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. (Tacac 1998) LLLT appears to have an effect on the cellular level, by increasing cellular function and stimulating various cells. (Kawalec 2004) 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 patient were included in the study; Out of which only eighteen patient had continue 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 interoitus 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 sessions. 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

<table>
<thead>
<tr>
<th>Group number</th>
<th>pain</th>
<th>tenderness</th>
<th>redness</th>
<th>oedema</th>
<th>discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st group</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>3 [37%]</td>
</tr>
<tr>
<td>mild</td>
<td>mild</td>
<td>moderate</td>
<td>severe</td>
<td>mild</td>
<td>8</td>
</tr>
<tr>
<td>2nd group</td>
<td>10</td>
<td>mild</td>
<td>moderate</td>
<td>severe</td>
<td>4 [40%]</td>
</tr>
<tr>
<td>mild</td>
<td>mild</td>
<td>moderate</td>
<td>severe</td>
<td>mild</td>
<td>5</td>
</tr>
</tbody>
</table>

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 dehiscence 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

<table>
<thead>
<tr>
<th>Group number</th>
<th>pain</th>
<th>tenderness</th>
<th>redness</th>
<th>oedema</th>
<th>discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st group</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>2 [25%]</td>
</tr>
<tr>
<td>mild</td>
<td>mild</td>
<td>moderate</td>
<td>severe</td>
<td>mild</td>
<td>5 [50%]</td>
</tr>
<tr>
<td>2nd group</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1 [10%]</td>
</tr>
<tr>
<td>mild</td>
<td>mild</td>
<td>Moderate</td>
<td>severe</td>
<td>mild</td>
<td>0</td>
</tr>
</tbody>
</table>

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 listed.

**Table 3: Patient’s symptoms 14 days after delivery**

<table>
<thead>
<tr>
<th>Group number</th>
<th>pain</th>
<th>tenderness</th>
<th>redness</th>
<th>oedema</th>
<th>discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st group</td>
<td>2 [25%]</td>
<td>2 [25%]</td>
<td>3 [37%]</td>
<td>2 [25%]</td>
<td>2 [25%]</td>
</tr>
<tr>
<td>mild moderate severe</td>
<td>1 0 1</td>
<td>mild moderate severe</td>
<td>1 0 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd group</td>
<td>1 [10%]</td>
<td>1 [10%]</td>
<td>1 [10%]</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>mild moderate severe</td>
<td>1 0 0</td>
<td>mild moderate severe</td>
<td>1 0 0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**

<table>
<thead>
<tr>
<th>Group number</th>
<th>pain</th>
<th>tenderness</th>
<th>redness</th>
<th>oedema</th>
<th>discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st group</td>
<td>1 [15%]</td>
<td>2 [25%]</td>
<td>1 [12.5%]</td>
<td>1 [12.5%]</td>
<td>1 [12.5%]</td>
</tr>
<tr>
<td>mild moderate severe</td>
<td>0 1</td>
<td>mild moderate severe</td>
<td>0 1 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd group</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>mild moderate severe</td>
<td>0 0 0</td>
<td>mild moderate severe</td>
<td>1 0 0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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 (Pourreau-Schneider 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. Al Watban and Zang (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, Hode 2002), 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 Watban and Zang (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.

References


Geoffery Chambelain, Gynecology by ten teachers, (1996), (16th Ed.).


Mester E, (1969), “(Experimentation on the interaction between infrared laser and wound healing)”. Z ExpChirurgie, 2, 94


Rane Thakar and Abdul H. (2009), “(Sultan Episiotomy and obstetric perineal trauma chapter 17 in best practice in labour and delivery)”, Cambridge University Press: p.182

تعجيل شفاء جرح قص العجان باستخدام ليزر الدائود 790-805 نانومتر

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(2) سري صلاح الدين سلمان

الخلاصة: للاختبار تأثير اشعاع ليزر الدائود (790-805) نانومتر على التئام الجروح كعلاج مساعد في النساء اللاتي لديهن جرح العجان وتقييم ثوابت الليزر المستخدم. ثمانية عشر مريضة اشتراكن في هذه الدراسة ودعمهن جميعا جرح العجان. عشر مريضات استلمن جرعات من ليزر الدائود (790-805) نانومتر بنمط متواصل. وكان هناك ثمانية مريضات كمجموعة سيطرة وكان تفاعل النقطة 8 ملم. وقت التعرض لكل نقطة 30 ثانية. كانت القوة المستخدمة 0.6 واط. وكانت كفاءة القوة لكل نقطة 1.19 واط.

الدراسة جلستان من ليزر يوم 4 و يوم 8 بعد الولادة. وتمت متابعة النساء من المجموعتين أيام 18,14,8,4,2,1 بعد الولادة. فيما يتعلق بالألقاح، التحسس بالألقاح، الاله، والاضطرابات. بعد التعرض الأول للليزر تم تقييم المرضى اليوم الثانى من الولادة، وأظهر القياس أن الألز موجود في 20% من المريضات. وقاداس بالأشب في 30% الألز، والقداس في 20% الألز، والقداس في 20% الألز، والقداس في 20% الألز. وكانت جميع معايير التقييم أقل من مجموعة السيطرة حيث كان الألم موجود في 62.5% والتقداس بالألقاح بالأرياح في 50% والألز في 25% ما بعد التعرض الثاني الذي تم بعد 14 يوم من الولادة. فأن الألم والتقداس للألقاح والقداس كان في 10% فقط من المريضات. بينما في مجموعة السيطرة كان الألم والتقداس للاه والأرياح في 25% والألز في 37%. استنتجت الدراسة أن التحسس الحيوي هو طريقة يمكن استخدامها للتعجيل في التئام الجروح إذا استخدم بمعايير مناسبة. يمكن استخدام ليزر الدائود 790-805 نانومتر تعجيل شفاء جرح العجان كعلاج مساعد عندما يتم استخدامه بنمط متواصل بقوة 0.6 واط وكتافة طاقة 1.19 واط لمسداس لكل نقطة.