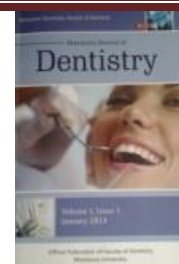




Biological Impact of Platelet Rich Fibrin and Bovine Bone on Bone Regeneration A histological Study in Guinea Pigs



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Abstract:

Background: Improving of bone defect healing is considered a highly challenged process in dentistry which may be affected by several factors such as age, hormonal status and related bone disease. In order to enhance bone healing the administration of bone grafts or autologous concentrate of platelets is widely used which act on increasing bone formation or inhibiting bone resorption.

Objectives: The goal of the research has been to evaluate the effect of *Bio-Oss* bone graft and platelet rich fibrin on healing of bone tissue in *guinea pig* through histological and histomorphometric analysis.

Results: Histological and histomorphometric finding showed gradual increase in bone formation in all groups with different degrees. The degree of formation of new bone in study groups has been markedly higher than the control group. Combination group presented higher rate of formation of bone matched to different groups.

Conclusion: In the current study it was found that, proper application of *Bio-Oss* bone graft in combination with platelet rich fibrin was excellent approach that gave better enhancement in osteogenesis and acceleration in bone healing than using each one of them separately.

Introduction

Localized bone tissues loss may be caused by many factors like extraction of teeth, fracture, infections and metastasis in bone defects filling by normal bones is difficult. Many elements may influence bone defects filling like age, nourishment, status of hormones and presence of concomitant diseases.(1)

Bone grafting was utilized in periodontal regenerating and implantation surgeries, and amongst the variable obtainable grafting materials, bone grafting materials which are currently utilized in biny defects are autogenous bones, allogeneic bones, xenogeneic bones, and alloplastic material.(2)

Amongst those, Bio- Oss® (Geistlich Pharma, Wolhusen, Switzerland) is a well-recognized grafting substance, and its influence for bone healing was assessed in clinical and animal studies.(3)

Platelet-rich fibrin has been advanced like a 2nd generation autologous platelets distillate without the usage of anti-coagulants or different additives. Recently, PRF effects were established in many investigations demonstrating its properties on tissue wound healing.(4)

Materials and methods:

Experimental model

Twelve male guinea pigs divided into four groups of twelve each with a mean weight of 350-500 gram have been utilized in this research. All animals have been kept in twelve hours light and dark cycles and have been offered normal nourishment and water. All investigational processes have been performed at medical experimental research center (MERC) under established regimen of ethical commission of Faculty of Dentistry, Mansura University, Egypt.

Animal grouping

In all guinea pigs a bilateral cortical bony defect were created in the submental area. The guinea pigs were allocated randomly and equally into four groups:

Group I Autogenous clot (control group)

Group II: PRF (autogenous PRF)

Group III: BO ((Bio-Oss)I.

Group IV: BOPRF (Bio-Oss mixed with PRF).

The guinea pigs have been euthanized after four weeks post surgically. Then the mandible was removed from each guinea pig and processed for the following:

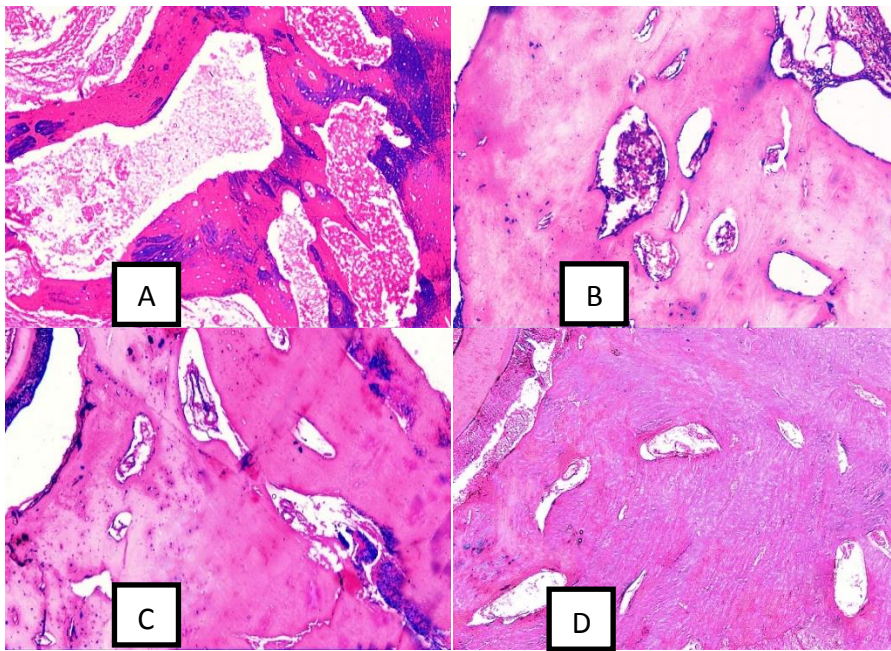
Histological evaluation with routine

- A-H&E
- B-Masson trichrome, to detect collagen fibers in newly formed bone, the collagen & osteoid tissue were stained blue while mineralized bone stained red.

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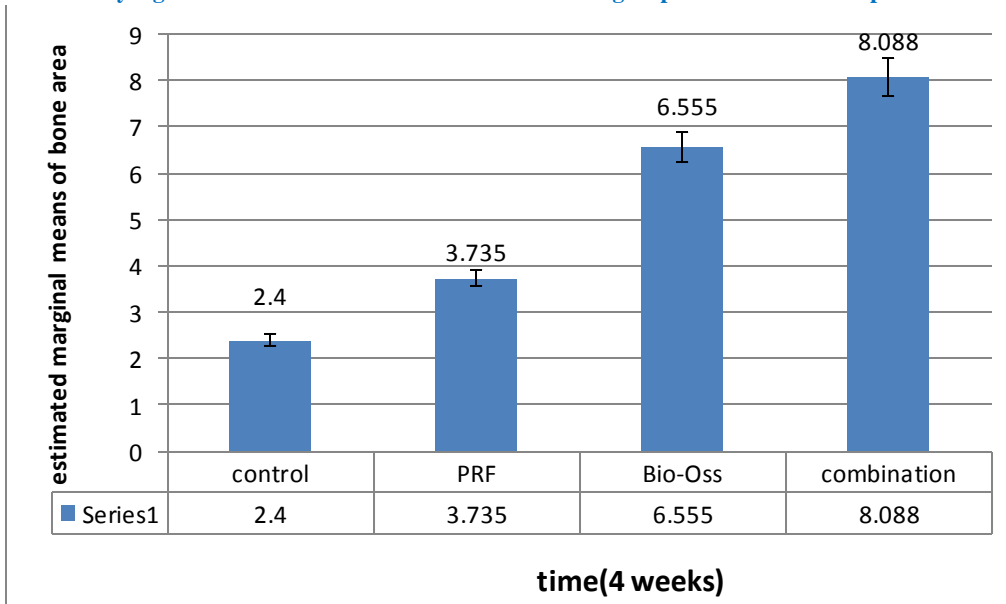
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Results:



Photomicrograph of the bone defect area after four weeks showing: (A) control group; the newly formed collagen fibers (blue color) only represented 2.4% Whereas: PRF group (B); the immature osteoid tissue (blue color) 3.735 % radiating from mature bone (red color) , Bio_Oss group (C); collagen fibers arranged in network of anastomosing osteoid tissue (blue color), the positive stained area is 6.555% and combination group (D) collagen fibers are arranged in the form of trabeculae (blue color) the amount of positive stained area is 8.088%.

Data were presented as mean ± SD. Comparison of BA between the 4 groups was done by One-Way ANOVA. This chart showed a statistically significant difference in BA between the four groups in the same time point.



Discussion:

Bone tissues regenerating and healing of bony defects yet signifies a major difficulty in dentistry particularly with big cavities which surpasses the critical span that can't recover spontaneously.⁽⁵⁾

presently, there is a high requirement for greatly bioactive and bio-degradable porous substances for in situ bone regenerating and repairing of bony flaws in the preparing for surgery prior to dental implants.⁽⁶⁾ The use of natural scaffolds as platelets rich fibrin for autologous tissue

regeneration is recently favored rather than the use of synthetic foreign materials.^(7,8)

Although PRF has longer resorption and remodeling time than the other described platelet concentrations, it has features to similar to those of natural clotting. Therefore, experimental evaluations investigating the early stages of bone healing.⁽⁹⁾

Bone grafting methods have many limitations, therefore, alternative methods are required for bone defects regeneration. Among these, Bio-Oss is a well-documented as

grafting material, and its effect for bone healing has been investigated in clinical and animal studies.⁽¹⁰⁻¹²⁾

Regarding to the experimental groups in this study, we observed difference in the healing of the bone defect between them. Histological observations in PRF group showed better bone healing than control group but less than other experimental groups, **Ozdemir et al** reported that PRF increased the marrow cells but had no influence on the bone regeneration.⁽¹³⁾ In another openinon **Anitua et al**, in his study had demonstrated the potential effects of different platelet rich products in accelerating the regeneration of bone tissues.⁽¹⁴⁾

Results of this study of Bio-Oss, revealed that bone healing was gradually enhanced better than each control and PRF group but less than combination group, the histological findings showed marked maturation of bone characterized by thick coalescence trabecular bone lined by osteoblast cells with definite osteon formation were filled the defect. These results could be explained by **Sartori et al**.⁽¹⁵⁾

Another study assessed that the osteointegration as well as the course of bone regeneration and healing processes increased using PRF as a filling material mixed with Bio-Oss.⁽¹⁶⁾ Among the advantages of platelet concentrates is its safety as an autologous source that helps to enhance earlier stability of bone grafts.⁽⁷⁾

Conclusion

The combination of platelet rich fibrin and Bio-Oss xenogeneic bone graft can accelerate bone healing more than when these materials are used alone.

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