Transcutaneous electrical nerve stimulation (TENS) has been used to diminish postoperative pain\(^1\) and many forms of chronic pain\(^2\) with reportedly good results. There have been few reports of the use of TENS during childbirth in the physical therapy literature. Several European studies have reported good effects of TENS in the reduction of pain associated with labor and delivery.\(^3\)\(^4\) Because TENS is a noninvasive analgesic procedure and no maternal or fetal side effects have been encountered,\(^5\)\(^6\) a firsthand evaluation of this modality seemed appropriate. In this case study, we portray how TENS was used with one patient to prompt physical therapists and other health care providers to develop protocols and conduct research for use of this modality.

Melzack and Wall's gate control theory of pain provides one theoretical foundation for TENS.\(^7\) According to this hypothesis, electrical stimulation of the large, afferent, high velocity fibers prevents the smaller, slow velocity, pain-carrying A delta and C fibers from transmitting pain signals to the higher brain centers. In keeping with Melzack's theory, high frequency, low intensity TENS blocks the transmission of nociceptive stimuli to the spinal cord.\(^8\)

Labor and delivery are divided into three stages. Stage one begins with contractions of the uterus that efface and dilate the cervix and that cause pain receptors to be activated.\(^9\)\(^10\) The evoked impulses are transmitted by the afferent fibers through the uterine, pelvic, and hypogastric plexes and reach the spinal cord through dorsal roots S2-4.\(^9\)\(^10\) The second stage of labor begins; the contractions of the uterus and voluntary contractions of the abdominal muscles push the baby through the vaginal canal. Pain receptors are activated by dilation of the vagina, pelvic floor, vulva, and perineum. The evoked impulses are transmitted by afferent fibers through the pudendal nerves and reach the spinal cord through dorsal roots S2-4.\(^9\)\(^10\) The third stage of labor is the delivery of the baby and the placenta.

**MATERIALS AND METHODS**

A Neuromod Selectra* TENS unit with dual channel output was used. As photographed by Robson,\(^4\) two EPC† and two Stemmen‡ disposable electrodes were applied on the paraspinal muscles from T10-L1 and at S2 and S3, respectively. The thoracic-lumbar electrodes were controlled by channel I, and channel II controlled the sacral electrodes. During the trial, the unit was kept in a high frequency continuous mode and a spike wave form was used.

**Patient Data**

The patient was a 29-year-old woman; this was her first pregnancy and the gestation period was 42 weeks. The pregnancy had been uncomplicated except for the prolonged gestation, mild pregnancy-induced hypertension with edema, proteinuria, and a 16-kg (35 lb) weight gain. Her preparation for labor and delivery included attending a prepared childbirth class with instruction in Lamaze breathing and relaxation techniques and practice with the Neuromod Selectra TENS unit. Before childbirth, she also received instruction from one of us (D.L.K.) in the use of the Neuromod Selectra TENS unit in conjunction with Lamaze breathing and relaxation.

**TREATMENT AND RESULTS**

The patient had spontaneous rupture of the amniotic membranes four hours before admission to the hospital without spontaneous contractions. Labor was induced by intravenous oxytocin drip, and continuous external fetal monitoring was initiated through transabdominal ultrasound with a transabdominal tocodynamometer to record uterine contractions. No other medication, except for local anesthetic for an episiotomy, was administered during labor and delivery.

The TENS unit was started after 2.5 hours of labor when contractions were two minutes apart and uncomfortable for the patient. The pulses per second were set at 85, and the intensity on channel I was adjusted to produce a comfortable "buzzing" sensation (Table). During uterine contractions, the intensity was increased to a level where a strong muscle contraction was achieved under the thoracic electrodes. Each uterine contraction could be felt by the patient as a strong pulling sensation in the lower abdominal area. The muscle contraction provided by the TENS unit was described as a deep pressure or massage that helped diminish the discomfort. The perceived strength of the uterine contraction was greater than that provided by deep pressure or massage that helped diminish the discomfort.

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\( ^1\) Codman and Shurtleff, Inc, Pacella Park Dr, Randolph, MA 02368.  
\( ^2\) Medtronic Inc, 3055 Old Highway Eight, Minneapolis, MN 55440.  
\( ^3\) Stemmen Laboratory, Inc, 1850 Whittier Ave, Costa Mesa, CA 92627.
when the TENS unit was turned off, and the patient elected to continue using the TENS unit.

Channel II and the sacral electrodes were also tried. The smaller area of the Stemmen electrode, however, produced a sharp, stinging sensation. Because this was uncomfortable for the patient, the use of this channel was discontinued. The EPC electrodes were not applied to the sacral area because the patient was able to maintain a comfortable, relaxed state during each contraction by using only channel I.

The TENS unit was used during two hours of active labor: the early transition phase (2–8 cm dilation) while the patient sat in a rocking chair and the late transition phase (8–10 cm dilation) while the patient was in a side-lying position in bed. Pain was kept at a tolerable level during both stages by the TENS-produced muscle contraction, total body relaxation, and breathing techniques. During the early transition stage, the patient herself could easily adjust the intensity of the unit according to the strength of the uterine contraction. The intensity was decreased to the lowest comfortable level between contractions to minimize accommodation to the stimulation (Table). During the late transition stage, when uterine contractions became very strong and close together, increased patient concentration was required and she no longer could control the TENS intensity herself. Instead, the therapist adjusted the intensity by observing the behavior of the patient and uterine contractions recorded on the fetal monitor.

As labor progressed to the second stage (full dilation of the cervix), the uterine contractions became farther apart and less intense. During this stage, the patient had to push effectively with the abdominal muscles and, therefore, needed to concentrate on and experience the full strength of the uterine contraction. The muscle contraction produced by the TENS unit was too distracting to allow this concentration; therefore, the TENS unit was discontinued after 2.5 hours. Contrary to some reports that the TENS unit disrupted the fetal ECG (Table), when the unit was turned off, the patient reported that TENS was more comfortable using TENS than when the unit was turned off. Lamaze breathing and relaxation is an accepted practice during most labor and delivery. Therefore, we chose to evaluate the effectiveness of TENS in addition to these pain reduction measures. The use of a subjective rating scale during labor and delivery would be helpful to evaluate pain control in future studies. The favorable results of this case study and the benign nature of this modality suggest that TENS could effectively complement other methods of pain control for childbirth. Controlled studies with large numbers of patients, however, are needed to evaluate possible long-term fetal effects and to develop protocols for the use of TENS during labor and delivery. Obstetrical physicians will delay general acceptance of this modality until appropriate studies have proved its efficacy and safety.

Acknowledgment. The authors wish to thank Mary Hutchinson, RN, for her assistance in this case study.

REFERENCES


Table

<table>
<thead>
<tr>
<th>Stimulation Factors</th>
<th>Time Since Application of TENS Unit* (hr)</th>
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<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Pulse rate (pps)</td>
<td>85</td>
</tr>
<tr>
<td>Intensity between uterine contractions (% output)</td>
<td>25</td>
</tr>
<tr>
<td>Intensity during uterine contractions (% output)</td>
<td>38</td>
</tr>
</tbody>
</table>

* The TENS unit was applied 2.5 hours after induction of labor.

The TENS could then be started in early labor and the intensity controlled by the patient through the active phase of stage one. In our case study, a health professional had to control the intensity during the transition phase (8–10 cm). A physical therapist or a labor room nurse who has been educated in the use of this modality can provide this service or supervise the patient’s labor coach, who can control the unit if necessary. Physical therapists may also wish to instruct patients in TENS use in childbirth education classes.

According to the literature, the effectiveness of TENS for pain control in labor is equivocal.1,4 The patient in this case report, however, was more comfortable using TENS than when the unit was turned off. Lamaze breathing and relaxation is an accepted practice during most labor and delivery. Therefore, we chose to evaluate the effectiveness of TENS in addition to these pain reduction measures. The use of a subjective rating scale during labor and delivery would be helpful to evaluate pain control in future studies. The favorable results of this case study and the benign nature of this modality suggest that TENS could effectively complement other methods of pain control for childbirth. Controlled studies with large numbers of patients, however, are needed to evaluate possible long-term fetal effects and to develop protocols for the use of TENS during labor and delivery. Obstetrical physicians will delay general acceptance of this modality until appropriate studies have proved its efficacy and safety.