The Effect of Enamel Matrix Derivate Proteins EMD on Ortodontically Induced Bone Resorption Based on Mini-implants

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Amelogenine protein is the major component of the continuously secreted enamel extracellular matrix that controls the mineralization of enamel crystals. Emdogain™ is an extract of porcine fetal tooth material, a product based on the high degree of homology between porcine and human enamel proteins, composed primarily of amelogenine protein. It was created to promote the regeneration of periodontal tissues such as cementum, periodontal ligament and alveolar bone by stimulating normal development of these tissues, it is used to treat deep intraosseus defects.

Keywords: amelogenine, emdogain, bone resorbtion, orthodontics, periodontics

Tooth enamel is a unique entity among all mineralized tissues because of the presence of high mineral content. The dental enamel is made of hydroxyapatite and impurities such as the carbonates or the fluorine [1]. Its formation occurs through a transient collaborating network of enamel matrix proteins, which controls hydroxyapatite crystal growth and orientation [2]. The amelogenins of developing dental enamel are tissue-specific proteins, rich in proline, leucine, histidine and glutamyl residues, and synthesized by the ameloblast cells of the inner enamel epithelium [3]. Amelogenins constitute about 90% of the total enamel matrix proteins and constitute the bulk of enamel matrix and play a major role in enamel bio mineralization [4] The characteristic enamel crystals are different in morphology from those of bone and dentin that are small and plate-like shaped. Amelogenine protein is the major component of the continuously secreted enamel extracellular matrix that controls the mineralization of enamel crystals [4]. It is the resulting protein during tooth formation of Hertwig root sheath and plays a significant role in the emergence of acellular root cementum. Specifically, amelogenin has been show to accelerate the nucleation kinetics and induce ordering of apatite nanocrystallites [5-7]. Recent studies show that the periodontal regeneration mediated by EMD is based on the concept that it develops a supporting apparatus for epithelial cells and blood clot [7]. Emdogain is an extract of porcine fetal tooth material, a product based on the high degree of homology between porcine and human enamel proteins, composed primarily of amelogenine protein. It is a resorbable material, implantable and is supplied in a sterile, lyophilized syringe. It was create to promote the regeneration of periodontal tissues such as cementum, periodontal ligament and alveolar bone by stimulating normal development of these tissues; it is used to treat deep intraosseus defects. Many researchers reached the conclusion that Emdogain is able to significant improve probing pocket depth [8-10] compared to flap surgery used in the treatment of bone defects.

The aim of this study was to confirm the predictability of use of enamel matrix derivate proteins to regenerate the periodontal tissue in patients with a medical history of bone resorbtion after orthodontic treatment with fixed appliances.

Experimental part

The study was planned as a controlled trial involving 5 patients with a medical history of orthodontic treatment with fixed appliances followed by periodontal pockets and bone resorbtion. Inclusion criteria for treatment were: confirmed diagnosis of true periodontal pockets after orthodontic treatment with fixed appliances; the presence of at least one bone defect (1-2 walled affected); periodontal pocket depth less than or equal to 7 mm, and associated bone defect had to be 4 mm or more in depth, and 2 mm or more in width, according to X-rays; age 18-26 years old.

Exclusion criteria were: poor oral hygiene, smokers, the presence of systemic diseases linked to periodontal disease, periodontal treatment in the last 6 months.

After being clinically examined (fig 1), followed by periodontal screening (fig 2), the patients were examined radiologically with panoramic radiographs (OPT) (fig 3) before treatment. Also PCR (Polymerase Chain Reaction) analysis for pathogenic bacteria was performed through paper-point sampling (fig 4), using an identification kit MicroIDent Plus, Hain Lifescience, Germany.

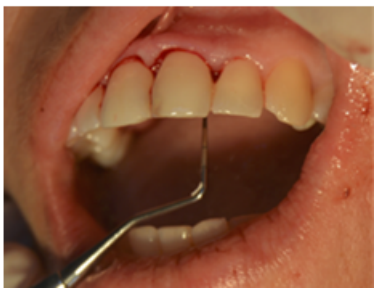

Fig.1 Clinical examination

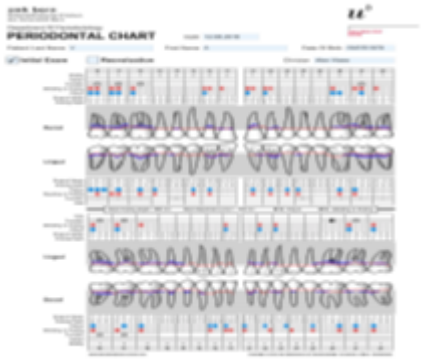

Fig.2 Periodontal screening

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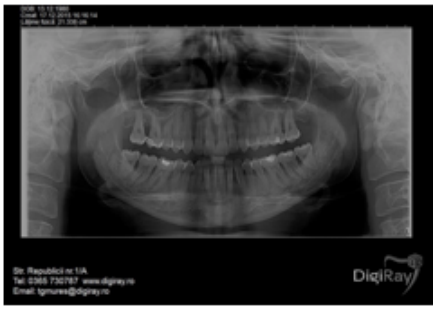

Fig.3 OPT X-ray before treatment

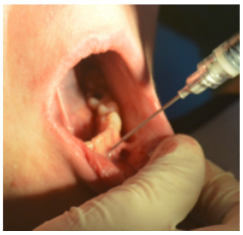

Fig. 5 Root surface conditioning with PrefGel

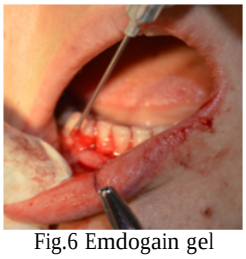

Fig.6 Emdogain gel application

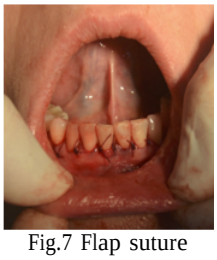

Fig.7 Flap suture

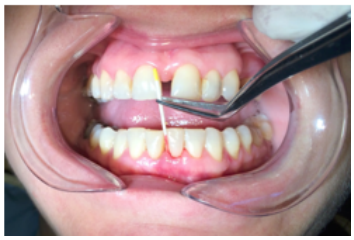

Fig. 4 Paper point sampling

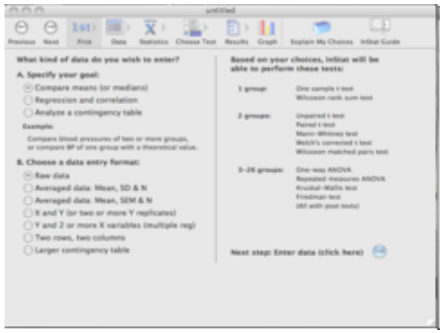

Fig.8 Instat GraphPad analysis

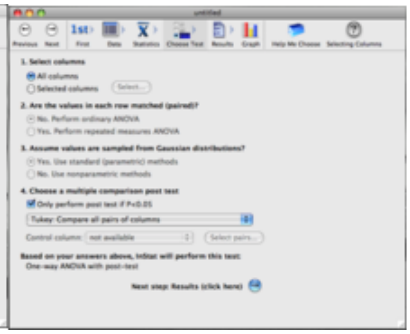

Fig.9 Fisher's exact test

After recording the initial clinical situation the patients underwent initial periodontal treatment, including manual debridement, antimicrobial therapy, patient education on proper brushing techniques and the use of oral hygiene aids. In the subsequent phase of the study, clinical and radiological bone attachment level was recorded and data were introduced in Microsoft Office Excel analysis program.

6 weeks after reassessing the subjects of sanitization and confirm the necessity of surgical therapy, all underwent surgery following protocol:

- anesthesia area of interest by: infiltration or Peripheral truncal anesthesia;
- incision: a horizontal incision in the package ± 1-2 tooth vertical incisions, starting from the horizontal to the bottom of the bag;
- mucoperiosteal flap reflection on the labial and / or oral tooth; for maintaining the viability of the flap irigation with saline solution was made;
- removal of granulation tissue adherent to the root surface to provide a better visibility on the root surface, removal of subgingival plaque and tartar;
- root surface conditioning with PrefGel 2 min (remove the smear layer) and then rinse thoroughly with water / sterile saline (fig.5);
- application of Emdogain Gel (fig.7) from apical to coronal on the root surface so as to cover all areas of exposed root surface, excess material being removed by applying pressure flap;
- flap reposition and suture (fig 7).

Statistical analysis

Data were recorded using the analysis software Microsoft Office Excel, and then was followed by Instat statistical analysis using the program GraphPad fig 8. For analysis was used Fisher's exact test figure 9, p-value was set at a confidence interval of 95%, p = 0.05

Results and discussions

Treatment effectiveness was evaluated at 6 months post surgery by measuring the reduction of pocket depth and the probing attachment gain. According to fig.10 and figure11 the average clinical attachment gain was 2.22 mm and the pocket depth value decrease from 4.36 mm to 1.48 mm, with an average of 2.88 mm. Post-operative checks revelead improved gingival bleeding index, plaque and tartar indices and reduced mobility of the tooth.

As stated in the study Illueca Alpista et al [11], most studies have been instituted strict maintenance protocols, which are generally applied in routine clinical situations. Even in these conditions, optimal treatment results are highly variable. Poor plaque control by the patient, and also a failure in maintenance visits are key factors in periodontal treatment outcomes and therefore may cause a reduction in the formation of new attachment and bone. This is supported by numerous published studies as support and Chambrone D et al [12] agreeing with the statement that indicates that the accumulation of de novo plaque causing a relapse of periodontal disease, even when a significant level attachment was obtained following treatment.

Characteristics	*Mean values in the study population*
Preop. Clinical attachment level	
Mean +/- SD	1.58 +/- 0.49
95% confidence interval	1.43-1.79
Postop. Clinical attachment level	
Mean +/- SD	3.8 +/- 0.8
95% confidence interval	3.17-3.63
Preop. Probing depth	
Mean +/- SD	4.36 +/- 0.66
95% confidence interval	4.17-3.54
Postop. Probing depth	
Mean +/- SD	1.48 +/- 0.88
95% confidence interval	2.17-2.63

Fig.10. Results

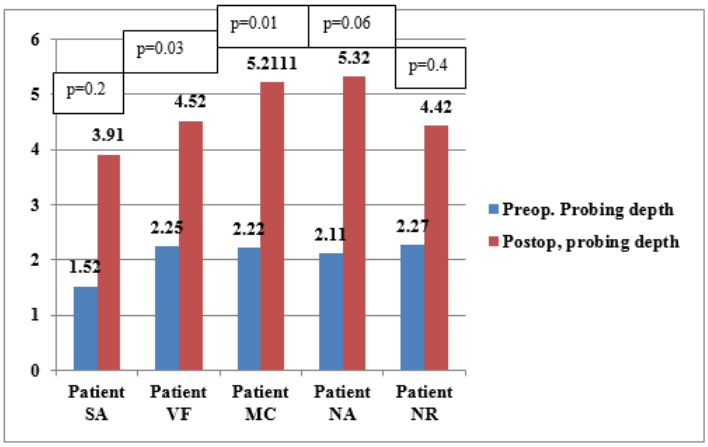

Fig.11 Individual results

Conclusions

For success in periodontal regeneration following EMD it is necessary to control important variables: root surface, the existence of progenitor cells, wound healing, control of plaque index, design of the flap and suture technique, postoperative indications. However, for continuous development and product improvement new methods are required for research in the future.

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