P-SU-39

CLINICAL INNOVATIONS

Evaluation of bone gain through computerized microtomography images through use of different titanium meshes associated with particulate bovine bone graft and collagen membrane - study in rats

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Abstract

Quality and new bone amount is one of the major challenges in today`s implantology. Titanium mesh has been demonstrating possibilities of bone reconstruction for vertical and height bone gain. However, morphology factors are discussed to ensure greater predictability. This study aimed to evaluate if there was quality and new bone volume difference by using titanium meshes with different pore size and thicknesses. Twenty-eight Wistar rats were randomly allocated into four main experimental groups, according to mesh pore size in µm: Group P300 (Neodent®; n = 7); Group P175 (Neodent®; n = 7); Group P85: (Bionnovation®; n = 7); Group P15: (Bionnovation®; n = 7). All femurs received bone graft (Bio-Oss Collagen Geistlisch®) below titanium mesh. *In vivo* computerized microtomography analysis were made at baseline and 30 days after surgery. Histologic analysis comprehends 30 days samples. Results demonstrated no statistic difference between groups in bone volume (p>0.05). Meshes with pore size > 1 mm demonstrated higher mineral bone density, comparing to meshes with pore size < 1 mm (p<0.05). Despite limitations, this study concluded that thickness of titanium mesh did not interfere in bone formation process and that mesh pore size can interfere in bone quality depending on bone graft used.

Background and Aim

Quality and new bone amount is one of the major challenges in today`s implantology. Titanium mesh has been demonstrating possibilities of bone reconstruction for vertical and height bone gain. However, morphology factors are discussed to ensure greater predictability. This study aimed to evaluate if there was quality and new bone volume difference by using titanium meshes with different pore size and thicknesses. Also, if there was difference in using additional collagen membrane.

Methods and Materials

Twenty-eight Wistar rats were randomly allocated into four main experimental groups, according to mesh pore size in µm: Group P3000 (Neodent®; n = 7); Group P1750 (Neodent®; n = 7); Group P850: (Bionnovation®; n = 7); Group P150: (Bionnovation®; n = 7). In all groups, each femur was subdivided into test and control: Test (T): Bio-Oss Collagen Geistlisch® (BC) and collagen membrane (BioGide Geistlisch®) were used; Control (C): only BC was used. *In vivo* computerized microtomography analysis were made at baseline and 30 days after surgery.

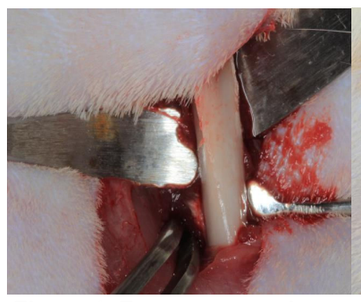

Figure 1. Femur exposed

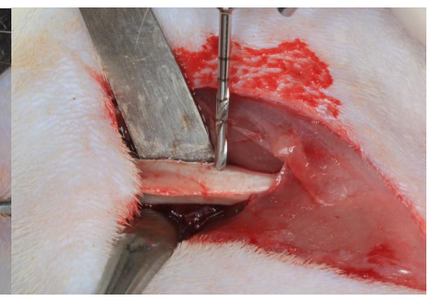

Figure 2. Decorticalization

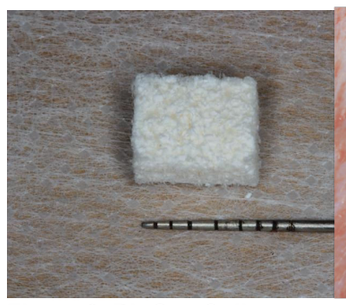

Figure 3. BioOss Collagen

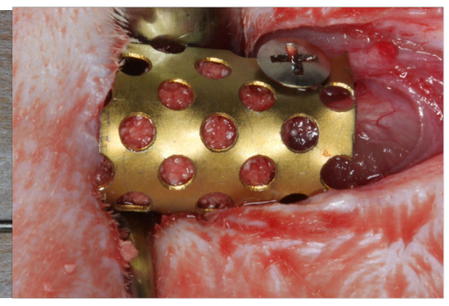

Figure 4. Group P3000 mesh

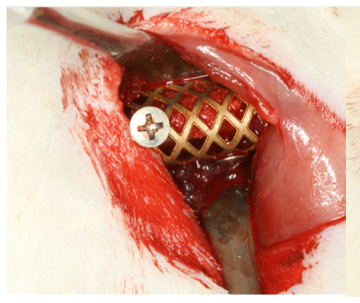

Figure 5. Group P1750 mesh

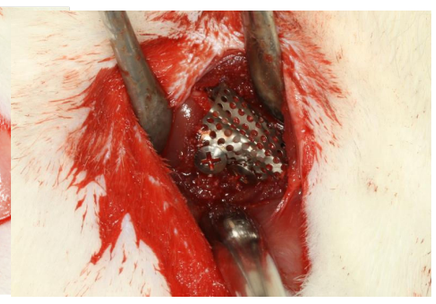

Figure 6. Group P850 mesh

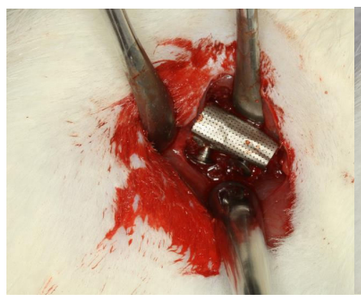

Figure 7. Group P150 mesh

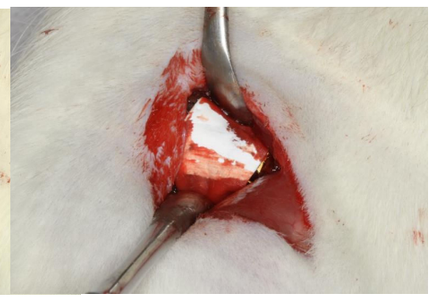

Figure 8. Collagen membrane in test femur

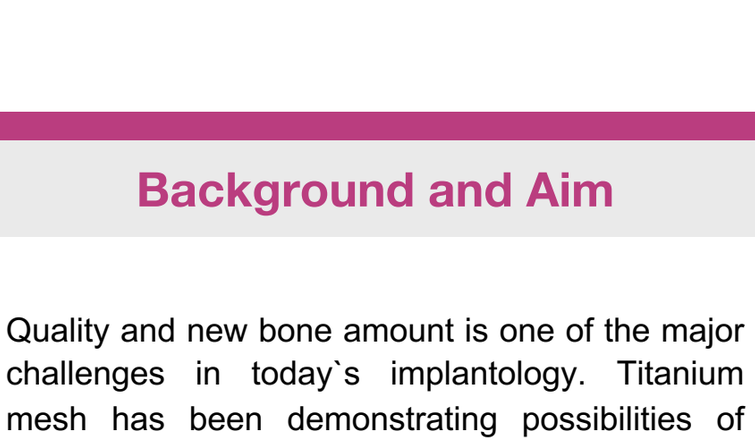

Figure 9. Micro CT 3D images of P3000 and P1750

Figure 10. Micro CT 3D images of 850 and P150

Results

No statistic difference between groups in bone volume (p>0.05). Meshes of group 1 demonstrated higher mineral bone density, when comparing to group 2 meshes (p<0.05), regardless collagen membrane. Meshes with pore size > 1 mm demonstrated higher mineral bone density, comparing to meshes with pore size < 1 mm (p<0.05).

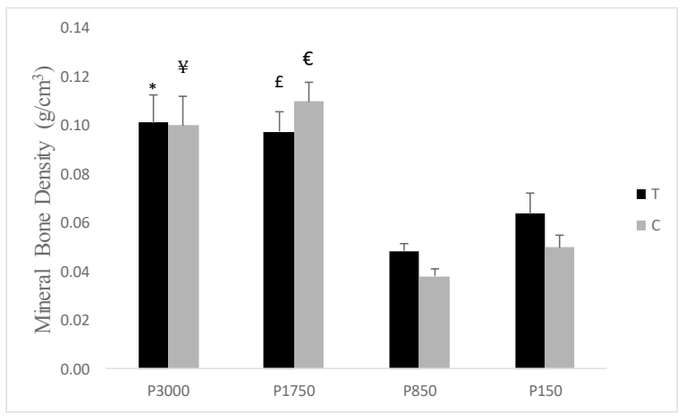

Figure 11. Mineral bone density

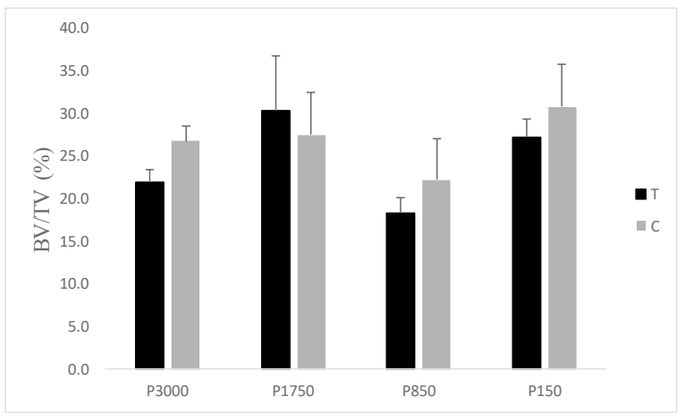

Figure 12. Percentual of bone volume

Conclusion

Despite limitations, this study concluded that thickness of titanium mesh did not interfere in bone formation process and that mesh pore size can interfere in bone quality depending on bone graft used. Additional use of collagen membrane on titanium mesh, associated with xenogen bone graft, did not determine formation of superior quality new bone.

References

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CLINICAL RESEARCH – SURGERY

Evaluation of bone gain through computerized microtomography images through use of different titanium meshes associated with particulate bovine bone graft and collagen membrane – study in rats

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Background: After loss of the dental element, the alveolar process undergoes significant changes, among them, the gradual reduction of the bone volume, making the edentulous region occupied by trabeculae of lamellar bone. This reduced amount of bone tissue in the alveolar ridges has been one of the great challenges in aesthetic-functional recovery in patients who have suffered dentoalveolar trauma, dental extractions, congenital dental absence, maxillary and mandible pathologies and infections.

Aim/Hypothesis: The aim of this study is to evaluate differences in quality of bone tissue through use of two types of titanium mesh, associated or not to collagen membrane, through in vivo computerized microtomography analysis.

Material and Methods: This study was previously approved by the Ethics and Research Committee on animals. Ten male Wistar rats weighing 400 g were used. Two titanium meshes were used – Bionnovation® with perforations of 0.85 mm in diameter (Group 1+ $n = 4$) and Bionnovation® with perforations of 0.15 mm in diameter (Group 2+ $n = 6$). The animals were anesthetized with ketamine and xylazine, according to individual weight. In all animals, the meshes were placed and screwed into the femur, associated with bovine bone graft (BioOss Collagen – Geistlich®). In one of the femurs, collagen membrane (BioGide-Geistlich®) was added, randomly. The surgical wound was sutured with Vycril® 5.0 suture. The animals were submitted to microtomographic evaluation in vivo after 1 and 30 days of the procedure. At day 30, the animals were euthanized. The analyzes measured were of bone volume and density. The data were analyzed in BioEstat 5.0 software using *t*-test for intra and intergroup comparisons.

Results: For intergroup evaluations, bone volume differences of 4.5 ± 3.3 in Group 1 and −1.8 ± 4.2 in Group 2 were observed only in the femur in which the collagen membrane was used. For the density parameter, no statistical differences were observed between the groups. For intra-group evaluations, volume differences were observed after 30 days in Group 2, in femurs in which the collagen membrane (−5.1 ± 4.8) was not used, and a lower density after 30 days (−0.007 ± 0.02).

Conclusions and Clinical Implications: Through the results, it can be concluded that presence of collagen membrane assisted in the maintenance of bone volume. In addition, titanium meshes with smaller diameter perforations demonstrate bone formation of lower volume and density due to reduced supply to underlying bone tissue.