A Comparison of Analgesic Effects Of Electroacupuncture, Placebo Electroacupuncture and Transcutaneous Electrical Stimulation

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Abstract

The analgesic effect of electroacupuncture was compared to that of placebo electroacupuncture and low frequency high intensity transcutaneous electrical nerve stimulation in 14 patients with chronic non-cancer pain. Patients underwent six randomly assigned treatment sessions, each lasting 20 minutes, at least 48 hours apart: two sessions of classical electroacupuncture, two sessions of placebo electroacupuncture using non-acupuncture points, and two sessions using surface electrodes placed over painful sites. For all sessions, current was set just above pain threshold, at a pulse width of 200 msec and a rate of 2 Hz. Pain ratings were determined before and immediately after stimulation and at intervals during the subsequent 48 hours. Five of the 14 patients demonstrated significant improvement in pain with all three types of stimulation. There was no significant difference in the degree or duration of analgesia achieved among the three modalities, suggesting that classical electroacupuncture is no more effective than other forms of low frequency high intensity stimulation.

Introduction

The use of electrical stimulation of the peripheral nervous system for the management of both acute and chronic pain is being utilized with increasing frequency. Transcutaneous electrical nerve stimulation (TENS) at

Table I
Patient Characteristics

Patient	Age	Sex	Tentative Diagnosis	Pain Duration	Usual Pain Rating
1	40	M	Migraine	14 Mo.	6
*2	19	F	Arthralgia, knees	9 Yr.	8
3	35	F	Myofascial back pain	9 Mo.	3
*4	68	F	Arthralgia, arm, knees	3 Yr.	8
*5	68	M	Myofascial shoulder pain	16 Mo.	7
6	54	F	Arthralgia, arms, knees	10 Yr.	2
*7	43	M	Myofascial back pain	5 Yr.	5
8	57	M	Lumbar radiculopathy	3 Yr.	6
9	31	M	Myofascial shoulder pain	1 Yr.	5
10	56	M	Arthralgia, knees	2 Yr.	1
11	51	F	Migraine	30 Yr.	3
12	50	M	Lumbar radiculopathy	25 Yr.	9
13	51	M	Arthralgia, arms, knees	9 Mo.	5
*14	46	M	Myofascial back pain	11 Yr.	3

*Patients reporting pain relief with electrical stimulation.

both low[1,2] and high[3,4] stimulation frequencies, peripheral nerve stimulation via implanted stimulating devices,[5] and electroacupuncture[6,7] (with electrical stimulation through percutaneously inserted needles) have all been used with some success.

It is unclear from prior studies [6,8,9] whether any one of the modalities utilizing low frequency high intensity stimulation is any more efficacious than the others. There is considerable controversy regarding the necessity of accurately localizing classical acupuncture points in order to produce analgesia with percutaneous electrical stimulation.[7,8,10] Likewise, it is unclear whether percutaneous electrode placement has any advantage over electrode placement on the skin surface.[8,9] It is the purpose of this study to determine whether electroacupuncture performed at classical acupuncture sites appropriate for the patient's pain distribution is more effective than electroacupuncture performed at nonacupuncture points in the treatment of chronic pain. It is also the purpose to determine whether TENS, using low frequency high intensity (acupuncture-like) stimulation is more or less effective than classical electroacupuncture.

Methods

Subjects

Fourteen adult men and women with chronic pain of nonmalignant origin were selected for this study. These patients had been treatment failures with a variety of other modalities, including high frequency low intensity TENS, nerve blocks, manipulation therapy, and surgery. One patient had previously received acupuncture with some benefit. Most of the patients were taking medications for pain. These included narcotics, non-narcotic analgesics, muscle relaxants, and tranquilizers. The sites of pain, pain duration, and presumptive diagnoses are shown in Table I. The patients all completed a preadmission pain questionnaire, which included zero to 10 visual pain scales, rating their most severe, least severe, and usual pain levels.

Treatment

After providing informed consent, each

patient underwent six treatment sessons, at least 48 hours apart, lasting 20 minutes each. Sessions were randomly arranged and were composed of two each of the following: (1) low frequency high intensity electroacupuncture stimulation utilizing traditional acupuncture sites appropriate for the patient's pain location; (2) low frequency high intensity "placebo" electroacupuncture stimulation at sites at least 5 cm from any traditional acupuncture site; (3) low frequency high intensity transcutaneous electrical nerve stimulation with electrodes placed directly over areas of maximum pain or tenderness.

For all sessions, stimulation was performed using a Grass stimulator (Grass model S9D, Grass Medical Instruments, Quincy, Massachusetts) delivering a modified rectangular wave with zero net DC current. Frequency was set at 2 Hz, pulse width at 200 msec. Current amplitude was set just above the level considered uncomfortable by the patient. Placement of acupuncture needles and TENS electrodes was performed by a single individual, who had received acupuncture training in the Peoples Republic of China. Selection of acupuncture points was based on classical Chinese medicine principles. Patients were unaware of which sessions were classical acupuncture and which were placebo acupuncture. This study was approved by the Human Research Review Committees of the Medical College of Wisconsin and the Milwaukee County Medical Complex.

Determination of Pain Relief

The patients scored pain intensity ratings on the zero to 10 visual analog pain rating scale. Pain ratings were assessed just before and immediately after treatment. The investigators were not present during marking of pain ratings. The patients were provided with a follow-up questionnaire in which zero to 10 visual pain rating scales were utilized every six hours over the next 48-hour period.

Data Analysis

The pre- and post-stimulation pain ratings for each of the three types of treatment session were averaged for all patients. The degree of change in mean pain ratings from before stimulation to immediately after stimulation was analyzed for each type of session using the paired t-test. In addition, the patient's usual pain ratings (from the preadmission questionnaire) were compared to the mean pain ratings in the 48-hour post-stimulation period by the same method. Mean pain ratings for classical acupuncture, placebo acupuncture and low frequency high intensity TENS taken before stimulation, immediately after stimulation, and over the 48-hour period subsequent to stimulation were compared using the Student's t-test. The mean change in pain ratings for acupuncture was compared to the mean change in pain ratings for placebo acupuncture and for TENS using the student's t-test.

Results

Five of the 14 patients in the study reported detectable changes in pain perception as a result of treatment (See Table I). For the nine patients who denied detectable pain relief, there was no significant difference in mean ratings between pre-stimulation and immediate post-stimulation pain levels, or between usual pain levels and 48-hour mean pain levels.

When only those five patients who reported pain relief were analyzed, it was found that there was a significant change in mean pain ratings from immediately pre-stimulation to immediately post-stimulation for all three modalities (See Table II). For

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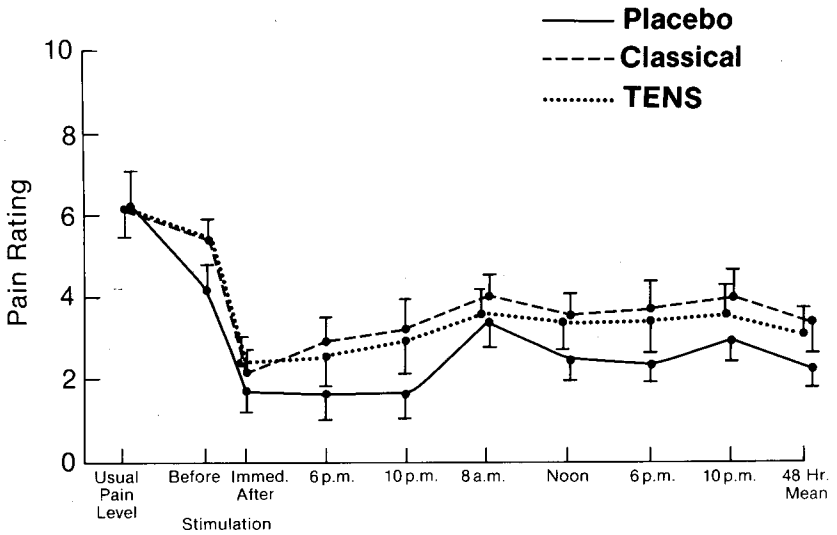

Fig. 1. Mean (± SEM) pain ratings for the five patients who reported pain relief. Differences between ratings for the 3 modalities were not significant at any points recorded (student's t-test).

classical acupuncture the mean rating immediately before stimulation was 5.49. The mean after stimulation was 2.39 ($p < 0.001$). For placebo acupuncture the mean pain rating dropped from 4.31 to 1.94 after stimulation ($p < 0.01$); for TENS the mean rating dropped from 5.35 to 2.77 after stimulation ($p < 0.01$). There was no significant difference in mean pain ratings either before or at any rating time after stimulation among the three modalities (See Figure 1), nor was the immediate pre-treatment to post-treatment change in pain ratings significantly different among the three modes of therapy. Analgesia persisted for the duration of the 48-hour period with all three modalities. The mean of usual pain ratings of the five patients prior to entering the study was 6.20. The mean pain rating over the 48 hours subsequent to stimulation was 3.40 following

Table II

Mean change in pain ratings from immediately before to immediately after stimulation for the five paints who reported pain relief.

	Mean Pain Rating Immediately Pre-Stimulation	Mean Pain Rating Immediately Post-Stimulation	Mean Change In Pain Rating (± SEM)	t_p	P*
Classical Acupuncture	5.49	2.39	−2.98 ± .79	3.77	<.001
Placebo Acupuncture	4.31	1.94	−2.24 ± .72	3.11	<.01
TENS	5.35	2.77	−2.68 ± .82	3.26	<.01

*Paired t-test.

Table III
Differences between mean usual pain ratings and 48-hour mean of post-stimulation ratings.

	Mean of Usual Pain Ratings (from questionnaire)	48 Hr. Mean of Poststimulation Pain Ratings	Mean Difference in Pain Ratings (± SEM)	t_p	P*
Classical Acupuncture	6.20	3.40	−2.80 ± .63	4.44	<.001
Placebo Acupuncture	6.20	2.35	−3.90 ± .51	7.64	<.001
TENS	6.20	3.20	−3.40 ± .32	10.62	<.001

*Paired t-test.

classical acupuncture ($p < 0.001$), 2.35 following placebo acupuncture ($p < 0.001$), and 3.20 following TENS ($p < 0.001$) (See Table III).

Discussion

High frequency low intensity stimulation, which is used primarily with TENS and with implantable nerve stimulators, is thought to work through changes in firing thresholds of peripheral nerves[11] and/or by a dorsal horn gating mechanism.[3,4,12] There is no evidence that endogenous opiate release is involved.[13,14] In contrast, low frequency high intensity stimulation, which is employed with electroacupuncture and in some instances with TENS, has been demonstrated to work through a different mechanism, which is at least partially dependent on activation of endogenous opiates.[2,15,16]

The results of this study indicate that low frequency high intensity electrical stimulation provides analgesia which persists over many hours for some patients with chronic pain. Neither the selection of appropriate classical acupuncture points nor the positioning of stimulating electrodes percutaneously rather than on the surface of the skin seems to alter the degree or duration of analgesia which is experienced. Although stimulation of classical acupuncture points has been shown to provide analgesia for many patients with chronic pain, stimulation of those particular points may not exert specific effects on painful areas. Lack of specificity of traditional acupuncture points was demonstrated by Lynn and Perl.[10] These authors were able to demonstrate significant decreases in pain sensitivity during acupuncture but the analgesic effect was not confined to those areas predicted to be influenced by stimulation of the selected acupuncture point.

The duration of analgesia achieved in the five patients who responded to electrical stimulation is similar to that seen in other studies. Fox and Melzack[9] showed a mean duration of analgesia of 40 hours for patients treated with manual acupuncture. Melzack[1] reported that analgesia induced by brief, intense low frequency electrical stimulation lasted up to several days.

We conclude that low frequency high intensity electrical stimulation provides analgesia for some patients with chronic pain. We find no evidence that classical acupuncture is more effective than acupuncture using non-acupuncture points or low frequency high intensity TENS. The transcutaneous mode of

application has several major advantages over the percutaneous route (acupunture). Its use is not confined to practitioners with specific training. There is no risk of infection or nerve damage, and patients can use the modality at home on a regular basis. Many of the transcutaneous electric stimulators presently on the market have low frequency settings. Therapy at such settings should be attempted in patients who do not respond to conventional high frequency low intensity TENS.

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