ABSTRACT

Objective: The aim of this work is to study the effects of intensive strengthening exercises on the functional ability, fatigue, psychological status as well as disease activity in patients with RA.

Methods: This study comprised 30 female patients with RA who were selected from the outpatient-clinics and in-patients of the departments of Rheumatology and Rehabilitation, Banha University Hospitals and Banha Teaching Hospital. These patients were randomly divided into 2 groups, each group consisted of 15 patients, where group (I) was allocated to an intensive exercise program twice weekly for 12 weeks. Group (II) patients were on a usual care program of range motion exercises. Both groups were matched as regard age (P = 0.23), duration of the disease (P = 0.15), weight (P = 0.3) and height (P = 0.9). All patients were almost on the same treatment regimen were subjected to a full history taking, thorough clinical examination, laboratory investigations and other clinical data (including: Multidimensional Assessment of Fatigue (MAF), Health Assessment Questionnaire (HAQ) and Disease Activity Score of 28 Joint Count (DAS28), walk test time, stair test time, depression and anxiety scores), that were obtained at presentation and after 12 weeks.

Results: By comparison between the two groups after 12 week, clinical evaluation data and laboratory data showed statistically significant differences as regard morning stiffness (P = 0.001), MAF (P = 0.001) and ESR (P = 0.002), and highly statistically significant differences as regard, HAQ, walk and stair tests, depression and anxiety scores (P<0.001) in favor of group (I). However, there were no statistically significant differences in DAS (P = 0.07) parameter between the two groups.

Conclusion: Twelve weeks intensive strengthening exercise program is effective in improving morning stiffness, fatigue, functional disability, depression and anxiety that occur in patients with RA. This program also has no deleterious effect on disease activity.

Introduction

RA is the most common inflammatory arthritis, often resulting in structural damage that can lead to severe disability (Paul et al., 2001). Pain and inflamed joints lead to diminished level of physical activity. Apart from damaging consequence of the disease on joints and muscles, physical inactivity contributes to contractures, muscles atrophy
and poor physical fitness (Hakkinen et al., 1995).

Disability is the most common complication associated with RA. As regard traditional trends in the management of RA which suggest joint rest and splintage; joint rest may contribute to increased muscle weakness and joints contracture which are caused also by the disease process of RA (Edward and Haris, 2001).

Exercise prevents the vicious cycle of joint pain that leads to joint stiffness, soft tissue contracture, diminished muscle strength and endurance, with loss of independence (Axel et al., 2003).

RA patients therefore are encouraged to exercise in order to increase muscle strength and joints mobility and owing to a fear of enhancing joint inflammation and accelerating cartilage destruction, it has been advocated that exercise treatment in RA should be restricted to gentle assisted range of motion (ROM) exercises (Vanden et al., 2000). Intensive weight-bearing exercises improve muscle strength and functional ability without increase in disease activity (Zuzana et al., 2003).

The aim of this work is to investigate the effectiveness and safety of intensive dynamic exercises in patients with rheumatoid arthritis in comparison to usual care regimens of range of motion and isometric exercises as regards changes in fatigue, functional ability, psychological status, as well as disease activity.

Patients and Methods

This study was carried out on thirty females with rheumatoid arthritis diagnosed according to the American College of Rheumatology (ACR) revised criteria (Arnett et al., 1988). These patients were selected from the outpatient clinics and inpatients of the departments of rheumatology and rehabilitation, Banha University Hospitals and Banha Teaching Hospitals.

Certain criteria should be present in these patients for including in the study, these criteria were justified by a careful clinical examination, that included:

- Age 30-60 years.
- ACR functional classes I-III.
- Stable DMARD (disease modifying anti-rheumatic drugs) regimen in past 3 months.
- Able to cycle.
- Willing to exercise biweekly on a fixed schedule.
- No prosthesis of a weight-bearing joint.
- No cardiopulmonary disease excluding intensive exercise.
- No comorbiditity causing a short life expectancy.
- No serious psychiatric disease.
- Able to complete a questionnaire.

Selected patients were randomly allocated into 2 groups:

**Group I:** Including 15 patients who were subjected to an intensive exercise-program that was performed for 45-60 minutes twice per week for 12 weeks.

**Group II:** Including 15 patients who were allocated for the usual care program for 12-weeks. This group was
designated as a control group.

All the patients were subjected to a full clinical examination with complete physical and functional evaluation at presentation and after 12 weeks of the designated program according to a standardized rheumatologic sheet including:

* **Clinical Assessment of Disease Activity:**

Using the modified disease activity score of 28 joint count (DAS28) (Prevoo et al., 1995).

\[
\text{DAS28} = 0.56 \sqrt{\text{TEN28}} + 0.28 \sqrt{\text{SW28}} + 0.70 \ln(\text{ESR}) + 0.014 \ (\text{GH})
\]

where;  
\[\begin{align*}
\text{TEN28} & = 28 \text{ joint count for tenderness.} \\
\text{SW28} & = 28 \text{ joint count for swelling.} \\
\ln \text{ESR} & = \text{natural logarithm of ESR.} \\
\text{GH} & = \text{general health or patient's global assessment of disease activity using VAS (100 mm).}
\end{align*}\]

* **Patient Evaluation and Assessment of Physical Function:**

1. **Fatigue:**

Patients were asked about their feeling of fatigue, which was assessed using: the Multidimensional Assessment of Fatigue (MAF) scale (Belza, 1995). The MAF scale contains 13 items and measures 5 dimension of fatigue: degree, severity, distress, impact on activities of daily living (ADL) and timing. For each of these dimensions the 100mm visual analog scale (VAS) was changed to a 10 point numerical rating scale. The possible score for our study ranged from 0 (no fatigue) to 50 (severe fatigue).

2. **Modified Health Assessment Questionnaire (MHAQ):** (Pincus et al., 1983).

This format was modified to include 8 of the 20 ADL questions of the original HAQ (Fries et al., 1980). The 8 activities were selected on the basis of intuitive choice of which one of the 2 or 3 in each HAQ category was most likely to apply to the largest number of people.

Responses regarding degree of difficulty were coded 0, 1, 2 and 3 identical to that of the HAQ. The 8 scores of the 8 sections are summed and divided by 8. The result is the disability index (DI) or functional disability index (FDI). The MHAQ is not scored if fewer than 7 items are completed.

3. **Observed functional performance:**

This was measured by a walk-test (time needed to walk a distance of 50 feet) and a stair-test (time needed to go up and down a flight of 10 steps) measured in seconds (Van den et al., 2000).

4. **Anxiety and depression scales:**

These parameters were derived from the Arthritis Impact Measurement Scales (AIMS) (Meenan et al., 1987).
Program of Exercises; Group (I):
a) Warming up for 10 minutes of peripheral and spinal range of motion exercises combined with or walking activity.
b) Cycling using a stationary bicycle for 20 minutes.
c) Strengthening exercises of 10-15 minutes for major peripheral muscles groups including elbow flexors, knee extensors, hip flexors and abductors, as well as muscles responsible for shoulder circumduction. The exercises were performed using weights that were gradually increased from 0.5 kg to 2 kg.
d) Cooling down for 10-15 minutes of static stretching activities.

The program of exercises was explained to patients to get their cooperation and consent. The patients were guided and carefully observed during sessions for any complaint. In cases of extra pain lasting for more than 2 hours and occurring within 24 hours after training, the exercise load was temporarily decreased.

Program of Exercise; Group (II):
The exercise program consisted of range of motion exercises and non weight-bearing isometric, muscle strengthening exercise for the trunk and upper and lower extremities. Exercises were proformed in prone, sitting and standing positions, for 20 minutes and patients were advised to exercise at least twice per week for 12 weeks.

Laboratory Investigations:
1. A full blood picture.
2. Hemoglobin concentration.
3. Erythrocyte sedimentation rate (ESR).
4. Rheumatoid factor in the serum, using the latex fixation test.

Results
This study comprised thirty female patients with RA who were randomly divided into two groups:
• Group (I) patients were allocated to an intensive exercise-program for 12 weeks, their ages ranged between 33-63 years (mean±SD = 39.4±8.6 years) and their duration of disease ranged between 1.5-8 years (mean±SD = 4.03±1.8 years).
• Group (II) patients were allocated to the usual care program that included range of motion exercises, their ages ranged between 31-63 years (mean±SD = 43.5±9.4 years) and duration of the disease ranged between 2-15 years (mean±SD = 5.6±3.7 years) these patients were considered as a control group. Both groups were matched as regard age (P = 0.23), duration of disease (P = 0.15), weight (P = 0.3) and height (P = 0.9).

Table (1) shows comparison of clinical and laboratory data of group (I) at presentation and after 12-weeks of intensive exercises with percent changes in these parameters.

There were significant reduction in morning stiffness (P = 0.001) by 34.3%, in fatigue scale (P = 0.001) by 26.75%, in HAQ (P = 0.001) by 39%, in walk test time (P = 0.002) by 10.5%, in stair test time (P = 0.01) by 7.9%, in depression score (P = 0.001) by
21%, in anxiety score (P = 0.001) by 17.6%, and in DAS (P = 0.02) by 4.6%. The ESR showed 2.5% non significant (P = 0.6) reduction.

Table (2) shows comparison of clinical and laboratory evaluation data before and after 12 week of usual care program in group II, with percent changes in these parameters.

There were significant increase in morning stiffness (P = 0.002) by 9.8%, in fatigue scale (P = 0.004) by 6.3%, in walk test time (P = 0.02) by 4.8%, in stair test time (P = 0.03) by 5.2%, in depression score (P = 0.002) by 7.5%, and in DAS (P = 0.002) by 4.35%. Also, there were non significant increase HAQ (P = 0.1) by 3%, in anxiety score (P = 0.12) by 3.04, and in ESR (P = 0.8) by 0.8%.

Table (3) shows comparison between both groups as regards clinical and laboratory evaluation data after 12 week.

There were statistically significant differences between both groups as regard morning stiffness (P = 0.001), MAF (P = 0.001) and ESR (P = 0.002), and highly statistically significant differences as regard, HAQ, walk and stair tests, depression and anxiety score (P<0.001). However, there were no statistically significant differences in DAS (P = 0.07) parameters between two groups.

Figure (1) show comparison between changes in the clinical and laboratory evaluation data after 12 week of exercise of both groups. All the results were statistically significant.

Table (1): Comparative study of clinical evaluation and laboratory data before and after exercise in group (I) patients.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>At presentation</th>
<th>After 12 week</th>
<th>P-value</th>
<th>Rate of changes in group I</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean±SD</td>
<td>Mean±SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MAF</td>
<td>21.5±11.5</td>
<td>15.8±9.1</td>
<td>0.001*</td>
<td>26.75%</td>
</tr>
<tr>
<td>HAQ</td>
<td>0.6±0.4</td>
<td>0.4±0.2</td>
<td>0.001*</td>
<td>39%</td>
</tr>
<tr>
<td>Walk test/sec</td>
<td>16.6±2.2</td>
<td>14.8±2.0</td>
<td>0.002*</td>
<td>10.5%</td>
</tr>
<tr>
<td>Stair test/sec</td>
<td>17.9±3.3</td>
<td>16.5±3.1</td>
<td>0.01*</td>
<td>7.9%</td>
</tr>
<tr>
<td>Depression score</td>
<td>22.1±8.0</td>
<td>17.5±5.0</td>
<td>0.001*</td>
<td>21%</td>
</tr>
<tr>
<td>Anxiety score</td>
<td>24.8±8.2</td>
<td>20.4±6.2</td>
<td>0.001*</td>
<td>17.6%</td>
</tr>
<tr>
<td>DAS</td>
<td>3.6±0.8</td>
<td>3.5±0.8</td>
<td>0.02*</td>
<td>4.6%</td>
</tr>
<tr>
<td>ESR mm/h</td>
<td>32.9±12.6</td>
<td>32.1±12.9</td>
<td>0.6</td>
<td>2.5%</td>
</tr>
<tr>
<td>Morning stiffness/minutes</td>
<td>72.0±32.7</td>
<td>47.3±29.08</td>
<td>0.001*</td>
<td>34.3%</td>
</tr>
</tbody>
</table>

* P-value <0.05 significant.
Table (2): Comparative study of clinical evaluation and laboratory data before and after 12-weeks of usual care program in group (II) patients.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>At presentation Mean ± SD</th>
<th>After 12 week Mean±SD</th>
<th>P-value</th>
<th>Rate of changes in group II</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAF</td>
<td>27.0±8.7</td>
<td>28.7±9.3</td>
<td>0.004*</td>
<td>6.3 %</td>
</tr>
<tr>
<td>HAQ</td>
<td>0.82±0.3</td>
<td>0.84±0.3</td>
<td>0.1</td>
<td>4.8 %</td>
</tr>
<tr>
<td>Walk test/sec</td>
<td>18.3±2.0</td>
<td>19.1±1.8</td>
<td>0.02*</td>
<td>4.8 %</td>
</tr>
<tr>
<td>Stair test/sec</td>
<td>19.2±2.0</td>
<td>20.2±1.6</td>
<td>0.03*</td>
<td>5.2 %</td>
</tr>
<tr>
<td>Depression score</td>
<td>25.09±6.0</td>
<td>27.0±6.0</td>
<td>0.002*</td>
<td>7.5 %</td>
</tr>
<tr>
<td>Anxiety score</td>
<td>28.2±5.2</td>
<td>29.09±4.7</td>
<td>0.12</td>
<td>3.04 %</td>
</tr>
<tr>
<td>DAS</td>
<td>3.9±0.9</td>
<td>4.0±0.9</td>
<td>0.002*</td>
<td>4.35 %</td>
</tr>
<tr>
<td>ESR mm/h</td>
<td>42.5±10.8</td>
<td>42.8±10.1</td>
<td>0.8</td>
<td>0.8 %</td>
</tr>
<tr>
<td>Morning stiffness/min</td>
<td>82.0±33.0</td>
<td>90.0±37.2</td>
<td>0.002*</td>
<td>9.8 %</td>
</tr>
</tbody>
</table>

* P-value <0.05 significant.

Table (3): Comparative study between both groups (I & II) as regards clinical evaluation and laboratory data before and after 12 week.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group (I) Mean±SD</th>
<th>Group (II) Mean±SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAF</td>
<td>15.8±9.1</td>
<td>28.7±9.3</td>
<td>0.001*</td>
</tr>
<tr>
<td>HAQ</td>
<td>0.4±0.2</td>
<td>0.84±0.3</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td>Walk test/sec</td>
<td>14.8±2.0</td>
<td>19.1±1.8</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td>Stair test/sec</td>
<td>16.5±3.1</td>
<td>20.2±1.6</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td>Depression score</td>
<td>17.5±6.0</td>
<td>26.9±6.0</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td>Anxiety score</td>
<td>20.4±6.2</td>
<td>29.09±4.7</td>
<td>&lt;0.001**</td>
</tr>
<tr>
<td>DAS</td>
<td>3.5±0.8</td>
<td>4.0±0.94</td>
<td>0.07</td>
</tr>
<tr>
<td>ESR mm/h</td>
<td>32.1±12.9</td>
<td>42.8±10.1</td>
<td>0.002*</td>
</tr>
<tr>
<td>Morning stiffness/min</td>
<td>47.3±29.08</td>
<td>90.0±37.2</td>
<td>0.001*</td>
</tr>
</tbody>
</table>

* P-value <0.05 significant.  * P-value <0.001 highly significant.
Discussion

Rheumatoid arthritis is a chronic inflammatory disease of joints which causes marked disability. Muscle weakness is a common manifestation of RA and may contribute to impaired performance of common activities of daily living (Ekdahl et al., 1990).

Owing to a fear of enhancing joint inflammation and accelerating cartilage destruction, it has been advocated that exercises in active RA should be restricted to gentle assisted range of motion. So far researches on conservative management of active RA has focused on the best amount of immobilization and bed rest which are considered an important component of management of active RA (Scott, 1992).

Approximately 58% of rheumatologists in the Arthritis Center believe that aerobic exercises are not useful for RA patients. There is a spectrum of studies addressing the consequence of repetitive joint loading. Experiments of clinical studies suggested that allowing acutely inflamed joints to rest reduce local and systemic signs of inflammation (Iversen et al., 1999).

In our study group (I) patients showed a significant decrease in fatigue scale (P = 0.001) by 26.75% in contrast to group (II) patients who showed a significant increase (P = 0.004) by 6.3%. These results are in agreement with Neurberger et al. (1997) who stated that appropriate exercise programs may lessen fatigue in persons with RA without worsening their arthritis.

In our study functional ability was measured subjectively by the modified HAQ, walk and stair test times. As regard HAQ
score, group (I) showed significant decrease (P = 0.001) by 39% while in group (II) it showed non significant changes (P = 0.1) by 3%. These data coincide with Van den et al. (2000), Sokka et al. (2002) and Hakkinen et al. (2004) who found significant differences in HAQ score in favor of experimental group of patients who were allocated to strengthening exercises. They concluded that individually tailored and regularly conducted physical exercises in the beginning of the disease lead to long term increase in physiological reserve and consequently the functional capacity of RA patients provided that the duration and intensity of muscle exercise are sufficient.

Our results also coincide with Zuzana et al. (2003) study in which the comparison between patients who performed exercise programs and a control group was significant in favor of the exercise group as regard physical function assessment using MACTAR questionnaire.

In addition, Marie et al. (2000) study showed that women with RA taking low dose steroid therapy can safely participate in a dynamic weight-bearing exercise program and also the exercise had positive effects on their physical function and activity with no exacerbation of disease activity.

Vliet et al. (2000) found that, the effect of dynamic exercises on functional ability was unclear; however, exercises were effective in improving aerobic capacity and muscle strength. Our results disagree with Johana et al. (1996), who showed non significant improvement in functional ability during 12-weeks of intensive exercise measured by HAQ in both experimental and control groups.

As regard walk test and stair test times group (I) patients showed significant improvement (P = 0.002) by 10.5% and (P=0.01) by 7.9% respectively. In contrast to group (II) patients who showed significant deterioration in both walk and stair tests (P = 0.02) by 4.8% and (P = 0.03) by 5.2% respectively. These results are in agreement with both Sokka et al. (2002) and Johana et al. (1996) studies, which stated that there was significant improvement in walk and stair test times in a high intensity exercise RA group in comparison with a control group.

Depression and anxiety scores of group (I) patients showed significant improvement (P = 0.001) by 21% and (P = 0.001) by 17.6% respectively. In contrast to group (II) patients who showed significant deterioration (P = 0.002) by 7.5% in depression score and non significant changes (P = 0.12) by 3.04% as regard anxiety score. These results coincide with Zuzana et al. (2003) study, which showed statistically significant improvement in depression and anxiety scores at 12 and 24 months in favor of a high intensity exercise group.

However, Johana et al. (1996) study, showed non significant improvement in scores of depression and anxiety in both groups (experimental and control) after 12-weeks of exercise.
As regard DAS, group (I) patients showed significant decrease (P = 0.02) by 4.6% after exercise in contrast to group (II) patients who showed significant increase (P = 0.002) by 4.4%. These results coincide with Vandenet et al. (2000) study, which showed that there was gradual decline in disease activity in both experimental and control groups with an improvement in measures of disease activity greater in patients on intensive exercises. Number of tender and swollen joints also decreased in the dynamic exercise group but not in the control group. This was also observed in Sokka et al. (2002) study.

Bearn et al. (2002) study, showed that strengthening exercise can reverse quadriceps sensorimotor dysfunction that is associated with RA without exacerbating disease activity.

Our study is not in agreement with Marie et al. (2000) study, that showed the effect of 1-year exercise program in women taking corticosteroid therapy in comparison with control patients on usual care. Their results showed that there were no significant differences in any of the groups with respect to disease activity.

Johana et al. (1996) study showed that there were non significant differences in DAS between experimental and control group after an exercise period except for the number of swollen joints in the high intensity exercise group which decreased significantly after exercise.

From our study we can conclude that a 12-week intensive exercise program is effective in improving morning stiffness, fatigue, functional disability, depression and anxiety that occur in patient with RA. This program also has no deleterious effect on disease activity.

We recommend that carefully designed intensive strengthening exercise programs to be incorporated in physical management of RA patients to improve their functional ability as well as psychological status without fearing of increasing the disease activity.

References
Ekhdal, C.; Andesson, S.I. and Svenssson, B. (1990): Muscle function of lower extremities in RA and


Sokka, T.; Kotaniemi and Hannonen, P. (2002): 2-


دراسة تأثير التمارين الديناميكية المكثفة على مرضى الرثيان المفصلي

أمل فتحى سليمان، سامية محمد عبدالمنعم، تغريد فتحى محمد
قسم الروماتيزم والتأهيل - كلية الطب - جامعة بنها

مرض الرثيان المفصلي هو إلتهاب مزمن غير معلوم سببه يصيب المفاصل وكثير من أجهزة الجسم ونتيجة لتأثيره السلبي على المفاصل فإنه يسبب إعاقة وظيفية وهي من أهم مظاهر هذا المرض وقد جرى العرف على أن علاج المرض يستلزم الراحة التامة ولكن هذا قد يؤدي إلى ضعف في العضلات وتيبس المفاصل.

ويهدف البحث إلى دراسة تأثير التمارين المكثفة الموقية للعضلات على مرضى الرثيان المفصلي بالنسبة لدرجة نشاط المرض والإجهاد والصحة النفسية للمرضى.

وقد أجريت هذه الدراسة على ثلاثين مريضة من مرضى الرثيان المفصلي وقد تم تقسمهم عشوائيًا إلى مجموعتين:

1. المجموعة الأولى اشتملت على خمسة عشر مريضة وقد قامت هذه المجموعة بتنفيذ برنامج تمارين مكثفة موقية للعضلات يومين في الأسبوع لمدة 12 أسبوع.

2. المجموعة الثانية اشتملت على خمسة عشر مريضة أيضًا وقد خضعت هذه المجموعة للعناية المعتادة للمفاصل واعتبرت هذه المجموعة الضابطة.

بمقارنة المجموعتين وجدت فروق ذات دلالة إحصائية في مدة التيبس الصباحي ومقياس الإجهاد والأداء الوظيفي ووقت اختبار المشي وصعود السلم ومقياس الإكتئاب والقلق ومعدل سرعة ترسب الكرات الحمراء، ولكن هناك فروق ليس لها دلالة إحصائية في درجة نشاط المرض بين المجموعتين.

تستخلص من هذه الدراسة أن التمارين المكثفة الموقية للعضلات لها تأثير فعال في تحسين التيبس الصباحي والإعاقة الوظيفية والصحة النفسية للمريض ولذلك نوصي بإضافة هذه التمارين إلى البرنامج التأهيلي لمرضى الرثيان المفصلي.