

# The Effect of Transcutaneous Electrical Nerve Stimulation for Pain Relief During Extracorporeal Shock-Wave Lithotripsy Procedure

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## ■ ABSTRACT:

The purpose of this study was to investigate the effect of transcutaneous electrical nerve stimulation (TENS) for pain relief during extracorporeal shock-wave lithotripsy (ESWL) procedure. An experimental study with repeated measures design was used in this study. Fifty patients aged 20-65 years receiving ESWL treatment were used for this convenience sample. Two applications were used for each patient: one involving administration of TENS instrument for ESWL treatment and the other without TENS. For effective stimulation, 2 stimulator electrodes were placed paravertebrally at L1 and 2 near the lithotripter shock tube before ESWL. Blood pressure, heart rate, pain intensity, analgesic use, and side effects were measured every 10 minutes during the procedure and after the end of ESWL. Results showed that TENS application decreased patients' intensity of pain and amount of analgesic requests and, related to that, decreased the incidence of side effects and increased patients' satisfaction during ESWL. TENS application is recommended as a pain-relieving technique during ESWL.

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Extracorporeal shock-wave lithotripsy (ESWL) has revolutionized the treatment of urinary stone disease because of its simplicity, efficacy, and minimal morbidity (Bal & Hatipoglu, 2002; Reichelt, Zermann, Wunderlich, Janitzky, & Schubert, 1999). Researchers have revealed that the ESWL procedure causes pain, and many pharmacologic methods are used to relieve the pain (Chin, Tay, Ng, Lim, & Chang, 1997; Ozcan, Yilmaz, Buyukocak, Basar, & Apan, 2002; Reichelt,

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Zermann, Wunderlich, Janitzky, & Schubert, 1999; Unsal, Cimentepe, Bozoklu, & Saglam, 2001). Two different causes may result in pain during the ESWL procedure. The first is the exogenous pain resulted from the trauma caused on pain receptors in skin by the shock waves moving through the skin and muscles toward the kidneys. The second is the visceral pain, which is the acute organ pain caused by distension of renal capsule around the affected area and the multiplied intrarenal pressure. In addition to this, it has been stated that the effect of shock waves on the twelfth costa and the movements of the stone fragments during the ESWL procedure contribute to the pain (Torrecilla-Ortiz, Rodríguez-Blanco, Díaz-Vicente, González-Satué, Marco-Pérez, Trilla-Herrera, ... Mila, 2000; Yilmaz, Batislam, Tuglu, Basar, Boratav, & Basar 2002). Moreover, besides the factors related to patients, shock wave generation and focusing, structure of the shock wave and the highest peak pressure, size of the focal zone, and area of shock wave entry at the skin are the physical factors contributing to cause pain (Ayyildiz, Nuhoglu, Huri, Gurdal, & Germiyuanoglu 2004; Chin et al., 1997; Resim, Gumusalan, Ekerbicer, Sahin, & Sahinkanat, 2005).

Inadequate pain control in patients can lead to many complications, reduction of participation in treatment and care, patient dissatisfaction, longer hospitalization, and increased costs (Allred, Byers, & Sole, 2010; Valente, 2006). During ESWL, cooperation of the patient to break up the stone easily and eliminating pain in the patient are important in increasing the effectiveness of ESWL. General anesthesia, spinal-epidural anesthesia, local anesthesia/analgesic agents, acupuncture, opioid analgesics, analgesic antiinflammatories, and sedatives have been used as methods and drugs for pain relief during ESWL (Ayyildiz et al., 2004; Turna, & Nazli, 2005).

Intravenous sedative analgesics, such as fentanyl, alfentanil, ketamine, and midazolam, are widely used in ESWL, which is a day case procedure, because they have especially short-term effects (Kararmaz, Kaya, Karaman, & Turhanoglu 2004; Resim et al., 2005; Unsal et al., 2001). Opioids seem to be a favorable analgesic during ESWL; however, opioid administration may be problematic, especially at high doses, because ESWL is generally carried out in an outpatient setting. Therefore, different techniques have been tried for decreasing the dosage of opioids (Ozcan et al., 2002).

Nurses spend more time with patients experiencing pain than any other health care professional and are therefore in an ideal position to consider other pain-relieving strategies to complement the analgesics currently used (Dunn, 2004). Although there is no

standard method that can be applied to all patients' pain control, pain management should begin with a preventive approach to pain, and both pharmacologic and nonpharmacologic methods should be used together for the most effective pain control (Allred et al., 2010). In pain control, nonpharmacologic pain control methods can be used to increase the effect of analgesics, in case of insufficient effect of analgesics, or when analgesics can not be used. Among nonpharmacologic pain control methods, transcutaneous electrical nerve stimulation (TENS), application of hot and/or cold compresses, exercises, positioning, and massage are physical techniques commonly used in pain control, and relaxation, distraction, and hypnosis are cognitive/behavioral techniques (Arslan & Celebioglu, 2004). The nonpharmacologic approach to pain management includes a wide variety of techniques that not only address the physical sensations of pain, but also attempt to prevent suffering by enhancing the psychoemotional and spiritual components of care (Yavuz, 2006).

TENS is a method for the electrical stimulation of nerves through electrodes applied to the skin (Ainsworth, Budelier, Clinesmith, Fiedler, Landstrom, Leeper, ... Sluka, 2006; Sluka & Walsh, 2003; Yavuz, 2006). Pain relief through skin stimulation methods is based on the Gate Control Theory or increase in levels of endorphin, which is the natural morphine of the body. Skin-stimulation techniques have some advantages, such as reducing the intensity of pain or sometimes relieving it, alleviating muscle spasm, increasing physical activity, creating general relaxation, reducing anxiety, and strengthening the patient-nurse relation (Kocaman, 1994). Therefore, use of nonpharmacologic methods in pain management may be more effective and beneficial, and pain could be managed more effectively through combination of pharmacologic and nonpharmacologic methods (McCaffery, 2002).

There are few research studies about the nonpharmacologic methods for controlling the pain during ESWL procedures. The results on effectiveness of these methods are contradictory and controversial. Therefore, further investigations are necessary to detect the effects of TENS for pain relief during shock-wave lithotripsy procedures. The purpose of the present study was to investigate the effect of TENS for pain relief during the ESWL procedure.

## METHODS

### Study Design

An experimental repeated-measures design and self-controlled design with patients acting as their own

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