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Original Article

# Pulsed high-intensity laser therapy versus low level laser therapy in the management of primary dysmenorrhea

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**Abstract.** [Purpose] To determine the effect of pulsed high intensity laser therapy (HILT) versus low level laser therapy (LLLT) in the treatment of primary dysmenorrhea. [Participants and Methods] This was a randomized clinical trial that included 30 females diagnosed with primary dysmenorrhea who were assigned randomly into two groups of equal numbers. The treatment was three sessions every cycle for three consecutive cycles, where group (A) received pulsed HILT and group (B) received LLLT. All participants were evaluated before and after treatment sessions by visual analogue scale (VAS) and at the end of treatment by pain relief scale (PRS). [Results] The results showed a significant decrease in the severity of pain in the two groups. Comparison between the two groups showed a statistically non-significant difference in the severity of pain and pain alleviation at the end of the treatment course. [Conclusion] Both pulsed HILT and LLLT are effective in the treatment of primary dysmenorrhea, with no significant differences between the two modalities.

**Key words:** Primary dysmenorrhea, Pulsed high-intensity laser, Low level laser

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## INTRODUCTION

Primary dysmenorrhea (PD) is a common gynecologic disease affects adolescents and women of reproductive age. It is characterized by cramp-like pain in the lower abdomen that may radiate to the thighs and lower back, which often occurs before or after the onset of menstrual bleeding[1)]. The pain is sometimes accompanied by associated symptoms (such as diarrhea, nausea, fatigue, headache, and dizziness) that render patients incapacitated for 1 to 3 days each menstrual cycle[2–4)], resulting in a restriction of daily activities[5, 6)], poor quality of sleep, and mood disturbance, which can lead to absence from school or work; thus, primary dysmenorrhea has a great impact on the quality of life[7, 8)]. The prevalence of dysmenorrhea is high, ranging from 45 to 93% of women of reproductive age[9, 10)], with the highest rates reported in adolescents[11, 12)]. The most accepted theories to explain the pain in women with PD are the production and excess release of prostaglandins through the endometrium during menstruation, causing uterine hypercontractility, hypoxia, and ischemia[13)]. The primary dysmenorrhea is commonly treated with non-steroidal anti-inflammatory drugs, prostaglandin antagonists, and antispasmodic drugs. However, these treatments are accompanied by a number of side effects[14)], including mild indigestion, decreased appetite, stomach pain, excessive bleeding, constipation, nausea, vomiting, itching, rash, dizziness, headache, and nervousness[15)].

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Studies on the effects of different physical movements on dysmenorrhea have shown controversial results[16]. Exercise affects the level of steroid hormones in blood circulation, reducing pain intensity, duration, and use of medications[17, 18]. Stretching and aerobic exercises have positive effects on primary dysmenorrhea, as reported in various studies[19–21]. However, it takes considerable time for exercising to produce a temporary analgesic effect, and high-quality trials are needed to confirm this effect[22]. Low level laser therapy (LLLT) is effective in treating painful conditions by raising β-endorphins, normalizing the speed of A-alpha nerve fibers rather than C-fibers, and increasing blood and lymph flow, resulting in elimination of waste metabolism from the area of pain[23]. LLLT has a good effect in controlling primary dysmenorrhea, as it diminishes the production of prostaglandins E and F by superoxide dismutase hastening[24–26]. Pulsed high-intensity laser therapy (HILT) is a recent rehabilitation therapy successfully used in orthopedic diseases and sports medicine, due to the speed of its efficacy and the permanent relief of pain with reduction of recovery time it produces[27–29]. The analgesic effect is produced by high intensity pulsed applications, which create photomechanical waves that stimulate the A-fibers and close the gate for pain transition, and the biostimulation effect that stimulates cell growth and cell repair[30–32]. Pulsed high-intensity laser therapy was effective in reducing primary dysmenorrhea, due to its significant effect in decreasing the severity of pain and prostaglandin levels in blood[33]. The purpose of this study was to determine the efficacy of pulsed high-intensity laser therapy versus low-intensity laser therapy on primary dysmenorrhea.

## PARTICIPANTS AND METHODS

This randomized clinical trial study was carried out after participants received a full explanation of the treatment protocol and signed a consent form. Research approval was obtained from the Ethics Review Committee of the Faculty of Applied Medical Sciences, Umm Al-Qura University. Inclusion and exclusion criteria were set as follow:

• Participants' body mass index should not exceed 30 kg/m$^2$; participants should have no medical or psychological problems.

• No participants received medical treatment for menstrual pain during the study course.

• Married females with irregular menstrual cycles, endometriosis, pelvic inflammatory disorder, or low back pain were excluded.

A total of 30 female participants aged between 18 and 23 years and diagnosed with primary dysmenorrhea were randomized into two groups of equal number, where group A received pulsed HILT and group B received LLLT. The treatment was three sessions every cycle for three consecutive cycles. Participants were quizzed on the severity of pain using visual analogue scales (VAS) and the pain relief scale (PRS).

Visual analogue scale (VAS) is a valid and reliable scale[34] in which 0 equal no pain, 1–3 equals mild pain, 4–6 equals moderate pain, 7–9 equals severe pain, and 10 equals unbearable pain. Participants themselves completed the scale before and after the end of each treatment course by marking the point that represented their perceived pain.

Pain relief scale (PRS) is a scale measuring the changing magnitude in pain intensity after treatment[35] that is widely used clinically for the assessment of pain[36]. In the PRS, 0 equals no relief, 1 equals slight relief, 2 equals good relief, 3 equals excellent relief, and 4 equals complete relief[37].

Participants in each group received the specified treatment on complaint of pain a day before the beginning of menstrual flow and on the first and second days after menstrual flow began.

Group (A) were treated with three pulsed HILT sessions every cycle for three consecutive cycles using a long pulse Nd:YAG laser from a LASERSIX ME 15W device (Sixtus italia srl) with pulsed emission 1,064 nm, peak power of 3 kW, energy density fluency from 810 to 1,780 mJ/cm$^2$, pulse duration of 120–150 msec, and a duty cycle of 0.1%, with a frequency of 10–50 Hz. The total average energy of the pulsed HILT application was 620 J, administered in three phases, from supine lying position on suprapubic region=300 J, initial phase (fast)=100 J, intermediate phase=100 J distributed at 5 points, final phase (slow)=100 J, from prone lying position on lumbosacral region (paraspinal) between $L_4$–$S_3$=320 J, initial phase (100 J): RT side 50 J + LT side 50 J, Intermediate phase (120 J): RT side (60 J) 3 points + LT side (60 J) 3 points, final phase (100 J): RT side 50 J + LT side 50 J.

Group (B) received three LLLT sessions every cycle for three consecutive cycles (a gallium–arsenide diode (GaAs) laser (BTL-5818SLM) was used). The LLLT was applied with the dose of 6 J\cm$^2$, power of 100 mw, area equal to 1 cm$^2$, and a duration of 1:15 min for 15 points, from supine lying position, 5 points on supra-pubic region, and from prone lying position, 10 points over lumbosacral region on $L_4$–$S_3$, 5 points on each side. Descriptive statistics were used in the form of means, standard deviation (SD), and qualitative variable analytical experimentations, including the use of a student t-test to comparatively examine means prior to and following the treatment. A significance level of 0.05 was applied across each statistical examination.

## RESULTS

As indicated in Table 1, pain severity in the HILT group before starting the treatment procedures was mild in two cases (13.3%), moderate in 10 cases (66.7%), and severe in three cases (20%). After treatment there was no pain in two cases (13.3%), mild pain in five cases (33.3%), moderate pain in seven cases (46.7%), and severe pain in one case (6.7%). Percent-

age of improvement was 33.27%. In Group B, before starting the treatment procedures, pain was mild in four cases (26.7%), moderate in six cases (40%), severe in five cases (33.3%), and unbearable in nine cases (45%). After treatment there was no pain in two cases (13.3%), mild pain in five cases (33.3%), moderate pain in five cases (33.4%), and severe pain in three cases (20%), with percentage of improvement at 29.42%. The mean difference within each group was significant ($p<0.05$), while the mean difference between the two groups was non-significant ($p>0.05$).

As indicated in Table 2, after the end of the treatment course, Group (A) participants reported complete relief in three cases (20%), excellent relief in one case (6.65%), good relief in seven cases (46.65%), slight relief in one case (6.65%), and no relief in three cases (20%). In Group B, after the end of the treatment course, there was complete relief in three cases (20%), excellent relief in six cases (40%), good relief in four cases (26.70%), slight relief in one case (6.65%), and no relief in one case (6.65%). The comparison between post mean value of pain relief after treatment showed non-significant ($p>0.05$) difference between the two groups.

## DISCUSSION

Primary dysmenorrhea (PD) is a common gynecologic disease[2], affecting 45 to 93% of women of reproductive age, characterized by cramp-like pain around the lower abdomen due to the excessive release of uterine prostaglandin, which cause ischemia and stimulation to nerve endings[38]. The purpose of this study was to compare the effects of pulsed HILT versus LLLT on primary dysmenorrhea. The results showed non-significant difference between the two modalities in comparing post mean value of pain relief after treatment ($p>0.05$); however, we found that both treatment modalities were effective ($p<0.05$) and safe in the management of primary dysmenorrhea.

These results are supported by Alayat MS et al. [39], who concluded that the sedative effect of pulsed HILT might be an outcome of its ability to reduce the conduction of pain through Aδ and C-fibers and increase the production of morphine-mimetic substances.

The results also agree with the previous study that revealed as pulsed HILT would be an effective modality in the treatment of primary dysmenorrhea by decreasing the prostaglandin level in blood[33] it can be used as an alternative conservative therapy for primary dysmenorrhea rather than medications that have numerous side effects. Also, these results are consistent with Thabet and Alshehri[39], who conducted a randomized controlled trial on 40 women with mild or moderate degrees of endometriosis and concluded that pulsed HILT is an effective method of pain alleviation, reducing adhesions, and improving

**Table 1.** The visual analogue scale before and after treatment in both groups

| | Pulsed HILT Group | | | | LLLT Group | | | |
|---|---|---|---|---|---|---|---|---|
| | Before treatment | | After treatment | | Before treatment | | After treatment | |
| | No. | % | No. | % | No. | % | No. | % |
| No pain | 0 | 0.00 | 2 | 13.30 | 0 | 0.00 | 2 | 13.30 |
| Mild pain | 2 | 13.30 | 5 | 33.30 | 4 | 26.700 | 5 | 33.30 |
| Moderate pain | 10 | 66.70 | 7 | 46.70 | 6 | 40.000 | 5 | 33.40 |
| Severe pain | 3 | 20.00 | 1 | 6.70 | 5 | 33.30 | 3 | 20.00 |
| Mean ± SD | 5.20 ± 1.69 | | 3.47 ± 1.42 | | 5.20 ± 1.86 | | 3.67 ± 2.50 | |
| Improvement (%) | 33.27% | | | | 29.42% | | | |
| p-value | 0.011* | | | | 0.043* | | | |
| | 0.825** | | | | | | | |

SD: standard deviation; ttt: treatment; *Significant; **not-significant.

**Table 2.** The degree of pain relief in both groups

| | Pulsed HILT Group | | LLLT Group | |
|---|---|---|---|---|
| | No. | % | No. | % |
| No Relief | 3 | 20.00 | 1 | 6.65 |
| Slight Relief | 1 | 6.65 | 1 | 6.65 |
| Good Relief | 7 | 46.65 | 4 | 26.70 |
| Excellent Relief | 1 | 6.700 | 6 | 40 |
| Complete Relief | 3 | 20.00 | 3 | 20 |
| Mean ± SD | 2.00 ± 1.36 | | 2.60 ± 1.12 | |
| p-value | 0.860** | | | |

SD: standard deviation; p-value: probability value; **not-significant.

the quality of life in women with endometriosis. The results are also in line with Thabet et al.[40], who carried out a study to determine the effect of LLLT and pelvic rocking exercises in reducing the pain of primary dysmenorrhea, reporting that LLLT in combination with pelvic rocking exercises has an excellent effect in the management of primary dysmenorrhea.

The obtained results also agreed with those of Aras et al.[41], who reported on the possible mechanisms of action of LLLT, which include endorphin secretion stimulation, reduction of interstitial fluid at the site of inflammation with a marked increase in vasodilatation, and improvement in local circulation. Also, the results concurred with those of Tortorici et al.[42], who found that postoperative oral LLLT appears to offer better analgesic efficacy than preoperative administration after third molar surgery under local anesthesia, as well as before lower third molar surgery, during tooth extraction.

It was concluded that pulsed HILT and LLLT are both effective in the treatment of primary dysmenorrhea, while there was no significant difference between the two modalities.

The study was planned to include measurement of prostaglandin before and after the course of treatment for both group but due to certain limitation of the presence of corona virus (COVID-19) we couldn't perform it.


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## *Conflicts of interest*

All authors declare no conflicts of interest.

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