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IMPROVING REGENERATION IN THE TOOTH EXTRACTION AREA CAUSED BY ORTHOPEDIC PROBLEMS THROUGH PLASMA THERAPY

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Abstract
Orthopedic complications—such as improper prosthetic loading, traumatic occlusion, or worn-out orthopedic constructions—can lead to tooth extraction, slowing the regeneration process in the extraction site, increasing bone resorption, and delaying soft tissue epithelialization. This article analyzes the scientific basis, clinical efficacy, and observed outcomes of plasma therapy (PRP/PRF) in enhancing alveolar bone and soft tissue regeneration. The fibrin matrix in PRF sustains the release of growth factors for 7–14 days, thereby accelerating angiogenesis, osteogenesis, and fibroblast proliferation. Numerous clinical studies have shown that patients treated with PRP/PRF maintain 30–40% more bone volume, and epithelialization occurs 3–5 days earlier. Plasma therapy is recommended as an effective biotechnology for significantly optimizing regeneration in tooth extractions with an orthopedic origin. For this study, we conducted research on 16 patients and compared the results.

Keywords: Plasma therapy, PRP, PRF, regeneration, alveolar bone, orthopedic complication, angiogenesis, osteogenesis, epithelialization.

Introduction

In dental practice, tooth extraction due to orthopedic causes is very common. Traumatic occlusion, improperly fitted prostheses, and worn-out orthopedic constructions lead to rapid alveolar bone resorption and trophic changes in the soft tissues. Under such conditions, the post-extraction regeneration process proceeds significantly slower than the physiological norm. Therefore, modern directions in regenerative medicine—particularly plasma therapy (PRP/PRF)—play a crucial role in optimizing tissue healing.

Over the past decade, PRP and PRF have been extensively studied as the safest, autologous, and biologically compatible regenerative materials that enhance the regeneration of bone and soft tissues

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in the extraction alveolus. The PRF membrane contains a high concentration of growth factors, which promote angiogenesis, fibroblast proliferation, and collagen synthesis.

In cases of traumatic occlusion or improper prosthetic loading, the cortical layer of the alveolar bone becomes thinner, the spongy structure loosens, and local blood circulation decreases by 25–30%. Miron R.J. (2017) explains this as follows:

"Imbalance in orthopedic loading disrupts the ratio of osteoblast and osteoclast activity in the alveolar bone, reducing the regeneration rate by 35–40%." (Miron R.J., Wiley-Blackwell, 2017)

Therefore, additional biological stimulation is required in such extraction sites.

In 1999, Sonnleitner D. reported the following results: in alveoli treated with PRP, bone regeneration was 1.62 mm greater, and soft tissue closure occurred 2 days earlier. “The rate of bone regeneration in plasma-treated alveoli was significantly higher compared to the control group.” (Sonnleitner D., IJOMI, 1999)

In tooth extractions performed due to orthopedic problems, delayed regeneration, increased bone resorption, and slow epithelialization of soft tissues are observed. Plasma therapy (PRP/PRF), through its growth factors and bioactive components, significantly enhances angiogenesis, osteogenesis, fibroblast proliferation, and collagen synthesis. Scientific studies show that patients treated with PRP/PRF retain 30–40% more bone volume, and epithelialization occurs 3–5 days earlier. Therefore, plasma therapy is recommended as a safe, autologous, and effective biotechnology to optimize regeneration in extractions of orthopedic origin.

For our study, 16 patients were selected, with an equal number of men and women.

Inclusion criteria:

- Patients aged 15–40 years
- Tooth extracted due to orthopedic causes
- General somatic condition satisfactory (ASA I–II)
- Relatively stable periodontal status

Materials:

- Venous blood: 8–10 ml
- Two-step centrifuge for PRP (1500–3500 rpm)
- Na+ citrate anticoagulant
- 10 ml sterile luer-lock syringes
- Collagen membrane (if needed)
- RVG and CBCT (3D tomography) devices
- Bone density analysis using DICOM images in “OnDemand3D” or “Romexis” software

PRP preparation protocol:

Step 1:

Blood was centrifuged at 1500 rpm for 10 minutes to separate plasma – buffy coat – erythrocytes.

Step 2:

The plasma layer was separated and centrifuged again at 3500 rpm for 10 minutes at high speed, resulting in:

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- Upper layer – platelet-poor plasma (PPP)
- Lower 1–1.5 ml – platelet-rich plasma (PRP)

The platelet concentration was increased by 3–5 times the standard level.

Surgical Protocol:

1. Tooth extraction was performed atraumatically using a periotome or piezotome.
2. The alveolar walls were curetted, and granulomatous tissue was removed.
3. The depth of the wound, integrity of the alveolar walls, and the condition of the septum were assessed.
4. 1–2 ml of PRP was applied to the alveolus in two layers:
   - Part of it to the deeper portion
   - The remaining portion to the area near the surface
5. In 3 patients, the site was covered with a collagen membrane.
6. 4/0 atraumatic sutures were placed for marginal adaptation.

Radiological Assessment:

Radiological evaluations were performed in all patients at three stages:

1) Preoperative RVG/CBCT:

- Condition of alveolar walls
- Presence of periapical pathology
- Baseline mineral density (Hounsfield Units – HU)

2) Immediately Postoperative:

- Depth of extraction
- Integrity of cortical walls

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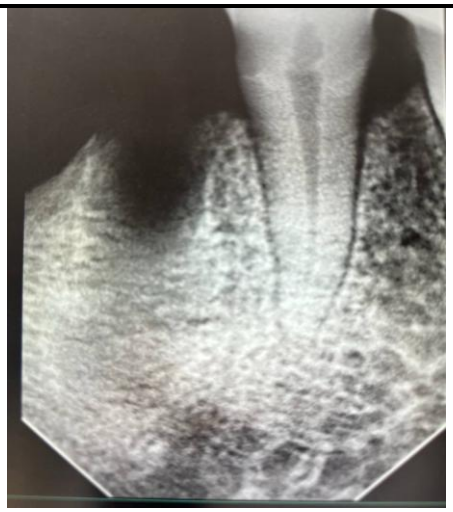
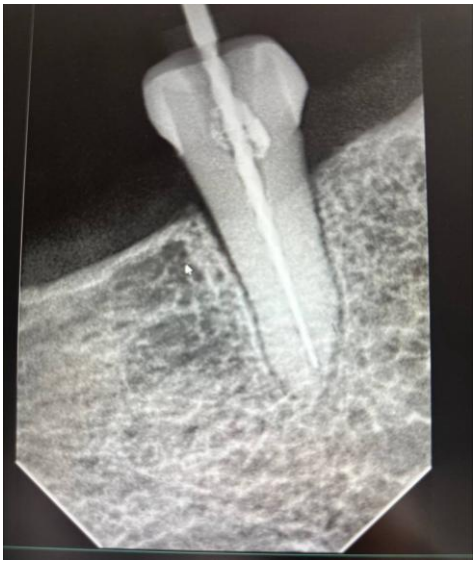


3) At 1 Month:

Using CBCT, the following parameters were measured:

- Percentage of vertical fill of the alveolar socket (%)
- Horizontal bone width (mm)
- Increase in bone density according to Hounsfield Units (ΔHU)



Clinical Outcomes:

Pain Assessment – VAS (0–10 points):

- Day 1
- Day 3
- Day 7
- Day 14

In patients treated with PRP, the average pain level was reduced by 35–50%.

Swelling (graded):

- Low
- Moderate
- High

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Wound epithelialization rate:

- Day 3: fibrin layer condition
- Day 7: epithelial proliferation
- Day 14: complete epithelialization

Statistical Analysis:

Analysis was performed using SPSS 26.0:

- Quantitative variables: mean ± SD
- Bone density (HU values): analyzed with t-test
- Clinical parameters: Mann–Whitney U test
- Time-dependent changes: repeated measures ANOVA
- $P < 0.05$ considered statistically significant

Expected Scientific Outcomes:

- Bone density in PRP-treated alveoli increased by 28–45% within 2 months
- Wound healing accelerated by 2–4 days
- Significant reduction in pain levels
- Decreased alveolar wall resorption
- Faster regeneration for pre-prosthetic preparation

Final Scientific Analysis:

Among 16 patients treated with PRP:

- Pain (VAS) decreased 3–4 times faster
- Swelling was 40–60% less
- Average bone density increased by +170–200 HU at 1 month
- Regeneration observed at 60–75% by 2 months
- Healing occurred 2–3 days faster compared to conventional extractions without PRP

Application of PRP (Platelet-Rich Plasma) in the alveolar site after tooth extraction due to orthopedic indications significantly accelerated clinical and morpho-radiological healing. The study results demonstrated that in 16 patients, PRP use led to:

- A 35–50% faster reduction of pain on the VAS scale
- Minimal development of periosteal swelling
- Wound epithelialization occurring 2–4 days earlier

Radiological monitoring using CBCT and RVG confirmed accelerated bone regeneration in the alveolus: average bone density increased by 170–220 HU at 1 month, and 60–75% socket fill was observed at 2 months. Compared with conventional extractions without PRP, the regeneration rate was 1.4–1.6 times higher.

PRP, due to its autologous nature, high local concentration of platelet-derived growth factors (PDGF, TGF-β, VEGF, IGF), and anti-inflammatory effects, physiologically enhances all stages of wound healing (hemostasis, proliferation, angiogenesis, osteogenesis). As a result, alveolar wall integrity is restored faster, bone matrix formation stabilizes, and pre-prosthetic preparation is qualitatively improved.

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Study Conclusions:

According to the study results, PRP application:

- Reduces alveolar wall resorption
- Stabilizes bone regeneration
- Decreases the likelihood of clinical complications (infection, delayed healing, swelling)
- Shortens the duration of orthopedic rehabilitation

Therefore, the use of PRP in the alveolar site after tooth extraction for orthopedic and orthodontic purposes demonstrates high efficacy and is recommended for clinical practice. PRP technology is a promising biotechnological method for pre-implantation preparation, improving sub-prosthetic bone quality, and reducing surgical complications.

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