Published online: 2019-10-01

Original Article

# Effectiveness of platelet-rich fibrin in the management of pain and delayed wound healing associated with established alveolar osteitis (dry socket)

Ashish Sharma[1], Nimish Aggarwal[1], Sanjay Rastogi[1], Rupshikha Choudhury[2], Siddhi Tripathi[3]

[1]Department of Oral and Maxillofacial Surgery, Kothiwal Dental College and Research Center, Moradabad, Uttar Pradesh, India,
[2] Department of Oral and Maxillofacial Surgery, Regional Dental College, Assam, India,
[3]Department of Prosthodontics, Kothiwal Dental College and Research Center, Moradabad, Uttar Pradesh, India

**Correspondence:** Dr. Sanjay Rastogi
Email: docos79@gmail.com

## ABSTRACT

**Objective:** To assess the efficacy of platelet-rich fibrin (PRF) on the pain and healing of the extraction socket related with established alveolar osteitis (dry socket, AO) after the removal of maxillary and mandibular molars. **Materials and Methods:** One hundred consecutive adult patients with age group ranging from 18 to 40 years along with established dry socket after maxillary and mandibular molar extractions who have not received any treatment for the same were included in this single-arm clinical trial. PRF was placed in the maxillary and mandibular molar extraction sockets after adequate irrigation of the socket. All the patients evaluated for the various study variables which include pain, degree of inflammation, and healthy granulation tissue formation (wound healing) at the 1st, 3rd, 7th, and 14th post-PRF placement day in the alveolar socket. Data were analyzed using Shapiro-Wilk's test, Chi-square test and/or Student's *t*-test, Friedman's test, Wilcoxon signed-rank test, and Bonferroni test, with the significance level set at $P < 0.05$. **Results:** There was significant reduction in pain associated with AO at the 3rd and 7th post-PRF placement day in the extraction socket along with mark decrease in the degree of inflammation at the 3rd post-PRF placement day, and there was better wound healing by the end of the 2nd week. **Conclusion:** The use of PRF in this clinical trial illustrates the promising results in terms of reduced pain and better healing in the patients with sustained AO.

**Key words:** Alveolar osteitis, dry socket, pain, platelet-rich fibrin, tooth extraction

## INTRODUCTION

Dry socket or acute alveolar osteitis (AO) is a quite painful and debilitating condition for the patients who underwent extractions.[1,2] The phrase dry socket was first formulated by Crawford;[1] it has been previously described by various terminologies in the literature,[1,2] and it can be defined by Blum as the subsistence of "postoperative pain in and around the site, which extraction increases in severity at any time between 1 and 3 days after the extraction, accompanied by a partially or totally disintegrated blood clot within the alveolar socket, with or without halitosis."[3]

Access this article online

Quick Response Code:

Website: www.eurjdent.com



**How to cite this article:** Sharma A, Aggarwal N, Rastogi S, Choudhury R, Tripathi S. Effectiveness of platelet-rich fibrin in the management of pain and delayed wound healing associated with established alveolar osteitis (dry socket). Eur J Dent 2017;11:508-13.

**DOI:** 10.4103/ejd.ejd_346_16

Its incidence after dental extractions is range from 1% to 30%.[3] As a result, dry socket leads to stress for the dentists in managing the patient after extractions of teeth. The essential characteristic of sicca dolorosa is loss of the normal clot from the socket along with exposed bony walls and sensitive on gentle probing. Halitosis (bad breath) is a common complaint from the patient; fever is occasionally present.[5,6] It is generally exist within 1–4 days following dental extraction of teeth commonly mandibular molars, commonly seen in the age group of 30 years or above; females are commonly affected than males.[7,8]

AO has been associated with various etiologies.[7,9-14] In recent past, a plethora of various researches had been done regarding the prevention and management of dry socket;[3,15-24] nonetheless, none of them provided the effective treatment of the AO.

Contemporary review of literature depicts that a lot of research has been done on platelet rich-fibrin (PRF), and numerous cases have been reported regarding the use of PRF clot and PRF membranes. Majority of the research has been concentrated on the use of PRF in oral surgery for bone augmentation, sinus lifts, avulsion sockets, etc., and its applications in periodontology and endodontics, but none of them established its use in the management of pain and delayed wound healing associated with the dry socket. PRF will act as a stable blood clot for neovascularization and accelerated tissue regeneration. This can be used to improve wound healing in immunocompromised and diabetic patients.[25-32]

In lieu of the above-mentioned versatility of PRF, the aim of the present trial was to appraise the efficacy of PRF in the management of pain and delayed wound healing affiliated with established AO consequently after the extraction of maxillary and mandibular molars.

## MATERIALS AND METHODS

A single-arm nonrandomized clinical trial was conducted with the approbation of the department of oral and maxillofacial surgery over a period of 18 months from September 2014 to March 2016. All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards, and the regional ethical review board of institution approved the study. The sample size of the study was determined by software "N Master" designed and developed by Biostatistics Department of CMC Vellore, Tamil Nadu, India. The level of significance, i.e., $\alpha$ – error was 5%, power was 80%, and the confidence interval was 95%. On calculation, we had found a sample size of 100 patients for the study. The procedure was explained to all the patients, and informed consent was obtained from all participants included in the study. Those who were not ready and failed to report according to the set criteria were excluded from the surgery.

### Inclusion and exclusion criteria

One hundred consecutive patients ranging from 18 to 40 years of age group with established dry socket after maxillary and mandibular molar extraction, usually reporting on the 3$^{rd}$ to 5$^{th}$ postextraction day who have not received any treatment for the same were included in the study. Patients free from any systemic diseases and without any signs of active infection in extracted socket were included in the study. Exclusion criteria were pregnant and lactating women or patients on oral contraceptives, previous history of antibiotic and anti-inflammatory therapy for the treatment of dry socket, participants with any underlying systemic disease or compromised immunity, and patients who were unable to provide informed consent to the maxillofacial surgeon at the time of procedure. Patients who have already received treatment for dry socket, for example, local dressing with zinc oxide eugenol pack, honey, etc., were also excluded from the study.

### Study process

The PRF was placed in the molar extraction socket with established dry socket after gentle irrigation of the socket with warm saline. A total number of 100 extraction sockets in 100 consecutive patients with established localized osteitis was treated in the similar way. All the participants have been discharged after the treatment without any postoperative analgesic and antibiotic coverage. All patients were re-evaluated after the 1$^{st}$, 3$^{rd}$, 7$^{th}$, and 14$^{th}$ post-PRF placement. To control the bias, a single operator had treated all the patients.

### Method of preparation of platelet-rich fibrin

The PRF was prepared according to the protocol of Choukroun *et al*.[22] which is as follows: The Institutional Review Board has approved the study, according to PRF protocol, blood samples were treated with a table centrifuge, and collection kits provided

by Remi, Mumbai, India (R-8C BL, Remi Labs, India). In short, samples were retreated from the patient without an anticoagulant in 10 ml glass-coated plastic tubes (Poly Medicure Ltd., New Delhi, India) and subjected to centrifugation at 3000 rpm for 12 min. A fibrin clot was formed in the middle part, acellular plasma present in the upper part of the tube, and the red corpuscles in the bottom part. The fibrin clot was abstracted comfortably from the basal part of the tube. The segregated PRF was placed into the dry socket and stabilized with the help of figure of eight sutures.

**Clinical parameters**

Various parameters were used to appraise the study participants [Tables 1 and 2].

*Pain*

It was assessed using a 10-point visual analog scale, with a score of "0" equals "no pain" and "10" equals "very severe pain" [Figure 1].

Pain was evaluated before PRF placement and post-PRF placement 1st, 3rd, and 7th day.

Moreover, all the patients were asked not to take any pain killers, i.e., nonsteroidal anti-inflammatory drugs for the postoperative pain to assess the antinociceptive property of PRF. Furthermore, the time required to achieve clinical healing was also noted.

*Degree of inflammation*

It was evaluated using severity index for inflammation from 0 to 3 which comprised of 0 - no inflammation, 1 - mild inflammation, 2 - moderate inflammation, and 3 - severe inflammation on the 1st, 3rd, and 7th day post-PRF placement. Inflammation was assessed clinically by gentle probing of the extraction socket to ensure the presence or absence of bleeding.

*Granulation tissue formation*

Granulation tissue formation at the molar extraction site treated with PRF was assessed clinically. This is evident clinically by the coverage of the exposed bony walls of the extraction site associated with AO by soft granulation tissue which can be graded as: 0 - no bony walls exposed, 1 - only one bony wall exposed, 2 - two bony walls exposed, 3 - three bony walls exposed, and 4 - four bony walls exposed. The granulation tissue was divided into healthy (pink and does not bleed on probing) and unhealthy granulation tissue (dark red and often bleeds on probing). Granulation tissue formation was evaluated on the 1st, 3rd, 7th, and 14th post-PRF placement.

The results of the clinical examination were recorded on a specific form. The data were subjected to statistical analysis using Shapiro-Wilk's test, Chi-square test and/or Student's *t*-test, Friedman's test, Wilcoxon signed-rank test and Bonferroni test, and SPSS version 20 (Chicago, Illinois, USA) software as per data requirements. The level of significance was concluded at $P < 0.05$.

**Table 1: Preoperative evaluation criteria**

| | Pain | Degree of inflammation | Exposed bone |
|---|---|---|---|
| Method | Visual analog scale | Clinical assessment | Number of socket walls exposed |
| Score | 1-10 | 1 - Mild<br>2 - Moderate<br>3 - Severe | 1 - One wall<br>2 - Two walls<br>3 - Three walls<br>4 - Four walls |

**Table 2: Postoperative evaluation criteria**

| | Pain | Inflammation | Healthy granulation tissue |
|---|---|---|---|
| Method | Visual analog scale | Presence and absence of bleeding | Clinical assessment |
| Score | 1-10 | 0 - No bleeding<br>1 - Mild bleeding<br>2 - Moderate bleeding<br>3 - Severe bleeding | 4 - Four walls exposed<br>3 - Three walls exposed<br>2 - Two walls exposed<br>1 - One wall exposed<br>0 - Zero wall exposed |

## RESULTS

Out of one hundred patients of dry socket, 21 were males and 79 were females with a ratio of 4:1. Dry socket was seen more commonly occurring in females. Patients <25 years of age were more commonly affected. Incidence of dry socket was more in the mandible than the maxilla ($P = 0.045$). Out of the one hundred patients, ten patients ($n = 10$) were excluded from the analysis due to consumption of analgesics for the pain in the follow-up period after the PRF placement in the alveolar socket. All patients measured severe pain on day 1 on visual analog scale, but there was a significant fall in the pain score on the 3rd and 7th post-PRF

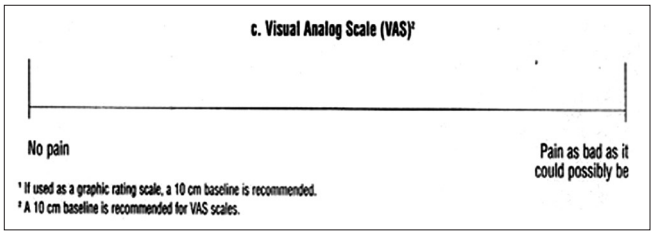


**Figure 1:** Visual analog scale

placement in the alveolar socket ($P < 0.05$). The degree of inflammation which was more on the 1st post-PRF placement day was also significantly decreased by the 7th day ($P < 0.05$). Denuded bony walls of the extraction socket, which were visible before the placement of PRF in the extraction sockets and in the immediate post-PRF placement day, were gradually replaced by granulation tissue. By the end of 2 weeks, no bony walls were exposed in any of the extraction sites ($P < 0.05$) [Tables 3-6].

## DISCUSSION

Dry socket is a frequent drawback of exodontia and results in pertubance of the patient. It is a postoperative sequelae often associated with the removal of mandibular third molars.[3] Several methods have been advocated to reduce the incidence of dry socket.[15-24] AO is known to have a multifactorial origin[7] where bacteria play an important role. The part of *Actinomyces viscosus* and *Treponema denticola* in dry socket has been propagated by various studies.[10,11] Because of which, the use of antibiotics in the form of mouthwash and intrasocket medication gained popularity.[3] Various pharmacological agents were proposed and designed for interception of dry socket for instance chlorhexidine in forms of gel and mouthwash.[15]

Topical anesthetics and obtundents or combinations of all three[3] have also been used for the treatment of dry socket. Intrasocket medications such as zinc oxide eugenol impregnated cotton pellets, alvogyl, dentalone, bismuth subnitrate, and iodoform paste on ribbon gauze are other alternatives used for the treatment of dry socket.

Certain studies implicated the use of topical parahydroxybenzoic acid and tranexamic acid[17] and the use of polymer polylactic acid[18] in the prevention of dry socket. However, these treatment options have not shown satisfactory results. Antimicrobial photodynamic therapy was employed in the management of dry socket, but further studies are required.[19]

Choukroun *et al*.[22] in France advocated the use of PRF which is a second-generation platelet concentrate. PRF is a stringently autologous fibrin matrix. Dohan *et al*.[26] suggested that PRF addition can correct destructive reactions in the natural process of healing of wound tissues. Thus, this determines that PRF has immune regulatory mechanism over the inflammation.

**Table 3: Demographic details**

| | *n* (%) |
|---|---|
| Age (years) | |
| <25 | 41 (40.6) |
| 26-35 | 38 (37.6) |
| >36 | 21 (20.8) |
| Total | 100 (100.0) |
| Sex | |
| Male | 21 (20.8) |
| Female | 79 (78.2) |
| Total | 100 (100.0) |
| Site | |
| Maxilla | 26 (25.7) |
| Mandible | 74 (73.3) |
| Total | 100 (100.0) |

**Table 4: Mean, standard deviation, and mean rank of participants' visual analog scale scores**

| | *n* | Mean | SD | Mean rank | $\chi^2$ | *P* |
|---|---|---|---|---|---|---|
| Preoperative | 100 | 8.51 | 0.55 | 4.00 | 302.41 | 0.000* |
| Postoperative 1 day | 100 | 4.57 | 0.62 | 2.99 | | |
| Postoperative 3 day | 100 | 2.38 | 0.48 | 2.01 | | |
| Postoperative 7 day | 100 | 0.00 | 0.00 | 1.00 | | |

*Friedman's test $P<0.05$. As Friedman's test showed statistical significant difference between different time intervals, *post hoc* pairwise comparisons were done by Wilcoxon signed-rank test with Bonferroni corrections. Thus $P<0.0125$ was considered as significant for *post hoc* test.
SD: Standard deviation

**Table 5: Mean, standard deviation and mean rank of participant's degree of inflammation**

| | *n* | Mean | SD | Mean rank | $\chi^2$ | *P* |
|---|---|---|---|---|---|---|
| Preoperative | 100 | 2.64 | 0.48 | 3.81 | 290.85 | 0.000 |
| Postoperative 1 day | 100 | 2.02 | 0.14 | 3.18 | | |
| Postoperative 3 day | 100 | 1.03 | 0.17 | 2.02 | | |
| Postoperative 7 day | 100 | 0.00 | 0.00 | 1.00 | | |

*Friedman's test $P<0.05$. As Friedman's test showed statistically significant difference between different time intervals, *post hoc* pairwise comparisons were done by Wilcoxon signed-rank test with Bonferroni corrections. Thus, $P<0.0125$ was considered as significant for *post hoc* test.
SD: Standard deviation

**Table 6: Mean, standard deviation, and mean rank of participants' bony walls exposed**

| | *n* | Mean | SD | Mean rank | $\chi^2$ | *P* |
|---|---|---|---|---|---|---|
| Preoperative | 100 | 3.63 | 0.48 | 4.99 | 394.69 | 0.000 |
| Postoperative 1 day | 100 | 2.62 | 0.48 | 4.01 | | |
| Postoperative 3 day | 100 | 1.60 | 0.49 | 3.00 | | |
| Postoperative 7 day | 100 | 0.60 | 0.49 | 1.80 | | |
| Postoperative 14 day | 100 | 0.00 | 0.00 | 1.20 | | |

*Friedman's test $P<0.05$. As Friedman's test showed statistically significant difference between different time intervals, *post hoc* pairwise comparisons were done by Wilcoxon signed-rank test with Bonferroni corrections. Thus, $P<0.01$ was considered as significant for *post hoc* test.
SD: Standard deviation

Although PRF has been used for several procedures such as ridge augmentation, in sinus lift procedures, for filling furcation defect, and for avulsion sockets, however, no studies were done on the use of PRF in managing dry socket and its associated pain and inflammation. The present study is an attempt which harnessed the healing potential of PRF and its immune regulatory capacity in the management of dry socket after extraction of molars.

Healing and immunity is benefit by the PRF which is an immune and platelet concentrate aggregate on a single fibrin membrane that comprises all the ingredients of blood. The development of microvascularization and cell migration into a wound can be compliment by PRF which is an indigenous fibrin-based biomaterial. Moreover, this grid contains leukocytes and assists their movement. In case of infected wounds, its acceptance appears to be of eminent concern.

In a clinical example depicted by Choukroun *et al*.[22] in which they used the PRF as a filling material in extraction socket, clinically, they confirm that neovascularization and epithelial coverage of the extraction socket can be achieved with the use of PRF. Finally, accelerated healing of the wound is contemplated without pain, dryness, or purulent complexities in the infectious and inflammatory wounds. This suggests that the use of PRF as a grafting material for the treatment of dry socket may improve the clinical healing. This perhaps due to copious amount of growth factors such as platelet-derived growth factor, transforming growth factor-beta, epidermal growth factor, insulin-like growth factor, and hepatocyte growth factor liberated from PRF mesh; these factors play an essential role in the reconstitution of forfeited tissue, covering of the wound, and re-establishing the vascular integrity. Contemporary literature demonstrated that PRF membrane has a very eloquent slow continuous release of essential growth factors for at least seven, and up to 28 days, which means during the period of remodeling, the membrane activates its background for a significant period. Furthermore, these molecules could accelerate a process that occurs by itself (it does not create a new process). Thus, it provides a great potential during wound healing in dry sockets.

In the present study, females were seen more commonly affected (78.2%). This is in accordance to other studies by Xu *et al*.[14] and Eshghpour *et al*.,[29] and the reason cited behind this high percentage is due to the use of oral contraceptives and menstruation.

The present study implies that the ubiquity of AO more in the mandible than in maxilla perhaps due to more deliverance of direct tissue activators secondary to bone marrow inflammation following more difficult and hence more traumatic extractions.[27]

Pain is inevitable for patients with dry socket which hampers the regular activities of life. The present study showed how severe pain was measured in the visual analog scale preoperatively, but after the application of PRF, there was marked reduction in pain. Kumar *et al*.[28] reported of reduction in pain level by the use of PRF. PRF acts as an immune regulator and may decrease the deleterious effects of inflammation as described by the Dohan *et al*.[26]

It implies that the fibrin matrix results in angiogenesis and contributes toward natural immunity, thus reducing inflammatory process. Therefore, it provides natural resurfacing of the dry socket wound, which ultimately results in the covering of the exposed nerve endings in the socket as a result; there was a significant decrease in the amount of pain associated with the condition.

A highly significant reduction in inflammatory response was also clinically observed in the present study. A study by Eshghpour *et al*.[30] also reported of reduction of inflammation with the use of PRF. Studies have shown that PRF can stimulate defense mechanism to prevent infections and has immune regulatory action.[26]

Denuded bony walls characteristically seen in dry sockets showed better healing, and there was coverage of bony walls due to granulation tissue formation on the 2nd week postoperatively, after being treated with PRF [Table 6]. This is attributing to the PRF inherent property of releasing growth factors in a controlled manner. The encouragement of the mitogenic response in the periosteum for bone repair during normal wound healing is due to the growth factors released after activation from the platelets entangled within fibrin matrix.[22]

## CONCLUSION

The occurrence of dry socket in an everyday oral surgery or dental practice is inescapable. The risk factors associated with AO are discernibly analyzed. Although various methods of prevention of dry socket have been employed, the management of established AO is a limited and difficult case. With PRF gaining grounds as a potent wound healer, the

present study focused on managing the bothersome pain and delayed healing associated with dry socket with this autologous material. Significant decrease in pain level was noted by the use of PRF, and better wound healing was promoted.

**Financial support and sponsorship**
Nil.

**Conflicts of interest**
There are no conflicts of interest.

## REFERENCES

1. Crawford JY. Dry socket. Dent Cosmos. 1896;38:929–993.
2. Bloomer CR. Alveolar osteitis prevention by immediate placement of medicated packing. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2000;90:282-4.
3. Blum IR. Contemporary views on dry socket (alveolar osteitis): A clinical appraisal of standardization, aetiopathogenesis and management: A critical review. Int J Oral Maxillofac Surg 2002;31:309-17.
4. Oginni FO. Dry socket: A prospective study of prevalent risk factors in a Nigerian population. J Oral Maxillofac Surg 2008;66:2290-5.
5. Quinley JF, Royer RQ, Gores RJ. "Dry socket" after mandibular odontectomy and use of soluble tetracycline hydrochloride. Oral Surg Oral Med Oral Pathol 1960;13:38-42.
6. Birn H. Aetiology and pathogenesis of fibrinolytic alveolitis (Dry socket). Int J Oral Surg 1973;2:251-63.
7. Tarakji B, Saleh LA, Umair A, Azzeghaiby SN, Hanouneh S. Systemic review of dry socket: Aetiology, treatment and prevention. J Clin Diagn Res 2015;9:ZE10-3.
8. Fernandes GJ, Hatton MN. Prevention of alveolar osteitis. A case report and review of literature. N Y State Dent J 2016;82:21-5.
9. Wates E, Ria B. The prevention and management of dry socket: Do antibiotics have a role to play? Prim Dent J 2015;4:42-3.
10. Hedström L, Sjögren P. Effect estimates and methodological quality of randomized controlled trials about prevention of alveolar osteitis following tooth extraction: A systematic review. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2007;103:8-15.
11. Nitzan DW. On the genesis of "dry socket". J Oral Maxillofac Surg 1983;41:706-10.
12. Freudenthal N, Sternudd M, Jansson L, Wannfors K. A double-blind randomized study evaluating the effect of intra-alveolar chlorhexidine gel on alveolar osteitis after removal of mandibular third molars. J Oral Maxillofac Surg 2015;73:600-5.
13. Rakhshan V. Common risk factors for postoperative pain following the extraction of wisdom teeth. J Korean Assoc Oral Maxillofac Surg 2015;41:59-65.
14. Xu JL, Sun L, Liu C, Sun ZH, Min X, Xia R, *et al.* Effect of oral contraceptive use on the incidence of dry socket in females following impacted mandibular third molar extraction: A meta-analysis. Int J Oral Maxillofac Surg 2015;44:1160-5.
15. Jesudasan JS, Wahab PU, Sekhar MR. Effectiveness of 0.2% chlorhexidine gel and a eugenol-based paste on postoperative alveolar osteitis in patients having third molars extracted: A randomised controlled clinical trial. Br J Oral Maxillofac Surg 2015;53:826-30.
16. Khiyavi R, Barghi V, Yazdani J, Ghavimi MA, Saadat M, Khiyavi G, *et al*. Effect of Biotene mouth wash on prevention of alveolar osteitis after extraction of permanent mandibular first molar teeth. Elixir Human Physiol 2012;47:8672-4.
17. Anand KP, Patro S, Mohapatra A, Mishra S. The efficacy of Tranexamic acid in the reduction of incidence of dry socket: An Institutional double blind study. J Clin Diagn Res 2015;9:ZC25-8.
18. Hooley JR, Golden DP. The effect of polylactic acid granules on the incidence of alveolar osteitis after mandibular third molar surgery. A prospective randomized study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1995;80:279-83.
19. Jovanović G, Urić N, Krunić N, Tijanić M, Stojanović S. Assessment of the effectiveness of low level laser in the treatment of alveolar osteitis. Vojnosanit Pregl 2011;68:506-10.
20. Goldsmith SM, De Silva RK, Tong DC, Love RM. Influence of a pedicle flap design on acute postoperative sequelae after lower third molar removal. Int J Oral Maxillofac Surg 2012;41:371-5.
21. Ross R, Glomset J, Kariya B, Harker L. A platelet-dependent serum factor that stimulates the proliferation of arterial smooth muscle cells *in vitro*. Proc Natl Acad Sci U S A 1974;71:1207-10.
22. Choukroun J, Diss A, Simonpieri A, Girard MO, Schoeffler C, Dohan SL, *et al*. Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part V: Histologic evaluations of PRF effects on bone allograft maturation in sinus lift. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006;101:299-303.
23. Haraji A, Lassemi E, Motamedi MH, Alavi M, Adibnejad S. Effect of plasma rich in growth factors on alveolar osteitis. Natl J Maxillofac Surg 2012;3:38-41.
24. Pal US, Singh BP, Verma V. Comparative evaluation of zinc oxide eugenol versus gelatin sponge soaked in plasma rich in growth factor in the treatment of dry socket: An initial study. Contemp Clin Dent 2013;4:37-41.
25. Corso MD, Toffler M, David M, Ehrenfest D. Use of autologous leukocyte and platelet rich fibrin (L-PRF) membrane in post avulsion sites: An overview of Choukroun's PRF. J Implant Adv Clin Dent 2010;1:27-35.
26. Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, *et al.* Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part III: Leucocyte activation: A new feature for platelet concentrates? Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006;101:e51-5.
27. Bortoluzzi MC, Manfro R, De Déa BE, Dutra TC. Incidence of dry socket, alveolar infection, and postoperative pain following the extraction of erupted teeth. J Contemp Dent Pract 2010;11:E033-40.
28. Kumar YR, Mohanty S, Verma M, Kaur RR, Bhatia P, Kumar VR, *et al.* Platelet-rich fibrin: The benefits. Br J Oral Maxillofac Surg 2016;54:57-61.
29. Eshghpour M, Rezaei NM, Nejat A. Effect of menstrual cycle on frequency of alveolar osteitis in women undergoing surgical removal of mandibular third molar: A single-blind randomized clinical trial. J Oral Maxillofac Surg 2013;71:1484-9.
30. Eshghpour M, Dastmalchi P, Nekooei AH, Nejat A. Effect of platelet-rich fibrin on frequency of alveolar osteitis following mandibular third molar surgery: A double-blinded randomized clinical trial. J Oral Maxillofac Surg 2014;72:1463-7.
31. Das S, Jhingran R, Bains VK, Madan R, Srivastava R, Rizvi I, *et al.* Socket preservation by beta-tri-calcium phosphate with collagen compared to platelet-rich fibrin: A clinico-radiographic study. Eur J Dent 2016;10:264-76.
32. Mathur A, Bains VK, Gupta V, Jhingran R, Singh GP. Evaluation of intrabony defects treated with platelet-rich fibrin or autogenous bone graft: A comparative analysis. Eur J Dent 2015;9:100-8.