

The infrared radiation effect to the trismus recovery after odontectomy

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ABSTRACT

Impacted was defined as unerupted teeth, it could some pathological conditions such as pain, swelling, trismus, and should be removed by an operative procedure called odontectomy. Nevertheless, this procedure could cause some complications such as pain, trismus and swelling. Trismus was a jaw restricted movement condition caused by inflammation, swelling and pain. Trismus could be cured by analgetic anti inflamation medicines, and physiotherapy such as jaw movement exercise, massaging, hot wet application and therapy used infrared light. Infrared light was an electromagnetic radiation with wavelength between 0.7 μm -1000 μm . It could reduced the inflammation in cell structure, pain and less of side effects. The research was carried out to know the infrared effect to the velocity of trismus recovery. Type of research had been used is quacy experimental in prospective way, using 15 patients with infrared radiation and 15 patients without infrared radiation. The result of research used t test with $\alpha = 0.05$ indicated that there were significant differences velocity of trismus after odontectomy recovery between infrared radiation and without infrared radiation. This study concluded that the velocity of trismus recovery was faster when applied by infrared radiation.

Key words: Odontectomy, trismus, infrared radiation

INTRODUCTION

Impaction teeth are teeth that are failed to erupt to the jaw arch or that the eruption path is blocked, usually by the adjacent teeth or pathological tissues.^{1,2} These impaction teeth can result in various disorders such as: infection, dentigerous cyst, jaw fracture, Trismus, pain and tinnitus which is noises and pulse inside the ear and head.

One of the treatments for impaction is by removal through odontectomy action, which is by cutting it through a previously made

mucoperiosteal flap and bone excision surrounding the removal area. Impaction removal is a surgery on asymptomatic or non-pathologic patient as the preventive action to prevent disorders related to impacted teeth. Impacted lower third molar enlargement often causes bigger trauma than regular third molar. Therefore, the tissue reaction is also bigger. Reaction resulted from this trauma produces secondary change in the tissue, which is inflammation. Inflammation is a response of living tissue toward injury that leads to exudate production.^{3,4}

In this odontectomy there are complications

that may happen during and after the surgery, i.e.: bleeding, swelling, post-surgery pain, dry socket, Trismus, paresthesia, and emphysema which is swelling caused by the air that are trapped in the soft tissue due to high-speed drill utilization. Post odontectomy complications that usually occur include pain, Trismus and swelling. Trismus is a motoric disorder of trigeminal nerve that leads particularly to spasm of mastication muscles with mouth-opening difficulty. This condition arises as a result of inflammation response after odontectomy that spreads to mastication muscles.

Trismus can be resulted from inflammation of mastication muscles especially the closing muscles and spasm or closing muscle lock due to prolonged mouth opening and also by mechanical restriction due to swelling or voluntary reflects to avoid the pain.⁵ Spasm is one of the direct pain causal factors and become the basic construct of syndrome or group of clinical symptoms because the mechanosensitive pain receptor is stimulated. This pain also caused by spasm that suppresses blood vessels and results in ischemia which is an ideal condition for releasing chemicals that will trigger pain such as bradikinin, serotonin, calcium ion, acid, acetylcholine, proteolysis enzyme.⁶

According to Clark⁷, Trismus is mandibular movement restriction due to abnormal stimulation or muscle activity inhibition. Trismus is generated from neurophysiologic protection normal process. In this condition, the mastication muscles try to avoid the pain caused by trauma of surgery by inhibit the movement.⁷

Trismus can be managed using thermal energy transferred through skin.⁸ According to Skjelbred and Lokken in a book written by Andreassen⁹, one of post-odontectomy therapies is by using ray exposure therapy in order to reduce the pain that can generates Trismus.

In this more modern era, the use of technologies in dentistry is a common practice. One of these is infrared that is used in post-surgery treatment. Based on the laboratory research, infrared can reduce inflammation in the cell structure and improve the recovery process, as well as reducing pain and bacterial number. The infrared therapy is beneficial to stimulate cell functions and it is also very accurate, appropriate, safe, and effective for recovery.^{10,11}

According to Al-Watban, recovery process is

started when the infrared is penetrated into the skin. When infrared touch the skin, mitochondria is stimulated to increase oxygen absorption so that energy (ATP) production will increase.¹² This ATP increase makes the cell function to be normal again so that the recovery is accelerated after producing two effects, i.e. anti inflammation and immunosupportive.¹³

The purpose of this study is to understand mouth opening after infrared radiation, and how much the infrared affects the speed of post odontectomy Trismus recovery process.

The benefit expected from this study is providing information for post-odontectomy Trismus treatment development, consideration materials for dentist in addressing tooth extraction complication especially Trismus and information about infrared benefits as one of post-odontectomy therapies.

METHODS

This study is a prospective quasi-experimental study on post-odontectomy Trismus patients with direct observation to patients at the Oral and Maxillofacial Surgery Department, Dr. Hasan Sadikin Hospital, during the period of September-November 2006. The sampling technique used is simple random sampling and the sample consists of patients that meet the following criteria: Men or women at the age of 20-40 years old with odontectomy indication; Patient with no systemic disease; Patient with less that two hours of surgery; Patient with class 1 and 2 impacted teeth according to Pell and Gregory.

The number of patients needed is 15 individuals with post-odontectomy Trismus that receive infrared exposure and 15 individuals who does not receive infrared exposure as the control group.

The materials used are caliper, mask, gloves, writing tools, and solux infrared lamp. Method: Record the Oral Surgery Department RSUP Dr Hasan Sadikin Patient data who are ready to perform the odontectomy treatment; Measure the jaw opening distance before odontectomy; Measure the jaw opening distance one day after odontectomy to define patient with Trismus; Trismus is positive (+) if the post-odontectomy distance is smaller than before odontectomy, and trismus is negative (-) if

the post odontectomy distance is not smaller than before odontectomy; After the Trismus patients obtained, the next step is determining the patients who will receive infrared exposure and patients who will not receive infrared exposure as the control using lottery or random selection; Perform radiation for 10 minutes to the Trismus patient on the first, second, third and fourth days after odontectomy; Perform measurement to patient in both group in second, third, and fourth days after odontectomy; From the second, third and fourth days after odontectomy measurement results, the data is then processed.

The data obtained from observation is presented in table and charts, the analysis is performed using t test with error level (α) of 0.05.

RESULT

The study was performed during the period of September-November 2006 on 30 patients, males and females, who visited Oral and Maxillofacial Surgery Department of Hasan Sadikin Hospital, Bandung Faculty of Dentistry Universitas Padjadjaran for impacted lower third molar surgery. Impacted teeth that meet the research criteria are class I or class II and position A or B according to Pell and Gregory. Class III and position C patients were not included in the sample because they need long-period of treatment with higher difficulty level and risk level. Of 30 samples, 15 samples were exposed by infrared and 15 others were not exposed by infrared or served as control.

The following Tab. 1 shows lower third molar post odontectomy Trismus recovery rate with infrared exposure. From the table, no patient recovered on the first day (0%), seven patients recovered on the second day (46.67%), seven patients recovered on the third day (46.67%), and one patient recovered on the fifth day, as illustrated in Chart 1.

From Tab.2, which is the non-treatment or control table, it can be observed that the patient recovery from trismus after odontectomy of the lower third molar up to the third day is nil (0%), three patients on the fourth day (20%), two patients on the fifth day (13.33%), and ten patients need more than five days (66.67%). From these data (see appendix) the estimation of

trismus recovery after odontectomy of the lower third molar without infrared exposure (control) based on the linear trend shown in chart 2 can be observed.

From chart 1 and 2 the average of the recovery rate of trismus after odontectomy of lower third molar using infrared exposure is 2.67 and the average of the recovery rate of trismus after odontectomy of lower third molar without infrared exposure is 6.47 days as depicted in Chart 3.

From statistical calculations it can be concluded that there is a difference between the recovery rate of trismus after odontectomy of lower third molar with infrared exposure and without infrared exposure. It seems that the recovery rate using infrared exposure is higher than the recovery rate of trismus after odontectomy without infrared exposure.

DISCUSSION

Odontectomy is a procedure to remove partial impacted teeth, unerupted teeth and residual root that cannot be removed using extraction pliers and need surgery.⁷ Indication for odontectomy is to prevent pathological conditions triggered by impacted teeth such as periodontal disease, caries, paricoronitis, root resorption, root fracture, cyst and tumor. In addition, odontectomy is also provided as a treatment for pain complaint caused by impacted third lower molar tooth and for orthodontic or other dental treatment reasons.

Odontectomy procedure will create surgery trauma that often leads to post surgery complication. The severity of the complication is related to the size of tissue trauma during surgery. According to Krekmanov¹⁴, the complications that are often seen after odontectomy include swelling, trismus, and pain. Trismus may be caused by jaw fracture, trauma, bleeding and infection. Another factor causing trismus is odontectomy technique used. A study performed by Irfani¹⁵ concluded that split bone surgery technique have bigger possibility to trigger trismus compared to tooth division technique.

Post odontectomy trismus relates to swelling, pain and inflammation. Inflammation is a complex response of the tissue towards all types of lesion that involves cellular, humoral

Table 1. Progress of trismus recovery rate after odontectomy using infra red exposure treatment.

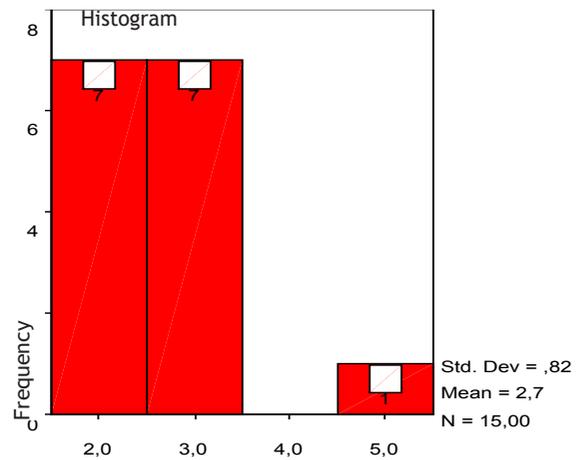
| No | Without exposure (control) | | | | |
|----|----------------------------|-------|-------|-------|-------|
| | day 1 | day 2 | day 3 | day 4 | day 5 |
| 1 | + | + | - | - | - |
| 2 | + | + | - | - | - |
| 3 | + | + | - | - | - |
| 4 | + | - | - | - | - |
| 5 | + | + | + | + | - |
| 6 | + | + | - | - | - |
| 7 | + | + | - | - | - |
| 8 | + | + | - | - | - |
| 9 | + | - | - | - | - |
| 10 | + | - | - | - | - |
| 11 | + | - | - | - | - |
| 12 | + | + | - | - | - |
| 13 | + | - | - | - | - |
| 14 | + | - | - | - | - |
| 15 | + | - | - | - | - |

Table 2. Progress of trismus recovery rate after odontectomy without infra red exposure (control).

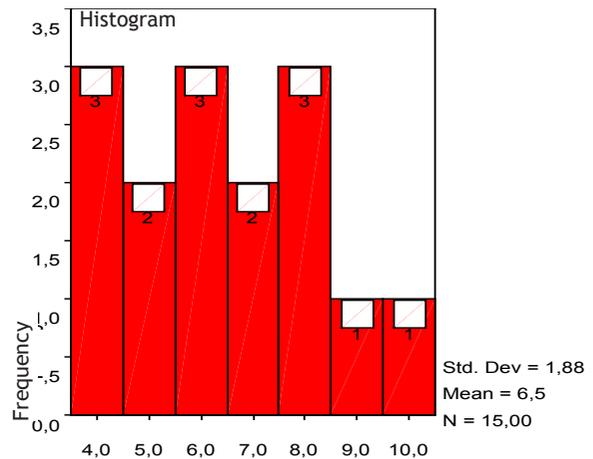
| No | With exposure (control) | | | | |
|----|-------------------------|-------|-------|-------|-------|
| | day 1 | day 2 | day 3 | day 4 | day 5 |
| 1 | + | + | + | + | + |
| 2 | + | + | + | - | - |
| 3 | + | + | + | - | - |
| 4 | + | + | + | + | + |
| 5 | + | + | + | + | + |
| 6 | + | + | + | + | - |
| 7 | + | + | + | + | + |
| 8 | + | + | + | + | + |
| 9 | + | + | + | + | + |
| 10 | + | + | + | + | + |
| 11 | + | + | + | - | - |
| 12 | + | + | + | + | + |
| 13 | + | + | + | + | + |
| 14 | + | + | + | + | - |
| 15 | + | + | + | + | - |

and vascular changes.¹⁶ The inflammation process destroys, solutes or limits lesion causing agent and start the process for recovering damaged tissue in the location. To achieve the goal, inflammation reaction often leads to clinical symptoms such

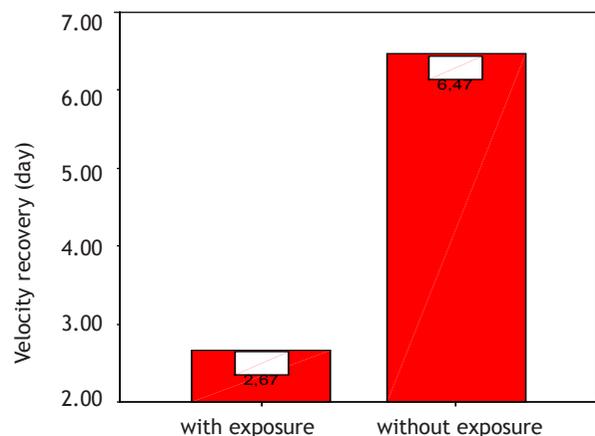
Graphic 1. Progress of trismus recovery rate after odontectomy of the lower third molar using infra red exposure treatment.



Graphic 2. Estimation of trismus recovery rate after odontectomy of the lower third molar without infra red exposure.



Graphic 3. Comparison of the average trismus recovery rate after odontectomy of the lower third molar with and without infra red exposure (control).



as swelling, rash, pain, local overheating and funtiolaesa or loss of function.^{17,18}

Inflammation is divided into acute and chronic inflammation.¹⁷ Acute inflammation consists of changes that occur in minutes and stay for several hours or days. This shows an effort of the body to destroy or neutralize acute inflammation causing agents that may include various factors such as organism, mechanic trauma, chemicals, radiations, huge temperature gap, loss of blood supply and immunological reactions.^{17,18} Main mediators of acute inflammation are various vasoactive amine such as histamine, kinine, protein, complement and arachadonat derivatives including prostaglandin and leucotrien. Acute inflammation is dominated by edema and neutrophil exudates. The accumulated neutrophils produce thick yellowish liquid known as pus.¹⁶

Inflammation recovery reaction immediately occurs after lesion at the time when the inflammation reaction is still in place. However, the recovery cannot be completed until the cause of the lesion is destroyed or neutralized. Recovery consists of changing death cells with live cells. The quality and adequacy of inflammation reaction and recovery response are determined by factors related to the cause of the lesion and host factors. The result of the lesion is determined by the balanced achieved between body immunity, recovery capacity of the host and the destruction effect of the agent causing lesion. The host factor that influences recovery process consists of systemic and local factors.¹⁸

Systemic factors such as patient nutrition and hormonal factors especially steroid may suppress inflammation reaction. Besides systemic factors, other factors that play important role in recovery process are local factors such as local blood circulation, infection, foreign matter, wound immobilization and the location of the lesion.¹⁸

Infrared exposure functions to reduce trismus triggered by odontectomy due to inflammation caused by trauma during surgery. Trismus is a clinical symptom when patient experiences mouth opening limitation. To measure the size of the mouth opening some instruments can be used including Willis nite gauge, Venier gauge and caliper. This study used caliper to measure distance between upper central incisive interincisal part with lower incisive interincisal

part according to the method previously used by irfani¹⁹ and Yusuf.¹⁵

From Tab. 1 it can be observed that Trismus started to resolve on the second day after odontectomy in seven patients. This may be due to the fact that the exposure performed on the first day was able to reduce inflammatory cells and mediators released during inflammation process. Based on the laboratory study, infrared can reduce inflammation in cell structures and is able to increase recovery process, reduce pain and reduce the number of bacteria.¹⁰ However, it is also observable that there were seven patients who were cured on day three and there were even some who recovered on day five.

The differences in this recovery rate is caused by various factors such as patient's immunity, medication consumption, the size of the trauma during surgery and the time spent for surgery. Patients who recovered in day five may have weaker immunity compared to the other fourteen patients. This is in line with the statement from Robbins and Kumar¹⁸ that the quality and adequacy of inflammation reaction recovery are affected by host factors including immunity quality. This difference may also be caused by the fact that the patient did not take medication according to the doctor's instruction or did not do opening and closing jaw exercise.

In Tab. 2 it can be observed that the trismus recovery starts from day four in three patients (20%), two patients on the fifth day (13,33%), and ten patients recovered after more than five days (66.67%). From chart 2 it can be observed that the average recovery rate from trismus after odontectomy without infrared exposure is 6. 47 hari. This result is in line with several studies stating that trismus will disappear after the fifth day post odontectomy.¹

From this study it is apparent that the average recovery rate for trismus after odontectomy of lower third molar using infrared exposure is faster than without infrared exposure (chart 3). This is in line with the statement of Simunic²⁰ stating that infrared can accelerate pain and inflammation recovery. Infrared ray has been used widely for post surgery recovery therapy including in the recovery of trismus after odontectomy. Infrared therapy is aimed at stimulating cell function. This therapy is very precise, accurate, save and

has been proven as very effective to be used in various conditions and methods.¹⁰

According to Al-Watban, recovery process is started when the infrared is penetrated into the skin. When infrared touch the skin, mitochondria is stimulated to increase oxygen absorption so that energy (ATP) production will increase.¹² This ATP increase makes the cell function to be normal again so that the recovery is accelerated after producing two effects, i.e. anti inflammation and immunosupportive.¹³

As we know human tissues are constructed from water and protein molecules. These water molecules are always unstable and if they are oscillated using infrared, there will be instability vibration or resonance. The resonance causes ionization which is referred as water activation. When this activation happens, the metabolism process of the cells will be more active leading to faster cell development and reduced inflammatory cells.²¹ The danger of infrared can only be experienced if the infrared expose the eyes directly. Therefore, in this study, black cloth was used to cover the eyes although the exposure direction is not towards the eyes, as recommended by Tuner.¹²

CONCLUSION

Infrared can reduce inflammation, pain and stimulate cell metabolism so that the cell growth will be faster too. Trismus after odontectomy is caused by inflammation and pain. Therefore, infrared exposure can reduce inflammation and pain so that trismus will heal faster or reduced significantly. From this study it can be concluded that infrared exposure can accelerate trismus recovery after odontectomy of lower third molar.

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