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Aerobic exercise in fibromyalgia: a practical review

Eric N. Thomas · Francis Blotman

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Abstract The objective of the study was to determine the current evidence to support guidelines for aerobic exercise (AE) and fibromyalgia (FM) in practice, and to outline specific research needs in these areas. Data sources consisted of a PubMed search, 2007 Cochrane Data Base Systematic review, 2008 Ottawa panel evidence-based clinical practice guidelines, as well as additional references found from the initial search. Study selection included randomized clinical trials that compared an aerobic-only exercise intervention (land or pool based) with an untreated control, a non-exercise intervention or other exercise programs in patients responding to the 1990 American College of Rheumatology criteria for FM. The following outcome data were obtained: pain, tender points, perceived improvement in FM symptoms such as the Fibromyalgia Impact Questionnaire total score (FIQ), physical function, depression (e.g., Beck Depression Inventory, FIQ subscale for depression), fatigue and sleep were extracted from 19 clinical trials that considered the effects of aerobic-only exercise in FM patients. Data synthesis shows that there is moderate evidence of important benefit of aerobic-only exercise in FM on physical function and possibly on tender points and pain. It appears to be sufficient evidence to support the practice of AE as a part of the multidisciplinary management of FM. However, future studies must be more adequately sized, homogeneously assessed, and monitored for adherence, to draw definitive conclusions.

Keywords Fibromyalgia · Aerobic exercise · Clinical trials · Review article

Introduction

Fibromyalgia (FM) is a common rheumatological condition characterized by chronic widespread pain and reduced pain threshold, with hyperalgesia and allodynia. Associated features include fatigue, poor sleep, anxiety, depression, headache and bowel dysfunction. A recent study showed a lack of inhibitory control in the brain to non-painful repetitive somatosensory stimuli suggesting a mechanism of central sensitization in FM [1]. The American College of Rheumatology (ACR) classification criteria for FM are the most commonly used in clinical and therapeutic research and define FM as widespread pain for longer than 3 months duration, with pain on palpation of at least 11 of 18 specified tender points on the body [2]. FM is a quite frequent condition since a recent large scale Canadian study described a self-reported prevalence of 1.83% in females and 0.33% in males [3]. Limitations in activities of daily living have been reported to be as high in FM as in rheumatoid arthritis [4]. FM symptoms affect every aspects of life and have important impact on ability to work. While the underlying pain is likely to contribute to sedentary lifestyle and poor physical condition, individuals with FM are able to perform aerobic, flexibility and muscle strengthening exercises. Based on current evidence, a stepwise program emphasizing education, medication, exercise and behavioral therapy should be recommended. Recently, exercise has been fully recognized as an important part of FM treatment following the European Ligue against Rheumatism (EULAR) recommendations for the management of FM syndrome whose conclusion is that individually tailored exercises programmes, including aerobic

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exercise (AE) and strength training can be beneficial to some patients with FM [5].

The main objective of our work is to inform clinicians of the recent efficacy evidences of physical treatment for FM management in their daily practice, based on a focused review of the randomized trials on aerobic-only exercise.

Methods

Physiological benefits of aerobic exercise

Peripheral tissues, most likely muscle, may contribute to chronic pain through initiating and/or maintaining nociceptive input which may significantly contribute to central sensitization and central pain processing increase. Staud's study demonstrated that exercise decreases pain sensitivity in normal subjects and increases it in FM patients, suggesting that powerful tonic inhibition of muscle nociception is effective in normal but insufficient in FM patients [6]. Some metabolic findings in muscle tissue are consistent with deconditioning. Valkeinen et al. [7] compared physical fitness and health-related quality of life (HRQOL) between postmenopausal women with FM and age-matched healthy women. FM women had significantly lower isometric force in bilateral leg extensors, unilateral knee extensors and flexors than healthy women. A secondary analysis using data from an Internet-based survey including 1,735 FM women aged 31–78 revealed that more than 60% of women reported difficulty going up/down one flight of stairs, walking ½ mile and lifting or carrying 10 lbs [8]. Aerobic training may contribute to normalize some abnormalities and determine some pain improvement. Aerobic training has also been shown to improve other symptoms (depression, sleep and fatigue) frequently encountered in FM patients. Etmier et al. [9] showed that FM women enrolled in a 18-week physical activity program had less fatigue, depression and FM symptoms than the control group at posttest.

Modes of training

Three major modes of exercise are used either singly or in combination: aerobic training, strength training, and flexibility [10]. Aerobic training includes cycling, walking, pool exercise or dance. Training intensity is usually targeted to heart rate frequency (120–150 bpm) or percent age-predicted maximum heart rate determined by standard equations (usually 40–80% of age-predicted maximum). Borg's rating of perceived exertion scale or the "ability to talk test" may also be used as evaluation of intensity of aerobic training. The number of exercise sessions is usually 2–3 per week, lasting an average of 60 min. The length of the interventions, excluding follow-up, ranges from 4 to 24 weeks.

Objectives of the study

To evaluate the effects of aerobic-only exercise on global well-being, selected signs and symptoms (pain, tender points, sleep, fatigue and depression), and physical function in individuals with FM, we selected randomized clinical trials that compared an intervention that included an exercise component with an untreated control, a non-exercise intervention, or other exercise programs. Patients were included in the study according to 1990 ACR criteria (widespread pain for longer than 3 months duration, with pain on palpation of at least 11 of 18 specified tender points on the body). Aerobic-only exercise was considered. Strength and flexibility exercise or mixed intervention including exercise and non-exercise component(s) delivered simultaneously or association of several exercise-only interventions were excluded of the review. No restrictions on programs frequency and intensity were made, provided their duration were no <6 weeks.

Outcome measures

The following outcome measures were considered: pain, tender points, perceived improvement in FM symptoms such as the Fibromyalgia Impact Questionnaire total score (FIQ), physical function, depression (e.g., Beck Depression Inventory, FIQ subscale for depression), fatigue and sleep.

Search methods for identification of studies

Literature search ranged from 1985 to March 2009, and it was conducted on PubMed. The keyword "fibromyalgia" was limited by "exercise" and "aerobic". References lists from identified articles, meta-analyses and reviews [11–14] of different types of treatments for FM were reviewed and all promising references were scrutinized. The research results of the most recently published Cochrane review and Ottawa panel guidelines were included as a priority in our search [15, 16]. Inclusion criteria were randomized controlled trials, published in the English language, and conducted in patients with FM evaluating the effects of aerobic-only exercise.

Results of search

We retained 19 original full-length articles describing experimental trials which examined the effects of interventions that include an AE component in subject with FM. The basic characteristics of the included studies are summarized in Tables 1, 2, and 3. Studies concerned evaluation of aerobic-only exercise and 1,392 participants were included in these 19 studies.

Table 1 Randomized controlled trials of land-based aerobic-only exercise versus other exercise programs

References	Number of subjects	Program duration exercise modalities	Aerobic group/control improvement
McCain et al. [17]	42	20 weeks cycle ergometry vs. flexibility	Fitness, pain threshold
Richards and Scott [18]	136	12 weeks aerobic (walking, cycling) vs. relaxation and flexibility	General health
Valim et al. [19]	76	20 weeks aerobic/stretching function vs. flexibility	VO ₂ max, depression, pain
Bircan et al. [20]	30	8 weeks vs. muscle strengthening	No significant change

Table 2 Randomized controlled trials of land-based aerobic-only exercise versus no exercise for patients with fibromyalgia

References	Number of subjects	Program duration exercise modalities	Aerobic group/control improvement
Mengshoel et al. [21]	35	20 weeks aerobic dance/no treatment	Upper extremity endurance
Wigers et al. [22]	60	14 weeks aerobic/stress management/no treatment	Aerobic capacity pain distribution tender point score
Verstappen et al. [23]	72	24 weeks aerobic running, cycling, swimming/no treatment	No significant change between groups
Gowans et al. [24]	50	23 weeks aerobic pool and land based vs. controls	6-min walk test depression, self-efficacy
van Santen et al. [25]	143	24 weeks aerobic/biofeedback/controls	No significant change
King et al. [26]	152	12 weeks aerobic/education/combined/written information	6-min walk test self-efficacy
Schachter et al. [27]	143	16 weeks aerobic long/short sessions/controls	Disease severity, well-being
Da Costa et al. [28]	79	12 weeks home-based moderate intensity exercise/usual care	Functional capacity upper-body pain FIQ total score
Etnier et al. [9]	16	18 weeks	Psychological aspects cognitive performances

Table 3 Randomized controlled trials of pool-based aerobic-only exercise for patients with fibromyalgia

References	Number of subjects	Program duration exercise modalities	Aerobic group/control improvement
Jentoft et al. [29]	34	20 weeks aerobic pool/land based	Grip strength (land based) pain, anxiety, depression self-reported physical impairment days of feeling good (pool based)
Altan et al. [30]	50	12 weeks pool-based aerobic/balneotherapy	Sleep, stiffness, depression
Cedraschi et al. [31]	164	6 weeks pool-based aerobic/waiting list	Quality of life, FIQ
Tomas-Carus et al. [32]	34	12 weeks aquatic training/leisure activities	Physical function, body pain, mental and general health balance, stair climbing
Tomas-Carus et al. [33]	30	8 months exercise in warm water/control group (inactive)	Physical function, pain anxiety, depression
de Andrade et al. [34]	46	12 weeks	Thalassotherapy > pool for depression

Results

Land-based aerobic-only exercise

Several studies have evaluated the effects of low moderate to high intensity land-based aerobic-only exercise.

Land-based aerobic-only exercise versus other exercise programs

McCain et al. [17] enrolled 42 FM patients in a 20-week program consisting of either AE or simple flexibility exercises.

Groups met for 60 min three times each week. The compliance rate was 90% and only two patients, in the aerobic group, did not complete the study. After 20 weeks, patients in the aerobic group achieved statistically significant improvement in their fitness scores compared with those receiving flexibility exercises ($P < 0.003$). In the aerobic group, pain threshold scores, measured over tender points, were statistically improved ($P < 0.04$), but not pain scores (visual analog scale). Sleep was not significantly improved in the aerobic group.

Short conclusion of the study: in comparison of flexibility exercise, AE significantly improves fitness but not pain and sleep.

Richards and Scott [18] compared the effects, in 132 male and female FM patients, of a supervised progressive graded AE (walking or cycling) for 60 min, twice-a-week for 12 weeks versus relaxation and flexibility exercise. Twelve participants in each group had dropped out by 3 months. Thirty-five percent of exercisers reported improved health compared with 18% in relaxation group ($P = 0.03$). People in the aerobic group also had greater reduction in tender points count (4.2 vs. 2.0, $P = 0.02$) and in scores on the FM impact questionnaire (4.0 vs. 0.6, $P = 0.07$).

In comparison of the flexibility-relaxation group, AE improves health, tender points count and FIQ scores.

Valim et al. [19] compared two exercise modalities, aerobic and stretching, 3 times/week for 20 weeks in 76 women. AE was superior to stretching in relation to VO_2 max, ventilatory anaerobic threshold, function, depression, pain, and the emotional aspect and mental health domains of SF-36. No association was noted between improvement in aerobic fitness and the improvement of pain, function, or scores in FIQ and SF-36.

In comparison of stretching, AE improves physical fitness, pain and psychological aspects associated with FM; but there is no relationship between physical fitness improvement and FM symptoms improvement.

The purpose of Bircan's study [20] was to compare the effects of AE with a muscle strengthening program in patients with FM. Thirty women were randomized to either an AE program (A) or a strengthening exercise program (S) for 8 weeks. There were significant improvements in both groups regarding pain, sleep, fatigue, tender points count, and fitness after treatment. Hospital anxiety and depression (HAD) scale scores improved only for depression. When the groups were compared, there were no significant differences in pain, sleep, fatigue, tender point counts, fitness, HAD and SF-36 scores.

In comparison of strengthening exercises, AE does not improve significantly FM symptoms.

Land-based aerobic-only exercise versus control (no exercise) treatment

Mengshoel et al. [21] compared, in a 20-week trial, 18 FM patients participating to a 60-min supervised exercise program (target heart rate 120–150 bpm) twice-a-week, with 17 FM control patients. No statistically significant changes or differences in general pain, pain coping and fatigue were seen after 20 weeks. In contrast, the upper extremity dynamic endurance work performance was improved ($P = 0.01$). Compliance rate was 61% in the treatment group. The authors concluded that FM patients may undergo low-intensity exercise without experiencing pain and fatigue exacerbation.

In comparison of controls, AE improves endurance (not pain and fatigue) but the study compliance rate was low.

Wigers et al. [22] compared short- and long-term effects of AE, stress management treatment (SMT), and treatment-as-usual (TAU) in FM. Sixty patients were randomized to 14 weeks of treatment by either AE (45 min of AE at 60–70% maximum heart rate for 20 min, 3 times/week), SMT or TAU. Aerobic capacity, pain distribution and tender points score improved in AE group compared to TAU group. Tender point score improved in SMT group compared to TAU group. AE was the overall most effective short-term treatment, despite skeptical patient attitude prior to the study.

In comparison of control or stress management groups, AE improves aerobic capacity, pain distribution and tender points score.

Verstappen et al. [23] randomized 72 patients in 2 groups, supervised AE ($N = 45$), 50 min twice-a-week for 6 months, versus no treatment ($N = 27$). At evaluation, no significant change was noted with regard to physical function but programmes were well received by patients.

In comparison of controls, AE does not improve physical function of FM patients.

In Gowans' study [24], subjects in the AE group were trained in a 3 × 30 min basis/week for 23 weeks and compared to a control group. In efficacy analysis, significant improvements were seen in the AE group for physical function and mood. These effects were reduced but remained during intent-to-treat analysis. Twenty-seven subjects completed the study in the exercise group.

In comparison of controls, AE improves physical function and mood.

To compare the therapeutic effects of aerobic or biofeedback training with the results of no modification of the previous treatment received by FM patients, van Santen et al. [25] studied 143 female randomized into 3 groups. The AE group received AE for 60 min 2–3 times/week for 24 weeks and the biofeedback group 30 min twice/week for 8 weeks. Half the patients in the active treatment groups also received an educational program aimed at improving compliance. After treatment, no significant differences in change scores of any outcome (pain, tender points number, total myalgic score, physical fitness, functional ability, psychological distress, patient global assessment or general fatigue) were found between the groups. A true high impact level for fitness training was not attained by any patient and the educational program did not result in higher compliance with training sessions. Twenty-five (17.5%) patients, similarly distributed over all groups, dropped out. Analysis of the subgroup of subjects with a high attendance rate also showed no improvement.

In comparison of biofeedback or no modification of the previous treatment received by FM patients, AE does not

improve physical fitness or FM symptoms and this was not related to compliance.

King et al. [26] randomized 152 women into one of 4 groups: aerobic-only exercise, education only, aerobic-only exercise and education, or control. If the program was followed, the combination of supervised AE program and group education provided persons with FM with a better sense of control over their symptoms. Fitness improved in the two exercise groups, but was maintained at followup in the AE only group and not in the combined group. Sixty-nine women complied with the protocol but the only significant group time interaction was reported with the compliance analysis for the self-efficacy coping with other symptoms subscale and the 6-min walk.

Aerobic exercise improves fitness. Aerobic plus education are associated with a better sense of control of FM symptoms.

The purposes of the study by Schachter et al. [27] was to assess the effectiveness of a 16-week progressive program of home based, videotape based, low impact AE on physical function and signs and symptoms of FM in sedentary women. The other objective of the study was to compare the effects of 1 long exercise bout (LBE) versus 2 short exercise bouts (SBE) per training day on physical function, signs and symptoms of FM and exercise adherence. Drop-out rates for the non-exercise, SBE and LBE groups were 14, 38 and 29%. Fifty-one women were randomly assigned to the LBE group, 56 in the SBE group and 36 in the no exercise group (NE). Both exercise groups (women who completed at least two-thirds of the recommended exercise) improved in disease severity, self-efficacy and well-being compared to the NE group. No differences were found in intent-to-treat analysis between the exercise groups. High attrition rates and problems with the exercise adherence were experienced in both exercise groups.

In comparison of non-exercise group, AE improves self-efficacy and well-being, despite high attrition rate in exercise groups.

Da Costa et al. [28] included 79 patients in a study comparing an individualized 12-week home-based moderate intensity AE program to no modification of the previous treatment received by FM patients. At 3 and 9 months follow-up, a significant improvement in functional capacity was observed in participants who were more functionally disabled at study entry. The mean estimated benefit of the intervention was more than ten points [-12.3 (95% CI -21.9 to -2.8); -10.8 (95% CI -21.5 to -0.2)]. Upper-body pain and FIQ total scores were still improved at 9 months follow-up.

In comparison of no modification of the previous treatment received by FM patients, AE improves functional capacity in the most disabled patients.

Etnier et al. [9] designed a pilot study to test the efficacy of an AE program for improving psychological variables, cognitive performance and FM symptoms. Sixteen women were randomly assigned to an 18-week exercise program or to a control condition. At posttest there were significant differences in fatigue [effect size (ES) = 1.86], depression (ES = 1.27), FM symptoms (ES = 1.56), self-reported cognitive symptoms (ES = 1.19) and delayed recall performance (ES = 1.16).

In comparison of the control group, AE improves psychological aspects and cognitive performance of FM patients.

Pool-based aerobic-only exercise

To examine the effects of pool-based (PB) and land-based (LB) exercise programs on FM patients, Jentoft et al. [29] randomized 34 patients (18 in the PB group and 16 in the LB group). Each patient received 60 min AE (40–50% of sessions at 60–80% maximum heart rate) twice-a-week for 20 weeks. Greater improvement in grip strength was seen in the land-based exercise group ($P < 0.05$). Cardiovascular capacity, walking time and daytime fatigue were improved in both groups. PB exercises had some additional effects on number of days of feeling good, self-reported physical impairment, pain, anxiety, and depression.

In comparison of the control group, pool-based AE had additional effects on the psychological aspects of FM.

Altan et al. [30] compared the effects of pool-based exercise and balneotherapy-only (pool-based activities without exercise) in 50 female FM. The exercise program included walking, jumping and out-of-pool exercises. Balneotherapy-only was applied without any exercise. Each treatment was applied for 35 min 3 times a week for 12 weeks. Compliance rate was 96% in the exercise group. At 24 weeks, the exercise group improved for pain, fatigue, sleep, stiffness and depression, whereas the balneotherapy-only group improved for pain and fatigue. No statistical differences were shown between groups.

Pool-based AE and balneotherapy-only work similarly in FM.

In Cedraschi's study [31], 164 FM patients were allocated to an immediate 6 week programme ($N = 84$) or to a waiting list control group ($N = 80$). The treatment group patients had a supervised pool exercise program with relaxation and education 45 min each twice-a-week. Compliance rate in the treated group was 72.6%. At follow-up patients in the exercise group improved their quality of life, FIQ scores ($P = 0.025$) and psychological general well-being ($P = 0.032$).

In comparison of the control group, pool-based AE improves psychological well-being and quality of life.

To evaluate the effects of a 12-week period of aquatic training and subsequent detraining on HRQOL and physical fitness in FM women, Tomas-Carus et al. [32] randomized 34 patients in 2 groups. In the exercise group, women were trained for 60 min, 3 times a week, in warm water, while women in the control group continued their habitual leisure-time activities. After 12 weeks of aquatic training, significant positive effects were found in physical function, body pain, general health perception, vitality, social function, role emotional problems and mental health, balance, and stair climbing. After the detraining period, only the improvements in body pain and role emotional problems were maintained.

In comparison of the control group, pool-based AE improves most of FM-associated symptoms but, in the detraining period, results persist only for body pain and emotional aspects of FM.

The same team [33] randomized 15 FM women to a 8-month AE program in warm water and 15 FM women served as controls. The exercise group improved, compared with the control group, in terms of physical function (20%), pain (8%), anxiety (41%) and depression (27%).

In comparison of the control group, a long-term pool-based AE program improves fitness, pain and anxiety/depression.

De Andrade et al. [34] evaluated the effectiveness of AE in water pool compared with aerobic training performed in sea (thalassotherapy) by FM women. Twenty-three women were randomly allocated to each treatment. After 12 weeks, women of both groups were significantly improved for pain, number of tender points, FIQ, SF-36, sleep and depression. There were no significant differences between two groups, except for depression ($F = 2.418$, $P < 0.0001$).

Pool-based AE and thalassotherapy give similar result on FM symptoms except for depression (best results for thalassotherapy).

Discussion

Taken together, most of the presented studies showed a positive effect of exercise in FM patients. However, in some studies the number of patients is very small, assessments and outcomes are not fully comparable. Future studies must be adequately sized, preferably multicentric, to reach statistical pertinence of clinical trials results.

In our review, we found AE generally efficacious for physical function, tender points count, and FIQ score. For pain, studies results are less clear. Only two studies displayed negative results. Verstappen et al. [23] found no change in physical function between the aerobic program and the control group, but programs were well received by patients. In van Santen's study [25], no significant differ-

ence could be noted in any score of any outcome (pain, tender points number, total myalgic score, physical fitness, functional ability, psychological distress, patient global assessment or general fatigue) between the aerobic and the biofeedback group but a truly high impact level for fitness training was not reached by any patient and the educational program did not received a high compliance in training sessions. Recently, the Ottawa panel gave evidence-based clinical practice guidelines for aerobic fitness exercises in the management of FM [16] and produced positive recommendations of clinical benefit. Grade A outcomes were found for pain relief, psychological well-being, endurance, anxiety, self-efficacy, depression, quality of life, muscle strength, cardiorespiratory fitness, physical awareness, and flexibility (to receive a grade A, and randomized controlled trial must have an outcome that is both statistically significant and clinically important, i.e., an improvement of more than 15% relative to control). A systematic review of the literature published until July 2005 by Bush et al. [15], including randomized trials evaluating cardiorespiratory endurance, muscle strength, and flexibility has shown comparable results. In their work, methodological trials quality was assessed using the van Tulder and Jadad instruments [35, 36]. Training protocols were evaluated using American College of Sports Medicine (ACSM) guidelines [37]. Meta-analysis of 6 studies provided moderate-quality evidence that aerobic-only exercise at ACSM-recommended intensity levels had positive effects on global well-being and physical function, and possibly on pain and tender points.

Improvement was generally higher in exercise groups than in non-exercise groups, but, exercise plus education programs gave better results than exercise only. Pool exercise was as effective as land-based exercise and might have greater benefits on mood and sleep quality.

However, compliance and adherence to interventions for women with FM is a huge issue and affects the results of some of the published studies, although compliance was not calculable in the majority of studies. Some studies analyzed data on intent-to-treat basis and did not report number of sessions subjects attended [10]. While a few researchers reported good adherence to moderate to high intensity exercise [7, 17], other researchers reported that participants had serious problems adhering to the exercise programs because of increased FM symptoms [11, 25]. Bush et al. [15] found that the attrition rates for the AE intervention groups averaged 27% (SD 18.9%, range 0–67%). As shown by Dobkin et al. [38], higher baseline disability and increases in barriers to exercise during treatment predicted worse maintenance of AE over follow-up period. Patients may benefit from cognitive-behavior therapy (CBT) that could teach these patients stress management techniques to limit barriers to exercise participation. Such complementary techniques like education, CBT, biofeedback and

relaxation may increase adherence to exercise programs. Concerning pool-based exercise, our review is not in favor of a better adherence than land-based exercise. However, Munguia-Izquierdo and Legaz-Arrese [39] recently found scarce dropout rate (6%), high attendance rate (88%) and high percentage of patients (79%) who continued the pool-based program 12 months after the completion of the study.

Training advices for patients (and their doctors)

Aerobic training is the important (and validated) point of exercise therapy in FM patients but it does occur last in the daily program. OHSU Fibromyalgia Treatment Team [40] recommends exercise progression as follows: to minimize pain, exercise must be progressive: muscle relaxation, flexibility, resistance training and then aerobic.

Step 1 maintain good posture against pain, learn deep breath, take 15-min progressive muscle relaxation.

Step 2 begin by range-of-motion flexibility exercises, later add static holds for correction of postural imbalance, gradually work up to 30-s holds as tolerated.

Step 3 resistance training : when starting to strength, begin with the core muscles (for stabilization). Work upper-body resistance in a seated position and then use standing balance techniques to provide lower body muscles strengthening.

Step 4 aerobic endurance training: an acceptable starting point for deconditioned patients is 2–3 daily exercise sessions of 3–5 min duration. The final aim is to maintain 60–70% of the maximal heart rate for 20–30 min using combined aerobic techniques such as outdoor or treadmill walking, reclining stationary cycles and water therapy.

Practical advices for the clinician

Clinicians must be guided through numerous published studies to decide what and how to prescribe for each individual patient with FM. From the present and other reviews [11] of the literature indications for FM physical treatment can be summarized as follows:

- Individualize prescription to patient's baseline physical function and severity of pain.
- Enhance adherence with programs begun at low-intensity, then gradually increased according to patient's tolerance to exercise-induced pain.
- Aerobic exercises, adapted to patient's initial capacity improve physical fitness, pain threshold and well-being.
- Pool exercise can have additional and independent effects on FM symptoms.

- Exercises must be supervised, at least at the beginning, and clinician should be aware of possible postexertional pain to adequately modify prescriptions.
- In case of FM symptoms flare, exercise intensity should be decreased but frequency has to be kept on.
- Regular exercising at low to moderate-high intensity levels two to three times a week may improve FM symptoms, psychological distress, and physical capacity in sedentary patients.
- Increases in self-efficacy can be reached through educational programs coupled to exercise.

Directions for future research [11]

- Exercise should be very carefully sized to patient's initial fitness to prevent low adherence rate.
- Adherence must become a non-optional part of the results section in all future papers.
- Future studies must be adequately sized, preferably multicentric, to reach statistical pertinence of clinical trials results.
- A set of outcome measures could make reports more homogeneous and interpretation of results easier.
- Longer follow-up periods could determine temporal response stability and minimum exercise needed to upkeep profits.
- More simple treatment protocols, should, if possible, avoid composite interventions, to allow independent interpretation of each type of exercise.

The treatment of patients with FM should include pharmacotherapy, explanations of the nature of the syndrome, relaxation, education in self-management of symptoms to prevent inactivity, improve coping and decrease feelings of anxiety and helplessness. Exercise may have a central role in the multidisciplinary management of FM patients as it enhances health, function and independence.

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