Clinical Efficiency of Different Regenerative Surgical Approaches to Restore Vertical Defects of the Mandible and Maxilla

Summary of the PhD thesis

by

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LIST OF PUBLICATIONS PROVIDING THE BASIS OF THE THESIS

1. **Sass T**, Bálint G, Koffol T, Piffkó J, Oberna F. A mandibula és a maxilla vertikális csonthiányainak autológ csontblokkal végzett augmentációja. Utánkövetéses retrospektív tanulmány [Augmentation of the vertical bone defects of the mandible and maxilla with autogenous bone block. A retrospective study with follow-up] Orv Hetil. 2021 (in print).

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2. **Sass T**, Piffkó J, Oberna F. Vertical mandibular bone augmentation by the osteodistraction of the transplanted fibula free flap: A case series with long-term follow-up. J Craniomaxillofac Surg. 2021 Jun 23:S1010-5182(21)00166-9.

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3. **Sass T**, Piffkó J, Braunitzer G, Oberna F. Esthetic and functional reconstruction of large mandibular defects using free fibula flap and implant-retained prosthetics - a case series with long-term follow-up. Head Face Med. 2021 Oct 20;17(1):43.

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I. INTRODUCTION

Bone augmentation procedures prior to prosthetic rehabilitation of the mandible and maxilla may be indicated from both functional and aesthetic standpoints. Fixed dental prostheses are more favored by patients during rehabilitation than removable dentures as they provide better quality of life. From a functional standpoint, they are smaller than removable prostheses, take up less space in the oral cavity and more efficient masticatory forces can be achieved by them. There are many cases where vertical bone augmentation needs to be done to improve the aesthetics prior to implant surgery to maintain the vertical occlusal dimension without disproportionately long teeth. Extended vertical bone defects can result in face deformity, the treatment of which treatment significantly improves the patient's facial aesthetics. In the frontal region, surgery provides adequate lip support to the patient creating a younger, smoother, and less wrinkled look. The reconstruction of the vertical defect of the maxilla in patients suffering from cheilognathopalatoschisis will also result in the correction of the hollowness at the base of the nose. The reconstruction of bone defects in the premolar

and molar regions helps to restore the symmetry and contour of the face.

At the moment, there are three accepted surgical approaches to the vertical augmentation of the alveolar bone with autologous material. These are: bone grafting without a vascular pedicle, osteodistraction, and free vascularized bone transplantation.

In our practice, we apply all three main surgical approaches to perform preprosthetic vertical augmentation, and the choice depends on the size of the defect. As a rule, for smaller defects (up to 8 mm), we utilize grafting without a vascular pedicle, and for larger defects (above 8 mm), we prefer distraction osteogenesis. However, if the defect is especially large or distraction is not a viable option for other reasons (e.g. when there is a high risk of complications like mandible fracture), we take the free vascularized flap approach. We have developed this classification based on the literature. The overall goal of the studies covered in this thesis was to demonstrate that this approach offers favorable and lasting functional and esthetic results.

II. OBJECTIVES AND HYPOTHESES

The thesis covers three studies. All three studies analyzed the data of patients who had undergone vertical bone augmentation of the mandible or maxilla to prepare implant-retained prosthetic rehabilitation.

In the first study, we retrospectively reviewed the files of our patients having undergone either of two vertical augmentation procedures in the mandible or the maxilla for preprosthetic purposes. Patients in one group were treated by sinus elevation, while patients in the other group were treated by vertical ridge augmentation. In all these cases, ≤ 8 mm vertical augmentation was necessary. In both groups, the treatment was carried out utilizing autogenous monocortical bone blocks. All patients received implant-retained prosthetic therapy. The follow-up covered a period of 3 to 12 years. Based on the literature, we hypothesized that vertical ridge augmentation would be characterized by a higher degree of bone resorption and that bone resorption would be a more frequent finding, while this would not interfere with the long-term success of these cases.

In the second study, we reviewed cases of patients with vertical mandible defects of 7-12 mm with maintained mandibular continuity. In these cases, osteodistraction was the method of choice, followed by implant-retained prosthetic rehabilitation. The follow-up period ranged 1 to 8 years. We hypothesized that the interventions would show success in the long term, both esthetically and functionally.

In the third study, cases involving the reconstruction of large defects of the mandible were reviewed. For all the cases, the mandibular continuity was maintained with a vertical bone defect of at least 1 cm over a segment of at least 5 cm, and the distance between the inferior alveolar nerve or the base of the mandible and the alveolar ridge was smaller than 5 mm. Vertical augmentation with free microvascularized fibula flap was carried out, followed by implant-retained prosthetic therapy. The follow-up covered 5 to 6 years. Like before, the hypothesis was that the applied therapy would turn out to be successful in the long term.

III. RESULTS

III.1. Augmentation of the vertical bone defects of the mandible and maxilla with autogenous bone block. A retrospective study with follow-up.

In all the reviewed cases, vertical augmentation proved to be successful in the long term, regardless of the applied surgical approach. No implant loss or complications were recorded. In the cases where ridge augmentation was the treatment of choice, bone resorption was more frequent (and somewhat more extensive) in the cervical region as compared to sinus elevation (regarding either the apical or the cervical region). At the same time, it must be seen that this had no clinical consequences whatsoever, even after a long time in function. Furthermore, following ridge augmentation, the augmented bone was less stable in the molar region as compared to the front region or cases of sinus elevation. The probable reason for this is that the surgical site under the sinus floor is completely isolated and protected from the oral cavity. This hypothesis is supported by the fact that even in sinus elevation cases, the volume of bone resorption in the cervical region was

higher than in the apical region. While the relatively small number of cases did not allow us to perform hypothesis testing, the observations suggest that all these differences are negligible from a clinical point of view. The donor site does not seem to have had any effect on bone resorption.

III.2. Vertical mandibular bone augmentation by the osteodistraction of the transplanted fibula free flap: a case series with long-term follow-up.

Osteodistraction of the fibula flap combined with implant therapy was successfully applied to correct the mandible defect and rehabilitate the patients both functionally and esthetically. In each case, 10 to 12 mm vertical bone gain was achieved. No bone loss (as evidenced by OPT scans) or peri-implant soft tissue inflammation was observed in any of the patients during the follow-up, which ranges from 1 to 8 years at the moment. It is equally important that we could always reach and maintain also a definitely esthetic outcome. This aspect was especially important in these cases, as for these relatively young patients (all under 50, with a mean age of 31.5 years) good esthetics can be a major determinant of psychosocial well-being. Osteodistraction, thus, turned out to be a predictable and

efficient procedure, which we could use even in difficult cases - in one case even after radiotherapy.

III.3. Esthetic and functional reconstruction of large mandibular defects using free fibula flap and implant-retained prosthetics – a case series with long-term follow-up.

The maximum follow-up in this study was 6 years. Autologous vertical augmentation with free microvascularized flap has proven to be a reliable approach that allowed lasting esthetic and functional reconstruction in cases involving large vertical defects of the mandible. The site healed per primam. No infection or permanent donor site morbidity was observed. The patients did not report excessive pain, discomfort or any other subjective complaint related to the surgery either in the postoperative or in the follow-up period. The patients' adherence and compliance were excellent throughout the treatment and follow-up (as indicated by the excellent condition of the dental work and the surrounding hard and soft tissues). we recommend the described approach for the treatment of large mandibular defects with maintained continuity in maxillofacial surgical centers.

IV. CONCLUSIONS

Regarding the preprosthetic vertical augmentation of the mandible and maxilla, we draw the following conclusions based on our long-term observations:

In general, we conclude that in such cases it is a good strategy to base treatment choice on the size of the defect. Avascular bone blocks are recommended only for smaller defects, while for larger defects, osteodistraction and free vascular flaps are recommended. Free vascularized flaps should be used only for extensive defects. The exact limit between small and big in terms of defect size is still a matter of debate. In our practice, we draw the dividing line at 8 mm, and we have achieved excellent results with this approach.

As for the vertical augmentation of small defects with avascular bone blocks, the results support the literature in that the risk of bone resorption is higher in cases of vertical ridge augmentation. However, this was not accompanied by functional alterations, peri-implant complications, or

inflammatory phenomena and neither did it lead to implant loss, even in cases with more than a decade of follow-up. So, we conclude that this approach is safe and reliable in the long term, regardless of whether for sinus elevation or ridge augmentation.

Osteodistraction of the transplanted fibula free flap is a useful and efficient method of secondary augmentation for cases of medium-sized vertical mandibular defects where the flap itself fails to produce the desired crestal height, and no other method is applicable. The cases show that the method allows outcomes that are highly satisfactory, both in the functional and esthetic sense.

Free microvascularized fibula flap reconstruction of large mandibular defects combined with implant-retained prosthetics allows a lasting functional and esthetic solution for large vertical bone defects in cases where the continuity of the mandible is maintained.

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