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Narative Review

Effect of Leukocyte-Platelet-Rich Fibrin on Bone Loss Following Dental Extraction.

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Abstract

Dental extraction often leads to bone loss, posing challenges for oral rehabilitation. This narrative review aimed to evaluate the effect of leukocyte-rich platelet-rich fibrin (L-PRF) on bone loss following dental extraction in healthy patients. A systematic search of the PubMed database was conducted, resulting in the inclusion of six randomized controlled studies. The review found evidence suggestive of less bone loss and improved healing after extraction when L-PRF was utilized. L-PRF, derived from the patient's blood, offers a promising approach with its growth potential and ability to provide a scaffold and matrix for wound healing and bone regeneration. While numerous studies have demonstrated the benefits of L-PRF in alveolar ridge preservation, more randomized controlled studies with larger sample sizes are warranted to fully understand its application in different clinical conditions and enhance oral health outcomes.

Keywords

Leukocyte-Rich Platelet-Rich Fibrin, Bone Loss, Dental Extraction.

Introduction

Routine dental extractions are commonly performed in oral surgery to address conditions such as pulpal, periapical, and periodontal disease[1,2]. However, post-extraction symptoms can impact patients' health and comfort, including pain, bleeding, swelling, infection, dry socket, secondary bleeding, dehiscence, hematoma, and ecchymosis[3,4]. The loss of a tooth also affects the supporting alveolar bone, leading to resorption and changes in both soft and hard tissues. These changes can have functional and aesthetic implications, potentially complicating natural rehabilitation with removable or fixed implant-supported prostheses[5].

Alveolar Bone Resorption and Healing

The alveolar bone relies on the continuous mechanical stimulation from the periodontal ligament (PDL) to maintain its shape[6,7]. However, after tooth loss, the absence of PDL leads to increased resorption, particularly horizontally (0.7-2mm) rather than vertically. Multiple tooth extractions and the use of removable complete dentures further contribute to alveolar bone loss[8]. Alveolar socket healing occurs clinically within 10 to 20 weeks, and radiographically, bone-filled sockets can be observed within 3 to 6 months. However, alveolar bone reorganization may continue for up to 1 year after extraction[9].

Impact on Soft Tissue and Hard Tissue

The periodontal ligament fibers play a crucial role in maintaining the shape of both soft tissue and hard tissue structures by attaching to bone, cementum, and gingival tissue. Following tooth loss, the absence of PDL stimulation results in changes in both soft and hard tissues, which can have functional and aesthetic consequences[10]. These changes may hinder natural rehabilitation with removable or fixed implant-supported prostheses.

Preservation Techniques and the Promise of Platelet-Rich Fibrin (PRF)

Various studies have investigated techniques for preserving alveolar bone, including bone grafting, surgical augmentation, and different flap and surgical procedures[11]. However, no material has yet demonstrated a consistently favorable response in reducing post-extraction resorption[12].

Recently, autogenous platelet-rich fibrin (PRF) has gained significant interest as a potential solution for minimizing bone resorption and promoting better bone maintenance[13]. PRF is a second-generation platelet concentration derived from blood centrifugation, without the need for biochemical handling. It contains leukocytes, platelets, cytokines, and stem cells within a fibrin matrix, mimicking natural fibrin-based materials. PRF attracts cells to the extraction socket, accelerates healing, and provides a scaffold for bone regeneration[14].

Benefits of Leukocyte-Platelet Rich Fibrin (L-PRF) in Dental Extraction

Studies have shown that applying PRF directly into the extraction socket leads to faster healing and reduced pain. The presence of leukocytes and growth factors attracts cells to the socket, enhancing vascularization and bone formation[15]. The fibrin matrix provides a stimulating environment for socket healing, promoting optimal outcomes.

Clinical Applications and Implant Success

Leukocyte platelet-rich fibrin has also shown promise in implant dentistry. When used in immediate implant placement within a fresh extraction socket, L-PRF provides a mesh for implant stability and bone formation, resulting in reduced bone resorption[16]. This approach has demonstrated improved esthetics, stability, and implant survival rates.

Post-extraction complications such as pain, bone loss, inflammation, dry socket, and infection can significantly impact patients' well-being. The application of leukocyte-platelet rich fibrin (L-PRF) in dental extraction has shown potential in reducing bone loss and promoting healing[17-19]. By harnessing the regenerative properties of PRF, clinicians may improve patient outcomes, minimize complications, and optimize the success of implant-based rehabilitation. This narrative review

aims to identify the effect of L-PRF on bone loss after dental extraction in healthy patients.

Search Strategy

To conduct a comprehensive review of the literature, an electronic search was performed on the PubMed database. The search aimed to identify relevant studies investigating the effect of leukocyte-platelet rich fibrin (L-PRF) on bone loss following dental extraction in healthy patients. The search strategy included the use of MeSH terms and relevant keywords.

The following search strategy was used in PubMed:(("platelet rich fibrin"[MeSH Terms] OR ("platelet rich"[All Fields] AND "fibrin"[All Fields]) OR "platelet rich fibrin"[All Fields] OR "L-PRF"[All Fields])AND("bone diseases, metabolic"[MeSH Terms] OR ("bone"[All Fields] AND "diseases"[All Fields] AND "metabolic"[All Fields]) OR "metabolic bone diseases"[All Fields] OR ("bone"[All Fields] AND "loss"[All Fields]) OR "bone loss"[All Fields])AND("extract"[All Fields] OR "extracts"[All Fields] OR "extraction"[All Fields] OR "extractions"[All Fields]))

To further refine the search results, filters were applied to include only full-text articles, randomized controlled trials, and studies published within the last 10 years.

((y_10[Filter]) AND (randomizedcontrolledtrial[Filter]) AND (fft[Filter]))

Inclusion Criteria

- Randomized controlled trials
- Full-text articles
- Studies published within the last 10 years
- Studies involving permanent teeth
- Studies comparing the healing outcomes between L-PRF and natural blood clots

Exclusion Criteria

- Studies involving implant placement with L-PRF
- Studies involving immediate implant placement
- Studies involving patients with systemic diseases

The search strategy aimed to identify relevant studies that meet the inclusion criteria and provide insights into the effect of L-PRF on bone loss following dental extraction in healthy patients. The search process aimed to ensure a comprehensive review of the literature to inform the narrative review in this study.

Discussion

A comprehensive search yielded 6 articles suggesting evidence of reduced bone loss and improved healing after dental extraction when using L-PRF. In a study by SecilCubuk et al. (2023), 13 patients underwent extraction of third molars and were randomly assigned to receive L-PRF or L-PRF combined with dental pulp stem cells. Vertical bone loss was significantly improved in both groups following L-PRF application, with no significant difference observed in the pulp stem cell group[20]. Xuzhou Wang et al. (2022) investigated the effect of L-PRF on bone loss in anterior teeth. They analyzed growth factor concentration in wound fluid and assessed soft tissue and hard tissue. While L-PRF increased growth factor concentration in wound fluid, no difference in bone loss or soft tissue was observed between the L-PRF and non-L-PRF groups[21].

SrisurangSuttapreyasri et al. conducted a clinical trial involving 20 premolar extraction sockets to evaluate the impact of L-PRF on wound healing, bone resorption, and alveolar ridge contour. They reported less bone resorption in the L-PRF group compared to the natural blood clot group (control) at 1 week after extraction. Additionally, the control group exhibited buccal bone contraction up to 8 weeks, while the L-PRF group remained stable after 4 weeks. Although the L-PRF group showed faster healing, no significant differences between the groups were reported[22]. Fabien Hauser et al. (2013) enrolled 23 patients requiring bicuspid extraction and randomized them into three groups: simple extraction with PRF placement, surgical flap followed by PRF filling, and natural healing without PRF. PRF resulted in better healing and alveolar

ridge preservation compared to the no-PRF group. However, the effect of L-PRF was neutralized in the second group due to mucosal flap invasiveness[23].

N. Girish Kumar et al. (2018) conducted a study on 48 patients to assess the role of PRF in ridge preservation with or without plaster of Paris following atraumatic extraction. The PRF group with plaster of Paris showed better ridge preservation, although the results were not statistically significant[24]. MoacyrTadeu Vicente Rodrigues et al. (2023) compared different materials' effects on alveolar ridge preservation by evaluating height and width using CBCT. The study included 40 patients and found no significant difference in healing between the natural blood clot and L-PRF groups. However, xenograft with free gingival graft provided better vertical ridge preservation, though not statistically significant[25].

Previous clinical studies have shown that bone loss and tissue changes occur after extraction, dependent on bone phenotype and surgical invasiveness. Various techniques for alveolar ridge preservation exist, including socket seal, soft tissue preservation, and guided bone regeneration, each with its indications and limitations. Immediate implant placement with grafts or guided bone regeneration has been reported to yield better outcomes[26-28]. Bone has the ability to remodel itself based on mechanical use and can undergo changes in height and width due to poor oral health, gum disease, periapical pathology, or trauma. Alveolar bone loss may occur following extraction, either due to traumatic/invasive treatment or natural bone atrophy[29].

Platelet-rich fibrin (PRF) is an autologous second-generation platelet concentrate derived from the patient's blood. It contains leukocytes, platelets, and fibrin, providing a scaffold for growth factors, cytokines, and cells. PRF slowly releases growth factors and cytokines in the initial weeks and can promote tissue and bone regeneration. It has been associated with better healing, pain reduction, and cost-effectiveness[30-34]. Ahmed et al. conducted a study in Saudi Arabia comparing post-operative healing after extraction between a PRF group and a control group. The test group receiving PRF showed reduced bone loss and increased bone formation compared to the control group over 1, 4, and 8 weeks post-extraction[34].

Conclusion

In conclusion, the use of L-PRF in reducing bone loss after extraction shows promising results, although statistically significant findings are lacking due to small sample sizes. Further randomized controlled trials with larger sample sizes are needed to establish a clear association between L-PRF and reduced bone loss, improving oral health outcomes for patients.

Conflicts of Interest

The author declares no conflicts of interest.

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