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Editorial

Adsorption of Enamel Matrix Derivative to Bone Grafts: Is the Devil in the Details

Yufeng Zhang[1*],Richard J. Miron[2]

[1]*The State Key Laboratory Breeding Base of Basic Science of Stomatology (Hubei-MOST) & Key Laboratory of Oral Biomedicine Ministry of Education, School & Hospital of Stomatology, Wuhan University, 237 Luoyu Road, Wuhan 430079, People's Republic of China.*

[2]*Faculté de medecinedentaire, Pavillon de médecinedentaire, 2420 rue de la Terrasse, Université Laval, Québec, Canada, G1V 0A6Department ofMedical Genetics, Faculty of Medical Sciences – State University of Campinas. Postal code: 13083-887.*

**Corresponding author:Yufeng Zhang, The State Key Laboratory Breeding Base of Basic Science of Stomatology (Hubei-MOST) & Key Laboratory of Oral Biomedicine Ministry of Education, School & Hospital of Stomatology, Wuhan University, 237 Luoyu Road, Wuhan 430079, People's Republic of China, Tel: 0086-27-62908278; Fax: 0086-27-87683260; E-mail: zyf@whu.edu.cn*

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Over 15 years has now passed since enamel matrix derivative (EMD) was shown to facilitate periodontal regeneration by stimulating new cementum, alveolar-bone and periodontal ligament formation [1-4]. The major component of EMD is a family of hydrophobic proteins,amelogenins, which account for more than 95% of the total protein content of the enamel matrix [5]. Other proteins found in the enamel matrix include enamelin, ameloblastin (also called amelin or sheathlin),amelotin, apin, and various proteinases [6, 7]. Despite the ability for EMD to facilitate periodontal regeneration, many clinicians have combined EMD with various bone grafting materials in order to improve the outcomes by preventing a flap collapse and improving blood clot formation [8-14]. Recently, the effects of EMD in combination with a bone grafting material were investigated in a systematic review [15]. It was found that while EMD was able to improve the regeneration with certain bone grafts, other types of materials have failed to improve clinical outcomes [15]. Thus, direct evidence supporting the combination approach is still missing and further investigation is required.

Recently we have been highly interested in investigating the adsorption properties of EMD to various bone grafting materials (data not published yet). It was found that the adsorption of amelogenin proteins to the surface of grafting material varied substantially based on the bone grafting surface topography, material chemical composition, as well as the delivery-system utilized for delivering enamel matrix proteins to the material surface. Emdogain®, which is the trademark name of EMD anddelivered in a propylene glycol alginate (PGA) carrier in gel-form adsorbed less protein to the surface of grafting particles, which easily dissociated from the graft surface following PBS rinsing. Emdogain® gel is formulated at a pH 5, and it is known that enamel matrix proteins aggregate and take their cellular effects more closely to pH 7 [16]. For these reasons, much interest is derived to study the adsorption properties of EMD to grafting materials. Our most recent in vitro studies combining the use of a bone grafting material with EMD have delivered enamel matrix proteins in a carbonate buffer at pH 7.4 and these studies elicit a significant up regulation of osteoblast differentiation markers and increases cell proliferation [17-20]. Currently our laboratory is investigating a new formulation of enamel matrix derivative with better physico-chemical properties which will be utilized specifically for mixing with bone grafting materials. As the surface characteristics and material composition vary quite significantly between bone grafting materials, it becomes a challenge in order to provide a more efficient way to deliver enamel matrix proteins to bone grafting material surfaces for the clinicians who wish to utilize this combination. In retrospect, it has become more and more obvious that the clinical variability in outcomes that exists between EMD with bone grafting material is largely governed by the adsorption of enamel matrix proteins to the material surface. This has led us to ask ourselves the question 'is the devil in the detail' when it comes to why so much variability exists in clinical outcomes obtained between clinical trials that have investigated the use of EMD in combination with various bone grafting materials.

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