Therapeutic Benefit of Aquaerobics for Individuals with Rheumatoid Arthritis

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Key Words

Rheumatoid Arthritis, Aerobic Exercise, Pool Therapy, Disease Activity, Functional Capacity

Traditionally, aerobic exercise was thought to exacerbate disease activity of individuals with RA. However, such exercises performed in water may provide cardiovascular conditioning with less repetitive loading of the involved joints. We investigated the effects of an aquaerobics program on exercise tolerance and disease activity on individuals with RA. Twenty-four subjects, 30-80 years of age and with functional classe II or III RA, were randomly assigned to one of two groups. The aquaerobics group attended an aquaerobics class three times per week for 10 weeks while the Range of Motion (ROM) group participated in a 10-week home program of ROM and strengthening exercises. Pre and post-testing included treadmill stress testing, the Health Assessment Questionnaire (HAQ), and recording of active joint count (AJC), ESR and grip strength. Repeated measures analysis of variance revealed significant trial effects, but insignificant group effects for duration and peak workload on treadmill, AJC, ESR and grip strength. Unexpectedly, significantly greater improvements were found for the ROM group in self-reported walking ability and total HAQ score. These findings suggest that participation in either program may result in improved exercise tolerance without exacerbating joint activity. Additional study is needed to determine the relative benefits on functional outcomes.

Traditionnellement, on pensait que les exercices aérobiques agravaient l'activité de la maladie chez les patients atteints d'arthrite rhumatoïde. Cependant, les exercices effectués dans l'eau peuvent fournir un conditionnement cardio-vasculaire sans imposer une charge répétée sur les articulations atteintes. Nous avons examiné les effets d'un programme aqua-aérobique (AQ) sur la tolérance à l'effort et l'activité de la maladie chez des personnes atteintes d'arthrite rhumatoïde (AR). Vingt-quatre sujets âgés de 30 à 80 ans atteints d'AR se classant dans la catégorie fonctionnelle II ou III ont été répartis au hasard dans deux groupes. Le groupe AQ a suivi des classes d'AQ trois fois par semaine pendant 10 semaines, alors que le groupe AM (amplitude des mouvements) a participé à un programme à domicile d'augmentation de l'amplitude des mouvements et d'exercices de renforcement. Les tests avant et après le programme comprenaient une épreuve sur tapis roulant, le questionnaire d'évaluation de la santé, la détermination du nombre d'articulations atteintes, le test de résonance magnétique électronique et la force de préhension. Une analyse de la variance des mesures répétées a révélé des effets significatifs sur les tests effectués, mais des effets non significatifs sur les groupes pour la durée et la charge maximale sur le tapis roulant, la détermination du nombre d'articulations atteintes, le test de résonance éléctronique et la force de préhension. Étonnemment, on a noté une amélioration significativement plus importante dans le groupe AM en ce qui concerne la capacité de marcher signalée par les patients et le score total du questionnaire d'évaluation de la santé. Ces observations indiquent que la participation à l'un ou à l'autre des programmes peut entraîner une amélioration de la tolérance à l'effort sans exacerbation de l'activité des articulations. Il sera nécessaire d'effectuer d'autres études pour déterminer les avantages relatifs sur les résultats fonctionnels.

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Rheumatoid arthritis (RA) is a chronic systemic disease involving inflammation of synovial joints. This inflammatory process can lead to the destruction of joint cartilage and bone. Individuals with RA experience: painful, swollen joints; loss of joint motion; muscle wasting; and excessive fatigue. These symptoms can limit participation in physical activities and may result in cardiovascular deconditioning.[1-3] In fact, Ekdahl and Broman[2] found that the aerobic capacity of a group of 67 people with RA (functional class II) was 80% of the capacity obtained for a healthy reference group. Minor et al.[3] documented that individuals with RA showed high energy expenditure under walking conditions considered to be almost optimal. Biomechanical inefficiency was proposed to be a major contributor to this finding.

Over the past few years investigators have begun to question the conventional exercise regime recommended for people with RA. Traditionally, rest was favored over exercise and vigorous exercise was discouraged.[4] The repetitive loading of the joints that is associated with vigorous exercise was thought to exacerbate joint pain and swelling, thereby accelerating deterioration of the joints. Exercises were limited to range of motion (ROM) exercises and isometric strengthening programs.

Several studies have indicated that aerobic exercise can be beneficial for patients with RA.[1,3,5-8] In a long-term study Nordemar and his colleagues[5] followed 23 patients with RA who participated for four to eight years in a program of cardiovascular training using bicycle ergometers and other activities and compared them to a control group of equal size and disease severity. They found that the active group had significantly less radiological evidence of joint destruction and concluded that the general prescription of rest in RA is not adequate. In a separate paper, Nordemar[6] reported that the active group demonstrated a higher functional capacity.

Harkcom et al[7] demonstrated decreased joint counts and increased aerobic capacity in a study of 20 women with RA who trained 15, 25, or 35 minutes, three times per week on a bicycle ergometer. The authors concluded that as little as 15 minutes of exercise three times a week can improve aerobic capacity in patients with RA.

Beals and colleagues[8] evaluated the effect of strenuous bicycle ergometer exercise on joint symptoms of eight subjects with RA and six with osteo-arthritis compared to six very inactive matched controls. Strenuous bouts of aerobic exercise performed on a bicycle ergometer for eight to eleven minutes did not exacerbate joint pain or cause inflammation of exercised joints.

Despite growing evidence of the benefits of exercises for individuals with RA, the issue remains controversial. In 1993, Hansen and colleagues[9] reported on the effects of a two-year physical training program using 75 patients with RA and concluded that "the results showed no effect of training on the disease activity or on the progression of the disease." (p. 107). Among the outcome measures used were the Health Assessment Questionnaire (HAQ), aerobic capacity, and duration of morning stiffness. A year later, Lyngberg et al [10] conducted a study involving 24 RA patients on steroid treatment who were randomly assigned to either a treatment group (interval training using an ergometer, twice weekly for three months) or an untrained control group. The work capacity of the trained group doubled by the end of the study. A 1995 study on the effects of dance exercise involved 29 subjects with RA, 19 of whom participated in a 12-week dance-based exercise program and the other 10 acted as controls.[11] Both groups improved in maximum aerobic power and maximum workload, but there was not a statistically significant group effect.

Water has long been considered an appropriate milieu for treating patients with RA.[12-14] Exercising in water is thought to minimize the possibility of exacerbating joint symptoms of patients with arthritic conditions because the warmth of the water helps to alleviate joint pain while its buoyancy reduces the joint compression forces acting on weight-bearing joints. Danneskiold-Samsøe and colleagues[12] reported that eight patients who participated twice a week in a 10-week program of non-aerobic hydrotherapy exercises demonstrated increased quadri- ceps strength and aerobic capacity. Measurements of joint activity and functional ability were not included.

Only two studies have been cited that investigated the effects of aerobic exercises performed in water. Minor et al.[15] studied a group of 40 patients with RA and 80 patients with osteoarthritis who were randomized into a 12-week exercise program of aerobic walking, aerobic aquatics, or non-aerobic ROM. At the completion of the program both the aquatic and walking exercise groups showed significant improvement over the ROM exercise group in aerobic capacity, anxiety levels, and physical activity. However, since the data were not reported separately for the subjects with RA versus those with osteoarthritis, the relative effectiveness of the exercise programs for individuals with RA cannot be ascertained. An unexpected finding was the significant improvement in aerobic capacity demonstrated by the ROM exercise group at the nine-month follow-up.

Stenstrom[16] and her colleagues reported on the long-term effects on RA patients of participating in a dynamic exercise program in water. Thirty patients were recruited for aquatic therapy (40 minutes per week for a four-year period). A comparison group of 30 patients was involved in land physiotherapy during the same interval. At post-testing the aquatic group had significantly greater grip strength and reported higher exercise activity levels. The conclusions that can be drawn from this study are limited for the following reasons: the subjects were not randomly assigned; the subjects were all in functional class II and hence not representative of the population seen clinically: aerobic capacity was not assessed; and one training session per week is not sufficient to produce aerobic conditioning.[17]

The purpose of our study was to investigate the therapeutic benefit of an aerobic aquatics (aquaerobics) program for individuals with RA (classes II or III) in comparison to a home program of range of motion exercises. Our hypotheses were: (1) that participation in either program would not increase disease activity; (2) that participation in the aquaerobics program would increase exercise tolerance; and (3) that participation in either program would improve functional ability.

Methods

Subjects and Evaluation.

Subjects were recruited from the outpatient population followed by rheumatologists in the local area. To be included in the study each patient had to have been diagnosed by a rheumatologist as having definite RA in functional class II or III of the classic American Rheumatism Association classification system.[18] The patient had to have been on a stable drug regime with no major changes in medication within the three month period preceding the study. In addition, each subject was required to sign a consent form that had been approved by the Hospital Research Review Committee. Individuals with a history of unstable heart disease and individuals already involved in an exercise program were excluded from the study.

Prior to initiation of the actual study a pilot project was undertaken to test the proposed protocol. Five subjects participated in a 10 week program of aquaerobics exercise. Minor changes were made in the protocol based on this pilot study and the Research Review Committee was notified of these changes.

Twenty-four subjects (19 female, five male) with a mean age of 58.4 years participated in the study. The original protocol included random assignment of subjects to an aquaerobics group or a control group that would not be involved in exercise during the period of study. However, for ethical reasons the protocol was revised and the subjects were randomly allocated to the aquaerobics or to a ROM exercise group by an individual who was not affiliated with the study. All subjects in both groups were evaluated one week prior to and one week following the exercise period. These evaluations were always conducted at the same time of day to control for diurnal effects on joint activity. An active joint count (AJC) was performed by a physiotherapist blinded to the grouping of the subjects. An AJC is the sum of all the joints that present with effusion, tenderness at joint line, and/or stress at end of ROM.[19] Grip strength of the dominant hand was measured with a Martin Vigorimeter*[20] and duration of morning stiffness, as reported by the subject, was recorded.

Standard laboratory tests for erythrocyte sedimentation rate (ESR) were performed. The Stanford Health Assessment Questionnaire (HAQ)[21] was completed by each subject. This questionnaire evaluates eight areas of function: dressing and grooming, rising from a chair, eating, walking, hygiene, reaching, gripping, and general activity. The reliability and validity of this questionnaire have previously been established.[21]

A self-limited exercise test was performed on the treadmill in a cardiac stress laboratory in the presence of a cardiologist. Heart rate, blood pressure, and 12-lead electrocardiogram tracing were monitored. Subjects were tested to their subjective maximal levels or until their tests were terminated by the cardiologist. The Modified Naughton protocol was used.[22] Among the parameters recorded during the stress tests were duration on treadmill, maximum heart rate, maximal rate-pressure product, peak work load, and reason for termination.

Exercise Protocols

The aquaerobics sessions were held three times per week for 10 weeks. The same physiotherapist instructed all of the classes with a maximum of five participants per class. Each session consisted of one hour of exercises performed in a hydrotherapy pool heated at 36°C. A 15-minute warm-up of slow stretches for the spine and extremities was followed by 20-25 minutes of aerobic exercises working up to a target heart rate of 70% of maximum heart rate. Maximum heart rate was determined from the treadmill stress test and patients were taught how to measure their radial pulse in order to monitor their activity. Aerobic activity consisted of combinations of upper and lower extremity movements (e.g. bilateral arm swings, jogging on the spot, jogging through the water, "jumping-jacks) performed in water up to the mid-sternum utilizing the properties of water (e.g. buoyancy, turbulence). The aerobic component was progressed over the 10 week period in accordance with each individual's capability. To close the class, a 15 minute cool-down was used which involved gentle stretching and relaxation. Throughout the entire class music was played, the tempo of which was consistent with the intensity of exercises being performed.

The subjects in the ROM exercise group were individually instructed in a program consisting of eight to ten general ROM exercises of five repetitions each that targeted the shoulders, hands, and knees. Each subject was also instructed in isometric strengthening exercises of the quadriceps femoris, wrist extensors, long finger flexors and shoulder girdle muscles to be performed 10 times each, two to three times per day. Isotonic exercises were added if joints were no longer active. In addition, general advise was given regarding the appropriate use of heat and cold. Recheck appointments were scheduled for every three weeks at which time the exercise program was reviewed and progressed as appropriate.

Subjects in both groups were cautioned not to begin any other new activities or to significantly alter their existing activity level during the course of the 10-week program. Activity diaries were recommended but were not required.

Data Analysis

Two-sample t-tests were used to test for group differences at the baseline assessment. Separate 2-factor (group vs time) ANOVAs with repeated measures were conducted on each dependent parametric variable. Nonparametric statistical procedures were used for the HAQ data; the Wilcoxon signed rank

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test for within-group change and the Mann-Whitney U test using differences between baseline and post-test scores for between-group change.[23]

Results

There were no statistically significant differences between exercise groups at baseline with regard to age, duration of arthritis, duration of morning stiffness, AJC, grip strength, ESR, HAQ scores, treadmill rate-pressure product, duration on treadmill, and peak work load. However, a trend was noted of somewhat older and more severely involved patients being in the aquaerobics group. Baseline data are summarized in *Table 1*.

Of the 24 subjects who entered the study, four did not complete the program. One subject in the aquaerobics group dropped out after seven weeks because she fractured her femur during a fall at home, resulting in a final retention rate of 92%. Three subjects in the ROM group dropped out, two of whom stated conflicts with their work schedule as the reason, resulting in a final retention rate of 75%. Mean attendance of the subjects who continued in the study was high—294 attendances out of a possible 330 (89%) for the aquerobics group with no participant missing more than four sessions. Each subject in the ROM group had four recheck appointments for a total of 36 for the group. There were a total of five cancellations in this group over the course of the study and no individual canceled more than once.

The ANOVA's of AJC and ESR revealed a significant time effect but not a group effect with AJC and ESR values decreasing for both groups at post-testing. Secondary analysis of AJC data of individual joints did not reveal a particular pattern of improvement of specific joints or of weight-bearing versus non-weighting joints. Analysis of grip strength measurements also revealed a significant time effect with both groups demonstrating an increase in grip strength. The ANOVA of duration of morning stiffness revealed no significant group, time, or interaction effects.

Termination of stress testing was subject-initiated in all cases. The reasons for terminating the initial tests included shortness of breath or lower extremity fatigue. On post-testing two subjects in the ROM group and three in the aquaerobics group indicated that joint pain was their reason for terminating while the rest cited shortness of breath or fatigue. The ANOVA's of duration on the treadmill and peak work load revealed a significant time effect but not a group effect with duration on the treadmill and peak work load increasing for both groups at post-testing. The ANOVA's of peak rate-pressure product and peak heart rate revealed no significant group, time or interaction effects. *Table 2* provides a summary of these findings.

Nonparametric analyses of baseline HAQ data showed no significant differences between groups for any of the eight categories of the HAQ. However, there was a trend of both lower baseline and post-test scores for the ROM group compared to the aquaerobics group. This is consistent with the above-mentioned trend regarding age and severity of disease. The ROM group alone showed a significant improvement in the walking category and total score of the HAQ. In addition, a trend was noted for improvement in the total HAQ score of the aquaerobics group, which did not reach statistical significance. *Table 3* provides a summary of these findings. Change scores were used to test for differences between groups but the mean scores are given for clinical interest.

Table 1. Characteristics of study population at baseline

Characteristics	Aquaerobics Group (n=12)	ROM Group (n=12)	t[a]
Sex (n and % female)	9 (75%)	10 (83%)	
Age (yr)			
Mean ± SD	61.9 ± 11.6	54.9 ± 14.9	1.3
Range	43 - 80	30 - 73	
Duration of arthritis (yr)			
Mean ± SD	20.2 ± 12.6	11.6 ± 7.6	1.9
Range	2 - 39	1 - 23	
Morning stiffness (hr)			
Mean ± SD	1.5 ± 1.7	0.7 ± 0.4	1.5
Range	0 - 4	0 - 2.5	
Active joint count (#)			
Mean ± SD	8.3 ± 6.0	10.6 ± 5.6	-0.9
Range	0 - 22	2 - 21	
Medications (n and % taking)			
Salicylates	3 (25%)	4 (33%)	
NSAID[b]	6 (50%)	6 (50%)	
Oral steroids	6 (50%)	2 (17%)	
Remittive agents	6 (50%)	9 (75%)	
Immunosuppressants	1 (8%)	0 (0%)	
Articular injections	0 (0%)	0 (0%)	

[a]df = 22, p is not significant

[b]NSAID, nonsteroidal, anti-inflammatory drugs

Discussion

The finding in our study that participation in either the aquaerobics or ROM program did not increase disease activity is consistent with our original hypothesis and is in agreement with the conclusions of other studies.[9-14] What was somewhat surprising was the lack of a group effect, in that both groups demonstrated a similar decrease in AJC as well as a significant decrease in ESR, which is considered to be a general indicator of disease activity. In addition, both groups demonstrated an improvement in grip strength, which has previously been reported to show a high correlation with joint inflammation as measured by the AJC.[20] While these findings are consistent with those of Minor's[15] study comparing

Table 2. Mean change in disease-related variables and exercise tolerance from baseline to post-test at 11 weeks[a]

	Aquaerobics Group		ROM Group			
	Baseline (n = 12)	**11-weeks (n = 11)**	**Baseline (n = 12)**	**11-weeks (n = 9)**	**F[b]**	**F[c]**
AJC (number)	8.3 ± 6.0	7.5 ± 6.1	10.6 ± 5.6	7.1 ± 4.6	0.1	12.8[g]
ESR (mm/hr)	25.5 ± 12.9	22.5 ± 12.5	28.7 ± 19.2	20.8 ± 19.9	0.2	6.5[g]
Morning stiffness (hr)	1.5 ± 1.7	1.3 ± 1.6	0.7 ± 0.4	0.5 ± 0.7	3.0	2.7
Grip strength[d] (kPa)	28.5 ± 16.3	32.9 ± 19.6	34.6 ± 10.0	45.9 ± 23.8	1.6	5.9[g]
Resting heart rate[e] (bpm)	91.5 ± 16.9	88.0 ± 12.7	99.9 ± 21.5	97.0 ± 17.6	3.3	0.3
Duration on treadmill (min)	9.6 ± 6.1	12.1 ± 6.6	12.6 ± 7.8	14.6 ± 8.8	0.7	22.2[g]
Peak work load (MET)	5.1 ± 2.8	6.3 ± 3.4	6.5 ± 3.8	7.7 ± 4.1	0.9	21.5[g]
Peak heart rate (bpm)	140.0 ± 26.6	141.5 ± 21.0	149.7 ± 37.6	150.6 ± 40.3	0.5	0.2
Peak rate-pressure product[f]	24.6 ± 6.4	24.5 ± 4.3	24.2 ± 5.1	24.4 ± 7.1	.01	0

[a]Values are the mean ± SD.
[b]Between-group differences in change scores.
[c]Within-group differences in change scores.
[d]Grip strength of dominant hand.
[e]Resting heart rate in standing measured in beats per minute
[f]Peak rate-pressure product = maximal heart rate x maximal systolic blood pressure/1000.
[g]$p < .05$.

Table 3. Mean change in self-reported functional status from baseline to post-test at 11 weeks.

	Aquaerobics Group		ROM Group		
	Baseline (n = 12)	**11-weeks (n = 11)**	**Baseline (n = 12)**	**11-weeks (n = 9)**	**Z[b]**
HAQ total score	19.2 ± 16.2	16.8 ± 11.2	12.1 ± 10.7	8.4 ± 9.7[c]	-1.37
Dressing	2.0 ± 1.8	1.8 ± 1.2	1.1 ± 1.2	0.7 ± 0.9	-0.50
Rising	1.3 ± 1.2	1.2 ± 1.4	1.0 ± 1.3	0.6 ± 0.9	-0.10
Eating	2.4 ± 2.2	2.3 ± 2.5	1.3 ± 1.0	1.0 ± 0.7	-0.30
Walking	1.5 ± 1.3	1.4 ± 1.0	1.0 ± 1.3	0.6 ± 1.0[c]	-1.00
Hygiene	2.6 ± 2.9	2.4 ± 2.6	2.1 ± 2.0	1.8 ± 2.1	-1.50
Reaching	2.5 ± 1.3	2.3 ± 1.5	1.6 ± 1.2	1.4 ± 1.2	-1.80
Gripping	2.8 ± 2.4	2.6 ± 2.3	1.6 ± 1.4	1.3 ± 1.3	-1.10
Activity	3.5 ± 2.5	3.4 ± 1.7	2.2 ± 1.8	1.8 ± 1.7	-1.83

[a]Values are mean ± SD.
[b]Between-group differences in change scores, by Mann-Whitney U test, $p > .05$
[c]$P \leq .05$ for within-group change, by Wilcoxin signed rank test.

ROM and aquaerobics programs for subjects with arthritis, the results are difficult to explain. It would seem reasonable to expect a greater decrease in joint activity for individuals involved in the aquaerobics program since the buoyancy of the water would lessen the joint compression forces at play while exercising.

On the pre-test stress tests shortness of breath and lower extremity fatigue, rather than joint pain, were cited as reasons for terminating, suggesting that performance was limited by exercise intolerance and not by joint pathology. At post-testing five subjects stated that joint pain was the limiting factor. However, since each of these patients had increased both their duration and peak work load on the treadmill when compared to the pre-test, an increase in exercise tolerance was assumed.

We had hypothesized that only those individuals who had participated in the aquaerobics program would experience an increase in exercise tolerance. However, both groups demonstrated this effect, as indicated by increased peak work load and duration on the treadmill. A similar result was reported in the study by Minor et al[15] although in that study the ROM group did not demonstrate a significant increase in exercise tolerance until the nine-month follow-up evaluation. The authors suggested that this unexpected result might have been a consequence of continued exercise and that "it may be that the exercise content of an initial class is not as important as being involved in a positive exercise experience." [p 1403] This may also explain the findings in the present study. In our study the patients in both groups initially demonstrated greater disease activity - functional classes II and III, as opposed to I and II than in other related studies.[12-16] Also, our subjects had somewhat lower baseline levels of aerobic capacity than did the participants in these studies. Moreover, all of our subjects had elevated resting heart rates which are characteristic of patients with RA and are interpreted by Piha and Voipio-Pulkki[24] to be an indication of physical deconditioning. Consequently, involvement in any form of exercise could have lead directly or indirectly to improved exercise tolerance in such deconditioned individuals.

Compliance with the home program prescribed for individuals in the ROM group was difficult to monitor. However, Terpstra and his colleagues[25] recently reported that 85% of their sample of 123 patients with RA continued to do their home exercise program six to 18 months after discharge. Consistent participation in a program of exercises, together with the concomitant decrease in joint activity demonstrated by both groups at post-test, could facilitate enhanced functional mobility, resulting in increased exercise tolerance.

Another possible explanation for the unanticipated findings could involve the trend, albeit not statistically significant, towards individuals in the aquaerobics group being older and more severely involved that the ROM group. This bias may have been sufficient to preclude a differential effect, particularly with such a small sample size (n=24).

With regard to sample size, Lyngberg et al.[10] also used 24 subjects to investigate the effects of a land exercise program for individuals with RA who were assigned to one of two groups (one training group and one non-training group). This sample size had sufficient power to reveal significant differences between the two groups after 12 weeks. In our study, the use of a *bona fide* control group receiving no intervention was not endorsed by the Ethics Review Committee. The rationale offered was that because sufficient evidence exits in the literature of the positive benefit of exercise for this population, exercise should not be withheld from any subject.

There are other possible explanations for the lack of a group effect with regard to exercise tolerance. Improved performance on the treadmill may simply have been due to a learning effect, although the 11-week interval between tests would mitigate against this effect. The finding that the group directly involved in a program of aerobic activity did not demonstrate a greater increase in exercise tolerance than the ROM group may suggest that the former group did not exercise at an intensity necessary to produce this differential effect. Kirby and his colleagues[26] measured oxygen consumption during exercise in a heated pool and determined that for young, healthy individuals only the more vigorous exercises were within the range likely to induce an aerobic training effect. During the 20-25 minute period of aerobic exercise the intent was to maintain a target heart rate of 70%, a rate that is considered to reflect aerobic activity.[17] It may be that periodic monitoring of the heart rate using radial pulse was inadequate to ensure that this intensity of exercise was maintained throughout this period.

Another factor to consider is the potential bias related to the drop-out rate—only one of the subjects in the aquaerobics group dropped out compared with three in the ROM group. Given the high compliance rate with a home program as reported by Terpstra et al,[25] the remaining participants in the latter group may have been particularly motivated to exercise, thus creating a bias against the possibility of a significant group effect.

The HAQ results indicated a statistically significant improvement in only two components of the questionnaire for the ROM group (i.e.total score and walking) and in none of the components for the aquaerobics group. This finding is contrary to our original hypothesis that *both* groups would improve in terms of functional ability. It also conflicts with the subjective commentary by the participants in both groups. It is even more surprising when one considers the decrease in disease activity and increase in exercise tolerance demonstrated by both groups at post-test. Pincus and his associates[21] reported limitations with the HAQ. They noted that the amount of perceived difficulty with a task was associated with the degree of patient dissatisfaction. It was observed that a patient's capacity might improve or decline significantly within the responses *with some difficulty* or *with much difficulty*. Liang et al[27] compared the original HAQ with four other health status instruments and found that the HAQ was less efficient than three of the other instruments in detecting changes in mobility status. This lack of sensitivity may have been the reason for the lack of significant changes in functional status in the present study.

Conclusion

The results of our study contribute to the body of literature that demonstrates that participation in exercise does not exacerbate joint activity in individuals with functional class II or III RA. The findings suggest that participation of the patient with RA in either aquaerobics or home exercise programs may result in reduction in joint activity and improvement in exercise tolerance. The data, however, fail to reveal a differential effect between the two forms of intervention and also do not indicate a concomitant improvement in functional ability as measured using the HAQ. Possible reasons for these unexpected outcomes are discussed. Further studies are warranted—studies that use a larger sample size; match groups for age and severity of disease; and employ a more sensitive indicator of change in functional status.

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