facial expression anterolaterally, and the masticator space and parotid gland posteriorly [17]. Contents of the buccal space include the fat pad, parotid duct, salivary glands, facial artery and vein, buccal artery, lymphatic channels and branches of the facial and mandibular nerves (Figs. 1, 2) [12, 26, 30].

The buccal fat pad is a tubular-shaped collection of adipose tissue that occupies a prominent position in the midface. It has numerous presumed functions including suckling, contributing to mastication, protection and cushioning of neurovascular bundles, separating the muscles of mastication from one another, and aesthetics, amongst others. In the infant, the buccal fat pad prevents the indrawing of the cheeks during sucking, while it enhances intermuscular motion. Both the shape and function of the buccal fat pad change significantly with age, as its suctorial function and prominence relative to surrounding structures diminishes over time [4].

The anatomy of the buccal fat pad has been extensively researched by many anatomists and physiologists, starting with Bichat [4], the French anatomist who first described it in 1802. A very detailed description of the buccal fat pad was provided by Gaughran in 1957 [13]; later anatomical explorations were performed by Sicher [9], Tideman [31] and Dubin [8].

Racz et al. [25], in studying the anatomy of the buccal fat pad in both adults and fetuses, described its structural and functional significance in detail. In fetuses, the buccal fat pad is prominent, globular-shaped, and well-limited. It is situated under the anterior border of the masseter, on the buccinator [25]. With age, three prolongations of the buccal fat pad develop, termed anteromalar, pterygomaxillary, and posterotemporal [25]. Racz et al. additionally asserts the blood supply to the buccal fat pad arises from three sources: the anterior deep temporal, buccal and posterior superior alveolar arteries.

Upon investigation of two cases of buccal fat pad pathology, one bilobed lipoma and one arteriovenous malformation,

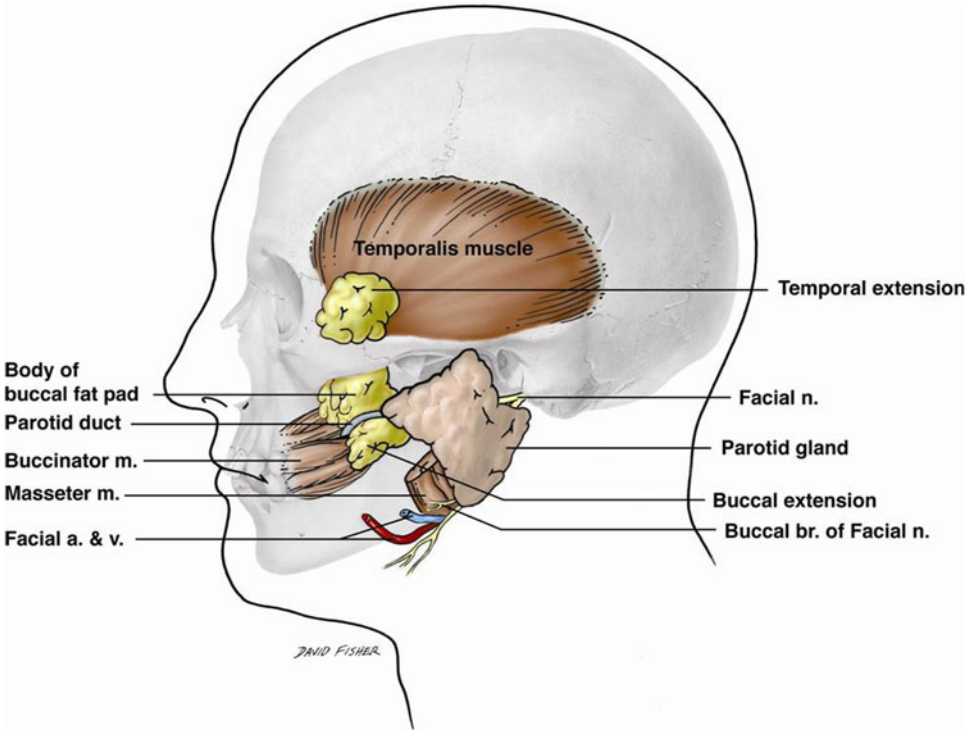


Fig. 1 Schematic representation of the buccal fat pad with its temporal and buccal extensions, as well as it relationship with important landmarks in the face such as the parotid duct, facial artery, parotid gland and buccinator muscle

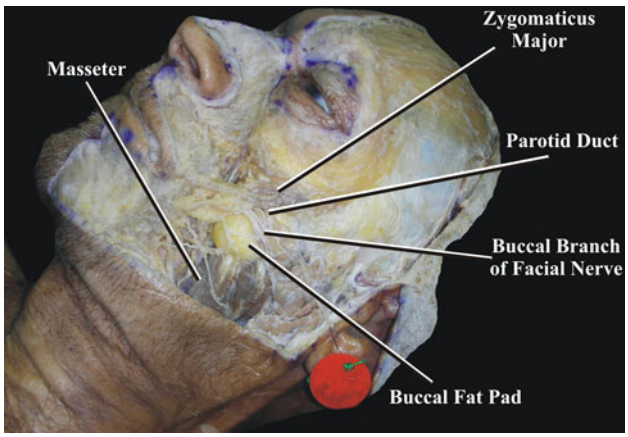
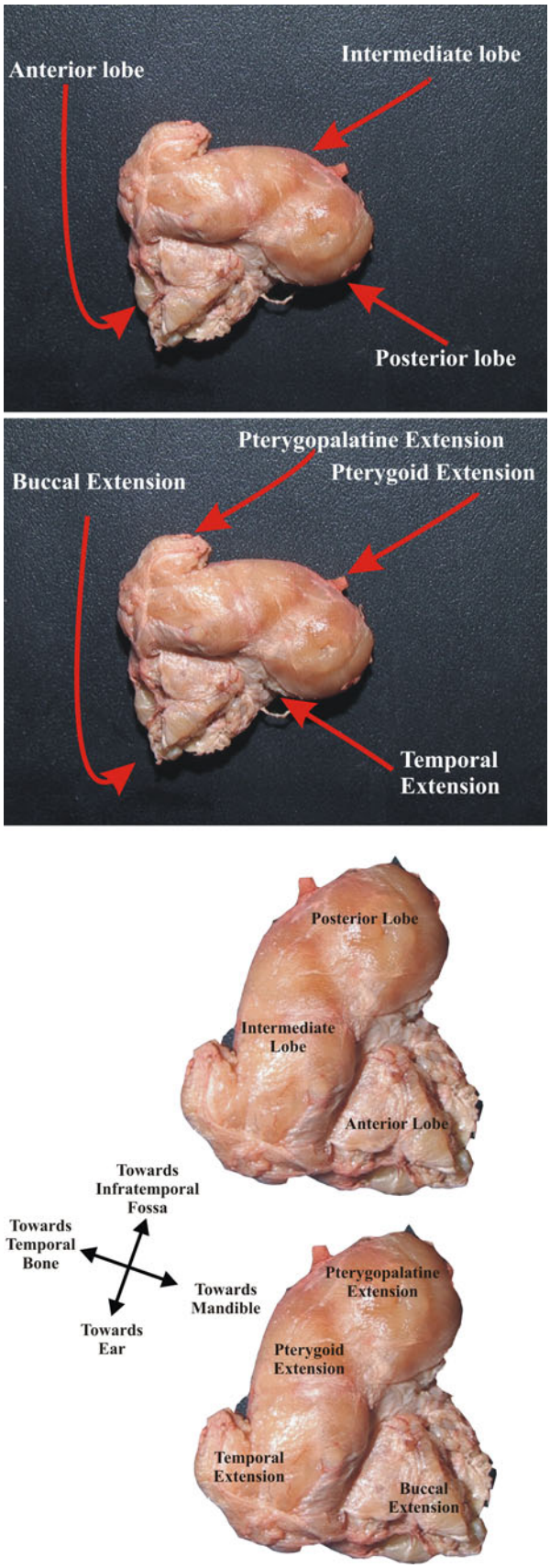


Fig. 2 The relationships of the BFP with important landmarks of the face. The skin, together with a small amount of subcutaneous fat, has been retracted laterally. The parotid duct and the parotid gland are exposed as well as the branches of the facial nerve

Dubin et al. [8] carried out fresh cadaveric dissections and confirmed the temporal/cranial extension of the buccal fat pad as beneath the zygomatic arch and the temporalis muscle, inserting on the coronoid process. Whereas Dubin et al. [8] deemed the fat pad in the temporal region a cranial extension of the buccal fat pad, Stuzin et al. [28] observed that within the temporal region of the face exists superficial and deep extensions that are, in fact, distinct fat pads not in continuity. It is the deep fat pad within the temporal region that is the true extension of the buccal fat pad, while the superficial temporal fat pad differs in both appearance and vascular supply, and is separated from the deep fat by a deep temporal fascia [28]. Failure to acknowledge and appreciate this cranial extension can result in patient morbidity, and will be discussed at length later.

In our review of the literature of the anatomy and clinical applications of the buccal fat pad, the most detailed description to it is provided by Zhang et al. [35]. The authors, as opposed to previous anatomists, divided the body of the buccal fat pad into three lobes: the anterior, posterior, and the new intermediate lobe (Fig. 3). These lobes are each "encapsulated by an independent membrane, fixed by some ligaments, and nourished by different sources of arteries" [35]. The anterior lobe is triangular and located below the zygoma, extending anterior to the buccinator. The anterior lobe has branches of facial nerve lying over its capsule, and is separated by connective tissue into even smaller masses which contain the infraorbital vessels.

The intermediate lobe, not observed in previous reports [2, 6, 15, 21, 29, 31, 34], is thin in adults and large in children, lying in the space around the lateral maxilla between the anterior and posterior lobes [35]. The posterior lobe, according to Zhang et al. is located in the masticatory space and its surrounding areas, running up to the infraorbital fissure and space around the temporalis muscle, down towards the upper rim of the mandibular body. The posterior lobe has four extensions: the buccal process (the most superficial process, below the parotid duct), pterygopalatine process (extends to the pterygopalatine fossa and envelops the pterygopalatine vessels), pterygoid process (stays in the



◀**Fig. 3** The external morphology of the BFP. The *upper figure* demonstrates the locations of the three lobes: anterior, posterior and intermediate. The *lower figure* demonstrates the four extensions of the BFP: buccal, pterygoid, temporal, and pterygopalatine (with permission from Loukas et al. [19])

pterygoid space), and the temporal process that is further separated into a superficial and profound process [35]. In a previous study on the buccal fat pad from our group, we were able to investigate on its volumetric variation [19]. Specifically, the mean volume of the buccal fat pad in male was 10.2 ml (7.8–11.2), while in females the mean volume was 8.9 ml (7.2–10.8). In addition, the mean thickness of the buccal fat pad was 6 mm, with a mean weight of 9.7 g [19].

Of both anatomical and clinical significance are the six ligaments that Zhang et al. have described which anchor the various parts of the buccal fat pad and also serve as entry points of vessels to the buccal fat pad. Each lobe is anchored to surrounding structures by two to four ligaments: maxillary, posterior zygomatic, medial and lateral infraorbital fissure, temporalis tendon, and the buccinator ligament. Furthermore, unlike previous anatomists, Zhang et al. [35] listed numerous blood vessels supplying the buccal fat pad (Table 2).

As Jackson [15] pointed out, two approaches can be used to expose and access the buccal fat pad. The safer method requires an incision in the upper buccal sulcus at the last molar tuberosity region. The other mentioned approach occurs during a face lift procedure, where branches of the facial nerve are identified near the masseter; if a gap in the thin fascia between the branches is opened, the buccal fat pad will emerge [15]. Other approaches have also been used to either access or resect a portion of the buccal fat pad, including dissecting bluntly [35], utilizing an incision through the gingivobuccal grove above the first molar [35], and incision of the buccal mucosal membrane 1 cm behind [29] or below [21] the parotid duct opening.

Functions of the buccal fat pad

Racz et al. [25] attributed many functions to the buccal fat pad. They stated that the reason why the buccal fat pad is so prominent in fetuses and neonates is for sucking, while after birth, it becomes an accessory organ of the masticatory process, aiding in chewing [25]. They also proposed a potential role of the fat pad as an "aspiratory-expulsive" pump. According to Zhang et al. [35] the anterior and posterior lobes, as well as pterygoid and buccal protrusions are all larger and more developed in children than in adults.

Table 2 Authors and description of buccal fat pad

Author	Year	Description of buccal fat pad	Arterial supply	Venous supply
Racz et al. [25]	1989	Fetus—more prominent, globular-shaped, and well-limited than adults. Situated under anterior border of masseter and buccinator Adults—uniformly shaped/developed; with age, three prolongations occur: anterior-malar, pteygomaxillary, posterotemporal	Three sources: deep temporal, buccal, and posterior superior alveolar	Five sources: tributaries of deep temporal, buccal and alveolar veins, pterygoid venous plexus, and opthalmic veins
Kahn et al. [16]	2000	Body of fat pad is made up of lower and upper (jugal) halves, separated by the parotid duct. Extensions are: masseteric, superficial temporal, deep temporal, pterygomandibular pterygopalatine, and lower orbital. Neonate: emphasis is placed on neonate's larger size of the masseteric extension		
Zhang et al. [35]	2002	Divided into three lobes: anterior, intermediate and posterior (four extensions: buccal, pterygoid, pterygopalatine, and temporal (superficial and profound))	Branches from: the posterior superior alveolar, anterior profound temporal artery anterosuperior branch of the posterior lobe (off of maxillary artery), superior buccinator branch (off of internal maxillary artery), middle branch of posterior lobe from pterygoid muscle artery, inferior buccinator artery of the facial artery, buccal extension branch from the middle facial artery	

While many authors have suggested mastication and sucking to be the main functions of the buccal fat pad due to its location within the masticatory process [18, 21, 25, 29, 33], Zhang et al. [35] suggested numerous other functions of the buccal fat pad. Because the lobes of the buccal fat pad fill various deep spaces of the face, muscle contraction and movement of the masticatory and mimetic apparatuses force the buccal fat pad lobes to function as gliding pads. The fat pad also serves as a cushion against injuries caused by muscle contraction or externally derived trauma that may injure facial neurovascular bundles.

Concerning aesthetics, the fullness of the anterior lobe of the buccal fat pad, as illustrated by Yousif et al. [34], may cause deepening of the nasolabial fold and relaxation of the mimetic muscles, both associated with aging. In addition, buccal fullness has always been explained by the anteroinferior protrusion of the buccal fat pad [18, 21, 25, 29, 33]. However, other causes of such fullness include relaxation of the mimetic muscles, poor ligamentous development, and rupture of the buccal fat pad capsule [35]. Additionally, these factors increase the chance for buccal prolapse into the oral cavity or subcutaneous layer.

Kahn et al. [16] undertook anatomical, histological and imaging studies of deep adipose tissues of the face, including the buccal and parapharyngeal fat pads. They, like Dubin et al. presented imaging evidence of a narrow connection bridging the body of the buccal fat pad as well as a superficial temporal extension [16]. They also showed that the superficial and deep temporal extensions were clearly delineated by temporal fascia and thus are separate from the temporal fat pad. These authors precisely described the morphological presentation of the buccal fat pad (Table 2), stating that it lies between the masticatory muscles and is involved in the sliding of these muscles over one another during their action. In their histological preparations of the buccal fat pad, they observed "pure white fat, with very fibrous trabeculae through which vessels passed" [16]. Its markedly lower density on a CT scan than freely mobile fats found throughout the body suggest that the buccal fat pad does not undergo lipid metabolism like most other fat in the body; histological preparations corroborate this finding with the presentation of less vesicles and smaller mitochondria, which are indicative of tissue undergoing less

metabolism. Kahn et al. [16] also acknowledged the use of the buccal fat pad as a fatty flap to repair losses of alveolar or palatine substance of the jaw.

Pathology of buccal fat pad

The continuity of adipose tissue as discussed by Kahn et al., especially within the deep face, allows for the potential of several pathological conditions including cellulitis and abscess formation. Muscle and adipose effacement, as well as emphysema produced by anaerobic organisms within the fat pad can be observed on CT. Facial trauma exposing surrounding adipose tissue can serve as a vehicle for infectious pathology to extend to various spaces in the head, such as the infratemporal fossa [16].

Trauma

Traumatic herniation of the buccal fat pad is often misdiagnosed as a lipoma. The problem lies within the fact that there is a time lapse between the traumatic event and the pathological appearance of the fat pad. It is for this reason the term traumatic pseudolipoma has been used since the 1970s. Pseudoherniation of the buccal fat pad is a term coined by Matarasso [22] which involves the outward displacement of the lower half of the buccal fat pad resulting in a "chipmunk cheek," where a walnut-sized mass of the fat pad is abnormally positioned. This is different from traumatic pseudolipoma, which is an intraoral herniation of the buccal fat pad which requires the piercing of both the buccinator muscle and oral mucosa.

One case report of a traumatic pseudolipoma involved a two and a half-year old boy who struck his face against a chair, causing bleeding from the mouth and a swelling on the inner aspect of the cheek [5]. The child presented with a pedunculated, grayish-yellow, soft, irregular swelling of the mucosa of his cheek adjacent to the occlusion of the molar teeth with coagulated blood around the lesion. Treatment involved blunt dissection under general anesthesia and closure with sutures. Upon histological examination, adipose tissue infiltrated the oral cavity with numerous polymorphonuclear leukocytes. Brooke and MacGregor [5] hypothesized that the patient had bitten through both the mucosa and the buccinator, thus allowing the herniation of the buccal fat pad. Had the history not been taken, a misdiagnosis of lipoma could have occurred, for the clinical findings are very similar.

Although rare, similar findings of traumatic herniations have been observed (Table 3). A review of the literature shows that most cases involve children less than 5 years of age. This fact can be due to many reasons:

1. The buccal fat pad is more prominent in children than in adults.
2. Children tend to place foreign objects into their mouths allowing for easy rupture of the buccal mucosa.
3. The suckling activity of neonates and infants can promote herniation via a mucosal defect.

The differential diagnosis, as noted by Wolford et al. [32], includes inflammatory hyperplasia, traumatic neuroma, lipoma, hemangioma, and salivary gland neoplasms.

Pseudoherniation of the buccal fat pad is a clinical syndrome that involves the outward displacement of its inferior-most portions. This is often observed as a soft, nontender walnut-sized mass that reduces into the buccal space [22]. When digital pressure is applied to the mass from the exterior, it is easily and painlessly reducible into the substance of the cheek. Differential diagnoses for similar findings can include salivary gland tumors, benign lesions, a dilated parotid duct, lymphadenopathy, soft-tissue malignancies, or abscesses. The conditions in which pseudoherniation occurred within the seven cases Matarasso observed were trauma, surgery (facialplasty or liposuction), corticosteroid use, idiopathic, or a congenital predisposition [22]. The position and size of the mass can vary and move with different facial expressions such as smiling and grimacing. Magnetic resonance imaging is the best method to study this condition and can provide important characteristics about the adipose tissue.

Reasons for pseudoherniation of the buccal fat pad, as stated by Matarasso [22], include natural weakness of the parotidomasseteric fascia or a discontinuity between the anterior margin and the posterior aspect of the fascia that cover the muscles of facial expression. Repetitive muscular activity or a loss of ligamentous support [23] can also lead to the eventual displacement of the buccal fat pad. Rapid and effective treatment for buccal fat pad pseudoherniation includes replacement or excision of the displaced fat pad.

Oncological defects of the buccal space and fat pad

Of particular clinical significance is the ability of the buccal fat pad to serve as an early marker for tumor invasion [1, 16, 17]. Common morphological presentations of tumors include effacement of adipose spaces or compression of the surrounding adipose tissue. Vascular malformations can potentially invade the buccal fat pad [16]. For instance, Dubin et al. [8] reported a case where an arteriovenous malformation existed within the temporalis muscle and the buccal temporalis extension of the buccal fat pad, which tracked into the lateral orbital wall, beneath the zygomatic arch. This malformation was primarily fed from the infraorbital and transverse branches of the facial artery. Removal

Table 3 Pathologies associated with buccal fat pad

Study source	Traumatic injury	Effect on buccal fat pad	Morphological characteristics of injury	Solution
Brooke and MacGregor [5]	2.5-Year-old face hit against chair	Postulated-child bit through both the mucosa and buccinator allowing for herniation of the buccal fat pad	Pedunculated, grayish yellow color swelling that was soft and irregular; swelling was of the mucosa of right cheek adjacent to molar teeth Coagulated blood was present. Adipose tissue infiltrated oral cavity	Blunt dissection of adipose tissue and wound closure via sutures
Marano et al. [20]	Blow to the right side of 21-year-old face with wooden club	Fracture of lateral wall of maxillary antrum caused obliteration of maxillary sinus by herniation of buccal fat pad	Preoperative radiographs showed radiopacity of maxillary sinus and fractured lateral sinus wall. Radiographs were indicative of herniation of buccal fat pad into maxillary sinus. Fracture of lateral wall of maxillary antrum was observed, as was minimal hematoma. Depressed zygomatic arch was also observed	Buccal fat pad was retracted into normal location and the sinus was packed with gauze to maintain its position
Browne [6]	10-Month-old had wooden model of antelope with sharp bone horns entered child's mouth in car accident	Buccal fat pad herniated through punctured oral mucosa	A soft, red, freely movable selling pedicled to the cheek, above the opening of the parotid duct was seen	Fat pad was maneuvered back through the wound which was repaired with two catgut sutures
Zipfel et al. [37]	9-Month-old fell with hairbrush in her mouth	Herniation of buccal fat pad through buccal mucosa	No significant bleeding; pedunculated mass seen protruding from lacerated left buccal mucosa	Most of extravasated mass was aputated; adipose tissue remaining at the base was placed back into buccal cavity
Zipfel et al. [37]	21-Month-old struck side of his face on table while playing the previous night	Herniation of buccal fat pad through buccal mucosa	Minimal, temporary amount of bleeding observed. Upon physical examination next day, red-blue mass was observed in oral cavity attached to right buccal mucosa via a stalk	Mass was avulsed from stalk

of a portion of the zygomatic arch revealed total replacement of the remaining buccal fat pad with the arteriovenous malformation [8]. Treatment involved resecting the vascular lesion and replacing the zygomatic arch back into its normal position.

Considering the number of structures compacted into the buccal space, multiple lesions of varying histology may arise within its boundaries. Kurabayashi et al. [17] evaluated the MRI characteristics of thirty patients with various buccal space lesions, including malignant tumors (adenoid cystic carcinoma, acinic cell carcinoma, fibrosarcoma, rhabdomyosarcoma, lymph node metastasis), benign tumors (hemangioma, lymphangioma, pleomorphic adenoma, neuroma, and lipoma), and nine cases of non-neoplastic inflammation. Some of the lesions were well-defined, and others showed infiltration into muscle, bone destruction, and edema. Thus, the differential diagnosis for buccal space lesions must include tumors having a glandular, vascular, lymphatic, connective, muscular, ductal or neural origin [17].

Clinical uses of the buccal fat pad

Within the past decade alone, with the use of MRI and CT investigations there have been many cases where the buccal fat pad was used as a flap for oral reconstruction after tumor removal or other oral lesion (Figs. 4, 5). It is for this reason the buccal fat pad is drawing attention in the field of aesthetic facial surgery, especially through modification of facial contours and the malar eminence. For example, Dean et al. [7] used a pedicled buccal fat pad flap to reconstruct oral defects caused by tumor removal in 32 patients (16 were localized to the palate, 6 in the buccal mucosa, 7 in the retromolar trigone, and 3 in the lateral pharyngeal wall). In all patients, the defects were adequately repaired.

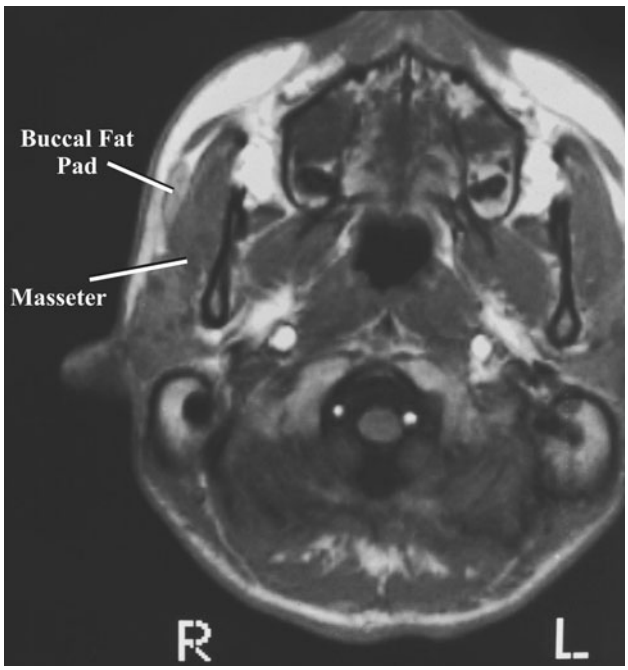


Fig. 4 Cross section of T2 MRI at the level of the oral cavity and the hard palate. The BFP is evident anteriorly to the masseter

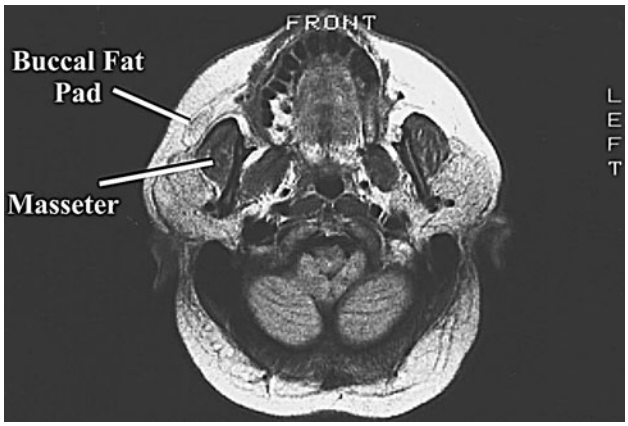


Fig. 5 Cross section of T1 MRI at the level of the oral cavity and the hard palate. The BFP is evident anteriorly to the masseter. Notice the volume of the BFP in relationship to the masseter

The buccal fat pad has also been successfully used as an unlined pedicled graft for maxillary defects, such as defects in the alveolar crest, maxilla, hard and soft palate, cleft, retromolar region of the mandible, and vestibular sulcus [3]. Furthermore, the buccal fat pad has been used on many occasions to repair palatal defects [14]. Surgery that involves the hard palate can often leave oroantral or oronasal defects resulting in considerable difficulty in speech and deglutition. The buccal fat pad, because of its close proximity to oral defects, can be used for reconstruction. In addition, the pedicled buccal fat pad graft can be used to support bone grafts in the reconstruction of the maxilla, which can restore the facial contour and function of the maxillary sinus in patients who have undergone partial maxillary resection [36]. It can also be used to effectively reconstruct small to medium-sized posterior maxillary alveolar defects [1].

Fan et al. [11] used the buccal fat pad as a pedicled graft in thirty patients with oral defects. Swelling ensued and fibrous tissue formed immediately after the reconstructive surgeries. However, the swelling significantly decreased within 2–3 weeks, as did the size of the defective areas [11]. Histological samples showed regenerated epithelia and mucosa, the mucosa developing an appearance similar to normal oral mucosa. Regeneration of tissue was observed in three areas: surrounding the normal mucosa, the buccal fat pad membrane, and epithelial tissue of the oral mucosa [11]. Thus, the buccal fat pad can be used to cover defects resulting from traumatic injury or malignant

tumors of the soft tissue of the oral cavity. Pedicled fat pad grafts are advantageous because they reduce the invasiveness and duration of the operation, and buccal fat pads that have served to reconstruct defects have been shown to lessen pain and operative trauma. In addition, the rich blood circulation to the soft tissue promotes the healing of nearby structures. The grafted fat pad also functions as a site for granulation (thus limiting scar contraction), and can physically close dead space of a defective area [27]. Furthermore, the buccal fat pad has strong anti-infection and reconstruction advantages with little necrosis or absorption [11].

Oroantral communication is of significance because it is often encountered by surgeons with patients that have defects resulting from congenital deformities such as cleft palate as well as operations removing tumors and cysts. In fact, the pedicled buccal fat pad was first used for the closure of oroantral and oronasal communications secondary to oncological resections by Egyedi [10]. To help restore mastication and articulation functions in these patients, local flaps such as a palatal or buccal sliding flaps are effective and not as invasive as other oral surgeries. For larger defects that may involve parts of the maxillary and palatine bones, the pedicled buccal fat pad graft is an effective, less invasive option with a better outcomes than other surgical techniques to heal similar oral defects [27]. The pedicled buccal fat pad has also been used to close chronic buccal fistula in the maxillary antrum [15].

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. Excising the contralateral buccal fat pad is often not needed because no asymmetry results from the elevation of the flap.
5. Failure and morbidity rates are very low, and
6. There is low patient morbidity [7].

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 [7].

Conclusions

The buccal fat pad has been studied extensively within the past four decades, and its use in repairing common and debilitating oral defects is the motive for continued research on this topic. Because of the location of the buccal fat pad, it is prone to undergo clinically significant pathologies such as lipoma, herniation, and pseudoherniation. The location, however, also allows for easy access to cover a myriad of oral defects and lesions including congenital palatal defects and numerous neoplastic lesions, among others. It is vital to understand the etiology of any oral defect, or of a lesion of the buccal fat pad, for a misdiagnosis can prevent effective treatment of the underlying problem. Furthermore, with increasing societal emphasis on the effects of aging, further research on these effects and other natural phenomena on the buccal fat pad are needed with hope that effective use of this multifarious adipose tissue can be maximized.

References

1. Amin MA, Bailey BM, Swinson B, Witherow H (2005) Use of the buccal fat pad in the reconstruction and prosthetic rehabilitation of oncological maxillary defects. Br J Oral Maxillofac Surg 43:148–154
2. Bagdade JD, Hirsch J (1966) Gestational and dietary influences on the lipid content of the infant buccal fat pad. Proc Soc Exp Biol Med 122:616–619
3. Baumann A, Ewers R (2000) Application of the buccal fat pad in oral reconstruction. J Oral Maxilofac Surg 58:389–392
4. Bichat F (1802) Anatomie Generale, Applique a la Physiologie et a la Medecine. Brosson Gabon and Cie, Paris
5. Brooke RI, MacGregor AJ (1969) Traumatic pseudolipoma of the buccal mucosa. Oral Surg Oral Med Oral Pathol 28:223–225
6. Browne WG (1970) Herniation of the buccal fat pad. Oral Surg Oral Med Oral Path 29:181–183
7. Dean A, Alamillos F, Garcia-Lopez A, Sanchez J, Penalba M (2001) The buccal fat pad flap in oral reconstruction. Head Neck 23:383–388
8. Dubin B, Jackson IT, Halim A, Triplett WW, Ferreira M (1989) Anatomy of the buccal fat pad and its clinical significance. Plast Reconstr Surg 83:257–262
9. DuBrul EL (1980) Sicher's oral anatomy, 7th edn. Mosby, St. Louis, p 213
10. Egyedi P (1977) Utilization of the buccal fat pad for closure of oro-antral/oro-nasal communications. J Maxillofac Surg 5:241–244
11. Fan L, Chen G, Zhao S, Hu J (2002) Clinical application and histological observation of pedicled buccal fat pad grafting. Chin Med J 115:1556–1559
12. Gallia L, Rood SR, Myers EN (1981) Management of buccal space masses. Otolayngol Head Neck Surg 89:221–225
13. Gaughran GR (1957) Fasciae of the masticator space. Anat Rec 129:383–400
14. Hai HK (1988) Repair of palatal defects with unlined buccal fat pad grafts. Oral Surg 65:523–525
15. Jackson IT (1999) Anatomy of the buccal fat pad and its clinical significance. Plas Reconstr Surg 103:2059–2060
16. Kahn JL, Wolfram-Gabel R, Bourjat P (2000) Anatomy and imaging of the deep fat of the face. Clin Anat 13:373–382
17. Kurabayashi T, Ida M, Tetsumura A, Ohbayashi N, Yasumoto M, Sasaki T (2002) MR imaging of benign and malignant lesions in the buccal space. Dentomaxillofac Radiol 31:344–349
18. Li WT, Xu DC, Zhong SZ (1993) Applied anatomy of the buccal fat pad transposition for the treatment of soft tissue defects in the maxillofacial region. Chin J Clin Anat 11:165–170

19. Loukas M, Kapos T, Louis RG Jr, Wartman C, Jones A, Hallner B (2006) Gross anatomical, CT and MRI analyses of the buccal fat pad with special emphasis on volumetric variations. Surg Radiol Anat 28:254–260
20. Marano PD, Smart EA, Kolodny SC (1970) Traumatic herniation of buccal fat pad into maxillary sinus: report of case. J Oral Surg 28:531–533
21. Matarasso A (1991) Buccal fat pad excision: aesthetic improvement of the midface. Ann Plast Surg 26:413–418
22. Matarasso A (1997) Pseudoherniation of the buccal fat pad: a new clinical syndrome. Plast Reconstr Surg 100:723–730
23. Matarasso A (2002) Pseudoherniation of the buccal fat pad: a new clinical syndrome: follow-up. Plast Reconstr Surg 112:1716–1718
24. Poissonet CM, Burdi AR, Bookstein FL (1983) Growth and development of human adipose tissue during early gestation. Early Hum Dev 8:1–11
25. Rácz L, Maros TN, Seres-Sturm L (1989) Structural characteristics and functional significance of the buccal fat pad (corpus adiposum buccae). Morphol Embryol 35:73–77
26. Rodgers GK, Myers EN (1988) Surgical management of the mass in the buccal space. Laryngoscope 98:749–753
27. Shibahara T, Watanabe Y, Yamaguchi S, Noma H, Yamane GY, Abe S, Ide Y (1996) Use of the buccal fat pad as a pedicle graft. Bull Tokyo Dent Coll 37:161–165
28. Stuzin JM, Baker TJ (1989) Discussion of Anatomy of the Buccal Fat Pad and Its clinical significance by Dubin B, Jackson IT, Halim A, Triplett WW, Ferreira M. Plast Reconstr Surg 82:263–264
29. Stuzin JM, Wagstrom L, Kawamoto HK, Baker TJ, Wolfe SA (1990) The anatomy and clinica applications of the buccal fat pad. Plast Reconstr Surg 85:29–37
30. Tart RP, Kotzur IM, Mancuso AA, Glantz MS, Mukherji SK (1995) CT and MRI imaging of the buccal space masses. Radiographics 15:531–550
31. Tideman H, Bosanquet A, Scott J (1986) Use of the buccal fat pad as a pedicled graft. J Oral Maxillofac Surg 44:435–440
32. Woldford D (1981) Traumatic herniation of the buccal fat pad: report of case. J Am Dent Assoc 103:593–594
33. Xie WY, Zhang KQ (1981) The anatomical study of the buccal fat pad. Chin J Stomat 16:199–205
34. Yousif NJ, Gosain A, Matloub HS, Sanger JR, Madiedo G, Larson DL (1994) The nasolabial fold: an anatomic and histologic reappraisal. Plast Reconstr Surg 93:60–69
35. Zhang H-M, Yan Y-P, Qi K-M, Wang J-Q, Liu Z-F (2002) Anatomical structure of the buccal fat pad and its clinical adaptations. Plast Reconstr Surg 109:2509–2518
36. Zhong LP, Chen GF, Fan LJ, Zhao SF (2004) Immediate reconstruction of maxilla with bone grafts supported by pedicled buccal fat pad graft. Oral Surg Oral Med Oral Pathol 97:147–154
37. Zipfel TE, Street DF, Gibson WS, Wood WE (1996) Traumatic herniation of the buccal fat pad: a report of two cases and a review of the literature. Int J Pediatr Otorhinolaryngol 38:175–179