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Fifth year, group 13

Effect of low level laser therapy on extraction of mandibular third molars conventional complications

A systematic review

Master’s Thesis

Supervisor

Doctor, Tadas Keizeris

Kaunas, 2018
Effect of low level laser therapy on extraction of mandibular third molars conventional complications

A systematic review

Master’s Thesis

The thesis was done
by student .................................................. (signature)

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Supervisor .................................................. (signature)

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(degree, name surname)

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1. SUMMARY

Background

Among all the practices performed in the field of maxillofacial and oral surgery, extraction of impacted mandibular third molar is most common. And after extraction, some general complications may follow. Such as trismus, edema and pain. There has been researches made about the effectiveness of low level laser therapy to promote faster rehabilitation from post-extraction complications of mandibular third molar. The aim of this review is to find out the significance of LLLT for reducing the post-surgical complications of mandibular third molar extraction.

Method

Extensive search of relevant original article has been made from Pubmed using keywords on table 2, and under inclusion criteria of English researches made with more than 20 participants with in this decade. Also each article had to be accessible via Lithuanian university of health and sciences library web database. According to the articles collected, a systematic review was performed and written.

Result

From 243 articles found from Pubmed database, using PRISMA protocol(1), the articles used in this review were 9. The criteria for assessment was pain, edema and trismus. Out of 9 original articles used, 1 article was inconclusive in all three criteria, 6 articles showed significant improvement of condition in edema, and 6 articles showed significant reduction of pain. But only 3 articles had statistically significant improvement in trismus.

Conclusion

It is conclusive that the low level laser therapy is effective when it comes to post extraction complication of mandibular third molar, and there are differences between the effectiveness of LLLT according to the location of its application. But due to the limitations of assessment methods used in the original articles, further researches should be made for the effect of LLLT under more concrete assessment methods.

Keywords: Mandibular third molar, Low level laser therapy, complications, systematic review
2. ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>LLLT</td>
<td>Low Level Laser Therapy</td>
</tr>
<tr>
<td>LLL</td>
<td>Low Level Laser</td>
</tr>
<tr>
<td>MTM</td>
<td>Mandibular Third Molar</td>
</tr>
<tr>
<td>VAS</td>
<td>Visual Analogue Scale</td>
</tr>
<tr>
<td>S</td>
<td>Seconds</td>
</tr>
<tr>
<td>H</td>
<td>Hours</td>
</tr>
<tr>
<td>mW</td>
<td>Milli Watt</td>
</tr>
<tr>
<td>APDT</td>
<td>Antimicrobial Photodynamic Therapy</td>
</tr>
<tr>
<td>NS</td>
<td>Not Significant</td>
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</tbody>
</table>

General metric abbreviations not mentioned in this table.

3. INTRODUCTION

Among all the practices performed in the field of oral and maxillofacial surgery, extraction of third molar is the most common practice performed. According to a systematic review, MTM impaction occurs about 73% of young adults in Europe. When it comes to extraction of impacted mandibular third molar, surgical intervention is necessary. Surgical intervention of impacted MTM, may result in post-extraction complications. These complications directly relate to patient satisfaction.

There are variety of complications resulted from the surgical intervention of extracting MTM. In this review, using low level laser therapy to reduce trismus, pain and edema after extracting MTM is analysed. Low level laser therapy, while widely used among the field of medicine, it is not seen in the surgery rooms for oral and maxillofacial surgery often.

The aim of this review is to observe the possibilities and effectiveness of LLLT on post-extraction complications of mandibular third molar. If LLLTs effectiveness on post-extraction complication of MTM is significant, to reduce the healing time and to promote better patient satisfaction, usage of LLLT could be implemented to a maxillofacial and oral surgery practices.

The task of this review is to gather statistically significant result from original researches to show the relevancy of LLLT when it comes to reducing the general complications of MTM extraction. Original 9 articles selected out of 243 articles using PRISMA protocol are included in
this review from 6 different countries and with total of 451 participants. All the articles are from within this decade to meet the relevancy requirement. There was no conflict of interest in any of the articles chosen.

4. SELECTION CRITERIA OF THE STUDIES. SEARCH METHODS AND STRATEGY

4.1 Comprehensive selection path of review

This review was done by using provided database from Lithuanian university of health and science. The database used was: Pubmed. Objective of this research was to clarify the positive effect of laser therapy on conventional complications of post-mandibular third molar extraction. The articles chosen for the review were to be written according to the clinical trials, and extra articles were selected for references.

4.2 Search terms and criteria:

The articles chosen had to contain certain key words (Table 2.) relevant to this systematic review. Initial search resulted with 243 articles from Pubmed database. To rule out out-dated articles, author restricted the search parameter on articles for last 10 years. Following the PRISMA protocol(1) for extracting the studies to be included, 9 articles were chosen to be reviewed for this study.

<table>
<thead>
<tr>
<th>Search terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Third molar</td>
</tr>
<tr>
<td>2. Clinical trial</td>
</tr>
<tr>
<td>3. Laser</td>
</tr>
<tr>
<td>4. Trismus</td>
</tr>
<tr>
<td>5. Swelling</td>
</tr>
<tr>
<td>6. Pain</td>
</tr>
<tr>
<td>7. Edema</td>
</tr>
<tr>
<td>8. Complications</td>
</tr>
<tr>
<td>9. Laser therapy</td>
</tr>
<tr>
<td>10. Low level laser</td>
</tr>
<tr>
<td>11. Systematic review</td>
</tr>
<tr>
<td>12. Post operative pain</td>
</tr>
</tbody>
</table>

A combination of 2 or more keywords used in each article search.
4.3 Inclusion criteria:

Studies chosen in this review are not published more than 10 years ago, English studies, clinical studies, and have a cohort number of at least 20(n), no sex predilection, ethnicity not taken in to consideration. Purpose of laser used in the studies were exclusively for the reduction of general side effects of extraction of mandibular third molar.

4.4 Exclusion criteria:

Studies that are done earlier than 2007 were excluded. Full text of studies that were not accessible through LUHS library server were excluded, Studies which were not written in English were ruled out from this review.

4.5 Research strategy and bias

This systematic review was done according to the provided terms and regulations. Articles that are relevant to the review were chosen by the author. Both the supervisor and the author had to agree upon each decision to whether include the article or not. In cases of disagreement, the head of Oral surgery department of Lithuanian university of Health and science would resolve the problem.
4.6 Full text for data extraction

22 trials were chosen for full text analysis, then filtered according to the inclusion and exclusion criteria (2.3 & 2.4) following PRISMA protocol (Fig. 1) for extracting data to include in the systematic review.

Fig. 1 PRISMA flow diagram 2009(1)
5. SYSTEMIZATION AND ANALYSIS OF DATA

5.1 Characteristics and type of studies:

The data of 9 articles were extracted and included in the study based on the inclusion criteria and PRISMA protocol. From the included studies:

- 7 were randomized clinical trial, and one was controlled clinical trial
- Of 7 randomized clinical trial, there were 3 split mouth studies
- Location of low level laser applied differs from extra-oral and intra-oral
- All 9 studies include assessment of either 2 of post-operative trismus, swelling and pain

5.1.2 Number of participants, mean age and gender:

Following the inclusion criteria, all studies have more than 20 participants, and ethnicity nor gender were taken in to consideration of choosing the studies. Even though there were no sex predilection on choosing the articles to be included, if stated, it was accounted for in this review. There were 150 participants in the study by G. Batinjan et al., 2013. Croatia making it the research with the highest amount of patient body, and least participants included in the study was by M. López-Ramírez et al., 2011. Spain. There were 451 participants in all the studies combined. Out of 8 studies, studies done by E. Merigo et al., 2015. Italy, and M. Petrini et al., 2017. Italy did not state the mean age nor gender of the patients. The mean age of 8 studies which stated the ages of patients were 25.5.

5.1.3 Country and publishing date of included studies:

From studies included, 2 were from Turkey, 4 researches from Italy and one studies each were chosen from Spain, United Arab Emirates, Croatia, Iran and Brazil. All studies included were published within last 10 years to eliminate out of date datas. Research done by M. H. Aras et al., 2009. Turkey was the oldest out of 9 articles included in this review and other studies were done within this decade.
5.1.4 Bias of included studies

Due to the lack of information provided in the included studies regarding bias and limitation, this systematic review could not assess the bias of included studies.

5.2 Intervention protocol of included studies

5.2.1 Designs of included studies

<table>
<thead>
<tr>
<th>Author, year, country</th>
<th>Study design</th>
</tr>
</thead>
<tbody>
<tr>
<td>M. H. Aras et al., 2009. Turkey</td>
<td>Randomized clinical trial</td>
</tr>
<tr>
<td>M. López-Ramirez et al., 2011. Spain</td>
<td>Randomized double-blind clinical trial, Split mouth</td>
</tr>
<tr>
<td>M. Ferrante et al., 2012. Italy</td>
<td>Randomized clinical trial</td>
</tr>
<tr>
<td>R. Pol et al., 2016. Italy</td>
<td>Randomized split mouth study</td>
</tr>
<tr>
<td>M. A. Hamid 2017. UAE</td>
<td>Randomized, controlled, double-blind, prospective split-mouth clinical trial</td>
</tr>
<tr>
<td>E. Merigo et al., 2015. Italy</td>
<td>Randomized, double-blind, split-mouth clinical trial</td>
</tr>
<tr>
<td>G. Batinjan et al., 2013. Croatia</td>
<td>Randomized clinical trial</td>
</tr>
<tr>
<td>S. Raiesian et al., 2016. Iran</td>
<td>Randomized, double-blind clinical trial</td>
</tr>
<tr>
<td>M. Petrini et al., 2017. Italy</td>
<td>Controlled clinical trial</td>
</tr>
</tbody>
</table>

5.2.2 Surgical intervention protocol

Out of 9 researches included in this review, 4 of the researches were split mouth trial. Participants involved in those studies had both sides of mandibular third molar extracted. For researches done by M. Ferrante et al., 2012. Italy, G. Batinjan et al., 2013. Croatia and M. Petrini et al., 2017. Italy, did not specify whether the extraction was done unilaterally or bilaterally. Most of the extraction was done by single surgeon on each researches but in research done by G. Batinjan et al., 2013. Croatia, there were 2 surgeons with more than 10 years of experience extracted the participants MTM. In the research done by S. Raiesian et al., 2016. Iran, the surgeon who extracted MTM was not specified. Technique involved in MTM extraction were all standard surgical protocols.
## 5.2.3 LLLT intervention protocol

Table 3.

<table>
<thead>
<tr>
<th>Author, year, country</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| **M. H. Aras et al., 2009. Turkey** | GaAlAs diode laser, wavelength 808nm, 100mW for 120s. Applied immediately after the operation.  
Point of application:  
Extra-oral: Insertion point of the masseter muscle  
Intra-oral: At the operation site, 1cm from the target tissue |
| **M. López-Ramírez et al., 2011. Spain** | GaAlAs diode laser, wavelength of 810nm, 32 s. Applied pre-op, post-op, post-op 48h.  
Point of application: Intra-orally, 1cm from theoretical position of the location of the spine of Spix |
| **M. Ferrante et al., 2012. Italy** | G-Laser 25 Galbiati, Wavelength of 980nm, in total of 180s in 3 points, 60s each.  
Applied immediately after the operation, post-op 24h.  
Point of application: Occlusal, buccal and lingual |
| **R. Pol et al., 2016. Italy** | GaAs diode laser, wavelength between 904 and 910nm, super pulsed (pulse of 200ns) for 15m. Applied immediately after the operation, post-op 24h and 48h.  
Point of application: Intra-orally 1cm above mucosal tissue |
| **M. A. Hamid 2017. UAE** | GaAlAs diode laser, wavelength 808±10nm, 90s, 30s each.  
Point of application: Occlusal, buccal and lingual |
| **E. Merigo et al., 2015. Italy** | GaAs diode laser, wavelength 910nm, super pulsed (pulse of 200ns) and 650nm continuous, for 15m.  
Point of application: Intra-orally |
| **G. Batinjan et al., 2013.**
| **Croatia** | HF laser, Wavelength 660nm, applied for 1 minute for P1 and 3 minutes for P2. Protocol for each group: P1- With photosensitive substance consisting of toluene chloride powder (155µg/ml), water, sodium phosphate and hydroxymethyl cellulose (Paro-PDT solution), wavelength 660nm, 60s (30s x 2) P2- Same manner but with 180s (2 x 90s) without the paro-PDT solution Point of application: 5mm above the bone surface |
| **S. Raiesian et al., 2016.**
| **Iran** | G-Laser 25 Galbiati, Wavelength of 980nm, continuous, 60s each. Point of application: Extra-oral: Emergence of the masseter muscle Intra-oral: 1cm above the surgery site |
| **M. Petrini et al., 2017.**
| **Italy** | G-Laser 25 Galbiati, Wavelength of 980nm, 180s (60s each point) intra-orally, 60s extra-orally. Point of application: Extra-oral: 1cm above masseter Intra-oral: 1cm above the gingiva of lingual side of the alveolus, and the vestibular wall |
In each research, location of LLLT applied varied. Also, there were 4 types of lasers used which are Ga-Al-As diode laser, G-Laser 25 Gabiati, GaAs diode laser and HF Laser. (as seen on table 4). The protocol involving each LLLT are as followed:

In some of the researches, extra-oral application of LLLT was used (see Fig. 2(6)) as well. For the research done by G. Batinjan et al., 2013. Croatia, the author tires to find out the effectiveness of Antimicrobial Photodynamic Therapy (APDT) and Low Level Laser Therapy (LLLT) after Third Molar Removal. In this study, for the participants assigned to P1 (APDT group) received photosensitive substance consisting of toluidine chloride powder (155µg/ml), water, sodium phosphate and hydroxymethyl cellulose (Paro-PDT solution) prior to LLL application.(7) In most researches, the point of application was Intra-oral, not distant from the extraction sites, but there were 3 researches where LLL was applied extra orally as well. In research done by M. H. Aras et al., 2009. Turkey, each participants received either extra-oral application of LLL on one side and intra-oral application (see Fig. 3(6)) on another.
### 5.2.4 Controlled group intervention protocol:

#### TABLE 5. CONTROLLED GROUP PROTOCOL

<table>
<thead>
<tr>
<th>Authors</th>
<th>Protocol Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>M. H. Aras et al., 2009, Turkey</td>
<td>Placebo - handpiece applied, but laser was not activated</td>
</tr>
<tr>
<td>M. López-Ramírez et al., 2011, Spain</td>
<td>Placebo - handpiece applied, but laser was not activated</td>
</tr>
<tr>
<td>M. Ferrante et al., 2012, Italy</td>
<td>Routine management</td>
</tr>
<tr>
<td>R. Pol et al., 2016, Italy</td>
<td>Placebo - handpiece applied, but laser was not activated</td>
</tr>
<tr>
<td>M. A. Hamid 2017, UAE</td>
<td>Placebo - handpiece applied, but laser was not activated</td>
</tr>
<tr>
<td>E. Merigo et al., 2015, Italy</td>
<td>Traditional drug treatment</td>
</tr>
<tr>
<td>G. Batinjan et al., 2013, Croatia</td>
<td>Without any additional therapy</td>
</tr>
<tr>
<td>S. Raiesian et al., 2016, Iran</td>
<td>Placebo - handpiece applied, but laser was not activated</td>
</tr>
<tr>
<td>M. Petrini et al., 2017, Italy</td>
<td>Routine management</td>
</tr>
</tbody>
</table>

There were 5 researches with placebo treatment where handpiece is applied to target location but the beam was not emitted, 2 researches were with only routine management after the...
extraction and one with traditional drug treatment. However the research done by G. Batinjan et al., 2013. Croatia, control group did not receive any additional therapy. In all studies, participants were not aware of the controlled nature and they were told not to take any analgesics 12 hours prior to surgery.

5.3 Outcomes

5.3.1 Assessment protocol:

In each research, assessment protocol was different. For the pain, most of the studies used Visual analogue scale (VAS), 0- no pain to 10 - extreme pain, but on research done by E. Merigo et al., 2015. Italy, the patient was interviewed instead of simple questionnaire. And measured swelling according to landmarks set.(see Fig. 4(6))(8) The protocol for measuring trismus differs but in most studies, interincisal opening was measured before the surgery and after the surgery in set times (pre-operation, post-operation 48th hours and 76th hours) using calliper. For edema, in study done by M. H. Aras et al., 2009. Turkey, outer contour of cheek was measured pre-operationally and after 2 days of operation and a week.(9) For research done by M. López-Ramírez et al., 2011. Spain, there were 2 measurements from 4 benchmarks taken from Figueiredo R et al., (10), which was tragus-lip commissure and gonion-external canthus of the eye.(8) M. Ferrante et al., 2012. Italy decided to check the postoperative swelling immediately after the first postoperative day and the baseline was determined postoperatively.(11) R. Pol et al., 2016. Italy used VAS scale for each follow up to measure subjective swelling felt by the patient in both controlled and treated sites, and the objective measurement was done by measuring graph paper affixed to skin surface on cephalometric points. (12) S. Raiesian et al., 2016. Iran and M. Petrini et al., 2017. Italy had more simplified approach by measuring distance between mandibular angle and lateral cants of eye(13) and measuring the distance between the tip of the chin and lower part of auricle lobe(14).
5.3.2 Assessment results:

Table 6. Results

<table>
<thead>
<tr>
<th>RESULT</th>
<th>TRISMUS</th>
<th>EDEMA</th>
<th>PAIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>M. H. Aras et al., 2009. Turkey[1]</td>
<td>Extra-oral (p=0.010)</td>
<td>Extra-oral (p=0.047)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intra-oral (p=0.002)</td>
<td>Intra-oral (NS)</td>
<td></td>
</tr>
<tr>
<td>M. Ferrante et al., 2012. Italy[3]</td>
<td>p&lt;0.05</td>
<td>p&lt;0.05</td>
<td>NS</td>
</tr>
<tr>
<td>R. Pol et al., 2016. Italy[4]</td>
<td>p=0.001 on 2nd, 0.006 on 5th postoperative day</td>
<td>p=0.008 on 2nd postoperative day</td>
<td></td>
</tr>
<tr>
<td>M. A. Hamid 2017. UAE[5]</td>
<td>P ≤ 0.05</td>
<td>P ≤ 0.05</td>
<td></td>
</tr>
<tr>
<td>E. Merigo et al., 2015. Italy[6]</td>
<td>p=0.003</td>
<td>p &lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>G. Batinjan et al., 2013. Croatia[7]</td>
<td>p &lt; 0.001 on first</td>
<td>p = 0.003 on first</td>
<td></td>
</tr>
<tr>
<td>S. Raiesian et al., 2016. Iran[8]</td>
<td>NS</td>
<td>NS</td>
<td>P = 0.036</td>
</tr>
<tr>
<td>M. Pettrini et al., 2017. Italy[9]</td>
<td>NS</td>
<td>p&lt;0.001</td>
<td>p=0.002</td>
</tr>
</tbody>
</table>

Research by M. H. Aras et al. did not have any data about pain and in the researches by R. Pol et al., E. Merigo et al., and G. Batinjan et al., did not evaluate trismus. (6, 7, 9, 12) According to each statistical analysis of respective researches, the result varies from one research to another. Table above describes extra-oral application of LLLT has more significance throughout the postoperative time period. However LLLT has less effectiveness statistically on trismus than on other criteria. On pain, yet not showing significant difference in the research by M. López-Ramírez et al., and M. Ferrante et al., the author mentioned that patient consumed less analgesics in the research by M. López-Ramírez et al. Participants complained less about the pain in the research by M. Ferrante et al., as well. In the research done by M. López-Ramírez et al., 2011. Spain, all the results were not significant, yet the author claims that in all criteria, there were noticeable differences in each complications.(8)

5.3.3 Influence of covariates:
As all the articles used in this review had different methods of evaluating each criteria, absolute unity in data extraction was not available. Also, on pain, due to the nature of pain is subjective, markings of participants could be biased. Articles by M. López-Ramírez et al., R. Pol et al., M. A. Hamid et al., and E. Mergio et al., were split mouth trials. By having the researches done split mouth, lowering the varied healing potential in individual participants. As articles by M. Ferrante et al., and M. Peterini et al., gave routine management to control group, E. Merigo et al., giving traditional drug therapy and G. Batinjan et al., giving control group no treatment at all, it may have influenced the result. It may be shown on the article by G. Batinjan et al., where control group had no treatment at all, the control group may had more prominent complication than in other researches. Research done by M. Petrini et al., as it was a controlled study, it may have created bias to participants unknowingly. In the article by G. Batinjan et al., the participants had MTM extracted by either one of two experienced surgeons. Yet, due to the nature of having separate surgeons before LLLT, surgical intervention aspect may have been different.

6. CONCLUSIONS

The usage of low level laser in maxillofacial and oral surgery is becoming more usual due to the size and price of the device has become more obtainable. The process of LLLT has become more efficient and specific, and the effect of it has been proven over time.(5) From 9 original articles analysed in this review, it is conclusive that the low level laser therapy is effective when it comes to post extraction complication of mandibular third molar, and there are differences between the effectiveness of LLLT according to the location of its application. But due to the limitations of assessment methods used in the original articles, further researches should be made for the effect of LLLT under more concrete assessment methods.

7. DISCUSSION

The bio-mechanism behind the effects of low level laser is not yet defined. Referring to articles, low level laser therapy can effect organisms in molecular level. And the reaction may vary from the mode of applications. In cellular level, there is significance of LLLT’s effect on mitochondria. (15) Low level laser therapy, according to the researches, may help on healing process of wounds by inducing local release of biological response modifiers such as cytokines and chemokines. It reduces the time of healing by breaking the strength of wound. The release of
chemokines, cytokines (and other modifiers with biological response) from LLLT is thought to have wound healing properties. A reduction required time period for wound closure and a better integrity and mean strength of the wound can be anticipated. (16-18)

**Limitations of included studies:**

Due to the fact that included articles using different wavelength and diodes of laser, it is limited to find the unity in the nature of studies. Regarding the criteria of each researches, M. H. Aras et al., 2009. Turkey did not collect data about pain,(9) and E. Merigo et al., 2015. Italy, G. Batinjan et al., 2013. Croatia did not have criteria about trismus.(6, 7) The condition of patient, though regulated by each researcher, varied - may have resulted in more troublesome healing process. In research done by M. H. Aras et al., 2009 Turkey, the author compares effectiveness of intra-oral and extra-oral application of LLLT.(9) In the articles by S. Raiesian et al., 2016. Iran and M. Petrini et al., 2017. Italy, the participants received both intra-oral and extra-oral application of LLLT.(13, 14) As this review is for general effectiveness of LLLT on complications of mandibular third molar extraction, the varying location of application was not taken in to account.

Usage of visualised analogue scale (VAS) to assess pain level among the participants should be taken in to consideration, as pain is subjective manner.(19) For pain threshold for each participants being different, one may claim to have excruciating pain even the LLLT was in fact effective but due to the participant having low threshold of pain, could not differentiate the effectiveness.(20)

G. Batinjan et al., 2013. Croatia, did not gave any additional treatment to control group after the extraction of MTM.(7) This may have resulted in collected data to be more significant than other researches. Due to control group not receiving additional treatment, pain, swelling and trismus control would naturally be more poor than other control groups from different researches.

M. H. Aras et al., 2009. Turkey, decides to research about “Placebo-controlled randomized clinical trial of the effect two different low-level laser therapies (LLLT)—intraoral and extraoral—on trismus and facial swelling following surgical extraction of the lower third molar.”(9) The research shows possible difference in effectiveness of intra-oral application and extra-oral
application of LLLT. In the article, it shows the effect of extra-oral application of LLLT is significant on edema (p=0.047) when intra-oral application of LLLT is not (NS). This shows it is necessary for more thorough future researches to be made about the localization of LLLT application.

“Effect of low-level laser therapy after extraction of impacted lower third molars” by M. López-Ramírez et al., 2011. Spain(8), had no significant result in all of the criteria. Way of approach in M. López-Ramírez et al.,’s research was to have a split mouth, randomized double-blind trial. Participants were regulated but the application of LLLT was different from other researches. As participants received LLLT before the extraction, after the extraction and 48 hours after the extraction. But the localization of LLLT was at the theoretical spot of spine of Spix. It shows that frequentness of LLLT application has less to do with the effectiveness than of localization.

8. PRACTICAL RECOMMENDATIONS

Post-operative recovery for mandibular third molar extraction can take up to 2 weeks, and during this time, post-operative complications can be a big factor for patient wellbeing. With simple procedure of low level laser therapy, it may be possible to reduce the time of recovery. When more researches are made and there are more conclusive results, it can be recommended to be implemented to surgical procedures of MTM extractions.

9. CONFLICT OF INTEREST

The author has not encountered any conflict of interests

10. FUNDING

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11. ACKNOWLEDGEMENTS

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12. REFERENCES


