MÆDICA - a Journal of Clinical Medicine

ORIGINAL PAPER

MAEDICA – a Journal of Clinical Medicine
2023; 18(3): 426-431
https://doi.org/10.26574/maedica.2023.18.3.426

Low-Level Laser Therapy Effects on Reducing Surgical Complications and Wound Infection after Cesarean Section

Leli Rezaie KAHKHAIE[a], Khadije Rezaie KEIKHAIE[b], Atefeh Amiri NASAB[c], Mahdi Rezaei Kahkha ZHALEH[d]

[a]Department of Internal Medicine, School of Medicine Amir al Momenin Hospital Zabol University of Medical Sciences, Iran

[b]Zabol medicinal plant Research Center, Zabol University of Medical Sciences, Zabol, Iran

[c]Student Research Committee of Zabol University of Medical Sciences, Zabol, Iran

[d]Department of Epidemiology & Biostatistics, School of Public Health Sciences, Isfahan University of Medical Sciences, Isfahan, Iran

ABSTRACT

Background: *One of the main problems in cesarean section cases is represented by postoperative pain that can cause delay in recovery and intense complications for patients. Therefore, the present study evaluates the effect and quality of treating infectious tissue and surgical complications using low-level lasers after cesarean section.*

Methods: *In this clinical study, 240 candidates for the same type of surgery using the spinal anesthesia technique, were randomly divided into a laser treatment group and a control group. Finally, the surgical incision in the laser group was irradiated by laser (810 nm). Furthermore, the same method was used for the control group. The first request for analgesia, total analgesic consumption and severity of postoperative pain by visual analogue scale (VAS) were monitored in all patients for 24 hours.*

Findings: *The 240 participants in the present study were equally allocated (1:1 ratio) to the case and control groups. There was a significant difference in average age (P=0.013) between subjects of the two study groups, with controls having a lower average age than participants in the case group based on the obtained results. However, the body mass index did not significantly differ between the two groups (p=0.1). The average use of painkillers (a painkiller is a pill or other form of drug that reduces or stops physical pain), suture removal time, and postoperative pain on days 3, 7, 14, and six weeks after surgery were lower in the case group than in the control group. The obtained difference was statistically significant (p<0.001).*

Conclusion: *According to the findings of this study, using low-level laser therapy with cluster current (wavelength 810 nm and power 300 mW and power density for low-level laser 4 W/cm2) can help reduce postoperative pain and the need for painkillers.*

Keywords: cesarean, low-level laser therapy, wound infection.

Address for correspondence:
Khadije Rezaie Keikhaie
Email: rezaie.azar@ymail.com

Article received on the 26th of May 2023 and accepted for publication on the 13th of September 2023

INTRODUCTION

Cesarean section is one of the most common surgical procedures performed worldwide, which can be elective or emergency (1). Moreover, pain following a cesarean section is one of the main issues among pregnant women. Postoperative pain can cause fear of operation and harm them. Furthermore, postoperative pain can limit the mother's ability to feed and care for the baby. Moreover, lack of movement, which is due to postoperative pain, can increase the risk of thromboembolism. A cesarean section may be followed by chronic pain but studies have shown that this pain could persist for up to six months. Furthermore, severe pain, especially 24 hours after surgery, can lead to continuous pain and postpartum depression in the following eight weeks. Therefore, it is essential to optimally manage the pain, which can effectively increase patient satisfaction and decrease postoperative side effects, hospital stays and healthcare costs (2-4).

Recently, compared to other Asian countries, the prevalence of cesarean deliveries in Iran increased, which has led to a higher rate of surgical complications (4, 5). Evidence shows that the prevalence of infections after cesarean section varies between 0.5-15%. Treatment methods such as antibiotics and low-level laser therapy (LLLT) for treating post-cesarean wound infections have been recommended (3).

Low-level laser therapy is an effective method that accelerates wound healing, so various reviews and meta-analysis studies have described it as a safe and effective treatment procedure. It has significant neuro-pharmacological effects on the synthesis, secretion and metabolism of biochemical substances such as prostaglandins and histamine. Also, this method aims to decrease the activity of C-fiber and bradykinin by stimulating the synthesis of endogenous endorphins and changing the pain threshold that causes analgesia (4-6). In general, many studies have reported optimal clinical effects, the usefulness of LLLT in wound healing, and a healing time (7). Also, studies have shown that LLLT can improve tissue responses and reduce pain and swelling caused by surgery (8). Research results showed that particular laser irradiation stimulated fibroblast proliferation without impairing procollagen synthesis. Also, since LLLT can modulate inflammatory processes in a dose-dependent manner, it can significantly reduce acute inflammatory pain (9, 10). However, according to some studies, LLLT can reduce pain but does not affect accelerating wound healing. Studies show that LLLT does not accelerate the healing of episiotomy wounds, although it reduces perineal pain in patients (11). Some studies also indicate that although LLLT reduces pain, LLLT intervention could not be a preventive factor for the growth of abdominal scar, which is considered one of the most essential beauty cases (12). Therefore, this study aims to determine the effectiveness and quality of LLLT on wound infection and surgical complications after elective cesarean section in Amir-Al-Momenin Zabol Hospital in 2022. ❑

MATERIALS AND METHODS

This prospective double-blind clinical study was conducted between 2021-2022. After the approval of the study proposal by the Research Council of the Faculty of Medicine, receipt of the Ethical code and necessary coordination with the hospital and operating room (OR) management, the project manager entered the OR. First, by explaining the research objectives and potential benefits and harms, participants were informed about the conditions of the study, and pregnant women who had been referred for selective cesarean section were examined after giving their consent. Patients with previous surgery, diabetes, malignancy, benign tumors which may pose the risk of malignancy, sensitivity to light such as history of epilepsy, seizures or lupus increased intracranial pressure (ICP), lower limb neuropathy and those who refused spinal anesthesia were excluded from the study. Oral and written personal consent was obtained from all patients. After the operation, patients were randomly divided into LLLT and control groups. The laser treatment group was treated with a continuous low-level laser along with cluster current (wavelength 810 nm and power 300 mW). Power density for the low-level laser is 2 W/cm^2. The control group was also subjected to laser treatment at the same time and for the same duration but as a placebo and in a silent state.

It should be noted that during this period, all study participants received routine antibiotics and

painkillers. In both groups, the treatment method, wound care conditions and environmental factors were the same, except for LLLT. After each laser irradiation, wound conditions, pain, cesarean section infection rate and need for painkillers and antibiotic treatment in the two groups were investigated and compared, and the collected information was entered into the questionnaire used in the present study. Also, demographic data, anthropometrics, underlying diseases, examinations, necessary laboratory as well as radiographic data and supplementary information were extracted from patients' medical files and entered into the questionnaire.

In order to prevent possible laser side effects, the following are recommended: 1) in the case of severe burning sensation, the specialist must be informed immediately; 2) patients should take necessary precautions before and after laser treatment – thus, the area under laser treatment must be kept moist, for which patients can use creams containing aloe vera as a moisturizer; laser-treated areas should not be exposed to direct sunlight, so ointments such as vitamin E or coconut oil are recommended to heal a part of the burned or injured skin; an ice pack may be used before and after laser treatment to help skin inflammation healing; also, a small ice pack can improve the redness and inflammation of the skin.

We assured patients that the damage caused by using these devices was temporary, and even those who suffered burns or scars would recover after special care.

FIGURE 1. Laser radiation to the surgical site

Statistical methods

Data were analyzed by using the Statistical Package for the Social Sciences, version 20.0, SPSS Inc., Chicago, Illinois, USA (SPSS), and were recorded as mean ± standard deviation (SD). Finally, the independent sample t-test and another measure test were applied to compare the two groups after average distribution analysis and homogeneity of variances. The Bonferroni test was considered a post hoc test. The 5% significance level was considered for the entire study ($P < 0.05$).

In the present study, 240 participants were equally assigned to case and control groups (case-to-control ratio 1:1). According to the obtained results, the average age of the case group

TABLE 1. Comparison of mean variables and significance test (independent t-test) in case and control groups

			Group N=240 (120/120)	Mean	Standard deviation	P-value
Age (year)			Case	29.78	5.824	.013
			Control	27.88	6.038	
Body mass index			Case	20.225	1.9531	.103
			Control	20.817	3.4446	
Used analgesics (mg)			Case	263.33	120.874	<0.001
			Control	989.17	345.145	
Pain after surgery	Day 3	Scale: (1-10)	Case	5.15	1.674	<0.001
			Control	9.17	1.311	
	Day 7		Case	2.26	1.458	<0.001
			Control	5.97	1.236	
	Day 14		Case	1.36	1.165	<0.001
			Control	4.01	1.405	
	Six weeks later		Case	.44	.619	<0.001
			Control	2.25	1.071	
Suture time (day)			Case	9.28	2.850	<0.001
			Control	14.45	2.145	
First analgesic (minute)			Case	182.5	40.71	<0.001
			Control	85.0	51.69	

TABLE 2. Level of patient complaints among subjects in case and control groups

			Case group	Control group	Total	P-value
Smoking status	Yes		4 (3.3%)	33 (27.5%)	37 (15.4%)	<0.001
	No		116 (96.7%)	87 (72.5%)	203 (84.6%)	
Number of pregnancies	First		30 (25.0%)	48 (40.0%)	78 (32.5%)	0.013
	Second and more		90 (75.0%)	72 (60.0%)	162 (67.5%)	
Antibiotic used in the study	Keflin		99 (82.5%)	120 (54.8%)	219 (91.2%)	<0.001
	Keflin & ceftriaxone 500 mg		21 (17.5%)	0	21 (8.8%)	
Primary tissue swelling	Yes		33 (27.5%)	85 (70.8%)	118 (49.2%)	<0.001
	No		87 (72.5.0%)	35 (29.2%)	122 (50.8%)	
Suture time	Day 3		10 (8.3%)	0	10 (4.2%)	<0.001
	Day 7		17 (14.2%)	0	17 (7.1%)	
	Day 10		84 (70.0%)	7 (5.8%)	91 (37.9%)	
	Days 11-15		9 (7.5%)	98 (81.7%)	107 (44.6%)	
	Days 16-20		0	15 (12.5%)	15 (6.3%)	
Post-surgical complications	Pain	Yes	0	116 (96.7%)	116 (48.3%)	<0.001
		No	120 (100.0%)	4 (3.3%)	124 (51.7%)	
	Burning	Yes	17 (14.2%)	113 (94.2%)	130 (54.2%)	<0.001
		No	103 (85.8%)	7 (5.8%)	110 (45.8%)	
	Bleeding	Yes	0	56 (46.7%)	56 (23.3%)	<0.001
		No	120 (100.0%)	64 (34.8%)	184 (76.7%)	
	Swelling	Yes	0	98 (81.7%)	98 (40.8%)	<0.001
		No	120 (100.0%)	22 (18.3%)	142 (59.2%)	

was higher than the control group, and this average difference was statistically significant (P=0.013). However, the body mass index (BMI) did not significantly differ between the two groups (p=0.1). The average use of painkillers (a painkiller is a pill or other form of drug that reduces or stops physical pain), suture removal time and postoperative pain on days 3, 7, 14 and six weeks after surgery were lower in the case group than the control one. The obtained difference was statistically significant (p<0.001).

The smoking status of pregnant mothers in both case and control groups showed that 3.3% of cases and 27.5% of controls were smokers (p<0.001). Also, 75% of subjects in the case group and 65% of those in the control group had experienced more than one pregnancy (p=0.01). The initial swelling of the operated tissue in the case and control groups was 27.5% and 70.8%, respectively, which indicated a statistically significant difference (p<0.001). More than 90% of surgical sutures were removed on the 10th day or before after surgery in the case group and on the 11th day postoperatively in controls (p<0.001) (Table 2).

The level of patient complaints was investigated based on four factors, including pain, burning, bleeding and swelling, and it was shown that subjects in the laser group reported fewer complaints in all four factors than those in the control group. In this way, in the case group, only 14.2% (17 patients) reported a burning complaint at the operation site. On the other hand, 96.7% of subjects in the control group complained of pain, 54.2% burning, 23.3% bleeding, and 40.8% swelling at the surgical site (p<0.001) (Table 2). ❑

DISCUSSION

The present study investigated the effects of laser therapy with continuous low-level laser with cluster current (wavelength 810 nm, power 300 mW and power density 4 W/cm^2). Cesarean section results showed a significant reduction in pain at 1, 4, 8, 12, 16, and 24 hours after surgery. In a study conducted by Safari *et al*, entitled "The functional effect of LLLT on cesarean section scar in 2020 (Iran)", 56 patients who underwent cesarean section were assigned to one case group and one control group, with LLLT being used in the case group; the authors found a statistically significant difference in pain score between the intervention group and the control one on the 5th and 10th day after delivery, respectively (P=0.000). Patients in the intervention group complained of less pain, but no significant difference was observed regarding the scar scale. Some studies also show that, although LLLT reduces pain, LLLT intervention could not be a preventive factor for the growth of abdominal scar, considered one of the

most essential beauty cases. Also, in the above cited study, no complications from laser therapy were reported (13), which was in line with our findings. In the study conducted by Pour Salehan *et al*, entitled "The effect of Low-Level Laser on Postoperative Pain After Elective Cesarean Section", 80 pregnant women with elective cesarean section were divided into a case group and a control one, and surgical incision in subjects of the case group, who received laser treatment, was examined. The study results showed that laser therapy significantly reduced pain in the intervention group compared to the control one, and finally suggested that LLLT was the best choice for reducing postoperative pain as it has been proved to be a safe non-invasive procedure, with no side effects such as nausea-vomiting, hypotension, or dizziness being observed in any of the two studied groups (12), which was consistent with the findings of the present study. In a study conducted by Oliveira *et al* in 2011, regarding LLLT effect on perineal pain and wound healing after episiotomy, 53 postpartum women who had mediolateral episiotomy in their first delivery were randomly divided into two groups (26 individuals) of cases and controls; subjects in the case group were treated with LLLT and laser radiation was applied at three points on the episiotomy incision after sutures and in three sessions after delivery, with pain and perineal wound being evaluated before and after each radiation; the case group showed significant pain reduction after the second and third sessions (P=0.001), while there was no significant difference in perineum recovery between the two groups. The above cited study concluded that LLLT did not accelerate the recovery of episiotomy incision, although perineal pain was reduced in these patients; also, no complications related to laser therapy were observed in the studied patients (14). In a study conducted by Mensifo *et al* in 2018, 40 diabetic women aged 28 to 38 years, who underwent cesarean section, were assigned into two case and control group; the case group was examined for six weeks under intensity laser therapy three times a week, along with standard treatment for diabetes and cesarean wounds, while the control group was subjected to fake laser treatment for six weeks and three times a week along with standard diabetes and cesarean wound treatment, and the size and appearance of all patients' wounds before and after treatment were examined and compared. The results of this study showed that laser therapy had made a significant difference in the size and appearance of the wound compared to the control group, so the final results indicated the effectiveness of LLLT in the healing of cesarean section wounds in patients with diabetes. However, there were no reports of complications caused by laser therapy (15), and in the study carried out by Mokameli *et al*, entitled "The Use of LLLT after Cesarean Section and its Relationship with Blood Prolactin Level and Lactation Status", 20 women with mastitis and LLLT treatment were assigned to an intervention group, who received laser therapy, and a control group, who received LLLT as a placebo. Blood prolactin levels and tissue sampling from the edges of the wounds were examined in both groups after three days. The study findings showed that, although there was a difference in blood prolactin levels between the two groups, it was not statistically significant. The final results indicated that LLLT did not cause severe effects on the lactation metabolism after delivery, and by modulating the metabolic processes, it modified the wound after the operation, and no significant complications were found in the treated patients (16-21). ❑

CONCLUSION

The present study showed that LLLT with cluster current (wavelength 810 nm, power 300 mW and power density for low-level laser 4 W/cm^2) could reduce both postoperative pain and consumption of postoperative painkillers.

Various side effects such as skin reactions, respiratory depression, ulcer peptic and analgesic nephropathy have been reported in other analgesia consumption methods but were not seen in LLLT. Finally, further studies are recommended on using LLLT in anesthesiology because it is a non-invasive, safe and widely accepted method by most patients. ❑

Conflicts of interest: none declared.

Financial support: none declared.

Ethical considerations: All patient information is confidential.

Acknowledgements: The authors would like to thank the Research Laboratory of Zabol University of Medical Sciences for their help.

References

1. **Carvalho B, et al.** Patient preferences for anesthesia outcomes associated with cesarean delivery. *Anesth Analg* 2005;101:1182-1187.
2. **Arroyo-Novoa CM, et al.** Efficacy of small doses of ketamine with morphine to decrease procedural pain responses during open wound care. *Clin J pain* 2011;27:561-566.
3. **Moore A, et al.** Gabapentin improves postcesarean delivery pain management: a randomized, placebo-controlled trial. *Anesth Analg* 2011;112:167-173.
4. **Faiz HR, et al.** Intravenous acetaminophen is superior to ketamine for postoperative pain after abdominal hysterectomy: Results of a prospective, randomized, double-blind, multicenter clinical trial. *J Pain Res* 2014;7:65.
5. **Pallasmaa N, et al.** Cesarean delivery in Finland: maternal complications and obstetric risk factors. *Acta Obstet Gynecol Scand* 2010;89:896-902.
6. **Landucci A, et al.** Efficacy of a single dose of low-level laser therapy in reducing pain, swelling, and trismus following third molar extraction surgery. *Int J Oral Maxillofac Surg* 2016;45:392-398.
7. **Meneses-Santos D, et al.** Effects of low-level laser therapy on reducing pain, edema, and trismus after orthognathic surgery: a systematic review. *Lasers Med Sci* 2022;37:1471-1485.
8. **Khot A, Kulkarni N.** Effectiveness of low-level laser therapy in post caesarean wound healing: a case report. *International Journal of Healthcare Sciences* 2019;6:330-333.
9. **Cotler HB, et al.** The use of low level laser therapy (LLLT) for musculoskeletal pain. *MOJ Orthop Rheumatol* 2015;2:00068.
10. **de Oliveira FLD, et al.** Bone neoformation induced by low level laser and methylene blue suggest early ossification in rats. *J Lasers Med Sci* 2022;13:e48.
11. **Özalp Ö, et al.** Comparative evaluation of the efficacy of ozone therapy and low level laser therapy on oral mucosal wound healing in rat experimental model. *J Stomatol Oral Maxillofac Surg* 2022;123:e670-e674.
12. **Kajagar BM, et al.** Efficacy of low level laser therapy on wound healing in patients with chronic diabetic foot ulcers – a randomised control trial. *Ind J Surg* 2012;74:359-363.
13. **Gasperini G, de Siqueira IR, Costa LR.** Does low-level laser therapy decrease swelling and pain resulting from orthognathic surgery? *Int J Oral Maxillofac Surg* 2014;43:868-873.
14. **Ramsay MAE.** Acute postoperative pain management. *Proc (Bay) Univ Med Cent* 2000;13:244-247.
15. **Mobini A, Mehra P, Chigurupati R.** Postoperative pain and opioid analgesic requirements after orthognathic surgery. *Journal of Oral and Maxillofacial Surgery* 2018;76:2285-2295.
16. **de Oliveira Santos J, et al.** A randomised clinical trial of the effect of low-level laser therapy for perineal pain and healing after episiotomy: a pilot study. *Midwifery* 2012;28:e653-659.
17. **Poursalehan S, et al.** The effect of low-level laser on postoperative pain after elective cesarean section. *Anesth Pain Med* 2018;8:e84195.
18. **Saffarieh E, et al.** Effects of Performing Low-Level Laser on Cesarean Section Scar. *Crescent Journal of Medical and Biological Sciences* 2020;7:47-53.
19. **de Oliveira Santos J, et al.** A randomised clinical trial of the effect of low-level laser therapy for perineal pain and healing after episiotomy: A pilot study. *Midwifery* 2012;28:e653-e659.
20. **Thabet AAE-M, et al.** Effect of pulsed high intensity laser therapy on delayed caesarean section healing in diabetic women. *Journal of physical therapy science* 2018;30:570-575.
21. **Mokmeli S, et al.** The application of low-level laser therapy after cesarean section does not compromise blood prolactin levels and lactation status. *Photomedicine and Laser Surgery* 2009;27:509-512.