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EXPERIMENTALLY INDUCED ISCHEMIC PAIN AND SO-CALLED DIAPHASE FIX CURRENT

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ABSTRACT. It has been claimed that the diadynamic currents have either analgesic or other beneficial effects during the treatment of various painful musculoskeletal disorders. However, no experimental or controlled clinical results have been presented to support these claims. In this study, the possible analgesic effect of the DF (diaphase fix)-current on experimental pain was evaluated. An ischemia was experimentally induced in the left arm of five healthy male volunteers by a modified submaximal effort tourniquet test. Each subject had two consecutive ten minute periods of ischemia, one with and another without the DF-current. The subjective pain responses to the ischemia were measured by the visual analogue scale. The DF-current did not cause any marked decrease in the mean pain responses in this experiment. This experiment did not support the idea of using the diadynamic currents in alleviating musculoskeletal pain.

Key words: ischemic pain, electrical nerve stimulation, musculoskeletal pain.

INTRODUCTION

The diadynamic currents were developed empirically by a French dentist, P. D. Bernard (1). The 50 Hz sinusoidal current is converted into diadynamic currents by a one- or two-way rectifier. Four different configurations of the diadynamic currents are illustrated in Fig. 1. DF (diaphase fix) and LP (module en longues periodes) are said to be analgesic and CP (module en courtes periodes) edema resorptive.

It has been reported that the diadynamic currents have favourable effects in acute clinical conditions (8). However, no experimental or placebo-controlled clinical findings to support this claim has been described. Moreover, controversial findings exist (9).

In this experiment, the possible analgesic effect of the diadynamic currents on experimental pain was examined. The DF-current was selected for testing because it is claimed to be analgesic.

METHODS

Five healthy males acted as volunteers. One of them was a dentist and the others were medical doctors. The age range was 27–47 years. All subjects were tested between 8.00 and 10.00 a.m. During the tests the subjects were sitting comfortably in a chair. The room temperature was 20–21°C.

For delivering the DF-current the DIDY-40A (DITER) was used. The metal electrodes (4×5 cm) were placed on the deltoid region and on the dorsal region of the left wrist 5 cm proximally from it. Moistened sponges were used under the electrodes. The anode was proximally and the cathode distally placed. The polarity of the current was from positive to negative. The intensity of the DF-current used was determined in each subject before starting the session. The current was slowly increased until the subject felt strong vibrations around the electrodes. The individual values were 2.5–5.5 mA (milliampers). The time was measured by a digital seconds counter installed in the DIDY-40A.

The technique for producing the ischemic pain was a modification of the submaximal effort tourniquet test described, for instance, by Woolf (10). The subject elevated his left upper extremity for 60 sec to drain the venous blood. A 14 cm wide cuff was placed just proximal to the cubital fossa and then inflated to 250 mmHg, and the upper extremity was then returned to the horizontal position. Immediately after the cuff inflation each subject performed 15 repetitions of a controlled exercise which included lifting a 5 kg weight up for 2 sec with horizontally positioned extended fingers, with the palms upwards. Each lifting movement was followed by 2 sec of relaxation. There were no difficulties in performing this

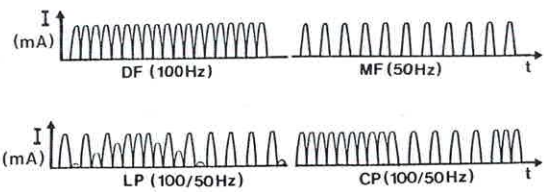

Fig. 1. Four mostly used configurations of the diadynamic currents. DF (diaphase fix) and MF (monophase fix) are one-way rectified constant currents with frequency of 100 and 50 Hz respectively. LP (module en longues periodes) and CP (module en courtes periodes) are two-way rectified constant currents with alternating frequencies (100/50 Hz). In LP even intensities are alternating.

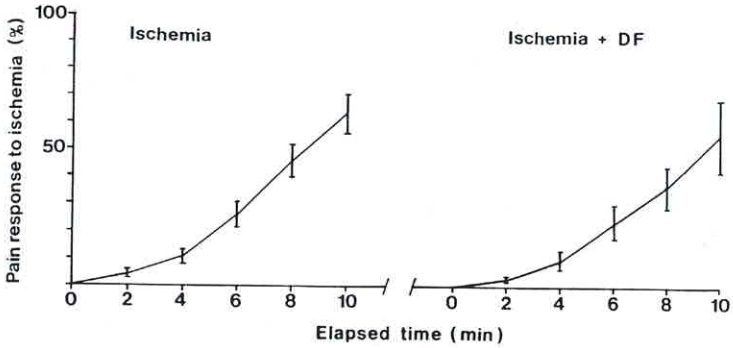

Fig. 2. The average change in subjective assessment of ischemic pain (visual analogue scale) in 5 subjects during the submaximal effort tourniquet test, with and without DF-current. The vertical bars represent ± SEM.

task. The end of the lifting exercise was determined as the starting point of the ischemia, and at the same time the examiner began to give the DF-current. Two consecutive ischemias were produced, lasting 10 min each. The interval between the two periods was 40 min. Three subjects had the DF-current during the first ischemic period.

The individual pain sensations were measured by the visual analogue scale (VAS). The length of the scale was 10 cm. The subject was asked to mark on the scale the intensity of the ischemic pain he was experiencing at the particular moment. A new unmarked visual analogue scale was presented to the subject at 2 min intervals throughout the test. From this scale, the subjective assessment of ischemic pain could be measured (1 mm = 1 %).

RESULTS

All the subjects reported that the DF-current caused strong vibrations around the electrodes, but that it was not painful.

Fig. 2 shows the average pain responses to ischemia with and without the DF-current. Although the pain responses to ischemia tended to be slightly decreased during the DF-current, the linear regression analyses revealed that the decrease was not significant.

In the case of ischemia without the DF-current the correlation coefficient was 0.892 and the equation of the line $y = 7.680x - 16.22$. When the DF-current was given concomitantly with the ischemia, the correlation coefficient was 0.779 and the equation of the line $y' = 6.675x' - 14.47$.

DISCUSSION

On the average, the DF-current did not show any significant analgesic effect in this experiment. This is consistent with the earlier clinical findings, which indicate that the effect of the diadynamic currents in chronic musculoskeletal conditions was not better than with the placebo (9). The electrical stimulation used in our study was the same as that used in normal therapy, and it lasted 10 minutes. The duration of the clinical treatment is usually 8–10 min. Our study was open, because it was impossible to produce placebo-DF for these well-informed subjects.

In contrast with the effects of the DF-current seen in the present study, TENS (transcutaneous electrical nerve stimulation) has proved to be effective both under experimental and clinical conditions (2, 4, 5, 6, 7, 10). Previously, Woolf has shown that high frequency TENS (100 Hz) at non-noxious intensities reduces the subjective pain assessment and elevates the pain tolerance in man (10). In this study the submaximal effort tourniquet test was used to produce experimental ischemic pain in a nearly similar fashion as in the present experiment. Thus it seems that different electrical nerve stimulation methods may not be equally effective in alleviating pain. In this study, the DF-current did not relieve experimental ischemic pain. This finding, and the earlier placebo-controlled clinical studies (3, 9), do not support the idea of using the diadynamic currents in alleviating musculoskeletal pain.

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