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OSTEOGENESIS CHARACTERISTICS IN THE BONE LOSS ZONE AFTER THE IMPACTED MANDIBULAR THIRD MOLAR ABNORMAL EXTRACTION

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Abstract

Introduction. Due to the anatomic topographic characteristics of Mandibular Third Molars' (MTM) location, the surgical interference in the process of their extraction is often quite complicated, long-lasting as well as traumatic

Purpose. Optimization of reparative osteogenesis in the area of bone defects which formed after the third molars extraction in the mandible.

Material and methods. 92 patients had their impacted MTM abnormally extracted. 58 people were enrolled into the follow-up study. The inclusion criteria were female and male patients at the ages from 19 to 38; female and male patients without physical pathonomia; patients with the major bone losses, caused by the 38th and 48th teeth's abnormal extraction; major bone loss or inter alveolar septum integration loss in the adjacent tooth area after the impacted tooth extraction; a written consent to participate in the study.

Results. Clinical state comparative study, conducted in the post-surgery period, pointed that the amount and duration of inflammatory complications in group III, which

appeared after the impacted MTM extraction, were significantly less than in groups I and II (p<0,05).

Conclusions. The technic with the use of a-PRF, i-PRF provides inflammatory complications decrease at the post-surgery period, influences on the bone regeneration time as well as on the graft quality, but it does not prevent its dimension loss in the long term period, which leads to the receded gums and the distal root baring of the 7th tooth.

Key words: mandibular third molars'; bone regeneration; reparative osteogenesis; bone recombinant morphogenetic protein rhBMP-2

Introduction

Due to the anatomic topographic characteristics of Mandibular Third Molars' (MTM) location, the surgical interference in the process of their extraction is often quite complicated, long-lasting as well as traumatic. It is followed by major bone loss in the interference zone and infectious inflammatory genesis post-surgery complications' progression [1, 4, 10]. There is variety of impacted MTM extraction technics that focused on the attenuated treatment towards the surrounding tissues accompanied with as fast and as full as possible bone regeneration in the defect zone and the second molar's roots area. Unfortunately, the latter is not usually given enough attention to in the practice. A great volume of the surgical trauma in impacted, embedded MTM extraction, pre-chronic inflammation, appreciable surgical trauma, blood clot disability become one more obstacle for the osteal wound primary healing which leads to the crestal bone height reduction, adjacent tooth distal root baring as well as its hypersensitization or even different forms of the extensive caries [8, 9].

On the basis of the foregoing, osteoanagenesis problem for the MTM extraction bone defects complete healing is currently important and warrants further investigation.

The search of the ways to optimize the bone tissues reparative process demands special attention among all the problems, given above. The usage of different fractions combinations of blood autoplasma PRF, i-PRF, a-PRF, enriched with the growth factors, stimulating vascular endothelium and bone tissue elaboration by the way of an effect on the proliferation, osteoblast, osteoclast, chondroblast and chondrocyte differentiation, can be beneficial to meet this objective. Injectable blood concentrate i-PRF enhances osteal metabolism and angiogenesis; moreover its injection administration has anti-inflammatory, osseo-inductive and local immunomodulatory effects [2, 6].

One of the most promising directions to solve the given problem is an implementation of the bone biocomposite, which includes the main tissue components and active protein substances (growth factors) (10, 11) as well as bone morphogenetic proteins (BMP) into the medical practice. BMP case boosted differentiation of mesenchymal stem cells into the chondroblasts and osteoblasts, enhance collagen fusion, suscitate alkaline phosphatase, increase osteocalcin fusion, stimulate extracellular matrix fusion and its further mineralization. Different growth factors local administration influences on the proliferation and differentiation of osteogenetic cells' precursors in their cultures with the osteogenesis [3].

Thus, growth factors as well as bone morphogenetic proteins are able to stimulate bone collagen protein fusion by osteoblasts and enrich the amount of latters with the help of the impact on their precursors' differentiation. Currently in our country the clinical research studies in osteotropic management strength are not widely used in the dentistry. So far its operation theory to optimize osteogenesis process in MTM extraction zone is not expressly studied and elaborated.

Purpose

Optimization of reparative osteogenesis in the area of bone defects wich formed after MTM extraction.

Material and methods

92 patients had their impacted MTM abnormally extracted. 58 people were enrolled into the follow-up study. The inclusion criteria were female and male patients at the ages from 19 to 38; female and male patients without physical pathonomia; patients with the major bone losses, caused by the 38th and 48th teeth's abnormal extraction; major bone loss or inter alveolar septum integration loss in the adjacent tooth area after the impacted tooth extraction; a written consent to participate in the study.

Clinical division included management of 58 patients aged from 19 to 38 years, 30 of them (51.7%) were women and 28 (48.3%) were men, who had their MTM abnormally extracted.

Before the surgical interference all the patients had their oral cavities antiseptisized with chlorhexidine bigluconate 0.02% fluid with 1 minute exposition.

At the post-surgery period these patients were divided into three groups according to the same age, sex and reciprocal bone losses (p>0,05). 18 patients (31,0%), who had their bone losses filled with their own blood clots and sutured after the impacted MTM extraction, were enrolled into the group I. 20 patients (34.5%), who had their bone losses filled with their own blood clots, followed by a-PRF automembrane administration and wound suturing with the interrupted stitches after the tooth extraction, were enrolled into the group II. Afterwards, the injectable concentrate i-PRF was administrated into the transitory fold. The group III consisted of 20 patients (34.5%) whose bone loss was filled with the calcium-phosphate biomaterial, based on the demineralized bone matrix (BCP), which was enriched with the recombinant morphogenetic protein rhBMP-2 at a ratio of weight parts 3 to 1. Immediately after the tooth extraction the HELBO anti-microbial treatment of the post-surgery area was administrated [7]. As a precaution of the nearest infectious inflammatory complications all the patients were secondly administrated with the HELBO anti-microbial treatment on the 2nd, 3rd and 4th days after the operation. The administration was made according to the next technic: photo synthetase was administrated into the retromolar area from glossal and facial surfaces via the pointless canula and influenced by laser with the help of sterile discardable light pipes. Photosensitiser operating time and laser exposition were identified with Helbo system chronometer. The coloring materials were being painted for 3 minutes, afterwards the rest of photosensitiser was deterged with the sodium chloride isotonic fluid to activate laser free.

The accredited clinical study methods of the examination of the patients with the given dental abnormality were used in the work. All the patients had the radiological study done with the help of Planmeca ProOne orthopantomograph ("Planmeca", Finland) before and after surgery as well as further terms (in 1,3,6, 12 months). Ct evidence-based analysis was made by the use of Planmeca Romexis Viewer 4.4.1.R program pack ("Planmeca", Finland). Laboratory study included the osteal biotransformation history investigation. Osteocalcin osteal biotransformation markers and β -Cross Laps in the blood serum and saliva were identified by the enzyme immunoassay (EIA) with the use of «N-MID-osteocalcin» and «CrossLapsTM ELISA» test kits, produced by «Nordic Bioscience Diagnostics A/S» firm.

Statistical analysis of the results was conducted with the use of license application program package STATISTICA (6.1, state registration number AGAR909E415822FA). The obtained data is performed as arithmetic mean, standard deviation of errors. Student's T-test was calculated to evaluate the accuracy between the groups. The findings considered accurate at p<0,05 [5].

The work was carried out following all the regulations of the medical ethics committee, drawn up taking in account the provisions of European Council convention "for the Protection of Human Rights and Dignity of the Human Being with regard to the Application of Biology and Medicine" (1997 y) and World Medical Relief Declaration of Helsinki (2008 y).

Results

Clinical state comparative study, conducted in the post-surgery period, pointed that the amount and duration of inflammatory complications in group III, which appeared after the impacted MTM extraction, were significantly less than in groups I and II (p<0,05). Thus, on the 3^{rd} day the patients, who had their bone loss replaced with the blood clot, had such clinical signs as inflammatory contracture of masseter muscles, collateral facial soft tissues edema, regional lymph nodes reaction, temperature rise more than 37,0°C. The given signs were recorded 30-40% more often than in the groups, where the inventive reparative technic was used (groups II and III) (tab. 1). Besides, on the 3^{rd} day 2 patients of the group I were diagnosed with peracute septic alveolar periostitis. Soft tissues edema in groups II and III was almost the same. However, wound edges hyperemia among the patients of the group III was more evident, maybe due to the reaction on the osteal soft material.

	Detection rate, wbc (%)				
Clinical signs of the post- complications	Group I (n=18)	Group II (n=20)	Group III (n=20)		
	aching	10 (70,0)	8 (54,2)	4(45,8)	
Constant unprompted pain	terebration	9 (30,0)	4 (45,8)	-	
	throbbing	4 (17,1)	2(8,3)*	-	
Odynophagia		6 (20,0)	10 (41,7)*	2(8,3)	
Inflammatory contracture of masseter muscles		9 (13,3)	4 (37,5)*	-	
Collateral soft tissues edema		18 (33,3)	17 (75,0)*	15(75,0)	
Edema and hyperemia of the retromolar area		18 (100,0)	14 (70,0)	13(65,0)	
Lowgrade fever (more than 37,0°C)		10 (26,7)	8 (75,0)*	2(8,3)	
Regional lymphadenitis		6 (20,0)	4 (37,5)	-	
Gingival flap tissue bleeding		11 (26,7)	6 (66,7)*	2(8,3)	

Table. 1. Characteristic of the post-surgery clinical signs, appeared on the 3rd day after the impacted mandibular third molar extraction in the patients of groups I, II and III

Nota bene.* - p<0,05 between the indicators of groups I, II and III.

Supervising of the patients on the 7th -8th day after the impacted MTM extraction, it was concluded that 4 (6,9%) patients of the group I had crest of the gum recession, second molar distal root baring for 3-4 mm. Despite a-PRF membrane administration for the patients of group II, gum recession and the 7th tooth distal root baring were found in 3 (5,2%) patients. III group patients who had the osteoplastic complex with BMP-2 used, were not diagnosed with gum recession.

Osteal positioning markers dynamic pattern on conditions of reconstructive actions (groups II and III) showed functional capacity intensification of osteoplastic type cells that play the main role in the osteogenesis: on the 7th day all the patients were diagnosed with the osteocalcin rise in the stoma in the setting of insignificant and doubtful increase of the osseous resorption β -Cross Laps level (tab. 2). In a month since the tooth abnormal extraction the patients of all the groups had a high-level of bone remodeling, however group I patients were recorded with the highest indicators of resorption (β -Cross Laps kept excessive in 1.7 times in comparison with the III group results). It was proved at the dental radiograph and was evident at the active osseous tissues regenerative process in the bone loss area. Densitometry indicators in groups II and III were significantly higher than in the group I, moreover in the group III they were close to the indicator of uninjured bone (491,0±40,7 HU). The low spissitude of osteal graft in the groups I and III indirectly arose recession of the second molar root (6 cases in group I and 3 cases in group II).

Table 2. Dynamic pattern of the bone remodeling and osseous tissues spissitude (according to the Hounsfield grading scale) depending on the impacted MTM surgical treatment

	Osseous tissues spissitude indicators and osteal biotransformation markers									
Groups	Osseous tissues spissitude average number, HU		Osteocalcin level in the stomatic solution sc/ml			Level of β-Cross Laps in the stoma, sc/ml				
	After 1 mon.	After 6 mon.	After 12 mon.	On 7 th day	After 3 mon.	After 6 mon.	After 1 mon.	After 3 mon.	After 6 mon.	
First (n=18) M±m	219±40,2	$338{\pm}40,5$	628±37,8	$31,1\pm 1,6$	$34, 3\pm 0, 9$	$33,8{\pm}0,6$	$2,46\pm 0,04$	1,66±0,03	$1,41\pm 0,03$	
Second (n=20) M±m	220,0±39,2	336,0±32,8	703,0±60,9	$34, 7\pm 0, 8$	$36,7{\pm}0,9$	$33,8{\pm}0,9$	$2,09\pm0,04$	$1,42{\pm}0,04$	$1,39\pm0,04$	
Third (n=20) M±m	$491,0\pm40,7*$	$573,0\pm41,5*$	809,0±39,9*	$47, 6\pm 1, 2^*$	$41, 6\pm 0, 9*$	$38,2\pm 0,8*$	$1,42\pm 0,04*$	$1,36\pm 0,03*$	$1,27\pm0,03*$	

Nota bene. * - p<0,05.

Conclusion

1. The technic with the use of a-PRF, i-PRF provides inflammatory complications decrease at the post-surgery period, influences on the bone regeneration time as well as on the graft quality, but it does not prevent its dimension loss in the long term period, which leads to the receded gums and the distal root baring of the 7th tooth.

2. The technic, with the use of calcium phosphate biomaterial, based on the demineralized bone matrix (BCP), enriched with the bone recombinant morphogenetic protein rhBMP-2 at the ratio of 3:1 should be chosen at the cases with the major bone losses.

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