INTRODUCTION
Viable postoperative pain help is a significant variable for an effective recuperation process after surgery. Around 23 million surgeries are performed in the United States every year. These techniques cause tissue injury and release of powerful mediators of inflammation and pain. In spite of critical advancement in comprehension the pathophysiology of pain, the improvement of remedial alternatives, and the distribution and spread of rules, patients are frequently under-medicated and once in a while get treatment for pain post pharmacologic strategies.\(^1\)

Pain is an essential negative impact in the postoperative advancement of stomach surgeries, particularly those in the upper belly, notwithstanding utilizing pain relieving drugs.

Pain has been described as “an unpleasant experience which we associate with tissue damage or express in terms of tissue damage, or both” (Merskey, 1978).\(^2\) Transcutaneous electrical nerve stimulation (TENS) is a seemingly simple therapeutic apparatus that is increasingly being used in the control and management of pain.\(^3\) Pain has a subjective and socio-emotional element. Hence, it is significant to search for full and humanized care and also non-pharmacological behaviors to handle pain that can minimize conceivable dangers to wellbeing.\(^4\) Considering the unfriendly impacts that can be brought on by drug. Transcutaneous electrical stimulation is a physical therapy instrument broadly used to relieve pain.\(^5\) It stimulates nerve fibers that send signals to the brain, which the thalamus interprets as pain. Transcutaneous electrical stimulation can be used in the postoperative hospital routine as adjuvant to conventional analgesia. Transcutaneous electrical nerve stimulation (TENS) is a nonpharmacologic methodology that is utilized to treat postoperative pain amid cholecystectomy.\(^6\) Laparoscopic sterilization, myomectomy, hysterectomy and surgical abortion. Further, in systematic reviews, Bjordal et al\(^7\) demonstrated decrease in pain relieving utilization in patients utilizing TENS postoperatively. In past studies, low and high frequencies of stimulation amid the same treatment have been appeared to increment postoperative agony help and diminish postoperative pain relieving necessities and symptoms more viably than the different use of low-frequency or high-frequency TENS. A few TENS and TENS-like devices incorporate frequency modulated and frequency alternating settings in their outline. Modulated currents are methodical variations in a specific parameter. Frequency-modulated TENS includes the change of pulse frequency (rate) between preset limits over a settled timeframe (e.g., from 50 pulses for each second [pps] to 100 pps and back to 50 pps at 1 pps steps over a 10-second duration). Frequency-alternating TENS switches pulse frequency between 2 preset values (e.g., 2 pps for 6 seconds took after by 110 pps for 6 seconds).

MATERIAL AND METHODS
Forty five patients, who were enrolled in the department of Surgery, were enlisted in this trial. Patients were selected from the population group satisfying the inclusion criteria from the patients of the department of surgery of K.S Hegde Charitable Hospital, Mangalore. Ethical approval was granted by the ethical committee of Nitte University, Mangalore. At first, all the patients underwent an evaluation. The principle target was to gather the information on general and medical history, pain intensity by visual analogue scale score. The targets of doing as such were disclosed to the patient and were educated about the treatment. They were advised that the treatment would not preclude with their different methods of treatment.

Inclusion criteria were patients with abdominal surgery, Patients age 25 – 50 years during the study trial, patients with post abdominal incision pain score > 3 considered by the visual analog scale (VAS) on the principal postoperative day, both sex, Patient ability to take an interest and the patients which were excluded were Cardio respiratory ailments, patients matured more than 50 Years, Hemoptysis, abnormal skin sensation, Psychiatric illness. The following were the three different groups of treatment:

**Modulated TENS Group:** In this group, 15 patients were given modulated frequency (4 -150 Hz) TENS. Injectable Tramadol drug 50 mg i.v 8 hourly was given for 5 days post surgery.

**Low TENS Group:** In this group, 15 patients were given low frequency (4 Hz) TENS. Injectable Tramadol drug 50 mg i.v 8
hourly was given for 5 days post surgery.

**Placebo TENS Group:** In this group, 15 patients were given injectable Tramadol drug 50 mg i.v. 8 hourly for 5 days without intervention of TENS. 9

Patients with post-operative incision pain were selected after obtaining surgeon’s permission. Two sterile electrodes (first unit channel) were placed on one side of the incision and two electrodes (second unit channel), on the other side. The electrodes were positioned 1 cm away from the future line. TENS was given using Gem Stim combo apparatus; model GM320TE, which is a battery-operated TENS. To apply TENS, the type of incision was not taken into consideration.

Based on subject’s tolerance, the intensity of the amplitude was adjusted individually generating a perceptible tingling sensation without significant muscle contraction for 20 minutes twice 4 and 8 hourly after surgery. All patients received 50 mg of Tramadol every 8 hours as requested to control pain after surgery. Pain was assessed by a VAS score before the application of TENS on the first post-operative day, and after application of TENS on the 1st, 2nd, 3rd, 4th and 5th postoperative days. 9

**ANALYSIS AND RESULTS:**
This study selected and evaluated 64 patients for qualification, where 19 patients were excluded from this study. 12 patients were not ready to satisfy the inclusion criteria, 5 patients declined to take an interest and 2 patients gave different reasons. 64 patients were haphazardly assigned to 3 distinctive groups (15 in each) by method for PC created programming. All the patients were treated with respect to their groups and analyzed. A stream outline of the procedure is as follows:

**Figure 1:** Study flow diagram according to CONSORT guidelines.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sphericity Assumed</td>
<td>998.356</td>
<td>5</td>
<td>199.671</td>
<td>746.693</td>
<td>.000</td>
<td>947</td>
</tr>
<tr>
<td><strong>Greenhouse-Geisser</strong></td>
<td>998.356</td>
<td>4.082</td>
<td>244.561</td>
<td>746.693</td>
<td>.000</td>
<td>947</td>
</tr>
<tr>
<td>Huynh- Feldt</td>
<td>998.356</td>
<td>4.792</td>
<td>208.340</td>
<td>746.693</td>
<td>.000</td>
<td>947</td>
</tr>
<tr>
<td>Lower-bound</td>
<td>998.356</td>
<td>1.000</td>
<td>998.356</td>
<td>746.693</td>
<td>.000</td>
<td>947</td>
</tr>
</tbody>
</table>

From table 2 we can find the F value for the “POD1” factor, its related significance level and impact size (“Partial Eta Squared”). As our information debased the assumption of sphericity, we take a look at the values in the “Greenhouse-Geisser” column (as showed in yellow). We can report that when utilizing an ANOVA with repeated measures with a Greenhouse-Geisser correction, the mean scores for VAS focus were measurably altogether distinctive (F(998.35, 56.15) = 746.693, p < 0.0005).

<table>
<thead>
<tr>
<th>Measure</th>
<th>(I) Groups</th>
<th>(J) Groups</th>
<th>Mean Difference (I-J)</th>
<th>Std. Error</th>
<th>Sig.</th>
<th>95% Confidence Interval for Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lower Bound</strong></td>
<td>Modulated TENS</td>
<td>Low TENS</td>
<td>-.256</td>
<td>.233</td>
<td>836</td>
<td>836.836</td>
</tr>
<tr>
<td><strong>Upper Bound</strong></td>
<td>Placebo TENS</td>
<td>- .978</td>
<td>.233</td>
<td>000</td>
<td>-1.559</td>
<td>-397</td>
</tr>
</tbody>
</table>

Table 1 demonstrates the mean and standard deviation of VAS scores. It was observed that the VAS score reduced from day three until the fifth post operative day in all the groups but modulated TENS group exhibits a faster pain reduction as compared to the other two groups.
found that low loyalty in studies might be in charge of un-
and the result measures were not standardized. Bennet et al.
these surveys did not mull over the viable parameters of TENS
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absence of pain, the part of TENS is uncertain. There is lim-
formed about their pain intensities after surgical incision im-
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in reduction of pain.
5. Modulated TENS showed clinically more effective
active day is compared to the 5th post operative day, there was
differences before treatment of TENS on the 1st post opera-
groups (Modulated TENS, Low TENS and Placebo TENS) the
In the above graphs when comparing the three experimental
groups (Modulated TENS, Low TENS and Placebo TENS) the
differences between the groups. We can see that there was a signifi-
can in the management of pain. Whereas when modulat-
ed TENS and low TENS groups were compared with the pla-
cebo groups, there was significant difference (p=0.001, 0.10
respectively), indicating that both the modulated TENS and low TENS groups were equally effective when compared with
placebo TENS group. From the “Mean Difference (I-J)“ column we can see that VAS concentration was significantly reduced
this time point.
**Table 3** above, gives us the significance level for differences
between the groups. We can see that there was a significant
difference in VAS application when all the three groups were
compared. When modulated TENS group was compared with
low TENS and placebo TENS group it was documented that there was no significant difference with the low TENS
group (p=0.836), which justifies that both the groups were
equally effective in managing pain. Whereas when modulat-
ed TENS and low TENS groups were compared with the pla-
cebo groups, there was significant difference (p=0.001, 0.10
respectively), indicating that both the modulated TENS and low TENS groups were equally effective when compared with
placebo TENS group. From the “Mean Difference (I-J)“ column we can see that VAS concentration was significantly reduced
this time point.

**Graph 1: Between-group comparison of mean VAS score**

In the above graphs when comparing the three experimental
groups (Modulated TENS, Low TENS and Placebo TENS) the
differences before treatment of TENS on the 1st post operative
day is compared to the 5th post operative day, there was
a pain reduction on all the 5 post operative days for all the
groups, but Modulated TENS showed clinically more effective
in reduction of pain.

**DISCUSSION:** In the current study, most of the patients in-
formed about their pain intensities after surgical incision im-
mediately in the post operative period. The routine analge-
sics or post operative drug for pain was maintained in each
patient in this study. Statistical analysis demonstrates that in
each of the three groups the pain relieving medicine did not
impact a large portion of the methodology. For post-operative
absence of pain, the part of TENS is uncertain. There is lim-
ited systemic review on effectiveness of TENS for post-opera-
tive analgesia. A systemic review on TENS concluded TENS to
be ineffective; be that as it may, the trials incorporated into
these surveys did not mull over the viable parameters of TENS
and the result measures were not standardized. Bennet et al.
found that low loyalty in studies might be in charge of un-
certain discoveries. They discovered many areas of concern
such as lack of information given to patients regarding the
sensations, lack of instruction on how to self-administer TENS
devices and assessment of compliance, improper use of TENS
in regards to duration and pattern, and failure to standard-
ise or report concurrent analgesia and to assess comparabili-
ty between groups. Notwithstanding, the principle region of
concern was the amlessness of the TENS mediation and poor
appraisal of results.

In this study, TENS was effective in calming pain brought
about by post surgical. The consequence of this study demons-
trates that all the modes of TENS altogether decreased abdo-
menal incision pain when compared with the control group.
This information is like that got by Ali et al. 10, who likewise
exhibited the adequacy of TENS in alleviating postoperative pain.

Post operative pain along the incision is one of the major hin-
dering factor which leads to difficulty in performing activities
of daily living caused due to pain after abdominal surgery. Var-ious physical therapy means such as abdominal binders were
used in past to overcome pain during movement. The most
common method used was the pharmacological interventions
but with a compromise of side effects. Transcutaneous elec-
trical nerve stimulation with conventional or acupuncture type
type of TENS with or without modulation was effectively used in
past to relieve pain. There are several studies documenting the
positive effects of low as well as high TENS for relieving pain.
The modulated frequency TENS has the properties to produce
the non-painful regulated sensory-motor stimulation which
may make a patient comfortable in receiving electrical mode of
intervention.

The strong evidence of modulated TENS for pain reduction in
post surgical pain suggesting that even modulated frequency
TENS is a successful option treatment strategy The aftereffects
of various examinations of this study confirming that modu-
lated frequency is a superior helpful device like low frequency
TENS. In addition, these outcomes likewise firmly relate with
past study aftereffects of Rakel B, et al. 11 who has done a
study on modulated TENS in the administration of post stom-
ach surgical pain. This present study results have shown the
further evidence for the therapeutic effectiveness of low Fre-
quency TENS in reducing pain.

Hansson and Ekblom, found no distinction between low (2-
Hz) and high frequency (100-Hz) electrical stimulation. None-
theless, the alternating example of low-and high-frequency
stimulation might offer favorable position over either frequen-
cy alone. Moreover, a study by Gary J Ordog and this study
demonstrate the effectiveness of TENS in the management of
pain and may be indicated for patients who cannot be given
medicines.

**CONCLUSION:** The current RCT results show that modulat-
ed TENS is effective in reducing post-abdominal incision pain
and pulmonary dysfunction as compared to the high TENS
and control group. This study shows that frequency-modu-
lated TENS and low TENS significantly reduces post-operative
incision pain as compared with the placebo group following
abdominal surgery. Due to the absence of complications and
adverse effects of TENS compared to conventional opioids and
non-opioid analgesics, it is suggested that TENS is safe and
may be a reliable therapeutic procedure that can be used as
an adjunctive to relieve postoperative pain.

**REFERENCES**
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