

# Effect Of Polarized Light Therapy On Incisional Pain After Cesarean Section

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**Abstract: Objective:** This study was conducted to investigate the effect of polarized light therapy on incisional pain after (SC). **Methods:** Forty primipara women complaining from incisional pain post CS participated in this study. They had a single full term fetus during their gestation. The participant's ages ranged from 25-35 years. The control Group (Group A) were treated by traditional medical treatment immediately after recovery from anesthesia. The Study Group (Group B) were treated by traditional medical treatment immediately after recovery from anesthesia and polarized light therapy with energy density of an average of 2.4 J/cm<sup>2</sup> 15 minutes/session, one session /day for 5 consecutive days. Visual analogue scale (VAS) and electronic algometer were used to measure intensity of incisional pain post CS in both groups (A&B) before and after treatment. **Results:** Results of this study found that there was significant decrease of VAS and significant increase of pressure algometer after treatment in both groups A and B when compared with corresponding pre-treatment values ( $p < 0.05$ ). there was significant difference in mean values of VAS and pressure algometer between both groups (A and B) after treatment ( $p < 0.05$ ) (with favor of group B, more decrease VAS and more increase in pressure algometer). **Conclusion:** It can be concluded that polarized light therapy for 5 consecutive days' post SC is an effective adjuvant therapy in treatment of incisional pain through reducing visual analogue scale (VAS) and increasing electronic algometer.

**Key words:** polarized light, incisional Pain, cesarean section.

## 1. INTRODUCTION:

One of the surgical procedures most widely performed is CS. Around 15 percent of births worldwide and 21.1 percent of those in western nations are projected to occur by CS. It is estimated that over a million caesarean deliveries are carried out annually in the USA alone [1].

Cesarean section varies from other big laparotomies because it is predicted that women can heal rapidly and care for their newborns within a few hours of surgery. [2].

Depending on the patient's pain tolerance, family and hospital staff support, the severity of pain experience varies from patient to patient. Having a baby is considered a good event, but if the mother is in pain during childbirth, it can be stressful [3].

In surgery, like CS, pain is a big issue. The CS proportion has risen significantly, making it the most common surgery performed worldwide [4]. In the first 48 hours after surgery, CS usually causes mild to extreme pain [5]. Despite developments in the understanding of post-surgery pain pathophysiology and the introduction of new pain medication and labour techniques, many patients have developed new analgesics and delivery techniques. [6].

Although high-quality pain relief lead to the speedy departure from the hospital and good early mother care to her child after CS [7], it must be taken into account that the transition of drugs into breast milk must also be minimal, with no adverse effects on the newborn. Pain relief may, however, be obtained either through medications or adjuvant treatments such as polarized light therapy. [8].

The Biopton Light Therapy System is a light emitting device with an optical unit that is identical to a part of the sun-produced electromagnetic spectrum but without UV radiation [6, 7]. It is possible to describe the light produced by the Biopton light therapy device as polarized (its waves oscillate on parallel planes), polychromatic (wavelength: 480-3400 nm), incoherent (out of phase light, unlike laser light) and low energy light [9].

Skin warming is caused by the polarized polychromatic non-coherent low energy light (PPL) produced by the Biopton apparatus because it includes infrared light. This exogenous light is interpreted by the chemoreceptors as irritation and contributes to the activation of segment-reflective and local reactions, improves microcirculation and exposed tissue trophics, has an anti-inflammatory impact. The light changes the sensitivity of the skin, it raises the tactile sensitivity and lowers the pain sensitivity [10].

The pain relief effect of polarized light from Biopton can be explained by the direct effect of neurotransmitter stimulation and endorphin release on the nerve endings and on the entire nervous system (the most powerful analgesic known today). The reason of pain, increased blood flow, elimination of pain-causing mediators, and the like were also positively affected by polarized light. [11].

## **2. MATERIALS AND METHODS:**

### **Subjects:**

Forty primipara women complaining from incisional pain post CS participated in this study. They had a single full term fetus during their gestation. They were selected randomly from Elmenia University Hospital for Gynecology and Obstetrics in Elmenia, Egypt. The study was conducted between July 2020 and November 2020. The participant's ages ranged from 25-35 years. They were medically stable and consented to participate in the study. Patients with history of any abdominal operations, history of any radiotherapy or chemotherapy, history of diabetes, psychological problems, acute infection in the area treated and skin disease are excluded from the study. This study was conducted under the ethical committee No: P.T. REC/012/002824. Faculty of Physical Therapy, Cairo University.

Design of study was pre and post experimental design. They were divided into two groups equal in number, Group A (Control Group) consists of 20 patients in 1st 24 hours after CS. They were treated by traditional medical treatment immediately after recovery from anesthesia. Group B (study Group) consists of 20 patients in 1st 24 hours after CS. They were treated by traditional medical treatment immediately after recovery from anesthesia and polarized light therapy with energy density of an average of 2.4 J/cm<sup>2</sup> 15 minutes/session, one session /day for 5 consecutive days.

### 3. MATERIALS:

- 1- Informed consent form.
- 2- Visual analogue scale (VAS).

It was used to assess pain intensity for both groups A and B before and after treatment.

- 3- An electronic algometer:

Force one gauge- model FDI” (Wagner instruments, Greenwish, CT, USA). It was used to measure tenderness by determining the pain pressure threshold using a pressure probe for both groups A and B before and after treatment.

- 4- Bioptron Pro 1 Class II:

Made by Bioptron AG, Wollerau, Switzerland, device with floor stand emitted polarized light lamp with wavelengths ranged from 480–3400 nm. It was used in treatment of patients in group B.

#### Procedures:

All patients in both groups A and B were informed about the procedures of the protocol of the study and each patient assigned the informed consent form before beginning of the study.

#### A- Evaluation procedures:

- 1- VAS:

Before beginning and after the end of therapy, pain was measured by VAS for each patient in both groups (A&B). It is normally a 100 mm long horizontal line, the ends of which are designated as the extreme ("no pain" and "pain as bad as it could be"). The patient is asked to put a mark showing their level of pain on the line. Sometimes descriptive, such as 'mild', 'moderate', 'sever', or numbers are provided along the scale for guidance. [12].

- 2- Electronic Algometer:

An electronic algometer “Force one gauge- model FDI” (Wagner instruments, Greenwish, CT, USA). It was used to measure tender point by determining the pain pressure threshold using a pressure probe, that’s placed on the trigger point. The score is calculated according to the amount of pressure. It was used for both groups A and B before and after treatment. (Figure 1) [13].



Figure (1): Electronic Algometer on incisional pain.

#### B- Treatment procedures:

Polarized Light Therapy:

Polarized Light Therapy Technical Steps [14].

Dressings were removed for all patients involved in the study and wounds were washed with regular saline prior to application. Patients and therapists put on glasses to secure their eyes. patient was placed in comfortable position (crock lying), Then the machine head was placed at a distance of 10 cm perpendicular to the incisional wound, the degree of polarization was > 95 percent, the power density of the polarized light therapy was approximately  $40 \text{ mW/cm}^2$ , which is equivalent to an energy density of an average of  $2.4 \text{ J/cm}^2$  per minute then Start the treatment and end the treatment after 15 min and dismiss the patient. Each patient was treated by polarized light therapy, one session /day for 5 consecutive days (Figure 2).



Figure (2): Polarized Light Therapy on Incisional Wound.

#### Statistical Analysis:

Using SPSS for windows, version 25, statistical analysis was performed (SPSS, Inc., Chicago, IL). Data for normality assumption and existence of extreme scores were scanned prior to final review. This analysis was done as a pre-requisite for the parametric estimation of the difference analysis. Descriptive analysis using histograms with the normal distribution curve and Normality test of data using Shapiro-Wilk test showed that the data of all numeric tested variables (Vas and Algometer) were normally distributed and not violates the parametric assumption. Dependent sample t-test was used for within group comparison while independent sample t-test was used for comparison between normally distributed variable among groups before and after treatment. Alpha level was 0.05.

#### 4. RESULTS:

##### I- Physical characteristics of patients (Age):

There was no significant difference between both groups regarding age, (P-value = 0.734). (Table 1).

Table (1): Comparison of patient ages between both groups (A and B):

Group	Age (years)	
	Group A	Group B
Mean $\pm$ S. D.	25.476 $\pm$ 2.804	26.211 $\pm$ 2.275
Mean difference	0.813	
T-value	38.000	
p- value	0.734	

<b>Level of significance</b>	NS
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## II- Visual Analogue Scale (VAS):

There was significant decrease of VAS after treatment in both groups A and B when compared with corresponding pre-treatment value ( $p < 0.05$ ) with percentage of improvement 65% and 80% respectively (Table 2).

Between groups, before treatment there was no significant difference in mean values of VAS ( $p > 0.05$ ) while after treatment, there was significant difference between both groups (A and B) ( $p < 0.05$ ) (more decrease in group B) (Table 2).

Table (2): VAS pre and post treatment comparison in and between both groups:

VAS	Mean± SD		MD	T value	P value	S
	Group A	Group B				
Before treatment	8.143±1.276	8.000±1.633	0.143	0.310	0.758	NS
After treatment	2.857±1.776	1.632±0.895	1.226	2.711	0.010	S
MD	↓5.286	↓6.368				
%of improvement	65%	80%				
T value	9.816	19.000				
P value	0.000	0.000				
S	S	S				

MD: Mean difference      S: Significance      NS: Non Significance

## III- Pressure Algometer:

There was significant increase of pressure Algometer after treatment in both groups A and B when compared with corresponding pre-treatment value ( $p < 0.05$ ) with percentage of improvement 100% and 261% respectively (Table 3).

Between groups, before treatment there was no significant difference in mean values of pressure algometer ( $p > 0.05$ ) while after treatment, there was significant difference between both groups (A and B) ( $p < 0.05$ ) (more increase in group B) (Table 3).

Table (3): pressure algometer pre and post treatment comparison in and between both groups:

Pressure algometer	Mean± SD		MD	T value	P value	S
	Group A	Group B				
Before treatment	0.456±0.086	0.415±0.078	-0.041	-1.577	0.123	NS
After treatment	0.910±0.109	1.498±0.178	0.587	12.725	0.000	S
MD	↑-0.454	↑-1.083				
%of improvement	100%	261%				
T value	-14.023	-24.866				
P value	0.000	0.000				
S	S	S				

MD: Mean difference      S: Significance      NS: Non Significance

## 5. DISCUSSION:

Effective postoperative pain relieve is essential because women who undergo caesarean delivery consider pain management as their primary concern during and after surgery, as postoperative pain may have lasting effects such as chronic pain, increased use of opioids,

impaired functional recovery and increased postpartum depression which are associated with extreme acute post cesarean pain, but management pain after caesarean delivery increases the capacity of a woman to work and communicate with her newborn child. [15].

The results of this study found that there was significant decrease of VAS after treatment in both groups A and B when compared with corresponding pre-treatment value with percentage of improvement 65% and 80% respectively.

The results of this study found that there was significant increase of pressure Algometer after treatment in both groups A and B when compared with corresponding pre-treatment value with percentage of improvement 100% and 261% respectively.

Between groups, before treatment there was no significant difference in mean values of VAS and pressure algometer while after treatment, there was significant difference between both groups (A and B) (with favor of group B, more decrease VAS and more increase in pressure algometer).

In the body, different tissues and cells have specific characteristics of light transmission (optical properties) that provide the highest stimulating efficacy. This electrical scope ranges from around 650 nm to 1200 nm, representing numerous positive changes at the cellular level. Light is absorbed by electric bands which is related to some molecular photoacceptors, or chromophores. The spectrum of action showed which unique wavelength of light in a particular chemical reaction was most effectively used. For this reason, the polarized light used in the present study combined multiple wavelengths of infrared and visible light in one device ranging from 480 nm to 3400 nm and containing no negative influences of ultraviolet light [16].

Polarized light is an electromagnetic wave that oscillates on a single plane that reacts with the electromagnetic radiation in the Krebs cycle more effectively than non-polarized light which is fluctuates throughout all dimensions. In addition, as it passes through the tissues, polarized light appears to improve essential biological reactions included the absorption, resonant and non-resonant scattering phenomena. [17]. Polarized light therapy has been used since 2000 on a regular basis in the postoperative care of our patients, with a recovery time much quicker than before. The most realistic way to demonstrate its post-surgery efficacy was to make a clear " on the spot " comparison. [18].

The pain reduction effect of polarized light from Bioptron is illustrated by the positive effect of neurotransmitter stimulation and endorphin release on the nerve endings and on the entire nervous system (the most powerful analgesic known today). The reasons of pain, increased blood flow, elimination of pain-causing mediators, and the like were also positively affected by polarized light. [11].

Bioptron light has many advantages as it speeds up the cellular pathways and increases the local blood supply, but its possible mechanism of action can be explained by sensitivity to both the visible and infrared portions of the electromagnetic spectrum of Bioptron light. To investigate exactly how this happens, further research is required [19].

**Huisstede et al., [20]** have researched that there are many hypotheses about the mechanism of action of Bioptron. Bioptron light is likely to speed up cellular pathways and enhance blood supply, decrease pro-inflammatory cytokines, and increase plasma levels of anti-inflammatory and fibroblast growth factors, but research is required to explore its precise mechanism of action.

The results of this study agreed with **Mihaylova et al., [21]** who found that PPL is a physical therapy technique that reduces pain, enhances lumbar region mobility and improves the quality of life of patients with lower back pain. Using polarized polychromatic non-coherent low-energy light with basic treatment produced better results than just basic treatment.

The findings of this study also agreed with **Mohamed et al. [22]**, who researched polarised polychromatic non-coherent light as one of the useful alternative methods to improve wound healing and pain control post episiotomy.

Our results are also agreed with **Stasinopoulos et al. [23]** who investigated that there are statistically significant improvements in pain via VAS and significant improvements in edema and ankle range of motion were observed in patients with acute ankle sprains who were subjected to cryotherapy plus Bioptron light therapy over a 5 d period.

The results of this study supported by **Limansky et al. [24]** who found that a single 10-minute exposure of polarized light to the analgesic acupuncture points on the mouse induced a statistically significant increase in the pain threshold.

Also the results also supported by **Pinheiro et al. [25]** who showed that polarization was also suggested as an essential factor for tissue absorption and responses. Nearly 80% of the effects of laser light may be produced by polarization. The degree of polarization decreases directly with the depth of the tissue, so polarized light causes its impact on more superficial tissues, contributing to more epithelialization and local peripheral vasodilatation, increasing the blood flow of the skin and delivery of oxygen to the wounded region, so that polarized light is regarded as anti-inflammatory therapy affecting the reduction of pain.

The results of this study came in consistence with that of **EL-Deen et al. [26]** who found that there was progress in healing of foot ulcers, after two months of treatment by both polarized light therapy which can be known a successful therapy for improve wound healing by stimulating and modulating regenerative processes, anti-inflammatory effects, and modulate human defense system's processes.

The results of this study also came in consistence with that of **Stasinopoulos, [27]** who investigated The efficacy of Bioptron in the management of lateral epicondylitis has been evaluated in a number of studies. In a study by Stasinopoulos, Bioptron therapy for 4 weeks led to significant functional and pain improvement in patients with lateral epicondylitis.

## 6. CONCLUSION:

It can be conducted that polarized light therapy for 5 consecutive days' post CS is an effective adjuvant therapy in treatment of incisional pain through reducing visual analogue scale (VAS) and increasing electronic algometer.

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