

BONE BLOCK AUGMENTATION - A LONG TERM FOLLOW-UP

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ABSTRACT

INTRODUCTION: Autogenous bone block grafting is used for both vertical and horizontal augmentation of the upper and lower jaw. The bone block could be provided using extraoral or intraoral donor location.

Aim: The aim of this study was to observe the survival rate, the marginal bone level and the bleeding on probing (BOP) for a period of 4 to 6 years of implants, inserted in autogenous bone block graft.

MATERIALS AND METHODS: We considered advanced horizontal bone loss, where guided bone regeneration with simultaneous implant placement could not be performed and/or vertical bone loss, where vertical augmentation of the alveolar bone of more than 3 to 6 mm is required, as indications for the bone block grafting procedure. As an intraoral donor site was used the mental area.

RESULTS AND DISCUSSION: The mean observation period was 4.81 years. The mean marginal bone loss was 0.442 mm, as bone resorption was established in 48% of all cases, BOP was observed in 17.7% of the cases. No correlation was found between BOP and bone loss. The survival rate of the implants placed into bone augmented using autogenous bone block graft was 98.7%.

CONCLUSION: For an implant placement we considered a period of 4 months after the procedure enough to provide high survival rate of the implants. The implants placed in bone augmented using autogenous bone block grafting according to our methodology demonstrated high survival rate and unstable marginal bone level.

Keywords: *bone block graft, implant placement*

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INTRODUCTION

Autogenous block grafting is used for both vertical and horizontal augmentation of the upper and lower jaw (1). The origin of the bone block may be an extraoral donor location: crista iliaca (2-22), the calvaria (4,8,14,15,20). For the same purpose intraoral donor sites could also be used: the mentum (8,9,15,23) and the lower jaw angle (24). The authors describe a success rate of 90 to 100% of bone block grafting pro-

cedures and survival rate of the implants, over a period of 6 to 24 months, of 60 to 100% (87% mean value). Over the same period, survival and success rate of the implants is higher with the delayed approach, at which augmentation precedes implant placement, compared to the simultaneous approach, when the reconstruction is followed by implant placement at the same stage. Reported complications are: 3.3% dehiscence of the graft and 1.4% loss of the whole graft (8,11).

In addition to autogenous bone in the literature are described also studies with an onlay block graft of allogeneic demineralized bone (24), alloplastic materials in combination with autogenous bone (22), as well as the use of alloplastic blocks with or without growth factors (25). Chiapasco et al. (26), in a systematic literature review, reported that there is insufficient data to draw a conclusion about the use of non-autogenous block grafts. At the same time, the analysis of the studies on the autogenous bone block graft leads to the following conclusion: bone loss is highest in the first year after the reconstruction and in the first year after the start of the functional loading of the implants placed in the augmented areas. The loss of graft volume due to resorption is related to the donor site - the highest volume loss is described in iliac grafts - 12 to 60%, and the lowest - in bone blocks of calvaria. It seems that cortical bone thickness of the bone block is essential for the loss of bone volume over time. The use of a membrane definitely decreases the loss of graft volume. According to Block and Degen (27) using lyophilized allogeneic bone without membrane application and consolidation time of 4 months, onlay graft resorption observed, causing volume loss of up to 50% of the initial bone volume. Previous studies offer that functional loading of the implants placed in an autogenous bone block graft occurs 6 to 12 months after implantation, because of the need of more time for implant integration (27,28). At the same time there is an obvious volume loss during this period. Sjostrom et al. (29) using resonance frequency analysis established that 24 weeks after implantation in augmented bone implants show similar implant stability quotient (ISQ) values compared to implants placed in non-augmented bone. The authors took notice of this fact in support of their thesis about earlier functional loading.

In an experimental study, De Santis et al. (30) compared the results of block grafting at four-walled defects recovered using autogenous bone blocks and blocks of deproteinized bovine bone mineral. Both materials were covered with a collagen barrier membrane. Six months after surgery, autogenous bone blocks were properly integrated and remodeled, while deproteinized bovine bone mineral blocks were infiltrated by a fibrous connective tissue and only a small part of them that contacted directly with the recipient bone bed seemed integrated with it, which led to the apparent immobility of the bone blocks. The implants placed in both types of blocks showed similar results - from full osseointegration (the autogenous bone block) to partial integration (block of deproteinized bovine bone mineral) - close to the walls of the recipient bone bed.

AIM

The aim of this study was to observe the survival rate, the marginal bone level and the bleeding on probing (BOP) for a period of 4 to 6 years of implants, inserted in autogenous bone block graft.

MATERIALS AND METHODS

The measurements of the existing alveolar bone of the patients considered for bone block grafting was done using cone-beam computed tomography. We considered as indicated for bone block grafting procedure, patients with advanced horizontal bone insufficiency, which does not allow the performance of guided bone regeneration with simultaneous implant placement, and vertical bone insufficiency, which requires augmentation of 3 to 6 mm in vertical direction. We used autogenous bone grafts, derived from the mental area. The planning and the measurements of the bone block were done using cone-beam computed tomography. There should be a distance of at least 5 mm between the upper edge of the bone block and the projection of the apexes of the lower anterior teeth on the anterior surface of the lower jaw. The mesial end of the autogenous block extends to the symphysis of the lower jaw, the caudal - to the lower frontal edge of the lower jaw and the distal boundary reached the mandibular canal, according to its anatomical variations. The thickness of the autogenous bone block may represent half of the thickness of the lower jaw in the relevant area (Fig. 1).

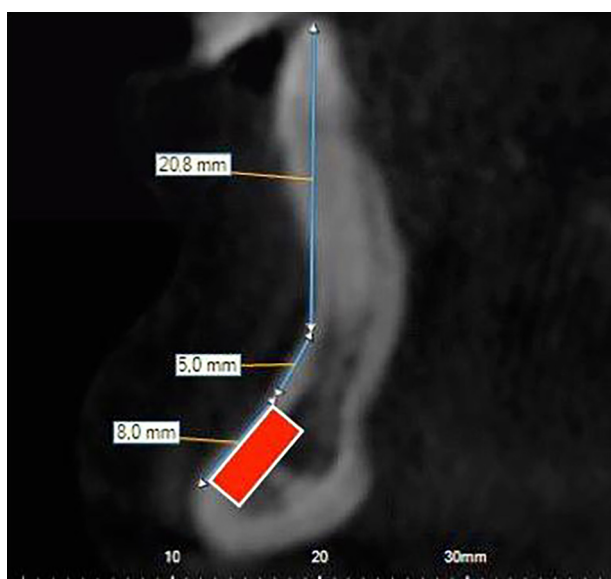


Fig. 1. Paraxial reconstruction in the area of planned autogenous bone block

The preparation of the recipient site was done before taking the autogenous bone block. The preparation of the recipient side included elevation of mucoperiosteal flap in the area subject to augmentation. The preparation of the bone block was performed using an incision in the mucogingival junction area in the relevant region. After that, a flap was elevated and the elevation of the periosteum and the muscle insertions in the area was performed very cautiously. The osteotomy was done to the planned depth, but not less than the thickness of the compact bone in the relevant section. The bone block was elevated using a curved chisel (Fig. 2). The donor site was filled with bone grafting material (Fig. 3) and was covered



Fig. 2. Elevation of the bone block using curved chisel



Fig. 3. Filling the donor site with bone grafting material

using a barrier membrane. The mucoperiosteal flap was repositioned and sutured.

The fastening of the bone block at the recipient site started after fixation with a suitable tool (bone fixation forceps – Aesculap AG) (Fig. 4). The fixation was performed using a 1.5 mm diameter microscrews (bone block fixation - Institut Straumann AG, Basel, Switzerland), the screw channel in the bone block was done using a 1.5 mm drill (Fig. 5), and in the walls of the recipient site it was done using a 1.25 mm drill. Once the bone block was fixed, it was covered with bone grafting material (Fig. 6) and colla-



Fig. 4. Fixation of the bone block at the recipient site using bone fixation forceps

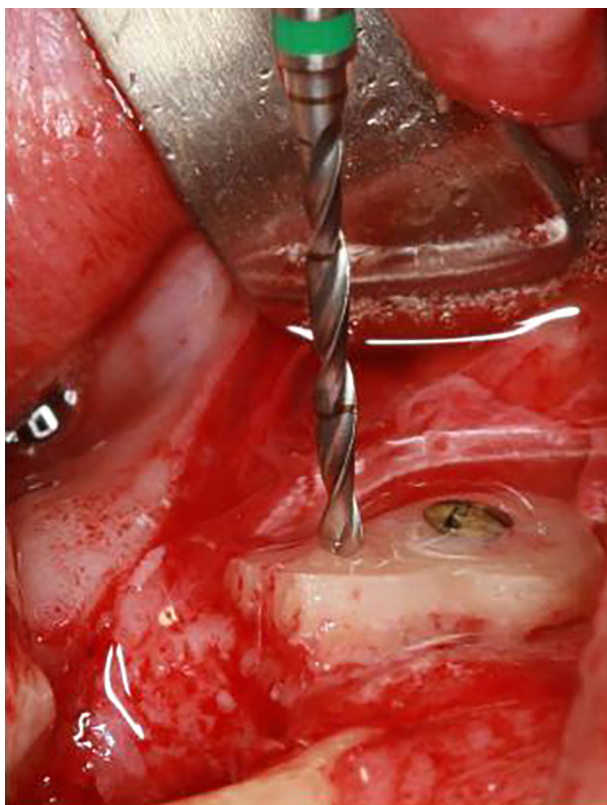


Fig. 5. The screw channel in the bone block was done using a 1.5 mm drill

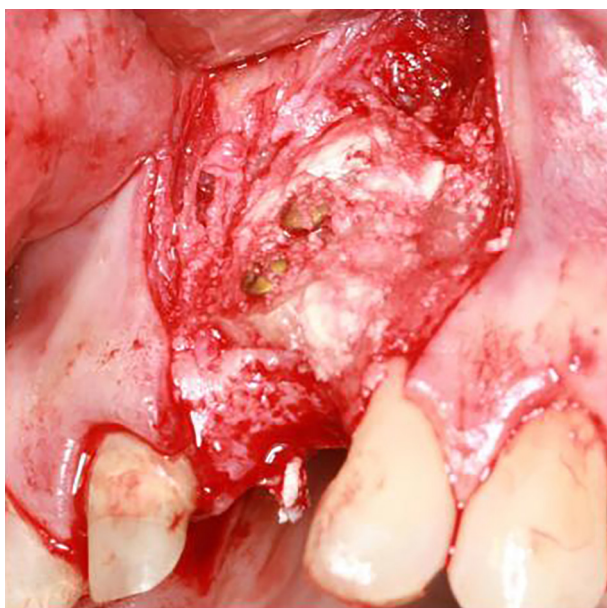


Fig. 6. The bone block is covered with bone grafting material

gen barrier membrane (Fig. 7). After that the flap was mobilized, repositioned and sutured using monofila-

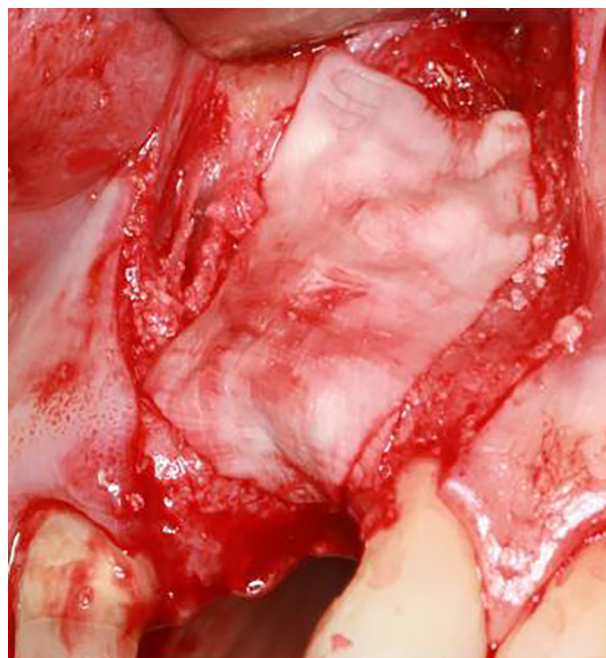


Fig. 7. The bone block and the bone grafting material are covered with collagen barrier membrane

ment suture material (Dafilon, B. Braun-Melsungen, Germany).

The following indicators were observed:

1. Presence of intraoperative and postoperative complications of donor and recipient site.
2. Survival rate for the observed period.
3. The presence of bone resorption visible on radiographic examination.
4. Bleeding on probing (established using UNC-15).

The data was analyzed using IBM SPSS Statistics 19.

RESULTS

We followed the cases of implant placement into bone augmented using autogenous bone block graft procedure over a period of time of 4 to 6 years (mean 4.81 years with a standard deviation of 0.533). The mean age of the patients was 34.25 years. Depending on the area, where the procedure was performed, the distribution of the cases was as indicated on Fig.8. The method was used in the upper anterior area mainly in cases of horizontal bone deficiency, while in the lower distal area - mostly with a vertical bone insufficiency (Fig. 9). The implants were loaded after a mean period of 3.11 months with a standard

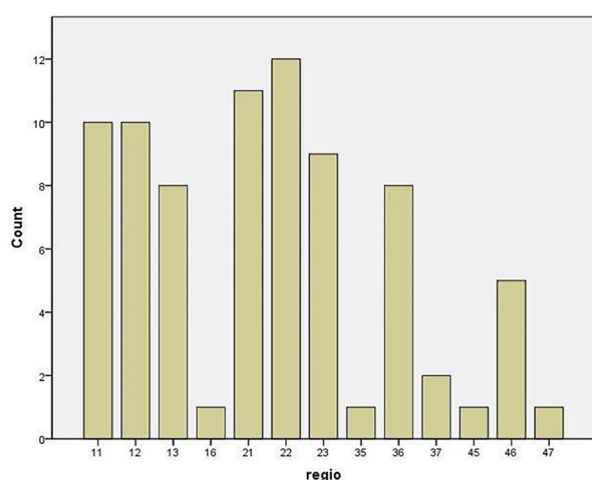


Fig. 8. Distribution of the cases depending on the area

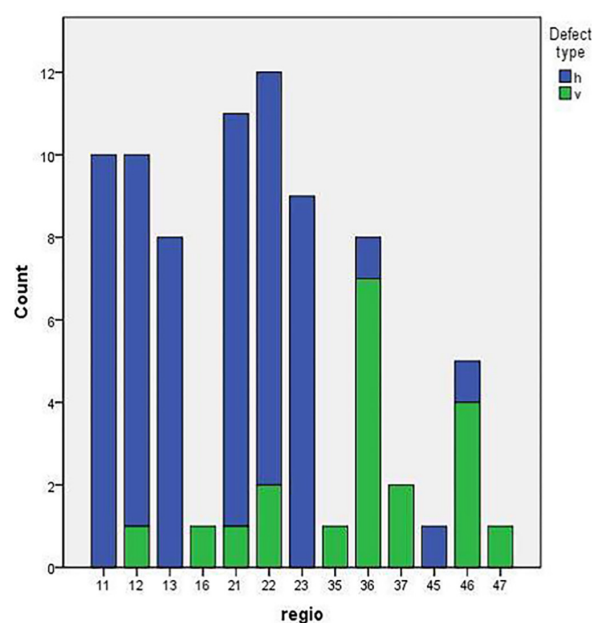


Fig. 9. Distribution of the cases depending on the area and type of bone deficiency: h-horizontal; v-vertical

deviation of 0.320. Bleeding on probing was observed in 17.7% of all cases. Correlation between bone resorption and bleeding on probing was not established. The survival rate of the implants was 98.7%.

The complication rate was 21.5%. In 17.7% of the cases dehiscence of the membrane and/or the graft was observed. In none of the cases special treatment due to complications was required. In 3.8% of the complications vitality loss of the teeth near the donor site was established. It required endodontic treatment of the affected teeth. In none of the cases

of vitality loss no more than one tooth at same clinical case was affected.

DISCUSSION

The survival rate of the implants was 98.7%. This is high survival rate exceeding the results reported by the majority of published studies (2,3,4,5,6,7,9,10,13,14,16,24) and is similar to the results published by Bell et al. (17), Verhoeven et al. (11), Chiapasco et al. (15), and Levin et al. (31). The implants were placed 4 to 6 months after the augmentation procedure, which did not affect the results. Marginal bone loss was 0.442 mm, which is significantly higher value than that established at guided bone regeneration with simultaneous implant placement. That gave us a reason to conclude that the performance of the method alone, especially in the aesthetic area, is inappropriate because of the impossibility of maintaining volume stability, as well as soft tissue aesthetics for a long period of time. It could also be suggested, in cases of advanced bone loss, requiring the performance of bone block grafting procedure with delayed implant placement, to perform at second surgical stage guided bone regeneration with simultaneous implant placement in an already augmented via bone block graft in order to ensure the volume stability of the restored tissues.

CONCLUSION

According to the investigated method, the implant placement in bone, augmented via block grafting procedure, demonstrated high survival rate of the implants – 98.7% and unstable marginal bone level with mean value of marginal bone loss of 0.442 mm for the observed period. A four-month period is sufficient for implant placement into bone augmented via block graft in order to ensure a high survival rate of the implants.

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