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Home based exercise programme for knee pain and knee osteoarthritis: randomised controlled trial

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Abstract

Objectives To determine whether a home based exercise programme can improve outcomes in patients with knee pain.
Design Pragmatic, factorial randomised controlled trial of two years' duration.
Setting Two general practices in Nottingham.
Participants 786 men and women aged ≥45 years with self reported knee pain.
Interventions Participants were randomised to four groups to receive exercise therapy, monthly telephone contact, exercise therapy plus telephone contact, or no intervention. Patients in the no intervention and combined exercise and telephone groups were randomised to receive or not receive a placebo health food tablet.
Main outcome measures Primary outcome was self reported score for knee pain on the Western Ontario and McMaster universities (WOMAC) osteoarthritis index at two years. Secondary outcomes included knee specific physical function and stiffness (scored on WOMAC index), general physical function (scored on SF-36 questionnaire), psychological outlook (scored on hospital anxiety and depression scale), and isometric muscle strength.
Results 600 (76.3%) participants completed the study. At 24 months, highly significant reductions in knee pain were apparent for the pooled exercise groups compared with the non-exercise groups (mean difference −0.82, 95% confidence interval −1.3 to −0.3). Similar improvements were observed at 6, 12, and 18 months. Regular telephone contact alone did not reduce pain. The reduction in pain was greater the closer patients adhered to the exercise plan.
Conclusions A simple home based exercise programme can significantly reduce knee pain. The lack of improvement in patients who received only telephone contact suggests that improvements are not just due to psychosocial effects because of contact with the therapist.

Introduction

Knee osteoarthritis contributes greatly to disability in the general population, particularly in elderly people.[1 2] Pain is the principal feature of knee osteoarthritis. Physiotherapy is often recommended, but many physiotherapy programmes have used intensive supervision and sophisticated equipment.[3 4] Since knee osteoarthritis is a considerable public health issue, a less expensive community based approach would be desirable.

We aimed to assess whether a home based exercise programme lasting two years could reduce knee pain and improve physical function in people with knee pain. We also aimed to determine the relative contribution of contact with a therapist in explaining these health outcomes.

Methods

Participants

A postal survey was sent to 9296 patients aged 45 and over registered at two general practices in Nottingham. Patients were defined as having knee pain if they responded "yes" to "Have you ever had pain in or around the knee on most days for at least a month?" and "If so, have you experienced any pain during the last year?"[5] Patients with knee pain were invited to an initial assessment. Exclusion criteria were total knee replacement, lower limb amputation, permanent cardiac pacemaker, unable to give informed consent, and no knee pain within the last week.

Interventions

The two year exercise programme was simple to use and applicable for all age groups. It was designed to maintain and improve the strength of muscles acting around the knee, the range of motion at the knee joint, and locomotor function. The programme was self paced but became progressively more challenging. Graded elastic bands were used to increase the resistance against which the muscles worked. The programme was taught in the participants' homes by a trained researcher. The initial training phase consisted of four visits lasting approximately 30 minutes in the first two months, with follow up visits scheduled at intervals of six months. Participants were encouraged to perform the programme with both legs for 20-30 minutes a day. They were instructed to increase the number of repetitions up to a maximum of 20 per leg. Adherence was assessed by means of self completed diaries, which were collected every six months.

Telephone contact consisted of monthly calls all made by the same researcher. The principal aim of the

Table 1 Characteristics of treatment groups treated for knee pain

Characteristic	Exercise and telephone (n=121)	Exercise, telephone, and dolomite (n=114)	Exercise (n=235)	Telephone (n=160)	Dolomite (n=78)	No intervention (n=78)
Mean (SD) age (years)	62.6 (9.36)	62.5 (8.86)	61.5 (9.58)	61.5 (9.02)	61.9 (9.84)	61.9 (9.39)
Mean (SD) body mass index	27.58 (3.93)	28.19 (4.76)	28.02 (4.18)	28.24 (4.93)	27.87 (5.53)	28.14 (4.81)
Mean (SD) WOMAC pain score	6.96 (3.54)	7.82 (3.61)	6.93 (3.55)	7.43 (3.48)	7.49 (3.63)	7.04 (3.67)
Mean (SD) strength of left quadriceps	204.61 (133.22) (n=74)	207.62 (109.96) (n=64)	218.16 (117.96) (n=141)	221.24 (127.14) (n=94)	213.46 (117.99) (n=45)	205.31 (99.96) (n=49)
Sex ratio (male:female)	39:61	38:62	36:64	34:66	35:65	35:65
No (%) with bilateral pain	89 (74)	79 (69)	161 (69)	102 (64)	50 (64)	48 (62)
No (%) with radiograph showing definite osteophyte	61/112 (54)	42/100 (42)	87/206 (42)	78/139 (56)	29/71 (41)	33/72 (46)

calls was to monitor symptoms and to offer simple advice on the management of knee pain. This intervention provided a control for the psychosocial contact inherent in delivery of the exercise programme. Participants in the control group (no intervention) received no contact between assessment visits.

Outcome measures

The primary outcome measure was self reported knee pain at two years. This was measured using the knee specific questionnaire of the Western Ontario and McMaster universities (WOMAC) osteoarthritis index. This has three domains: pain, stiffness, and physical function.[6] The pain domain produces a score of 0-20, with higher scores indicating more pain.

Secondary measures consisted of change in knee specific stiffness and disability, general physical function,[7] psychological score,[8] and isometric quadriceps muscle strength.[9] Radiographic osteoarthritis was defined by the presence of definite osteophyte in either compartment of at least one knee.[10]

Randomisation and blinding

Participants were allocated randomly to one of four groups: exercise therapy, monthly telephone contact, exercise therapy plus telephone contact, or no intervention. Participants allocated to the no intervention and combined exercise and telephone groups were further randomised to receive or not receive a placebo tablet (dolomite, a health food product containing calcium and magnesium) twice a week. The assessor was blinded to the intervention group and was the same for each assessment.

Statistical analysis

Analysis was performed on an intention to treat basis, with data carried forward from the last available assessment unless values were missing at the first assessment. We used a factorial analysis of variance model to assess changes in self reported knee pain at two years and number needed to treat to assess the clinical importance of these findings.[11 12] A clinically important improvement was defined as a reduction in pain $\geq$50%. As number needed to treat is known to be highly sensitive to baseline values, the odds ratio is also presented.

Results

In total, 786 participants were recruited between January 1996 and January 1997. Follow up was completed in January 1999. Characteristics were comparable at baseline (table 1). Overall, 600 (76%) participants completed the study and returned for final assessment at 24 months.

Factorial analysis

No significant differences were found between the groups that did and did not receive the placebo intervention (no intervention *v* placebo, P=0.66; exercise plus telephone *v* exercise, telephone, and placebo, P=0.94). These subgroups were therefore merged, and the analysis performed on the original four groups.

Primary outcome

At 24 months the exercise groups differed significantly from the non-exercise groups (table 2). Similar improvements were not observed for the telephone groups compared with the non-telephone groups or for the interaction of the exercise and telephone groups.

Sensitivity analysis excluding those patients who received the placebo tablet did not change our conclusions. Mean differences were −1.12 (95% confidence interval −1.71 to −0.54) for exercise versus non-exercise and −0.44 (−1.02 to 0.13) for telephone versus non-telephone.

On the basis of a the comparison of the exercise group with the non-exercise group, the number needed to treat to achieve a $>$50% improvement in knee pain in 13.0 (6 to 20). This equates to an odds ratio of 1.5. Exercise was consistently better at reducing pain at 6, 12, and 18 months than no exercise (table 2).

Secondary outcomes

At two years, 226 (48%) of those allocated to receive exercise therapy completed the programme. The most common reasons for failing to adhere to the programme were related to health problems (back and hip pain) and lack of time. Fifty two (11%) of those exercising reported side effects, but these were generally minor (for example, the exercise band was painful around their ankle). Self reported adherence to the exercise programme was crudely graded as high (n=128), medium (n=32), or low (n=307). The impact of exercise adherence on self reported pain at 24 months suggested a dose-response effect, with effect sizes of 0.42, 0.34, and 0.16 for the three grades of adherence, respectively.

Scores for stiffness and physical function on the WOMAC index both showed significant improvements for the exercise groups compared with the non-exercise groups (table 2). Isometric muscle strength was higher in the exercise groups than in the non-exercise groups (mean difference 18.4 N (95% confidence interval 7.0 to 29.8); P=0.002), but general physical function, anxiety, and depression at 24 months

Table 2 Change in WOMAC pain scores at follow up, and physical function and stiffness of knee at 24 months. Negative values show improvement in symptoms

Outcomes	No of patients	Baseline	Mean difference (95% CI)†	P value	Effect size
Primary outcome					
Knee pain at 6 months:					
Exercise	467	7.15	−0.61 (−1.0 to −0.2)	0.003	0.21
Non-exercise	316	7.35			
Knee pain at 12 months:					
Exercise	467	7.15	−0.61 (−1.0 to −0.2)	0.005	0.20
Non-exercise	316	7.35			
Knee pain at 18 months:					
Exercise	467	7.15	−0.69 (−1.1 to −0.2)	0.003	0.22
Non-exercise	316	7.35			
Knee pain at 24 months:					
Exercise*	467	7.15	−0.82 (−1.3 to −0.3)	0.001	0.25
Non-exercise	316	7.35			
Telephone*	393	7.10	−0.16 (−0.6 to 0.3)	0.50	0.05
Non-telephone	390	7.40			
Secondary outcome					
Physical function at 24 months:					
Exercise	466	23.15	−2.57 (−4.1 to −1.1)	0.001	0.25
Non-exercise	316	22.97			
Stiffness at 24 months:					
Exercise	470	3.42	−0.29 (−0.5 to −0.1)	0.01	0.18
Non-exercise	316	3.46			

Values for telephone groups compared with non-telephone groups were not significant at 6, 12, and 18 months.
*P=0.54 for interaction of exercise and telephone.

What is already known on this topic

Physiotherapy is often prescribed for the treatment of knee pain

Previous trials have usually been short and used intensive supervision and sophisticated equipment

The impact of psychological factors in reducing pain is unclear

What this study adds

Home based programmes involving exercise for up to 30 minutes a day significantly reduce self reported knee pain

Social support alone does not improve health outcomes

Reductions in pain are greater for patients the closer they adhere to exercise programmes

were not significantly altered by any of the study interventions.

Discussion

This study shows that simple home based exercise therapy over two years can produce small but significant reductions in knee pain. The exercise programme was generally well tolerated, although adherence was moderate. The introduction of telephone support contributed little to observed reductions in knee pain. It is reasonable to attribute the beneficial effects primarily to the exercise intervention rather than to secondary effects because of improved psychosocial contact.

Comparison with other studies

That this was a pragmatic study is important when comparing it with other studies. In addition to using an intention to treat analysis, we used a practical intervention that involved limited input from health professionals, a long period of follow up, and entry criteria based on knee pain rather than radiographic status. We anticipated that these factors would improve the generalisability of our study findings, but that effect sizes would be smaller than those reported by other exploratory trials. For example, a large study comparing exercise therapy with education reported effect sizes of 0.3-0.6 for pain and function.[13] It was based in primary care, it involved contact with a physiotherapist one to three times per week, and outcomes were assessed after 12 weeks. Follow up data show that these improvements were not sustained at nine months.[14]

A more comparable 18 month study compared aerobic exercise and resistance exercise with an education programme.[15] This study reported 12% and 8% reductions in pain and effect sizes of 0.5 and 0.3 in the aerobic and resistance exercise groups, respectively. Again this involved an element of supervised therapy, and patients were included on the basis of both radiographic evidence of osteoarthritis and difficulty with activities of daily living, in addition to self reported knee pain.

Conclusion

Simple home based exercise programmes can produce significant reductions in knee pain over two years. Such programmes are ideally suited for primary care. Future work should focus on establishing which patients are likely to benefit most from an intervention of this kind.

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The SCOFF questionnaire and clinical interview for eating disorders in general practice: comparative study

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Standards 2 and 3 of the national service framework for mental health outline the need to improve health care for patients with anorexia nervosa and bulimia nervosa.[1] Healthcare workers in primary care are at the forefront of screening and managing these disorders. Assessment tools available to primary healthcare professionals can take a long time to administer and may need to be interpreted by specialists[2]; this may limit improvements in care. A screening tool was developed, but only to facilitate epidemiological research.[3]

The SCOFF questionnaire is a brief and memorable tool designed to detect eating disorders and aid treatment (see figure). It showed excellent validity in a clinical population and reliability in a student population.[4,5] We assessed the SCOFF questionnaire in primary care.

Participants, methods, and results

We invited sequential women attenders (aged 18-50) at two general practices in southwest London to participate. We gave participants information sheets that described the study. Women who verbally consented to participate were asked the SCOFF questions in a separate room; this took about two minutes. A researcher blind to the woman's score on the SCOFF questionnaire conducted a clinical diagnostic interview lasting 10-15 minutes, based on criteria from the *Diagnostic and Statistical Manual of Mental Disorders* (fourth edition). Women identified by the interview as having an eating disorder were invited to discuss this and were offered the contact number for the Eating Disorders Association. The local research and ethics committee approved the study.

Of the 341 women who agreed to take participate, one (who had a body mass index of 17 (weight (kg)/height $(m)^2$)) had anorexia nervosa, three had bulimia nervosa, and nine had an "eating disorder not otherwise specified." A receiver operating curve set the optimal threshold for the questionnaire at two or more positive answers to the five questions. With this cut off, the SCOFF questionnaire detected all four cases of anorexia nervosa and bulimia nervosa and seven of nine cases of eating disorders not otherwise specified (figure). The questionnaire had a sensitivity of 84.6% (95% confidence interval 54.6% to 98.1%). In the 328 women confirmed not to have an eating disorder, the questionnaire indicated 34 false positives. It had a specificity of 89.6% (86.3% to 92.9%), positive predictive value of 24.4% (12.9% to 39.5%), and negative predictive value of 99.3% (97.6% to 99.9%).

Comments

The SCOFF questionnaire detected all cases of anorexia and bulimia nervosa. It is an efficient screening tool for eating disorders.

Two missed cases of eating disorders not otherwise specified reflect the reality of clinical situations, in which denial or non-disclosure by patients may occur. One of the patients in whom the diagnosis was missed later disclosed disordered eating behaviour. It may be more difficult and perhaps less pertinent to detect patients who do not meet full criteria for anorexia nervosa or bulimia nervosa.

The positive predictive value of the questionnaire is low because of the low prevalence of eating disorders in this sample, which was consistent with the Western

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