



Enhancement of Episiotomy Healing Using (790-805) nm Diode Laser as a Supplementary Treatment

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Abstract: To show the impact of 790-805 nm diode laser irradiations on wound healing as a supplementary treatment in women underwent episiotomies, and to assess the laser parameters that were used. **Material and methods:** Eighteen female patients were included in this study; all of them underwent mediolateral episiotomy. Ten patients received laser therapy- diode laser (K Laser) (790-805) nm in CW mode of operation (and eight patients were the control group. Spot size of 8mm, time for exposure for each spot was 30 seconds. The power used was 0.6 W. The power density for each spot of treatment was 1.19 W/cm² per session (non contact mode of application of laser therapy). The group studied received 2 sessions of laser radiation, day 4, and day 8 after labour and the women of both groups were followed on day 4, 8, 14 and 28 post delivery in terms of pain, tenderness, redness, oedema, and discharge. After the 1st exposure the patients had been assessed on day 8 of delivery; and their assessment showed that pain was present in 20% of the patients, tenderness in 30%, redness and oedema in 20% and 10% with discharge; which was less than the control group that had pain in 62.5% tenderness in 50%, redness and oedema in 50%, and discharge in 25%. After the 2nd exposure (patients were assessed on day 14 post-delivery) pain, tenderness and redness present only in 10%, while in the control group: pain, tenderness, oedema and discharge in 25%, and redness in 37%. Biostimulation is a method that can be used to enhance wound healing if used with appropriate parameters. Diode laser (790-805) nm can be used for enhancing episiotomy healing as a supplementary therapy when used in the CW mode with 0.6 w power and 1.19 w/cm² power density for 30 seconds for each spot.

Introduction

When introduced for medical use, lasers delivered a variety of new options in the treatment of diseases, which are resistant to other forms of therapy. Non-invasive laser irradiation was first used in 1969 by Mester (Mester 1969) who applied low-level laser irradiation to stimulate biological processes in difficult to heal wounds and ulcers. This event gave rise to the development of Low Level Laser Therapy (LLLT).

LLLT has many different effects on biological tissue like anti-inflammatory, analgesic, anti-oedematous effect; higher rates of ATP, RNA & DNA synthesis, and thus better tissue

oxygenation and nutrition and increase in the absorption of interstitial fluid. (Tcac 1998) LLLT appears to have an effect on the cellular level, by increasing cellular function and stimulating various cells. (Kawalec2004) biostimulation low level laser therapy (LLLT) also known as photobiomodulation, and is a treatment which uses low-level lasers or light-emitting diodes to stimulate or inhibit cellular function. The technique is also known by other terms such as laser therapy, "cold laser" and phototherapy (though the latter more accurately refers to light therapy), which may also be used to describe other medical techniques (Huang 2009)

There are perhaps three main areas of medicine practice where LLLT has a major role to play these are:

- (i) wound healing, tissue repair and prevention of tissue death.
- (ii) relief of inflammation in chronic diseases and injuries with its associated pain and oedema.
- (iii) relief of neurogenic pain and some neurological problems (Michael 2006)

Episiotomy is a surgical incision made with scissors or a scalpel into the perineum in order to increase the diameter of the vulval outlet and facilitate delivery. (Ranee and Sultan 2009)

Material

This study was conducted in a clinic and the cases were collected from al Yarmook teaching hospital and clinic patients to assess the effect of 790-805 nm diode laser as a supplementary treatment to enhance episiotomy healing. Twenty two patients were included in the study; out of which only eighteen patients had continued the follow up for 28 days after delivery. Fifteen were primiparous and three were multiparous, all of them were term delivery.

Methods:

Eighteen patients were included in this study, all of them underwent mediolateral episiotomy and received prophylactic antibiotics (in form of cephalosporin and metranidazole) as well as analgesics in form of non-steroidal anti-inflammatory drug (mefenamic acid).

The inclusion criteria were:

- Women age was between 20-33yrs,
- Non-diabetic patients (as diabetes mellitus might affect the healing process),
- No previous history of offensive vaginal discharge, or pruritis within the last month of their pregnancies as an indication of vaginal infection,
- Living in a nearby area as they need frequent visits for follow up; this was not applicable for women in rural or far area,
- Not receiving steroid treatment [for its effect on inflammation], Not having allergy to drugs that had been prescribed as prophylactic antibiotic.

Grouping the patients:

Group (1): women without laser treatment (control group).

Group (2): women with laser treatment (study group).

Laser parameters in current study

Diode laser wavelength which had been used in this study was (790-805) nm the power used was 0.6 W the spot size was 8mm the power density was 1.19 W/cm² time of exposure was 30 seconds for each spot.

Laser application:

After taking an oral consent for applying laser to the wound and after reassuring the patient that the treatment is not painful; the patient lied in lithotomy position, the interioitus had been exposed. A piece of sterile cotton was pushed into the vagina to prevent the contamination of the working field by vaginal discharge or blood. The length of the skin part of the episiotomy was ranging between (3 to 5) centimetres, the wound was exposed to laser irradiation; one spot after another using spot size of 8mm (which was measured on the wound by means of a graduated wooden spatula), time for exposure for each spot was 30 seconds. The power density for each spot of treatment was 1.19 W/cm² per session, the terminal end of the probe was placed 2 millimetres away from the skin surface (non contact mode of application of laser therapy). Each woman received 2 sessions of laser radiation, one session day 4, another on day 8 after labour of the same laser dose, and the women were followed on day 4,8,14 and 28 post-delivery.

Criteria for follow up were:

1. Severity of pain associated with the wound that can interfere with usual life activities (e.g.: sitting, walking, climbing stairs)
2. Evidence of wound inflammation [tenderness, redness, oedema, discharge].

Results

This study had been conducted to see the effect of (790-805)nm diode laser in wound healing in form of episiotomy and comparing them to a control group that did not receive a laser session. The results are tabulated Tables 1, 2, 3, and 4. The 1st group (8 patients) did not receive any supplementary therapy apart from antibiotics and analgesics (non-steroidal anti-inflammatory drugs) that had been consumed by the second group as well. The 2nd group (10 patients) had two sessions of laser therapy on day 4, and 8 post-delivery. Both groups had

been assessed in terms of severity of pain, (according to what the patient described), as well as tenderness, redness, oedema, swelling, and presence of discharge (according to the observer).

1st assessment (day 4 post-delivery):

1st group: had experienced pain tenderness, redness, oedema, swelling in all the patients and discharge in 3 patients.

2nd group: All the patient had experienced pain, tenderness, redness, oedema, swelling. And only 4 patients had discharge from the wound.

Table 1: patient's symptoms 4 days after delivery

Group number	pain			tenderness			redness	oedema	discharge
	1 st group	8			8			8	8
mild		moderate	severe	mild	moderate	severe			
3		2	3	2	1	5			
2 nd group	10			10			10	10	4 [40%]
	mild	moderate	severe	mild	Moderate	severe			
	3	3	4	2	3	5			

This group then had their 1st session of laser therapy

2nd assessment (day 8 post delivery):

1st group: still having pain in 5 patients, tenderness in 5 patients, redness in 4 patients, oedema in 4 patients and discharge in 2 patients, one patient had a complete dehiscent scar with offensive smell discharge.

2nd group: still having pain in 2 patients, tenderness in 3 patients, redness in 2 patients, oedema in 2 patients discharge in 1 patient and no patient showed dehiscence of the wound.

Table 2: Patient's symptoms 8 days after delivery

Group number	pain			tenderness			redness	oedema	discharge
	1 st group	5 [62.5%]			5 [62.5%]			4 [50%]	4 [50%]
mild		moderate	severe	mild	moderate	severe			
2		2	1	2	2	1			
2 nd group	2 [20%]			3 [30%]			2 [20%]	2 [20%]	1 [10%]
	mild	moderate	severe	mild	Moderate	severe			
	1	1	0	2	1	0			

This group then had their 2nd session of laser therapy

3rd assessment (day 14 after delivery):

1st group: 2 patient still experiencing pain ,2 patient had tenderness, 3 patients had redness, 2

patients had oedema,2 patients had discharge, one patient had complete dehiscence of scar that necessitate secondary suture. One patient had

partial dehiscence that is less than 2 cm in length. 2nd group: pain in 1 patient that did not affect her activities (walking, sitting) this patient

had tenderness and redness, no oedema, no discharge had been ellisted.

Table 3: Patient's symptoms 14 days after delivery

Group number	pain			tenderness			redness	oedema	discharge
	1 st group	2 [25%]			2 [25%]			3 [37%]	2 [25%]
mild		moderate	severe	mild	moderate	severe			
1		0	1	1	0	1			
2 nd group	1 [10%]			1 [10%]			1 [10%]	0	0
	mild	moderate	severe	mild	Moderate	severe			
	1	0	0	1	0	0			

4th assessment (28 days after delivery):

1st group: 1 patient had pain, 2 patient with tenderness, 1 with redness, 1 with oedema, 1 with discharge; secondary suturing had been performed to that woman at the end of her purperium due to dehiscence of scar .

2nd group: No patient had pain, 1 patient with very mild tenderness, no oedema, redness, or discharge

Table 4: Patient's symptoms 28 days after delivery

Group number	pain			tenderness			redness	oedema	discharge
	1 st group	1 [15%]			2 [25%]			1 [12.5%]	1 [12.5%]
mild		moderate	severe	mild	moderate	severe			
0			1	0	1	1			
2 nd group	0						0	0	0
	mild	moderate	severe	mild	Moderate	severe			
	0	0	0	1	0	0			

Discussion

Low level laser therapy (LLLT) has been promoted for its beneficial effects on tissue healing and pain relief. Instead of producing a thermal effect, LLLT may act via nonthermal or photochemical reactions in the cells, also

referred to as photobiology or biostimulation. Several researchers have used superficial wounds to assess the putative effects of LLLT on healing. Some have used clinical wounds or ulcers of various sizes and depths (Chromey 1992, Gogia 1988, Lundeberg 1991), and others have developed superficial wound models in

animals.(Hunter 1984,Dyson 1986. Mester 1973),.These different methods have produced varied results and conclusions as to the effectiveness of LLLT. When analyzing healing among wounds, it would be beneficial if the wounds were as alike as possible; therefore, the differences in healing could be attributed to the treatment and not to other factors, such as wound variability, so episiotomy had been chosen in the current study; being related to my field and due to a lot of debate regarding its efficacy and the complication that is associated with it in our country.

Although LLLT has received only specified united states Food and Drug Administration clearance, its clinical efficacy for tissue healing has been widely reported (Sugrue 1990). In vitro data suggest that LLLT facilitates collagen synthesis (Abergel 1984) keratinocyte cell motility (Haas 1990) and growth factor release (Yu 1990) and transforms fibroblasts to myofibroblasts (Poureaux-Schneide and, Ahmed 1990) Many authors of clinical studies have reported the benefits of LLLT on tissue healing, in agreement with our results, in contrast to Allendorf et al (1997) who had shown no effect. These conflicting results are likely due to variations in treatment factors and limitations in experimental design, including comparison of heterogeneous clinical wounds, lack of control groups, [which had been avoided in the present study by standardizing the treatment of the patient and selecting a control group with the same type of wound], yet the number of our b patients was small due to the limited time for the research.

Low level laser therapy devices include the gallium arsenide (GaAs), gallium aluminium arsenide infrared semiconductor (GaAlAs), and helium neon (He-Ne) lasers. The 632.8 nm wavelength He-Ne laser emits visible red light and may have a shallow penetration into skin. The GaAlAs, infrared laser has a longer wavelength than red beam laser and may have deeper tissue penetration. AlWatban F and Zhang ZY (1996) had shown that He-Ne laser is superior to diode laser in enhancing wound healing but the diode laser wavelengths used in that study were 780nm and 840nm which does not match the laser which had been used in this study (790-805 nm).

The pain and tenderness changed from severe to moderate after the 1st exposure to laser this is in agreement with Pinheiro et al (1997) who demonstrated a reduction of pain-related

symptoms after treating patients with maxillofacial pain disorders, including trigeminal neuralgia, with laser therapy in a nonrandomized, unblinded study. Hagiwara (2008) claimed that decrease pain was due to enhancement of peripheral endogenous opioid analgesia in their experiment which had been conducted in rat, while the reduction of oedema redness and discharge became more prominent after the 2nd dose of laser. According to Tuner and Hode, laser therapy for wounds is ideal, since it promotes healing and reduces pain at the same time (Tuner, Hode2002), this was also suggested by Hopkins (Ty Hopkins 2004).

The time of healing of episiotomy scar was long in the control group; probably due to use of mediolateral episiotomy rather than midline episiotomy which take a longer time to heal and also could be due to use of catgut material in suturing the wound which cause more inflammation than other material (e.g.vicryl). (Mackrodt et al 1998. Livingstone E et al 1974, Olah 1990).In the current study continuous laser had been used, in agreement with Al Watbanandzhang (2004) who had found that the frequency of pulsed CW laser was not found to increase wound healing in rats compared with normal CW laser .

Many mechanism had been proposed for biostimulation, Karuhas shown that visible and near-infrared radiation is absorbed in the respiratory chain molecules in the mitochondria (e.g., cytochrome oxidase), which results in increased metabolism, which leads to signal transduction to other parts of the cell, including cell membranes, and ultimately to the photoresponse, e.g., stimulation of growth, wound healing, (Karu 2003).

In this study many obstacles were faced like difficulty to get a group of patients without the systemic effect of antibiotic or analgesic drugs to see the effect of biostimulation on wound healing so it was a supplementary treatment. Another obstacle was difficulty to compare the dose parameters which had been used in the current study with other study dose parameters as no study had used a similar wavelength laser in this aspect.

Conclusion

Biostimulation is a method that can be used to enhance wound healing if used in appropriate parameters. Diode laser (790-805) nm can be used for enhancing episiotomy healing as a

supplementary therapy to enhance healing and reduce pain when used in cw mode with 0.6 w power, and 1.19 w/cm² power density for 30 seconds for each spot.

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تعزيز شفاء جرح قص العجان باستخدام ليزر الدايدود 805-790 نانومتر

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الخلاصة: لظهور تأثير اشعاع ليزر الدايدود (805-790) نانومتر على التئام الجروح كعلاج مساعد في النساء اللاتي لديهن جرح العجان ولتقييم ثوابت الليزر المستخدم . ثمانية عشر مريضة اشتركن في هذه الدراسة ولديهن جميعا جرح العجان . عشر مريضات استلمن جرعات من ليزر الدايدود (805-790) نانومتر بنمط متواصل وكان هنالك ثمانية مريضات كمجموعة سيطرة وكان قياس النقطة 8 ملم ، وقت التعرض لكل نقطة 30 ثانية . كانت القوة المستخدمة 0.6 واط . وكانت كثافة القوة لكل نقطة 1.19 واط/سم² لكل جلسة (بنمط غير متصل من علاج الليزر) . استلمت مجموعة الدراسة جلستان من الليزر يوم 4 و يوم 8 بعد الولادة ، وتمت متابعة النساء من المجموعتين ايام 4,8,14,28 بعد الولادة فيما يتعلق ب الالم ، التحسس بالالم ، الاحمرار ، الودمة ، و الافرازات . بعد التعرض الاول لليزر تم تقييم المرضى اليوم الثامن من الولادة وظهر التقييم ان الالم موجود في 20% من المريضات ، والاحساس بالالم في 30% الاحمرار والودمة في 20% والافرازات في 10% . وكانت جميع معايير التقييم اقل من مجموعة السيطرة حيث كان الالم موجود في 62.5% والتحسس للالم في 50% الاحمرار والودمة في 50% والافرازات في 25% اما بعد التعرض الثاني الذي تم بعد 14 يوم من الولادة ، فان الالم و التحسس للالم والاحمرار كان في 10% فقط من المريضات . بينما في مجموعة السيطرة كان الالم و التحسس للالم والودمة والافرازات في 25% والاحمرار في 37% . استنتجت الدراسة أن التحفيز الحيوي هو طريقة يمكن استخدامها للتعزيز في التئام الجروح اذا استخدم بمعايير مناسبة . يمكن استخدام ليزر الدايدود 805-790 نانومتر لتعجيل شفاء جرح العجان كعلاج مساعد عندما يتم استخدامه بنمط متواصل بقوة 0.6 واط وكثافة طاقة 1.19 واط/سم² ل 30 ثانية لكل نقطة .