Research Article

Comparison of High Versus Low Transcutaneous Electrical Nerve Stimulation for Pain Management After Caesarean Section: A Clinical Trial

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Abstract

Objective: To evaluate the efficacy of high and low transcutaneous electrical nerve(TENS) in controlling pain after Caesarean (C) Section to measure the time period of pain relief through high and low TENS.

Methodology: A total of 60 females who delivered via C Section were selected. 10 refused to participate in study and 50 were randomly divided into control and treatment group comprising 25 in each group. Pain level was measured by Numeric Rating Pain Scale (NRS) and analgesic need was measured by noting the time period of pain alleviation after TENS application. Postpartum exercises were performed for three days under supervision and then guided as home plan.

Results: Control group (Low TENS group) and treatment group (High TENS group) both showed statistically lower NRS score after TENS application. On comparison, treatment group was found to be more effective ($p < 0.05$) as it resulted in lower NRS ratings and less requirement of analgesic.

Conclusion: In terms of controlling postoperative C Section pain, the high TENS is relatively effective tool compared to the low TENS as it has better pain management and less analgesic requirement.

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Introduction

Ultimate stage of pregnancy is birth of a baby. Child birth can be through vaginal route or through surgical procedure i.e. episiotomy or Caesarean Section. CS rate is increasing worldwide especially in developing countries.1Postoperative pain may be defined as "an acute pain temporarily related to surgical injury that heals in permitted healing duration".[2]

Postpartum pain after Caesarean section is due to uterine contractions and inflammatory process that takes place as a result of incisional injury.[1] To assess and control pain during and after labor is necessary not only for mother's health but also for the newborn in order to decrease hospitalization and boost recovery time.[3]

In physiotherapy practice, Transcutaneous Electrical Nerve Stimulation (TENS) is non invasive method that can easily be applied to reduce the intensity of pain.[1,4] The mechanism of high and low TENS in controlling pain is based on Melzeck and Wall's pain gate theory and opioid release theory respectively.[5] The level of pain reduction depends on the TENS parameters e.g. TENS Frequency, Intensity and Mode.[6]

TENS is a machine that has four electrodes that are placed on the patient skin and low voltage current is flowed to decrease the pain. According to this theory when current is passed through the skin of patient, myelinated A fibers are activated that in turn stimulate the dorsal horn of spinal cord and inhibit nociceptive impulses.[1,2]

TENS decreases the pain during walk and during breathing. TENS combined with postpartum exercises can be used to decrease pain.[7] Exercises that are essential for postpartum woman are kegal and abdominal exercises. Aim of kegal exercises in postpartum period is to strengthen the pelvic floor muscles. The aim of performing abdominal exercises is to minimize the risk of diastasis recti and back pain. It includes tummy bracing and pelvic tilt.[7] The present study hypothesized that the high and low TENS are not equally effective for controlling pain after C-Section. Therefore, the aim of study was to evaluate the efficacy of high and low transcutaneous electrical nerve (TENS) in controlling pain after Caesarean (C) Section to measure the time period of pain relief through high and low TENS.

Methods

The present study is a randomized controlled trial conducted from January 2017 to June 2017 at District Head Quarters Hospital, Faisalabad Pakistan. The study protocol was reviewed and analyzed by university ethical board (The University of Faisalabad, Faisalabad Pakistan).

Convenient sampling technique was used to recruit 60 females of 18-35 years of age were included into the study. From these females, 10 refused to participate into the study so were excluded. Remaining 50 females were randomly divided into two groups through convenient sampling technique. Screening of population was based on the pre-set inclusion criteria(females of age 18-35 year and undergoing 1st post-op day (elective Caesarean Section) Primipa-rous or Multiparous) and exclusion criteria(delivery via vaginal route or episiotomy, high risk pregnan-cies, presence of malignancies and pelvic dysfunction or demylenating diseases). In addition, only those females were included in study who were willing and who met the selection criteria. Consent form was distributed and signed from all the patients. A selection criterion is described in the table below:

Primary outcome measure of this study was to measure pain intensity and secondary outcome measure was to check required analgesic need. Consent was taken from each patient. Demographic and obstetric data was obtained about the patient. Objectives of the study and whole procedure of TENS application was explained to the patient in their native language (Urdu/Punjabi) and made sure that they understood the information fully. Patient confidentiality was taken into consideration.

Self report questionnaire was used to collect data and pain killer induction was stopped temporarily in both groups and only given when patients felt pain. Intensity of Pain was measured every time before and after the application of TENS for the three days on 1st, 2nd and 3rd postoperative day. Also time period was measured that after how many hours analgesic dosage is required.

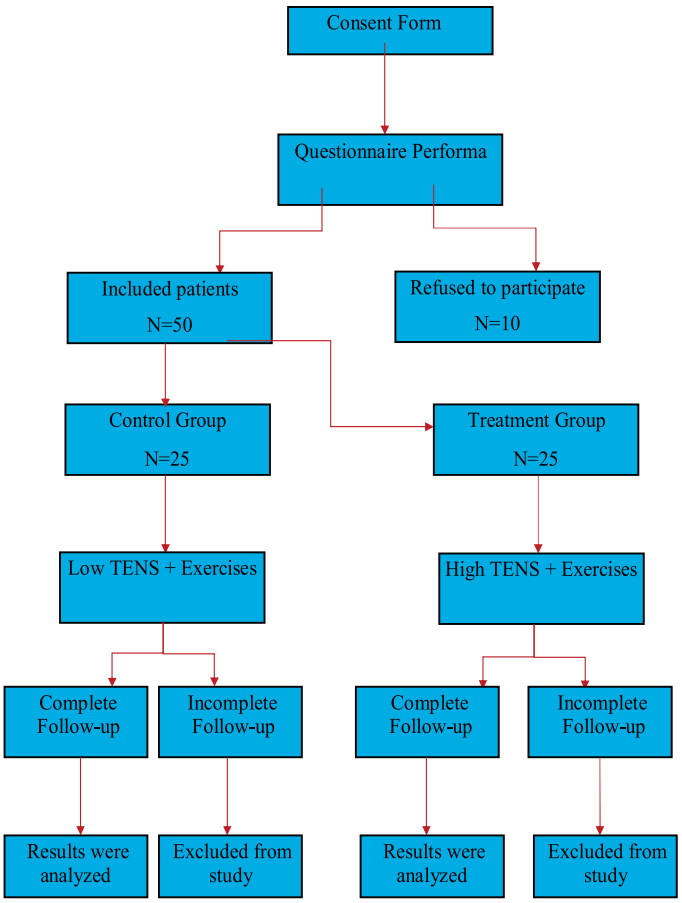
Patients were kept in resting position during the whole procedure and TENS pads were placed above and below the surgical incision. Comfy Stim company model Ev 804 was used for each participant and four silicon pads were used individually. In control and treatment group low (4 HZ) and high (100 HZ) TENS was applied respectively. Intensity was set according to patient tolerance for 20 minutes.

Firstly, patient was asked about her pain and pain level was marked on NRS. After twenty minutes TENS was removed and patient was again asked about her pain level and intensity of pain was marked on NPRS. Patient was remained under supervision and time was noted that after how many hours of TENS application patient required analgesic dosage. This procedure has been repeated twice a day for consecutive 3 days (1st, 2nd and 3rd post-op day). Kegal and abdominal exercises were performed in both groups under supervision after the application of TENS and guidelines for home plan exercise was provided at the end of session. Primary outcome measure was pain intensity before and after application of TENS that is measured through Numeric Rating Pain (NRP) scale. Secondary outcome measure was to check need of analgesic on hourly basis after TENS application. Both outcome

measures were measured and documented by researcher.

Analysis was performed by SPSS version 20. To measure the efficacy of TENS to control pain in low TENS group and high TENS group, repeated ANOVA was applied and mean plus standard deviation were noted. To compare pain intensity was compared in both groups, paired sample t-test was applied and values were noted.

To check the need of analgesic in both groups, descriptive statistics was applied. To compare need of analgesic between control and treatment group, paired sample t-test was applied and readings were noted.



The main issue was to administer analgesic on need basis. Analgesic dosage was only given when it was needed to reduce pain after TENS application.

Results

There were total 60 females in my study. Two groups were made, group 1 was treatment group and group 2 was control group. Out of 60, 10 females refused to participate in study. Each group was containing 25 patients. Group 1 was treated with high TENS while group 2 was applied with low TENS after Caesarean Section. Pain was recorded for three days in two shifts through Numeric Rating Pain Scale (NRPS) each time before and after application of TENS and need of analgesic was measured twice in a day after application of TENS.

To measure the pain level, descriptive statistics (repeated ANOVA) was applied individually in each group and independent sample t test was applied for comparison of both groups.

In high TENS group, throughout the three days of follow-up pain level was high at to NPRS scale before treatment session but it decreased to a very low level after TENS application which proves that high TENS is effective to control pain.

In low TENS group, before application of TENS pain was high and after TENS application pain decreased gradually from 1st to 3rd day but this decrease in pain was not significant.

When high and low TENS were compared to check the level of pain decrease, it was found that both types of TENS can lower pain level however high TENS is very effective in controlling pain after Caesarean Section.

For analgesic requirement, repeated ANOVA was applied individually in each group and independent sample t test was applied for comparison in both groups.

In high TENS group, the time period (hours) increased from 1st to 2nd and from 2nd to 3rd day during morning session which showed that analgesic requirement was after long hours. In evening session, high TENS again reduced the need of analgesic by increasing the time period after TENS application.

In low TENS group, analgesic requirement was reduced from day 1 to day 2 and then increased from day 2 to day 3 during morning session. It showed that analgesic need increased as time period was short. In evening session, there was decrease in time period from 1st to 2nd day which remained constant from 2nd to 3rd day. It proved that hours were reduced so need for analgesic was increased.

In high TENS group, first analgesic dosage was required after 8.28 hours (mean value) while in low TENS group, this dosage was required after 3.3 hours (mean value). The p value for comparison between two groups was 0.00 which is highly significant proving that TENS can reduce analgesic need after treatment application.This result showed that analgesic dosage need reduced to the half. Normally analgesic dosage is required after every 3-4 times a day to reduce the pain but with high TENS, dosage was required twice a day.

Table 1:

Comparison of High versus Low TENS for 3 Days	Group	N	Mean	Std. Deviation	Std. Error Mean
Pain level at day 1 Morning Pre Treatment	High TENS	25	5.7600	1.09087	0.21817
	Low TENS	25	6.0400	0.78951	0.15790
Pain level at day 1 Morning Post Treatment	High TENS	25	2.5600	0.91652	0.18330
	Low TENS	25	3.6000	1.38444	0.27689
Pain level at day 1 Evening Pre Treatment	High TENS	25	4.9200	1.07703	0.21541
	Low TENS	24	5.3333	0.76139	0.15542
Pain level at day 1 Evening Post Treatment	High TENS	25	1.8400	0.68799	0.13760
	Low TENS	24	2.9583	0.75060	0.15322
Pain level at day 2 Morning Pre Treatment	High TENS	24	5.8333	0.81650	0.16667
	Low TENS	23	5.6087	0.58303	0.12157
Pain level at day 2 Morning Post Treatment	High TENS	24	2.4583	0.97709	0.19945
	Low TENS	23	3.6522	0.98205	0.20477
Pain level at day 2 Evening Pre Treatment	High TENS	23	4.7391	1.05388	0.21975
	Low TENS	22	5.3636	0.78954	0.16833
Pain level at day 2 Evening Post Treatment	High TENS	23	1.6522	0.88465	0.18446
	Low TENS	22	3.0455	1.17422	0.25034
Pain level at day 3 Morning Pre Treatment	High TENS	23	5.2174	0.85048	0.17734
	Low TENS	21	5.7143	0.71714	0.15649
Pain level at day 3 Morning Post Treatment	High TENS	23	1.6957	0.76484	0.15948
	Low TENS	21	3.2381	0.99523	0.21718
Pain level at day 3 Evening Pre Treatment	High TENS	23	4.3913	0.65638	0.13686
	Low TENS	21	5.1905	0.60159	0.13128
Pain level at day 3 Evening Post Treatment	High TENS	23	1.3478	0.71406	0.14889
	Low TENS	21	2.6667	0.79582	0.17366

Table 2:

NOA Comparison in High and Low TENS Group	Group	N	Mean	Std. Deviation	Std. Error Mean
Analgesic need at day 1 Morning	High TENS	25	8.2800	2.03142	0.40628
	Low TENS	25	3.3152	1.95259	0.39052
Analgesic need at day 1 Evening	High TENS	24	8.7083	1.98865	0.40593
	Low TENS	24	4.9167	5.94845	1.21422
Analgesic need at day 2 Morning	High TENS	23	8.8696	1.89027	0.39415
	Low TENS	23	3.2752	1.73712	0.36221
Analgesic need at day 2 Evening	High TENS	23	8.9565	1.71830	0.35829
	Low TENS	22	3.5455	1.76547	0.37640
Analgesic need at day 3 Morning	High TENS	23	9.0435	1.49174	0.31105
	Low TENS	21	3.4867	1.86755	0.40753
Analgesic need at day 3 Evening	High TENS	23	9.1739	1.74908	0.36471
	Low TENS	21	3.7143	1.82052	0.39727

From this comparison, it was concluded that high TENS is capable of reducing analgesic requirement as compared to low TENS as it increases the pain free time period after treatment session.

Discussion

TENS is used by many health care professionals in terms of controlling and relieving pain such as post-operative pain, labour pain and pain due to MSK (musculoskeletal disorders) disorders. TENS is a device that provides pain relief by blocking pain receptors through electrical stimulation. TENS is a reliable, non-invasive and cheap method of pain relief that has no adverse effects.[5]

In current study, high and low TENS were used to measure their efficacy of controlling post operative pain and it was concluded that high TENS is more effective as compared to low TENS. This is supported by Lima, et al.[1] who measured the effect of high and low frequency TENS and showed that high frequency TENS is more effective than low frequency in controlling post C Section pain. The parameters were almost same in both studies except the sample size that was smaller than the current study due to which results were in favour of current study.

Kayman-kose, et al.[2] determined the TENS efficacy after vaginal delivery and C Section. In this study sample size was 100 that is larger than current study and they made 4 groups while in current study 2 groups were made. Pain level and Analgesic need after TENS application was measured in both studies and concluded that TENS is effective for postpartum pain reduction and analgesic need was also reduced after TENS application. The results of this study were also in favour of current study.

In present study, it was concluded that TENS reduces pain after the application of TENS. Under discussion study is supported by Sousa, et al.8who investigated the effect of TENS usage in relieving postpartum pain due to uterine contractions during breast feeding in multiparous females. It was a randomized controlled trial in which 32 females were divided into control group and experimental group. Conclusion of this study was that TENS is an effective tool in reducing postpartum pain due to uterine contractions during breast feeding.

Under discussion study concluded that high TENS is more effective in controlling pain after C section and it can reduce the pharmacological analgesia need after C section. This study is supported by Santana, et al[9] and determined that TENS reduces pain and postpones the need for pharmacological analgesia during labour. In this randomized controlled study, 46 females with gestational age >37 weeks were divided into 2 groups (control and experimental group). The conclusion of this study was in favour of under discussion study that TENS produces a significant decrease in pain during labour and postpones the need for analgesia to relieve pain.

In another study performed by Olsen, et al.[10] high versus low TENS comparison was done. From this study, it was found that females who received high TENS showed significant decrease in pain intensity and less distress as compared to females who received low TENS. Parameters like sample size, pain intensity scale, placement of electrode were different in this study as compared to the current study but the supported current study in which high TENS was more effective than low TENS.

Furthermore Veyilmuthu11 tested the effect of TENS on labour pain relief among primigravida and multigravida mothers. Total 1041 women were included in this retrospective study. 88% females were having vaginal delivery and 12% had C Section. Conclusion of this study was that TENS had a very good effect in coping up the labour pain and it can be used during first and 2nd stage of labour.This study supported the under discussion study that TENS can decrease pain.

The present study results showed that both high and low TENS can decrease the post caesarean pain. This was also supported by shahoei, et al[12] who measured the effect of TENS on the severity of labour pain among nulliparous women. Total 90 women were divided into 3 groups; control, treatment and placebo group and pain was measured by pain severity scale. Conclusion of this study was that TENS can affect pain relief during labour and 4 hours after labour.

The present research study identified high TENS as an effective tool to manage postoperative pain but these results were different from a previous study performed by Chen,et al[13] who investigated the effectiveness of acupoint versus non-acupoint stimulation for postoperative pain relief by using TENS. Results showed that mixed frequency TENS (2-100 Hz) was better in reducing need of opioids than either frequencies of low (2 Hz) or high (100 Hz) alone. The difference in results of both studies may be due to the difference in surgical procedure and sample size.

Current study is supported by Binder, et al[14] who carried out a research on HI-TENS combined with PCA morphine as post-caesarean pain relief. 42 multiparous females were included in this study. Visual analogue scale was used to measure pain at one, three, six, nine, twelve and twenty four hours postpartum and it was concluded that TENS with patient controlled analgesia can reduce pain more effectively as compared to patient analgesia alone.

Under discussion study concluded that TENS can relieve postoperative pain. This is supported by Saxena et al[15] who measured the comparative evaluation of efficacy of transcutaneous electrical nerve stimulation administered by dermatomal stimulation versus acupuncture point stimulation. Study was conducted on 40 women with 37-42 weeks gestation. Visual analogue scale was used to measure the pain

and it was concluded that TENS administered with dermatomal stimulation can significantly decrease the pain as compared to acupuncture stimulation.

The most of the previous studies were measuring pain intensity only for one time while the present study measures the pain intensity for multiple times (2 times in a day for consecutive 3 days). Need of analgesic was also followed for the consecutive three days (2 times in a day) while most of the earlier studies do not measure analgesic consumption for the multiple times which makes the present study different from other studies that were performed earlier.

There is lack of standardized protocols for the application of TENS regarding postpartum pain (gynaecological conditions). Present study was also limited by sample selection from one hospital only as setting and guidelines for patients of each hospital are different. Also there is lack of previous literature regarding use of TENS in CS patients. Small numbers of studies were found in which TENS was used as pain relieving agent after CS surgery.

Conclusions

The findings of present research study showed that both high and low TENS are effective in managing pain after C Section. However, when both are compared with each other than high TENS is more effective as compared to low TENS for postoperative pain reduction and decreased analgesic induction.

Current study can be used in future for advance study on the efficacy of TENS in gynaecological conditions especially in C Section. It is recommended that TENS should be in common use after CS for better patient outcome. Gynaecologists as well as patients should be aware about the efficacy of TENS. Funding should be provided by institutions or organizations in an easy way for further or more effective research output. Further studies regarding this topic should be performed in government as well as in private gynaecological set-up to measure if it makes difference in results. Also further studies should be performed with large number of sample size in order to gain more accurate results.

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Conflict of Interest: None
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