Periodontal Regeneration

Subjects: Dentistry, Oral Surgery & Medicine
Contributor: Leonardo Mancini, Adriano Fratini, Enrico Marchetti

Periodontal regeneration is a technique that aims to regenerate the damaged tissue around periodontally compromised teeth. The regenerative process aims to use scaffolds, cells, and growth factors to enhance biological activity.

Keywords: periodontal regeneration ; GTR ; biomaterials ; growth factors ; biologics ; periodontitis

Periodontitis is a multifactorial disease characterized by microbially-associated, host-mediated inflammation that results in loss of periodontal attachment, eventually leading to tooth loss [1]. Periodontitis is the sixth most prevalent disease for mankind [2] and is a public health problem since it is so widely prevalent, causes disability [3], and numerous clinical and experimental studies have shown the presence of an association between periodontitis and some systemic diseases, in particular cardiovascular diseases, diabetes, lung diseases, and pregnancy complications [4][5]. The goal of periodontal therapy is to arrest progressive attachment loss, through the control of infection, to prevent tooth loss [6]. Probing pocket depth reduction as a surrogate outcome variable is validated by data demonstrating lower risk for disease progression and tooth loss [7][8] associated with the absence of bleeding on probing [9][10]. Periodontal pockets related to intraosseous defects often remain after nonsurgical treatment and could increase risk of progressive periodontitis [11][12] and, as such, are often considered to require surgical intervention. Based on the studies of Melcher (1976) [13], who developed the concept of using barrier membranes to “guide” the biological process of wound healing, in the mid-1980s clinical reports showed that intraosseous defects have potential for healing through regeneration using barrier membranes [14][15]. Today we know which bio-clinical principles regulate periodontal regeneration: wound stability, space provision, and primary intention healing [16]. Many randomized controlled trials and systematic reviews have shown that periodontal regenerative therapies can achieve better treatment outcomes compared to open flap debridement in the treatment of angular defects [17][18][19]. Several techniques and biomaterials have been studied for periodontal regeneration of intraosseous defects, but from a histological and clinical point of view, guided tissue regeneration (GTR), enamel matrix derivatives (EMD), and decalcified freeze-dried bone allograft (DFDBA) are the most effective approaches to periodontal regeneration [20][21][22][23][24]. A recent consensus report of the American Academy of Periodontology recommended surgical intervention as the treatment of choice for intraosseous defects [25].

References

1. Tonetti, M.S.; Eickholz, P.; Loos, B.G.; Papapanou, P.; van der Velden, U.; Armitage, G.; Bouchard, P.; Deinzer, R.; Dietrich, T.; Hughes, F.; et al. Principles in prevention of periodontal diseases: Consensus report of group 1 of the 11th European Workshop on Periodontology on effective prevention of periodontal and peri-implant diseases. J. Clin. Periodontol. 2015, 42, S5–S11.
2. Kassebaum, N.J.; Bernabé, E.; Dahiya, M.; Bhandari, B.; Murray, C.J.; Marcenes, W. Global burden of severe periodontitis in 1990–2010: A systematic review and meta-regression. J. Dent. Res. 2014, 93, 1045–1053.
3. Baehni, P.; Tonetti, M.S.; Group 1 of the European Workshop on Periodontology. Conclusions and consensus statements on periodontal health, policy and education in Europe: A call for action--consensus view 1. Consensus report of the 1st European Workshop on Periodontal Education. Eur. J. Dent. Educ. Off. J. Assoc. Dent. Educ. Eur. 2010, 14, 2–3.
4. Kinane, D.; Bouchard, P.; On Behalf of Group E of the European Workshop on Periodontology. Periodontal diseases and health: Consensus Report of the Sixth European Workshop on Periodontology. J. Clin. Periodontol. 2008, 35, 333–337.
5. Romandini, M.; Baima, G.; Antonoglou, G.; Bueno, J.; Figuero, E.; Sanz, M. Periodontitis, Edentulism, and Risk of Mortality: A Systematic Review with Meta-analyses. J. Dent. Res. 2021, 100, 37–49.
6. Hujoel, P.P. Endpoints in periodontal trials: The need for an evidence-based research approach. Periodontol. 2000 2004, 36, 196–204.

7. Claffey, N.; Egelberg, J. Clinical indicators of probing attachment loss following initial periodontal treatment in advanced periodontitis patients. J. Clin. Periodontol. 1995, 22, 690–696.
8. Matuliene, G.; Pjetursson, B.E.; Salvi, G.E.; Schmidlin, K.; Brägger, U.; Zwahlen, M.; Lang, N.P. Influence of residual pockets on progression of periodontitis and tooth loss: Results after 11 years of maintenance. J. Clin. Periodontol. 2008, 35, 685–695.
9. Lang, N.P.; Adler, R.; Joss, A.; Nyman, S. Absence of bleeding on probing. An indicator of periodontal stability. J. Clin. Periodontol. 1990, 17, 714–721.
10. Schätzle, M.; Löe, H.; Lang, N.P.; Bürgin, W.; Anerud, A.; Boysen, H. The clinical course of chronic periodontitis. J. Clin. Periodontol. 2004, 31, 1122–1127.
11. Papapanou, P.N.; Wennström, J. The angular bony defect as indicator of further alveolar bone loss. J. Clin. Periodontol. 1991, 18, 317–322.
12. Rams, T.E.; Listgarten, M.A.; Slots, J. Radiographic alveolar bone morphology and progressive periodontitis. J. Clin. Periodontol. 2018, 89, 424–430.
13. Melcher, A.H. On the repair potential of periodontal tissues. J. Periodontol. 1976, 47, 256–260.
14. Nyman, S.; Lindhe, J.; Karring, T.; Rylander, H. New attachment following surgical treatment of human periodontal disease. J. Clin. Periodontol. 1982, 9, 290–296.
15. Gottlow, J.; Nyman, S.; Lindhe, J.; Karring, T.; Wennström, J. New attachment formation in the human periodontium by guided tissue regeneration. Case reports. J. Clin. Periodontol. 1986, 13, 604–616.
16. Susin, C.; Fiorini, T.; Lee, J.; De Stefano, J.A.; Dickinson, D.P.; Wikesjö, U.M. Wound healing following surgical and regenerative periodontal therapy. Periodontology 2000 2015, 68, 83–98.
17. Cortellini, P.; Tonetti, M.S. Clinical and radiographic outcomes of the modified minimally invasive surgical technique with and without regenerative materials: A randomized-controlled trial in intra-bony defects. J. Clin. Periodontol. 2011, 38, 365–373.
18. Pagliaro, U.; Cortellini, P.; Nieri, M.; Rotundo, R.; Cairo, F.; Pini-Prato, G.; Carnevale, G.; Esposito, M. Author's Response: Re: Finkelman RD. Letter to the Editor: Re: "Clinical Guidelines of the Italian Society of Periodontology for the Reconstructive Surgical Treatment of Angular Bony Defects in Periodontal Patients". J. Clin. Periodontol. 2009, 80, 722.
19. Tu, Y.K.; Woolston, A.; Faggion, C.M. Do bone grafts or barrier membranes provide additional treatment effects for infrabony lesions treated with enamel matrix derivatives? A network meta-analysis of randomized-controlled trials. J. Clin. Periodontol. 2010, 37, 59–79.
20. Bowers, G.M.; Chadroff, B.; Carnevale, R.; Mellonig, J.; Corio, R.; Emerson, J.; Stevens, M.; Romberg, E. Histologic evaluation of new attachment apparatus formation in humans. Part I. J. Periodontol. 1989, 60, 664–674.
21. Cortellini, P.; Pini Prato, G.; Tonetti, M.S. Periodontal regeneration of human infrabony defects. II. Re-entry procedures and bone measures. J. Periodontol. 1993, 64, 261–268.
22. Sculean, A.; Donos, N.; Blaes, A.; Lauermann, M.; Reich, E.; Brecx, M. Comparison of enamel matrix proteins and bioabsorbable membranes in the treatment of intrabony periodontal defects. A split-mouth study. J. Periodontol. 1999, 70, 255–262.
23. Sanz, M.; Tonetti, M.S.; Zabalegui, I.; Sicilia, A.; Blanco, J.; Rebelo, H.; Rasperini, G.; Merli, M.; Cortellini, P.; Suvan, J.E. Treatment of intrabony defects with enamel matrix proteins or barrier membranes: Results from a multicenter practice-based clinical trial. J. Periodontol. 2004, 75, 726–733.
24. Needleman, I.G.; Worthington, H.V.; Giedrys-Leeper, E.; Tucker, R.J. Guided tissue regeneration for periodontal infra-bony defects. Cochrane Database Syst. Rev. 2006, CD001724.
25. Kao, R.T.; Nares, S.; Reynolds, M.A. Periodontal regeneration—Intrabony defects: A systematic review from the AAP Regeneration Workshop. J. Periodontol. 2015, 86, S77–S104.