

Treatment of Extended Periodontal Defects Using a β -TCP Composite Material

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Periodontitis – a Common Disease

Periodontitis is an inflammatory disease of the periodontal tissues. It is usually caused by microorganisms, leading to the degradation of connective tissues and alveolar bone and subsequent formation of soft-tissue pockets,¹ which in turn may result in mobility of the affected teeth, pain, loss of tooth function, and even loss of the teeth themselves. In fact, periodontitis is the main cause of tooth loss in adults.¹ More than a third of the U.S. population suffers from periodontitis, with 13% of all Americans being afflicted by a moderate to severe form of the disease.² In many cases, periodontally compromised teeth have to be extracted and replaced with a dental restoration, a costly and time-consuming procedure. Any therapy resulting in these teeth being preserved with reasonable effort is therefore highly welcome.

Over the past two years, we have developed a successful dual strategy for the treatment of large periodontal bone defects. The bacterial infection is contained systemically and locally, and the debrided pockets are filled with an easy-to-use synthetic bone graft substitute.

Treatment of Periodontal Defects

Patient History and Diagnosis

The preservation of severely periodontally compromised teeth should be attempted only if there is a good chance of success, taking significant systemic and local factors such as overall patient health, oral hygiene, tooth position, and tooth condition into account. The treatment described here is generally used for systemically healthy patients with moderate to good oral hygiene. Endodontic problems should be excluded first, and vital teeth are an advantage. The treated tooth should be part of a dental arch, i.e. preferably supported by neighboring teeth on either side, but at least by one neighboring tooth on the mesial side.

Preparations

The periodontal pockets are debrided and filled. Antibiotics are administered using 500 mg of amoxicillin and 400 mg of metronidazole three times daily.³ Antibiotic treatment starts three days ahead of the procedure and ends three days after its completion. Systemic antibacterial therapy may inhibit the growth of microorganisms in locations inaccessible to dental instruments or superficial bactericidal treatment.⁴ However, the effect of antibiotics on post-operative healing has not been sufficiently investigated due to the complexity of the disease and the many different contributing agents.^{5,6} Because smoking has been shown to have a highly negative influence on tissue healing following periodontal treatment,⁷ the patient is urgently advised to refrain from smoking, at least temporarily.

Immediately before the procedure itself, the microbiological load in the oral cavity is further reduced by professional tooth cleaning followed by a chlorhexidine digluconate rinse.

Debriding the Periodontal Pockets and Introducing Bone Replacement Material

The mucosa and the periosteal tissue are separated with a crestal incision in the interdental space and elevated vestibularly and lingually using a raspator. Care is taken to ensure that only the necessary minimum of soft tissue is separated from the bone. The granulation tissue is removed with sharp elevators and curettes. Any exposed bifurcation or trifurcation areas are carefully cleaned. Any remaining bacteria are inactivated using a photo-activated

disinfection (PAD) procedure: bacteria are selectively stained and subsequently eliminated by intensive light of a specific wavelength, without compromising the surrounding hard and soft tissues.

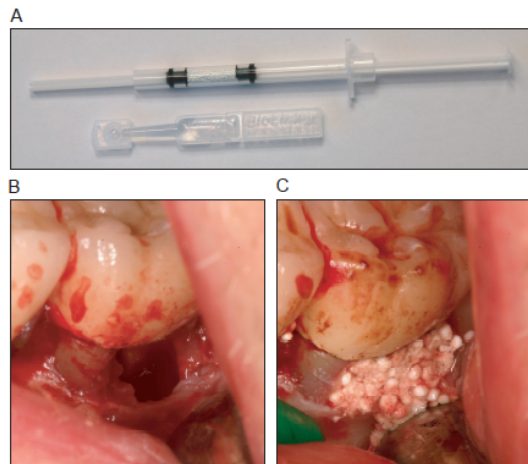


Figure 1. Bone substitute The β -TCP composite is mixed inside the syringe (A). The illustration shows a periodontal bone defect before (B) and after (C) introduction of the synthetic bone substitute. The wound can be sutured without membrane coverage, because the β -TCP composite within the defect hardens to form a porous body.

Filling bony periodontal defects with autologous bone or bone substitute has a positive influence on the clinical result.⁸ The bone substitute used (easy-graft™, Degradable Solutions AG, Schlieren, Switzerland) is a 100% synthetic composite material consisting of β -tricalcium phosphate (β -TCP) and a polylactide (PLGA); it is completely resorbable. The material is mixed in the applicator syringe (Fig. 1) and can be transferred directly from the syringe to the defect, where it hardens to form a porous, defect-congruent body. Prior to introducing the bone substitute, the bony walls of the defect are once again “freshened up” thoroughly to facilitate the adduction of blood. To fill the pockets as thoroughly as possible, the β -TCP composite is introduced incrementally and condensed with a spherical plugger. As the material will harden only when in contact with aqueous liquids such as blood and will continue to be moldable otherwise, the operator is in no hurry to complete this step. The amount of β -TCP to be introduced will depend on the level of the bone margin (Fig. 1B,C). To allow tension-free suturing, the defect should be overfilled only slightly. The wound is closed by adapting the flaps as appropriate and securing them in place with polypropylene sutures, making sure to avoid tension. No knots should be tied on top of the incision; if at all possible, they should be located vestibularly. No membrane is required to cover the bone substitute, as the β -TCP composite will harden, preventing any dislocation of granules. In addition to saving time and money, this has the advantage that the bone replacement material is accessible for cellular and vascular ingrowth. The individual β -TCP particles are coated with a thin layer of PLGA, which will be decomposed within a period of approximately 4 weeks. Uptake of bacteria into the microporous granulate during application of the material is prevented by this polymer layer. We have not witnessed any infection-related complications inside the replacement material to date.

Follow-up and Healing

Wound healing is checked one day after the procedure. The sutures are removed after 5 to 8 days. Patients are scheduled for control examinations at 6 weeks and 6, 12, and 18 months post-op. They are instructed not to eat during the first two hours following the procedure. During the first week, the surgical site is rinsed with chlorhexidine digluconate solution once daily, making sure the affected site is protected during regular oral hygiene procedures. Professional tooth cleaning is performed at six-month intervals. Patients will normally be asymptomatic after the procedure, although a slight increase in mobility of the affected tooth may occur during the first two days. The tooth will begin stabilizing from the third week onward. At this time, patients no longer have to protect the tooth, and the gingiva will hug the tooth closely.

Case 1

A 38-year-old male patient, a non-smoker with moderate to bad oral hygiene but no particular medical history otherwise, presented with a lower left first molar (tooth 36) with class 2 to class 3 tooth mobility. The radiograph showed a large periodontal defects zone (Fig. 2A). After exposing the bone, the defects were treated as described, and the wound was sutured (Fig. 2). At 3 and 12 months post-op, the tooth was firm (Fig. 3). At 2 years post-op, the situation continues to be stable, with the tooth still vital and well anchored (Fig. 4).

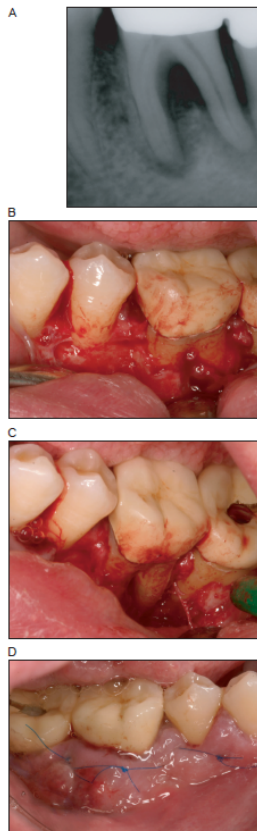


Figure 2. Baseline situation and treatment, Case 1 Pre-operative radiograph (A). The defect following exposure (B) and thorough removal of the granulation tissue (C). Status of wound healing after one day (D).

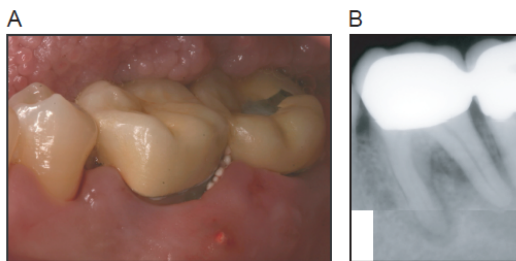


Figure 3. Short-term healing, Case 1 When the sutures were removed after eight days, a few bone substitute particles emerged (A). Radiological situation at 3 weeks post-op (B). The image shown here was composed of two individual images.

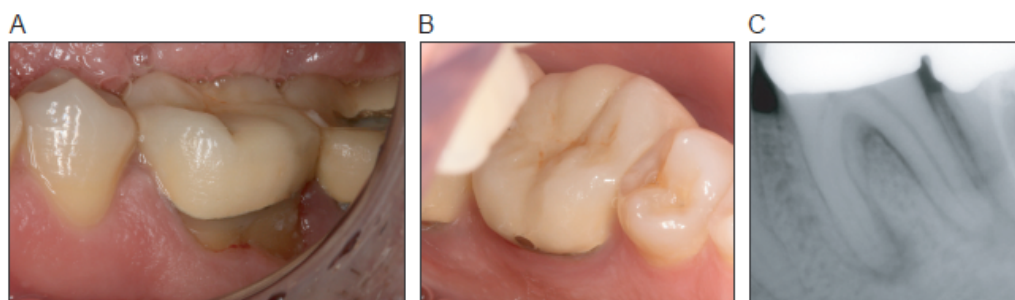


Figure 4. Case 1, 25 months post-op Clinical (A,B) and radiological (C) situation at 25 months.

Case 2

A 53-year-old female patient, a non-smoker with good oral hygiene, presented without any radiological evidence of a major periodontal defect (Fig. 5A). Her vital lower left first molar (tooth 36) was periodontally involved. The tooth exhibited no mobility, but once the bone was exposed, a pocket almost 20 mm in depth became evident (Fig. 5B,C). The defect had healed after 13 months; the gingiva hugged the tooth closely and was not irritated (Fig. 6).

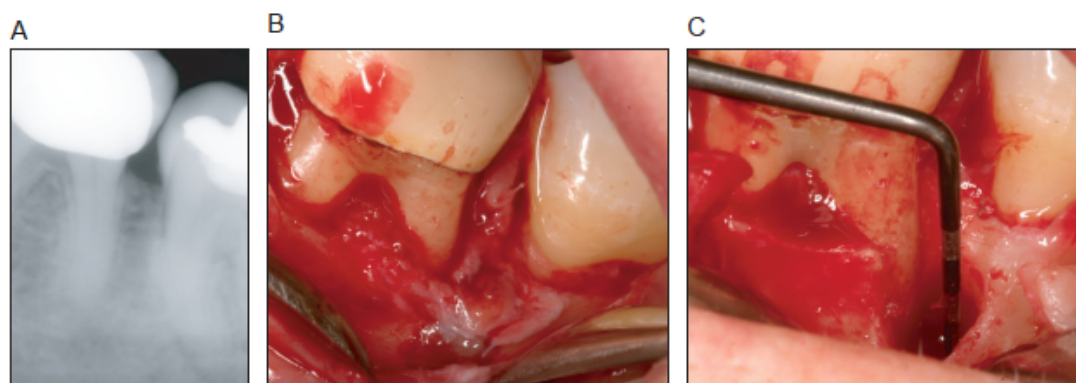


Figure 5. Baseline situation and treatment, Case 2 Baseline radiograph (A) A bone defect is not detectable. (B) A defect was clearly visible after elevating a flap (B) and (C) removing the granulation tissue.

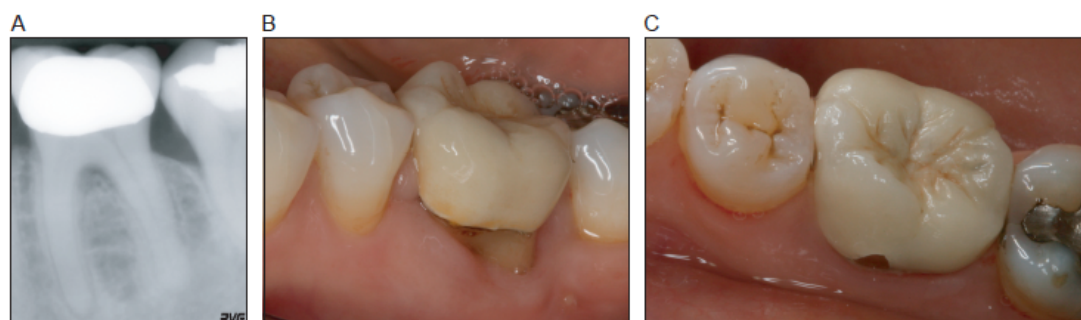


Figure 6. Case 2, 13 months post-op Radiograph (A) and clinical photographs (B,C).

Summary and Conclusion

Over the past two years, our office has treated severely periodontally compromised teeth using a method aimed at maximum elimination of the causative pathogens and regeneration of the bony defect. This type of treatment is recommended especially where preconditions are favorable (good systemic health, vital teeth with at least mesial support, adequate oral hygiene) in order to avoid tooth extractions and subsequent prosthetic restoration. The infection is commented at three levels: systemically by antibiotic therapy, panorally by professional tooth cleaning, mouth rinses and improved oral hygiene, and locally by thorough removal of the inflammatory tissue followed by photo-activated disinfection (PAD). The bony defects are filled with a β -TCP composite material for regeneration. This synthetic bone substitute is easy and efficient to use. It hardens to form a stable porous molded body inside the defect, making the use of membranes dispensable.

Since early 2007, we have been treating approximately 40 patients with the method presented here, with good overall results. Patients were asymptomatic; mobile teeth have become firm, and none of the teeth treated has had to be extracted to date.

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