

Transcutaneous electrical nerve stimulation in osteoarthritis: a therapeutic alternative?

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SUMMARY Thirty patients with chronic pain due to osteoarthritis (OA) of the knee were enrolled in a randomised double-blind cross-over trial of self-administered transcutaneous electrical nerve stimulation (TENS) and placebo TENS. Medication was standardised to paracetamol tablets only. As measured on visual analogue scales for pain relief 46% of patients responded to active therapy and 43% to placebo. The length of pain relief during active therapy was significantly longer than that during placebo. At the end of the trial more patients wanted to continue using active TENS in preference to placebo or their original medication. Although most of the parameters observed favoured active TENS, it was not possible to establish its clear superiority over placebo, because the response rate to placebo TENS was high and sustained for at least 3 weeks. This trial suggests that a longer study is required to establish the role of TENS as a therapeutic agent in the treatment of the pain of chronic arthritis.

Numerous reports have been published in the last decade on the successful treatment of acute and chronic pain conditions with transcutaneous electrical nerve stimulation (TENS).¹⁻⁴ This physical noninvasive therapy is now used in pain clinics in the United Kingdom.⁵ No controlled studies, however, have been conducted which consider TENS as a primary therapy rather than as an adjunct to medication or other physical treatments.

Nonsteroidal anti-inflammatory drugs (NSAIDs) are commonly used in the treatment of pain due to osteoarthritis (OA) of the knee, but recently the value of these drugs in OA has been seriously questioned on the grounds that their expense may not be justified in terms of therapeutic efficacy⁶ and that there remains the possibility that deleterious effects may result from their use.⁷

In contrast to drug therapy the potential side effects of TENS are minimal (e.g., skin irritation) and contraindications (e.g., use with cardiac pacemakers) are few.

Material and methods

Thirty patients attending the Outpatient Department

of the Centre for Rheumatic Diseases were enrolled in the trial, which was based on 2 main criteria for entry: a definite diagnosis of OA of the knee and chronic knee pain for at least 12 months. Twenty-two of the patients were female and 8 male; their median age was 61 years (range 40-83 years) and median duration of knee joint pain was 7.5 years (range 1-40 years).

To assess pain, active and passive knee movements and weight bearing were scored to derive a pain index. Other assessment techniques included: visual analogue scales (VAS) for pain relief recorded weekly, the return count of paracetamol tablets, the duration of relief following each TENS treatment recorded by patients in a daily diary, and a questionnaire of patients' opinions.

After a 'washout' week in which paracetamol only was allowed, patients were instructed to self-administer TENS to the painful knee joint selected for therapy 3 times per day for a minimum of 30 minutes and a maximum of 60 minutes. Paracetamol tablets could then be taken if insufficient pain relief resulted. Each week patients returned to the hospital for assessment.

The portable, battery-operated RDG Tiger Pulse stimulator was used. For placebo use the contact made by the electrode leads at the jack-plug was broken so that no current passed to the patient, but

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when the device was turned on the red indicator light glowed as though the unit was operating. Each stimulator was fixed at a frequency of 70 Hertz. Four siliconised rubber electrodes were applied round the knee at classical Chinese acupuncture points.⁸

Results

Two patients did not complete the trial, one due to an intervening chest infection, the other because of increasing pain.

Of the remaining 28 patients the majority (61%) recorded more than 50% pain relief and were therefore identified as 'responders.' Eight responded to both active and placebo TENS, 5 to active only, and 4 to placebo only. In comparison with the level of pain relief experienced by patients at week 0 of the trial when still on their original medications (Table 1) there was a significant improvement in relief after 3 weeks of active TENS ($p < 0.05$ Wilcoxon matched pairs signed-rank test) but not placebo TENS. Both phases of active and placebo stimulation, however, provided more relief than paracetamol alone ($p < 0.005$). The median length of pain relief following each active and placebo treatment was 151 minutes and 110 minutes respectively. The difference in duration of relief between the 2 therapies was significant ($p < 0.01$). When the pain index after each phase of therapy was compared with the initial index, there was a significant decrease after both active TENS ($p < 0.005$) and placebo TENS ($p < 0.05$). Similar significant reductions occurred in paracetamol intake.

All but one patient said they felt 'some relief' from their knee pain during the active and/or placebo phases of therapy. Twelve out of the 28 patients wanted to continue using active TENS at the end of the trial, 4 preferred placebo, 10 their previous medication, and 2 were uncertain of their preference.

Table 1 Pain relief recorded during different phases of the trial

Trial phase	No. of patients	Pain relief VAS (cm) median (range)
Pretrial medication (at week 0)	30	3.5 (0-8.4)
Paracetamol (at week 1)	27*	2.3 (0-7.4)
Active TENS (after 3 weeks)	29†	5.5 (0-9.8)
Placebo TENS (after 3 weeks)	29‡	4.8 (0-9.8)

*Three patients chose not to take any paracetamol during week 1.

†One patient did not complete 3 weeks' active TENS.

‡One patient did not complete 3 weeks' placebo TENS.

Discussion

The cross-over from one stimulator to the other was achieved with no patient suspecting the nature of the placebo stimulator. All accepted that the 2 treatments were electrically different and hence that they would feel different. On discontinuing formerly prescribed medications, including NSAIDs at the start of the trial, the relatively few patients who experienced additional discomfort found that this resolved after 7-10 days. The order of therapy did not seem to influence response, that is, no carry-over effect from active TENS to placebo was observed.

In all, 43% (12/28) of patients responded to placebo. This figure is higher than the placebo response rates of 32% and 36% already reported.^{9 10} The duration over which the placebo was recorded as being effective was 3 weeks, which was longer than we expected. Given that some placebos are more effective than others,¹¹ the novel appearance and purported electrical properties of TENS may well have influenced the response. Conversely, the role of endorphins as likely mediators of placebo analgesia has recently been explored.¹² In the light of such work the nature and significance of the placebo response may well need to be carefully re-evaluated.

The 46% response rate to the active therapy is considerably lower than in many other reports which have not attempted a controlled evaluation. The possibility remains, however, that a higher response rate to active TENS could have been achieved if alternative types of TENS stimulation had been used¹³ and/or if the stimulation parameters and electrode positions had been altered to suit individual patients, as generally advocated in TENS literature.

Effective pain relief for OA of the knee was achieved during this trial, but the analgesic efficacy of TENS in the long term, and the significance and duration of its placebo effect, require further evaluation before the value of TENS as a therapeutic alternative in OA can be established.

Further details of this study are available from the authors on request.

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References

- 1 Shealy C N, Maurer D. Transcutaneous nerve stimulation for the control of pain. *Surg Neurol* 1974; 2: 45-7.
- 2 Bates J A V, Nathan P W. Transcutaneous electrical nerve stimulation for chronic pain. *Anaesthesia* 1980; 35: 817-22.

- 3 Vanderark G D, McGrath K A. Transcutaneous electrical stimulation in treatment of post-operative pain. *Am J Surg* 1975; **130**: 338-40.
- 4 Mannheim C, Lund S, Carlsson C A. The effect of transcutaneous electrical nerve stimulation (TENS) on joint pain in patients with rheumatoid arthritis. *Scand J Rheumatol* 1978; **7**: 13-6.
- 5 Lloyd J W. Equipment for setting up a pain clinic. *Br J Hosp Med* 1981; **25**: 179-82.
- 6 Bird H A, Rhind V M, Leatham P A, Wright V. Non steroidal ineffective in OA? *Rheumatol Rehabil* 1982; **21**: 187.
- 7 Brooks P M, Potter S R, Buchanan W W. NSAID and osteoarthritis—help or hindrance. *J Rheumatol* 1982; **9**: 1-5.
- 8 Academy of Traditional Chinese Medicine. *An outline of Chinese acupuncture*. Peking: Foreign Languages Press, 1975.
- 9 Thorsteinsson G, Stonnington H H, Stillwell G K, Elveback L R. The placebo effect of transcutaneous electrical stimulation. *Pain* 1978; **5**: 31-41.
- 10 Evans F J. The placebo response in pain reduction. In: Bonica J J, ed. *Advances in neurology*. New York: Raven Press, 1974: 4.
- 11 De Ceulaer K, Dick C W. The clinical evaluation of anti-rheumatic drugs. In: Kelley W N, et al., eds. *Textbook of Rheumatology*. Philadelphia: Saunders, 1981.
- 12 Levine J D, Gordon N C, Fields H L. The role of endorphins in placebo analgesia. In: Bonica J J, ed. *Advances in pain research and therapy*. New York: Raven Press, 1979: 3.
- 13 Eriksson M B E, Sjolund B H, Nielzen S. Long term results of peripheral conditioning as an analgesic measure in chronic pain. *Pain* 1979; **6**: 335-47.

Book review

Clinics in Rheumatic Diseases. Vol. 8, No. 2. **Cutaneous Lesions in the Connective Tissue Disorders.** Edited by J. P. Callen. Pp. 520. £10.75. Saunders: London. 1982.

Cutaneous manifestations are a prominent feature of rheumatic disorders, not only as manifestations of the disease which may be so typical as to be diagnostic, but also as side effects of drug therapy. This volume contains descriptive essays of the skin lesions which characterise certain systemic disorders which are seen, albeit rarely, by clinicians working in rheumatology. It represents a useful addition to the series of *Clinics in Rheumatic Diseases*. The authors are dermatologists who have been instructed to provide practical accounts of certain subjects in which they have particular expertise. The result is a slim volume which is easy reading

and deals with a broad range of subjects including lupus erythematosus, dermatomyositis, nail fold capillary abnormalities, and cutaneous reactions to rheumatological drugs. For the most part the contributions are comprehensive, well illustrated, and well referenced. Chapters on subacute cutaneous lupus erythematosus by J. N. Gilliam and R. D. Southeimer, Sweet's syndrome by K. E. Greer and P. H. Cooper, and cutaneous immunofluorescence by R. E. Jordan are particularly successful and easy to read. The chapters on eosinophilic fasciitis, which stands out from the others by its lack of illustrations, and leucocytoclastic vasculitis, which becomes bogged down in terminology, are less successful. On the whole, however, the book fulfils its brief as a practical guide for clinicians working with rheumatic disease patients.

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