Journal of research in health science
Volume 7-8 issue. 4 2020, pp. 107-115
ISSN 2523-1251 (Online) ISSN 2523-1243 (Print)
JOURNAL DOI 10.37057/2523-1251
www.journalofresearch.org
info@journalofresearch.org

SJIF 2020: 6.224
IFS 2020 4.085

Experimental study of the effectiveness of osteoplastic material on reparative osteogenesis of the bone tissue of the lower jaw

Kholigov Azizbek Alimurodovich[1], Yuldashev Abduazim Abduvalievich[2], Fattayeva Dilorom Rustamovna[2], Alimzhanov Kamronbek Zhasurjanovich[2], Khudoykulov Akbarali Saidovich[3]

1-Samargand State Medical Institute, Republic of Uzbekistan
2-Toshkent State Dentistry Institute, Republic of Uzbekistan
3-№ 7- clinical hospital of the city of Tashkent Republic of Uzbekistan

azizbekkholiqov1985@gmail.com

Abstract. The development of technologies for the control of reparative regeneration of bone tissue and the replacement of bone defects is one of the urgent tasks of surgical dentistry. The close attention of researchers to this problem is due to the wide spread of inflammatory and oncological diseases of the bones, the high incidence of postoperative complications. To restore the volume of lost bone tissue, biomaterials and their synthetic analogues are successfully used. Despite the wide selection of modern materials for bone grafting, many of them have a number of significant drawbacks, which negatively affects the timing of formation and quality of the regenerate and, accordingly, limits their widespread use in medical practice. One of the promising areas of cellular technologies in the field of reparative regeneration of bone tissue is the development and application of tissue-engineered structures based on porous materials, which are a matrix for cell delivery, or a structure for its active colonization with recipient cells. It is quite obvious that the use of composite bone grafting materials should be clearly argued depending on the nature, type and location of the injury. In this regard, the currently accumulated rather

Journal of research in health science
Volume 7-8 issue. 4 2020, pp. 107-115
ISSN 2523-1251 (Online) ISSN 2523-1243 (Print)
JOURNAL DOI 10.37057/2523-1251
www.journalofresearch.org
info@journalofresearch.org

SJIF 2020: 6.224
IFS 2020 4.085

extensive material needs further experimental and clinical confirmation of the effectiveness of the structures and the development of clear indications for their use.

Keywords: bone grafts, bone defect, reticulo-fibrous and lamellar bone tissue, reparative regeneration, osteoblasts, osteocytes

---

Introduction. Restoration of defects in the bone tissue of the lower jaw is one of the most pressing problems of modern dentistry and orthopedics. The reasons for bone loss are varied: tooth extraction, inflammation, trauma, tumors, osteoporosis. In some cases, in dental practice, the process of orthopedic rehabilitation is associated with the need to heal bone defects in the lower jaw. In this regard, the search for the optimal material for plastic replacement of defects in the lower jaw is relevant [3,4].

It is quite obvious that the use of composite bone grafting materials should be clearly argued depending on the nature, type and location of the injury. In this regard, the currently accumulated rather extensive material needs further experimental and clinical confirmation of the effectiveness of the structures and the development of clear indications for their use. One of the requirements for plastic material in orthopedic and any other pathology is tissue specificity, absence of toxicity, high regenerative potential and the formation of organ-specific tissue in the transplantation area [1,5].

The choice of a plastic material for replacing a bone defect is associated with the peculiarities of the histogenesis of the lower jaw. It is known that in the process of embryonic development and during regeneration, bone tissue is formed on the basis of coarse fibrous bone tissue [6].

Objective: To study the morphological features of the reparative regeneration of the bone tissue of the lower jaw after the formation of a bone defect before and

Journal of research in health science
Volume 7-8 issue. 4 2020, pp. 107-115
ISSN 2523-1251 (Online) ISSN 2523-1243 (Print)
JOURNAL DOI 10.37057/2523-1251
www.journalofresearch.org
info@journalofresearch.org

SJIF 2020: 6.224
IFS 2020 4.085

after the use of the "Osteon ™ IICollagen" composite bone graft material in experiment.

Materials and methods of research the study was carried out on animals in compliance with the provisions of the European Convention for the Protection of Animals used in Scientific Research [2]. Animals were removed from the experiment on days 8, 15, 24, 32 and 65 after the defect was created.

Osteon II (biphasic calcium phosphate filled with 30% hydroxyapatite + 70% β-Tricalcium phosphate) + natural (bovine) type I collagen are the main structural components of the "Osteon^{TM}IICollagen" composite bone graft material. Cylinder dimensions: 6 x 5 mm or 6 x 10 mm.

Different Ca / P ratios for hydroxyapatite make it possible to vary the isomorphic substitution of calcium for water and for a hydrogen ion - both on the surface and inside the crystals, which in a wound is one of the most important characteristics of the material that determines the ability to retain a blood clot [6].

At the same time, osteotropy in hydroxyapatite is expressed by the ability to activate the differentiation of osteogenic cells, and the osteointegrative effect is manifested in the formation of a strong chemical bond with the bone and subsequent resorption with complete bone replacement [11].

Due to these features, the bone graft has the potential for the formation of diffinitive bone tissue.

Composite bone grafting material "Osteon^{TM}IICollagen" has the following features, which was taken into account when choosing this material: Collagen coating facilitates the capture of the material, reducing the overall operation time; after getting wet it becomes plastic, which makes it easy to distribute over the defect area; after placing the fragment in the area, the collagen membrane dissolves.

Journal of research in health science
Volume 7-8 issue. 4 2020, pp. 107-115
ISSN 2523-1251 (Online) ISSN 2523-1243 (Print)
JOURNAL DOI 10.37057/2523-1251
www.journalofresearch.org
info@journalofresearch.org

SJIF 2020: 6.224
IFS 2020 4.085

Experimental verification of the regenerative potencies of the "Osteon^{TM}IICollagen" bone graft was carried out on 30 Chinchilla rabbits, 1 year old. Under general anesthesia, a 10 mm incision was made using a scalpel in the projection of the mandibular angle. The chewing muscle was detached with a raspor and the bone was exposed. With the help of a hard-alloy spherical bur, bone defects of 10x5 mm were formed from the vestibular surface of the branch of the lower jaw at a distance of 3 mm above the angle of the lower jaw. The wound was closed with «CoatedVicryl» material.

All animals were divided into 2 groups: control (n = 15) and experimental (n = 15). In two groups according to the timing of the experiment: the 1st was studied after 8 days, the 2nd on the 15th, the 3rd on the 24th, the 4th on the 32nd and the 5th on the 64th day of the experiment. A defect was formed in animals of the control group, and the defect was closed with fascia and masseter muscle, without filling the defect. The experimental group of animals, the defect was filled with an osteograft with a diameter of 6x5 mm. After getting wet, the bone graft became plastic, tightly adhered and easily distributed over the defect area; after placing the fragment in the defect area, the collagen membrane dissolved. The defect replaced by the bone graft was closed with the fascia and the masseter muscle.
The presence of a residual defect and the severity of soft and bone hypertrophy in the area of transplantation were visually assessed. The transplantation area was examined radiographically. The preparations of the lower jaw were fixed in 10% neutral formalin for 24 hours. After washing under running water, the bone material was carried out in alcohols of increasing concentration. Decalcification was performed using trichloroacetic acid, after which the pieces were washed with 90% alcohol. To prepare histological preparations, decalcified bone material was embedded in paraffin. Hematoxylin-eosin and orsein were used to stain sections of decalcified

Journal of research in health science
Volume 7-8 issue. 4 2020, pp. 107-115
ISSN 2523-1251 (Online) ISSN 2523-1243 (Print)
JOURNAL DOI 10.37057/2523-1251
www.journalofresearch.org
info@journalofresearch.org

SJIF 2020: 6.224
IFS 2020 4.085

bone tissue. The process of reparative osteogenesis was assessed under the OPTIKA microscope (Germany).

Research results. Morphological features of reparative regeneration of the bone tissue of the lower jaw with an artificially formed defect in the dynamics of the experiment after the use of the composite bone grafting material "Osteon^{TM}IICollagen".

Morphological study of reparative regeneration of bone tissue with an artificially created defect in the bone tissue of the lower jaw in the dynamics of the experiment in animals of the control group on the 8th day of the experiment showed that the zone of the former defect is filled with a blood clot, around which the osteogenic tissue is determined in which the primary bone structures are formed.

In the animals of the experimental group, for this period of research in the area of the defect, an osteograft in the form of a loose mass is found, due to the perforation of blood vessels from the surrounding bone tissue into it. On the 15th day of the experiment, in the control group of animals, in place of a blood clot, a delicate loose connective tissue appears in the form of a network, collagen fibers are located between fibroblasts and single vessels. The process of bone formation is absent. In the animals of the experimental group, for this period of research, primary bone tracts are traced around the blood vessels, surrounded by osteoblasts in the form of chains. The transplantation area is surrounded by bone tissue, the interbeam space is occupied by osteoblasts and vascular cavities lined with endothelium. On the 24th day of the experiment, an ossification zone in the form of tender young bone beams was found in the control group. Interbeam spaces have blood vessels around which osteoblasts are located. In the experimental group of animals during this period of the experiment, the intensive process of osteogenesis continues. The bone beams are

Journal of research in health science
Volume 7-8 issue. 4 2020, pp. 107-115
ISSN 2523-1251 (Online) ISSN 2523-1243 (Print)
JOURNAL DOI 10.37057/2523-1251
www.journalofresearch.org
info@journalofresearch.org

SJIF 2020: 6.224
IFS 2020 4.085

more massive and are also found around the blood vessels. The proportion of bone material decreases.

On the 32nd day of the experiment, the picture of osteogenesis in the experimental group of animals is most pronounced in comparison with the control group. Osteoplastic material is gradually replaced by bone tissue. The area of the defect is filled with relatively mature bone tissue, in some places the formation of a compact bone in the form of delicate bone plates is found. This picture was not observed in the control group. After 2 months of the experiment, in the control animals in the area of the defect, an alternation of the bar and lamellar structure of the bone tissue was observed. In some places, the bone tissue looks like delicate bone beams, in some places it looks like formed bone beams, and in some places it looks like delicate bone plates.

This apparently indicates the continuation of the process of transformation of coarse-fibrous bone tissue into lamellar. In the experimental group of animals for this period of the experiment in the field of defect replacement with an osteograft, a single bone mass was formed in the form of lamellar bone tissue, which is typical for the lower jaw. The transplantation area has merged with the maternal bone tissue, the boundaries of the former defect are not established.

Conclusion.

After the use of the "Osteon^{TM}IICollagen composite bone graft material to replace an artificially created defect in the bone tissue of the lower jaw, rapid bone tissue regeneration is observed based on the chemical composition and natural (bovine) type I collagen. Collagen coating facilitating the capture of bone material, reducing the overall operation time. The bone graft showed good indicators of the attachment of osteoblasts to the surface of the bone trabeculae by activating them, which accelerates the formation of the structural components of the lamellar bone. An

Journal of research in health science
Volume 7-8 issue. 4 2020, pp. 107-115
ISSN 2523-1251 (Online) ISSN 2523-1243 (Print)
JOURNAL DOI 10.37057/2523-1251
www.journalofresearch.org
info@journalofresearch.org

SJIF 2020: 6.224
IFS 2020 4.085

increase in the activity of osteoblasts is determined by an increased secretion of carbohydrate, protein and mineral components of the bone, vascular growth factors that initiate the mechanism of revascularization [4]. The process of osteogenesis is carried out in a direct way based on the formed in vitro osteogenic tissue. Such properties of the graft allow for complete replacement of the defect in a short time. The unique properties of the studied OsteonTMIICollagen transplant material also [5,6] allow xenotransplantation and thereby avoid additional manipulations associated with graft collection from patients.

Journal of research in health science
Volume 7-8 issue. 4 2020, pp. 107-115
ISSN 2523-1251 (Online) ISSN 2523-1243 (Print)
JOURNAL DOI 10.37057/2523-1251
www.journalofresearch.org
info@journalofresearch.org

SJIF 2020: 6.224
IFS 2020 4.085

References

1. Ardary WC. / Plate and screw fixation in the management of mandible fractures. // Clin Plast Surg. -1989. -16: - P. 61-67.

2. Black B.S., Gher M.E., Sandifer J.B., Gucini S.E., Richardson AC.// Comparative study of collagen and ePTFE membranes in the treatment of human class II furcation defects // J Periodontology.- 1994.- Vol.65. - P.598-604.

3. Biomechanical optimization of bone plates used in rigid fixation of mandibular symphysis fractures / S. Lovald [et al.] // J. Oral Maxillofac. Surg. – 2010.– Vol. 68, N 8. – P. 1833-184.

4. Baker S, Betts NJ. Mandibular angle fractures. In: Abubaker AO, Strauss RA, eds.// Oral and Maxillofacial Surgery Update - Trauma. Rosemont, IL: //American Association of Oral and Maxillofacial Surgeons. -1998. -2. - p. 11-27.

5. Crltchlow M.A. The effect of exogenous transforming growth factor-beta 2 on healing fractures in the rabbit / M.A. Crltchlow, Y.S. Bland, D.E. Ashhurst //Bone. — 1995. — Vol. 16. — P.521-527.

6. A. I. Bychkov Significance of the severity of the surface microrelief of the osteoplastic material for optimal adhesion of osteogenic stromal progenitor cells / A.I. Bychkov, A.S. Ivanov // DentalForum. - 2012. - No. 1. - S. 13-16.

7. Volozhin A.I., Agapov B.C. et al. Osteoplastic efficacy of various forms of hydroxyapatite according to experimental morphological research // Dentistry. 2000. Vol. 79, No. 3. C.4.

8. Kirilova I.A. Study of osteoinductive properties of new osteoplastic materials / I.A. Kirilov, V.T. Podorozhnaya // Traumatology and Orthopedics. - 2008. - No. 1. - S. 71-73.

9. Korotkikh N.G. Aspects of maxillofacial surgery and plastic surgery / N.G. Short // Friendship. Frendschaft. - Voronezh, 2006 .-- S. 73-83.

Journal of research in health science
Volume 7-8 issue. 4 2020, pp. 107-115
ISSN 2523-1251 (Online) ISSN 2523-1243 (Print)
JOURNAL DOI 10.37057/2523-1251
www.journalofresearch.org
info@journalofresearch.org

SJIF 2020: 6.224
IFS 2020 4.085

10. Kurdyumov S.G., Istranov L.P., Orlovsky V.P., Volozhin A.I. Osteoplastic and wound healing materials and new generation preparations based on hydroxyapatite. Materials of the IX scientific-practical conference of otorhinolaryngologists in Moscow // Problems of implantology in otorhinolaryngology // March 24, 2000 M .: "Pressso", 2000, pp. 16-18.

11. Fedurchenko A.V. Clinical and experimental substantiation of the choice of osteoplastic material for replacing bone defects in the jaws: author. dis. ... Cand. medical sciences / A.V. Fedurchenko. - Stavropol, 2009 .-- 22 p.