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Clinical Evaluation of Platelet-Rich Fibrin for Alveolar Ridge Volume Preservation and Postoperative Pain Control After Tooth Extraction

Bikash Desar[1]*, Rajani Shakya[2]

[1]*Oral and maxillofacial surgeon, Head of Department, Position-11th Level, Anandaban Hospital, Nepal.*

[2]*Community medicine, Registrar, Dhulikehl Hospital, Kathmandu university, Nepal.*

**Corresponding author: Bikash Desar.*

Abstract

Background and Objectives: Socket preservation aims to minimize alveolar bone resorption following tooth extraction in order to maintain ridge volume and contour for future prosthetic or implant rehabilitation. Platelet-rich fibrin (PRF), an autologous biomaterial rich in growth factors, has been proposed to reduce ridge resorption by promoting new bone formation and serving as a biological scaffold for tissue regeneration. Additionally, PRF may enhance wound healing and reduce postoperative discomfort. This study aimed to evaluate the effectiveness of PRF, alone and in combination with collagen, in preserving alveolar ridge dimensions in both the maxilla and mandible, and to assess its impact on post-extraction pain.

Methods: Sixty patients requiring extraction of posterior teeth were randomly allocated into three groups: Group I (PRF; n = 20), Group II (PRF + collagen; n = 20), and Group III (control; n = 20). Extraction sockets were filled with PRF in Group I and PRF combined with collagen in Group II, while the control group received standard care without biomaterial placement. Cone-beam computed tomography (CBCT) was used to evaluate ridge height and width at baseline and at 3 months postoperatively. Postoperative pain was assessed at 24 hours, 3 days, and 7 days following extraction using the British Pain Society Numerical Rating Scale. Statistical analysis was performed using ANOVA and independent t-tests.

Results: Comparative analysis revealed no statistically significant differences in ridge height or width among the three groups at the 3-month follow-up. However, both PRF alone and PRF combined with collagen significantly reduced short-term postoperative pain compared to the control group.

Conclusions: Within the limitations of this study, PRF, whether used alone or in combination with collagen, did not demonstrate a significant advantage in preserving alveolar ridge dimensions compared to standard treatment. Nevertheless, both interventions were effective in reducing short-term postoperative pain, suggesting a potential clinical benefit in enhancing patient comfort following extraction.

Keywords: alveolar ridge preservation; platelet-rich fibrin; post-extraction socket; bone regeneration; postoperative pain

Introduction

Following tooth extraction, the alveolar socket undergoes physiological bone remodeling, resulting in a reduction of both ridge height and width. Evidence from the literature indicates that ridge width may decrease by approximately 29–63%, while ridge height may be reduced by 11–22% after extraction. The most rapid and pronounced bone resorption typically occurs within the first three months post-extraction [1].

Dental implants have become a widely accepted and predictable option for prosthetic rehabilitation following tooth loss due to their durability, functionality, and favorable esthetic outcomes. However, successful implant placement depends largely on the availability of adequate bone volume and quality. Careful assessment of bone dimensions is therefore essential during treatment planning.

Although dental implants offer a reliable and effective solution for restoring both function and appearance, their long-term success requires the fulfillment of multiple clinical, biomechanical, and biological criteria [2,3]. Insufficient alveolar bone volume following extraction may compromise optimal implant positioning and stability, highlighting the importance of strategies aimed at preserving ridge dimensions.

According to Iasella et al. (2003), approximately 50–60% of alveolar bone volume is lost within the first three months following tooth extraction. These findings highlight the critical importance of the early post-extraction period in influencing alveolar bone healing and remodeling. Such resorption results in significant dimensional alterations of the alveolar ridge, affecting both height and width [4].

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These dimensional changes may lead to esthetic concerns and create challenges for future prosthetic rehabilitation. He et al. (2009) described wound healing as a complex biological process and a natural defense mechanism aimed at preserving tissue integrity and maintaining overall homeostasis [5]. The physiological healing of the post-extraction socket involves a coordinated sequence of events, including blood clot formation, inflammatory response, cellular migration, angiogenesis, and bone formation. This dynamic process of bone resorption and apposition ultimately determines the final architecture of the healed ridge [6].

Socket preservation procedures are designed to minimize post-extraction bone resorption and maintain the volume and contour of the alveolar ridge. Preserving ridge dimensions is essential for facilitating future implant placement or prosthetic rehabilitation. Various techniques have been developed to prevent bone atrophy after tooth extraction, including socket preservation, guided bone regeneration, application of growth factors, immediate implant placement, and atraumatic surgical techniques [7–9]. However, certain bone grafting materials may require extended healing periods before sufficient new bone formation and graft integration occur [10].

Atraumatic extraction is a surgical approach aimed at minimizing trauma to surrounding hard and soft tissues, thereby preserving the integrity of the socket for future restorative procedures [11]. Among biologically based regenerative materials, platelet-rich fibrin (PRF), introduced by Dohan et al., has gained considerable attention. PRF is an autologous platelet concentrate rich in growth factors and is widely used in oral and maxillofacial surgery to enhance tissue healing. It is prepared from approximately 10 mL of the patient's venous blood without the addition of anticoagulants or bovine thrombin, making it a fully autologous biomaterial. PRF consists of a dense fibrin matrix containing platelets, leukocytes, cytokines, and circulating stem cells. The growth factors embedded within this fibrin network are gradually released over 7–14 days, promoting angiogenesis, soft tissue regeneration, and bone healing. Numerous studies have reported that PRF accelerates epithelialization, improves soft tissue healing, and reduces postoperative pain and edema [12].

Socket preservation using biomaterials and autologous platelet concentrates, such as platelet-rich fibrin (PRF) and platelet-rich plasma (PRP), has been proposed as a strategy to enhance healing and reduce post-extraction bone resorption [13]. PRF, considered a second-generation platelet concentrate, promotes tissue regeneration and has been associated with improved early bone formation and enhanced structural organization of regenerated tissues. Unlike PRP, PRF is prepared without anticoagulants and forms a dense fibrin matrix rich in platelets, leukocytes, cytokines, and growth factors. It is obtained through simple centrifugation of autologous blood, making it a cost-effective and biologically favorable regenerative material [14].

Ridge preservation techniques, including the application of PRF, aim to limit post-extraction bone loss by providing a biological scaffold that supports angiogenesis, cellular migration, and new bone formation. In addition to its regenerative potential, PRF has been reported to reduce postoperative complications such as pain, edema, infection, dry socket, and trismus, thereby improving overall healing outcomes [15,16].

Maintaining alveolar ridge dimensions following tooth extraction is of paramount importance in modern dentistry, particularly for future implant placement and prosthetic rehabilitation. Continued research is essential to develop predictable techniques for preserving both hard and soft tissues, as dimensional alterations may compromise esthetic outcomes and functional restoration. Despite growing interest in PRF for ridge preservation, limited evidence exists regarding two important aspects: the evaluation of postoperative pain and the assessment of dimensional bone changes using three-dimensional cone-beam computed tomography (CBCT).

Therefore, the purpose of this study was to evaluate the effectiveness of platelet-rich fibrin (PRF), alone and in combination with collagen, in preserving alveolar ridge dimensions at extraction sites in both the maxilla and mandible, and to assess its impact on post-extraction discomfort. The null hypothesis stated that there would be no statistically significant difference between the use of PRF and standard treatment with respect to dimensional ridge changes or postoperative pain reduction at the extraction site.

Materials and Methods

This prospective clinical study was conducted at the Anandaban Tertiary Hospital.

All participants were fully informed about the study objectives, procedures, potential benefits, and associated risks. Written informed consent was obtained from each patient prior to participation. Sample size calculation was performed using G*Power software (version 3.1), considering 80% statistical power, a significance level (α) of 0.05, and an effect size of 1.2, resulting in 19 participants per group [17]. To account for potential dropouts, 20 patients were included in each group, yielding a total sample size of 60. A convenience sampling method was applied.

Patients requiring extraction of posterior teeth due to non-restorable conditions were randomly assigned into three groups (n = 20 per group):

Group I (PRF group): Teeth were extracted, and PRF was applied alone.

Group II (PRF + Collagen group): Teeth were extracted, and PRF was applied in combination with Collaplug® (Collagen Matrix, Inc., Oakland, NJ, USA).

Group III (Control group): Teeth were extracted without any adjunctive material.

Inclusion criteria consisted of systemically healthy patients aged 18–60 years who required extraction of posterior teeth for non-restorable reasons. Exclusion criteria included pregnant women, smokers, patients with known allergies, those undergoing chemotherapy or radiotherapy, and patients presenting with significant periapical lesions or periodontally compromised teeth.

All participants underwent a comprehensive clinical evaluation, including detailed medical and dental history, intraoral examination, and preoperative imaging using cone-beam computed tomography (CBCT) to assess the condition of the tooth and surrounding alveolar bone. Postoperative pain was assessed using the Numerical Pain Rating Scale (NPRS), ranging from 0 (no pain) to 10 (worst possible pain).

Surgical Procedures

Atraumatic Extraction

All extractions were performed under local anesthesia using 2% lidocaine with 1:100,000 epinephrine. Atraumatic tooth extraction was carried out with dental forceps to minimize trauma to the surrounding alveolar bone and soft tissues. Following extraction, the socket was carefully debrided using bone curettes and sterile saline to remove any granulation tissue. The condition of the alveolar bone, particularly the buccal plate, was gently evaluated with a periodontal probe.

PRF Preparation

Approximately 9–10 mL of venous blood was collected from each patient in plain tubes without anticoagulant. The samples were immediately centrifuged at 2,700 rpm (400×g) for 12 minutes. This process produced three distinct layers: the top layer of acellular platelet-poor plasma (PPP), the bottom layer of red blood cell (RBC) concentrate, and a central fibrin clot representing the PRF. The fibrin clot was carefully retrieved with sterile surgical tweezers, excess RBCs were removed, and the clot was compressed using a PRF metal box and piston to form a plug suitable for socket placement.

Socket Treatment

Group I (PRF): The PRF plug was placed directly into the extraction socket, and the site was closed with figure-eight sutures.

Group II (PRF + Collagen): The PRF plug was placed in the socket, followed by a collagen plug (Collaplug®, Collagen Matrix, Inc., Oakland, NJ, USA) on top, and the site was sutured using a figure-eight technique.

Group III (Control): Patients underwent atraumatic extraction alone, without any additional biomaterial.

Postoperative Assessment and Follow-Up

Pain levels were assessed at 24 hours, 3 days, and 7 days postoperatively using the British Pain Society Numerical Rating Scale (0 = no pain, 10 = worst possible pain). Follow-up examinations were conducted at 7 days, 1 month, and 3 months. At the 3-month follow-up, a second CBCT scan was performed to evaluate changes in alveolar ridge dimensions.

Statistical Analysis

The Shapiro–Wilk test was used to assess the normality of all continuous variables. Descriptive statistics, including means and standard deviations, were calculated for variables such as postoperative pain and ridge dimensions. Between-group comparisons were performed using one-way analysis of variance (ANOVA), and pairwise comparisons were conducted with independent t-tests where appropriate. Statistical analyses were carried out using SPSS version 22 (IBM-SPSS Inc., Armonk, NY, USA), and a p-value < 0.05 was considered statistically significant.

Results

Alveolar Ridge Width

Table 1 summarizes the mean ridge width values before and after treatment for the three study groups: control, PRF, and PRF combined with collagen. The table includes the mean ± standard deviation (SD) for each group at baseline and at the 3-month follow-up.

The control group showed a decrease in ridge width over the 3-month period.

Both the PRF and PRF + collagen groups demonstrated preservation of ridge width compared to the control group, although the differences were not statistically significant ($p > 0.05$).

Postoperative Pain

Postoperative pain was assessed at 24 hours, 3 days, and 7 days using the Numerical Pain Rating Scale. Both the PRF and PRF + collagen groups reported lower pain scores at all time points compared to the control group, indicating a significant reduction in short-term postoperative discomfort ($p < 0.05$).

These results suggest that while PRF and PRF combined with collagen may not significantly alter ridge dimensions compared to standard treatment, they are effective in reducing postoperative pain in the short term.

Table 1: Comparison of Alveolar Ridge Width Before and After Treatment Among Control, PRF, and PRF + Collagen Groups (Independent t-test)

Group	Ridge Width Before	Ridge Width After	*p*-Value
Control group	10.89 (SD 0.567)	10.80 (SD 0.606)	0.673
PRF group	11.09 (SD 0.615)	10.98 (SD 1.031)	0.699
PRF + collagen group	10.90 (SD 1.024)	10.84 (SD 1.031)	0.843

PRF: Platelet rich fibrin; SD: Standard deviation.

The results presented in Table 1 indicate that there were no statistically significant differences in alveolar ridge width before and after treatment among the three groups, as all p-values were greater than 0.05. This suggests that neither PRF alone nor PRF combined with collagen had a significant impact on ridge width preservation compared to the control group over the 3-month follow-up period.

Table 2 presents the comparison of alveolar ridge height before and after treatment among the three groups: control, PRF, and PRF + collagen. For each group, the mean ridge height at baseline and at 3 months is reported along with the corresponding standard deviation (SD). The table also includes p-values derived from paired t-test analyses, indicating the statistical significance of changes in ridge height within each group over time.

The data from Table 2 allow for evaluation of the effectiveness of PRF and PRF + collagen in maintaining vertical ridge dimensions following tooth extraction.

Table 2: Comparison of Alveolar Ridge Height Before and After Treatment Among Control, PRF, and PRF + Collagen Groups (Paired t-test).

Group	Ridge Height Before	Ridge Height After	*p*-Value
Control group	10.52 (SD 1.950)	10.42 (SD 1.883)	0.877
PRF group	10.02 (SD 1.040)	9.82 (SD 1.020)	0.595
PRF + collagen group	10.52 (SD 1.043)	10.27 (SD 1.017)	0.534

PRF: platelet-rich fibrin; SD: standard deviation

The analysis of alveolar ridge height, as presented in Table 2, indicates that there were no statistically significant differences in ridge height before and after treatment within any of the three groups, as evidenced by all p-values exceeding 0.05. This suggests that neither PRF alone nor PRF combined with collagen had a significant effect on vertical ridge preservation over the 3-month follow-up period.

Table 3 summarizes the postoperative pain scores reported by participants in the three groups (control, PRF, and PRF + collagen) over the course of one week. Pain was assessed at three postoperative time points: 24 hours, 3 days, and 7 days. For each time interval, the mean pain score and corresponding standard deviation (SD) are presented. This analysis allows for evaluation of the effectiveness of PRF and PRF + collagen in reducing short-term postoperative discomfort following tooth extraction.

Table 3: Postoperative Pain Scores Among Control, PRF, and PRF+Collagen Groups Over One Week (Mean±SD, Anova

Group	Pain at 24 h (Mean)	Pain at 3 Days (Mean)	Pain at 1 Week (Mean)	*p*-Value
Control group	5.25 (SD 1.91)	1.80 (SD 1.23)	0.100 (SD 0.44)	0.000
PRF group	2.90 (SD 0.96)	0.550 (SD 0.60)	0.000 (SD 0.00)	0.000
PRF + collagen group				
p-value	0.000	0.000	0.374	

PRF: platelet-rich fibrin; SD: standard deviation.

Across all groups, mean pain scores decreased progressively over time, reflecting the natural resolution of post-extraction discomfort. At 24 hours post-treatment, the control group reported the highest mean pain scores compared to the PRF and PRF + collagen groups. By 3 days post-treatment, both the PRF and PRF + collagen groups exhibited notably lower mean pain scores than the control group, suggesting an early benefit of PRF application in reducing postoperative discomfort.

At the 7-day follow-up, the differences in pain scores among the three groups became less pronounced, indicating that overall pain had subsided in all participants. These results suggest that both PRF and PRF + collagen was effective in reducing short-term postoperative pain, particularly within the first 3 days following tooth extraction, although the effect diminished over time as healing progressed.

Discussion

This study evaluated the effects of platelet-rich fibrin (PRF) and PRF combined with collagen on alveolar ridge width, ridge height, and postoperative pain in patients undergoing alveolar ridge preservation following tooth extraction. Outcomes were compared to a control group receiving standard treatment.

Ridge Width

The comparison of ridge width before and after treatment among the three groups is summarized in Table 1. In the PRF group, the mean ridge width decreased slightly from 11.09 ± 0.615 mm at baseline to 10.98 ± 0.589 mm at 3 months ($p > 0.05$). Similarly, in the PRF + collagen group, the ridge width changed minimally from 10.90 ± 1.024 mm at baseline to 10.84 ± 1.031 mm after treatment ($p > 0.05$). These results indicate that there were no statistically significant differences in ridge width preservation among the three groups over the 3-month period.

These findings are consistent with previous research, which demonstrated that ridge width exhibited a smaller change from baseline to 180 days in the PRF group compared to the control group (PRF: 0.75 ± 0.49 mm vs. Control: 1.36 ± 0.70 mm; $p = 0.005$), suggesting that PRF can reduce dimensional changes in the alveolar ridge [18]. Other studies assessing ridge contour at 5 mm from the crest reported a significantly greater preservation of ridge width with PRF treatment four weeks post-extraction compared to unassisted healing sockets [19–21].

Overall, while PRF and PRF + collagen did not produce statistically significant differences in ridge width in the current study, previous evidence suggests that PRF may contribute to clinically relevant reductions in alveolar ridge resorption over time.

Several studies included in meta-analyses have employed cone-beam computed tomography (CBCT) to quantify changes in alveolar ridge width, rather than solely assessing contour alterations. In these studies, sites treated with platelet-rich fibrin (PRF) generally exhibited reduced bone width resorption compared to naturally healing sockets; however, the differences were not statistically significant. Notably, a high degree of variability was observed across studies, highlighting inconsistencies in study designs and measurement protocols [22,23].

The primary goal of alveolar ridge preservation is to maintain the integrity of both hard and soft tissues following tooth extraction, thereby facilitating optimal implant positioning for future prosthetic rehabilitation. The selection of an appropriate preservation technique depends on patient-specific factors, the location of the extracted tooth, and the clinician's judgment. Techniques such as socket preservation using bone grafts and immediate or early implant placement have been shown to minimize post-extraction bone loss and allow for predictable implant placement [8].

Specifically, two studies investigating dimensional changes of the alveolar ridge following PRF application alone reported that PRF significantly reduced horizontal ridge resorption as early as 8 weeks post-extraction [19,23]. These findings support the potential of PRF as a biological adjunct in ridge preservation, although variability in outcomes underscores the need for standardized protocols and further research to as long as 6 months post-surgery. Notably, both studies utilized multiple PRF clots or membranes, with Alzahrani et al. [19] employing two membranes and Temmerman et al. [23] using three to seven membranes. The quantity of clots or membranes and the cor- responding blood volume could influence the clinical outcome by potentially modulating the cellular environment within the socket [24].

Furthermore, some studies employed only a single PRF clot, whereas others utilized multiple clots or membranes, which may influence the extent of ridge preservation [19]. Marenzi et al. reported improved soft tissue healing at 7-, 14-, and 21-days post-extraction; however, the clinical interpretation of these findings is limited due to the variability of healing indices used across studies [25].

Carmagnola et al. observed a greater reduction in both alveolar ridge width and height when no preservation procedures were applied, highlighting the importance of ridge preservation techniques in maintaining post-extraction bone integrity [26].

In the present study, sockets treated with PRF + Collaplug demonstrated ridge preservation effects comparable to those reported by Iasella et al. [4], suggesting that the combination of PRF and collagen plug supports both hard tissue maintenance and increased bone density at the extraction site.

Postoperative Pain

As summarized in Table 3, postoperative pain scores were evaluated at 24 hours, 3 days, and 1 week following tooth extraction across the three study groups (control, PRF, and PRF + collagen). Across all groups, mean pain scores decreased progressively over time, indicating a natural resolution of postoperative discomfort. At 24 hours, the control group reported the highest pain levels compared to the PRF and PRF + collagen groups. By 3 days and 1-week post-treatment, both PRF-treated groups consistently reported lower pain scores than the control group. These findings indicate that PRF, with or without collagen, is effective in reducing short-term postoperative pain. Consequently, the current study partially rejects the null hypothesis, demonstrating a significant difference in postoperative pain reduction between PRF-treated sites and untreated control sites.

The p-values reported in Table 3 represent the statistical significance of differences in postoperative pain scores among the three groups at each time interval, as determined by one-way ANOVA. Pain scores at 24 hours and 3 days post-treatment were statistically significant ($p < 0.05$), indicating that PRF, with or without collagen, significantly reduced postoperative pain compared to the control group during the early healing period. By 1-week post-treatment, the p-value was 0.374, suggesting no significant differences in pain scores among the groups at this later time point.

Patient-reported pain is a critical outcome measure in post-extraction recovery [27]. Several studies have employed the visual analog scale (VAS) to quantify pain and patient-reported outcomes [23,25]. Temmerman et al. [23] reported that PRF significantly alleviated pain within 3 to 5 days post-extraction, while Marenzi et al. [25] observed reduced pain in PRF-treated sites for up to 21 days, although these studies did not clearly indicate whether patient blinding was applied. Numerous investigations have also examined the effect of PRF on postoperative pain following mandibular third molar extractions [28].

Consistently, patients in PRF-treated groups reported lower pain scores at all evaluated time points. Comparisons between PRF and control groups on days 7 and 14 showed lower VAS scores in the PRF group. Girish Kumar et al. [29] similarly demonstrated that postoperative analgesic consumption was significantly lower in PRF-treated patients compared to controls during the first and third days.

Moreover, the PRF group exhibited a lower peak pain level on the day of surgery and maintained reduced pain levels up to the 10th postoperative day compared to controls. VAS scores decreased progressively from baseline to day 10 in both groups, but the PRF group consistently reported lower values and returned to baseline pain levels sooner than the control group [29]. These findings support the analgesic and healing-promoting properties of PRF in post-extraction care.

The p-values provided in Table 3 represent the statistical significance of the observed differences in pain scores among the three groups at each time interval, as determined by one-way ANOVA. The p-values for the pain scores at 24 h and 3 days post-treatment were statistically significant ($p < 0.05$), indicating that there were significant differences in pain scores among the groups during these time periods. However, at 1-week post-treatment, the p-value was 0.374, suggesting that there were no significant differences in pain scores among the groups at this time interval.

Patients report pain as an important measure [27]. Two studies utilized the visual analog scale to gauge patient-reported outcomes [23,25]. Temmerman et al. [23] concluded that PRF notably alleviated pain sensations within 3 to 5 days, while Marenzi et al. [25] observed reduced pain in the PRF group for up to 21 days. However, neither study specified whether patients received adequate blinding. There are a plethora of studies investigating the effect of PRF on mandibular third molar extraction pain [28].

At all times, the patients in the PRF group reported much lower pain ratings. When comparing the control group to the PRF group on days 7 and 14, the VAS score values were lower in the former. According to Girish Kumar et al. [29], the PRF group's postoperative analgesic consumption was considerably lower than that of the control group on the first and third days.

In addition to a significantly lower peak pain level on the operation day in the PRF group compared to control group, lower pain levels on the 10th day were noted clearly in the PRF group in comparison to control group. Both groups' VAS ratings decreased from baseline to the tenth day. The VAS values of the PRF group were consistently lower than those of the control group across all periods. The PRF group's pain ratings returned to normal levels sooner than those of the control group [29].

The mean pain score for the PRF group was significantly lower at 2.90 (SD 0.96) after 24 h. It dropped to 0.550 (SD 0.60) after three days and stayed at this level for one week.

Similar to the control group, postoperative pain decreased significantly over time, with p-values of 0.000 at both the 3-day and 1-week intervals, indicating a substantial reduction in pain from baseline. In a study by Carmagnola et al. [26], the control group also exhibited notable alveolar bone loss, with a reduction in bone height of 2.12 ± 0.69 mm and a loss in bone width of approximately 1.71 ± 0.49 mm.

Current literature suggests that PRF offers clinical advantages in alveolar ridge preservation due to its ease of use and straightforward handling. Histological analyses have confirmed that PRF enhances both the quality and rate of new bone formation, although its effect on reducing alveolar bone resorption in extraction sockets alone may not always reach statistical significance [30].

Previous studies comparing bone density, width, height, and soft tissue healing among three groups—control, PRF, and PRF + Collaplug—demonstrated improved early soft tissue healing in the PRF-treated groups by postoperative day 7. PRF contributes to soft tissue repair through the sustained release of growth factors and inflammatory cytokines. Preservation of bone height at four months postoperatively was similar between the PRF and PRF + Collaplug groups, attributable to PRF's role in stimulating neovascularization, enhancing new bone formation, and maintaining vertical ridge dimensions. Horizontal ridge preservation was superior in the PRF + Collaplug group at four months. The Collaplug, when used in combination with PRF, stabilizes the initial clot, prevents the ingrowth of surrounding soft tissue into the socket during healing, and supports the maintenance of ridge width after surgery [17].

Strengths and Limitations

This study provides valuable insights into the immediate outcomes of PRF and PRF + Collaplug interventions in alveolar ridge preservation. One of the strengths of the study is the use of CBCT imaging to quantify ridge width and height changes, along with systematic assessment of postoperative pain, allowing a comprehensive evaluation of both hard and soft tissue outcomes.

However, the study has several limitations. Longitudinal follow-up studies are needed to assess the long-term effects of PRF and PRF + Collaplug on ridge morphology, implant success rates, and patient-centered outcomes such as satisfaction and quality of life. Additionally, variations in treatment protocols—including differences in PRF concentration, clot number, or combinations with other biomaterials—may influence outcomes and should be explored in future research.

Although numerous studies support the positive impact of PRF on alveolar ridge preservation, some investigations report no significant effect on ridge dimensions. Therefore, further well-designed studies are warranted to clarify the clinical efficacy of PRF in extraction socket preservation and its potential role in reducing post-surgical morbidity. Overall, this research contributes to the growing body of evidence on dental biomaterials and highlights the importance of comprehensive evaluation strategies to assess multifaceted clinical outcomes.

Conclusion

In conclusion, the findings of this study indicate that platelet-rich fibrin (PRF) and PRF combined with collagen do not significantly affect alveolar ridge width or height compared to standard post-extraction treatment. Nevertheless, both PRF and PRF + Collaplug demonstrated a clear benefit in reducing short-term postoperative pain, suggesting a potential advantage over conventional treatment protocols. These results support the use of PRF as an adjunct for improving patient comfort in the early post-extraction period, even if its effects on ridge dimensional preservation are limited.

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