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Efficacy of Laser, Platelet Rich Fibrin and Ozone Therapy in Wound Healing After Third Molar Extraction –A Review

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Abstract

This study aims to compare the effect of Low Level Laser Therapy [LLLT], Platelet Rich Fibrin [PRF] and Ozone therapy on bone healing in patients during mandibular third molar extractions by systematic review. The PUBmed and Google Scholar databases were retrieved and the effect of LLLT, PRF, and ozone therapy on the healing process of the alveolar socket after surgical extraction of mandibular third molar was evaluated. The post-operative pain, swelling, trismus, osteoblastic activity and soft tissue healing were also considered contributing the overall healing process but not in all studies. A total of 17 studies in total were considered where approximately 761 patients were taken into consideration in this review. Within the limitations of the available evidences, there has been paucity of articles on LLLT and ozone and therefore PRF shows better results than LLLT and ozone. Hence furthermore studies should be taken to estimate the effect of these 3 factors on socket regeneration or bone healing.

Keywords: Third Molar Extraction, Enhanced Wound Healing Process, Low Level Laser Therapy, Platelet Rich Fibrin, Ozone.

Introduction

The most commonly performed procedure in dentistry is tooth extraction whether it stays management of tooth decay, complicated fractures, periodontal diseases, infections or orthodontic treatment.

Healing of an extraction socket is a specialized example of healing by secondary intention. After the removal of tooth from the socket, blood fills at the extraction site which leads to the formation of blood clot; which is the most important phase in tissue healing. For a complete soft tissue healing it takes around 1 -1.5 months and to heal the bony architecture it takes around 3 months. The fibroblasts, endothelial cells, macrophages and

osteoblasts are attracted to the blood clot ;which are the main elements until complete healing is established .[1]

However problems may occur that may lead to an increase in the healing period and lead to other postoperative complications .To overcome this various pharmacological and non pharmacological methods have been used for the ease of the patient and to increase the healing efficiency. This include the use of NSAIDS (nonsteroidal antiinflamatory drugs),local or systemic corticosteroids, enzymes, tube drains , different incisions, icepacks, cryotherapy, ultrasound , lasers, ozone therapy, platelate rich fibrin , ultrasound, etc. [1,2,3]But these drugs can sometimes induce side effects and can be unsafe, so some alternative methods have been adopted which are free from adverse effects.

LASER (light amplification by the stimulated emission of radiation) was first described by Mesler et al in 1971. Many researches prove that laser therapy improved the wound healing process. As alveolar wound healing is a complex process which includes the epithelium as well as the bone , the application of laser could accelerate the regeneration ,migration ,proliferation of cells and remodeling which could intern improve the wound healing process.[1]

PRF (Platelet rich fibrin) is a second generation platelet concentrate. It is prepared with a simplified, inexpensive process and without biochemical blood handling. It is autologous in nature and hence prevents the foreign body invasion /response .PRF releases various growth factors ie. transforming growth factor ,platelet derived growth factor ,vascular endothelial growth factor and epidermal growth factor which helps in angiogenesis and tissue healing after extraction .[4]

Ozone therapy have increased their importance as they have biocompatibility, antimicrobial activity , disinfectant action and healing .It can be administered by three routes ozonized gas, ozonized water and ozonized oil[5]. According to the study done by Robson Pchepiorka In the year 2020 application of ozonized oil increases healing by promoting proliferation and synthesis of collagen , increasing growth factors such as PDGF, TGF-P, VEGF, whereas application of ozonized water decrease the severity of wound.

Many researchers prove how lasers, ozone therapy and platelet rich fibrin are useful for healing after dental extraction .Some histomorphometric studies done to study the laser applications (by nesma kbalil) on the extraction socket healing in rats state that laser application can be used to enhance bone formation after tooth extraction .Similarly many other studies prove the efficacy of lasers.

Few studies have demonstrated clinically and radiographically that platelet rich fibrin (PRF) woll accelerate socket wound healing after tooth extraction by increasing the bone fill and reducing bone resorption (ahmed Abdullah alzahrani)

Few research have also shown the benefits of using the ozone therapy ie. simplicity, good tolerance of patient,absence of side effects or adverse reactions. Similarly studies have proved that ozone therapy was effective in improving angiogenesis and fibroblast count which in turn enhances the wound healing.

There are also some studies which prove the comparitive evaluation between laser and ozone therapy but till date no studies have provided a comprehensive , comparative analysis between laser ,PRF and ozone and as these three are free from adverse effects , this article is to evaluate or to summarize the comparision of efficacy of laser ,ozone therapy and platelet rich fibrin in wound healing after dental extraction and to conclude which one is more effective to accelerate the healing after extraction of teeth.

Methodology

Study Design

The following research questions "Is there any difference in efficacy of laser, ozone therapy and platelet rich fibrin in wound healing after dental extraction? Studies evaluating lasers, ozone therapy and platelet rich fibrin along with their role in wound healing as compared to the normal healing process.

Eligibility Criteria

Inclusion criteria

The inclusion criteria were as follows:

- Study design: In – vivo studies – Observational studies ,clinical trials ,animal studies
- Participant characteristics: All participants more than 18 yrs of age without any systemic disease were selected
- Outcome measurements: Diagnostic accuracy of laser , ozone therapy and platelet rich fibrin in secondary healing of extracted socket
- Articles written in English language
- Articles published from 1990-2022 and available as free full text.

Exclusion criteria

The exclusion criteria were as follows;

- Non – clinical studies ,in –vitro studies
- Studies not fully available in the database
- Studies done to study the periodontal healing
- Articles reporting only abstracts were also excluded
- Studies not reporting primary outcome as healing were also excluded.

Search Protocol and Study Selection

A comprehensive electronic search was performed till 31st December 2022 for the studies published within the last 22 years (from 2000 to2022) using the following databases: PubMed and Google Scholar to retrieve the articles in English language. In addition to the electronic search a hand search was also made and reference lists of the selected articles were screened.

Search Strategy

Appropriate key words and medical subject heading (MeSH) terms were selected and combined with boolean operators like and. the search strategy used was as follows [laser and ozone therapy and platelet rich fibrin and extracted wound healing]. also the boolean operators like or and not were included to exclude other criteria and focus on others.

a two phase selection of articles was conducted . In phase one two reviewers reviewed titles and articles. Articles that did not meet the inclusion criteria were excluded. In phase two, selected full articles were independently reviewed and screened by the same reviewers. And disagreement was resolved by discussion. When mutual agreement between the two reviewers was not reached, a third reviewer was involved to make the final decision. The final selection was based on consensus among all three authors.

Data Extraction

For all included studies , following descriptive study details were extracted by two independent reviewing authors using pilot tested customized data extraction forms: authors , study year , mean age of participants , sample size , gender [male / female] , the method used for investigation , reference standard and conclusion . The corresponding author was contacted via email where further information was needed.

Results

Study Characteristics

As shown in table 1 the data was evaluated from 17 numbers of studies from a total of 20-80 patients each study.

Among these 17 studies ; 6 studies were done in India [4,5,6,7,15,16,], 6 in Turkey[2,3,8,9,11,17] ,1 in

Lithuania [1] , 1 in Switzerland [10], 1 in Brazil [12] ,1 in Cardiff [13] and 1 in Croatia [14].

The mean age of the study participants was 18-35 years.

Among the included studies there was a comparison between Ozone, Laser and Platelet Rich Fibrin.

8 studies concluded that Platelet Rich fibrin improved the healing and also reduced swelling, trismus and post-operative pain as compared to the normal blood clot, while 2 studies show no significant difference.

3 studies about laser shows improved bone healing and reduced pain when compared to the normal blood clot while 1 study shows no significant difference.

2 studies on ozone concludes improved healing and reduced post- operative pain when compared to normal blood clot.

A combined study including both laser and ozone shows that these both reduce post- operative pain but laser also reduces swelling and trismus unlike ozone.

Table 1:

Sn.	Author (Year)	Country	Sample Size (N)	Mean Age (Years)	Follow Up	Intervention	Comparator	Conclusion
1.	Daugela Et.Al 2018	Kaunas,Lithuania	34 Pts	18-60	1,3,7,14 Days	Leucocyte And Platelet Rich Fibrin(L-Prf)	Regular Blood Clot	L-Prf Improved Soft Tissue Healing And Reduced Postoperative Pain And Swelling
2.	Gurbuzer Et Al 2010	Turkey	14 Pts	20-30	4 Weeks	Platelet Rich Fibrin	Regular Blood Clot	No Significant Difference
3.	Baslari Et.Al 2014	Turkey	20 Pts	19-34	30 And 90 Days	Platelet Rich Fibrin	Regular Blood Clots	No Significant Difference
4.	Kumar Et Al 2014	Karnataka, India	31 Pts	26	1 Day,1 Month,3 Months	Platelet Rich Fibrin	Flap Reapproximation With Sutures	Prf Enhanced Healing And Also Reduced Pain, Swelling And Trismus
5.	Singh Et Al 2012	India	20 Pts	18-50	Day- 1,3,7 Month-1,2,3	Platelet Rich Fibrin	Regular Blood Clot	Prf Enhanced Bone Healing And Decreased Pain
6.	Yelamali Et. Al 2014	India	20pts	18-28	Soft Tissue Healing-1Week Bony Healing - 4 Months	Platelet Rich Fibrin	Platelet Rich Plasma	Prf Is Significantly Better Than Prp In Soft Tissue And Bony Healing
7.	Varghese Et.Al 2017	Kerala, India	30 Pts	18-35	1 Week,4 Weeks,16 Weeks	Platelet Rich Fibrin	Regular Blood Clot	Prf Shows Better Osseous Regeneration And Soft Tissue Healing.
8.	Afat Et Al 2018	Istanbul, Turkey	60 Pts	18-30	7^{th} ,14^{th} 21^{st} Day	Leucocyte And Platelet Rich Fibrin(L-Prf)	L-Prf + Hyaluronic Acid And Normal Blood Clot	L-Prf And L-Prf+ Ha Improves Soft Tissue Healing And Prevents Alveolar Osteitis And Infection.

9.	Ozgul Et Al 2015	Turkey	56 Pts	18-28	24 Hrs, 72 Hrs And 7th Day	Platelet Rich Fibrrin	Regular Blood Clot	Prf Reduces Postoperative Swelling
10.	Trybek Et Akl 2021	Switzerland	90 Pts	18-37	6 Hrs,1 Day,3rd Day,7th Day	Platelet Rich Fibrin	Regular Blood Clot	Prf Prevents Pain ,Swelling And Trismus
11.	Kahraman Et Al 2016	Turkey	60 Pts	16-35	1 Week	Gallium Aluminium Arsenide (Gaalas)830 Nm Laser [Transcutaneous And Intraoral]	Regular Blood Clot	Intraoral Application Of Laser Reduces Pain Than Extraoral Application
12.	Moraes Et Al 2020	Brazil	57 Pts	-	3rd Day, 7th Day ,1 Month ,3 Month ,6 Month	Low Level Laser Therapy Of 10 J/Cm^2 And 30 J/Cm^2	Regular Blood Clot	The Laser Using 10 J/Cm^2 Is More Effective In Tissue Healing And Preventing Edema
13.	Fernando Et Al 1992	Cardiff	64 Pts	18-50	1 Week	Laser Of 830 Nm	Regular Blood Clot	No Significant Difference After 1 Week Noted
14.	Batinjan Et Al 2014	Croatia	40 Pts	19-32	3 Days,7 Days	Antimicrobial Photodynamic Therapy[A-Pdt]	Regular Blood Clot	Postoperative Swelling Reduced In A-Pdt Group.
15.	Bahl Et.Al 2022	India	72 Pts	25-34	3rd Day, 7th Day	Ozonated Oil	Normal Saline Irrigation	Ozone Therapy Accelerates Healing And Reduces Pain
16.	Prasad Et Al 2016	India	33 Pts	18-50	3rd,4th And 5th Day	Topical Ozone/ Ozone Gel	Systemic Antibiotics	Ozone Reduces Postoperative Pain, Swelling And Trismus
17.	Kazancioglu Et Al 2013	Turkey	60 Pts	18-25	1st ,3rd ,7th Day	Low Level Laser Therapy And Ozone Therapy	Normal Blood Clot	Ozone and Lllt Reduces Postoperative Pain. Lllt Also Reduces Swelling and Trismus Unlike Ozone .

Table 1 showing descriptive study details of all included studies.

Discussion

The aim of this systematic review was to summarize existing evidences on the three criteria's ie. Laser, Ozone and PRF and to compare them with regard to the soft tissue and hard tissue healing. healing of the wounds is a specialized example of healing by secondary intention Here,in this systematic review we have considered the healing and all the other factor which directly or indirectly contribute towards it . To the best, this is a first systematic review in which all this three factors are considered in one. A total of 17 studies in which approximately 761 patients were taken into

consideration in this review. To further evaluate their accuracy we also included other factors like postoperative pain, swelling and reduction in mouth opening [trismus].

In this review article 10 studies were of platelet rich fibrin as a healing factor, 4 were of laser, 2 of ozone and 1 study consisted both of laser and ozone. From the 10 studies 4 studies of PRF were done in India. 2 studies done by Kumar et al and Singh et al in the year 2014 and 2012 respectively cocluded that PRF enhanced healing and also reduced postoperative pain, swelling and trismus . While some studies showed positive response the others which were carried out for a less period of time showed no significant difference. The examples of such studies were by Gurbuzer et al and Baslari et al in the year 2010 and 2014 respectively. There was another study by Yelamali et al in the year 2014 done in india were Platelet rich plasma was compared to platelet rich fibrin for healing of wound which concluded that platelet rich fibrin showed better results than platelet rich plasma.

Form the 4 studies that were done on laser. in the first study which was done by Kahraman et al in the year 2016 a GaAlAs laser of 830 nm was used which resulted in reduction of pain on intraoral application. Another study by Moraes in the year 2020used low level laser therapy which resulted in better healing and reduced edema. While a study by Fernando et al in the year 1992 showed no significant difference because the study was carried out for a period of 1 week only.

2 of 2 studies which are considered in this review for Ozone were done in india. The studies were by Bahl et al and Prasad et al in the year 2022 and 2016 resoectively. this studies concluded that ozone accelerates healing and also reduces postoperative pain, swelling and trismus .

An another comparative study between low level laser therapy and ozone which was done by Kazancioglu in the year 2013 concluded that both ozone and low level laser therapy reduces postoperative pain but laser also reduces swelling and trismus unlike ozone.

In my entire research I found out many articles almost 10 out of 17 on platelet rich fibrin and hence considered it as the most ancient and superior way in accelerating the healing process.

Although, a comparative article by kazancioglu et al in the year 2013 compartes between ozone and laser and states that both reduce postopereative pain but only laser reduces trismus unlike the other; whereby this article prove laser being superior than PRF and ozone the comparision stays in between laser and ozone only and nowhere about PRF .

Even though the review is to be about healing after tooth extraction we have also considered other factors that directly or indirectly contribute towards wound healing ie. postoperative pain, trismus and swelling; the above mentioned article gives an indirect relation between the same.

Conclusion

Based on the number of studies available and the selection criteria - PLATELET RICH FIBRIN > LOW LEVEL LASER THERAPY > OZONE.

Limitations

It has been found that there is paucity of articles on laser and ozone especially ozone.

There are also very less in-vivo human trials done.

Hence, furthermore studies should be taken on the same.

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