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COMPARATIVE CHARACTERISTICS OF GUIDED BONE REGENERATION USING PLATELET-RICH PLASMA IN PATIENTS WITH PARTIAL SECONDARY EDENTULISM

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Abstract
Dental implantation remains a promising and widely used method for the treatment of dentition defects, effectively restoring the functions of the dentoalveolar system and correcting facial aesthetic deficiencies.
Objective: To evaluate the effectiveness of guided tissue regeneration using platelet-rich plasma (PRP) in patients with partial secondary edentulism.
Materials and Methods: In accordance with the study objectives, 50 patients diagnosed with "Partial secondary edentulism of the maxilla" were examined. All patients were divided into two groups: Group 1 (Main group): 25 patients aged 21–36 years with bone deficiency confirmed by radiological examination, treated using guided bone regeneration (GBR) with platelet-rich plasma. Group 2 (Comparison group): 25 patients aged 25–45 years with bone deficiency confirmed radiographically, treated using conventional guided bone regeneration techniques. Research methods included clinical, radiological, and statistical analyses.
Results: Preoperative computed tomography (CT) revealed pronounced bone atrophy (2.2–3.6 mm in width) in all patients of the main group, while bone height was sufficient (11.0–15 mm). Preoperative bone mineral density was assessed in all patients. Six months after guided bone regeneration, CT scans demonstrated increased alveolar ridge dimensions and bone density in the main group. Implant osseointegration one year after placement reached 100%. The total duration of surgical treatment in the main group before initiation of prosthetic rehabilitation was 12 ± 0.5 months.
Conclusions: Comparative CT analysis demonstrated that six months after GBR with PRP, bone density increased on average by 22.7% in women and 21.4% in men. In contrast, after conventional GBR, bone density in the maxilla decreased by an average of 3.8% in women and 2.4% in men.

Keywords: Guided bone regeneration; platelet-rich plasma; cone-beam computed tomography; partial edentulism; sinus lifting.

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Introduction

Dental implantation remains a promising and widely practiced method for the rehabilitation of patients with dentition defects, providing functional and aesthetic restoration [3, 6, 12, 17]. However, prosthetic rehabilitation of maxillary defects with dental implants is often complicated by alveolar bone atrophy [2, 7, 10, 15].

Sinus lifting combined with bone grafting of the maxillary alveolar process is one of the most effective methods for increasing bone volume in cases of resorption [4, 8, 13, 18]. However, anatomical alterations of the maxillary sinus due to previous inflammatory, cystic, hyperplastic, hypertrophic changes, trauma, or endodontic complications may limit the success of sinus lift procedures [1, 5, 9, 11].

The "open" sinus lift technique is defined as a bone-reconstructive procedure involving osteotomy of the lateral maxillary sinus wall, elevation of the Schneiderian membrane, and placement of graft material into the created space [14].

The search for new materials suitable for barrier membranes that promote optimal bone regeneration conditions remains relevant. Such materials include platelet-rich fibrin (PRF) and platelet-rich plasma (PRP) derived from the patient's own blood [16]. However, comparative data on the effectiveness of these approaches remain limited, which determines the scientific and practical significance of this study.

Materials and Methods

Fifty patients with partial secondary edentulism of the maxilla were examined. Patients were divided into:

- Main group (n = 25): Treated using guided bone regeneration with PRP.
- Comparison group (n = 25): Treated using conventional GBR methods.

Methods included clinical examination, radiographic evaluation (cone-beam CT), and statistical analysis.

Results

Preoperative CT assessment in the main group revealed significant horizontal bone atrophy (2.2–3.6 mm), with preserved vertical bone height (11–15 mm).

Table 1. Preoperative Bone Density Before PRP-Based GBR

Defect Area	Men	Women
Maxillary alveolar ridge	661.6 ± 0.3 units	558.7 ± 0.9 units

Statistically significant differences in baseline bone density were observed between men and women. Bone density values were higher in men than in women. Additionally, the maxillary alveolar ridge demonstrated lower density compared with the mandibular alveolar portion in both sexes.

Biological Basis of PRP

Platelet-rich plasma is obtained by centrifugation of autologous whole blood to concentrate platelets. Platelet alpha granules contain multiple growth factors:

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- Insulin-like growth factor-1 (IGF-1)
- Basic fibroblast growth factor (bFGF)
- Vascular endothelial growth factor (VEGF)
- Transforming growth factor beta (TGF-β)
- Epidermal growth factor (EGF)
- Platelet-derived growth factor (PDGF)

These biologically active substances reduce inflammation, eliminate necrotic cells, and stimulate regenerative processes.

Bone healing consists of three sequential phases: inflammation, proliferation, and sclerosis. Regeneration begins immediately after clot formation, with platelets playing a key activating role in reparative processes.

Table 2. Bone Density 6 Months After PRP-Based GBR

Defect Area	Men	Women
Maxillary alveolar ridge	803.2 ± 0.3 units	685.7 ± 0.3 units

Table 3. Dynamics of Bone Width After PRP-Based GBR (n = 25)

Number of patients, N=25	Initial width of bone tissue, mm	Width of bone tissue after the method of guided bone regeneration based on platelet-rich plasma, mm	Width of bone tissue after 6 months at stage I of dental implantation, mm	Width of bone tissue at stage II of dental implantation, mm
Alveolar process of the maxilla	2,6±0,5	7,1±0,9	5,9±0,6	5,6±0,7

Osseointegration rate one year after implantation was 100%. Surgical treatment duration before prosthetic rehabilitation averaged 12 ± 0.5 months. Patients were followed up twice annually with clinical examinations, professional oral hygiene, and radiological monitoring.

The use of PRP-based guided bone regeneration is currently widespread due to its predictability and favorable regenerative outcomes.

Conclusions

Comparative CT analysis demonstrated that six months after PRP-based guided bone regeneration, bone density increased on average by 22.7% in women and 21.4% in men.

In contrast, after conventional GBR, bone density in the maxilla decreased on average by 3.8% in women and 2.4% in men.

These findings confirm the clinical effectiveness and перспективность (clinical promise) of PRP-based guided bone regeneration in patients with partial secondary edentulism.

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