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ORIGINAL ARTICLE

Combination of bone allograft, barrier membrane and doxycycline in the treatment of infrabony periodontal defects: A comparative trial

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Abstract *Aim:* The purpose of the present study was to compare the regenerative potential of noncontained periodontal infrabony defects treated with decalcified freeze-dried bone allograft (DFDBA) and barrier membrane with or without local doxycycline.

Methods: This study included 48 one- or two-wall infrabony defects from 24 patients (age: 30–65 years) seeking treatment for chronic periodontitis. Defects were randomly divided into two groups and were treated with a combination of DFDBA and barrier membrane, either alone (combined treatment group) or with local doxycycline (combined treatment + doxycycline group). At baseline (before surgery) and 3 and 6 months after surgery, the pocket probing depth (PPD), clinical attachment level (CAL), radiological bone fill (RBF), and alveolar height reduction (AHR) were recorded. Analysis of variance and the Newman–Keuls post hoc test were used for statistical analysis. A two-tailed *p*-value of less than 0.05 was considered to be statistically significant.

Results: In the combined treatment group, the PPD reduction was 2.00 ± 0.38 mm (32%), CAL gain was 1.25 ± 0.31 mm (17.9%), and RBF was 0.75 ± 0.31 mm (20.7%) after 6 months. In the combined treatment + doxycycline group, these values were 2.75 ± 0.37 mm (44%), 1.5 ± 0.27 mm (21.1%), and 1.13 ± 0.23 mm (28.1%), respectively. AHR values for the groups without and with doxycycline were 12.5% and 9.4%, respectively.

Conclusion: There was no significant difference in the regeneration of noncontained periodontal infrabony defects between groups treated with DFDBA and barrier membrane with or without doxycycline.

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1. Introduction

Bone grafts can be used for reconstructing periodontal osseous defects and achieving new attachment for connective tissue fibers. Among the available graft materials, only autogenous bone and decalcified freeze-dried bone allograft (DFDBA)

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have histological evidence supporting their use in humans as regenerative materials (Darby, 2011; Rosen et al., 2000). In addition to patient-specific characteristics (plaque control, smoking habits, wound healing potential), factors related to the defect morphology, particularly the morphology of the remaining wall in the defect, may play important roles in regenerative outcomes (Cortellini et al., 1998; Park et al., 2014).

DFDBA has osteoinductive activity because it contains bone morphogenic proteins (BMPs). Decalcification of the graft exposes and may activate bone-inductive proteins in the bone matrix (Behfarnia et al., 2012). Studies have confirmed that the use of DFDBA can lead to the formation of new attachments (Darby, 2011). There are several advantages to using bone grafts with guided tissue regeneration (GTR). For example, bone grafts prevent membrane collapse inside the defect, improve space maintenance and clot stabilization, and facilitate the proliferation of osteogenic progenitor cells (Paolantonio et al., 2010; Sculean et al., 2008). Polylactic acid/polyglycolic acid (PLA/PGA) membrane is a synthetic bioabsorbable barrier membrane made from a copolymer of glycolide and lactide. Many studies have used PLA/PGA membrane in the treatment of infrabony defects (Aimetti et al., 2005; Kim et al., 2002).

Doxycycline facilitates regenerative therapy by initiating demineralization of the bone surface layer. This demineralization results in the release of osteogenic factors, such as transforming growth factor (TGF), insulin-like growth factor, and BMPs, which trigger bone induction (Kaur and Sikri, 2013). Doxycycline has anticollagenolytic and antiproteolytic properties that enhance the bone-forming ability via osteoblast cell chemotaxis and reduced bone resorption (Chaturvedi et al., 2008).

It could be beneficial to use local doxycycline with a bone graft in anatomically unfavorable infrabony defects, which are more vulnerable to oral contamination due to their noncontained nature and have inherently less osteogenic potential due to the smaller amount of remaining wall. However, little data are available comparing the combined use of DFDBA plus barrier membrane with and without local doxycycline in human periodontal infrabony defects. Therefore, the present study was undertaken to explore the beneficial effects of combined therapy with local doxycycline in noncontained periodontal infrabony osseous defects.

2. Materials and methods

2.1. Patients

This study included 48 infrabony periodontal defects (27 two-wall and 21 one-wall defects) in 24 patients (14 males and 10 females; age: 30–65 years) who were seen at the Outpatient Department of Periodontics, Aligarh Muslim University, Aligarh for treatment of moderate to severe chronic periodontitis. Inclusion criteria were the presence of contralateral one- and two-wall intraosseous infrabony defects with a pocket probing depth (PPD) of 5 mm or more and a defect depth (as assessed through bone probing) of 3 mm or more, as well as fewer than 20% of gingival sites exhibiting bacterial plaque (%PL+) or bleeding on probing (%BOP+). Exclusion criteria were any systemic disease, medication use, pregnancy or lactation, smoking habit, previous periodontal treatment, and furcation (according to Glickman). After recruitment of patients, the study protocol, risks, benefits, and procedures were explained, and written informed consent was obtained from every patient. All examinations, treatments, and procedures associated with this study followed the principles of the Declaration of Helsinki. The study was reviewed and approved by the ethics committee of Aligarh Muslim University.

2.2. Study design

The study was designed as a randomized, double-blinded study comparing the periodontal outcomes obtained when using DFDBA plus a barrier membrane with or without local doxycycline in the treatment of intrabony defects. A split-mouth design was used. Defects were randomly divided into two groups by a computer-generated system, according to treatment. The control group was treated with DFDBA and a barrier membrane (combined treatment group). The test group was treated with DFDBA, barrier membrane, and local doxycycline (combined treatment + doxycycline group). Defects were analyzed clinically and radiologically at baseline (before surgery) and 3 and 6 months after regenerative surgery by a single investigator for each surgical site.

2.3. Clinical and radiographic parameters

Every patient received a complete periodontal examination, oral hygiene instructions, and a thorough scaling and root planing session prior to surgery. Nonsurgical therapy and presurgery recordings were performed 4 weeks before surgery. Presurgical evaluation included %PL+ or %BOP+ sites, PPD, and clinical attachment level (CAL). Parameters associated with the defects were not significantly different between the control and test groups. PPD and CAL were recorded to the nearest millimeter with the help of a manual UNC-15 probe (Hu-Friedy Mfg. Inc., Chicago, IL) at the deepest point of the periodontal pocket, from the vertical groove in the acrylic stent on the occlusal surface.

Radiographic parameters included the radiographic bone fill (RBF) and resorption of alveolar bone height (alveolar height reduction, AHR). The distance from the reference point (radiographic cemento-enamel junction, CEJ) to the base of the defect (BD) and to the crest of the bone (CB), and the distance from the CB to the BD (radiologic defect depth, RDD) were measured. RBF was defined as the difference between the pre- and post-treatment measurements of RDD. AHR was defined as the difference between the pre- and post-treatment measurements of the distance from the radiologic CEJ to the alveolar bone height (ABH). Intraoral periapical radiographs were taken with the parallel cone technique and a customized film holder. An effort was made to obtain similar projection geometries and optical densities for the pre- and post-operative radiographs. Parameters were recorded to the nearest millimeter with a radiological grid (1×1 mm).

2.4. Surgical protocol

After administration of local anesthesia, intrasulcular incisions were made, and full-thickness mucoperiosteum flaps were