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Case Report

Comparison between the Bone Regeneration Using Tooth Graft with or without Tooth Transformer in Sheep

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Abstract

Introduction

Human dentin matrix can be successfully used for bone grafting procedure. It is well known that dentin grafts can induce osteoblasts proliferation. An innovative preparation method, using the dedicated automated device Tooth Transformer, which is able to transform autologous teeth in suitable grafting material, has been recently introduced. The aim of the present paper is to analyze the histologic outcomes in four hollow titanium cylinders 4.0-mm internal diameter and 8-mm length, termed "bone growing chambers" (BGC). BGC were inserted in two sheep mandibles: in the right side the BGC was filled by the tooth graft treated using a Tooth Transformer device while in the left side BGC was filled with tooth graft without any treatment (control group). After 2 months of healing the BGC were retrieved and histological analysis were performed.

Results

All titanium chambers were well osseointegrated after 2 months of healing. In the test group, newly formed bone mixed with tooth graft granules appeared incorporated in the new trabeculae and revealed no inflammatory or infective reactions against tooth graft. In the control group the tooth graft granules were not covered by new bone. This fact testified that the treatment using a new device (TT TOOTH TRANSFORMER SRL, Via Washington, 59 – Milan, Italy) is safe and increases the optimal bone response.

Discussion

Results from the present histological evaluation reveal that there are big differences between tooth grafts and they depend from the treatment performed. The success of the tooth graft treatment is established from the treatment performed.

Key Words: Tooth; Dentin Graft; Bone Regeneration

Introduction

The tooth grafting procedure has been introduced by Urist et al. more than 50 years ago, when they discovered the osteoinduction potential of demineralized dentin matrix [1-2].

It is clear that both bone and dentin matrix contained fundamental growth factors for bone regeneration. Dentin represent an efficient reserve of BMPs, bioactive growth factors (GFs), and transforming growth factor-B (TGF-B), which are well known to be involved in bone repairing processes [3]. Some authors theorized that the demineralization process allows better bone augmentation than non-demineralized dentin [4].

Demineralization is a required process to free growth factors and proteins, because the release of growth factors is blocked from the hydroxyapatite crystals [5].

The tooth graft without any treatment is contaminated and is not safe to use it in surgical procedure.

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Recently, an innovative medical device (TT TOOTH TRANSFORMER SRL, Via Washington, 59 – Milan, Italy) was introduced to the market. This device is used to obtain suitable tooth graft materials starting from the whole tooth of the patient. TT tooth Transformer ensures completely automated disinfection, grinding and demineralizing processes without any possible mistake induced by human manipulation. In vitro studies, testing the graft material obtained by this new device, demonstrate that the demineralization process leads to an increase of BMP-2 bioavailability [6].

The present paper aims to describe the histologic comparison between the Tt tooth transformer tooth graft procedure and the tooth graft without any disinfection and demineralizing processing.

Materials and Methods

Four hollow titanium cylinders, termed "Bone Growing Chambers" (BGC), have been used to contain the tooth graft. Two BGC cylinders were filled with the tooth graft treated using a Tooth Transformer device while other two were filled with tooth graft without any treatment (control group) .The dimensions of the BGCs were of 4.0-mm (internal diameter) and 8-mm (length).The cylinders were made of commercially pure titanium Grade 4. In the walls of the cylinders, a number of large holes, 2 mm in diameter, were created to allow bone in growth from the lateral bone surfaces. The upper and the lower end of the hollow cylinder were opened to allow bone in growth from the apical bone and the periosteum. One sheep was selected. The animal was given thiopental (Thiopental, Hoechst, Austria) for induction of anesthesia as needed. After or tracheal intubation and ventilation, anesthesia was sustained with nitrous oxide oxygen with 0.5% halothane. Physiologicsaline wasadministered for fluidreplacement.

The inferior edges of the mandible were exposed through ask in incision of 15 cm in length. The skin and facial layers were opened and closed separately. After dissection of the soft tissues exposing the bone edge, one BGC site was prepared in each (left and right) side of the mandibular inferior edge of each animal using standard drilling sequence under saline solution irrigation. One surgeon placed all titanium chambers. The drilling speed was set at 1000 rpm for all groups. In each animal, the right BGC was filled by the tooth graft made from Tooth Transformer while the left BGC was filled by tooth; only clean with diamond bur, without disinfection and demineralization process. 2 months after implantation the BGC were retrieved immediately fixed in 10% neutral buffered formalin. After dehydration, the specimens were infiltrated with a methyl methacrylate resin from a starting solution 50% ethanol/resin and subsequently 100% resin, with each step lasting 24 h. After polymerization, the blocks were sectioned and then ground down to about 40 µ. Toluidine blue staining was used to analyze the different ages and remodeling pattern of the bone. The histomorphometric analysis was performed by digitizing the images from the microscope through a JVC TK-C1380 Color Video Camera (JVC Victor Company, Yokohama, Japan) and a frame grabber.

The images were acquired with a ×10 objective including the entire implant surface.

Results

All the BGCs were integrated into the mandibular bone after 2 months of healing. At the surgical reentry the BGCs were visible on the crest mandible and easy to distinguish from the surrounding bone. Stable

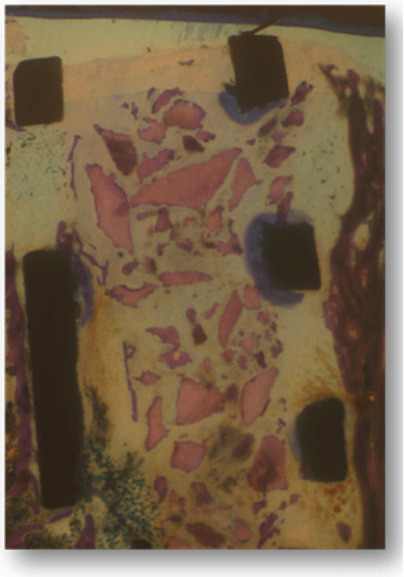

Figure 1

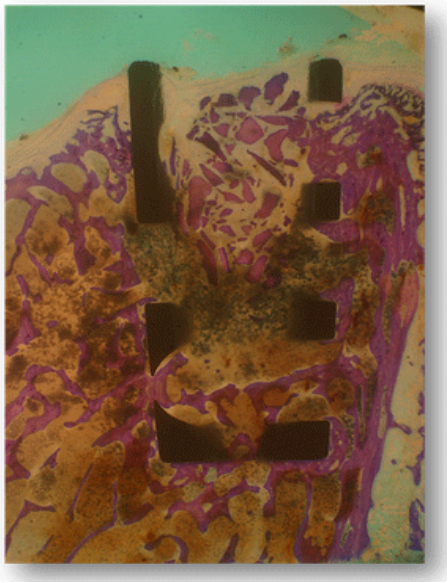

Figure 2

BGCs demonstrated the presence of bone tissue inside the hollow space. A healthy pattern of bone repair process was detected around and inside the chambers. A small amount of bone penetration inside the regenerating space was found in controls BGCs and the granules are not surrounded by new bone (Figure 1-2).

In BGCs filled with the Tooth Transformer grafting material (test group), the formation of a more compact bone structure was evident and composed of newly formed bone mixed with grafted granules almost completely incorporated in the new trabeculae of the newly formed bone (Figure 3-4).

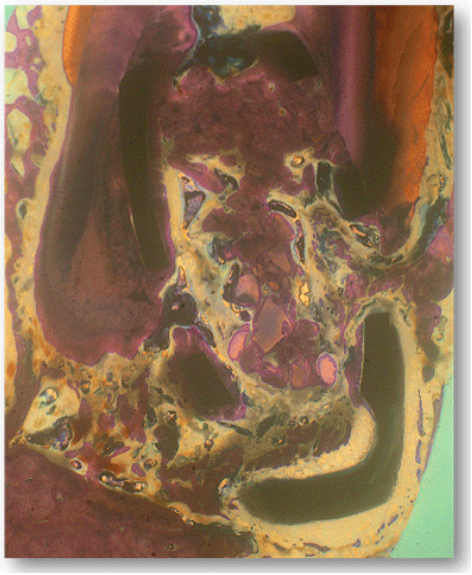

Figure 3

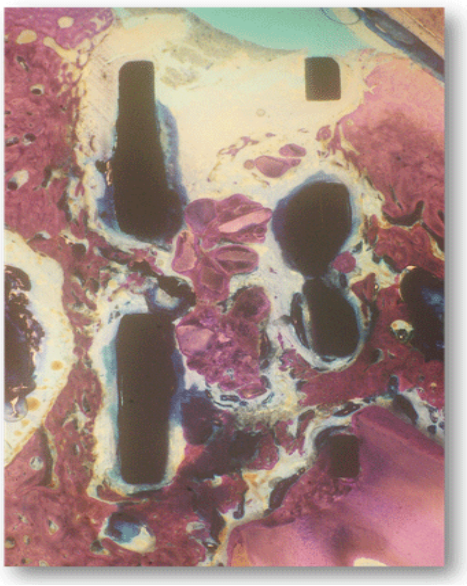

Figure 4

Discussion

The aim of the present study is to compare the regenerated tissue created using two different treatments: tooth graft only cleaned with bur (without any treatment) and tooth graft treated with Tt Tooth Transformer device. This device ensures completely automated disinfection, grinding and demineralizing.

The results of the present study clearly showed that the tooth graft obtained with a specific device has a better integration than the same tooth graft without any treatment.

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