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COMPLEX, THREE-DIMENSIONAL RECONSTRUCTION OF CRITICAL SIZE DEFECTS FOLLOWING DELAYED IMPLANT PLACEMENT USING STEM CELL-CONTAINING SUBEPITHELIAL CONNECTIVE TISSUE GRAFT AND ALLOGENIC HUMAN BONE BLOCKS FOR HORIZONTAL ALVEOLAR BONE AUGMENTATION: A CASE REPORT AS PROOF OF CLINICAL STUDY PRINCIPLES

Grimm W.-D.[1], Plöger M.[2], Schau I.[2], Vukovic M. A.[3], Shchetinin E. V.[4], Akkalaev A. B.[4], Avanesian R. A.[4], Sirak S. V.[4]

[1] University of Witten, Germany
[2] Implantology Center Detmold, Germany
[3] Praxisteam Hasslinghausen, Germany
[4] Stavropol State Medical University, Russian Federation

For the three-dimensional reconstruction of alveolar ridge defects prior to implantation, the implant serves mostly autogenous bone block grafts from the iliac crest, pubic symphysis or ramus of the mandible. This means a second surgical site procedure with additional risks to the patient and donor site morbidity [1].

The purpose of our *proof of principle* study is to evaluate the potential of Adult Palatinum as a Novel source of stem cells in combination with transplantation of OsteoGraft™ Spongiosa/Corticalis Bone Blocks for two-stage bone augmentation and delayed implant placement.

These combination of methods for horizontal and vertical augmentation in critical size defects will be tested in in a multicentric, *«proof of principle»* randomized, controlled, clinical, radiological and, histological trial [2].

The following case report is to focus of using stem cell-containing subepithelial connective tissue graft [3] and allogenic human bone blocks for horizontal alveolar bone augmentation in critical size bone defects of maxilla [4]. To avoid a second surgical procedure with appropriate donor site morbidity and correlated surgical risks due to the bone block grafts for the past six years we have worked with an allogeneic bone replacement material in block form (OsteoGraft™ block DIZG Berlin, distributed by Argon Medical®, Bingen am Rhein, Germany).

Case report. A 68-year old patient presents with an edentulous maxilla and the desire of a fixed implant-supported prosthesis in our study center. The primary clinical site is shown in Figure 1. Assessing the real bone situation using DVT imaging of the upper jaw we can see a much worse bone site than expected in comparison with the clinical picture (Fig. 2). An average bone width of 2–3 mm does not allow immediate implantation. Further, the entire maxillary ridge must be augmented laterally with allogenic bone blocks. A bone graft from the iliac crest, pubic symphysis or ramus ascendens of the mandibula appears impractical due to the large amount of material needed. We decided to use a stem cell-containing subepithelial connective tissue graft and allogenic human bone. As a carrier of our stem cell containing soft tissue from the palate we have used a sterile, high-safety (donor selection, virus testing, chemical cleaning, processing and sterilization) allograft bone product, derived of human donor bone (OsteoGraft™ block). The high biologic regeneration capability of this allogenic bone block results in a predictable clinical outcome.

Properties of OsteoGraft™ block

- Preserved biomechanical properties
- Sterile without antigenic effects
- Storable at room temperature for 5 years
- Osteoconductive properties supporting natural and controlled tissue remodeling.

Surgical Procedures. We decided to use an non-removable zirconia bridge on eight implants.

Dr. Wolf-Dieter Grimm, Professor of Periodontology, PhD, MSc, Periodontology, Department of Dental Medicine, Faculty of Health, University of Witten/Herdecke, Germany, Private Practice, Molthera GmbH Ruhrstr. 76, 58452 Witten, Germany;
tel.: +49(0)230252971, fax: +49(0)230252972;
e-mail: prof_wolf.grimm@yahoo.de

Dr. Mathias Plöger, MSc, Implantologist, Implantology Center Detmold, DIZ – Deutsches Implantologie e.V., Lemgoer Straβe 20, 32756 Detmold, Germany; tel.: (+495231)302055, fax: (+495231)302019; e-mail: info@diz-dt.de

Dr. Ingmar Schau, MSc, Implantologist, Implantology Center Detmold, DIZ – Deutsches Implantologie e.V., Lemgoer Straβe 20, 32756 Detmold, Germany; tel.: (+495231)302055, fax: (+495231)302019; e-mail: info@diz-dt.de

Dr. Marco Alexander Vukovic, MSc, Implantologist, Praxisteam Hasslinghausen, Mittel.: str. 70, 45 549 Sprockhövel, Germany, tel.: +492339911160, fax: +492339911162;
E-mail: team@ph-zahnaerzte.de

Shchetinin Eugeny, MD, PhD, Professor of Pathological Physiology, Head of Department of Pathological Physiology, Stavropol State Medical University, Russian Federation;
tel.: (8652)352524; e-mail: ev.cliph@rambler.ru

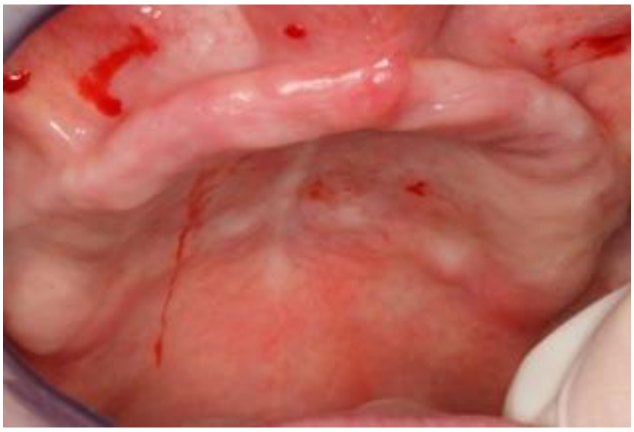

Fig. 1. Clinical situation of a 68-year old patient with an edentulous maxilla

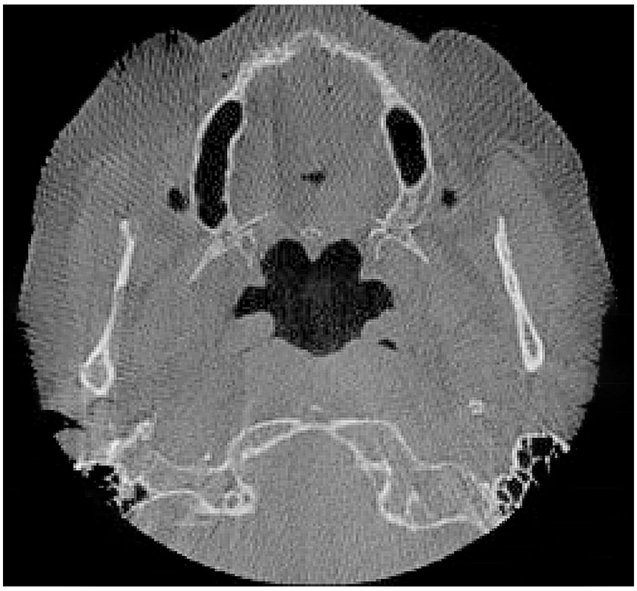

Fig. 2. Assessing the real bone situation using DVT imaging of the upper jaw we can see a much worse bone site than expected in comparison with the clinical picture

Fig. 3. The residual ridge areas have been augmented by boneblocks finally congruently adapted to the spongy bone base and screwed with osteosynthesis screws at least two per block

Fig. 4. After filling all remaining bone spaces with bone granulate

The three-dimensional reconstruction of the maxilla has been provided by using a bilateral external sinus lift procedures and a circumferential lateral augmentation with allogeneic bone grafts. The residual ridge areas have been augmented by boneblocks finally congruently adapted to the spongy bone base and screwed with osteosynthesis screws at least two per block (Fig. 3). After filling all remaining bone spaces with bone granulate (Fig. 4), the fenestrations of the sinus walls, and all grafted sites were covered with a stem cell-containing subepithelial connective tissue graft and finally with collagen membranes.

For harvesting the stem cell-containing subepithelial connective tissue graft [5] from the palate a horizontal incision to the bone will be made 5 mm from the palatal gingival margin and the micro-blade will be subsequently placed parallel to the long axis of the roots. Another horizontal incision will be made 2 mm coronal to the first incision and the periosteum will be dissected before removing the wedge of soft tissue. An approximately 10×6 mm subepithelial connective tissue graft (SCTG) has been harvested from the palate in the second premolar to second molar region as the source of ecto-mesenchymal stem cells. The SCTG trimmed precisely to adapt to the recipient site.

Conclusion. Several tissue engineering approaches have been tried to stimulate bone formation. The addition *of in vitro* cultured mesenchymal stem cells (MSCs) has proven to stimulate osteogenesis. Preclinical and clinical studies have demonstrated the ability of bone marrow-derived stem and progenitor cells to regenerate various tissues, including bone [3, 6, 7, 8]. *This in vitro* cultured bone induced bone formation and osseointegration of the placed dental implants. To bypass the problem of selection, multiplication, and differentiation, most of the mentioned studies selected MSCs, multiplied them, and then differentiated them to the osteogenic lineage. As this is unreasonable to do in daily practice, in this *«proof of principle»* clinical-controlled study an approach was chosen in which allogenic bone blocks will be combined with palatal-derived stem cells (paldSCs). Based on the hypothesis that the number of paldSCs is secondary, the individual potential of paldSCs to survive high stress and chemotactically attract osteogenic progenitor cells will dominate. As the augmentation material is far from local blood supply, it can be assumed that a natural selection procedure will be applied to the cells. As blood and oxygen supply are reestablished, the paldSCs could then unfold their full potential.

The results of this case presentation encourage us to provide a clinical-controlled study in which allogenic bone blocks will be combined with palatal-derived stem cells (paldSCs).

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For three-dimensional reconstruction of defects of the alveolar crest to the conduct of dental implantation today use autogenous blocks grafts from the iliac crest, the pubic symphysis or branches of the lower jaw. The authors evaluate the regeneration potential of the soft tissues of the sky as a new source of stem cells in combination with transplantation of osteoplastic material for building bones and delayed implantation. Developed the method of treatment showed the ability of the bone marrow, stem and progenitor cells for the regeneration of various tissues, including bone.

Key words: regeneration and transplantation, bone block, jaw

КОМПЛЕКСНАЯ ТРЕХМЕРНАЯ РЕКОНСТРУКЦИЯ ОБЪЕМНЫХ КОСТНЫХ ДЕФЕКТОВ ДЛЯ ПОСЛЕДУЮЩЕЙ ОТСРОЧЕННОЙ ИМПЛАНТАЦИИ С ИСПОЛЬЗОВАНИЕМ СТВОЛОВЫХ КЛЕТОК ИЗ СУБЭПИТЕЛИАЛЬНОЙ СОЕДИНИТЕЛЬНОЙ ТКАНИ АЛЛОГЕННОГО ТРАНСПЛАНТАТА И ЧЕЛОВЕЧЕСКОЙ КОСТИ ДЛЯ АУГМЕНТАЦИИ АЛЬВЕОЛЯРНОГО ОТРОСТКА: КЛИНИЧЕСКИЙ СЛУЧАЙ КАК ЭЛЕМЕНТ ДОКАЗАТЕЛЬНОЙ МЕДИЦИНЫ

В.-Д. ГРИММ, М. ПЛЁГЕР, И. ШАУ,
М. А. ВУКОВИЧ, Е. В. ЩЕТИНИН, А. Б. АККАЛАЕВ,
Р. А. АВАНЕСЯН, С. В. СИРАК

Для трехмерной реконструкции дефектов альвеолярного гребня до проведения дентальной имплантации сегодня используют аутогенные блоки трансплантатов из гребня подвздошной кости, лобкового симфиза или ветвей нижней челюсти. Авторы статьи дают оценку регенераторного потенциала мягких тканей нёба в качестве нового источника стволовых клеток в сочетании с трансплантацией остеопластического материала для наращивания кости и отсроченной имплантации. Разработанный способ лечения продемонстрировал способность костного мозга, стволовых и прогениторных клеток к регенерации различных тканей, в том числе костной.

Ключевые слова: регенерация, трансплантация, костный блок, челюсти