IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 15, Issue 2 Ver. V (Feb. 2016), PP 31-32
www.iosrjournals.org

Periostin/Postn – a Philosopher's Stone in Periodontal and Translational Research

Dr Harshavardhan Patwal , Dr Nandini Manjunath, Dr Pooja Patwal

Abstract: *Periodontium consists of soft and hard tissues that are responsible for maintaining the teeth in their functional and anatomical positions throughout life bearing the functional and parafunctional loads at the same time. Periodontal ligament (PDL) is the specialized connective tissue that provides the teeth support owing to collagen fiber content, protection and neurosensory supply for performing masticatory function. PDL also provides a constant source of multipotent mesenchymal stem cells that differentiate into osteoblasts and cementoblasts throughout life. (Seo et al 2004). Therefore, PDL is important for periodontal healing, bone remodelling and tissue regeneration owing to its diverse fibrous and cellular and extracellular contents. (Beersten et al 1997) The present article will be looking into detail about a newly found key matricellular protein Periostin and its role in maintaining the integrity of the periodontium.*

I. Introduction

Periostin is a key extracellular matrix (ECM) responsible for periodontal homeostasis. (Kii and kudo et al 2007, anastasilakis et al 2013, romanos et al 2013). It is a gla domain vit K dpendant protein. It is also called as POSTN, PN, osteoblast-specific factor OSF-2. First cloning of POSTN was reported 20 years back. In humans periostin gene (POSTN) is encoded by 835 amino acids. It contains a 90-kDa in its full-length isoform which has 4 tandems, Fas domains. Periostin was first considered as a highly conserved osteoblast-restricted adhesion molecule. But now, it is considered as an important regulator of matricellular dynamics relevant to cancer biology, cardiovascular diseases, pulmonary morphogenesis and dental and periodontal conditions (rios 2014). PDL –specific periostin is identified which regulates cytodifferentiation and mineralization in periodontium (yamada et al, 2014)

There are several isoforms of periostin that are identified. They are large type and tissue specific type. The larger ones are full length 90-87 kDa isoforms, normally secreted by neuro-ectodermal derived fibroblasts and usually associates with pathological responses. The tissue specific types are modulators of the specific tissues. They are more physiologic and stable, regulate cell function and cell matrix interactions and also act as mechanosensors. (takeshita et al 1993, horiuchi et al 1999, litvin et al 2004, kim et al 2008, bai et al 2010).

The PDL-specific mechanism of periostin reported by Yamada et al regulates the cytodifferentiation and mineralization in periodontium. This human PDL-specific periostin variant can regulate FAK signaling and upregulate mineralization when overexpressed, in vitro. Thus in speculation with Yamada's observation, the PDL-specific periostin is helpful only iof it is transient. That is, it should diminish once the inflammation reduces or else, the normal tissue function is compromised. (rios 2014)

Since PDL helps the tooth bear the masticatory load, it requires to have enough tensile strength in its collagen content. Periostin knockout mice are unable to sustain normal physiological occlusal forces, causing destruction of periodontium, advanced bone loss, severe clinical attachment loss and significant widening of PDL region (rios et al 2005). Periostin is shown to interact with several ECM molecules such as type I collagen and tenascin to increase the collagen fiber diameter and thus the tissue strength by increasing the modulus of elasticity. It has a high binding affinity to $\alpha_\gamma\beta_3$ integrin receptors, which triggers AKT/PKB signaling and thus increases the fibroblast and epithelial/endothelial migration. It also activates the mTOR signaling pathway, thus increasing the proliferation. Periostin expression is regulated by TGF-β in response to mechanical stimulation. Periostin is important in maintaining the functional and structural integrity of periodontium to ensure anchorage of teeth to maintain craniofacial homeosatsis. (rios et al 2005, 2008, ma et al 2011) In consideration with its increased levels in post-surgical healing phases and on active delivery, its role in stabilizing ECM and promoting periodontal cell activity can be applied therapeutically. Periostin can be a promising therapeutic tool in periodontal wound healing and regeneration, alas, studies to potentiate these possibilities needs to be undertaken.

Periostin is predominantly expressed in collagen rich tissues like perichondrium, ligaments, tendons, heart, periosteum amd peridontium. It has a role in normal cardiovascular development. Its an important structural mediator in the development of heart. In adult heart, it helps tissue recovery and healing by modulating repair mechanism after pathological insults and myocardial infarction (dorn 2007, Kuhn et al, 2007, shimazaki et al 2008, shimazaki and kudo 2009, segers and lee 2010). Periostin deficient animals show significantly poor healing post myocardial infarction and periodontal destruction. Regulation of periostin like

molecules can help determine the adaptive, regenerative and reparative responses of the tissue by modulating functions among important growth factors, cytokines and proteases, thus allowing proper healing and function. (rios 2014) Increase in periostin levels in infracted tissues results from its deposition by the circulating fibroblasts. This regulates cellular interaction and matrix organisation.

II. Summary

Thus periostin plays an important role in structural and functional integrity of both dental and cardiac tissues. Owing to its role in regenerative and reparative capacities of the peridotnal tissues it shows a promising therapeutic role in future periodontal therapy. But, exact mechanisms as to how the concentration of periostin is going to affect the regeneration and repair and also its transient requirement depending on the tissue conditions needs to be evaluated in detail.

References

[1]. Bai Y, Nakamura M, Zhou G, Li Y, Liu Z, Ozaki T, et al. (2010). Novel isoforms of periostin expressed in the human thyroid. Jpn Clin Med 1:13-20.
[2]. Horiuchi K, Amizuka N, Takeshita S, Takamatsu H, Katsuura M, Ozawa H, et al. (1999). Identification and characterization of a novel protein, periostin, with restricted expression to periosteum and periodontal ligament and increased expression by transforming growth factor beta. J Bone Miner Res 14:1239-1249.
[3]. Kim CJ, Isono T, Tambe Y, Chano T, Okabe H, Okada Y, et al. (2008). Role of alternative splicing of periostin in human bladder carcinogenesis. Int J Oncol 32:161-169.
[4]. Kuhn B, del Monte F, Hajjar RJ, Chang YS, Lebeche D, Arab S, et al. (2007). Periostin induces proliferation of differentiated cardiomyocytes and promotes cardiac repair. Nat Med 13:962-969.
[5]. Litvin J, Selim AH, Montgomery MO, Lehmann K, Rico MC, Devlin H et al. (2004). Expression and function of periostin-isoforms in bone. J Cell Biochem 92:1044-1061.
[6]. Ma D, Zhang R, Sun Y, Rios HF, Haruyama N, Han X, et al. (2011). A novel role of periostin in postnatal tooth formation and mineralization. J Biol Chem 286:4302-4309.
[7]. Rios H, Koushik SV, Wang H, Wang J, Zhou HM, Lindsley A, et al. (2005). Periostin null mice exhibit dwarfism, incisor enamel defects, and an early-onset periodontal disease-like phenotype. Mol Cell Biol 25:11131- 1144.
[8]. Rios HF, Ma D, Xie Y, Giannobile WV, Bonewald LF, Conway SJ, et al. (2008). Periostin is essential for the integrity and function of the periodontal ligament during occlusal loading in mice. J Periodontol 79:1480-1490.
[9]. 8 Segers VF, Lee RT (2010). Protein therapeutics for cardiac regeneration after myocardial infarction. J Cardiovasc Transl Res 3:469-477.
[10]. Shimazaki M, Kudo A (2009). [Periostin, acting in regeneration of periodontal ligament, contributes to cardiac healing and tumor capsule formation].Fukuoka Igaku Zasshi 100:67-74 [article in Japanese].
[11]. Shimazaki M, Nakamura K, Kii I, Kashima T, Amizuka N, Li M, et al. (2008). Periostin is essential for cardiac healing after acute myocardial infarction. J Exp Med 205:295-303.
[12]. Takeshita S, Kikuno R, Tezuka K, Amann E (1993). Osteoblast-specific factor 2: cloning of a putative bone adhesion protein with homology with the insect protein fasciclin I. Biochem J 294(Pt 1):271-278.
[13]. Yamada S, Tauchi T, Toshihito A, Maeda K, Kajikawa T, Yanagita M, et al. (2014). Characterization of a novel periodontal ligament-specific periostin isoform. J Dent Res 93:891-897.
[14]. Dorn GW 2nd (2007). Periostin and myocardial repair, regeneration, and recovery. N Engl J Med 357:1552-1554.