

## Phonophoresis Versus TENS on Low Back Pain after Delivery

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### Abstract

**Background:** About Thirty-five percent of women have severe low back pain after delivery. Phonophoresis is effective in treating acute and chronic back pain.

**Aim of Study:** This study was conducted to compare between the efficacy of Phonophoresis and Transcutaneous electrical nerve stimulation (TENS) on low back pain after delivery.

**Patients and Methods:** This study was carried out on Forty multiparous women suffering from severe Low back Pain For at Least 3 months after delivery. They were selected randomly from the outpatient clinic of orthopedic of Zagazig University Hospitals. Their ages were ranged from 25-35 years old; their body mass index (BMI) didn't exceed 30 kg/m<sup>2</sup> and their parity was ranged from (2-4) children. All participants were experienced normal delivery or cesarean section. All patients were divided randomly into 2 groups equal in number, group (A) & group (B). Group (A) received Ketoprofen phonophoresis on her lower back for 10 minutes, 3 times/week for 8 weeks, while group (B) received transcutaneous electrical nerve stimulation on her lower back (With frequency 80-120 HZ, pulse width 200 us with low intensity) for 30 minutes, 3 times/week for 8 weeks. Low back pain was evaluated by visual analogue scale (VAS) and serotonin level in blood plasma before and after treatment.

**Results:** The results of this study revealed that, both groups (A&B) showed statistically ( $p$ -value <0.001) significant decrease in VAS scores and increase in serotonin level in blood plasma after treatment, but the percent of decrease in pain sensation and percentage of increase in serotonin level were more pronounced and more noticeable in (group A) when compared to group (B). This means that, phonophoresis was more effective than TENS in relieving low back pain after delivery.

**Conclusion:** Phonophoresis is more effective than TENS treating low back pain after delivery.

**Key Words:** Low back pain – Phonophoresis – TENS – Visual analogue scale – Serotonin level.

### Introduction

**BACK** pain is a common complain of pregnant woman. This is generally characterized as an axial or parasagittal discomfort in the lower lumbar region and is musculoskeletal in nature. This can be due to combination of mechanical, hormonal, circulatory, and psychosocial factors. Treatments that are available usually have a low success rate and consist mainly of lifestyle adjustments and bed rest [1].

Low back pain in pregnancy is generally ascribed to the many changes in load and body mechanics that occur during carrying of a child. It is normal to gain between 20 and 40 pounds during pregnancy. This clearly shifts the body's center of gravity anteriorly and increases the moment arm of forces applied to the lumbar spine. Several studies had been suggested the anterior shift leads to severe lumbar lordosis and an increase in the nature inward curvature of the spin [2].

No doubt that, this increase mechanical stress on lower back causes severe pain. The abdominal muscles are also stretched to accommodate the expanding uterus. As they stretch, they lose their ability to maintain body posture causing the lower back to support the majority of the increased weight of the torso. Hormonal changes during pregnancy also cause inflammation and pain in the back. It has been suggested that, the hormone relaxin increases 10-folds in concentration during pregnancy. As the structure of the pelvis and lower spine soften and become more pliant, discomfort may result particularly not only in the Sacro-iliac joint but also over the entire lower back.

Phonophoresis is a technique by which therapeutic ultrasound is used to introduce pharmacologic agents, usually anti-inflammatory or analgesic drugs, through intact skin into the subcutaneous

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tissues. Theoretically, phonophoresis can provide a safe and painless alternative to injections for treatment of common inflammatory conditions such as bursitis, sprains, strains, and tendinitis. Phonophoresis has been studied in vivo with several anti-inflammatory drugs. In vitro studies of the photophoretic effect of ultrasound reported that ultrasound enabled a greater transport of whole molecules across synthetic or organic semipermeable membranes than was afforded by ultrasound [3].

Transcutaneous electrical nerve stimulation (TENS) is a physical therapy modality that uses low voltage electrical current to provide pain relief. A TENS unit consists of a battery-powered device that delivers electrical impulses through electrodes placed on the surface of your skin. The electrodes are placed at or near nerves where the pain is located or at trigger points [4].

### Subjects and Methods

*Subjects:* This study was carried out on Forty multiparous women suffering from severe Low back Pain For at Least 3 months after delivery. Their ages were ranged from 25-35 years old, their body mass index (BMI) didn't exceed  $30\text{kg/m}^2$  and their parity was ranged from (2-4) children. All participants were experienced normal delivery or cesarean section. All patients were divided randomly into two groups equal in number as group (A) and group (B).

Group (A) consisted of 20 patients. Each patient in this group received Ketoprofen phonophoresis on her lower back for 10 minutes, 3 times/week for 8 weeks. In the same time, each patient was asked to perform strengthening exercises for abdominal muscles, posture correction exercise and posterior pelvic tilting exercise for 60 minutes, 3 times/week for 8 weeks. While group (B) received transcutaneous electrical nerve stimulation on her lower back (With frequency 80-120 HZ, pulse width 200 us with low intensity) for 30 minutes, 3 times/week for 8 weeks. In the same time, each patient was asked to perform the same strengthening exercises for abdominal muscles, posture correction exercises and posterior pelvic tilting exercises as in group (A) for 60 minutes, 3 times/week for 8 weeks.

#### Materials:

*Consent form:* Each patient in both groups (A&B) was asked to sign on the consent form before participating in this study.

*Recording data sheet:* It was used to record all data of each patient in both groups (A&B) in it before starting the treatment course. It included: name, age, address, occupation, diagnosis, chief complain, type and date of delivery, number of parity, past and present history as well as family history.

*Weight-height scale:* It was used to measure weight and height of each patient in both groups (A&B).

*Ultrasonic device:* This device was used to treat all patients in group (A)

*Transcutaneous electrical nerve stimulation (TENS) device:* This device was used to treat all patients in group (B).

*Ketoprofen gel (Fastum gel):* It is non-steroidal anti-inflammatory analgesic drug. It was used during ultrasonic treatment.

*Visual analogue scale (VAS):* Used in assessment of pain intensity before and after treatment.

*Syringes:* They were used to withdraw blood samples from each patient in both groups (A&B) before and after the treatment course to measure serotonin level in blood plasma in the early morning.

*Stop watch:* It was used to determine the time of each treatment session.

*Plinth:* It was used by each patient in both groups (A&B) to receive the treatment session.

White sheets, towels, stole, bottle of alcohol and cotton.

*Mirror:* Used in postural correction exercises.

#### Methods:

##### (A) *Evaluative procedures:*

- 1- All data of each patient in both groups (A&B) were recorded in the recording data sheet before starting the treatment course.
- 2- Weight and height of each patient in both groups (A&B) were measured and BMI will be calculated before starting the treatment course.
- 3- A blood sample of 3cm was withdrawn from the antecubital vein of each patient in both groups (A&B) before and after the treatment course and it was sent immediately to the laboratory center to measure serotonin level in the blood.

*This procedure was done as the following:* Each patient in both groups (A&B) will be asked to sit on arm chair, the antecubital fossa was cleaned with a piece of cotton immersed in alcohol then a blood sample was withdrawn from the antecubital vein by a disposable sterilized syringe early in the morning.

Then all blood samples of all patients were collected in sterilized tubes and they were sent immediately to the laboratory center for analysis.

Also, each patient in both groups (A&B) was asked to put a mark on VAS to estimate intensity of her pain in her lower back. This was done before and after the treatment course (8 weeks).

*(B) Treatment procedures:*

*Group (A):*

Each patient was asked to Lie on the plinth, in prone Lying position, supported her head on her Flexed hands and deviating her head to one side to breathe comfortably and quietly. Then, she was covered with a white sheet except the treated area which will be cleaned with a piece of cotton immersed in alcohol to decrease skin resistance.

After that, the physiotherapist adjusted the ultrasonic device. Then, a sufficient amount of Ketoprofen gel was applied on her Lower back. After that, the physiotherapist handled the transducer head (the treatment head) of the ultrasonic device from its hand and switch on the ultrasonic device, then he started to move the transducer head on Lower back in a Circular movement continuously for 10 minutes.

After that, the ultrasonic device was switched off, and its head was cleaned with a piece of cotton immersed in alcohol to avoid transmission of infection, also the lower back of the mother was cleaned with a piece of Cotton immersed in alcohol.

*Abdominal strengthening exercises:*

*(A) Static abdominal exercises:*

The mother was asked to lie in crock lying position, the therapist stride standing, the mother was asked to contract her abdominal muscles and press her back firmly on to the bed. Hold this position for five counts then relax.

*(B) Dynamic abdominal exercises included:*

1- Lateral flexion of the pelvis (Hip shrugging): the mother was asked to lie in half crock lying position, the therapist stride standing, the mother was asked to contract her abdominal muscles firmly, then draw the straight leg up towards the ribs to

seem shorter, then push it down to seem longer, return to the starting position and relax.

2- Lateral flexion of the trunk: The mother was asked to lie in supine lying position, the therapist standing beside her, the mother was asked to pull her abdomen in firmly and slide her right hand down toward her right foot. Hold there for five counts then come back to the middle and relax. Then, the mother was asked to repeat the same movement to the left side and relax. This exercise can be done from different position such as: crock lying, sitting, stride standing, prone kneeling and side lying position.

3- Pelvic rotation exercise: The mother was asked to lie in crock lying position, the therapist stride standing beside her, the mother was asked to pull her abdomen in firmly, and press her shoulders down hard on the table, then roll her knees slowly to the right side until her thigh touches the table. Hold this position for five counts, then bring her knees up to the middle and relax. After that, the mother was asked to repeat the same movement to the left side and relax.

Also, it can be done from half cock lying position.

4- Trunk rotation exercise: The mother in sitting position, the therapist standing beside her, the mother was asked to pull her abdomen in firmly, then rotate her upper trunk to the right side as far as she can, let her head follows the movement and her eyes looking behind her shoulder, while her knees & hips remain facing forward to avoid twisting the knees. Hold in this position for five counts then return to the middle and relax. After that, the mother was asked to rotate her upper trunk to the left side and relax. This exercise can be done from different positions as: stride standing, prone kneeling and from crock lying position.

5- The antero-posterior flexion of the trunk (curl-up): The mother was asked to lie in supine lying position, the therapist stride standing beside her, the mother was asked to pull her abdomen in firmly, stretch her hands out in front of her, then raise her head& shoulders and look at her feet, then relax.

*Group (B):*

Each patient was asked to lie on the plinth, in prone lying position, supported her head on her flexed hands and deviating her head to one side to breathe comfortably and quietly. Then she was covered with a white sheet except the treated area (lumbo sacral area), the skin of this area was

cleaned with a piece of cotton immersed in alcohol to decrease the skin resistance.

After that, the physiotherapist placed the electrodes of the TENS unit on lumbo sacral area, paravertebrally, and adjust the TENS unit.

After that, the physiotherapist switched on the TENS unit for 30 minutes, then switched off the TENS unit and removed the electrodes. Once the treatment session was finished, the mother was asked to perform abdominal strengthening exercises, posture correction exercise and posterior pelvic tilting exercises for 60 minutes as in group (A).

*Statistical analysis:*

- Results are expressed as mean ± standard deviation. Comparison between variables in the two groups was performed using unpaired *t*-test.
- Comparison between before- and after-treatment data in the same group was performed using paired *t*-test. Comparison between after treatment data in the two groups was performed using unpaired *t*-test.
- Statistical Package for Social Sciences (SPSS) computer program (version 19 windows) was used for data analysis. *p*-value ≤0.05 was considered significant.

**Results**

By comparing the two groups (A & B) after treatment regarding to VAS, it was found that, both groups showed a decrease in VAS after treatment, group (A) achieved 66.4% while group (B) achieved 19.21 % but the percentage of decrease in VAS was more pronounced and more notable in group (A) when compared with group (B), this means that combined ketoprofen phonophoresis and strengthening exercises was more effective than transcutaneous electrical nerve stimulation in decreasing VAS.

Comparison between the two groups (A & B).

Table (1): Illustrates mean ± SD for VAS before and after treatment for both groups (A & B).

Variable	Group A		Group B	
	Before treatment	After treatment	Before treatment	After treatment
Mean ± SD	31.75±0.44	1.26±0.51	3.80±0.41	3.07±0.31
MD	2.49		0.73	
# value	33.227		11.769	
<i>p</i> -value	0.001		0.001	
% of ↓↓ in VAS	66.40%		19.21 %	
Significance	Highly significant		Highly significant	

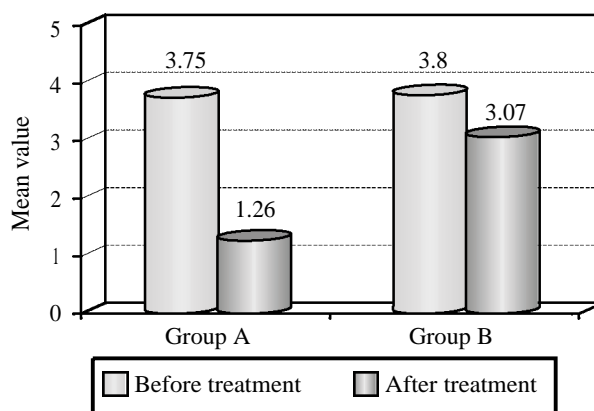


Fig. (1): Illustrates mean values of VAS measured before and after treatment in the two studied groups (A & B).

By comparing the two groups (A & B) after treatment regarding to serotonin, it was found that, both groups showed an increase in serotonin after treatment, group (A) achieved 62.08% while group (B) achieved 21.07% but the percentage of increase in serotonin was more pronounced and more notable in group (A) when compared with group (B), this means that combined ketoprofen phonophoresis + strengthening exercises was more effective than transcutaneous electrical nerve stimulation in increasing serotonin.

Comparison between the two groups (A & B).

Table (2): Illustrates mean ± SD for serotonin before and after treatment for both groups (A & B).

Variable	Group A		Group B	
	Before treatment	After treatment	Before treatment	After treatment
Mean ± SD	31.25±8.21	50.65±8.35	29.90±6.66	36.20±6.52
MD	-19.40		-6.30	
# value	-127.483		-59.925	
<i>p</i> -value	0.001		0.001	
% of ↑↑ in serotonin	62.08 %		21.07%	
Significance	Highly significant		Highly significant	

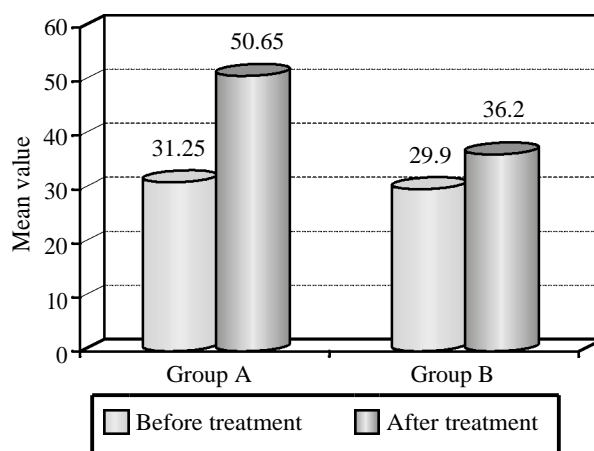


Fig. (2): Illustrates mean values of serotonin measured before and after treatment in the two studied groups (A&B).

## Discussion

The results of this study come in agreement with the results of an experimental study to compare between efficacy of Ketoprofen phonophoresis and TENS on low back Pain after delivery. The results of his study revealed That "Using Ketoprofen with phonophoresis was more efficient and superior to TENS in reducing Pain and alleviating symptoms in cases of low back pain after delivery" [5].

The results of the current study are confirmed by that "Ketoprofen Phonophoresis is a good treatment option to treat low back pain after delivery. It can decrease Pain & Inflammation, improve general condition and help Patient to return to her optimal Function as quickly as possible" [6].

The results of the present study are consistent with the results of "Phonophoresis is a technique that has a highest level of efficacy since it enhances the percutaneous absorption of certain pharmacological agents such as anti-inflammatory steroids into the under lying subcutaneous structures by ultrasound, therefore, it improves their effectiveness. For this reason, this procedure is commonly used in physical therapy practice to treat many musculoskeletal conditions including acute and chronic low back pain" [7].

The effectiveness of phonophoresis is debated in the medical world and there are studies that Vouch For the usefulness of this treatment. Phonophoresis is a safe and painless procedure that commonly used to treat inflammatory issues and injuries of soft tissues. Also, it is more effective for pain relief than medication alone. Therefore, it to commonly prescribed to treat L.B.P after delivery. This comes in agreement with the results of the current study.

Phonophoresis helps to decrease Pain in individuals with severe low back pain. Also, Phonophoresis is significantly more effective than using TENS or ultrasound alone to relieve back pain after delivery. This agrees with the results of the current study [8].

Phonophoresis has a high level of efficacy to relieve pain, reduce inflammation and improve overall functional mobility. It is usually recommended to treat several conditions such as: Low back pain, sprains, strains, capsulitis, tendonitis, bursitis, arthritis and muscle soreness that occurs after vigorous exercise. This agrees with the results of the present study [9].

Phonophoresis is commonly used to treat inflammatory tissues and injures of soft tissues. Several studies suggested that "phonophoresis is significantly more effective for pain relive than medication or ultrasound alone". The effectiveness of phonophoresis is debated in the medical world. There are studies vouch for usefulness of this treatment in several musculoskeletal problems such as low back pain. Phonophoresis may work best when the topical drug being used is left on the skin for few seconds before applying ultrasound. Doing this will allow it to sink through the skin properly so that, it can work more effectively. Phonophoresis helps a drug to penetrate the skin to reach up to 5 cm deep and taking only 10 minutes". This confirms the results of this study [10].

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## Conclusion:

Phonophoresis is more effective than TENS treating low back pain after delivery.

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## مادة الكيتوبروفين المدخلة بواسطة الموجات الصوتية مقابل تحفيز العصب الكهربى عبر الجلد على آلام أسفل الظهر بعد الولادة

يهدف هذا البحث إلى توضيح تأثير مادة الكيتوبروفين المدخلة بواسطة الموجات الصوتية مقابل تحفيز العصب الكهربى عبر الجلد على آلام أسفل الظهر بعد الولادة.

أجريت هذه الدراسة على أربعين امرأة يعانين من آلام أسفل الظهر استمر لمدة ثلاثة أشهر بعد الولادة، تراوحت أعمارهم ما بين ٢٥ و٣٥ عاماً، لم يتعدى مؤشر الكتلة كجم/م<sup>٢</sup>، وتراوحت النقص بين (٢-٤) طفلاً تم توزيعهم عشوائياً فى مجموعتين متساويتين فى العدد مجموعة (أ) تلقت هذه المجموعة العلاج عن طريق مادة الكيتوبروفين المدخلة بواسطة الموجات الصوتية لمدة ١٠ دقائق، ثلاث مرات أسبوعياً، لمدة ٨ أسابيع بالإضافة إلى التمرينات العلاجية لمدة ٦٠ دقيقة. مجموعة (ب) تلقت العلاج عن طريق تحفيز العصب الكهربى عبر الجلد لمدة ٣٠ دقيقة ثلاث مرات أسبوعياً، لمدة ٨ أسابيع بالإضافة إلى التمرينات العلاجية لمدة ٦٠ دقيقة. وقد تم تقييم المرضى فى المجموعتين عن طريق مقياس شدة الألم وكذلك قياس نسبة السيروتونين فى الدم قبل بداية العلاج وبعد الانتهاء من البرنامج العلاجى. وقد أسفرت النتائج عن وجود نقص ذات دلالة معنوية فى الإحساس بشدة الألم وكذلك زيادة فى نسبة السيروتونين فى الدم بعد البرنامج العلاجى للمريضات فى كلتا المجموعتين غير أن النقص فى شدة الألم والزيادة فى نسبة السيروتونين فى الدم كانت أكثر وضوحاً ودلالة فى المجموعة (أ) عند مقارنتها بالمجموعة (ب) مما يمكن معه استخلاص أن مادة الكيتوبروفين المدخلة بواسطة الموجات فوق صوتية ذات تأثير فعال فى علاج آلام أسفل الظهر بعد الولادة.