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# Low-Rate TENS as an Effective Treatment for Pelvic Pain - A Retrospective Case Report

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## Abstract

**Purpose:** Chronic pelvic pain (CPP) affects 27% of the world's female population. The purpose of this case report was to investigate the use of low-rate transcutaneous electrical nerve stimulation (TENS) for pain relief in a woman with CPP. Few studies have investigated the effects of low-rate TENS on gynecological-related pelvic pain. **Methods:** A 21-year-old woman presented with a six-month history of pelvic pain and decreased quality of life. Persistent pain led the patient to seek physical therapy treatment. Single-channel low-rate TENS (five hertz frequency, 250 microseconds phase duration) was provided for 30 minutes daily at the maximum tolerated intensity, for ten weeks. Two-inch electrodes were placed on the patient's low back bilaterally, one inch from the second lumbar spinous process. Pain intensity was assessed on the verbal numeric rating scale (VNRS) with a range of 0-10/10. **Results:** Pain levels began at 5/10 and were reduced to 0-1/10 with the application of TENS. Pain reduction lasted up to 24 hours after each TENS treatment. The pain completely resolved after ten weeks of low-rate TENS use. The patient remained pain-free with follow-ups at four-month intervals with the most recent follow-up 16 months after cessation of the TENS treatments. **Conclusion:** This retrospective case report found that low-rate TENS was effective in resolving CPP in a 21-year-old woman. The results of this study indicate that low-rate TENS may be a viable option to consider for treating CPP in women and may be used in addition to other treatments or services provided by allied health professionals.



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# Low-Rate TENS as an Effective Treatment for Pelvic Pain: A Retrospective Case Report

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**ABSTRACT**
**Purpose:** Chronic pelvic pain (CPP) affects 27% of the world's female population. The purpose of this case report was to investigate the use of low-rate transcutaneous electrical nerve stimulation (TENS) for pain relief in a woman with CPP. Few studies have investigated the effects of low-rate TENS on gynecological-related pelvic pain. **Methods:** A 21-year-old woman presented with a six-month history of pelvic pain and decreased quality of life. Persistent pain led the patient to seek physical therapy treatment. Single-channel low-rate TENS (five hertz frequency, 250 microseconds phase duration) was provided for 30 minutes daily at the maximum tolerated intensity, for ten weeks. Two-inch electrodes were placed on the patient's low back bilaterally, one inch from the second lumbar spinous process. Pain intensity was assessed on the verbal numeric rating scale (VNRS) with a range of 0-10/10. **Results:** Pain levels began at 5/10 and were reduced to 0-1/10 with the application of TENS. Pain reduction lasted up to 24 hours after each TENS treatment. The pain completely resolved after ten weeks of low-rate TENS use. The patient remained pain-free with follow-ups at four-month intervals with the most recent follow-up 16 months after cessation of the TENS treatments. **Conclusion:** This retrospective case report found that low-rate TENS was effective in resolving CPP in a 21-year-old woman. The results of this study indicate that low-rate TENS may be a viable option to consider for treating CPP in women and may be used in addition to other treatments or services provided by allied health professionals.

**Keywords:** chronic pelvic pain, transcutaneous electrical nerve stimulation (TENS), low-rate TENS, case report

## INTRODUCTION

Chronic pelvic pain (CPP) is a common problem that negatively impacts a woman's quality of life.[1-3] The global prevalence of CPP is 6 to 27%.[4] Chronic pelvic pain is described as non-cyclical pelvic or lower abdominal pain present for six or more months, leading to functional changes and medical intervention.[5] Causes of CPP include ovarian cysts, endometriosis, pelvic inflammatory disease, pelvic congestion syndrome, irritable bowel syndrome, and bladder hypersensitivity.[1]. The exact pathophysiology of CPP is unknown, but researchers propose there are multiple factors involved including immunological, psychological, neurological, and endocrine.[3]

Transcutaneous electrical nerve stimulation (TENS) is a viable source of pain relief. Pain medication consumption is reduced with TENS usage.[6] High-rate (conventional) TENS (80-150 Hz, 50-80 microseconds) at sensory level stimulation results in brief pain relief by the gate theory.[7,8] Low-rate TENS (2-10 Hz,150-300 microseconds) at motor level stimulation above pain threshold causes a diffuse noxious inhibitory mechanism phenomenon, which stimulates endogenous opioids and provides longer analgesic results than high-rate TENS.[7,9] This "extra-segmental" mechanism releases the endogenous opioids during stimulation of the motor and sensory nerve fibers and activates the descending inhibitory pathway for pain reduction including the periaqueductal gray matter and the raphe nucleus.[8,10] Recent studies have found analgesia lasting 10.5 hours following a 30-minute application of low-rate TENS.[7] Low-rate TENS is less effective if combined with opioid medication since it involves the same endogenous system.[9,11] TENS is an inexpensive (costing under $30) and portable treatment providing pain relief with minimal to no adverse side effects, provided the patient is not pregnant, or does not have a pacemaker/defibrillator.[6,7,12-14] The long-lasting analgesic effects and safety of low-rate TENS suggest that it would be an appropriate treatment option for CPP.

Low-rate TENS has been shown to be effective for pain reduction for various conditions. A randomized controlled trial that included a group of individuals with chronic low back pain discovered that low-rate TENS led to a significant reduction in pain ($p = .003$). This study compared a 15-minute treatment with a 30-minute treatment of low-rate TENS and found similar long-lasting pain relief from a 15-minute treatment as compared to a 30-minute treatment.[7] A double-blind, placebo-controlled trial on participants diagnosed with subacromial impingement of the shoulder, elicited a painful stimulus and used functional magnetic resonance imaging (fMRI) to evaluate the effects of a single low-rate TENS treatment session on the pain. A significant analgesic effect was found in the TENS group as compared to the placebo group. There was a significant correlation between the visual analog scale rating and the pain modulation center activity in the brain for the low-rate TENS group, with no significance in the placebo group.[15]

Several studies have investigated high-rate TENS for dysmenorrhea. A study found that using high-rate TENS during and three days before the commencement of the menstrual cycle was effective in reducing pain with a significant difference in the group that received TENS before their menstrual cycle started and with the group who received TENS during their cycle ($p = 0.001$).[16] Another study found that high-rate TENS was effective for significantly reducing menstrual-related pain ($p = .000$) in adolescent females. There was also a significant reduction in the use of concurrent analgesics ($p = < .01$) as compared to the placebo group, which prevented potential negative effects of pain medications.[6] Several other research studies concluded that high-rate TENS was effective in pain reduction in women with dysmenorrhea.[13,17-20]

Few studies have investigated TENS and CPP. One study analyzed the effects of high-rate TENS use on women with CPP. Participants were divided into four groups including low- (<25 hertz), medium- (25-75 hertz), and high- (75-100 hertz) rate TENS, and a placebo group. All active TENS groups were instructed to use the maximally tolerated intensity. The results showed that all active TENS groups had a significant pain reduction ($p = .0001$), whereas the placebo group had no reduction in pain. This study concluded that high-rate TENS (75-100 hertz) had the maximum pain-relieving effect.[21] A scoping review on TENS and pelvic pain concluded that low-rate TENS increases circulation when set to an intensity that produces motor level stimulation.[8] Since hypoxia is related to CPP, increasing circulation may contribute to the alleviation of pain.[8] The authors concluded that treatment for CPP is multifaceted with TENS being only one of the many components of the rehabilitation process.[8]

The purpose of this case report was to investigate the use of low-rate TENS for pain relief in a woman with CPP.

## CASE PRESENTATION

### Case Description

This retrospective case report was performed on a 21-year-old woman receiving pro-bono therapy on a university campus with a six-month history of consistent bilateral lower abdominal/pelvic pain. The medical history and presentation included dysmenorrhea, polycystic ovarian syndrome (PCOS), and a period of emotional stress six months before the pain onset. Pelvic magnetic resonance imaging (MRI) showed PCOS bilaterally, with a moderate amount of pelvic free fluid, and a normal-appearing uterus. Computed tomography (CT) of the abdomen and pelvis with contrast showed nonspecific free fluid in the pelvis and adnexa. An abdominal ultrasound was performed with no acute abnormalities noted, however, the ultrasound was epigastric and did not include

the pelvic region. Medical interventions that were discontinued before commencing PT included oral contraceptives, nonsteroidal anti-inflammatory drugs (NSAIDs), and a heating pad. The patient discontinued the use of oral contraceptives due to multiple negative effects, including weight gain, abdominal bloating, emotional lability, and no reduction in pain. The NSAIDS and heating pad were only temporarily helpful. Persistent daily pain led to a decreased quality of life and caused the patient to seek PT for pain relief.

The patient consented to PT examination and treatment and understood the treatment could be stopped at any time. Examination, evaluation, and treatment were completed by a PT and a PT student based on the chief complaint of lower abdominal/pelvic pain associated with gynecologic pathologies. The verbal numeric rating scale (VNRS) was used to measure pain levels. The VNRS measures pain on a scale of 0-10, with 0 being no pain and 10 being the worst pain possible.[22] Musculoskeletal examination results were within functional to normal limits. Functional testing revealed sharp lower abdominal/pelvic pain (VNRS 5/10) during sit-to-stand transfers. Abdominal assessment and palpation revealed moderate fascial restrictions in the lower abdominal quadrant and negative abdominal visceral tests. The patient's physician approved TENS use. The patient had no contraindications or precautions for the use of TENS.

**Therapeutic Interventions**

Low-rate TENS was chosen as the treatment method due to its activation of the endogenous pain system.[7] The patient and a companion were trained on the proper safety, placement, and parameters for low-rate TENS. Electrodes were applied to the patient by the trained companion. Treatment was delivered at the patient's residence for daily, 30-minute sessions and was discontinued after ten weeks due to the resolution of pain. Two-inch electrodes were placed on the patient's low back bilaterally, one inch from the second lumbar spinous process to access the lumbar sympathetic chain (see Figure 1 for ideal placement).[23,24] The two electrodes were connected to a single-channel on the portable TENS 7000 Digital Unit.[12] The parameters were 250 microseconds, 5 hertz, "Continuous" and "Normal" modes, for a 30-minute treatment time (see Table 1).

**Figure 1.** Ideal Low-rate TENS Electrode Placement

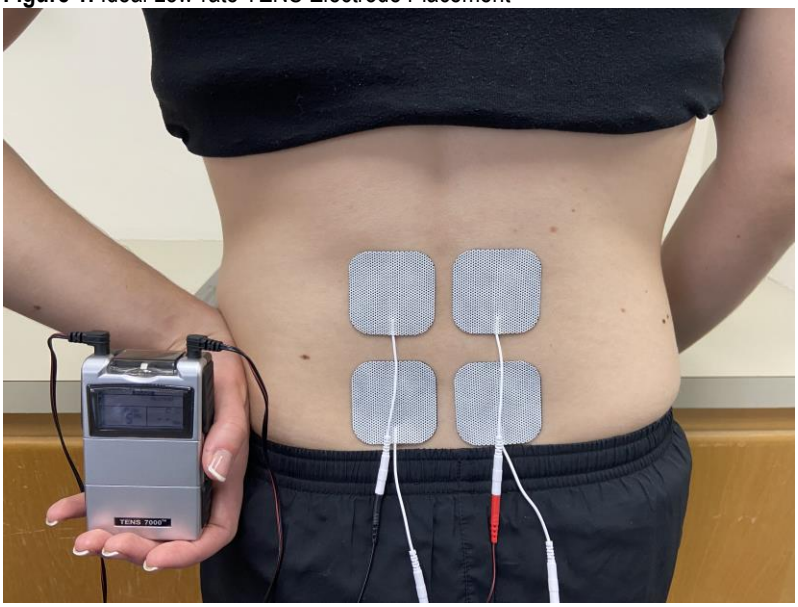


**Table 1.** Table 1 Low-rate TENS Intervention

| | |
|---|---|
| **Unit:** | "TENS 7000 Digital TENS Unit" |
| **Electrodes:** | Two-inch electrodes |
| **Electrode Placement:** | Bilaterally, one inch lateral to the second lumbar spinous process |
| **Time/Frequency:** | 30 minutes, daily |

| | |
|---|---|
| **Unit:** | "TENS 7000 Digital TENS Unit" |
| **Phase/Pulse Duration:** | 250 microseconds |
| **Frequency (Rate):** | 5 hertz |
| **Intensity:** | Maximum tolerated (4/8 for this patient) |
| **Modes:** | "Continuous" and "Normal" |

The treatment was applied between 7-9 PM in conjunction with the patient's highest daily pain level. The patient's initial maximum tolerated intensity was level 3/8 and increased to level 4/8 by the end of the ten weeks of TENS use. Treatment was missed once every two weeks for various reasons including busy schedules and forgetfulness. Otherwise, the patient adhered to the daily TENS treatment consistently and tolerated the treatments well. Tolerance and adherence were assessed verbally by checking in with the patient before and after each session. The patient was offered other PT interventions including manual therapy to address the lower abdominal quadrant fascial restrictions. However, the patient declined and was only interested in the TENS treatment.

## RESULTS

The patient reported a decrease in pain from 5/10 to 0-1/10 (VNRS) within one hour of each 30-minute TENS treatment. Pain reduction lasted up to 24 hours after treatment. The patient reported less aggravation of pain throughout the day and a better quality of life following the low-rate TENS intervention. After ten weeks of low-rate TENS, the patient's pain was resolved to 0/10. The patient remained pain-free with follow-ups at four-month intervals with the most recent follow-up 16 months after cessation of the TENS treatments.

### Follow-up diagnostics

Two months after the resolution of the pain, the patient's gynecologist performed a diagnostic abdominal laparoscopy to assess for endometriosis or other causes of the previous pelvic pain. The results included a normal appearance of the uterus, fallopian tubes, ovaries, liver, and appendix. No endometriosis was present.

## DISCUSSION

This retrospective case report demonstrated the complete resolution of pain in a 21-year-old woman with CPP following ten weeks of daily use of an inexpensive, safe, and easy-to-use low-rate TENS intervention. While this patient had a history of dysmenorrhea, it was not the primary underlying cause of this patient's pain. The daily, constant lower abdominal/pelvic pain this patient experienced for the six months before initiating TENS treatment, was not only in conjunction with menstruation. Before commencing PT, the patient tried oral contraceptives and NSAIDs, which proved to be inadequate for reducing pain. Several diagnostic tests were performed including an abdominal ultrasound; however, a pelvic ultrasound was not performed. A pelvic ultrasound is commonly used to identify local organ and tissue abnormalities and has a prominent role in the medical investigation process for patients with CPP, and may have provided more specific diagnostic information in this case.[1] Low-rate TENS was chosen for this patient due to the long-lasting analgesic effect of releasing endogenous opioids.[7] Research has demonstrated pain relief lasting up to 10.5 hours with low-rate TENS.[7] However, in this study, the patient experienced up to 24 hours of pain relief. Low-rate TENS benefited this patient by complete alleviation of the CPP.

Several strengths of this study were evident. The patient was motivated and compliant with the daily TENS intervention, only missing a few treatment days over ten weeks. A companion was available, willing, and able to apply the electrodes to the patient's low back, which likely increased the accuracy of the application. The low-rate TENS protocol was simple and easy for the patient and companion to learn and perform correctly. TENS was an affordable treatment option.[6] Using low-rate TENS instead of NSAIDs effectively relieved pain without the harmful side effects such as gastrointestinal irritation or ulcers that may be associated with using NSAIDs.[25] There were no negative side effects with low-rate TENS.[13] Complete and long-lasting pain relief was achieved daily, despite the pain modulation challenges associated with CPP.[26]

### Limitations

There were limitations to this study. This patient had a lower tolerance for a higher intensity of TENS. The intensity was kept at a comfortable level and gradually increased according to the patient's tolerance. The patient was encouraged to increase intensity throughout the intervention but only progressed from level 3/8 to level 4/8. If the patient had been able to utilize higher TENS

intensity levels, it is feasible that the pain resolution may have occurred sooner than 10 weeks. In retrospect, a Fear Avoidance Beliefs Questionnaire would have been ideal for the patient to complete before initiating and after completing TENS treatment to assess fear as a potential contributing factor to treatment outcomes and quality of life. In addition, single-channel electrode placement was used on the patient. A two-channel setup was ideal and may have resulted in earlier pain resolution (see Figure 1 for ideal electrode placement). The TENS treatment protocol was performed on only one individual; therefore, the results could not be generalized to all patient populations.

The short-term psychological stress the patient experienced six months prior to initiating low-rate TENS treatment may have contributed to the chronic pain. Current understanding of pain science claims that emotional factors may affect pain modulation and negative emotions may increase sensitivity to pain.[27] However, the patient utilized stress relieving methods to mitigate psychological stress, including healthy eating, regular exercise, and a strong emotional support system of family and friends. The patient utilized these stress-relieving methods before, during, and after TENS treatment. There was no pain resolution until after initiating TENS treatment, therefore, it is unlikely that psychological stress played a major role in this patient's pain.

Further studies, including randomized controlled trials with large sample sizes, are needed to fully evaluate the effects of low-rate TENS on CPP. Additional studies are recommended to compare low-rate TENS alone versus low-rate TENS in conjunction with other PT interventions to guide decision-making for future CPP treatment.

## CONCLUSION

This retrospective case report found that low-rate TENS reduced pain for up to 24 hours in a 21-year-old woman with CPP, which completely resolved after ten weeks of treatment. Low-rate TENS is an affordable, effective, and safe alternative to other methods of pain relief. Research on CPP relief using low-rate TENS is minimal. Further research is warranted, including large-scale randomized controlled trials to examine the effectiveness of low-rate TENS on CPP in younger and adult women. The results of this case report indicate that low-rate TENS may be a viable option for treating CPP in women and may be used in addition to other treatments or services provided by allied health professionals.

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**Patient Consent**
Written informed consent was obtained from the patient and the image model for publication of this case report and the accompanying image.

**Conflict of Interest Statement**
The authors of this study declare that they had no conflict of interest regarding the publication and production of this case report.

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## APPENDIX A

***Patient Perspective***

I began receiving treatment for my chronic abdominal pain via transcutaneous electrical nerve stimulation (TENS). My trained companion placed electrodes on my back for 30 minutes of TENS daily which allowed me to experience an absence of pain for 24 hours following the treatment. On the days that I missed treatment, the pain in my lower abdomen would return, significantly impacting my quality of life. After months of continuous treatment, I found that I no longer needed to apply the TENS unit to relieve my pain, it was gone completely! I am thankful to the therapists who searched for solutions to help relieve my pain and have helped my quality of life drastically improve.