

# Electrotherapy and the management of minimally displaced fracture of the neck of the humerus

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*A poor outcome arising from a minimally displaced fracture of the neck of the humerus may be the result of a contracture of the capsule of the glenohumoral joint. Pulsed high frequency electromagnetic energy (PHFE) is an electrotherapy to reduce pain and swelling and to enhance healing. If PHFE is effective, early mobilization of the injured shoulder will be possible, reducing the risk of joint capsule contracture. We therefore conducted a double-blind trial of PHFE in minimally displaced fractures of the neck of the humerus. Early physiotherapy produced an excellent outcome in all cases. The functional outcome depended on age rather than time of starting treatment, although a relationship was found between the time of starting treatment and the duration of therapy required. The use of PHFE did not improve the result further.*

## Introduction

Fracture of the neck of the humerus is a common injury, the incidence of which increases with age (Horak and Nisson, 1975). The incidence of the fracture has been reported as 142 per 100 000 among women and 48 per 100 000 among men (Kristiansen et al., 1987); 85 per cent of fractures of the neck of the humerus are minimally displaced. Treatment with physiotherapy is reported to produce a satisfactory outcome. Early treatment is thought to produce a better outcome (Brostrum, 1943; Maitland, 1980; Young and Wallace, 1985), although this approach may be limited by pain. Many electrotherapeutic measures are used by physiotherapists to reduce pain and swelling, pulsed high frequency electromagnetic energy (PHFE) being the most commonly employed (Haynes, 1984). A prospective, double-blind, controlled trial was conducted to investigate the efficacy of this treatment in permitting early movement.

## Method

All patients with fractures of the neck of the humerus seen at Mansfield District General Hospital from November 1988 to May 1990 were referred to the physiotherapy department without delay. Minimally displaced fractures, those with separation of the fragments of less than 1 cm and angulation of less than 45° (Neer, 1970), were reviewed. Those patients able to co-operate with treatment and able to attend for daily therapy for the first 10 working days were entered into the trial.

Informed consent was obtained. The patients were randomized into two groups; one received PHFE from a

'Curapulse' machine, the other sham treatment with a deactivated machine. Treatment was administered for 30 min a day for the first 10 working days. The machine settings were intensity 3, pulse repetition frequency 35 and maximum pulse power 300 watts. Electrodes were applied in a standard fashion, employing the capacitance method, in front of and behind the shoulder (Figure 1). Additionally, all patients underwent the same standardized physiotherapy regimen.

Assessments were carried out at 1, 2 and 6 months, later assessment being unnecessary (Young and Wallace, 1985). Assessments of pain at rest and on movement were made on a five-point scale; analgesia requirements were also noted. Muscle wasting and strength were assessed by comparison with the uninjured shoulder. The combined range of



Figure 1. Positioning of the electrodes and patient during electrotherapy.

movement of the glenohumeral and scapulothoracic joints were measured with a long-arm goniometer (Wallace, 1982). Functional assessments were performed with the European Shoulder Association assessment charts.

At the end of the trial period the code was broken and results analysed by means of unpaired *t* tests, Mann-Whitney *U* test and the Spearman rank correlation coefficient.

**Results**

During the 18-month period of the study, 67 patients were referred; 16 did not fulfil the entry criteria. There were 22 patients randomized to the treatment group; one failed to complete follow-up. Of the 26 patients allocated to the control group, two were lost to follow-up. The two groups were similar in demographic and treatment details, as shown in *Table I*.

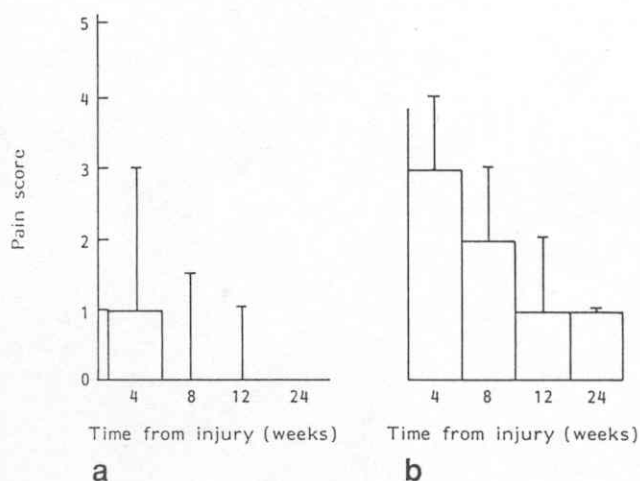
No significant difference was found between the two groups at any stage of the trial by means of the assessment. No difference was found in the patients' subjective opinion of the treatment. None of the patients receiving PHFE noted a heating effect.

A total of 48 patients completed the treatment and review periods. All patients attained a 'good' result; there were no 'poor' results in either group. A 'good' result was defined as useful power in the limb, no pain, abduction beyond 60° and ability to place the hand behind the neck (Young and Wallace, 1985). Four patients, aged under 20 years, sustained an epiphyseal fracture. With these excluded to allow comparability with other studies, a strong correlation between the time of beginning treatment to the time of discharge (correlation coefficient 0.4236, *P* < 0.02) was seen. No correlation was found between the functional outcome at 6 months and the time of starting treatment (*cc* -0.06). The older patients complained more of pain (*cc* 0.489, *P* < 0.001) and loss of function (*cc* 0.585, *P* < 0.01) than younger patients. An inverse correlation being found between age and the functional outcome (*cc* -0.55, *P* < 0.001).

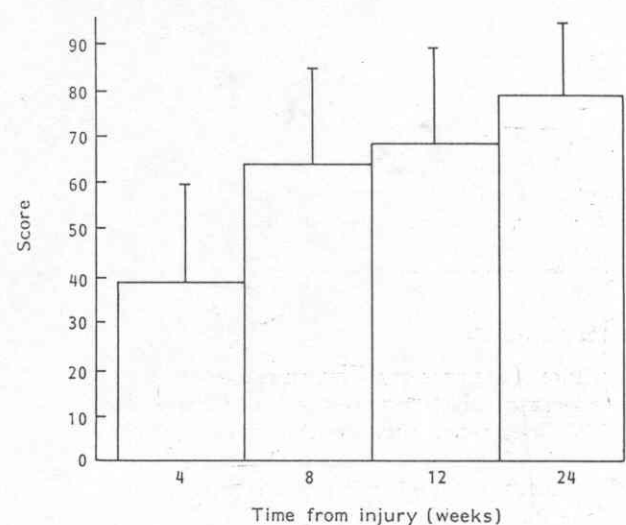
The pattern of recovery from pain is shown in *Figure 2* and recovery of function (AFI) in *Figure 3*. The range of internal rotation recovered rapidly; other movements were slower to recover showing a continued improvement over the follow-up period. Rest pain settled rapidly although pain on movement was fairly common for the first 3 months. The functional scores of the older patients showed no significant change between the 3 and 6 months follow-up (*Figure 4*), while those of the younger patients continued to improve even after treatment ceased.

**Table I.** Demographic details of the patients

Groups	Treatment	Control	Combined aged over 20 years
Average age (range)	60.7 years (11-83)	62.6 years (14-85)	67.9 (20-85)
Sex	Male 5 Female 17	Male 6 Female 20	Male 10 Female 34
Injured side	Left 11 Right 11	Left 15 Right 11	Left 24 Right 20
Dominant side injured	9	14	20
Average time from injury to start of Rx (range)	7.4 days (0-17)	9.9 (1-27)	8.6 (0-27)
Average time from injury to discharge (range)	80.6 days (18-165)	76.4 days (36-163)	78 (18-165)



**Figure 2.** Pain scores at rest and on motion, median and interquartile ranges given. Pain scored on a five-point scale: 0 No pain, 1 Occasional pain on sudden movement, 2 Mild pain on movement, not affecting activity, 3 Moderate pain on movement, 4 Severe pain on movement, 5 Pain at rest.



**Figure 3.** European Shoulder Association functional assessment scores of the combined group; average and standard deviation values are shown. The score is calculated as the sum of the pain index, the functional index, muscular strength and patients' subjective assessment of their handicap on a linear scale. The total is then subtracted from 100 to give the 'algo-functional index' (AFI).  $AFI = 100 - Pi + Fi + MS + H$



**Figure 4.** Mean functional scores (AFI) given by age.

## Discussion

Few studies of fractures of the neck of the humerus have considered the management of the majority of these injuries, the minimally displaced fractures. Early mobilization has been advised as the management of this injury. Cadwell and Smith (1936) recommended strapping the arm for 3 weeks followed by mobilization using pendulum swings. Brostrom (1942) advocated a more aggressive approach, with the application of heat to reduce pain on day 1 and motion beginning on day 4; good or excellent results were obtained in 60 per cent of patients. Clifford (1980) reviewed 46 patients with a Neer type 1 injury at an average of 18 months. Movement began at 4 weeks, treatment continuing for 2 months; 93 per cent obtained a good or excellent result. A relationship was noted between time spent resting in a sling prior to treatment and the length of therapy required to produce a satisfactory result; it did not reach statistical significance.

Young and Wallace (1985) reported a prospective study of conservative management of humeral fractures, 37 patients with a Neer type 1 injury. Treatment began at an average of 27 days and continued for 61 days. At 6 months no patient reported significant pain. They formed the impression that better results were obtained among those patients in whom treatment began early, the relationship did not reach statistical significance.

Our patients are similar to those of previous studies. Treatment began at an earlier stage, at an average of 8.6 days. A significant correlation between the time of starting treatment and the time of discharge was found. All patients were discharged at the same stage of function. The rate of recovery improved when treatment began early. The final outcome did not correlate with time of commencement of treatment; however, no 'poor' results were seen. Among older patients the functional scores did not significantly improve after treatment ceased; this was not the case with younger patients. The outcome in terms of pain and function was worse in the older age groups. We therefore conclude that younger patients could be discharged from treatment at an earlier stage, whereas older patients should have a more prolonged course of therapy.

Two studies have suggested that no benefit is obtained with the treatment of this injury by means of physiotherapy (Lundberg et al., 1979; Bertoft et al., 1984), we have not found this to be the case. An early attempt to regain abduction must be made if a good result is to be obtained (Maitland, 1980; Young and Wallace, 1985). The Swedish physiotherapy regimen delayed the onset of abduction; this may account for their finding. The major problem with the early commencement of physiotherapy in this injury is pain. It is an injury of the elderly, a group who tolerate pain badly, but tolerate stiffness well if only one shoulder is involved. On several occasions, patients complaining of increasing pain during treatment were noted to develop a 'reverse scapulothoracic rhythm' in an attempt to maintain their range of abduction while decreasing the pain arising from their shoulder. The treatment was slowed; the pain settled and a normal movement pattern returned. Although treatment should begin early, pain must be minimized and abduction achieved rapidly to attain the best possible outcome.

Electrical treatments of various types have been used to treat painful skeletal disorders since the discovery of electricity. Shortwave radiation, 27.12 MHz, delivers both electrical and magnetic energy 180° out of phase. Although

such energy may cause heating, the therapeutic effect is thought to result from the electromagnetic changes (Nagelschmidt, 1940; Golden et al., 1981), possibly by the restoration of cell membrane potentials leading to physicochemical changes of osmosis secondary to the passage of ions (Binder, 1981). Pulsed systems of delivery (PHFE) have been developed to exploit the electromagnetic phenomena while allowing heat to dissipate between bursts of energy. Such systems are widely used in physiotherapy departments (Haynes, 1984; Oliver, 1984).

Numerous trials in the use of PHFE have been undertaken to demonstrate its role in the reduction of inflammation, pain and swelling as well as its ability to enhance healing (Steinberg, 1964; Braun, 1965; Kaplan and Weinstock, 1968; Wilson, 1972; Bentall and Eckstein, 1975; Golden et al., 1981; Barclay et al., 1983; Barker et al., 1985; Wagstaff et al., 1986). However, few of the trials were blind and most included multiple diagnoses. We have been unable to demonstrate any benefit from PHEE in this series.

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