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Original Research Article

EFFECT OF LOW LEVEL LASER THERAPY AND LOW INTENSITY PULSED ULTRASOUND ON PAIN FOLLOWING TOOTH EXTRACTION: A SINGLE BLINDED STUDY

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ABSTRACT

Background: Tooth extraction can affect the quality of life of patients during the initial postoperative days. After tooth extraction, traditionally analgesics like NSAIDs are given which has certain degree of side effects for which an alternative therapy was needed to minimize them. Thus the study was intended to know the effectiveness of LLLT and LIPUS when compared with traditional analgesic therapy following tooth extraction.

Materials and Methods: 40 subjects were included in the study according to the fulfillment of the inclusion and exclusion criteria. Subjects were randomly allocated into one of the four groups using envelope method. Group A received medications along with intra-oral infra-red laser with wavelength of 655 nm. Group B received medications along placebo laser therapy, Group C received medications along low intensity pulsed ultrasound of ratio 1:4 and frequency 1MHz. Group D received medications along placebo ultrasound. Therapy was given for three consecutive days. Pain level was measured before the first session of treatment (24hr after extraction) and then after third session of treatment (72hr after extraction) using Visual analogue scale(VAS).

Results: All the groups show significant reduction in pain with p-value 0.0050, 0.0050, 0.0050, 0.0052 for group A, B, C, D respectively. Although there was slight better effect in group C (p-0.0050) as compared to group D (p-0.0052)

Conclusion: The present study concluded that Low intensity pulsed ultrasound was found to be more effective as compared to the placebo- Low intensity pulsed ultrasound, Low level laser therapy and placebo- Low level laser therapy. There was significant difference in pain scores in all four groups. Low intensity pulsed ultrasound and Low level laser therapy can be used as an adjunct therapy in the routine treatment after tooth extraction.

KEY WORDS: Low Intensity Pulsed Ultrasound (LIPUS), Low Level Laser Therapy (LLTT), Premolar Tooth Extraction, Visual Analogue Scale (VAS), Non-Steroidal Anti-Inflammatory Drugs (NSAID).

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INTRODUCTION

Extraction of tooth is defined as "the painless removal of a tooth or tooth root with minimal trauma to the tooth and its surrounding tissue." Exodontia which involves basic principles of surgery and physics to remove tooth. There are mainly two method of extraction; the first is forceps extraction. It is also known as intra-alveolar or closed

method of extraction. This makes use of forceps to remove the tooth from the socket. The second type is trans-alveolar extraction also known as open method of extraction or surgical extraction. This is done in cases where forceps extraction is not possible. It requires the reflection of muco-periosteal flap, cutting of bone obstructing removal of tooth and if required sectioning of roots and then removal [1-3]. Low intensity laser therapy had been proved to be effective in reducing pain and swelling and improve healing of the wound created due to tooth extraction [4]. Low level laser therapy in the red to infrared spectral range (630-1000nm) and non-thermal power (less than 200mW) has been used in many clinical setting. The treatment dosage typically ranges from 1- 10 J/ cm^{-2} [4]. Laser helps in cell proliferation, collagen production and ultra structural changes [5,6]. It helps to increase in proliferation of fibroblasts and angiogenesis and granulation tissue formation [7].

Ultrasound therapy is given either on continuous or pulsed mode. Continuous mode used where thermal effects are desired. In pulsed mode the thermal effects are reduced. Two frequencies are used in ultrasound application 1MHz having skin penetration power 3-5cm and 3MHz having skin penetration power 1-2 cm. For pulse US, the duty cycle is on for a percentage of time and off for the rest of the time. A typical duty cycle is 20%(1:4 ratio) which is indicated in acute stage of wound healing [8]. Therapeutic application of 0.1-0.8W/cm^2 is most effective in acute stage of wound healing. The biological effect of different types of ultrasound was tested and it was concluded use of non-invasive low intensity pulsed ultrasound has an optimal effect in promoting tissue healing [9].

Tooth extraction has post-operative complications like hemorrhage, wound, pain, swelling, dry socket, difficulty in mouth opening and speaking due to pain and if not controlled can lead to infection at the extracted site. These can affect the quality of life of patients during the initial postoperative days [10]. To minimize these effects traditional NSAIDs, steroids are used. They have side effects on body [10]. There was a need of alternative therapy which enhances the wound healing and thus reduces pain with minimal side effect. Hence the study was intended to know the comparative effect of LLLT and LIPUS.

MATERIALS AND METHODS

Ethical clearance was obtained from Institutional Ethical Committee. All subjects were screened for their inclusion and exclusion criteria before their recruitment. An inclusion criterion includes subjects of age group 20 to 40 year who underwent forceps premolar tooth extraction. Extraction followed by road traffic accident, trans-alveolar extraction, oral carcinomas, infections, metal implants and unwillingness of participations were excluded. Informed consent was obtained from the subjects after explaining the procedure. Forty subjects were randomly allocated into four groups using envelope method.

Group A: Medications + low level laser therapy: 10 subjects who received sterile intra-oral infra-red laser having wavelength of 655 nm along with routine medical management. The wound was divided in to four parts. The probe kept at a distance of 1cm away in such a way that it covered each part of the wound and energy was applied 5J/cm^2 for 8sec /point

Group B: Medications + placebo low level laser therapy: 10 subjects who received placebo low level laser therapy along with routine medical management. The method of application was same as group A.

Protective glasses were used by both the therapist and the subjects for protection of eyes in both group A and group B.

Group C: Medication + low intensity pulsed ultrasound: 10 subjects who received ultrasound therapy which was externally applied using pulsed mode of 1:4 ratios. The frequency used for the therapy was 1MHz and the intensity was 0.5W/cm^2 for 8 minutes. Ultrasonic gel used as coupling medium (couplant).

Group D: Medication + placebo low intensity pulsed ultrasound: 10 subjects who received placebo low level ultrasound therapy along with routine medical management. The method of application was same as group C.

The first dosage in all groups was given 24hr after the premolar tooth extraction. The visual

analogue scale (VAS) was used as an outcome measure in this study to assess pain. It consisted of a 10-cm horizontal line, which has at one end by the label "No pain" and the other end by "Worst possible pain." The patient was asked to mark on the line, the spot for pain intensity, which was then measured. The outcome measure (VAS) was taken before the first session of treatment (24hrs after extraction) and was later taker after third session of treatment (72hrs after extraction).

RESULTS

Statistical analysis for the present study was done manually as well as using statistical package of social sciences (SPSS) version 21 so as to verify the results obtained. For this purpose data was entered into an excel spread sheet, tabulated and subjected to statistical analysis. Various statistical measures such as mean, standard deviation, un-paired t –test and Wilcoxon matched pair test were used. Nominal data from patient's demographic data i.e. the age, gender and site of extraction were analyzed using t-test. Comparison of four groups with respect to pre-test and post- test VAS scores was calculated by Wilcoxon matched pairs test. Probability values less than 0.05 were considered statistically significant.

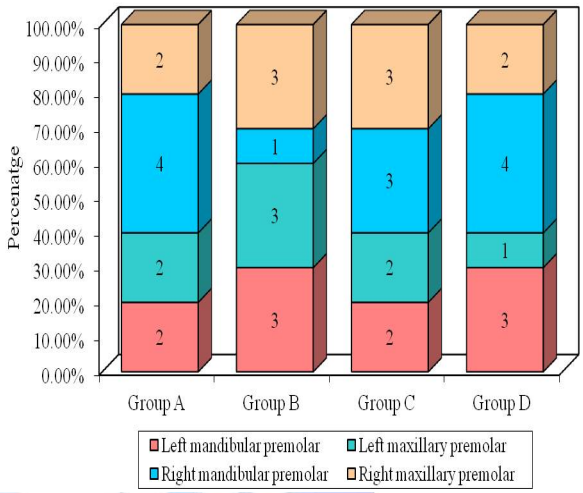
Age Distribution: Age of the subjects in the study was between 20 to 40 years. The mean age of the subjects in group A was 29.30±4.60 year, in group B was 31.50 ±6.70 years, in group C was 30.10±7.82 years and in group D was 33.50±3.84 years. .The difference in mean age of all groups was statistically not significant (p= 0.4249). (Table No.1)

Table 1: Comparison of four groups with mean age.

Age groups	Group A	Group B	Group C	Group D	Total
Age (Mean + SD)	29.30±4.60	31.50±6.70	30.10±7.82	33.50±3.84	31.10±5.95
F-value	0.9539				
p-value	0.4249				

Site of extraction: There were four sites of extraction in this study, left mandible premolar, left maxillary premolar, right mandible premolar and right maxillary premolar. In group A right mandible premolar extraction, in Group B left mandible, left maxillary, right maxillary extraction was predominant. In group C right maxillary, right mandible premolar tooth extraction and in Group D right mandible premolar extraction was predominant.

Fig. 1: Comparison of four groups with site of extraction.



Outcome Measurements:

Visual Analog Scale: In group A mean VAS score before the treatment was 3.30±1.16 and after three days of treatment 0.6±0.52. The p-value was significant (p=0.0050). In group B mean VAS score before the treatment was 5.70±1.06 and after three days of treatment 1.10±1.10. The p-value was significant (p=0.0050). In group C mean VAS score before the treatment was 4.80±2.25 and after three days of treatment 0.90±1.29. The p-value was significant (p=0.0050). In group D mean VAS score before the treatment was 5.50±2.01and after three days of treatment 4.30±1.77. The p-value was significant (p=0.0052).

On doing pair wise comparison of four groups of VAS scores by Mann-Whitney U test, there was a significant difference between group A vs. group B with a p value of (p=0.0028), in between Group A vs. Group C with a p value of (p=0.0376), in between Group A vs. Group D with a p value of (p=0.0007), in between Group B vs. Group D with a p value of (p=0.0002) and in between Group C vs. Group D with a p value of (p=0.0002).there was no significant difference between the Group B vs. Group C with a p value of (p=0.2265). (Table 2)

Table 2: Comparison of Pre and post test VAS scores in four groups (A, B, C, D) by Wilcoxon matched pairs test.

Groups	Time	VAS (mean ±SD)	Difference (mean ±SD)	% of change	Z-value	p-value
Group A	Pretest	3.30±1.16	2.70±0.82	81.82	2.803	0.0050*
	Posttest	0.60±0.52				
Group B	Pretest	5.70±1.06	4.60±1.17	80.7	2.803	0.0050*
	Posttest	1.10±1.10				
Group C	Pretest	4.80±2.25	3.90±1.29	81.25	2.803	0.0050*
	Posttest	0.90±1.29				
Group D	Pretest	5.50±2.01	1.20±0.42	21.82	2.7901	0.0052*
	Posttest	4.30±1.77				
Pair wise comparisons of groups by Mann-Whitney U test						
Group A vs Group B		p=0.0012*				
Group A vs Group C		p=0.1212				
Group A vs Group D		p=0.0156				
Group B vs Group C		p=0.1405				
Group B vs Group D		p=0.7624				
Group C vs Group D		p=0.4497				

DISCUSSION

There are various studies that have proven the effects of low level laser therapy following molar tooth extraction. There is a study on low level laser therapy in management of complications after intra oral surgeries, where diode laser with 660nm wavelength in continuous scan mode is used covering the entire surgical area which was divided into four quadrants, each of 1cm^2 area at a distance of 1cm. the energy applied was 5J/cm^2 for 8 sec. The result showed that it was effective in reducing pain and swelling following oral surgery [11]. Similarly in this study, laser therapy showed significant difference seen in pre- and post-test VAS.

The underlying repair process after the application of Therapeutic Ultrasound is an inflammatory phase that is known to accelerate wound healing, leading to the reduction in swelling and pain due to the possibility that the heat reduction in the local metabolites, toxins and chemical mediators may reduce the irritation of nerve endings and thereby the pain. In this study group that received ultrasound therapy found significant difference in pain. This could be the probable mechanism responsible for significant change in the pre-test and post-test VAS scores of Group C.

There was a study on effects of low intensity pulsed ultrasound exposure on gingival cells (cultured) which was exposed to 15mins of 3MHz, 40mW/cm^2. The results were that there was increased m-RNA cells and connective tissue growth factors which accelerates the healing of soft tissue a typical duty cycle is 20%(1:4 ratio) which is indicated in acute stage of wound healing [12]. Therapeutic application of 0.1-0.8W/cm^2 is most effective in acute stage of wound healing and pain relief. Our study also shows the same results.

A study was conducted on young adults in order to check the comparative effect of ultrasound therapy and laser therapy for pain, trismus and swelling following third molar surgeries, where 30 subjects were taken and were randomly put in two groups, one groups receiving ultrasound (1MHz, pulsed 20%, and dose 1.0W/cm^2 for 7mins) and another laser (power 15mW, pulsed 80% and dose 4.3J/cm^2 for 6 mins) which concluded that there was significant differences in pain , swelling, trismus on respective groups but had no significant difference in their comparison [13]. In this study on premolars, there was significant difference in pain between the LLLT and LIPUS therapy (pre-test and post-test VAS).

The medications which are common to all the groups might have added advantage leading to overall improvement in the outcome measures

in all groups. Pain relief and reduction in swelling was achieved in all the groups could have lead to consistent improvement in the performance of functional activities in all the subjects.

CONCLUSION

The present study concluded that Low intensity pulsed ultrasound was found to be more effective as compared to the placebo- Low intensity pulsed ultrasound, Low level laser therapy and placebo- Low level laser therapy. There was significant difference in pain scores in all four groups. Low intensity pulsed ultrasound and Low level laser therapy can be used as an adjunct therapy in the routine treatment after tooth extraction. Limitation of the study is that it was done only in premolar tooth extraction and forceps tooth extractions.

Conflicts of interest: None

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