



Effect of infrared light on wound healing in patients who underwent sternotomy in a tertiary care hospital

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Abstract: An estimated 2 million cardiac surgical procedure are performed around the rld. A total of 60,000 open heart cases performed in India with the sternotomy approach. The complication rates for median Sternotomy ranges from 0.5% to 5%. Most common complication of Sternotomy is pain and wound healing. The reported incidence of sternal infection ranges from 0.9 % to 20% Application of Infrared light can be beneficial in enhancing wound healing. The study was done with the aim to evaluate the effect of infrared light application wound healing in patient who underwent sternotomy in tertiary care hospital. In this study, quasi-experimental non-equivalent pre-test-post-test design was used. 43 samples (21in experimental group and 22 in control group) were selected with the purposive sampling technique. Each individual in the experimental group received 5 doses of infrared light from 3rd post-operative day (pm) to 5th post-operative day and routine care was given in control group. The wound healing level was assessed using Southampton wound assessment scale on day 5th and 10th post-operative day .The result no showed significant difference on wound healing between the experimental and control group. But a statistical significance of wound healing score was seen within the experimental group (p<0.05). The study concluded that infrared light application didn't pay a significant effect in wound healing level rather enhanced the process.

Key words: Infrared Light, Sternotomy, Post-Operative Day, Wound Healing, Tertiary Care Hospital.

INTRODUCTION

An estimated 2 million cardiac surgical procedure are performed around the world. In a study Conducted in 2018 revealed total no. of cardiac surgeries done was 234.2 million per year and the rate of surgery included to be 295 per 100,000 populations [1]. A total of 60,000 open heart cases performed in India [2]. The complication rates for median Sternotomy ranges from 0.5% to 5%. Most common complication of

Sternotomy is pain and the reported incidence of sternal infection ranges from 0.9 % to 20% [3]. After a cardiac surgery, Post-operative sternal wound infections have led to as high as 40% mortality with risk factors such as obesity, diabetes. The infra-red light is an electromagnetic wave which is also emitted from the sun [4] The biological effect of infrared radiation therapy is related to decrease in inflammatory cells, formation of granulation tissue and increased collagen synthesis. Exposure to dry heat by mean can enhance wound healing process [5]

A study conducted to see the effect of infrared light (Photobiomodulation) is one of the methods which have positive effect on healing process after CABG and post-operative complication. It was conducted on 192 volunteers who were randomly divided into the 2 groups. As a result it showed significantly lower post-surgery complication [6]

In this quasi-experimental non-equivalent pre-test-post-test design study, we aim to evaluate the effect of infrared light on wound healing for patient who underwent sternotomy, based on the hypothesis that application of infrared light will significant improvement in the wound healing after application of infrared light

MATERIAL AND METHODS

This quasi-experimental non-equivalent pre-test-post-test design study was conducted between February 2022 and June 2020. Its protocol was approved by ethical committee of King Georges' Medical University (No.2270/ethics/2022). Written informed consent was obtained from all patients on the 3rd post-operative day after cardiac surgery using sternotomy approach. The patients above the age group of 18 years were included and who had underwent sternotomy. The patients were excluded if (a) were under 18 years, (b) were used stapler for sternotomy closure, (c) clinically unstable after surgery, and (d) presented post-operatively with cardiac morbidity and expected prolonged ventilation (>48 hours). During the study period, a sample size of 43 patient was derived which were divided in experimental group (21) and control group (22) using purposive sampling technique

The patient in the experimental group received 5 doses of infrared light from 3rd post-operative day (starting in the evening). The pre-assessment of level of wound healing was done on day 3 using Southampton wound assessment scale before any intervention The therapy was given for 6-10min (depending on patients tolerance). The post-assessment was done on 5th and 10th post-operative day. The patient in the control group

received routine nursing care which included administration of medication. The two groups were kept in 2 different section of the ICU to prevent any biasness. The data was analysed with parametric test using SPSS IBM 16. A p value <0.05 was considered statistically significant. Power analysis was used to determine the sample size which SD1 was 1.446(pre-test score) and SD2 was 0 (post-test score).we determined that sample size of 43 patients was necessary to achieve power (1-beta) of 90%at significant of 10% (beta)

RESULT

The result was analysed based on the hypothesis testing where H1: There is a significant improvement in the wound healing after application of infrared light The demographic data included the age, sex, gender, education status, personal habits, occupation, diet pattern and history of associated illness in both experimental and control was present using percentage and frequency distribution

The effect of infrared light on wound healing in patients who underwent sternotomy within the experimental and control group was done using statistical paired t test where in experimental group the Southampton wound assessment scale showed a mean and SD of 4.48 + 0.08 on pre-test before dose 1 and was 4.10+0.30 on post-test after the 5th dose on 10th post-operative shows great significance. The statistical significance is calculated after each dose to show the significance on each day progression.

In the control group, the Southampton wound assessment scale showed a mean and SD of 4.45 + 0.89 on pre-test before dose 1 and was 4.14+0.35 on post-test after the 5th dose on 10th post-operative shows great significance

To evaluate effect of infrared light on level of wound healing between the experimental and control group was done using statistical un-paired T test, which was found to be no significance after intervention on 5th and 10th post-operative day .

Table1. Comparison of effect of infrared light in wound healing in the control group and experimental group after intervention

No. Of days	Experimental group		Control group		Critical value
	n=21		n=22		
	Mean	SD	Mean	SD	
DAY 5	4.19	0.40	4.27	0.55	0.27 2.02

DAY 7	4.10	.30	4.14	0.35	0.42	2.02
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Designation: *t' (41)2.02, p<0.05

The categorical association was found to be insignificant of demographic and clinical variable with wound healing score

DISCUSSION

There were significant effect in the wound healing score after intervention in the experimental group on post-operative day 5 p<0.05 and day 7 p<0.05 and there was an improvement in the wound healing score in control on post-operative day 7 p<0.05. but no significance established between the group

A study conducted in 2013 on effectiveness of infrared rays on wound healing among caesarean section mothers in Puducherry. The study shows that the 5th day post mean on wound healing scores were 2(1.4) and 1.38(0.987) for control and experimental group which didn't bring any significance when tabulated t value 2.559 was compared whereas on day 7th the p value of (0.008) shows significance in experimental group in comparison to the control group[7].

A study conducted in 2020 so evaluate the effect of applied far-infrared radiation pain and wound healing post-operatively after a rotator cuff repair showed the healing failure rate was not significant statistically (p=0.999) and healing was found to be effective without FIR.[8]

CONCLUSION

The overall findings of the study were that there was no statistically significant difference in level of wound healing after application infrared light between the experimental and control group. Infrared light therapy , also known as Photobiomodulation is one of the new technology used for wound healing and pain management, Therefore, this study suggest a longer duration study , follow up and in multiple set-up will help to develop in clinical significance of application of infrared light,

Author's contribution

- Sneha Angel Solomon: carrying out the data collection / writing thesis / manuscript/ Data Analysis
- Rashmi P John: Research design, manuscript preparation, literature search and Supervision
- Dr. S.K. Singh: Research methodology, manuscript review and supervision

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REFERENCE

1. Pezzella AT. Global Cardiothoracic Surgery Advances and Challenges in Developing Countries and Emerging Economies. October 2018.
Doi:10.25373/ctsnet.7247249.
<https://www.ctsnet.org/article/global-cardiothoracic-surgery-advances-and-challengesdeveloping-countries-and-emerging>
2. Vaithianathan R, Panneerselvam S, emerging alternative model for cardiothoracic surgery training in India, Medical Education online, 2013 may 6; 18(10)
Doi: 10.3402/meo.v18i0.20961
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3647042/>
3. Orgill D P , Butler C E, surgical management of sternal wound complication, up-to-date y
<https://www.uptodate.com/contents/surgical-management-of-sternal-wound-complications>
4. Flick, Sarah .Postoperative sternal wound infection .Nursing Critical Care. March 2015 ; Vol 10(2): p 31-36
doi: 10.1097/01.CCN.0000461169.85066.4d
5. DynaMed [Internet]. Ipswich (MA): EBSCO Information Services. 1995 - . Record No. T922760, Sternal Wound Complications; [updated 2018 Dec 04]
Available from <https://www.dynamed.com/topics/dmp~AN~T922760>
6. Kazemikhoo N, Kyavar M, Razzaghi Z, Ansari F, Maleki M, Ghaffarinejad M H, et al. Effects of intravenous and transdermal Photobiomodulation on the postoperative complications of coronary artery bypass grafting surgery: a randomized, controlled clinical trial. Lasers Med Sci. 2021 Dec; 36(9):1891-1896.
doi: 10.1007/s10103-020-03236-3. Epub 2021 Jan 4.

7. Dash M, Selvi S. Effectiveness of Infrared Rays on Wound Healing among Caesarean Section Mothers at Puducherry, American Journal of Nursing Research ;2013 1(1):page no. 43-46 , <http://pubs.sciepub.com/ajnr/1/1/7/index.html>
8. Yoon Y J, Park H J, Lee K J, Kim H S, Rhee S M, Oh J H, The effect of postoperatively applied far-infrared radiation on pain and tendon-to-bone healing after arthroscopic rotator cuff repair: a clinical prospective randomized comparative study. Korean J Pain. 2020 Oct 1; 33(4): 344–351. Doi: 10.3344/kjp.2020.33.4.344