Safety of a home exercise programme in patients with polymyositis and dermatomyositis: a pilot study

H. Alexanderson1, C. H. Stenström1,2 and I. Lundberg3

1Department of Physical Therapy, Department of Rheumatology, Karolinska Hospital, Karolinska Institute, Stockholm, 2Department of Physical Therapy, Karolinska Institutet, Stockholm and 3Department of Rheumatology, Karolinska Hospital, Stockholm, Sweden

Abstract

Objectives. To investigate whether a home exercise programme could safely be performed by patients with stable, inactive polymyositis (PM) and dermatomyositis (DM), regarding disease activity, muscle function, health status and pain.

Methods. Ten patients with reduced muscle function completed the study. A home exercise programme including exercises for strength in the upper and lower limbs, neck and trunk, for mobility in the upper limbs and moderate stretching was developed. The patients exercised for 15 min and took a 15 min walk 5 days a week during a 12 week period. Assessments included clinical evaluation of disease activity, serum creatinine phosphokinase (CPK) levels, magnetic resonance imaging (MRI) of the quadriceps, repeated muscle biopsy of the vastus lateralis, a muscle function index (FI), a walking test and a health status instrument (the SF 36) performed at the start of the study and after 12 weeks.

Results. After 12 weeks of exercise, there were no signs of increased disease activity as assessed clinically, by CPK values, MRI or muscle biopsy findings. On an individual basis, all patients improved regarding muscle function according to the FI, in six cases the improvement reached statistical significance ($P < 0.05$). A significant improvement regarding muscle function in the upper and lower limbs, walking distance and general health status was achieved.

Conclusions. Our results indicate that this home exercise programme can be safely employed in patients with stable, inactive PM and DM, with beneficial effects on muscle function.

Key words: Muscle function, Inflammatory myopathies, Muscle inflammation, Training programme.

The characteristic clinical features of polymyositis (PM) and dermatomyositis (DM) are proximal and symmetrical muscle weakness, reduced muscle endurance and in some cases muscle pain [1, 2]. Most patients respond to high doses of corticosteroids, at least to some degree, but a substantial number develop a chronic course with persisting muscle weakness [3–5]. Disuse of muscle, corticosteroid myopathy or persistent disturbed metabolic function are all potential mechanisms for this chronic muscle weakness in which physiotherapy could have a beneficial effect [6, 7]. In patients with PM and DM, the role of physiotherapy has been unclear, however, due to fear that exercise could aggravate the muscle inflammation [8–10]. The basis for avoiding active exercise in the rehabilitation of patients with inflammatory myopathies seems, however, to be founded on myths based on the knowledge that vigorous exercise, such as a marathon race, could cause muscle fibre damage [11]. No published data support the concept of rest and restricted exercise for patients with PM and DM. On the contrary, a few recent studies encompassing a limited number of patients have reported a favourable outcome of active exercise in patients with PM and DM [12–14]. These reports encouraged us to develop an exercise programme that could be performed at home.

The aim of this study was to evaluate the safety and effects of a home exercise programme for flexibility and strength employed in patients with inactive, stable PM or DM regarding disease activity, muscle function and pain.
Patients and methods

Patients

Eleven women and two men with stable, inactive PM or DM with a history of remaining muscle weakness were included in the study. Diagnosis had in all cases been verified by inflammatory infiltrates in a muscle biopsy or by pathological EMG according to suggested diagnostic criteria [15, 16]. Patients diagnosed with inclusion body myositis (IBM) were excluded. Three patients were unable to complete the study. One had a flare of myositis just before starting the exercise programme, a second patient stopped exercising due to a bout of influenza and was later not motivated to continue the exercise, and a third patient had an infectious bronchitis during the last 6 weeks of the study. Thus, the results are based on the remaining 10 patients.

Assessments

Laboratory, clinical and functional assessments were conducted at the start of the study and after 12 weeks. Laboratory measurements included erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) (normal value <10 mg/l and creatine phosphokinase (CPK) (normal value for women <2.5 μcat/l and for men <3.3 μcat/l).

Muscle biopsies and magnetic resonance imaging (MRI) of the thigh muscles were performed at the start of the study and after 12 weeks. The muscle biopsies were taken from the vastus lateralis under local anaesthesia by a percutaneous technique using a conchotome according to the method of Henriksson et al. [17]. The repeated biopsy was performed on the contralateral side.

Pain and subjective muscle weakness during the last week before each assessment were registered using a visual analogue scale (VAS; 0–100) in which 0 indicated no muscle pain or no weakness and 100 indicated the worst muscle pain or weakness that could be imagined [18].

The muscle function tests were all performed by the same investigator. Muscle function was assessed according to the FI [19]. This index includes muscle endurance encompassing a total score of 64 points per right and left side, indicating no limitation of muscle function. To measure grip strength, we employed the Grippit instrument [20], which after a separate investigation was determined to be more reliable than the sphygmomanometer originally included in the muscle function index.

Walking distance was assessed on a treadmill. After trying different speeds for 1 min, patients were instructed to choose a speed for a 7 min submaximal walk. When starting the test, the treadmill was sloped 5.5%. In the case where the patient felt exhausted before 7 min the test was stopped and considered completed, and the distance was registered.

For health status assessment, the SF-36 instrument was used [21]. High scores indicate well-being and low scores a reduced quality of life.

Statistical analysis

To compare the status of the patient group and individual status at the start of the study and after 12 weeks, we used the Wilcoxon signed rank test.

Results

After 12 weeks of exercise, there was no evidence of increased disease activity according to CPK, ESR or CRP levels. The median CPK value at study onset was 3.25 μcat/l and at 12 weeks 3.35 μcat/l. There were no signs of increased muscle inflammation observed in the repeated muscle biopsies or the MRI investigations. In one of the 10 subjects, a perivascular infiltrate was observed in the muscle biopsy at the start of the study.

Table 1. Demographic and background characteristics of 10 patients with myositis

<table>
<thead>
<tr>
<th>Diagnosis, PM/DM (n)</th>
<th>5/5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female/male (n)</td>
<td>8/2</td>
</tr>
<tr>
<td>Age, yr, median (range)</td>
<td>53 (27–60)</td>
</tr>
<tr>
<td>Disease duration, yr, median (range)</td>
<td>4 (2–10)</td>
</tr>
</tbody>
</table>

Medication*:

- Oral steroids (n) 6
- Azathioprine (n) 5
- Methotrexate (n) 1
- NSAID (n) 1
- Work, full/part (n) 1/5
- Sick leave, retired (n) 4

Exercise, days/week (n):

- Twice 3
- Once 4
- None 3

*Several patients had more than one type of medication.
In the second set of biopsies, performed after 12 weeks of exercise in nine cases, there were no signs of inflammation. MRI performed in nine cases indicated an increased amount of fat in one subject on both examinations, all other MRI scans appearing normal. Medical treatment remained unchanged during the 12 weeks of exercise for seven patients, but in two patients who improved clinically the prednisone dose was tapered from 12.5 to 10 mg/day and from 5 to 2.5 mg/day, respectively, and in one case azathioprine was reduced from 150 to 50 mg/day.

After 12 weeks, the group improved significantly regarding muscle function, as assessed by several parameters ($P < 0.05$), which are presented in Table 2. On an individual basis, all patients improved according to the FI, six of them significantly ($P < 0.05$). Those four patients who did not improve significantly as assessed by the FI had <20% reduction of FI at the start of the study. No patient declined in any function, except for one patient who had problems with stiffness in her hands which led to a slight decrease in total FI score on the left side by one point. A significant improvement of health status, as assessed by SF 36, was also observed (Table 2). The exercise programme was well tolerated. One of the 10 patients could not, however, perform the exercise programme during 2 of the first 6 weeks due to a viral infection, and another patient exercised twice a week and walked 5 days a week during the first 6 weeks due to lack of time and a common cold.

### Discussion

A physically active lifestyle has a beneficial effect on general fitness and in lowering mortality in healthy people, with a reduction of cardiovascular disease [22]. Resistive exercise is also well documented to have beneficial effects on muscle function under normal conditions and in patients with various neuromuscular disorders [23–25]. In inflammatory myopathies, however, active resistive exercise has, on the contrary, been considered to be possibly harmful [8–10]. Thus, the primary aim of this study was to investigate the safety of a moderate exercise programme for patients with stable inactive PM or DM. Careful follow-up was undertaken and, in agreement with a recently published study on sporadic IBM cases, no evidence of increased muscle inflammation could be detected in repeated muscle biopsies or with MRI [26]. The immunosuppressive treatment was even reduced in some cases due to clinical improvement.

A second aim of the study was to develop an exercise programme with easy to moderate resistive exercise that could easily be performed at home. By alternating between exercises of the upper and lower limbs, neck and trunk muscles, the risk of overexertion of any muscle group was minimized. The programme was also well tolerated. A significant improvement of muscle strength in upper and lower limbs, and walking abilities, was achieved. Two patients with a mild reduction of muscle weakness considered the programme too easy and did not improve significantly. The absence of improvements of strength in neck and trunk muscles, and mobility in bed, could be explained by the initial minimal reduction of function in these muscle groups. An improvement of health status as assessed by the SF 36 instrument was achieved simultaneously, emphasizing the clinical significance of the improvements. In the subject who had the prednisone dose slightly increased at the start of the study because of increased muscle pain, it seems unlikely that this change of therapy influenced the improvement in function as the reduction in muscle function had persisted on the higher prednisone dose long before.

To evaluate the effect of the exercise programme, we chose to use a test of muscle function [19]. The advantages of this index compared to measurements of muscle strength are several, the most important being that it measures muscle endurance, the clinically predominant problem. Furthermore, the tests are relevant to daily activity which may motivate patients to pursue regular exercise. The FI had previously not been used to assess changes during follow-up and it was found to lack sensitivity when detecting a low extent of muscle weakness. In the patients who had an almost normal FI score at the start of the study, an isokinetic system might have been a more sensitive tool and could thus have been a valuable complement to assess muscle function.

This study confirms earlier reports that moderate,

### Table 2. Assessment results at the start of the study and at 12 weeks of exercise for 10 patients with polymyositis and dermatomyositis

<table>
<thead>
<tr>
<th>Function</th>
<th>At start of the study</th>
<th>At 12 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$n = 10$ md (range)</td>
<td>$n = 10$ md (range)</td>
</tr>
<tr>
<td>Disease impact (0–5)</td>
<td>3 (1–5)*</td>
<td>2 (0–5)*</td>
</tr>
<tr>
<td>Pain (0–100)</td>
<td>13 (0–75)</td>
<td>9 (0–52)</td>
</tr>
<tr>
<td>Muscle weakness (0–100)</td>
<td>45 (2–70)</td>
<td>33 (0–62)</td>
</tr>
<tr>
<td>SF-36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical Functioning</td>
<td>57.5 (20–80)</td>
<td>75 (20–85)**</td>
</tr>
<tr>
<td>Role–Physical</td>
<td>12.5 (0–100)</td>
<td>75 (0–100)**</td>
</tr>
<tr>
<td>Bodily Pain</td>
<td>87.8 (24.5–100)</td>
<td>51 (31–100)</td>
</tr>
<tr>
<td>General Health</td>
<td>52 (15–87)</td>
<td>55 (25–92)*</td>
</tr>
<tr>
<td>Vitality</td>
<td>77.5 (20–100)</td>
<td>70 (10–100)*</td>
</tr>
<tr>
<td>Social Functioning</td>
<td>87.5 (25–100)</td>
<td>100 (25–100)*</td>
</tr>
<tr>
<td>Role–Emotional</td>
<td>100 (0–100)</td>
<td>100 (0–100)*</td>
</tr>
<tr>
<td>Mental Health</td>
<td>90 (40–100)</td>
<td>92 (24–100)*</td>
</tr>
<tr>
<td>UL, right (0–20)</td>
<td>17.5 (7–20)</td>
<td>18.5 (11–20)*</td>
</tr>
<tr>
<td>UL, left (0–20)</td>
<td>17 (4–19)</td>
<td>18 (10–20)*</td>
</tr>
<tr>
<td>LL, right (0–25)</td>
<td>20 (8–25)</td>
<td>25 (14–25)*</td>
</tr>
<tr>
<td>LL, left (0–25)</td>
<td>20 (7–25)</td>
<td>24.5 (14–25)*</td>
</tr>
<tr>
<td>Neck (0–5)</td>
<td>4.5 (0–5)</td>
<td>5 (1–5)</td>
</tr>
<tr>
<td>Trunk (0–5)</td>
<td>5 (0–5)</td>
<td>5 (2–5)</td>
</tr>
<tr>
<td>Transfer (0–6)</td>
<td>6 (4–6)</td>
<td>6 (4–6)</td>
</tr>
<tr>
<td>PEF (0–3)</td>
<td>3 (2–3)</td>
<td>3 (2–3)</td>
</tr>
<tr>
<td>Total right score (0–64)</td>
<td>48.5 (32–64)</td>
<td>57 (41–64)*</td>
</tr>
<tr>
<td>Total left score (0–64)</td>
<td>47.5 (28–63)</td>
<td>57 (42–64)*</td>
</tr>
<tr>
<td>Walking distance (m)</td>
<td>312 (81–422)*</td>
<td>404 (124–549)*</td>
</tr>
</tbody>
</table>

* $P < 0.05$ compared with the start of the study. UL, upper limbs; LL, lower limbs; PEF, peak expiratory flow.

*One missing value.

*Two missing values.

*No significant difference regarding Role–Physical.
resistive exercise can be safely performed in patients with stable, inactive PM and DM. Based on the general positive effect of physical exercise compared to a sedentary lifestyle, we suggest that a moderate exercise programme should be included in the rehabilitation of patients with PM and DM, and that this could preferably be performed as a home exercise programme.

Acknowledgements
We would like to thank Dr Inger Nennesmo for assessing the muscle biopsies and Dr Robert A. Harris for critical reading. Financial support was provided by the Swedish Rheumatism Association, the King Gustav V 80 year Foundation, the Börje Dahllins Foundation, the Åke Wiberg Foundation and the Prof. Nanna Svartz Foundation.

References