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Case report

RADIOGRAPHIC EVALUATION OF BONE FILLING IN INTRABONY PERIODONTAL DEFECTS WITH CERABONE® AS BONE REPLACEMENT GRAFT: CASE SERIES

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ABSTRACT

The regeneration of lost periodontal tissues due to periodontal disease remains a difficult clinical challenge. As clinicians, we look for procedures with improved predictability, beneficial impact on the treatment of periodontal disease, and in the long term – improvement of prognosis of the involved teeth.

Various types of grafting materials with substantial research evidence reporting on their efficacy have been introduced in regenerative periodontal therapy based on their ability to facilitate the reconstruction of the lost supporting apparatus. Consequently, the periodontal regeneration of intrabony defects involves not only the experience and skills of the clinicians but also the selection of suitable regenerative material.

The type of tissue filling in a periodontal defect after surgical treatment can only be precisely evaluated by histological means, and it is restricted to a few cases due to ethical reasons. Histologic studies have demonstrated regeneration potential for GTR, allografts, xenografts and growth factors. And since the periodontal regeneration includes the regrowth of alveolar bone, by using radiographs, changes of the alveolar crest may be used to monitor periodontal healing.

Our case series present the radiographic evaluation of the bone fill of 6 vertical bone defects treated with Cerabone®. The xenograft Cerabone® is a 100% pure bone mineral of bovine origin that has been successfully applied in regenerative dentistry and has been in use for more than 15 years in various medical applications (e.g. craniofacial surgery, oncology and hand and spine surgery).

Keywords: xenografts, periodontal regeneration, Cerabone®, vertical bone defects, radiographs

INTRODUCTION

The presence of periodontal osseous lesions is an important clinical reality. It is related to the loss of tooth support, to the site specificity of periodontal destruction, and to the possibility that the ecological niches (deep pockets) which are associated with the osseous lesions may represent site-specific risk factor or indicator for disease progression.

Each osseous defect affecting a specific tooth in the dentition of a certain patient presents unique anatomy. Aimed at guiding the clinicians with their diagnosis, treatment, and prognosis and based upon specific morphological criteria, classifications of periodontal osseous defects have been made. The intrabony defects have been classified according to their morphology in terms of residual bony walls. Three-wall, two-wall and one-wall defects have been defined on the basis of the number of residual alveolar bone walls. Frequently, intrabony defects present complex anatomy consisting of a three-wall component in the most apical portion of the defect and a two- and/or one-wall component in the more coronal portions. Such lesions are referred to as combined defects [1].

Often the periodontal treatment approaches and outcomes are assessed quantitatively on the defect angulation and defect depth observed on radiographs. The width of the intrabony component, measured as the angle that the bony wall of the defect forms with the root surface and the depth of the defect, measured as the distance in mm between the bottom of the defect and the alveolar crest are important morphological characteristics. Based on these parameters, there are certain radiographical classifications of vertical bone defects given by Steffensen and Weber, Papapanou and Wennstrom, Cortellini and Tonetti and Tsitoura et al.

Steffensen and Weber classify the vertical defects on the base of radiographic defect angle as:

a. Small angles (0–45°) b. Wide angles (45–90°) [2].

Papapanou and Wennstrom classify the defects depending on their depth of into:

a. Degree 1: up to 2 mm b. Degree 2: from 2.5 mm to 4 mm c. Degree 3: > 4.5 mm [3].

Cortellini and Tonetti classify the radiographic angle of the defects into:

a. Narrow angle - 25° or less b. Wide angle - 37° or more [4].

Tsitoura et al. proposed another classification system:

a. Narrow defect angle – angle of 22° or less

b. Intermediate defect angle-angle between 22° to 36°

c. Wide defect angle – angle of 36° or more [4].

Grafting of vertical bone defects is usually suggested when the intrabony component measures at least 3 mm in depth and is surrounded by two or three bony walls [5]. Autogenous bone was the most popular material when periodontal grafts were initially attempted [6]. Later on, other materials were tested in order to fill vertical bony defects in a predictable way. Allografts (especially demineralized freeze-dried bone), alloplasts and xenografts are now commonly used as bone substitutes in periodontal surgery.

For effective treatment, the chemical and physical properties of artificial bone should correspond to the replaced part of the bone tissue as closely as possible. The Cerabone® bone tissue substitute, hydroxyapatite $Ca_{10}(PO_4)_6(OH)_2$, is made of the mineral phase of bovine bone, which has maximum similarity to the human bone by the surface morphology, porosity and chemical composition [7]. Cerabone® presents with slow dissolution, rapid integration with the bone tissue and long-term dimensional stability of the implant. Its manufacturing process involves high-temperature procedures that remove all organic components and thus prevent possible immunological reactions [8]. The pure phase hydroxyapatite without organic components, the rough and open porous structure comparable to native human bone, the hydrophilicity, the biocompatibility and the rapid osseous integration make Cerabone® clinically successful [9]. The grafted site results with high volume stability and bone density.

METHODS AND MATERIALS

Four healthy and non-smoker patients with isolated intrabony defects were treated. Surgical access to the defect was provided by a sulcular incision performed on the facial and lingual, with the interproximal space being conserved by either papilla preservation or extending the incision interdentally as far as possible. The flaps were extended one tooth mesial and distal to the graft site and reflected to allow complete visualization of the intrabony lesion while minimizing the trauma to the soft tissue. The defect was debrided of all soft tissue using hand, ultrasonic, and rotary instruments. Following the granulation tissue removal, the radicular surface was scaled and planed, and the intrabony defects were filled with Cerabone®. The bone replacement graft material was packed into the defect to fill the defect to the level of the remaining alveolar bone. Flaps were closed and sutured for primary closure and complete coverage of the bone replacement graft. Sutures were removed from the 7th day up to the 10th day.

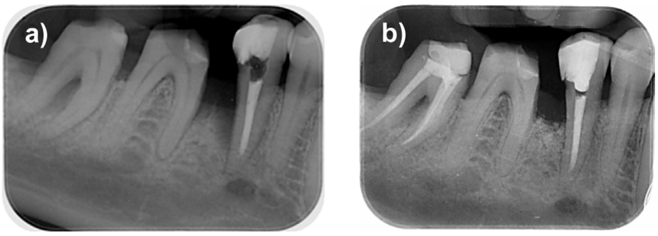
Radiographs were taken at baseline and 6 months after surgery. Radiographic defect fill was assessed by the difference between the defect depth before surgery and after 6 months.

RESULTS

Case 1

Intrabony defect associated with the right mandibular second premolar (fig.1)

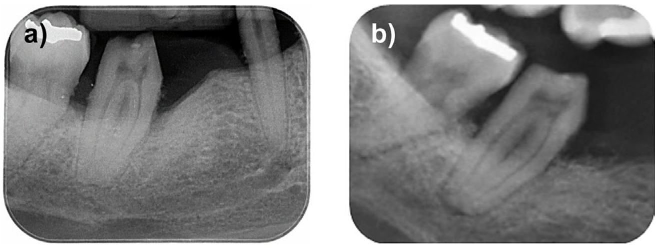
Fig. 1. a) Baseline radiograph showing the extent of the intrabony defect associated with the right mandibular premolar **b)** Rradiograph taken 6 months post surgically showing the complete radiographic bone fill



Case 2

Intrabony defect associated with the right mandibular second molar (fig.2)

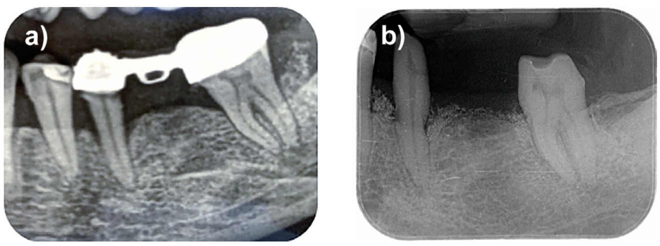
Fig. 2 a) Baseline radiograph showing the extent of the intrabony defect associated with the right mandibular molar **b)** Rradiograph taken 6 months post surgically showing the radiographic bone fill



Case 3

Intrabony defects associated with the left mandibular premolar and molar (fig.3)

Fig. 3. a) Baseline radiograph showing the extent of the intrabony defects associated with the left mandibular second premolar and molar **b)** Rradiograph taken 6 months post surgically showing the radiographic bone fill



Case 4

Intrabony defects associated with the left maxillary premolar (fig.4)

Fig. 4. a) Baseline radiograph showing the extent of the intrabony defect associated with the left maxillary second premolar **b)** Radiograph taken 6 months post surgically showing the radiographic bone fill.

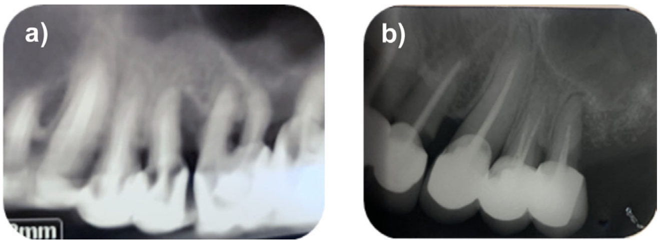


Table 1 summarizes the data from the radiographic assessment.

Table 1. Radiographc measurements at baseline and 6 months after surgery

CASE	TOOTH	Defect angle	X-ray measurements defect depth /mm/	
			before	after
1	45D	30°	5	0
2	47M	25°	3	0
3	35M	10°	3	0
	35D	26°	3	0
	37M	29°	3	0
4	25D	35°	4	1

DISCUSSION

Although radiographic evaluation of periodontal destruction is a complementary examination that has to be utilized together with the clinical examination, it has taken on a decisive role in establishing the state of the bone tissue.

Measuring the success in osseous grafting requires an analysis of all periodontal parameters and compareing them with the initial status. Though the ultimate test for regeneration is histological assessment, this measurement is often prevented in human trials by ethical considerations. At the same time, radiographs are a remarkable data source. They provide a permanent visual record of the bone support and allow for linear, area, and volume measurements of periodontal lesions.

Our case series show significant improvements in radiographic parameters for intrabony periodontal defects after treatment with Cerabone®. All grafted sites show radiographically defect fill. However, further studies should be directed toward long-term postsurgical evaluation for further confirmation of periodontal regeneration.

CONCLUSION

Radiographs are effective for identifying the bone-fill after regenerative periodontal surgery. Treatment of intrabony defects with Cerabone® demonstrates bone fill as evidenced by radiographic examinations performed on the 6th month. The above case series indicate that Cerabone® is a highly effective graft material in the elimination of interproximal vertical defects.

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