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Prospects of buccal fat pad use for the treatment of alveolar bone ridge defects

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Abstract
In modern surgical dental practice, dentists often face the need to close soft tissue defects in the oral cavity. Recent research has been aimed at developing surgical methods that would ensure the sanitation of the inflammatory lesion, the revival of physiological processes at the site of the soft tissue defect, or create conditions for their recovery and ensure full function. The ease of access to the buccal fat pad arouses interest in its use for closing defects.
The study aimed to analyze and study the literature data on various methods of using buccal fat pads for autotransplantation in the treatment of maxillofacial defects in comparison with the use of other grafts.
Results: In recent years, methods of reconstructive plastic surgery using autografts have become widespread. There is evidence in the literature of positive results of surgical closure of tissue defects using autografting of adipose tissue and, in particular, the buccal fat pad. The buccal fat pad has its connective tissue capsule and a well-developed vascular network, which provides nutrition to the graft and rapid healing of the postoperative wound; it does not require preliminary preparation and adaptation to the recipient bed. This allows it to be used in maxillofacial surgery to close defects of the upper jaw, eliminate the oral-antral junction, reconstruction of intraoral defects, such as oroantral fistula, in the loss of mandibular bone mass in the areas of molars and premolars, to eliminate defects after treatment of oncological processes of the face.
Conclusions: The favorable anatomical location, good blood supply, and almost complete absence of innervation of the buccal fat pad alleviate the surgeon's task and give better results of operations. The study proves the process of wound epithelialization one week after surgery and a stable clinical flow without complications in the long-term follow-up, which proves the relevance of the use of the buccal fat pad in modern maxillofacial surgery to improve existing and develop new methods of autotransplantation.

Keywords: Buccal fat pad, maxillofacial defects, methods of reconstructive plastic surgery, osteoplastic materials, autografting, long-term follow-up

Introduction
In modern surgical dental practice, doctors often face the need to close defects in the soft tissues of the oral cavity, which can be both primary (occurring immediately after surgery) and in the form of formed defects that do not heal over a long period after surgery [1, 2]. At the same time, the size of the soft tissue defect can vary from insignificant (not requiring additional plastic surgery) to significant (1-1.5 cm or more).
This situation leads to destructive changes and the formation of significant defects in the soft tissues of the alveolar bones of the jaws, which can be of various shapes and depths and require radical surgical interventions with defect closure to restore normal tissue structure and function. To close such defects, materials of biological origin and synthetic production are used. These are, first of all, resorbable membranes and various osteoplastic materials used to fill bone defects, as well as homo- and autografts [3, 4, 5, 6].
When closing significant soft tissue defects in the alveolar bone of the jaws, the surgeon should adhere to the principle of maximum possible restoration of supporting tissues and complete healing of soft tissues. There are many methods of surgical treatment of soft tissue defects of the alveolar processes of the jaws, but the prevention and surgical treatment of these defects remains insufficiently studied [2, 5, 7].
The study aimed to analyze and study the literature data on various methods of using buccal fat pad for auto transplantation in the treatment of maxillofacial defects in comparison with the use of other grafts.

Deformation of the contours of the alveolar processes of the jaws as a result of soft tissue deficiency accompanies most traumatic injuries, is often found in infectious and inflammatory diseases, and is also the result of various postoperative changes. Research in recent years has been aimed at developing surgical methods that would ensure the rehabilitation of the inflammation area, the revival of physiological processes at the area of soft tissue defect, or create conditions for their restoration and to ensure full function. This is especially true for the closure of significant postoperative defects that cannot be restored using local tissue for plastic surgery [2, 8].

In recent years, methods of reconstructive plastic surgery using autografts have become widespread. Undoubtedly, the use of autografts reduces the risk of rejection, infection, and the development of allergic reactions [9, 10], which is observed when using materials of biological origin and synthetic production [11, 12, 13, 14]. Among the autografts, the most commonly used are grafts on the legs taken from the vestibule, palate, and lower surface of the tongue, as well as free mucous membranes (from the hard palate, cheek, and lower surface of the tongue) or skin (from the abdomen, thigh bone, posterior or subclavian areas in the form of thin flaps by Thiersch *et al*. or split flaps) [15].

There is evidence in the literature of positive results of surgical closure of tissue defects by autotransplantation of adipose tissue and, in particular, the buccal fat pad, in which interstices there are fibroblasts, tissue basophils, lymphocytes, thin collagen fibers, blood and lymphatic vessels and their capillaries [9; 16; 17; 18]. The buccal fat pad, in addition, has its connective tissue capsule and a well-developed vascular network that provides nutrition to the graft. The presence of these structures promotes the regeneration of fibrous tissue, stimulates the growth of mucosal epithelium, and rapid healing of the postoperative wound. Moreover, the buccal fat pad does not require preliminary preparation and adaptation to the recipient bed [9].

The buccal fat pad is an important formation that can be used in maxillofacial surgery to close defects of the upper jaw. Due to its accessibility and good blood supply, it can be used as graft on the leg to close soft tissue defects of the alveolar ridge of the upper jaw and hard palate. The favorable anatomical location, good blood supply, and almost complete absence of innervation relieves the surgeon's task and provides better results of operations [19].

In 1977, Egyedi P. [20] first described the method of closing the oroantral junctions with the buccal fat pad. Its advantages include high efficiency in restoring structure and function in cases where other methods were unsuccessful. Since then, the buccal fat pad has become a recognized option for the reconstruction of small and medium-sized soft tissue defects in the oral cavity. In 1983, Neder A. [21] reported the use of buccal fat pad as a free graft in two patients with oral defects, and in 1986, Tideman H. [22] described the surgical technique and results of reconstruction of oral defects with cheek fat. There is also data described in the literature (in the period 2004-2009) on the use of buccal fat pad for the reconstruction of congenital defects of the oral cavity [23]. The study by Toshihiro Y., Nariai Y., Takamura Y., and co-authors (2013) [24], which was conducted on 23 patients, is noteworthy, where the buccal fat pad was used to close defects of the mucous membrane of various parts of the oral cavity.

When using buccal fat pad for the treatment of peri-implantitis, researchers reported no-pain or low-pain intensity on third day after surgery. No complications were observed during the treatment, the survival and success rate of the implant was 97.6%, and the average marginal bone loss one year after treatment was 0.58±0.27 mm [25].

According to some literature data successful bone reconstruction of oral defects requires, first of all, such factors as physical protection of the graft from trauma, absence of rough postoperative scars, and good microcirculation.[26] The researchers managed to achieve all these conditions by using the buccal fat pad's membrane supporting the bone graft.

Kablan F. describes a number of studies where the adipose tissue is used in combination with bone substitutes for the regenerative treatment of peri-implantitis [27]. At the same time, the author emphasizes that the donor site of the buccal fat pad is easily accessible in the oral cavity, the graft harvesting is not accompanied by complications and especially determines its rapid epithelialization. Also, studies have shown that adipose tissue is able to transform a thin periodontal tissue biotype into a thick one, thereby improving the quality and volume of soft tissue in the recipient area. In addition, the author obtained excellent functional and aesthetic results without the recurrence of peri-implantitis.

Agarwal C. successfully used buccal fat pad in the treatment of III-IV class gums recession according to Miller P., the treatment of which using alternative approaches hardly ever lead to positive results [28]. At the same time, the author investigated the sufficient volume and structure of the graft tissue in the reconstruction area.

According to literature data, buccal fat pad was successfully used in a 57-year-old patient with a tumor of the minor salivary gland located on the hard palate [25]. The authors noted that the tumor removal was accompanied by the closure of the defect on the palate with a mucosal flap, which was rejected after 3 months. Repeated surgery, using buccal fat pad as a graft, led to positive clinical dynamics in the long-term follow-up.

A number of Brazilian scientists [29] provided treatment of root furcation defects in the complex treatment of inflammatory and destructive diseases of periodontal tissues using a combination of autogenous bone and buccal fat pad as a membrane. Clinically, 6-12 months after treatment, a keratinized gingival margin in place of defect was determined, and radiologically, complete bone restoration in the furcation area was objectified.

The buccal fat pad is successfully used to eliminate the oroantral junction that can occur after molar extraction and implant placement. After 15 months of follow-up, patients had no pain, nasal obstruction, or nasal secretions [30].

Dean A. *et al*. [31] successfully used buccal fat pad in the reconstruction of intraoral defects, such as oroantral fistula, in cases of mandibular bone volume loss in the areas of molars and premolars, to eliminate defects in cases of facial oncological pathologies. At the same time, the researchers determined the process of wound epithelialization 1 week after surgery and a stable clinical course without complications in the long-term follow-up.

Transplantation of buccal fat pad on a titanium membrane led to positive clinical outcomes in the treatment of orbital trauma, which can be accompanied by secondary endophthalmitis [32]. It should be noted that this treatment tactic led to faster osteointegration according to computer tomography. When using this technique, the bone

microarchitecture is maintained with an appropriate network of blood cells and its own cellular content, as well as the nature of the transplanted matrix and its local activators in the form of growth factors released from platelet-rich plasma, causing the formation of new bone tissue, as a result, mechanisms that include direct osteogenesis, osteoinduction, and osteoconduction.

When studying the macro- and microstructure of buccal fat pad, one cannot ignore the anthropometric shapes of the head and face, which significantly affect the width, length, and volume of this formation.

The size of the head and face is influenced not only by the structure of the facial skeleton but also by the expressivity of soft tissues: muscles, fascia, connective tissue, subcutaneous fat layer, and skin. The identity of the face depends on the degree of its development, the state of health, racial and constitutional characteristics, age, and sex [33].

The anthropometric study of the head consists of studying the size, shape, and dimensions of the face and its individual parts, as well as the relationship between the size and shape of the facial skull and dental and alveolar ridges. When studying the head, three oriented dimensions are used according to Simon (1923): mid-sagittal, ear-orbital, and frontal. These dimensions are located perpendicular to each other [34].

In the brain skull, there are frontal, temporal, parietal, and occipital areas, as well as the base of the skull. Opinions about the boundaries of the face are different. Some authors define its boundaries from the scalp to the most prominent point of the chin; others define it from the tangent line drawn to the upper edge of the eyebrows to the most posteriorly located point of the nose bridge. In order to study the patient's face and take various measurements, it is necessary to know the location of anthropological points on the skull (craniometric points) and the face (cephalometric points).

To determine the proportions of the head areas, indices are proposed, the value of which distinguishes between head and face types. The shape of the head is determined according to the formula:

(wide part of the head)/(long part of the head) x 100%.

Indicators up to 75.9 indicate a dolichocephalic head shape, 81.0 to 85.1 – mesocephalic head shape, 85.5 and more – brachiocephalic head shape (Williamsta *et al*., 1995 and Panero, 1979).

The shape of the face according to Garson (1980) is determined according to the ratio: (morphological facial height)/(facial width in the area of the zygomatic arches) x 100%.

In this case, 78.9 is a very wide face (hypereuriprosis); 79.0-83.9 is a wide face (euriprosis); 84.0-87.9 is a medium face (mesoprosis); 88.0-92.9 is a narrow face (leptoprosis); 93.0 and more is a very narrow face (hyperhidrosis) [33; 34].

Conclusions

The analysis of the literature proves the relevance of further study of the anatomical features, variant anatomy, and spatial and temporal transformations of the topography of the buccal fat pad. The needs of modern maxillofacial surgery require a morphological basis for improving existing and developing new methods of auto transplantation.

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