The Problem of Maintaining the Volume of Bone Tissue After Tooth Extraction and Ways to Solve it

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ABSTRACT

Dental implantation of teeth is a modern technology that helps patients return to a full life after the psychological and physical discomfort of losing teeth. These days, dental implantation is a revolutionary method of restoring damaged or completely missing (after extraction or loss) teeth. It has been successfully used by dental clinics around the world for more than two decades. Dental implantation has replaced the more outdated method of prosthetics, when adjacent teeth were killed, between them the doctor installed bridges, and then crowns. Using implantation as a way to restore teeth and their function, the remaining neighboring teeth are not damaged at all (Vinichenko O.Yu., 2016; Zhdanov E.V., 2016).

Direct implant placement immediately after tooth extraction is a fairly common and effective procedure. Although the percentage of implantation success both when using the algorithms of one-stage and delayed installation is almost identical, however, according to the literature, when carrying out the loading procedure immediately after extraction, it is possible to preserve the hard and soft tissues of the buccal wall of the alveolar socket and prevent their progressive loss by at least 1 mm, especially in cases of a thin biotype of the vestibular cortical wall (Vishnyakov V.V. 2010; Kulakov A.A. 2010; Koshel V.I. 2014; Sirak S.V. 2014).

Keywords: Dental implantation, biotype, buccal wall, alveolar socket..

After tooth extraction, there is an inevitable cascade of bone resorption and socket size reduction. This decrease seems to have a greater effect on the height of the vertical ridge on the buccal side compring to the lingual side. (Araujo and Lindhe, 2005), causing aesthetic compromise, especially when restoring teeth in the anterior aesthetic zone.

Introduction. Immediate implant placement, which in the past was described as a method of preserving the alveolar ridge, gives excellent survival results, but apparently does not affect this biological reaction of bone resorption. (Botticelli et al., 2004; Araujo and Lindhe, 2005). Regenerative materials and atraumatic removal of tooth with short term prognosis were also combined with immediate implant placement, as well as a traditional implantation protocol that showed results, but could not avoid changing the size of the socket to such an extent as to give a predictable, satisfactory aesthetic result. (Araujo et al., 2015; Fickle et al., 2009)

Herzeler et al. ((2010), noting the excellent results of preserving the alveolar ridge using the coronal separation of an ankylosed tooth, first seen by Malgrem et al. (1984) and osseointegration of implants in contact with ankylosed fragments of teeth (Davarpanakh and Schmukler-Montclair, 2009), as well as in other animal studies and clinical trials, the root shield technique was developed. The root shield is a method in which the buccal part of the root of a tooth with

short term prognosis intended for extraction is preserved intact in the tooth socket together with the buccal part of the alveolar bone in order to avoid pronounced size changes after removal, which usually occur and acquire a more aesthetic result. This technique is always combined with the installation of the implant in the lingual side of the wall.

This is a very new method, the first animal trial that took place only in 2010, although the documented results that have been noted have aroused great interest in this method, which has led to numerous clinical trials in recent years. In this study, they examine the results, benefits and limitations of this technique after histological and volumetric studies, as well as clinical and animal trials found on the internet.

Tooth extraction is one of the most frequent operations in the practice of surgical dentistry. The resulting defects of the dentition are restored with the help of orthopedic treatment. After tooth extraction, atrophy of the alveolar bone occurs, which is associated with the destruction of the alveolar walls of the well. To minimize bone destruction and reduce trauma to surrounding soft tissues, atraumatic tooth extraction is used in modern surgical dentistry, [1,2,3,18].

Even after the usual tooth extraction, physiological atrophy of the alveolar bone may occur. The bone atrophy that occurs after tooth extraction after 1 year, on average, is about 1 mm horizontally and 2 mm vertically. The maximum loss of more than 1 mm horizontally occurs in the initial months after removal and accounts for 55% of the total horizontal resorption [4,5,19,20].

When studying the process of bone formation in the socket of the removed tooth, after the formation of a blood clot, and then granulation tissue, on the 14th – 18th day, in parallel with the formation of young connective tissue, atrophy of the alveolar bone with Sharpey fibers occurs. This is primarily due to a violation and nutrition from the periodontal ligament of the tooth, which is reduced after tooth extraction. The vestibular bone plate of the frontal part of the teeth mainly consists only of the alveoli with Sharpei fibers, so bone resorption is always more pronounced on the vestibular side.

In the case of complete peeling of the flap to remove the root of the tooth, physiological atrophy of the bone plate occurs in the first 50 days and is about 0.4 mm. Depending on the general status, localization of the causal tooth, gum biotype, regeneration potential and age of the patient, these values may be different [6,7,21].

Material and methods. Using the example of the clinical case L. Mahesh et al. (2012), it was shown that bone atrophy begins after tooth extraction, while a decrease of the alveolar bone parameters is observed both in height and width. Bone resorption leads to morphological changes that create unfavorable conditions for dental implantation. In this case, additional surgical manipulations are required to restore the volume of bone tissue when installing dental implants [8,22].

However, there are factors affecting the processes of bone resorption. These factors include the periodontal status of adjacent teeth, bone quality (osteoblast content), and the thickness of the outer cortical plate.

Bone density may change with age, the number of osteoblasts in the bone decreases, and therefore the layer of the outer cortical plate becomes thinner, the density of trabeculalar bone decreases [2, 9, 10].

In addition to local factors, concomitant systemic diseases also affect bone quality. The endocrine system has a great influence on changes in bone composition. Women are more susceptible to endocrine disorders and osteoporosis. Also, bad habits of the patient lead to bone atrophy, such as, for example, malicious smoking, incorrect orthopedic and orthodontic treatment. Factors affecting bone loss can also include bruxism. [11,12,23].

Due to the above factors, one of the important issues in surgical dentistry is the

preservation of the parameters of the well after tooth extraction, since significant bone atrophy of the upper and lower jaws creates difficulties during dental implantation followed by orthopedic treatment. To install dental implants in patients, the height and width of the alveolar ridge of sufficient volume are required [13,14,15].

In modern dentistry, many methods and protocols have been described for preserving the volume of the alveolar process after tooth extraction, as well as accelerating the formation of bone in the wells after removal.

From the recently proposed concepts [IDR], to reduce bone resorption after tooth extraction, the implant is installed in the well immediately after its removal, while using a complex of tissues, the donor zone of which is often the upper jaw mound. Immediate implant placement is possible in the absence of a focus of infection, with sufficient volume of the alveolar ridge and primary stability of the implant. Unfortunately, conditions do not always allow the implant to be installed simultaneously with tooth extraction. in addition, simultaneous implant placement has a high risk of implant disintegration during the rehabilitation period [16].

In their studies on dogs, Araujo et al. (2006) refuted the assumption that immediate implantation allows to preserve the volume of bone structures of the alveolar ridge. It turned out that the immediate installation of a titanium screw implant does not prevent resorption of the vestibular compact bone [17].

Botticelli et al. (2004) obtained similar clinical results, which show that after the immediate installation of implants and with immediate prosthetics, a recession of soft tissues is also likely. The degree of recession varied significantly in various studies, which indicates the difficulty of predicting the reaction of soft tissues after immediate implantation. On average, the recession rate was up to 1.5 mm from the compression of the abutment, which leads to the exposure of the implant neck [4].

However, the immediate installation of implants in itself refers to manipulations aimed at preserving the volume of the alveolar ridge. Moreover, immediate implant placement in combination with directed bone regeneration should be considered critically due to the high risk of complications [7,10,11].

The standard method of dental implantation is surgery, which is performed approximately 4 months after removal. This method eliminates all of the above risks and complications, but delayed implantation for three months or more can lead to significant bone atrophy. To prevent this, preventive procedures are used [3,15,16].

The topic of restoring the volume of the alveolar ridge is constantly evolving. One of the modern techniques is directed tissue regeneration (DTR) using bioresorbable membranes. Bioresorbable membranes perform a barrier function, when covering bone defects with them, the membranes prevent fibrous germination of the bone regeneration site.

Conclusion: Thus, based on the information given above, it follows that in order to fully study this technique, it is necessary to conduct an additional sample research in order to study the morphological parameters of the newly formed bone, determine bone density, installed implants stability and evaluate the long-term results when using this method in clinical practice

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