Clinical applications of PRF in maxillofacial surgery and the centrifugation protocols used

| Authors | Diagnostic | Results |
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| Centrifugation protocol: 3,000 rpm ×10 min | | |
| Suttapreyasri *et al.* [2013] (35) | Socket preservation | Platelet-rich fibrin clinically showed early healing of soft tissue covering socket orifices in the first 4 weeks. At the first week, the horizontal resorption on PRF (1.07±0.31 mm) was significantly less than that of the control (blood; 1.81±0.88 mm) |
| Yelamali *et al.* [2015] (39) | Socket preservation | This study included split mouths of 20 patients who underwent bilateral extraction of impacted third molars. The mean values of bone density measured over digitalized OPG images for PRF groups (156.10±9.74) were significantly higher as compared to PRP groups (145.21±11.37) |
| Doiphode *et al.* [2016] (51) | Socket preservation | A total of 30 patients having bilateral mandibular third molar impaction were included. Alveolar bone height (CEJ to Alveolar crest), distal to 2nd molar after 6 months. Control 2.77±2.24; PRP 2.1±1.4; PRF 1.57±0.62. |
| Varghese *et al.* [2017] (59) | Socket preservation | The average percentage of bone fill in the PRF group was 57.90±26.78 and that of the non-PRF group was 46.74±17.71; P<0.05. Soft tissue healing as evaluated by the healing index of Landry *et al.* also was found to be better at the PRF test site and it was statistically significant (P<0.05) |
| Centrifugation protocol: 2,700 rpm ×12 min | | |
| Anwandter *et al.* [2016] (106) | Socket preservation | Eighteen single rooted maxillary and mandibular sockets were filled with L-PRF without soft tissue closure. The socket by itself showed a bone fill of 5.72±3.6 mm (P=0.0001). The mean horizontal bone loss was 1.56±0.07 mm |
| Temmerman *et al.* [2016] (109) | Socket preservation | Treatments were randomly assigned (L-PRF socket filling versus natural healing). Significant differences were found for socket fill (visible mineralized bone) between test (94.7%) and control sites (63.3%) |
| Centrifugation protocol: 3,000 rpm ×10 min | | |
| Hamzacebi *et al.* [2015] (43) | Implant stability and bone regeneration | At 3 and 6 months after surgery, the PRF group demonstrated higher mean probing depth reductions (2.41±1.06 and 2.82±1.03 mm versus 1.65±1.02 and 2.05±0.77 mm) and more gains in clinical attachment level (2.89±1.01 and 3.31±1.08 mm versus 1.43±1.08 and 1.84±0.81 mm) compared with the control group (only access flap). In addition, the increase in the amount of keratinized mucosa from baseline to 6 months postoperatively was statistically significant for the PRF group (P<0.001) |
| Boora *et al.* [2015] (44) | Implant stability and bone regeneration | In PRF Group statistically significant crestal bone level changes were noted within three months, with a mean change of 0.25±0.06 mm mesially and 0.27±0.07 mm distally. Within non PRF Group Statistically significant crestal bone level changes were noted within three months, with a mean change of 0.57±0.22 mm mesially and 0.65±0.28 distally. Study group had statistically significant lesser mean value than control group. |
| Diana *et al.* [2018] (84) | Implant stability and bone regeneration | Forty-one implants were placed in 31 subjects with one or more non-restorable single-rooted teeth. Autologous PRF was placed in the peri-implant region of the study group (n=21) and no augmentation was done in the control group (n=20). A significant increase in implant stability was noted in both groups over the 3-month period (implant stability quotient: study group 56.58±18.81 to 71.32±7.82; control group 60.61±11.49 to 70.06±8.96; P=0.01). No significant difference was observed between the groups in terms of implant stability |
| Centrifugation protocol: 3,000 ×12 min | | |
| Khan *et al.* [2018] (88) | Implant stability and bone regeneration | 17 patients were initially enrolled for the study with 38 sites and were randomly assigned to receive either as Group 1 (Control) i.e., extraction site received immediate implants without any PRF, and Group 2 (experimental) i.e., extraction sites received immediate implants with PRF. The mean change (bone loss) within the groups at 9 months was more for control group than experimental group representing more bone loss in control group than the experimental group at both mesial and distal aspect of implants, but without statistical difference |
| Centrifugation protocol: 2,800 rpm ×12 min | | |
| Tabrizi *et al.* [2018] (96) | Implant stability and bone regeneration | Stability of implants placed in the posterior maxilla. PRF was used on one side (group 1); no PRF was used on the other (group 2). At 2 weeks, the mean ISQ was 60.60±3.42 in group 1 and 58.25±3.64 in group 2; at 4 weeks it was 70.30±3.36 in group 1 and 67.15±4.33 in group 2; at 6 weeks it was 78.45±3.36 in group 1 and 76.15±2.94 in group 2. Significant differences in RFA were found between the groups at 2 weeks (P=0.04), 4 weeks (P=0.014), and 6 weeks (P=0.027) after placement |
| Centrifugation protocol: 2,700 rpm ×12 min | | |
| Öncü *et al.* [2015] (102) | Implant stability and bone regeneration | Mean implant stability quotients (ISQs) of the PRF+ implants were 69.3±10.5, and mean ISQs for the PRF– implants was 64.5±12.2 at the end of the first week. The mean ISQs at 4 weeks postoperatively were 77.1±7.1 for the PRF+ group and 70.5±7.7 for the PRF– group. |
| Öncü *et al.* [2017] (110) | Implant stability and bone regeneration | A total of 60 immediate implants were evaluated. After the extraction, using split-mouth design, test sockets were coated with L-PRF (L-PRF+) and control sockets were not (L-PRF–). Results showed a statistically significant difference between the implant stability quotient of L-PRF+ (54.39±15.88) and L-PRF– (48.67±13.6) implants at 1 week and at 1 month (69.99±11.87 and 61.03±12.02). Mean marginal bone resorption was higher in the control group at 1 year |
| Centrifugation protocol: 3,000 rpm ×10 min | | |
| Kumar *et al.* [2015] (40) | Reduction of pain and swelling | Over a 2-year period, 31 patients required surgical extraction of a single impacted third molar were recruited. In the Control group only primary closure was done whereas in the Case group PRF was placed in the socket followed by primary closure. In our study, pain (P value 0.017), swelling (P value 0.022) and inter-incisal distance were lesser (P value 0.040) in the Case group as compared to the Control group on the first post- operative day and this difference was statistically significant |
| Gülşen *et al.* [2017] (62) | Reduction of pain and swelling | After extraction, the sockets were treated with PRF or without PRF. Both groups recorded significant improvement compared to the baseline levels in almost all of the outcome variables. There was no statistically significant difference between the study and control groups (P>0.05) |
| Afat *et al.* [2018] (69) | Reduction of pain and swelling | The mean increase in tragus to pogonion (edema measurements; TPO), TPO on day 2 was significantly higher in the control group than in the L-PR– plus-HA group (P=0.001), and the mean increase on day 7 in the control group was significantly higher than in the L-PRF group (P=0.003) and L-PRF– plus-HA group (P=0.007). There was no significant difference among groups in trismus measurements or VAS pain scores |
| Caymaz *et al.* [2019] (83) | Reduction of pain and swelling | The study was conducted with 27 patients. The visual analog scale pain scores of the L-PRF group during first (P<0.05), second, and third days and total values (P<0.01); the number of analgesics on days 2 (P<0.01) and 3; and their total values (P<0.05) were significantly higher than the A-PRF group. A-PRF after mandibular third molar extraction significantly reduces postoperative pain and the patients need to take analgesics of A-PRF group compared to L-PRF group |
| Centrifugation protocol: 2700 rpm ×12 min | | |
| Asutay *et al.* [2017] (119) | Reduction of pain and swelling | In a double-blinded, split-mouth randomized study, thirty patients with bilateral symmetric impacted third molars were enrolled in this study to receive surgery. The PRF was randomly placed in one of the extraction sockets, whereas the other socket was left without treatment. Statistical analyses revealed that there were no significant differences between the control and study groups regarding postoperative pain (4.87±11.42, 8.18±15.52), swelling (5.79±5.01, 7.25±5.73), and trismus (37.54±5.62, 36.76±7.95) |
| Centrifugation protocol: 3,000 rpm ×10 min | | |
| Simonpieri *et al.* [2011] (29) | Sinus-lift | Twenty-three lateral sinus elevations were performed on 20 patients with simultaneous implant placement. The maximum follow-up was 6 years, and all patients were followed up for a minimum of 2 years. No implant was lost during this 6-year experience, and the vertical bone gain was always substantial, between 8.5- and 12-mm bone gain (10.4±1.2) |
| Kanayama *et al.* [2016] (53) | Sinus lift | Platelet-rich fibrin as a sole grafting material. Twenty-seven patients with 39 implants (19 hydroxyapatite (HA) and 20 sand-blasted acid-etched (SA) were included in this study. The mean residual bone measurements before surgery in the SA and HA groups were 2.85 and 2.68 mm, respectively. The mean average bone gains for 1 year in the SA and HA groups were 4.38 and 4.00 mm, respectively |
| Centrifugation protocol: 878 g ×12 min | | |
| Olgun *et al.* [2018] (133) | Sinus lift | Eighteen posterior maxilla requiring sinus-lifting procedures using the balloon- lifting technique for implant placement were selected. Ten sinuses were randomly assigned to T-PRF as the test group and eight to allografts as the control group. Histomorphometric results showed that newly-formed bone ratios were 17.28±2.53 and 16.58±1.05 in the allograft group and T-PRF groups, respectively. There was no significant difference between the test and control groups (P=0.611) for implant stability values |
| Centrifugation protocol: 3,000 rpm ×10 min | | |
| Soydan *et al.* [2014] (37) | Management of Bisphosphonate-related osteonecrosis of the jaw | Total closure of moderate bone exposure in persistent BRONJ in 2 weeks with a double-layer PRF membrane. PRF |
| Asaka *et al.* [2017] (56) | Management of Bisphosphonate-related osteonecrosis of the jaw | Delayed recovery was observed in 9 out of 73 control patients (12%), whereas 29 PRF patients exhibited complete epithelialization of the socket within 1 month |
| Park *et al.* [2016] (57) | Management of Bisphosphonate-related osteonecrosis of the jaw | In this study the success rate of surgical treatment, involving removal of necrotic bone until fresh bleeding from L- PRF alone was 88% |
| Centrifugation protocol: 2,700 rpm ×12 min | | |
| Gönen *et al.* [2016] (107) | Management of Bisphosphonate-related osteonecrosis of the jaw | A 77-year-old male patient with Stage-3 BRONJ was treated with minimal surgical operations and PRF membrane. The patient was followed up for 18 months, and there was no recurrence or exposure |
| Centrifugation protocol: 1,300 rpm ×14 min | | |
| Norholt *et al.* [2016] (129) | Management of Bisphosphonate-related osteonecrosis of the jaw | The study population consisted of 15 patients with ONJ lesions in the maxilla (n=3), mandible (n=11), or both (n=1). Thirteen patients had grade 2 ONJ lesions and two had grade 3 lesions. Complete mucosal healing and an absence of symptoms were found in 14 of the 15 patients (93%). The patient with persistent bone exposure had a grade 3 ONJ lesion before surgery |
| Centrifugation protocol: 3,000 rpm ×10 min | | |
| Bilginaylar [2017] (60) | Closure of orocutaneous fistula (OCF) | Root canal treatment, apical surgery was performed and platelet-rich fibrin (PRF) was administered to the cavity of the lesion. Three months later, clinical and radiological examination showed total healing without scar formation |
| Bilginaylar [2019] (80) | Closure of acute oroantral communication (AOACs) | In 36 patients, following the extractions of posterior maxillary teeth, AOACs which were larger than 3mm diameter were detected. In group A, PRF clots were used in 21 patients and group B, classic buccal advancement flap was used in 15 patients. A, statistically significant reduction was examined (P<0.05) in pain and the analgesic doses taken in group A. Both methods were successful for the immediate closure of AOACs |
| Centrifugation protocol: 1,500 ×8 min | | |
| Demetoglu *et al.* [2018] (128) | Closure of oroantral communication | A total of 21 patients were included in the study. Plasma-rich fibrin membranes were inserted in layers into the tooth socket so that they covered the OAC. Then these membranes were fixated with the sutures to the surrounding gingiva. All patients tolerated PRF perfectly, and the soft tissue recovery was completed without any problem. Full epithelization was observed in the defect area in all patients between 3 and 5 weeks |
| Centrifugation protocol: 3,000 rpm ×10 min | | |
| Mahajan *et al.* [2018] (79) | Enhancement of soft tissue healing | 30th day follow-up showed 86.66% cases in Group A (excised lesions were grafted with PRF membrane) showing no pain as compared to 60% in Group B (excised lesions were grafted with collagen membrane). Healing was accelerated in Group A on 15th and 30th day follow-up, but it was the same on the 60th day |
| Asmael *et al.* [2018] (71) | Enhancement of soft tissue healing | PRF fibrin enhanced soft tissue healing and reduced inflammatory process within the study group compared with control group (heal naturally without PRF) as the 2-tailed P value equaled 0.0035 which was very statistically significant |
| Centrifugation protocol: 2,800 rpm ×12 min | | |
| Ustaoğlu *et al.* [2016] (94) | Enhancement of soft tissue healing | Free gingival graft (FGG) donor sites were treated with titanium-prepared, platelet-rich fibrin (T-PRF) and compared with an untreated control group. Complete wound epithelization was observed at a higher frequency in the test group than in the control group on day 14. Post-operative pain, as measured using the VAS, did not differ between the two groups during the first week (P>0.05). The palatal soft-tissue thickness (PSTT) in the T-PRF group was significantly thicker than that in the control group after 6 months of healing (4.51±0.58 mm in the T-PRF group and 3.93±0.69 mm in the control group) (P<0.05) |
| Daugela *et al.* [2018] (98) | Enhancement of soft tissue healing | 30 patients met the inclusion criteria for this split-mouth randomized clinical trial. Following extraction, one socket randomly received L-PRF, and the other socket served as a regular blood clot control. Sites treated with L-PRF resulted in improved HI (P=0.001) and lower pain VAS scores (P=0.001) in the first post-operative week. |
| Centrifugation protocol: 2,700 rpm ×12 min | | |
| Temmerman *et al.* [2018] (120) | Enhancement of soft tissue healing | Eight patients in need for bilateral widening of the KM around implants in the lower jaw were recruited for a spit- mouth randomized controlled trial. At the control site, a free gingival graft (FGG) was used, whereas at the other side (test), L-PRF membranes were applied. The total width of KM was significantly increased in the control group (10.0±7.5) and test group (8.5±6.3). All values of the postoperative pain scores at the control site were higher than at the test site. The mean surgery time in the test and control group was 29.1±4.8 and 48.1±7.7 minutes, respectively |
| Marenzi *et al.* [2015] (101) | Enhancement of soft tissue healing | Twenty-six patients were treated with multiple extractions, with a total of 108 extractions. After 7-14 days from the extractions, the values of modified Healing Index in the experimental and control groups were, respectively, 4.8±0.6 and 5.1±0.9 (P<0.05) |
| Centrifugation protocol: 1,300 rpm ×8 min | | |
| Fortunato *et al.* [2018] (131) | Enhancement of soft tissue healing | A case of local pyoderma gangrenosum. Medical treatment included oral corticosteroid therapy and topical treatment with PRF in solid and liquid form. This therapy initially led to the reduction of the ulcer's size and an improvement in symptoms, until the ulcer was completely healed after 4 weeks |
| Centrifugation protocol: 700 rpm ×3 min | | |
| Fortunato *et al.* [2018] (131) | Enhancement of soft tissue healing | A case of local pyoderma gangrenosum. The treatment protocol was initially based on the intralesional application of A-PRF membranes and the i-PRF injection around the injured area using an insulin syringe once a week for 4 weeks. This therapy initially led to the reduction of the ulcer's size and an improvement in symptoms, until the ulcer was completely healed |
| Centrifugation protocol: 2,700 rpm ×18 min | | |
| Sammartino *et al.* [2011] (99) | Hemostatic control of patients with anticoagulant oral therapy | Fifty heart surgery patients under oral anticoagulant therapy who needed dental extractions were selected for the study. Patients were treated with L-PRF clots placed into 168 post-extraction sockets without modification of anticoagulant therapy (mean international normalized ratio 3.16±0.39). Only 38 patients (76%) showed an adequate hemostasis after the dental extractions. In all cases, no alveolitis or painful events were reported, soft tissue healing was quick, and wound closure was always complete at the time of suture removal one week after surgery |
| Centrifugation protocol: 400 g ×12 min | | |
| de Almeida Barros Mourão *et al.* [2018] (141) | Hemostatic control | Interventional case series describes the treatment of 10 patients with excisional biopsy of benign oral cavity lesions. After treatment with PRF, patients presented mean time for postoperative hemostasis of 10.3±2.5 s, requiring the average use of three membranes to cover the surgical area. The results suggest that the use of platelet-rich fibrin membranes may represent a feasible alternative hemostatic material. Four months after removal of the lesion, the tissue was completely healed |
| Centrifugation protocol: 3,500 rpm ×12–15 min | | |
| Moussa *et al.* [2016] (24) | Bone augmentation | The test group (PRF was used to cover the bone block) showed statistically significantly lower mean graft resorption than the control group (Bone block alone) (test, 0.8±0.6 mm; control, 1.6±0.9 mm; P=0.006) |
| Centrifugation protocol: 3,000 rpm ×10 min | | |
| Shawky *et al.* [2015] (45) | Bone augmentation -Alveolar cleft | The percentage of newly formed bone (quantity) in group A (patients grafted with PRF combined with autogenous anterior iliac crest bone graft) with a mean percentage of 82.6%±3.9%. In group B (patients were grafted using autogenous bone graft alone), the mean percentage of 68.38%±6.67%. There was a statistically significant increase in the percentage of newly formed bone in group A. The mean bone density (quality) of the newly formed bone was lower in group A than group B, but the difference was not statistically significant (P<0.05) |