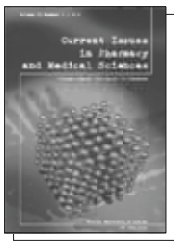

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The use of alloplastic biomaterials in the surgical treatment of aggressive periodontitis – a case report

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ABSTRACT

Periodontitis is a commonly encountered disease of the mouth, in man. This inflammatory process results in the impairment of the connective tissue attachment and alveolar bone resorption. Guided tissue regeneration, which aims at rebuilding the lost periodontal tissue and restoring its function, involves the use of barrier membranes and bone substitutes. This paper presents an aggressive periodontitis treatment with the use of a combination of alloplastic biomaterials applied in the anterior maxillary region of a 38-year-old female patient. The used biomaterials, i.e. hydroxyapatite and calcium sulfate, served as space fillers, the latter was also used as a barrier membrane. Satisfactory therapy results obtained in the patient were maintained throughout a 21-month postoperative follow-up period. Alloplastic materials appear to be useful in regeneration of the periodontal structures and may serve an alternative to xenografts and allogenic grafts.

Keywords: calcium sulfate, hydroxyapatite, bone regeneration.

INTRODUCTION

Effective periodontal treatment should aim at eradicating the existing inflammatory process, as well as rebuilding the lost periodontal tissue, i.e. the connective tissue attachment, periodontium, root cement and alveolar bone. Periodontal treatment may involve non-surgical or surgical treatment which relies on either resection or regeneration of the periodontal tissue. Non-surgical and conventional surgical methods make it possible to prevent further progress of periodontitis, but they have little effect on formation of the new alveolar bone and periodontal ligament. Instead, a connective tissue scar is formed [14]. Guided tissue regeneration enables rebuilding of the new root cement, periodontium and alveolar bone. This kind of treatment involves application of resorbable and non-resorbable barrier membranes and grafting biomaterials [18,6]. The use of biomaterials, together with barrier membranes, appears to bring better results than the use of bone substitutes alone [7]. Application of grafts as the deficient bone fillers is justified by their osteogenic, osteoinductive and osteoconductive qualities. Osteogenesis is characteristic of the materials which contain living osteoblasts (autologous bone). Osteoinductive materials are rich in bone growth stimulants, whereas osteoconductive grafts provide scaffolds for the ingrowing bone [2]. The use of a barrier membrane provides isolation of the connective and epithelial tissues from the bone defect, which gives the affected bone the time to heal and rebuild [14,18].

This paper gives an account of a regenerative treatment of bone defects in generalised aggressive periodontitis in which a combination of two alloplastic biomaterials, i.e. hydroxyapatite and calcium sulfate was used.

BACKGROUND

Calcium sulfate has long been used in the regeneration of bone defects. Dreesman was the first to report calcium sulfate application as a bone substitute in the late 1800s [17]. Other reports of calcium sulfate application go back to 1961 (Peltier), when this chemical, named "plaster of Paris", was used to fill bony defects, mainly of traumatic or TB origin [9]. Calcium sulfate is well tolerated and it resorbs thoroughly, hence, it carries no risk of inflammation [6]. The total resorption time is from 45–72 days, whereas complete bone regeneration takes 3 months [17]. This bone substitute is obtained from cheap and easily accessible raw materials, therefore it is relatively inexpensive. $CaSO_4$ may serve as a carrier for introducing medications or growth factors into the body [5,13]. It finds application in orthopedics and dentistry as a bone defect regenerative material, and is also used in the treatment of osteomyelitis, maxillary sinus lifting, alveolar ridge resorption prophylaxis and tissue augmentation in oral implantology. Despite its numerous advantages, $CaSO_4$ is not as popular as some other grafting materials, although recently, more and more professionals have been

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taking interest in its application [17]. The barrier capabilities of this material appear to be of particular significance in periodontal treatment, as calcium sulfate does not require the use of barrier membranes when applied as a hardening surface layer [5,16,8,1]. A study in dogs showed that the most effective bone regeneration was obtained with the use of PTFE (Gore Tex) membrane; the application of resorbable membranes (PLGA and collagen) alone brought about much worse clinical results, whereas calcium sulfate appears to be a possible alternative to PTFE membranes [20]. Application of a resorbable grafting material with barrier capabilities eliminates the necessity to perform a surgical removal of the nonresorbable membrane. Doing this always carries the risk of bone resorption.

Hydroxyapatite (HA) is one of the most common and well known alloplastic bone substitutes. Its chemical composition is similar to the minerals found in the human bones and teeth. Hydroxyapatite has found its application in orthopedics and dental surgery as a useful material for regeneration of bone defects. The chemical formula of this material is $Ca_{10}(PO_4)_6(OH)_2$. It is a non-toxic, well tolerated substance which triggers no allergic or inflammatory reactions. Another advantage of this synthetic compound is that during its manufacturing process, it is possible to obtain a highly porous structure of controlled porosity, usually from 200 to 800 μm [4]. Some scientific reports suggest that the size of pores in the 200–400 μm graft is most beneficial for angiogenesis, as well as for migration, adhesion and proliferation of the osteoblasts, which will eventually result in the overgrowth of the material by newly formed bone [4,15,3]. Because of its relatively low mechanical durability, the porous hydroxyapatite is not recommended for the use in the areas where large mechanical forces are in action. Granulated hydroxyapatite is a slowly resorbable material of low solubility, and even five years following the grafting, its total replacement by bony tissue may still be incomplete. The structure formed thereby exhibits lower mechanical qualities than the original bone. This should be taken into consideration when dental implant treatment is planned [3,21].

CASE REPORT

A 38-year-old female was referred to the dental clinic for a periodontal consultation and continuation of dental treatment after she had refused to undergo numerous tooth extractions prior to recommended complex implantological treatment. The main complaints of the patient were gum recessions and increased mobility of the anterior maxillary teeth. The intraoral examination revealed generalised aggressive periodontitis, Class 2 mobility (tooth moves in arc of more than 1 mm but less than 2 mm) of the upper and lower anterior teeth, as well as endo-perio syndrome affecting the tooth 11. The activity of the inflammatory process, which manifested itself as the periodontal tissues' tendency to bleed, was evaluated by means of bleeding on probing (BOP) [19], the results being 67%. The patient approved of the suggested treatment plan which included surgical, endodontic, periodontal and prosthodontic treatment with the use of fixed dentures. The tooth 27, which was surrounded by the granulation tissue, was extracted. The tooth 11 underwent endodontic treatment. The patient received detailed instructions on how to maintain proper oral hygiene. She also underwent scaling and root planning procedures. In the posterior regions of the alveolar ridge, curettages were performed. In the anterior maxilla, a resin enhanced wire splint was applied in order to stabilize the teeth. Next, the patient received pharmacological treatment in the form of a course of Rovamycin, 1500000 i.u. 2x1 daily and Metronidazole, 0,25g 3x1 daily. This combination of medicines was chosen because of its high efficacy against periodontal pathogens and possibly achievable high drug concentrations in the gingival crevicular fluid. The dose of Rovamycin can be reduced when used together with Metronidazole [12,11,10].

Fig. 1. Entry panoramic X-ray of the patient

Fig. 2. Panoramic X-ray of the patient 21 months after GTR

Following the conservative and pharmacological treatment, the BOP index decreased to 15%. Six weeks after the anti-inflammatory treatment, the probing pocket depth (PPD) and clinical attachment level (CAL) in the teeth 13,12,11,21,22,23 were examined (Table I). The hygienic regimen of the oral cavity was also inspected. Next, a guided tissue regeneration procedure in the region from the tooth 13 to 23 was carried out. During the procedure, a lack of labial cortical bone was revealed. Two alloplastic bone substitutes were used as defect fillers, i.e. BoneMedik-S, which is a coraline hydroxyapatite of granulation from 0.5–1 mm,

Table 1

Tooth	13				12				11				21				22				23			
	Before surgery																							
Pocket	D	P	L	M	D	P	L	M	D	P	L	M	M	L	P	D	M	L	P	D	M	L	P	D
PPD	7	2	2	7.5	6.5	2	2.5	5.5	8	3	5	7.5	6	1.5	1	3.5	5.5	2	2	6	7	2	2	6
CAL	8	3	3	8.5	8	3	5	7.5	10	3.5	7	9.5	6.5	1.5	2	3.5	5.5	3	2	7	8	2	2.5	7.5
	4 months after surgery																							
PPD_1	4	2	2	3.5	3	1.5	2	3.5	Tooth excluded from evaluation				3	1.5	0.5	3	3.5	2	1.5	4	3	1.5	1.5	3.5
CAL_1	5	2.5	3	5	5	2	5	4.5					4.5	1.5	2	2.5	3.5	2	1.5	5	4.5	2	2.5	4.5
ΔPPD_1	3	0	0	4	3.5	0.5	0.5	2					3	0	0.5	0.5	2	0	0.5	2	4	0.5	0.5	0.5
ΔCAL_1	3	0.5	0	3.5	3	1	0	3					2	0	0	1	2	1	0.5	2	3.5	0	0	3
	21 months after surgery																							
PPD_2	4.5	2	2.5	3.5	3	2	2	4	Tooth excluded from evaluation				3	2	0.5	3.5	3.5	1.5	1.5	4.5	3.5	2	1.5	3.5
ΔPPD_2	2.5	0	-0.5	4	3.5	0	0.5	1.5					3	-0.5	0.5	0	2	0.5	0.5	1.5	3.5	0	0.5	2.5

D – distal, P - palatal, L - labial, M – mesial, ΔPPD_1 – PPD reduction 4; months post-op; ΔPPD_2 - PPD reduction 21 months post-op; ΔCAL_1 - CAL reduction 4 months post-op

containing 1% of silicon mixed with Surgi Plaster G170, which is a calcium sulfate hemihydrate of granulation from 500–1000 μm. The barrier was made of a calcium sulfate powder (Surgi Plaster) mixed with a fluid to form a paste. The applied combination of these two chemicals made it possible to benefit from the slow resorption time of hydroxyapatite and barrier capabilities of calcium sulfate. Following the surgery, the patient was instructed to rinse her mouth with chlorhexidine digluconate and apply Solcoseryl ointment in order to enhance the healing process. A post-op control panoramic x-ray was taken. On intraoral performed three weeks later, a progressing recession in the tooth 11 was found. PPD and CAL measurements 4 months after the operation are shown in Table I. The mean PPD reduction ranged from 10% in the palatal pockets, to 47% in the distal pockets. The mean CAL reduction was from 6.9% in the palatal tooth surfaces, to 38.9% in the distal tooth surfaces (Table II). In the fifth month after the surgery, a porcelain bridge was fixed in the region between the teeth 15–24. In order to prevent pre-prosthetic endodontic treatment of the tilted teeth, an adhesive inlay-supported porcelain bridge was fixed in the lateral region of the maxilla. Because of financial reasons, the patient postponed prosthetic treatment of the mandible for 21 months after the operation, the results of the treatment, however, remained stable (Table II). At that time, it was not possible to assess CAL precisely because of the bridge covering the previously visible cemento-enamel junction. The patient was satisfied with the results.

Table 2.

	Comparison of mean values			
	D	P	L	M
PPD	5.8	1.8	2	6.3
CAL	6.8	2.5	2.9	7.2
	4 months after surgery			
PPD_1	3.5	1.4	1.8	3.3
CAL_1	4.4	2.1	2.7	4.4
ΔPPD_1	2.3	0.4	0.2	3
ΔPPD_1 (%)	39.66%	22.22%	10.00%	47.62%
ΔCAL_1	2.4	0.4	0.2	2.8
ΔCAL_1 (%)	35.29%	16.00%	6.90%	38.89%
	21 months after surgery			
PPD_2	3.8	1.5	2	3.5
ΔPPD_2	2	0.3	0	2.8
ΔPPD_2 (%)	34.48%	16.67%	0.00%	44.44%

Pockets: D – distal, P – palatal, L – labial, M – mesial. ΔPPD_1 – PPD reduction 4 months post-op; ΔPPD_2 – PPD reduction 21 months post-op; ΔCAL_1 – CAL reduction 4 months post-op

CONCLUSIONS

Psychological objections of the patients and a relatively high cost of the preparations are potential reasons why patients may refuse to undergo regenerative procedures involving sophisticated and expensive barrier membranes, allografts and xenografts. Therefore, alloplastic materials appear to be a useful alternative. Unfortunately, none of the available biomaterials meets all the requirements of the ideal bone substitute. For this reason, application of a combination of various grafts may bring better results. Long-term post operative observation suggests that the use of alloplastic materials makes it possible to achieve satisfactory and stable clinical results. The way in which the procedure is carried out, tooth stability during the healing process, as well as the patients' cooperation and commitment, are also of great importance. Any patient with diagnosed periodontitis should visit their dentist on a regular basis, since only in this way may any inappropriate oral hygiene habits be detected and corrected.

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