Platelet-Rich Fibrin in Bone Regenerative

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Background: Preservation of the alveolar bone is determinant in the outcome of orthodontic treatment. Alveolar bone defects or decrease of its height and width may occur due to common reasons such as inflammation, tooth extraction or cleft lip and palate. The aim of this systematic review was to investigate and appraise the quality of the most up to date available evidence regarding the applications and effects of platelet-rich fibrin (PRF) in orthodontics. Methods: This study was carried out according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines using the following databases: Medline via PubMed, Cochrane Library, Web of Science Core Collection and EMBASE. The qualitative assessment of the included studies was performed using Cochrane Risk of Bias tool and ROBINS-I guidelines. Results: From a total of 489 studies, 9 studies were selected. The majority of the included studies demonstrate that autogenous anterior iliac graft with PRF had higher amount of newly formed bone. Furthermore, this review also suggests that application of platelets derivatives in the extraction socket can accelerate orthodontic tooth movement. Conclusion: Despite the limitations in the included studies, this systematic review suggested that PRF can improve alveolar cleft reconstruction and orthodontic tooth movement.

Orthodontics Bone Regeneration Platelet Rich Fibrin Platelet concentrate

1. Introduction

Regenerative therapy in oro-dental and maxillo-facial defects is challenging because the oral cavity has several tissues with distinct cell populations (ectodermal and mesodermal), making regenerative procedures more complex[1]. Bone and soft tissue regeneration may be indicated for managing defects subsequent from several conditions, such as congenital defects (cleft lip and palate), alveolar bone resorption, periodontal defects (recession coverage and furcation defects), cystic cavities, bone infection (osteomyelitis), and traumatic bone destruction [1][2][3][4].

Platelet derivatives are increasingly used in regenerative dentistry, particularly in implantology, oral surgery, and periodontology. Choukroun et al. reported that the platelet-rich fibrin (PRF) improves tissue repair and regeneration. PRF is prepared from centrifuged autologous blood with no addition of bovine thrombin or anticoagulants [5].

This fibrin matrix contains platelets, leukocytes, growth factors and cytokines, such as interleukin (IL)-1β, IL-4, and IL-6, transforming growth factor-beta1 (TGF-β1), platelet-derived growth factor (PDGF), and vascular endothelial growth factor (VEGF) [5][6]. These factors can promote the proliferation/differentiation pathways of osteoblasts,

endothelial cells, chondrocytes, and various sources of fibroblasts, which can stimulate the regenerative capacity of periosteum and enhance bone and tissue repair and regeneration [7].

Tissue regeneration is a new emerging approach in orthodontics because a high percentage of patients need both regeneration and orthodontic treatment. Orthodontic treatment can be performed on children, young adults, and adults. All of these patients may need regenerative approaches due to different indications (e.g., children with cleft lip and palate who need closure of alveolar cleft; older patients who need an orthodontic treatment due to bone defect as a result of tooth loss). Moreover, the application of mechanical force on the teeth affects the periodontal ligament and the alveolar bone, which allows orthodontic tooth movement (OTM) [8]. Thus, a change in support structures may interfere with orthodontic success. Therefore, the use of PRF can improve orthodontic treatment results, since it promotes a biological response involving a minimally invasive procedure. During recent years, clinical applications and effects of PRF in regenerative dentistry have been reviewed, but studies on the application of PRF in orthodontics are sparse.

2. Objective

The purpose of this entry was to systematically investigate and appraise the quality of the most up to date available evidence from human studies regarding the applications and effects of PRF in orthodontics.

3. Main Results/Discussion

A total of 9 studies were included. Six studies investigated the efficacy of PRF in maxillary alveolar cleft reconstruction and three articles investigated tooth movement and post-orthodontic stability. Three studies were judged as having high risk of bias, two trials were judged as low risk of bias and the remaining studies were considered as unclear risk.

Orthodontic treatment combined with surgical approaches is a common procedure in cleft lip and palate patients. Alveolar cleft reconstruction with bone graft allows the adequate volume of alveolar bone, which is fundamental for the dental movement in the maxillary aesthetic zone throughout the orthodontic treatment. PRF membranes promote soft tissue healing functioning like a matrix to support neoangiogenesis, and migration of stem cells and osteoprogenitor cells into the graft [5].

Regarding orthodontic tooth movement, the two trials included in the present systematic review showed that the use of PRF or L-PRF in the extraction socket could accelerate OTM ($p=0.006$), specifically in the beginning of orthodontic treatment (alignment and leveling) [9][10]. Thus, the application of PRF may shorten the orthodontic treatment time reducing associated costs, which nowadays is a concern in orthodontic patients, specifically in adults and patients with longer treatments such as those needing tooth extractions.

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