

## Histologic evaluation of healing process of bone defects with or without using of guide bone regeneration techniques - animal studies on rabbits

**Language:** English

**Authors:**

DDS Marzena Dominiak, Katarzyna Łysiak-Drwał,  
 Department of Oral Surgery, Silesian Piasts University of Medicine of Wrocław,  
 Leszek Solski, Bogusława Żywicka, Stanisław Pielka,  
 Department of Experimental Surgery and Investigation of Biomaterials,  
 Tomasz Konopka,  
 Department of Oral Pathology

**Date/Event/Venue:**

10 - 12. 05. 2007  
 International Symposium Osteology  
 Monaco

**Introduction**

The purpose of the study is histologic evaluation of healing process of the intraosseus defects in rabbits with or without using of GBR techniques after 6 months. Obtained results will be useful to work out a treatment pattern of the human intraosseus defects after apectomy or cystectomy. Main difficulty in setting of this algorithm is to establish conditions in which GBR is not necessary and defect will be filled with proper bone tissue. However in cases which require GBR is essential to establish the way of choice of optimal GBR technique on the basis of clinical conditions and restrictions of using some kinds of biomaterials.

**Material and Methods**

12 adult white rabbits were used in this study. This animal study was approved by the I Local Animal Experimentation Committee in Wrocław nr. 30\\05. Under general anesthesia a cutaneous incision (Figure 1) and blunt muscles preparation was made. The periosteum was incised and lifted to expose the thighbone- the operation area (trochanter major ossis femoris). One hole (diameter of 5 mm) will be drilled using a round steel bur (Figure 2). The same procedure will be carried out on the second leg.



Figure 1: Cutaneous incision



Figure 2: Drilling procedure

The rabbits were divided into three groups (three in each group) for the sake of the way of intraosseus defects treatment.

- I. (C) - control group with ID with no GBR procedures (Figure 3).
- II. (BOC+BG) - group with ID filled with Bio-Oss Collagen (Geistlich, Switzerland) and covered Bio Gide Perio (Geistlich, Switzerland) membrane (Figure 4).
- III. (BOC+PRP) - group with ID filled with Bio-Oss Collagen (Geistlich, Switzerland) in connection with PRP - (Platelet- Rich Plasma) (Figure 5).

In the third group 4 ml of blood was taken from an ear vein. The blood will be used to receive PRP (MPW 223 prod. MPW Instruments + PRP-Kit) (Figure 6). The selected materials were inserted into the hole of the bone (1 rabbit = 2 holes).

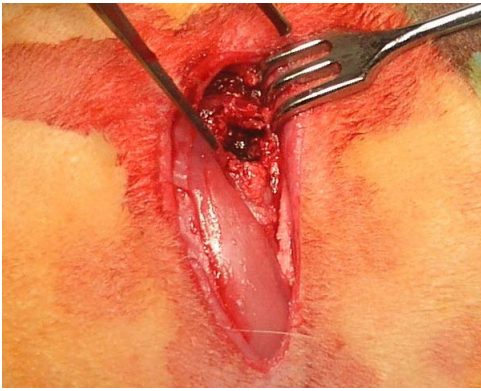


Figure 3: First group- intraoperation view- infrabone defect with no GBR procedure



Figure 4: Second group- intraoperation view- infrabone defect filled with Bio-Oss Collagen and covered Bio-Gide Perio membrane

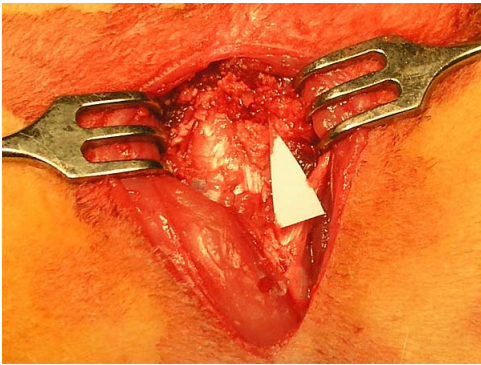


Figure 5: Third group- intraoperation view- infrabone defect filled Bio-Oss Collagen in connection with PRP

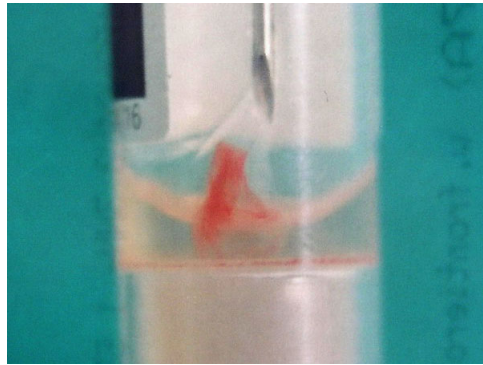


Figure 6: Platelet Rich Plasma



Figure 7: Centrifuge of MPW Instruments

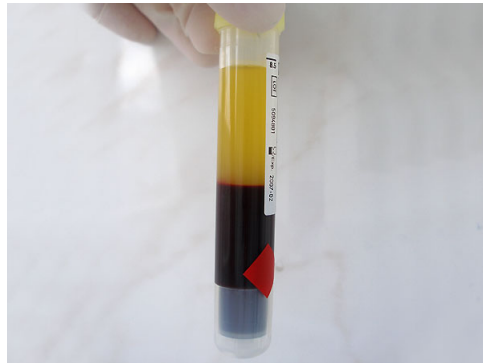


Figure 8: First stage of centrifugation

The animals were euthanized with an overdose of pentobarbital 6 month after surgical procedure (Figure 9-I group, Figure 10- II group, Figure 11- III group). The sections were stained with hematoxylin and eosin and with van Gieson method. Qualitative histologic parameters will be assessed: overall tissue health and degree of inflammation and integration of the xenogenic bone mineral particles into the host bone.

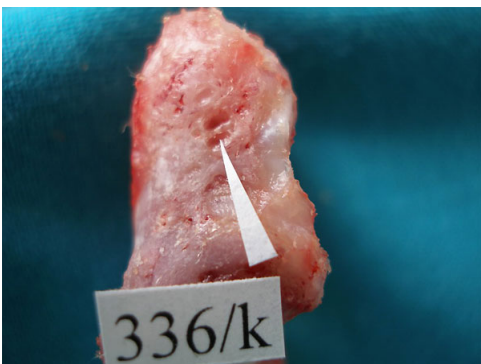


Figure 9: Macroscopic view of first group 6 months after operation

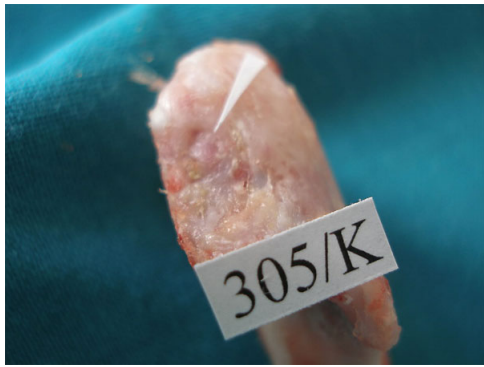


Figure 10: Macroscopic view of second group 6 months after operation

Figure 11: Macroscopic view of third group 6 months after operation

## Results

### Group C

The bone defect was filled with spongy bone, which generally had mature and lamellar structure. Bone remodeling was observed in a few spaces with characteristic narrow threads of the plexus bone. Bone trabeculas were surrounded by marrow. The entrance to osseus defect was filled from upper side with cortilaginous tissue, lamellar and plexus bone with significant amount of blood vassels. There were no signs of inflammation. Histologic markers of inflammation, eg. neutrophilis, macrophages were not observed (Figure 12).

### Group BOC+ BG

The bone defect was filled with spongy bone (lamellar and plexus bone) surrounded by yellow and red marrow. The remains of biomaterial were observed. No evidence of residual membrane components was found in any of the sections. There were fewer quantity and more significant fragmentation of biomaterial in comparison with the PRP group. Generally there were no histological signs of inflammation (Figure 13).

### Group BOC+PRP

Remnants of biomaterial with surrounding spongy bone tissue were seen. In infrabone defect there is much more bone trabeculas and they are thicker in comparison with control group. Around every remains of material newly formed bone trabeculas or trabeculas in forming stage were presened. Biomaterials in various phase of resorption and fragmentation which was followed by change of pigmentation and structure (since places with normal structures- to defragmentated strongy alkali- change of pigmentation into strongly violet). Direct contact biomaterial/plexus bone and subsequently lamellar bone. In rare cases the material was surrounded by connective tissue. In some of the sections there were clinical signs of inflammation (Figure 14).

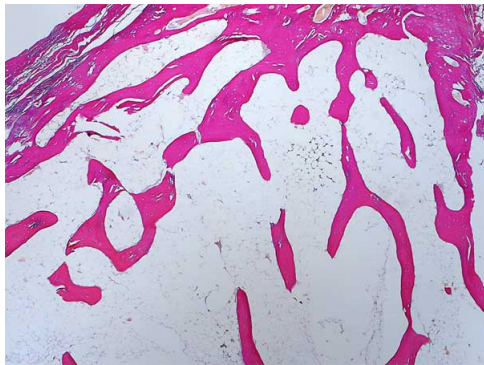


Figure 12: Histologic section of the bone defect 6 months after operation (magnification x 4, Van Gieson stain)

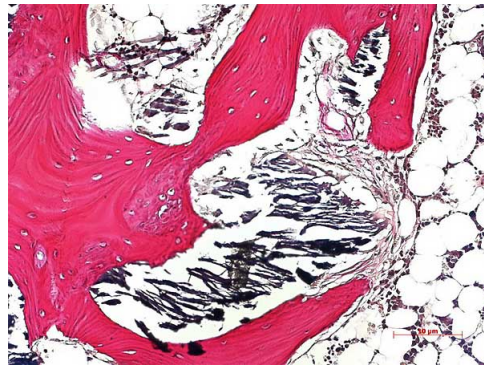


Figure 13: Histologic section of the bone defect 6 months after grafting biomaterial Bio-Oss Collagen and Bio-Gide membrane (magnification x 20, Van Gieson stain)

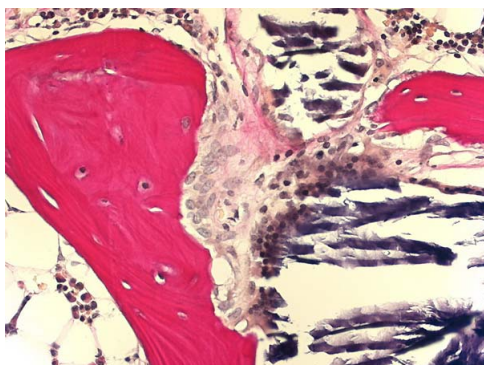


Figure 14: Histologic section of the bone defect 6 months after grafting biomaterial Bio-Oss Collagen with Platelet Rich Plasma (magnification x 40, Van Gieson stain)

## **Conclusions**

Usage of guide bone regeneration controlled after six months post augmentation caused increase of number of bone trabeculas in comparison with the control group. Biomaterial osteointegration process in the second group was faster with less intensity of inflammatory reaction than in the third group, but in both cases this process was not finished.

## **Abbreviations**

Study partially supported by Osteology Foundation

*This Poster was submitted by [DDS Marzena Dominiak](#).*

## **Correspondence address:**

[DDS Marzena Dominiak](#)  
Silesian Piasts University of Medicine of Wrocław,  
Department of Oral Surgery,  
ul. Krakowska 26  
50-425 Wrocław  
Poland

Dominiak Marzena<sup>1</sup>, I.ysiak-Drwal Katarzyna<sup>1</sup>, Solski Leszek<sup>2</sup>, Żywicka Bogusława<sup>2</sup>, Konopka Tomasz<sup>3</sup>, Pielka Stanisław<sup>2</sup>  
 Department of Oral Surgery<sup>1</sup> Department of Experimental Surgery and Investigation of Biomaterials<sup>2</sup> Department of Oral Pathology<sup>3</sup>  
 Medical University of Poland



## Histologic Evaluation of Healing Process of Bone Defects With or Without Using of Guide Bone Regeneration Techniques – Animal Studies on Rabbits\*

**Objectives:** The purpose of the study was to histologic evaluation of healing process of the intrasosseus defects in rabbits with or without using of GBR techniques after 6 months.

**Methods:** 12 adult white rabbits were used in this study. General anesthesia were induced by injecting pentobarbital (Vetbutal – max 25 mg/kg, iv), Fentanyl 0.05 mg/ml to 10 cm NaCl-iv). Under local anesthesia (2% Lignocainum) a cutaneous incision and blunt muscles preparation was made. The periosteum was incised and lifted to expose the thighbone. One hole (diameter of 5 mm) will be drilled using a round steel bur. The same procedure will be carried out on the second leg.



The rabbits were divided into three groups:

- I First group (3 rabbits) (C) – control group with infrabone defects with no GBR procedures.
- II Second group (3 rabbits) (BOC+BG) - with infrabone defects filled with Bio-Oss Collagen® and Bio Gide Perio® membrane
- III Third group (3 rabbits) (BOC+PRP) - with infrabone defects filled with Bio-Oss Collagen® in connection with PRP – (Platelet-Rich Plasma). In third group 4 ml of blood was taken from an ear vein.



The selected materials were inserted into the hole of the bone. The implanted materials were covered by replacing the periosteum and cutaneous flap, which will be sutured with absorbable sutures. Postoperatively, the animals will be given antibiotics. The animals were euthanized with an overdose of pentobarbital 6 month after surgical procedure.

The sections were stained with hematoxylin and eosin and with van Gieson method. Qualitative histologic parameters will be assessed: overall tissue health and degree of inflammation and integration of the xenogenic bone mineral particles into host bone.

### Results:

I group (C)

The bone defect was filled with spongy bone, which generally had mature and lamellar structure. Bone remodeling was observed in a few spaces with characteristic marrow threads of the plexus bone. Bone trabeculae were surrounded by yellow and red marrow. The entrance to osseus defect was filled from upper side with cartilaginous tissue, lamellar and plexus bone with significant amount of blood vessels. There were no signs of inflammation. Histologic markers of inflammation, eg. neutrophils, macrophages, were not observed.

II group (BOC+BG)

The bone defect was filled with spongy bone (lamellar and plexus bone) surrounded by yellow and red marrow. The remains of biomaterial were observed. No evidence of residual membrane components was found in any of the sections. There were fewer quantity and more significant fragmentation of biomaterial in comparison with PRP group. Generally there were no histological signs of inflammation.

III group (BOC+PRP)

Remnants of biomaterial with surrounding spongy bone tissue were seen. In infrabone defect there is much more bone trabeculae and they are thicker in comparison with control group. Around every remains of material newly formed bone trabeculae or trabeculae in forming stage were present. Biomaterials in various phase of resorption and fragmentation which was followed by change of pigmentation and structure (since places with normal structures – to defragmentated strongly alkali – change of pigmentation into strongly violet). Direct contact biomaterial plexus bone and subsequently lamellar bone. In rarely cases material was surrounded by connective tissue. In some of the sections were clinical signs of inflammation.



### Conclusions:

Using of guide bone regeneration techniques controlled after six months post augmentation caused increase of number of bone trabeculae in comparison with control group. Biomaterial osteointegration process in second group was carrying on faster with less intensity of inflammatory reaction than in third group, but in both cases this process was not finished.

\*Study partially supported by

