

Effectiveness Of Infrared Radiation On Wound Healing And Pain In Women After Caesarean Section.

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Abstract:

Background: Childbirth causes pain whether it be vaginal or caesarean section. Infrared radiation has been used as a form of heat therapy to promote healing and reduce pain.

Purpose: To assess the effectiveness of wound healing and level of pain among women after caesarean section with infrared radiation.

Method: A quasi-experimental research design was adopted. 60 subjects in the experimental group and 60 subjects in the control group were selected by simple random sampling technique. The level of wound healing was assessed using Southampton Wound Scoring System and the level of pain using Numerical Pain Intensity Scale. Infrared radiation was administered to the experimental group and routine care was followed in the control group.

Results: There is a significant difference in the level of wound healing and level of pain in the experimental and control groups. The difference between the pre and post-assessment scores for the level of wound healing was 2 (0, 3) in the experimental group and 0 (-1, 0) in the control group ($p < 0.001$). Similarly, the difference between the pre and post-assessment scores for the level of pain was 2 (0,3) in the experimental group and 1 (0,1) in the control group on day 1 morning ($p < 0.001$) and 1(0,1) on day 3 evening in both experimental and control groups ($p = 0.001$). There was association between the level of pain with previous caesarean section ($p = 0.048$).

Conclusion: Thus, infrared radiation helps in promoting wound healing and reduction of pain in women after caesarean section.

Keywords: women after caesarean section; wound healing; pain; infrared radiation.

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I. Introduction

Pregnancy is a unique, exciting and often joyous time in a woman's life, as it highlights the woman's amazing creative and nurturing powers while providing a bridge to the future⁸. Every pregnant woman hopes for a short labor and delivery with no complications. Some babies need to be delivered via cesarean section (C-section)¹¹. Post caesarean wound infection is not only a leading cause of prolonged hospital stay but a major cause of the widespread aversion to caesarean delivery in developing countries⁹. One of the most common sites of infection following a caesarean section is the incision. Because the skin is host to a variety of bacteria, infection can set in. A caesarean section can also cause internal tissues to become infected³. During post-caesarean period, moderate to severe postoperative pain is a regularly reported problem. Ideally, the intensity of postoperative pain should be predicted so as to customize analgesia¹². Infrared radiation is a type of electromagnetic radiation. Infrared light is the part of the electromagnetic spectrum that people encounter most in everyday life, although much of it goes unnoticed. It is invisible to human eyes, but people can feel it as heat¹⁴. Infrared light therapy is a unique form of treatment where the healing effects of the light is utilized for treating episiotomy wound. In this therapy, the injury site of the body is exposed to infrared radiation with a light source of 245 volts at a distance of 45-50 cm from it for 10 –15 minutes which provides relief from the discomfort. It is very simple, absolutely painless and has no major side effects¹⁶. Infrared radiation increases blood capillary circulation and vascular activity by promoting improvement in the metabolism of nitric oxide (NO). This facilitates improved regulation of vasodilation and leads to the formation of new capillaries and this in turn provides additional oxygen and nutrients to accelerate natural tissue healing processes and eventually evokes a cascade of beneficial biochemical processes⁷.

II. Material And Methods

A Quasi-Experimental research design was carried out to assess the level of wound healing and level of pain among women after caesarean section with and without infrared radiation in obstetrics ward of a tertiary care teaching hospital. A total of 120 women were selected in the study, 60 women in the experimental group and 60 women in the control group.

Study Design: Quasi-Experimental research design

Study Location: The study was conducted in a tertiary care multispecialty hospitals with 2903 beds.

Study Duration: 6 weeks

Sample size: 120 women after caesarean section.

Sample size calculation: The sample size was estimated based on the statistical formula in which the standard deviation of group I is 1.4 and group II is 0.9 with the mean difference of 0.6, alpha error is 5% and power is 80%. The required sample size per group is 60.

Subjects & selection method: Simple random sampling technique was used to select women after caesarean section. A list of all the women after caesarean section who fulfilled the inclusion criteria was prepared by the investigator. Subjects were selected for the experimental group and control group by lots method.

Inclusion criteria: Women who delivered by lower segment caesarean section after 24-32 hours of delivery, either emergency or elective caesarean section.

Exclusion criteria:

- Women who underwent classical caesarean section
- Women with oozing and drainage from caesarean wound.
- Women with postpartum hemorrhage.
- Women who underwent re-exploration after caesarean section.
- Women with immunocompromised disorders (HIV / HbsAg)
- Women on regular Intravenous / oral antibiotics started during antenatal period and before the period of sample selection.

Procedure methodology

The study was conducted on women who delivered by caesarean section and were admitted in obstetric wards of a tertiary care hospital. Simple random sampling technique was used to select the subjects. Pre-assessment of the level of wound healing and level of pain was done by the investigator and post-assessment was done by the staff nurses working in the respective wards. The level of pain was self-expressed by the subjects via the numerical pain rating scale and the expressed value was noted by the investigator in the pre-assessment and by the staff nurses in the post-assessment. The staff nurses were taught by the investigator to use the Southampton Wound Scoring System (SWSS) to assess the level of wound healing and Numerical Pain Intensity Scale (NPIS) to assess the level of pain. The investigator prepared a list of subjects who fulfilled the inclusion criteria. After completing data collection for the experimental group, the investigator proceeded to control group. Subjects were selected by lots method. Rapport was developed and the purpose of the study was explained. Patient information sheet was provided to each subject and an informed written consent was obtained. Pre- assessment of the level of wound healing was done by the investigator once on the first day of the subject selection before the intervention was administered for the experimental group and before routine care for the control group. Pre-assessment of the level of pain as expressed by the subject was done by the investigator before each intervention for the experimental group and before routine care for the control group. Following pre-assessment of the level of pain, infrared radiation was administered for a time period of about 15-20 minutes twice a day for 2 to 3 days for the experimental group and for the control group followed by routine care. Post- assessment of the level of wound healing was done by the staff nurses in the ward after the intervention is completed, either on the second or third day for both the experimental and control groups on the day of discharged. Post-assessment of the level of pain as expressed by the subject was done 30 minutes after each intervention by the staff nurses in the ward for the experimental group and same was followed for the control group with routine care. The second subject was selected after completing the procedure for the first subject and the similar steps were followed.

Statistical analysis

Data management and analysis was done using Statistical Package for Social Science (SPSS), 17.0 version. Descriptive analysis of demographic and clinical variables was done using frequency and percentage. Descriptive measures such as Mean and Standard deviation, Median and Interquartile range was used for the level of wound healing and level of pain across the groups and frequencies and percentages was presented for the categorizing wound healing score and pain score respectively. The wound healing score and pain score between the experimental and control groups was calculated using Mann-Whitney test. The comparison of the level of wound healing and level of pain pre-assessment and post-assessment scores was compared using Wilcoxon signed rank test. Chi-square test, Fisher exact test and Continuity correction was used to associate the level of wound healing and level of pain with the demographic and clinical variables. The p value of less than 0.05 was considered to be statistically significant. The results of the study finding are presented as tables and figures in the following sections.

III. Results

Table 1 Selected demographic variable shows that 70% and 60% of women in the experimental group and control group belongs to the age group more than 25 years. According to the educational status 58.3% and 51.7% of women in the experimental group and control group were graduates.

Table 1: Distribution of women in the experimental group and control group according to the Demographic Variables. (N=120)

Variables	Experimental(n=60)		Control(n=60)		p value
	n	%	n	%	
Age (years)					0.251
≤25	18	30.0	24	40.0	
>25	42	70.0	36	60.0	
Education					0.700
Secondary	15	25.0	19	31.7	
Higher Secondary	10	16.7	10	16.7	
Graduate	35	58.3	31	51.7	

Table 2 shows that 65.0% in the experimental group were multiparas and 51.7% in the control were primiparas. In the time of assessment after caesarean section in the experimental group 78.3% had their dressing removed between 24-32 hours as compared to the control group where in 66.7% the dressing was removed after 32 hours which is statistically significant ($p<0.001$). This could be due to variation in the protocols followed in different wards. About 53.3% and 66.7% of the women in the experimental group and control group respectively had no history of previous caesarean section. About 68.3% of the women in the experimental group and 81.7% in the control group had normal haemoglobin level. There were 63.3% and 55% of women whose BMI was above 25 in the experimental group and control group respectively. About 58.3% in the experimental group and 51.7% in the control group had no risk factors.

Table 2: Distribution of women in the experimental group and control group according to the Clinical Variables. (N=120)

Variables	Experimental (n=60)		Control (n=60)		p value
	N	%	n	%	
Parity					0.065
Primi	21	35.0	31	51.7	
Multi	39	65.0	29	48.3	
Time of assessment after C-section (hours)					<0.001
24 – 32	47	78.3	20	33.3	
>32	13	21.7	40	66.7	
Previous C-section					0.136
Yes	28	46.7	20	33.3	
No	32	53.3	40	66.7	
Haemoglobin level (g %)					0.092
>10.9	41	68.3	49	81.7	
≤10.9	19	31.7	11	18.3	

BMI (kg/m ²)					0.353
18.5 – 24.9	22	36.7	27	45.0	
>25	38	63.3	33	55.0	
High Risk factors					0.463
Yes	25	41.7	29	48.3	
No	35	58.3	31	51.7	

Table 3 shows that in the experimental group there is a significant difference in the level of wound healing as assessed by SWSS score in the pre-assessment and post-assessment and found statistically significant ($p < 0.001$).

Table 3: Distribution of the level of wound healing as assessed by Southampton Wound Scoring System (SWSS) in the experimental group before and after infrared radiation. (N=60)

Variable	Pre-assessment		Post-assessment		Z value	p value
	Mean $\pm$ SD	Median (IQR)	Mean $\pm$ SD	Median (IQR)		
SWSS to assess level of wound healing	2.1 $\pm$ 1.9	2.0 (0.0, 3.0)	0.3 $\pm$ 0.8	0.0 (0.0, 0.0)	-5.57	<0.001

* SD- Standard Deviation * IQR- Interquartile range * Wilcoxon signed rank test

Table 4 shows that in the control group there is no significant difference in the pre-assessment and post-assessment of the level of wound healing. The median varies in the post assessment and it is not found statistically significant ($p=0.174$).

Table 4: Distribution of the level of wound healing as assessed by Southampton Wound Scoring System (SWSS) in the control group before and after routine care. (N=60)

Variable	Pre-assessment		Post-assessment		Z value	p value
	Mean $\pm$ SD	Median (IQR)	Mean $\pm$ SD	Median (IQR)		
SWSS to assess level of wound healing	1.4 $\pm$ 1.4	1.0 (0.0, 3.0)	1.8 $\pm$ 1.9	2.0 (0.0, 3.0)	-1.36	0.174

Table 5 shows that there is reduction in the level of pain in the post-assessment after each intervention. The mean and standard deviation in the pre and post-assessment were 6.2 ± 1.0 vs. 4.4 ± 1.1 on day 1 morning and 1.6 ± 0.8 vs. 0.6 ± 0.6 on day 3 evening respectively. Out of 60 subjects 28 got discharged on the second day.

Table 5: Distribution of the level of pain as assessed by Numerical Pain Intensity Scale (NPIS) in the experimental group before and after the intervention in the morning and evening on day1, day2 and day3. (N=60)

Variables	n	Pre-assessment (NPIS)		Post-assessment (NPIS)	
		Mean $\pm$ SD	Median (IQR)	Mean $\pm$ SD	Median (IQR)
Day 1 Morning	60	6.2 $\pm$ 1.0	6.0 (5.3, 7.0)	4.4 $\pm$ 1.1	4.0 (4.0, 5.0)
Day 1 Evening	60	5.2 $\pm$ 0.7	5.0 (5.0, 6.0)	3.4 $\pm$ 0.8	3.0 (3.0, 4.0)
Day 2 Morning	60	4.3 $\pm$ 0.6	4.0 (4.0, 5.0)	2.8 $\pm$ 0.8	3.0 (2.0, 3.0)
Day 2 Evening	60	3.6 $\pm$ 0.6	4.0 (3.0, 4.0)	1.9 $\pm$ 0.7	2.0 (1.3, 2.0)
Day 3 Morning	32	2.6 $\pm$ 0.6	3.0 (2.0, 3.0)	1.3 $\pm$ 0.6	1.0 (1.0, 2.0)
Day 3 Evening	32	1.6 $\pm$ 0.8	2.0 (1.0, 2.0)	0.6 $\pm$ 0.6	1.0 (0.0, 1.0)

* SD-Standard Deviation * IQR- Interquartile range * Wilcoxon signed rank test

Table 6 shows that there is not much change in the reduction of the level of pain in the post assessment with routine care. The mean and standard deviation in the pre and post-assessment were 6.2 ± 1.0 vs. 5.5 ± 0.9 on day 1 morning and 1.9 ± 0.8 vs. 1.4 ± 0.7 on day 3 evening respectively. Out of 60 subjects 32 got discharged on the second day.

Table 6: Distribution of the level of pain as assessed by Numerical Pain Intensity Scale (NPIS) in the control group before and after the routine care in the morning and evening for day1, day2 and day3. (N=60)

Variables	n	Pre-assessment (NPIS)		Post-assessment (NPIS)	
		Mean $\pm$ SD	Median (IQR)	Mean $\pm$ SD	Median (IQR)
Day 1 Morning	60	6.2 $\pm$ 0.9	6.0 (5.0, 7.0)	5.5 $\pm$ 0.9	5.0 (5.0, 6.0)

Day 1 Evening	60	5.2 ± 0.7	5.0 (5.0, 6.0)	4.6 ± 0.7	5.0 (4.0, 5.0)
Day 2 Morning	60	4.3 ± 0.6	4.0 (4.0, 5.0)	3.7 ± 0.7	4.0 (3.0, 4.0)
Day 2 Evening	60	3.5 ± 0.7	3.0 (3.0, 4.0)	2.9 ± 0.8	3.0 (3.0, 3.0)
Day 3 Morning	28	2.8 ± 0.7	3.0 (2.0, 3.0)	2.5 ± 0.6	3.0 (2.0, 3.0)
Day 3 Evening	28	1.9 ± 0.8	2.0 (1.3, 2.8)	1.4 ± 0.7	1.0 (1.0, 2.0)

* SD- Standard Deviation * IQR- Interquartile range * Wilcoxon signed rank test

Table 7 shows that in comparison of the difference in the level of wound healing as assessed by SWSS the investigator found that there is a statistically significant difference in the pre and post-assessment between the experimental group and control group with median of 2 in the experimental group and 0 in the control group at Z value -6.114(p <0.001)

Table 7: Comparison of the difference in the level of wound healing as assessed by Southampton Wound Scoring System (SWSS) in the pre and post assessment between the experimental group and control group. (N=120)

Variable	Experimental (n=60)	Control (n=60)	Z value	p value
	Median (IQR)	Median (IQR)		
Difference between pre and post-assessment SWSS scores	2.0 (0.0, 3.0)	0.0 (-1.0, 0.0)	-6.114	<0.001

*IQR- Interquartile range * Mann-Whitney test.

Table 8 shows that in comparison of the difference in the level of pain the investigator found that there is a statistically significant difference in the level of pain pre and post-assessment between the experimental group and control group on day 1, day 2 and day 3 with median of 2 in the experimental group and 1 in the control group on day 1 morning at Z value -6.866 (p < 0.001) and median of 1 in both the experimental group and control group on day 3 evening at Z value -3.305 (p=0.001).

Table 8: Comparison of the difference in the level of pain as assessed by Numerical Pain Intensity Scale (NPIS) in the pre and post assessment between the experimental group and control group. (N=120)

Difference between pre and post-assessment NPIS score				
Variables	Experimental (n=60)	Control (n=60)	Z value	p value
	Median (IQR)	Median (IQR)		
Day 1 Morning	2.0 (1.0, 2.0)	1.0 (0.0, 1.0)	-6.866	<0.001
Day 1 Evening	2.0 (1.0, 2.0)	1.0 (0.0, 1.0)	-7.620	<0.001
Day 2 Morning	1.0 (1.0, 2.0)	1.0 (0.0, 1.0)	-6.646	<0.001
Day 2 Evening	2.0 (1.0, 2.0)	1.0 (0.0, 1.0)	-7.732	<0.001
	Experimental (n=32)	Control (n=28)		
Day 3 Morning	1.0 (1.0, 2.0)	0.0 (0.0, 1.0)	-5.415	<0.001
Day 3 Evening	1.0 (1.0, 1.0)	1.0 (0.0, 1.0)	-3.305	0.001

*IQR- Interquartile range * Wilcoxon signed rank test

Table 9 shows that there is no significant association between the level of wound healing with the demographic variables such as age and education as well as with the clinical variables such as parity, time of assessment after caesarean section, previous caesarean section, haemoglobin level, BMI and high risk factors.

Table 9: Association of the level of wound healing with the demographic variables. (N=120)

Demographic Variables	Level of wound healing score				Chi-square	p value
	Normal healing		Minor complication			
	n	%	n	%		
Age (years)						
≤25	42	37.5	-	-	3.11	0.078
>25	70	62.5	8	100		
Education						
Secondary	32	28.6	2	25.0	0.21	1.000
Higher Secondary	19	17.0	1	12.5		
Graduate	61	54.5	2	62.5		

* Chi-square test and Continuity correction

Table 10 shows that there is no significant association between the level of wound healing with the clinical variables such as parity, time of assessment after caesarean section, previous caesarean section, haemoglobin level, BMI and high risk factors

Table 10: Association of the level of wound healing with the clinical variables. (N=120)

Clinical Variables	Level of wound healing score				Chi-square	p value
	Normal healing		Minor complication			
	n	%	n	%		
Parity						
Primi	50	44.6	2	25.0	1.17	0.463
Multi	62	55.4	6	75.0		
Time of assessment after C-section (hours)						
24-32	62	55.4	5	62.5	0.01	1.000
>32	50	44.6	3	37.5		
Previous C-section						
Yes	45	40.2	3	37.5	0.02	1.000
No	67	59.8	5	62.5		
Haemoglobin level (g %)						
>10.9	83	74.1	7	87.5	0.71	0.678
≤10.9	29	25.9	1	12.5		
BMI (kg/m²)						
18.5-24.9	47	42.0	2	25.0	0.20	0.470
>25	65	58.0	6	75.0		
High risk factors						
Yes	51	45.5	3	37.5	0.19	0.729
No	61	54.5	5	62.5		

* Chi-square test and Fisher Exact test

Table 11 shows that there is no association between the level of pain with the demographic variables such as age and education

Table 11: Association of the level of pain with the demographic variables. (N=120)

Demographic Variables	Level of pain score				Chi-square	p value
	Moderate pain		Severe pain			
	n	%	n	%		
Age (years)						
≤25	29	36.3	13	32.5	0.16	0.685
>25	51	63.8	27	67.5		
Education						
Secondary	26	32.5	8	20	2.66	0.264
Higher Secondary	14	17.5	6	15		
Graduate	40	50	26	65		

* Chi-square test and Fisher Exact test

Table 12 shows that there is association between the level of pain with previous caesarean section ($\chi^2=3.90$, $p=0.048$) whereas there is no significant association between the level of pain with the other clinical variables such as parity, time of assessment after caesarean section, haemoglobin level, BMI and high-risk factors.

Table 12: Association of the level of pain with the clinical variables. (N=120)

Clinical Variables	Level of pain score				Chi-square	p value
	Moderate pain		Severe pain			
	n	%	n	%		
Parity						

Primi	31	38.8	21	52.5	2.05	0.152
Multi	49	61.3	19	47.5		
Time of assessment after C-section (hours)						
24-32	46	57.5	21	52.5	0.27	0.603
>32	34	42.5	19	47.5		
Previous C-section						
Yes	37	46.3	11	27.5	3.90	0.048
No	43	53.8	29	72.5		
Haemoglobin level (g %)						
>10.9	59	73.8	31	77.5	0.20	0.655
≤10.9	21	26.3	9	22.5		
BMI (kg/m²)						
18.5-24.9	34	42.5	15	37.5	0.28	0.599
>25	46	57.5	25	62.5		
High risk factors						
Yes	35	43.8	19	47.5	0.15	0.697
No	45	56.3	21	52.5		

* Chi-square test and Fisher Exact test

IV. Discussion

The study was conducted with the purpose of assessing the effectiveness of infrared radiation on the level of wound healing and level of pain in women after caesarean section.

70% in the experimental group and 60% in the control group belonged to the age group of more than 25 years. Majority of the women 58.3% and 51.7% in the experimental group and control group respectively were graduates. The level of wound healing in the experimental group, there was a significant difference in the level of wound healing in the pre-assessment and post-assessment and was found statistically significant ($p < 0.001$). Whereas in the control group there was no significant difference in the pre-assessment and post-assessment of the level of wound healing. The median varies in the post assessment and it was found not statistically significant ($p=0.174$).

In the experimental group there was reduction in the level of pain in the post-assessment after each intervention. The pre and post-assessment mean and standard deviation were 6.2 ± 1.0 vs. 4.4 ± 1.1 on day 1 morning and 1.6 ± 0.8 vs. 0.6 ± 0.6 on day 3 evening. Out of 60 subjects 28 got discharged on the second day. Whereas in the control group there is not much change in the reduction of the level of pain in the post assessment with routine care. The pre and post-assessment mean and standard deviation were 6.2 ± 1.0 vs. 5.5 ± 0.9 on day 1 morning and 1.9 ± 0.8 vs. 1.4 ± 0.7 on day 3 evening. Out of 60 subjects 32 got discharged on the second day.

There was improvement in the level of wound healing and reduction in the level of pain in the post-assessment in the experimental group rather than in the control group. The present study was supported by the studies of Aswathy M (2016), in her study on effect of infrared therapy on wound healing and pain among mothers who underwent caesarean section found that the pretest mean and SD in the experimental group for wound healing score was 0.4 ± 0.5 whereas in the control group was 0.5 ± 0.5 . The posttest mean and SD of the wound healing score was 0 ± 0 in the experimental group as well as in the control group. The researcher also found that the pretest pain score mean and SD was 3.9 ± 1 in the experimental group whereas in the control group was 4.5 ± 1 . The posttest mean and SD of the pain score was 0.4 ± 0.5 in the experimental group and in the control group was 1.3 ± 0.6 . The result describes that there was improvement in the level of wound healing and level of pain in the experimental group as compared to the control group².

This study findings revealed that post assessment following infrared radiation in the experimental group and routine care in control group was not much different in the number of women with normal healing between both the groups (100% vs. 88.3%) but still 11.7% of women got discharged with minor complications in the control group and if not taken care it can lead to major complications as most of the women do not even touch or wash the wound due to pain. On day 1 morning more women in the control group were in severe pain after routine care as compared to women in experimental group who had intervention (15% vs. 1.7%, p -value < 0.001). This difference however was not seen in women with moderate pain (85% vs. 80%, p value $= 0.471$). On day 1 evening comparing experimental and control groups, in post-assessment only 45% women in experimental group had moderate pain as compared to 95% in the control group (p value < 0.001). On day 2 morning this was in contrast to only 26% decline in women with moderate pain. Following intervention in the experimental group and routine care in the control group, there was a significant difference in percentage of women with moderate pain (20% vs. 65%), which is statistically significant ($p < 0.001$). On day 2 evening in the post-assessment across the

experimental group and control group there were 16.7% women with moderate pain in the control group in comparison to none in the experimental group ($p < 0.001$). At the end of day 2 evening, no women had moderate pain following intervention in the experimental group as compared to 56.7% women prior to intervention. On day 3 morning there were only 32 subjects on day 3 morning. In the post assessment 9.4% of women experienced no pain in the experimental group after the intervention as compared to none in the control group where all women experienced mild pain (100%). On day 3 evening following infrared radiation only 53% women in the experimental group had mild pain as compared to 93% women in the control group following routine care ($p < 0.001$). From the above findings revealed that majority of the women had same level of pain that is, moderate and severe pain at the time of assessment after caesarean section in both the experimental group and control group. But there is reduction in the level of pain after infrared radiation in the experimental group when compared to the control group with routine care. Majority of the women were advised to ambulate and take bath after the dressing was removed but due to pain, they hesitate to come down from their beds especially the obese women.

The present study is supported by the studies of Borges, et al (2017) in their study on postoperative pain in women undergoing caesarean section found that the incidence of pain was 92.7%, average level of pain intensity at the time of worst pain was 6.6 and the description of pain was aching (91.6%), tender (70%) and throbbing (56.1%). This study concluded that high intensity post-operative pain is a reality for post-caesarean women and it was important to assess the pain for implementation of curative and preventive actions to reduce losses in recovery of women⁵. Aswathy M. (2016) in her study on effect of infrared therapy on wound healing and pain among mothers who underwent caesarean section found that 100% of mothers who underwent caesarean section had very good wound healing on the day of discharge in both the experimental group and control group. She also found that majority of the mothers had moderate level of pain in both experimental group (66.67%) and control group (81.82%) during the pretest. In the posttest their pain score was reduced to a significant level².

In comparison of the difference in the level of wound healing in the pre and post assessment between the experimental group and control group it was found that there was a statistically significant difference in the level of wound healing pre and post-assessment between the experimental group and control group with median of 2 in the experimental group and 0 in the control group at Z value -6.114 and found that it was statistically significant ($p < 0.001$). This study shows that there was improvement in the level of wound healing in the experimental group with infrared radiation as compared to the control group with routine care. In the experimental group soon after the dressing was removed infrared radiation was administered and it was found that there was improvement in the wound healing. In obese women the pendulous abdomen over-lap the incision site and did not allow the caesarean wound site to stay dry.

In the comparison of the difference in the level of pain in the pre and post assessment between the experimental group and control group it was found that there is a statistically significant difference in the level of pain pre and post-assessment between the experimental group and control group on day 1, day 2 and day 3 with median of 2 in the experimental group and 1 in the control group on day 1 morning at Z value -6.866 ($p < 0.001$) and median of 1 in both the experimental group and control group on day 3 evening at Z value -3.305 ($p = 0.001$). This study revealed that there was difference in the level of pain in the experimental group as compared to the control group from first day of assessment to the day of discharged. It was obvious that the intensity of pain did statistically reduce after the intervention in the experimental group as compared to the control group.

One of the reasons for reduced pain intensity could be that the heat focused on the caesarean wound causes some alteration of sensation in the wound and the soothing effect of heat promoted comfort to the caesarean women. When the dressing was removed most of the women complained of moderate to severe pain especially after 24 hours when intravenous analgesics was stopped. Attention was given to the post caesarean section women to reduce pain intensity by giving infrared radiation in the experimental group. Most of the women verbalized reduction of pain after the intervention and they were highly satisfied with the infrared radiation given to them. During the intervention most of the women verbalized that they were feeling sleepy due to the soothing effect of infrared radiation. On the other hand, there was also reduction in the level of pain in the control group. This could be due to the effect of analgesics that was administered to the post caesarean section women.

The present study is supported by Shi-Shun, Jie, Mei-yu, (2017) in their study on effect of infrared radiation therapy on control of postoperative incision infection and improvement of microcirculation of patients undergoing caesarean section found that the total effective rate of control of infection was 100% in the observation group, higher than 90% in the control group and there was significant difference ($P = 0.05$). Therefore, it was referred that the infrared radiation therapy can achieve significant effect on control of the postoperative incision infection in the patients undergoing cesarean section and has positive effect on improvement of local cervical microcirculation¹⁵. Aswathi, Toppo, Hariharan, (2016) in their study on effect of infrared radiation therapy on wound healing and pain among postnatal mothers who underwent lower segment caesarean section found that the wound healing status in experimental group was 6.7 with standard deviation of 1.00 and in the control group it was 8.56 and standard deviation 0.50. The mean difference was 1.80 and df was 58 which was found to be significant (at $t = 8.760$, $p < 0.001$). The major findings of the study revealed, that there was significant reduction

in pain at LSCS suture just after intervention and the therapy lasted for 30 minutes after intervention and it slowly comes back near to the pre observational data¹.

In the association between the level of wound healing with selected demographic and clinical variables it was found that there was no significant association between the level of wound healing with the demographic variables such as age and education as well as with the clinical variables such as parity, time of assessment after caesarean section, previous caesarean section, haemoglobin level, BMI and high-risk factors.

In the association between the level of pain with selected demographic and clinical variables, it was found that there was no significant association between the level of pain with the demographic variables such as age and education whereas, there was association between the level of pain with previous caesarean section ($\chi^2=3.90$, $p=0.048$) and there was no significant association with the other clinical variables such as parity, time of assessment after caesarean section, haemoglobin level, BMI and high risk factors. The present study is supported by Aswathy M (2016) in her study on effect of infrared therapy on wound healing and pain among mothers who underwent caesarean section found that there was no association between age, education, parity, weight and previous caesarean with the level of wound healing. But there was association between age and weight with the level of pain².

V. Conclusion

The overall finding of the study was that there was a statistically significant difference in the level of wound healing and level of pain scores after infrared radiation in the experimental group. 100% of women had normal healing in the experimental group after infrared radiation as compared to the control group. Majority of the women expressed that they experienced reduction in the level of pain after having infrared radiation. Therefore, this study has proven that infrared radiation plays an important role in promoting wound healing and reducing pain in women after caesarean section.

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