Rheumatology and Rehabilitation, 1974, **13**, 190

EVALUATION OF PHYSIOTHERAPY IN THE TREATMENT OF OSTEOARTHROSIS OF THE KNEE*

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SUMMARY

Numerous factors may contribute to the effectiveness of conventional physiotherapy. In this study we have minimized the influence of such factors by application of scientific method in trial design, concentrating on particular components of therapy. Patients with osteoarthrosis of the knee referred for conventional therapy were randomly allocated to three treatment groups, ice, short-wave diathermy, and untuned short-wave diathermy as a control. It is shown that by three months most patients, whatever the therapy, improved significantly in six out of the seven outcome measures. However, the group receiving ice made better early progress and by three weeks the improvement in the pain score was similar to that attained after three months by the other groups. It is emphasized that trials such as this seek to provide guidelines for the therapist rather than didactic formulae.

ONE of the aims of the Oxford Rehabilitation Research Unit is to evaluate the various components which comprise conventional physical therapy. In most treatments the patient receives passive palliative physiotherapy in conjunction with active exercises. All treatments are accompanied to a greater or a lesser degree by functional assessment and advice from the physiotherapist. Improvement experienced by the patient may derive from any one or a combination of such factors in the treatment.

The non-specific factors may have a particularly important influence on outcome, but it is these factors which create difficulties in trial design. For example, Hamilton (1959) administered four treatments—short-wave diathermy, infra-red radiation, faradism to the quadriceps and untuned short-wave diathermy—over a five-month period to patients with osteoarthrosis of the knee. Although the trial was carefully designed to avoid bias arising from order of treatments, all patients were on a "good basic regime of exercises, analgesics, splintage and encouragement". Lawrence and Sladden (1955) administered thirteen different treatments to each patient, but although the order was randomized, each patient received massage concurrently. No interval was allowed between treatments so that there was a possibility of carry-over effects. Further, the patients had several therapists each with their own personal approach to the problems involved. This aspect of treatment may have been important in the study by Wright (1964) in which the role of the placebo response was analysed in patients with osteoarthrosis of the knees. In the three treatment groups, short-wave diathermy, placebo injections and placebo tablets, there was considerable discrepancy in the amount of attention given by a doctor or therapist so that like was not compared with like as far as patient care was concerned. In order to link cause and effect, existing methods of

*Based on a paper "Treatment of Chronically Painful Knee Joints" read at the Annual Meeting of the British Association for Rheumatology and Rehabilitation, London, April 1974.

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assessment need re-examining and developing, while more rigorous trial design should concentrate on particular aspects of treatment. Patients with osteoarthrosis of the knee are frequently referred for conventional therapy and this group of patients has been studied. In this trial we have compared the value of ice and short-wave diathermy, using untuned short-wave diathermy as a control treatment.

TRIAL DESIGN

All treatments were given in the normal outpatient department by the same physiotherapist who fully understood the design of the trial. Treatments were randomly allocated and all were given three times a week for three weeks. Care was taken to ensure that equivalent time, attention and advice was given to all patients. The treatments given were ice and short-wave diathermy administered according to standard practice. The control group received untuned short-wave diathermy. Most patients had had a full course of anti-inflammatory or analgesic tablets with little benefit. They were, therefore, easily discouraged from self-medication during the course of the trial apart from occasional tablets for severe pain. The patients received no other therapy. No patient had received intra-articular injections or other physiotherapy during the preceding year and most had never had either of these treatments. Certain categories of patients were excluded from the trial (see Table I).

TABLE I

REASONS FOR EXCLUSION OF PATIENTS FROM THE TRIAL

1. Acute inflammatory arthritis requiring rest, splintage or other therapy.
2. Peripheral circulatory defects.
3. Sensory abnormalities.
4. Hip or spinal disorder causing pain in or around the knee.
5. Metal prostheses in or near the knee.
6. Sickle-cell disease, or cold agglutinins.
7. Obvious psychological disorders.

All patients were assessed before starting treatment, at three weeks, and at three months, using grading systems for pain, stiffness, tenderness and swelling. All assessments were carried out by one observer who had no knowledge of the treatment given. The range of motion, pain during movements, quadriceps bulk and knee circumference, and walking time were also recorded. The X-ray changes in the affected knee were also graded.

METHODS

PAIN

Pain was graded according to a four-point scale:

0 = nil; 1 = slight; 2 = moderate; 3 = severe.

Pain at rest, with walking, and the overall pain with other activities were graded in this way. Additional points were scored for night pain, pain preventing onset of sleep (1); sufficient to wake the patient from sleep—occasionally (1), every night (2)—and for each of five activities, other than walking, that the patient found painful. These individual gradings were summed giving each patient a pain score (maximum 17).

Stiffness

The patient's assessment of stiffness was graded 0–3.
0 = nil; 1 = slight; 2 = moderate; 3 = severe.

Physician's Assessment

The physician's assessment comprised the sum of the grades scored in tenderness, swelling and pain on motion. These were graded as follows:

Tenderness: 0 = nil; 1 = complaint of pain; 2 = complaint of pain and wincing; 3 = complaint of pain, wince and withdrawal.

Swelling: 0 = nil; 1 = palpable swelling; 2 = palpable, visible swelling; 3 = palpable, visible, changing contour of the joint.

A point was also scored for each painful area on motion.

Other Measures

The knee circumference was measured at the upper pole of the patella, and quadriceps bulk at 15 cm above this point. The range of motion was measured with a standard goniometer (Zimmer). The walking time over 50 ft was recorded in seconds.

The patients were asked to make an assessment at three weeks and three months. This was graded as:

−2 = Much worse;
−1 = Worse;
+0 = No change;
+1 = Slightly improved;
+2 = Moderately improved;
+3 = Considerably improved or no complaint.

Radiographs

The radiographs were graded for each compartment of the affected knee. For the medial and lateral compartments, particular attention was paid to joint space. A system based on a comparison of non-weightbearing and weightbearing films was devised and grades ranged from 0–4 with special attention to sclerosis, osteophytes and distortion.

The patello-femoral joint was graded as:

I. Minimal joint narrowing, small osteophytes;
II. Large osteophytes;
III. Marked joint-space narrowing and sclerosis.

RESULTS

Forty-eight patients were admitted to the trial comprising 33 females and 15 males all of whom had been referred to orthopaedic clinics because of painful knee joints. Forty-five patients completed the course of treatment. Thirty-nine patients have been assessed at three months. Three patients were withdrawn from three-week assessment, two of these requested other treatment and the other had an arthrogram performed. A further six were withdrawn from three-month assessment, three because of further treatment, two others had intercurrent illness, and one went abroad.

The numbers in the groups are as shown in Table II. The groups were homogeneous regarding age, sex, ponderal index, duration of disease and X-ray score (Table III).

TABLE II

NUMBER OF PATIENTS IN TRIAL

Treatment group	Initially	3 weeks	3 months
Placebo	16	13	12
Short-wave diathermy ..	17	17	13
Ice	15	15	14
	48	45	39

TABLE III

COMPOSITION OF GROUPS

Group	Number of patients	Mean age years	Number of males	Ponderal Index Ht. in cm Wt. in kg	No. with left leg affected	Duration of disease years	Mean X-ray score		
							Patella	Medial	Lateral
Placebo	13	63	4 (31%)	39.80±1.99	8 (62%)	3.2	1.0	1.6	0.33
Short-wave diathermy	17	57	6 (35%)	38.66±2.93	9 (53%)	2.8	1.1	1.0	0.36
Ice	15	64	4 (27%)	39.79±2.11	7 (47%)	2.7	1.1	1.1	0.21
Total	45	61 (S.D.±15.5)	14 (31%)	39.34±2.45	24 (53%)	2.9 (S.D.±1.4)	1.1	1.2	0.30

The groups were also homogeneous as regards the initial pain score, physician's assessment, range of motion, and thigh circumference. These outcome measures were subjected to an analysis of covariance, which adjusts for any minor group differences on the initial readings. The patient's assessment was analysed by straightforward analysis of variance. The groups were not entirely homogeneous as regards stiffness, walking time, and knee circumference, and for these variables chi-square tests were performed on the proportion of patients improving in each group.

Analysis at Three Weeks

The mean pain scores at three weeks showed a significant difference between the group receiving ice and the other two groups ($t = 2.4$; $P<0.05$) (Table IV, Fig. 1).

TABLE IV
MEAN PAIN SCORES

Group	Initially	3 Weeks	3 Months
Placebo	9.5	7.5	5.7
Short-wave diathermy	10.7	7.5	5.3
Ice	9.9	4.8*	4.1
Total (Mean±S.D.)	10.1±3.2	6.6±3.8	5.0±3.8

*Significantly different at 5% level.

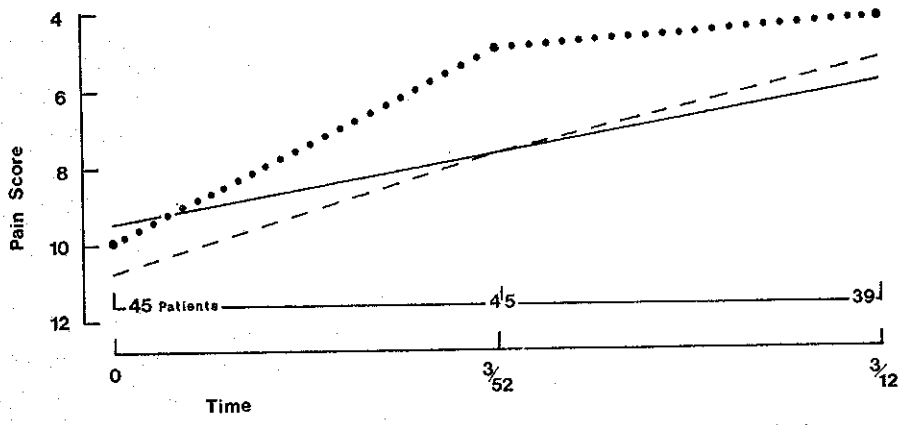

FIG. 1.—Analysis of groups according to pain score at three weeks and three months. .... ice; — — — short-wave diathermy; ———— placebo.

The significance disappeared at three months. The other results at three weeks are shown in Table V.

Stiffness, physician's assessment, and patient's assessment all favoured ice, but only the result for stiffness achieved significance. The other three parameters, knee circumference, range of motion, and walking time showed no significant difference between the groups at three weeks. The results at three months showed no significant difference between the groups on any measure, none of the results even approaching significance.

TABLE V

RESULTS AT THREE WEEKS (MEAN IMPROVEMENT±S.D.)

	Ice	Short-wave diathermy +placebo	Significance (from Anocova)
Stiffness	1.80±0.84	0.33±1.39	*
Physician's assessment ..	<2.47±3.87	0.93±4.02	N.S.
Knee range	<1.91±8.70	3.38±9.43	N.S.
Walking time	<0.96±2.14	<1.66±4.00	N.S.
Knee circumference ..	<0.27±0.73	<0.03±0.71	N.S.
Patient's assessment ..	2.00±1.13	1.43±1.01	†

* = $P<0.05$; † = $P<0.10$; N.S. = not significant.

QUADRICEPS SIZE

Before treatment the size of the quadriceps in the affected leg compared to the unaffected leg was slightly reduced (mean reduction 0.38 cm) but only with borderline significance ($P=0.08$), the reduction being approximately the same in each treatment group.

By three months there was actually a slight increase in the circumference of the thigh in all three groups (mean increase 0.29 cm).

ALL PATIENTS AT THREE MONTHS

If the results at three months are compared with the initial findings, most of the patients had improved at this stage as shown in Table VI. In fact 82% of all patients improved on at least three of the measures.

A significant improvement occurred in all measures except the knee circumference.

TABLE VI

IMPROVEMENT AFTER THREE MONTHS

Parameter	Mean improvement±S.D.	Significance
Pain	5.36±4.17	‡
Stiffness	0.58±1.58	*
Physician's assessment ..	1.94±5.05	*
Patient's assessment	2.06±1.25	‡
Knee range (degrees) ..	3.18±7.60	*
Walking time (sec)	1.65±2.12	‡
Circumference of knee (cm) ..	0.24±1.27	N.S.

* = $P<0.05$; ‡ = $P<0.001$; N.S. = not significant.

DISCUSSION

In this trial we have attempted to apply scientific methods of evaluation to a simple common form of physiotherapy, the palliation of pain in the osteoarthritic knee. We have been able to show a significant difference in response in the short term in patients receiving ice compared with short-wave diathermy whether tuned or untuned.

The ability to demonstrate a difference is likely to derive from rigorous trial design, although closer definition of the outcome measures may be important. In the experimental design we have been careful to ensure that all patients received equivalent care, and as far as treatment is concerned we have eliminated all other treatments, including exercise, and avoided carry-over effects. It might be considered that we should have included quadriceps exercises to make the treatment more complete and more acceptable to therapists. However, we were dealing with a chronic condition and as we wished to isolate each part of treatment, we felt that for a short course of treatment our decision was acceptable. In the event, no significant change in the quadriceps bulk occurred in any group during the period of the trial and indeed there was a tendency for it to increase. Active treatment of the quadriceps may be relevant only in acute incidents where rapid wasting can occur. In the chronic state and in the absence of marked wasting, general encouragement in activity is likely to be accompanied by maintenance of quadriceps bulk.

We were concerned to study measures of improvement particularly objective measures, since it is against these that subjective measures such as pain, ought to be compared. However, in patients with a chronic condition objective measures are unlikely to undergo change over a three-week period, and knee range, knee circumference and walking time showed no significant change between the groups at three weeks. For this reason more attention was paid to the pain, the main symptom with which this group of patients present, and the pain score was designed to provide a detailed analysis of this symptom. Thus we graded pain at rest, pain with walking, and pain with a range of other common activities. Night pain was common, and a number of patients were woken by their pain every night. No one component of the pain score could be used to differentiate between the groups at three weeks but when considered as a whole the pain score clearly showed a difference between those receiving ice and the other groups.

Stiffness is an inconstant symptom of osteoarthrosis of the knee. However, there was a significant reduction in the group receiving ice. This may be merely a reflection of the greater mobility resulting from pain relief in this group.

The physician's assessment and the patient's assessment both favoured ice at three weeks, but both need further evaluation as outcome measures.

At three months there was no real difference between the groups on any measure. Nevertheless, by three months most patients had improved, and this was shown by a significant change in all but one of the outcome measures (Table VI). It is not surprising that knee circumference showed no change, since patients with acute inflammatory episodes, and large effusions, were excluded and there is a need to study the treatment of such patients in a separate trial. The overall improvement may be due to the natural history, but it is tempting to relate it to the three-week period of care and attention

Evaluating physiotherapy is particularly difficult because the therapist has been taught, quite rightly, to adapt her therapy to the individual requirements of the patient at the time of treatment. Rigid treatment regimes are, therefore, anathema to the good therapist, but it is impossible to assess treatments if flexibility is allowed. Trials such as this can only attempt to provide the therapist with guide lines upon which treatment can be based.

ACKNOWLEDGMENTS

We wish to express our appreciation to colleagues whose patients were included in the study. We also wish to acknowledge the valuable secretarial help given by Mrs. N. Wright and Mrs. J. Ronniger of the Oxford Rehabilitation Research Unit.

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GENERAL DISCUSSION (ABRIDGED)

In reply to questions from DR. T. C. BELL, DR. CLARKE said that patients had been included unless they showed obvious psychiatric disturbance. Ice had been applied in bags above and below the knee. DR. M. A. CHAMBERLAIN mentioned a study which she was carrying out to evaluate physiotherapy for osteoarthritis. She suggested that the frequency of treatment was an important factor to be taken into consideration.