Detection of the Effect of Platelet-Rich Fibrin on the Management of Dry Socket

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ABSTRACT

A dry socket is a commonly seen issue that happens throughout the process of wound healing following a tooth extraction. The etiology of this condition is still limited understood, and it frequently manifests in persons who have a state of good health. As a consequence, the management strategies for dry sockets have always depended on practical experience rather than scientific theory. This study aims to assess the efficacy of platelets-rich fibrin (PRF) in treating dry sockets and compare it with traditional therapy methods.

A randomized controlled clinical trial was conducted among patients with a dry socket, who were categorized into two treatment groups. In the group I, the conventional treatment was used with performing gentle socket curettage and saline irrigation. The group II was treated with platelet-rich fibrin (PRF); the dry socket patients were examined at day 0 and achieved one of two treatment options, then scheduled follow-up appointments on days 4 and 7 after therapy. The pain score, inflammation and tenderness around the socket, and quantity of granulation tissue formation were assessed, respectively.

In total, sixty patients with a dry socket were included in two treatment groups. The results show that The conventional therapy group required more than seven days to reach the same healing phase as group II with PRF-treated socket. It was observed that the PRF-treated group II patients experienced an improvement in pain, tenderness, inflammation and granulation tissue formation.

The sockets treated with PRF showed statistically significant improvement in the healing process and granulation tissue formation compared with conventional treatment.

1. Introduction

The global prevalence of dry socket, 1–4% after routine dental extractions, is concerning (Oualha et al. 2012 . Lower teeth have a 10 times higher risk than upper teeth, and mandibular third molar extraction may reach 45%(1). Dry socket, or alveolar osteitis, is a common post-tooth extraction problem. Without a blood clot in the socket, the bone is exposed (Mamoun, 2018). The management of dry socket has historically been based on observation and experience rather than scientific evidence. Practitioners employ several therapeutic techniques: Hyaluronic acid wound dressings exhibited antioxidant properties(2).Honey and turmeric have the ability to improve the process of regeneration and promote growth(3).The pain management dressings utilized zinc oxide eugenol and either butamben or iodoform for their antibacterial properties. Eugenol had antimicrobial and analgesic properties. Biocompatible fibrous fillers such as Peshawar Djambi(4)and topical rifampicin(5)have been utilized for its antibacterial effectiveness. The socket is fitted with vitamin-C dressings (6).

Traditional methods of irrigating dry sockets include using physiological saline and chlorhexidine (5) These treatments relieve symptoms and preserve the wound, but they fail to solve the primary problems with wound breakdown and regenerative therapy. The standard treatment for dry sockets is gentle curettage and saline rinse. Biological repair then heals the socket (7).

The cause and management of dry socket are still debated. Since dry socket causes delayed wound healing, scientists must study wound healing mechanisms to develop a regenerative medicine treatment for lesions. PRP and CGF are intraoral regenerative wound-healing treatments in dentistry , (8) (7). and low-intensity pulsed ultrasound therapy (LIPUS) and low-level laser therapy (LLLT) (9) (7).

Platelet rich fibrin (PRF) is derived from an individual's blood through the process of centrifugation. Platelet-rich fibrin (PRF) is a fibrous structure composed of fibrin, containing growth factors that function as catalysts for tissue regeneration, (10) along with cells such white blood cells that produce cytokines. The matrix comprises these constituents, which can be released in a progressive manner.

PRF can function as a biocompatible membrane that can be absorbed by the body(11).

Choukroun and his colleagues were among the first to use the PRF protocol in oral and maxillofacial surgery, with the goal of improving bone healing in implant dentistry. Autologous platelet-rich fibrin (PRF) is considered a regenerative biomaterial that possesses therapeutic characteristics for healing. Presently, research has substantiated its application in different fields of dentistry (7). The objective of the present study to evaluate the effect of PRF on management of dry socket.

2. Methodology

A pilot randomized controlled clinical trial was conducted among patients with a dry socket, who were categorized into two treatment groups at AL-Ameed University Dental Hospital from August 2022 till December 2023.

For Human Ethics, the Research Ethics Committee at the University of Al-Ameed approved the study (number: UAM/EC/5/2017). Patients diagnosed with alveolar osteitis were sent to the oral surgery department. All patients within the age range of 28 to 50 years who had a nonsurgical tooth extraction and were diagnosed with alveolar osteitis during the study period were included. Patients who declined participation in the trial or failed to complete the follow-up were removed. Prior to starting therapy, a periapical radiograph of the socket was obtained for each group in order to eliminate the potential presence of remaining apices, bone fragments, and alveolar fractures. In these instances, the patients were also excluded.

Information regarding the dry socket condition was provided to all patients, and their informed consent was obtained. The participants were divided into two groups at random. A total of sixty patients were split into two groups: In group I, the dry socket was delicately curetted and treated with saline solution under local anesthesia. In group II, following socket curettage and irrigation, the PRF clot was promptly placed into the socket. A volume of 9 mL of the individual's blood was extracted into a vacuum blood collection tube. The blood was subjected to centrifugation at the chairside for a duration of 10 minutes at a speed of 3,000 revolutions per minute (rpm). The formation of the dense gel layer, commonly referred to as PRF, was ultimately achieved. Using a surgical tweezer, the PRF clot was directly placed into the socket. Next, secure the PRF clot by suturing the socket. As shown in picture 1

Picture 1. A show the clot of PRF , B Show the insertion of PRF in the socket

The data obtained included demographic information such as age and gender, a visual analogue pain scale ranging from 1 to 10, ratings for peri-socket inflammation and discomfort, socket depth, and the extent of granulation tissue formation. Participants were assessed on days 0, 4, and 7 of the monitoring time in two separate groups.

The pain score was evaluated using numeric rating scales, which usually include a range of numbers from 0 to 10. These numbers represent the full spectrum of possible pain experiences, with the

endpoints labeled as "no pain" and "worst possible pain," respectively. Patients select the numerical value that most accurately represents the severity of their suffering,(12). The perisocket inflammation and tenderness assessed recording in Table 1

Table 1 assessment of perisocket inflammation and tenderness

Perisocket inflammation	Score
Normal pink perisocket gingiva	0
Mild redness at perisocket gingiva	1
Moderate redness with increase vascularity at perisocket gingiva	2
Severe redness with increase vascularity at perisocket gingiva extending to vestibule	3
Perisocket tenderness	Score
No perisocket tenderness on palpation	0
Perisocket tenderness on palpation	1
Perisocket tenderness on slight touch	2
Perisocket tenderness on slight touch extending to vestibule and cheek	3

For the socket depth used the WHO probe, the distance from the bottom of the socket to the level of cement _enamel junction of the adjacent tooth was measured during each visit.

Statistical Analysis

The statistical analysis was performed using Graph Pad Prism version 9.2 (Graph Pad Software Inc., LaJolla, CA). One Way ANOVA (Tukey's Test) and Two Way ANOVA (Šídák's Test) were used to determine whether group variance was significant or not. Pearson coefficient r value was employed to assess correlation. Chi-square was employed to test count variances. Quantitative parametric data were subjected to Shapiro-Wilk test to confirm the normal distribution and were expressed as mean ± SD and statistical differences were defined as * $p < 0.05$ and ** $p < 0.01$.

3. Results and discussion

In total, sixty patients with a dry socket, were included into two treatment groups. 30 patients participated in group I, 30 patients in group II. The difference between the age and number in these groups was non-significant.

The results of the present study show that on day 0 before intervention, the pain index, presocket inflammation index (PSI) and preresocket tenderness index (PST), showed no significant difference between these groups except for the depth of socket, as shown in Table 2.

Table 2: Show the difference in pain, PSI, PST, and depth of socket between groups on day 0.

DAY 0	CONTROL	PRF	P VALUE
PIAN, medium (Q25%-Q75 %)	9(8-10)	9(9-10)	0.130
PSI, medium (Q25%-Q75 %)	2(2-3)	2(2-3)	0.380
PST, medium (Q25%-Q75 %)	3(2-3)	3(2-3)	0.550
Depth of socket ,medium (Q25%-Q75 %)	11.5(11-12)	12.5(11.75-13)	0.003

On days 4–7 of follow-up, the data show significant improvement in pain, tenderness, inflammation, and granulation tissue formation in the PRF group, as illustrated in Table 3 and Table 4

Table 3: Show the difference in pain, PSI, PST, and depth of socket between groups on day 4.

DAY 4	CONTROL	PRF	P VALUE
PIAN, medium (Q25%-Q75 %)	5(5-6)	1(0-4)	0.000
PSI, medium (Q25%-Q75 %)	2(2-2)	0(0-31)	0.000
PST, medium (Q25%-Q75 %)	2(2-2)	0(0-1)	0.000
Depth of socket medium (Q25%-Q75 %)	9.5(8-10)	5(4-6)	0.000

Table 4 shows the difference in pain, PSI, PST, and depth of socket between groups on day 7.

DAY 7	CONTROL	PRF	P VALUE
PIAN, medium (Q25%-Q75 %)	3(2-4)	0(0-0)	0.000
PSI, medium (Q25%-Q75 %)	2(1-2)	0(0-0)	0.000
PST, medium (Q25%-Q75 %)	2(1-2)	0(0-0)	0.000
Depth of socket , medium (Q25%-Q75 %)	4(3.5-6)	1(1-2)	0.000

Discussion

The global prevalence of alveolar osteitis, also known as dry socket, which has been documented to range from 1 to 4% after routine dental extractions, is a cause for concern(13). The lower teeth have a 10 times increase in risk compared to the upper teeth, and the risk may potentially approach 45% for the removal of the mandibular third molar.(1). Dental practitioners frequently underestimate the level of pain intensity experienced by individuals with dry socket and sometimes fail to provide sufficient care to these individuals. the inflammation in the per socket sometimes extended to the buccal or labial vestibule and sometimes towards the cheek. However, there was no elevation in body temperature. This phenomena has confirmed that the classical dry socket is a specific pathological condition that only affects the maxillary or mandibular alveolar process, without causing any systemic disturbance(14) .

Irrespective of the type and severity of the damage, wound healing is a complicated biological process consisting of interconnected stages that are categorized as inflammation, angiogenesis, granulation tissue formation, and tissue remodeling and regeneration. These steps are components of a biological cascade that leads to tissue regeneration and the repair of wounds (15).

Therefore, the inflammation score and granulation tissue formation used as parameters for healing the dry socket beside to compare the pain score and tenderness around the socket between the groups The study found that socket curettage resulted in hemorrhage and clotting in a broken tooth socket that did not heal effectively after the initial attempt. Gentle curettage with saline irrigation of the socket aid in removing infected soft and hard tissue that cannot be cleared by normal physiological processes. Since all the patients were in good health, their capacity for healing remained unaffected, even though there was a projected delay following the creation of the new blood clot.

Group II is expected to benefit from the insertion of PRF clot into the socket to aid healing in the impaired socket.It is commonly seen that dry sockets take longer to heal after receiving appropriate therapy compared to recovering sockets without complications (16).

Scientifically, the application of growth factors in oral surgery generates a mixture that boosts healing in a dry socket by modulating the immune system (17) to decrease inflammation and stimulate the

growth of cells needed for regeneration. Pain and sensitivity decrease, allowing for the restoration of early oral functions.

Platelet-Rich Fibrin (PRF) contains a concentrated cocktail of various growth factors trapped within its fibrin matrix. These growth factors play a crucial role in stimulating healing and tissue regeneration following tooth extraction. As shown in table 5.

Table 5 shows the PRF growth factors and their specific roles,(18).

Factor	Action
Interlukin-1 (IL-1)	· key mediator of inflammation control · stimulates T-helper lymphocytes
Interleukin-6 (IL-6)	· differentiation factor for B-lymphocytes · activator for T lymphocytes · stimulates the secretion of antibodies · supports the chain reaction leading to inflammation, destruction and remodeling
Tumor necrosis factor alpha (TNF alpha)	· activates monocytes · stimulates the remodelling capacities of fibroblasts · increases phagocytosis and neutrophil cytotoxicity · modulates the expression of IL-1 and IL-6
Interleukin-4 (IL-4)	· supports proliferation and differentiation of activated B cells · supports healing by moderating inflammation. · increases fibrillary collagen synthesis by fibroblast
Cytokine vascular endothelial growth factor (VEGF)	· functions to start angiogenesis
Transforming growth factor β1 (TGF β1)	· can induce a massive synthesis of collagen and fibronectin
Platelet derived growth factors (PDGF)	· regulates migration, proliferation and survival of mesenchymal cell lineages · plays an essential role in physiologic cicatrisation and pathogenesis of atherosclerosis and other fibroproliferative diseases
Insulin like growth factors (IGFs) 1 and 2	· cell multiplication mediator in apoptosis · exerts chemotactic effects towards human osteoblasts

The results of the present study showed that the patients in group II had rapid remission of perisocket inflammation and a reduction in discomfort by day 4 in all sockets also the granulation tissue rapidly filled the socket by days 4 and 7,the fourth day showed a decrease in tenderness around the infected socket as the granulation tissue invaded the socket, leading to reduction of pain score to zero for each socket by the seventh day in PRF group. The clinical observations of the present study agree with many previous studies, such as Pavlovic et al. (2021), which state that the PRF gradually releases growth factors, significantly influencing wound healing and tissue regeneration(19).

According to the Simonpieri et al. 2016 , study, which explores the scientific evidence for PRF's effectiveness in various clinical applications, It mentions the presence of growth factors like PDGF, TGF-β, VEGF, and IGF-1 within PRF, as well as their potential impact on wound healing processes (20).Identifying treatment solutions for dry socket is challenging due to the unclear understanding of its pathophysiology. The study suggests that conventional treatment for dry sockets, which relies on the body's innate healing process, is less efficacious compared to treatments involving molecular regeneration. The use of PRF has demonstrated enhanced efficacy in enhancing the healing process of dry socket wounds as compared to traditional methods. This is achieved by reducing inflammation, stimulating tissue regeneration, and relieving pain.

There are many limitations of the study, such as a small sample size and no finding of a histological study to record precisely the amount and number of cells formed; also, the follow-up of the study was more difficult, especially after seven days. But on the other hand, the PRF was less expensive and easy to prepare.

The recommendation of the present study, the larger sample size, histological study to determine the quality and quantity of GT formed in the socket, and to detect the effect of PRF on new bone density formed in the socket

4. Conclusion and future scope

PRF plays a significant role in accelerating the production of GT and providing relief from pain symptoms within the initial seven days of treatment. Conversely, the conventional dry socket treatment, which involves meticulous scraping and rinsing, is linked to a prolonged healing process.

Conflict of interest

The authors declare no conflicts of interest.

Author contributions

K.S.M.contributed to the conception or design of the work and was responsible for the acquisition of data. A.C performed the statistical analysis. M.M.A and E.M contributed to the interpretation of results. K.S.M ,E.M and A.C drafted the work. All authors approved the final version of the manuscript and are responsible for all aspects of the work.

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Ethical approval

All of the participants were given thorough information about the study and the procedures involved, and their informed consent was acquired on a form approved by the ethics committee of the AL Ameed University /College of Dentistry (Number: UAM/EC/5/2017).

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