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ORIGINAL ARTICLE

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Pain relief in labour by transcutaneous electrical nerve stimulation (TENS)

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Abstract For several years Transcutaneous Electrical Nerve Stimulation (TENS) has been used in the management of chronic and acute pain. The aim of this trial was to determine its effectiveness in providing pain relief during labour as well as its influence on the incidence of requests for epidural analgesia. The experimental group (receiving TENS by a burst – conventional obstetric TENS-apparatus) and the control population (not receiving TENS) consisted of 24 and 35 women respectively. In the experimental group the TENS application was switched off for a period of 15 min. The 24 women were asked to point out the intensity of their pain on a visual analogue scale before, during and after this temporary interruption. Two days postpartum the parturient's satisfaction was evaluated by two questions, a procedure which revealed that 96% degree of satisfaction. The incidence of epidural analgesia in the experimental group was compared to the control-group. During TENS application the pain scores were significantly lower ($p<0.0001$), but no statistically significant difference in incidence of epidural analgesia was found between the experimental group and the control group.

Keywords Electric stimulation · Labour · Pain · Physiotherapy · TENS · Analgesia

Introduction

Pain relief in labour is a very important area in medicine and rehabilitation as it concerns thousands of women. Methods of pain relief have allways varied. In recent years an obvious trend could be distinguished towards a strong increase in the use of analgesia (e. g. nitrous oxide, pethidine, spinal and epidural anesthesia). On the other hand there appears to be a simultaneous desire to avoid these conventional and invasive types of analgesia in order to promote and experience a natural childbirth. It was against this background that Transcutaneous Electrical Nerve Stimulation (TENS) has been introduced in some hospitals in Great-Brittain and the United States several years ago as a painrelieving method during labour. TENS is battery-powered unit which sends electrical impulses through electrodes placed on or near the painful site. One theory on how TENS works is that it blocks pain in the spinal cord. Another is that stimulation with TENS causes natural pain relieving substances to be released, thereby reducing pain. As TENS had proven to be useful in the treatment of various types of chronic and acute pain, it seemed to offer many advantages even in obstetrics. As most important benefits of TENS during labour one could mention the facts that it is non-invasive, safe, easy to apply and remove, it has no side-effects, it does not interfere with consiousness, there is no point in labour when it would be "too late" to apply TENS, the mother remains alert, mobile and is in control. Whereas conventional modes of analgesia are invasive, prevent mobility and affect the baby as well as the mother.

Although the mechanism of pain during labour is not yet known exactly, there are some valid hypotheses. As most important factors we quote the dilatation of the cervix [1, 15, 17] and the contractions of the uterus. During each contraction blood vessels in the uterine wall are compressed, causing ischaemia of the myometrium during strong contractions [16, 17]. This pain can be compared to the myocardial pain which occurs during decreased coronary blood flow. The individual pain perception also depends on the intensity and duration of the contractions, the speed with which the cervix dilates, the physical condition of the woman [17] and a complex of psychological factors due to previous experiences, present expectations, cultural factors, fear and panic [10, 17]. Certainly during labour these psychological factors are of paramount importance.

The pain experienced during uterine contractions can be described as visceral pain: pain referred to the in-

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volved dermatomes, i. e. thoracic 10–12 and sacral 2–4. The pain is primarily located in the suprapubic and sacral areas. As the intensity of the contractions increases the pain expands towards the regions above and below the mentioned zones. Empirism however has shown that the localisation of the pain varies considerably from woman to woman.

Relating to the type of pain fibres involved during labour some authors [1, 19, 22] mention only type IV (C)-fibres being stimulated, whereas others report stimulation of both type III (Aδd) and type IV (C) fibres. The nature of the involved pain conducting fibres will determine the choice of TENS-mode which has to be used. The combination of parameters in conventional TENS provides stimulation of the group II (Aβb) fibres, which causes analgesia primarily by spinal segmental mechanisms which inhibit the type IV (C) fibres and type III (Aδd) fibres. These stimulation parameters are: low intensity, high frequency (above 100 Hz) with a pulse width of short duration (50–80 μs). Burst TENS (a mixture of conventional and acupuncture-like TENS) comprises a baseline low frequency current (1–4 Hz) together with high frequency trains (100–150 Hz). The intensity is usually high enough to produce visible muscular contractions. This mode of TENS is believed to operate primarily by stimulating group III (Aδd) nociceptive fibres, inducing a release of endogeneous opiates (for example endorphins, the body's own pain killing chemicals which bind to opioid receptors in the brain and have a potent analgesic effect) at spinal and supraspinal level. These agents inhibit the pain (especially transferred by C-fibres) through the descending pain system ; thus there is a relatively longer onset to analgesia, but the analgesia typically lasts longer compared to conventional TENS.

Both uncontrolled [1, 2, 23] and controlled [9, 12, 14, 15, 24] studies found a positive effect of TENS on pain during labour and delivery. Some authors reported that TENS specifically provided a positive influence on the low back pain which was experienced during labour [1–3, 6, 10, 11, 18, 19, 25] however have not been able to ascertain any effectiveness of TENS. Enkin et al. [8] even mentioned an increase of pain during the TENS-application.

In most of the controlled studies TENS was compared to a no-treatment group [3–5, 9, 12, 15, 18, 22, 25]. Only in two studies the efficiency of TENS was compared to other pain relieving methods, such as nitrous oxide [6, 11], pethidine and promazine [11], and lumbar epidural anaesthesia [11]. In the last study [11] however the influence of TENS on the incidence of epidural analgesia was not evaluated. In several studies [9, 12, 14, 18, 22, 25] the experimental group acted as its own control by turning the TENS-machine off during a number of contractions. Harrison et al. [10], Lee et al. [15], Nesheim [19], Tajali-Awal [24] and Thomas et al. [25] compared the effect of TENS with placebo-TENS. None of them however found a statistically significant difference between the TENS group and the placebo group.

Although some research already has been done about the pain relieving effect of TENS during labour, the available literature appears to be very conflicting and confusing, as well with regard to the used research protocols as to the results. Moreover little or no research has been executed about the influence of TENS on the incidence of requests for epidural analgesia.

Methods

Twenty-four parturients entered the experimental group. The control group consisted out of 35 pregnant women, randomely chosen when they were admitted to the hospital. All deliveries took place at the Department of Obestetrics of the University Hospital of Ghent.

All 59 parturients gave informed consent to participate in this study. All of them were enrolled in this assay based on 8 inclusion criteria:

1. voluntary informed participation to the study,
2. an initial wish to deliver without epidural analgesia,
3. vaginal childbirth,
4. foetal vertex presentation,
5. at term,
6. non-complicated pregnancy,
7. age between 20 and 40 years and
8. Dutch-speaking, capable to understand the study.

To both the experimental as the control group the principle of the visual analogue scale was amply explained. The experimental group was clearly informed about the mechanism and use of the TENS-apparatus during labour. It was also once applied antenatelly, to familiarize the woman with the pulse sensation and to determine the appropriate intensity.

In this investigation TENS was achieved by the twin-channel "Lifetime Obstetric" with a fixed internal frequency of 80 Hz and a burst frequency of 2 Hz. It is a typical example of a burst – conventional obstetric TENS-apparatus. By simple pressure on a dedicated button the woman can easilly switch from burst to conventional TENS and vice versa. The apparatus produces a modified biphasic asymmetric pulse. The duration of the pulse was fixed at 275 μs and the amplitude was variable between 0 and 50 mA. As the compact and portable apparatus was a dual channel unit, simultaneous use of two pairs of electrodes was possible. The size and weight were 70×70 mm and 85 g (9 V battery not included), respectively (Fig. 1). Disposable electrodes with a size of 32×90 mm were used. The two pairs of electrodes were placed paravertebrally, at the levels of thoracal 10 to lumbar 1 and sacral S2-S4. These are the spinal levels which ultimately receive the nociceptive information from the uterus and cervix. The afferent innervation of the corpus and fundus uteri involves the spinal levels thoracal 10–12. Pain fibres from the cervix are conducted by the sacral nerves S2-S4. These regions also correspondend with the pain localisations during labour as we have found them in literature.

For the evaluation of pain intensity during labour we used the visual analogue scale (VAS) as this is the most simple and indeed reliable form of pain measurement. The women were asked to mark the 10 cm line at the point which represented their 'pain intensity during the last contractions'. The marking took place between and not during the contractions. It was also an averaged pain level of the last couple of contractions, as one contraction is more painful than the other. Afterwards the distance between the 'no pain' end to the parturients mark was measured.

Notes were made about variables important to ascertain the two groups were matched, i. e. parity (primiparae – multiparae), the time of rupture of the membrane (early or rupture at 0–3 cm of dillatation – middle, or at 4–7 cm of dillatation – late, or at 8–10 cm), induction (induced – spontaneous), whether augmentation of the contractions was necessary (yes – no), duration of labour and the emotional status of the woman (Did she attend prenatal class? Does she react in a relaxed way to her contractions or does she panic? Is her partner present during labour?).

Fig. 1 Lifetime Obstetric

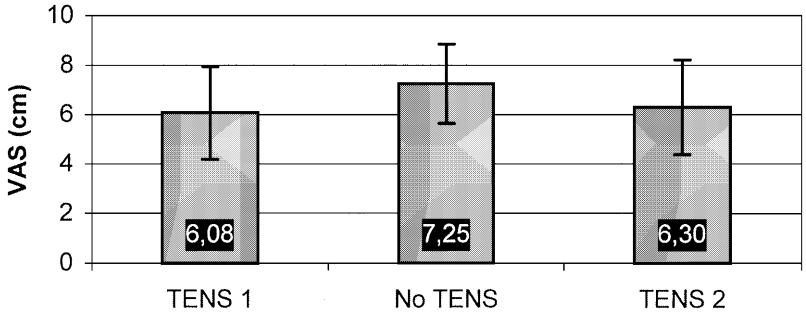
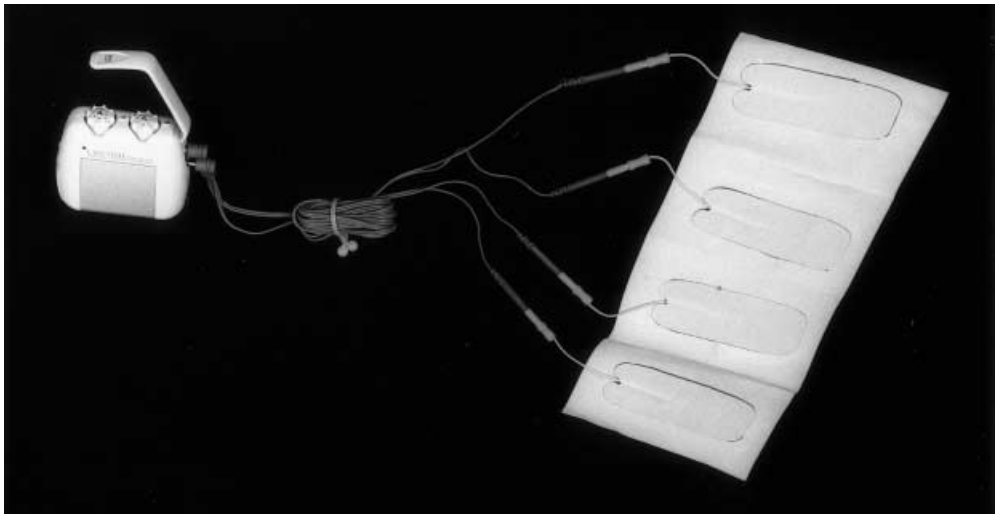


Fig. 2 Average VAS-score (±standarddeviation) in the experimental group in the respective periods of TENS-application



In the experimental group TENS was applied as soon as the woman mentioned painful contractions inflicting on a regular base. The amplitude was increased until the woman felt the pulse as a clearly perceptible, but still pleasant tingling sensation. Because of the application of TENS during the preliminary informative conversations the woman was already familiar with the pulse sensation and knew that she had to use Conventional-TENS during the contractions and burst-TENS in between. By a simple trigger switch the woman was able to switch between the two different types of TENS.

Each woman served as her own control by turning off the TENS-machine for a period of 15 min during the course of her delivery. This was done after the woman had scored her pain intensity while she was still receiving TENS. After switch-off, the contractions took place without TENS and the parturient marked her pain again. Afterwards the TENS-apparatus was turned on again and after approximately 15 min the pain was re-evaluated. In summary the woman marked her pain sensation at the VAS three times, with a period of about 15 min between each mark: the first time with TENS, then without TENS and finally again with TENS.

The TENS-application was stopped at the point of complete cervical dilatation, when the woman wanted to change to epidural analgesia or in case TENS was found irritating.

In the control group the women also had to mark the intensity of pain on the VAS at predetermined moments of labour.

Two days postpartum the women of the experimental group were asked whether or not they were satisfied by the use of TENS during delivery and whether they would like to use it again in a next child-birth even if she would have to pay a reasonable financial contribution.

Data were collected, tabulated and computerized for further analysis. The VAS-scores before, during and after the TENS-interruption were statistically processed by the Friedman two-way variance analysis. To compare the situation before and after the interruption we applied the Wilcoxon test for matched-pairs.

In order to perform a valid comparison between the experimental and the control population several factors which might cause intergroup bias were checked. The factors parity, the time of rupture of the membranes, induction, augmentation of labour and the emotional status of the woman were compared with the χ^2-test for independent samples. With regard to the duration of labour the Wilcoxon Mann-Whitney U test was used. After this a difference between the two groups in incidence of epidural analgesia was evaluated by the χ^2-test. The level of significancy was set at $p<0.05$.

Results

Figure 2 summarizes the findings where each woman in the experimental group served as her own control by scoring her pain levels at three distinctive moments. Friedman two-way analysis of variance shows a highly significant difference ($p<0.0001$) between the VAS-scores with TENS (before the temporary interruption), without TENS (during the interruption) and again with TENS (after the interruption). No statistically significant difference was seen between the moments of observation with TENS before and after the temporary interruption ($p=0.066$). This suggests that TENS produces a statistically significant decrease in pain during labour.

Assessment two day postpartum of the degree of satisfaction with TENS during labour produced the follow-

Table 1 Numeric comparison of the experimental and the control group concerning the different variables in both groups

Characteristics	Experimental group (*n*)	Control group (*n*)
Nulliparous women	19	26
Multiparous women	5	9
Rupture of membrane: early	4	4
Rupture of membrane: middle	15	24
Rupture of membrane: late	5	7
Induction	11	14
No induction	13	21
Augmentation	16	24
No augmentation	8	11
Duration of labour (mean in hrs)	10,5	9,7
Emotional status		
3 positive factors	12	21
2 positive factors	11	10
1 postive factor	1	4
Epidural analgesia	14	22
No epidural analgesia	10	13

ing results : only 4% (1 of the 24 women) was not satisfied. To the question "Would you like to use TENS in a next delivery again, even if you would have to pay a reasonable financial contribution for it?" 87.5% (21 of the 24 women) were willing to do so.

χ^2-tests demonstrated that the parturients in the experimental group and the control population were comparable in parity (p=0.903), point of membrane rupture (p=0.830), induction (p=0.859), augmentation (p=0.897), duration of labour (p=0.516) and emotional status (p=0.312). The exact numbers are depicted in Table 1. The groups were considered similar enough to allow valid direct inter-group comparison. Concerning the incidence of epidural analgesia we saw that in the experimental group 42% and in the control group 37% of the women did not need epidural analgesia, χ^2-test for independent samples, p=0.938. According to these results TENS thus has no statistically significant influence on the incidence of epidural analgesia. No patients asked for the TENS-machine to be removed or switched off.

Discussion

The design of trials for physical therapy can often be criticised as it is frequently almost impossible to conduct a fully double blind study and to use adequate placebo controls. According to Deyo et al. [7] the inclusion of a placebo group is not reliable in the case of TENS as there is no placebo equivalent of sensory stimulation. In their study they saw that more than 40% of the patients in a sham TENS group (TENS unit switched on with red light glowing but with no output) were not convinced that their TENS unit was functioning. In a preliminary research we had the same findings. Therefore a placebo control group was not included in our study. We also found a control group ethically not justified, bearing in mind the characteristics of epidural anesthesia as the only and also permanently availlable alternative for pain relief in the University Hospital of Ghent.

To assess the intensity of the labour pain we have used a visual analogue scale. Preliminary we have tried to use the McGill Pain Questionnaire which quantifies the sensory, affective and evaluative dimensions of the pain experience. Nevertheless in our study the visual analoque scale appeared to be more practical than the rating scale because of its simplicity and speed of completion. Women found it too difficult to concentrate on the questions in order to fill them in concienciously and accurate.

In some earlier investigations [1, 9, 15, 16, 19,21, 22] only Conventional TENS was applied, both during the contractions and in between. In our study we have used low frequency burst mode TENS between the contractions, as it has been suggested that low frequency, high intensity stimulation activates opioid systems. As high frequency, low intensity stimulation probably initiates a neural blockade and segmental inhibition of the pain, we have used it during the contractions. This alternation is in accordance with other studies [2, 4, 5, 6, 10, 14, 17]. By using the two modes, the benefits are combined and adaptation of the nervous system to repetitive stimuli is prevented.

The TENS-apparatus used in our study, especially designed for use during labour, had a fixed frequency (80 Hz) and pulse duration (275 µs). These values however do not correspond completely with the classical applied stimulation parameters. We notified that after a couple of hours some women said the pulse sensation diminished during the conventional mode. This accomodation of nerve fibres can be overcome by modulation in pulse frequency. Unfortunately this kind of modulated output is not possible with the twin-channel "Lifetime Obstetric". In our opinion it would be better to have the possibility to modulate the frequency and choose the optimal stimulation parameters. In our study conventional and burst-TENS were alternated, which is also a way to avoid or limit accomodation. During the administration of burst-TENS we have not increased the intensity to a level at which muscle contractions were visible, because the women found this unpleasant and less effective. In former investigations this was not included either.

These results suggest that TENS is able to provide a statistically significant relief of pain during labour. When comparing these results to other studies where the experimental group also acted as its own control group, we find that our results are in agreement with former results [9, 12, 14, 18, 22]. Only Thomas et al. [25] did not find a decrease of pain during the period in which TENS was turned off. Postpartum our statistical data were confirmed by the answers of the women to the two questions which reflect the subjective experience of the parturients.

On the other hand however data analyses show that TENS had no statistically significant influence on the incidence of epidural analgesia. This somehow contradictory result is also seen in the study of Harrison et al. [10]. We think this discrepancy can, at least for our study, be explained in that details of management in obstetric practice (e. g. techniques of antenatal preparation, place of birth, position at birth and methods of pain relief) are strongly determined by culture and fashion. The use, familarity and type of invasive method of pain relief in labour (as narcotics, inhalation-analgesia, local analgesia, spinal analgesia or epidural anaesthesia) vary from country to country, even from hospital to hospital. The pregnant woman, who does not know what she can expect, is certainly sensitive to the opinion of her gynaecologist and will also be influenced by her surroundings. In Belgium epidural analgesia is the most common and very frequently used method of pain relief. This implies for our study that most women antenatally in some way will have heard about epidural analgesia and have a certain expectation of it. When a woman during labour decided to stop TENS and change to epidural anaesthesia, she expected that the pain would completely disappear. Moreover the study was done at a University Hospital where anaesthesists are available 24 h a day. This means that women can ask for it any time, in contrast to a local hospital where epidural anaesthesia has to be requested for in advance. Postpartum (and able to compare TENS to epidural anaesthesia) a lot of women told us that retrospectively they rather had continued with TENS and not switched. Unfortunately chosing for epidural analgesia during labour is a definitive decision. These factors may explain why in our study no significant difference in incidence of epidural analgesia was found between the two groups, whereas 96% (23 out of the 24 women) postnatally was very satisfied about the TENS during their labour.

Although we haven't investigated specifically the effect of TENS on suprapubal and sacral pain, we did observe that TENS especially had a very good effect on low back pain. Unfortunately we didn't have enough data to control the relation between the incidence of epidural anaesthesia and the localisation of the pain. Of course, considering the size of the included groups, type II error cannot be excluded. On the other hand this also may explain why the difference in incidence of epidural analgesia was not significant. By some investigators [17, 18, 26] a placebo effect of TENS was found. We also have to take this possible explanation into account.

Finally we want to give some remarks made by women from the experimental group. According to some women concentrating on the TENS procedure was a good association. Some of our patients felt that it was easier to breathe during the contractions when TENS was working. This is also mentioned by Grim and Morey [9]. Further, a positive influence on low back pain was reported. This is also found in former studies [2, 4, 5, 22]. Some parturients said that the contractions were felt during a shorter time. Only the 'peak' of the contraction was clearly experienced. During the temporary switch-off they were very well able to assess the difference: at that time the contraction was felt completely. No woman found the vibrating, tingling sensation of the TENS pulse disturbing. To the contrary, some compared the sensation to 'a local massage'. Some women said that TENS made the pain less disturbing without reducing its intensity. It took 'the edge of pain' and helped to feel more relaxed and in control of the experience.

To our opinion TENS certainly should not be considered an alternative to effective epidural analgesia for quality of pain relief. Indeed TENS may not give sufficient relief for those women who are experiencing high levels of pain or who are in labour for a very long time. But we feel that TENS is useful in many cases where, for various reasons, an epidural service is not in operation (f. e. deliveries at home), not permanently available, or in case the expectant mother wants to manage labour 'on her own', without the use of epidural analgesia. It should therefore not be seen as a replacement for an epidural anaesthesia, but be considered as a a safe complement of coping skills, such as breathing- and relaxation techniques. It is not possible to predict which women may benefit from TENS. But if TENS appears to be ineffective, no time is lost, no harm has been done and no drugs remain to be eliminated. Of course it is very important that women who intend to use TENS during labour are given adequate information antenatally and know what they may expect from TENS : no total pain relief, but rather the extra assistance necessary to deal with the intense experience of labour. The women also have to be properly taught how to use the TENS-apparatus. In case there is no physiotherapist present they have to know exactly how to apply the electrodes, how to adjust the unit's controls. All of them have to experience TENS stimulation prior to labour.

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References

1. Augustinsson LE, Bohlin P, Bundsen P, Carlsson CA, Forssman L, Sjoberg P, Tyreman NO (1977) Pain relief during delivery by transcutaneous electrical nerve stimulation. Pain 4:59–65
2. Bundsen P, Ericson K (1982) Pain relief in labor by transcutaneous electrical nerve stimulation. Safety aspects. Acta Obstet Gynaecol Scand 61:1–5

3. Bundsen P, Peterson L, Selstam U (1981) Pain relief in labor by transcutaneous electrical nerve stimulation. A prospective matched study. Acta Obstet Gynaecol Scand 60:459–468
4. Bundsen P, Ericson K, Peterson L, Thiringer K (1982) Pain relief in labor by by transcutaneous electrical nerve stimulation – Testing of a modified stimulation technique and evaluation of the neurological and biochemical condition of the newborn infant. Acta Obstet Gynaecol Scand 61:129–136
5. Bundsen P, Peterson L, Selstam U (1982) Pain relief during delivery – an evaluation of conventional methods. Acta Obstet Gynaecol Scand 61:289–297
6. Chia YT, Arulkumaran S, Chua S, Ratnam SS (1990) Effectiveness of transcutaneous electric nerve stimulator for pain relief in labour. Asia-Oceania J Obstet Gynaecol 16:145–151
7. Deyo RA, Walsh NE, Schoelfeld LS (1990) Can trials of physical treatments be blinded? The example of transcutaneous electrical nerve stimulation for chronic pain. Am J Phys Med Rehabil 69:6–10
8. Enkin M, Keirse MJNC, Renfrew M, Neison J (1995) A guide to effective care in pregnancy and childbirth. Oxford University Press, Oxford
9. Grim LC, Morey SH (1985) Transcutaneous electrical nerve stimulation for relief of parturition pain. A clinical report. Phys Ther 65:337–340
10. Harrison RF, Woods T, Shore M, Mathews G, Unwin A (1986) A pain relief in labour using transcutaneous electrical nerve stimulation (TENS) A TENS/TENS placebo controlled study in two parity groups. Br J Obstet Gynaecol 93:739–746
11. Harrison RF, Shore M, Woods T, Mathews G, Gardiner J, Unwin A (1987) A comparitive study of transcutaneous electrical nerve stimulation (TENS), entonox, pethidine + promazine and lumbar epidural for pain relief in labour. Acta Obstet Gynaec Scand 66:9–14
12. Keenan DL, Simonsen L, McCrann DJ (1985) Transcutaneous electrical nerve stimulation for pain control during labor and delivery. A case report. Phys Ther 65:1363–1364
13. Koel G (1991) Transcutane Elektrische Neurostimulatie (TENS) ter be van pijn en weefselcirculatie. De Tijdstroom, Lochem
14. Lea P (1992) Delivering women from labor pain. Can Nurse 88:17–19
15. Lee EWC, Chung IWY, Lee JYL, Lam PWY, Chin RKH (1990) The role of transcutaneous electrical nerve stimulation in management of labour in obstetric patients. Asia-Oceania J Obstet Gynaecol 16:247–254
16. Lewis TLT, Chamberlain GVP (1990) Obstetrics by ten teachers, 15th edn. Hodder & Stoughton, London
17. Liu DTY, Fairweather DVI (1991) Labour ward manual, 2nd edn. Butterworth-Heinemann, Oxford
18. Miller Jones CMH (1980) Transcutaneous nerve stimulation in labour. Anaesthesia 35:372–375
19. Nesheim B (1981) The use of transcutaneous nerve stimulation for pain relief during labor. A controlled clinical study. Acta Obstet Gynaecol Scand 60:13–16
20. Polden M (1985) Transcutaneous nerve stimulation in labour and post-caesarian. A controlled clinical study. Physiotherapy 71:350–353
21. Polden M, Mantle MJ (1994) Physiotherapy in obstetrics and gynaecology. Butterworth-Heinemann, Oxford
22. Robson JE (1979) Transcutaneous nerve stimulation for pain relief in labour. Anaesthesia 4:357–360
23. Stewart P (1979) Transcutaneous nerve stimulation as a method of analgesia in labour. Anaesthesia 34:357–360
24. Tajali-Awal A (1995) TENS zur Linderung von Geburtsschmerzen. Krankengymnastik 11:1590–1593
25. Thomas IL, Tyle V, Webster J, Neilson A (1988) An evaluation of transcutaneous electrical nerve stimulation for pain relief in labour. Aust N Z J Obstet Gynaec 28:182–188
26. Van der Ploeg JM, Vervest HAM, Liem AL, Schagen van Leeuwen JH (1996) Transcutaneous nerve stimulation (TENS) during the first stage of labour: a randomized clinical trial. Pain 68:75–78

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