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Physical activity in the treatment of fibromyalgia

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Abstract

International treatment recommendations for fibromyalgia (FM) highlight the importance of adapted physical activity (APA) combined with patient education. Cognitive and behavioral therapies as well as an interdisciplinary approach can be proposed for more complex or severe clinical situations, with a biopsychosocial vision of rehabilitation.

To personalize the rehabilitation's therapeutic approach, a clinician can use simple and validated instruments for measuring physical performance that will highlight levels of physical conditioning, which range from low to very low in FM patients.

Several systematic reviews and meta-analyses have found strong evidence that supervised aerobic and resistance training programs reduce the pain intensity and significantly improve the quality of life and the physical and psychological functioning of female FM subjects. These therapeutic approaches appear safe and promising in terms of cost-effectiveness and should be the subject of more randomized controlled trials among male FM subjects and adolescents.

Keywords

Fibromyalgia – aerobic exercise – resistance training – interdisciplinary therapeutic programs – altered functional performance – adapted physical activity

Introduction

Fibromyalgia (FM) or FM syndrome is a form of diffuse chronic pain associated with other symptoms such as fatigue, sleeping and mood disorders, cognitive disorders, and physical deconditioning that has been present for at least 3 months. The etiology and pathophysiology of FM are complex since they involve various biological, psychological and social factors. This is a difficult diagnosis to make since the classification and diagnostic criteria are still in flux and there are no specific clinical or laboratory signs associated with this condition [1]. Its treatment requires a biopsychosocial vision of this high-cost disease for the society, in which the patient takes an active role in his/her health through a rehabilitation project [2,3].

A. International recommendations for fibromyalgia management

A recent publication [4] compared the four latest international evidence-based guidelines for the clinical management of FM patients (European, German, American and Canadian). The common element was that the highest ranking of recommendation was assigned to exercise, patient education, multidisciplinary care and cognitive-behavioral therapy. An algorithm was proposed by the EULAR in 2017 [5] that highlights the importance of exercise (adapted physical activity) and patient education as the basis for treatment.

B. Physical conditioning in fibromyalgia patients

Assessment of the patient's functional status and the impact of FM on their day-to-day life is crucial to set-up and guide the optimal personalized treatment approach that will be put into place. Given the complexity and heterogenous nature of FM, the symptoms, functional condition and quality of life can vary greatly from one patient to another, but also for the same patient over time [6].

When compared to control subjects, FM patients have low to very low physical conditioning associated with pain, fatigue, stiffness, fall risk, anxiety, depression. These are negatively correlated with quality of life [7]. Conversely, several studies have shown that better physical conditioning is consistently associated with lower levels of pain and better quality of life [8,9,10].

1. Reduced cardiorespiratory capacity

The 6-minute walking test is a valid, reproducible and sensitive measurement in FM, but it is not predictive of the patients' cardiovascular capacity (VO_2 max.) [11]. A systematic review [12] found moderate evidence that submaximal effort tests are reliable, valid and acceptable in the domain of chronic pain, and particularly FM, but that maximum effort tests are not valid because physical performance is limited, not by the patient's aerobic capacity but by their motivation and/or pain apprehension. In a Canadian review [13], 12 studies mention that cardiorespiratory capacity was reduced by 12% to 35% in FM patients compared to controls or to normal values during testing on a bicycle ergometer or treadmill.

2. Amplification of perceived exertion

Perceived exertion measures the intensity of an effort by integrating all the sensations and repercussion of exercise on the body. The Borg scale [14], which is used to measure perceived exertion, is significantly increased in FM patients during a submaximal cycle ergometer test [15] or during a 500 m walking test, the 60-step stairs climbing test, the measurement of maximum quadriceps strength or during activities of daily living [16,17,18]. The overscoring of perceived exertion appears to be a major sign of FM [15].

3. Reduced muscular strength and endurance

Several studies have found a significant reduction in muscle strength (upper and lower limbs) or dynapenia on various performance tests that are validated and reproducible in FM, such as the 30-second Arm Curl test, the 30-second chair stand test, or hand grip strength measurements [19,20,21]. The static endurance of shoulder abductor muscles was reduced by 80% in 16 FM patients compared to 85 controls in a study performed in Belgium [22].

4. Increased musculotendinous stiffness at the ankles and reduced walking speed and coordination

The feeling of abnormal stiffness can be quantified as a significant increase in the passive viscoelastic stiffness in the muscles around the ankle in younger and middle-aged FM patients, but paradoxically, not in older patients [23]. Reduction in walking speed, bradykinesia [24,25] and loss of motor agility can lead to a higher incidence of falls in FM [20,26].

5. Fear of movement, kinesiophobia

Kinesiophobia or an enhanced and irrational fear of movement is present in more than 38% of FM patients [27]. It is weakly but significantly correlated with the perceived disability level, pain intensity, depressive mood and inversely correlated with performance on a treadmill.

6. "Hyperactive" lifestyle

A premorbid "hyperactive" lifestyle [28], propensity to action with tendency to go beyond one's limits, perception of elevated physical, cognitive or emotional allostatic overload, i.e., excessive and cumulative increase in the allostatic load (which corresponds to the physiological cost of maintaining stable equilibrium despite environmental changes) [29,30] are frequently seen in FM patients and they can contribute to or aggravate, over an extended period to time, physical deconditioning.

In a study of 45 FM patients, premorbid representational hyperactivity (i.e., their own representation of the activity level that they could previously accomplish) is associated with basic bodily needs neglect (such as feeding and rest), a level of self-oriented perfectionism and behavioral hyperactivity (i.e., effective engagement in several activities) is associated to a large number of children [31,32].

All these physical, cognitive and emotional deficiencies can progress into a cascade of deconditioning and severe physical and psychosocial disability (Figure 1).

7. Comparison of physical condition, quality of life, level of perceived disability in fibromyalgia *versus the general population and in chronic rheumatological diseases*

In a study with the self-reported International Fitness Scale (IFS) that evaluates the overall levels of physical conditioning, cardiorespiratory endurance, muscle strength, flexibility and balance, 65% to 80% of female patients with FM reported a low to very low level of physical conditioning, versus 8% to 50% in the control population [33].

Several studies have compared the quality of life of patients with FM to that of the general population based on the SF-36 or SF-12. Most published studies found significantly lower scores than in the general population with a larger gap on physical dimensions [34,35]. In comparison with patients who have rheumatoid arthritis, the SF-36 and SF-12 scores are often lower in patients with FM, although the differences are rarely significant [36]. The level of perceived disability measured by the Health Assessment Questionnaire (HAQ) in FM appears to be similar to the one measured in patients who have rheumatoid arthritis [37].

C. Exercise in fibromyalgia patients

An umbrella review published in 2020 analyzed 37 systematic reviews of which 16 had been published since 2014 [38]. The authors reported that aerobic exercise and strength training are the most used non-pharmacological treatment modalities for treating FM.

There is strong evidence that adapted physical activity reduces the intensity of the perceived pain, improves quality of life and the physical and psychological function of FM subjects. The incidence of side effects related to exercise programs is low, and to our knowledge, no serious adverse events have been reported in the literature. However, clinical observations show that FM patients have trouble performing high-intensity exercise because of pain and fatigue secondary to these efforts [39,40].

1. Aerobic exercise

The first study about a supervised cardiovascular fitness training program in FM patients was done in Canada in 1988 [41,42]. The FM patients in the aerobic exercise group increased their functional capacity and pain pressure threshold and reported improved overall well-being compared to a group who only did stretching exercises.

Over the past 30 years, a growing number of research articles, including systematic reviews and meta-analyses, have showed that regular aerobic exercise improves quality of life by reducing the pain level and improving function [43,44,45]. These treatment modalities have been the subject of the largest number of randomized controlled trials (RCT) and the best-quality methodology. However, the treatment effect remains weak (Table 1).

The intensity of the aerobic exercise should be between 40% and 80% of the maximum heart rate or at a perceived exertion level between 9 and 15 on the Borg scale [46].

2. Resistance exercise

Strength training is a specific type of physical activity in which progressively higher load is used to improve muscle strength, power or endurance. The progressive nature of the training is key: if the load or volume (repetitions) are not increased over time, the progress will be very limited. Modulation of the intensity of resistance training must be based on perceived exertion (e.g., Borg scale). The effectiveness of resistance training is currently low in the small number of RCTs done, although these are plagued by evaluation bias and low-quality methodology [33].

3. Stretching

The level of evidence for effectiveness of stretching exercises appears low to moderate; it is low if done alone and moderate when combined with aerobic exercise, leading to improved quality of life [47].

4. Aquatic exercise

The results of three systematic reviews [48,49,50] are positive in terms of the improvement in quality of life, sleep and physical performance (physical condition). The exercises proposed are mixed (aerobic, stretching, resistance, relaxation) and supervised. The withdrawal rate is comparable to a control group. Few adverse effects have been reported, although this aspect is not discussed in detail in these studies. The level of evidence for efficacy of water-based exercises appears to be low, thus it should be reserved for subgroups such as patients with physical deconditioning or older patients suffering from FM for a long time [48].

5. Mixed exercise training

A systematic review [51] including 29 RCTs with protocols involving at least two types of exercises (aerobic, resistance, stretching) found moderate evidence with likely improvement in quality of life, physical function and fatigue. Only physical function improved in every

participant in most studies although some had very weak methodology (selection bias, small sample size, etc.).

6. Mediative movement therapy

Meditative movement therapy such as yoga, tai-chi and Qi gong are alternative and complementary modalities that may be useful for patients who have low compliance with traditional exercise programs (i.e., cardiovascular and resistance training) and who continue to experience pain and fatigue [38]. These therapies appear effective for improving sleep quality but not for reducing the fatigue level due to a lower physical load than other exercise programs, which help to reduce the sympathetic tone and increase the parasympathetic activity [52].

D. Biological mechanisms explaining the treatment effect of exercise in fibromyalgia

The recent scientific literature points to several biological mechanisms that can explain the therapeutic effects of exercise in FM patients. The effects of exercise are not limited to a single physiological system and can affect the entire individual.

Regular exercise may have the ability to influence the nociceptive, neuroendocrine and autonomic system, along with cognitive ability and mood disorders in subjects with FM. As for the nociceptive system, the hypothesis of an effect of exercise on descending pain modulation has all its full meaning. Thus, cardiovascular fitness training three times per week for 20 weeks increases the level of serotonin and its metabolite 5-hydroxyindolacetic acid (5-HIAA), suggesting stimulation of the descending pain modulation [53]. Furthermore, the authors observed that the most physically active FM subjects were better able to modulate repeated painful thermal stimuli than minimally active FM subjects [54].

The hypothesis of an effect of exercise on the hypothalamic–pituitary–adrenal axis has been made based on the study by Genc et al. [39] who proposed 6 weeks of aerobic exercises in 50 FM subjects. This led to reduction in pain, morning stiffness and significant increase in growth hormone along with significant reduction in the serum cortisol levels.

A systematic review [55] showed that moderate to intense aerobic exercise done twice per week was effective by reducing the dysfunction of the autonomic nervous system and increasing heart rate variability. Furthermore, strength training reduced anxiety and depression symptoms while improving muscle strength in a systematic review of patients with fibromyalgia [56].

The effect of exercise on cognitive ability is still hypothetical by may turn out to be interesting. A Spanish study [57] showed that exercising in warm water improved cognitive functions such as working memory, episodic memory and semantic memory. Cherry et al [58] observed that the improvement in physical conditioning (mobility, strength, balance, flexibility) in subjects with FM was strongly correlated with the improvement in cognitive performance on working memory, cognitive flexibility, and attention tests.

A recent study [59] found a significant improvement in cognitive processing speed on the Stroop Color and Word Test (SCWT) after a 15-week exercise program. According to these authors, the underlying mechanisms may be related to amygdala activation observed in functional MRI, leading to better concentration and lower sensitivity to distractions.

E. Multimodal and interdisciplinary treatment approaches integrating exercise

Patient education is mentioned in the EULAR recommendations as one of the most useful and essential steps in the treatment approach for FM [60]. Two systematic reviews of patient education in FM [61,62] confirm that patient education itself has no proven effectiveness on

function and quality of life, even if it can alter the beliefs and/or perceptions about FM, contrary to the combination of patient education plus exercise (aerobic, resistance, stretching) on dry land or in water, which provides a significant reduction in pain levels along with improvement in quality of life (measured with the FIQ or SF36) and functionality (6-minute walking test) in the short, medium and long term.

Several older meta-analyses looked at the effects of non-pharmacological interventions on FM and showed that the combination of cognitive behavioral therapy (CBT) plus an exercise program is the most effective treatment for FM [63,64,65]

The "pacing activity" or change of rhythm appropriate for the management of physical and daily activities must be considered as an important element of multimodal treatment programs for FM with the need for personalization and customization [66,67,68].

The interdisciplinary biopsychosocial treatment strategy integrating exercise into a unit of place such as a chronic pain center shows the strongest evidence for forms of chronic disabling pain, especially FM, with the treatment results being maintained for more than 2 years [69].

F. Barriers and beliefs about physical activity

Several patients with FM do not believe that physical activity will reduce their level of perceived pain [70,71]. The first experience for a FM patient who is given a non-personalized exercise program is often negative, related to the feeling that FM and its consequences on day-to-day life is not well understood by the prescribing physician or the physical therapist. The main barriers to exercise in FM are the omnipresent fatigue, pain and fear of making the symptoms worse, especially after effort, but also the level of disability, mood disorders, weak self-efficiency for exercise and inadequate social support network [70].

G. Adherence to exercise programs

Several authors mention a large variability in the adherence rate to exercise programs [72,73]. More specifically, the mean compliance rate was 84% (range 54–100%) for a strength training program [56]. Several variables such as age, symptom severity and comorbidities may have an effect, as well as the lack of time stated by patients. Stoppage of exercise can also be explained by unsuitable personal beliefs about the effectiveness of these treatments or by high intensity or excessive intense exercise or by an overly high external health locus of control [74]. Moreover, a meta-analysis showed that supervised exercise programs at least 26 weeks in length could improve adhesion to exercise and symptoms (especially anxiety) versus short-term supervised exercise programs [75]. A Spanish meta-analysis on adherence to a walking-for-exercise program in female FM patients showed that encouragement by the doctors related to regular walking and supervision by a nurse yielded better adherence to this practice [76].

H. Health economic consequences of non-pharmacological treatments for fibromyalgia

While doctor hopping is throught to be costly for the individual and the community as a whole (multiple consultations, redundancy of supplementary examinations, inappropriate prescriptions, numerous hospitalizations) [77], three studies suggest promising cost-utility results of rehabilitation and physiotherapy in warm water along with group CBT and psychoeducation [78,79,80].

I. Exercise in children and adolescents with fibromyalgia

Very few RCTs have been done on exercise alone or in combination with other therapies (CBT, psychotherapy) in children or adolescents with FM. A Canadian study [81] found a significant decrease in pain and improvement in physical condition at 12 weeks after an

aerobic exercise program and meditative movements of Qi gong. A British study [82] showed the benefits of an intensive physical activity program (walking, going up stairs, squats, dance) combined with CBT for a minimum of 4 hours per week in 64 adolescents with FM. Quality of life and school function were improved while pain decreased.

CONCLUSIONS

An exercise program that is individualized and supervised over a set period allowing the patient to learn aerobic, strength and flexibility exercises must be considered as the treatment of choice for FM in close association with patient education. However, various research questions remain to be answered about the intensity, frequency, progression of the exercises, how to integrate these exercise programs into daily and professional activities, and also how to ensure adherence to these exercise programs.

Conflict of interest disclosure:

Conflicts of interest: none

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Figure 1

Inspired from Préfaut C and Ninot G. La réhabilitation du malade respiratoire chronique [Rehabilitation of chronic respiratory disease patients] Paris: Masson, 2009:528p

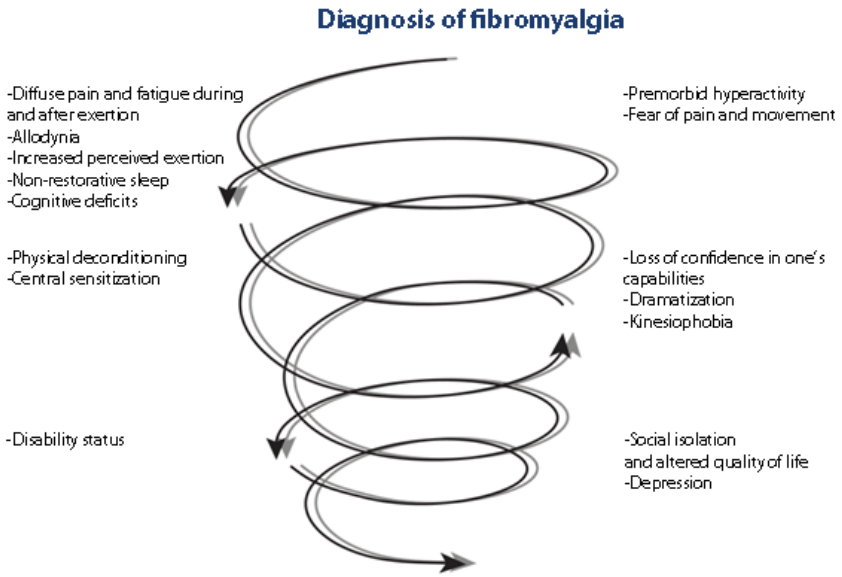

Table 1: Training on regular practice of supervised aerobic exercise in patients suffering from fibromyalgia (based on Bidonde, 2017)

Parameters (tools)	**Number of RCT done**	**Exercise group vs control group (No. subjects)**	**Relative improvement* (95% CI)**
Quality of life after 12 to 24 weeks (FIQ)	5	228 vs 144	15 % (5 %-24 %)
Pain after 6 to 24 weeks (VAS)	6	210 vs 141	18 % (7 %-30 %)
Fatigue after 14 to 24 weeks (VAS)	3	179 vs 107	8 % (−0.4 %-16 %)
Stiffness after 16 weeks (FIQ)	1	107 vs 36	11 % (1 %-21 %)
Physical function at 8 to 24 weeks (FIQ and SF-36)	3	159 vs 87	21.9% (−10.7-33.2 %)

**Relative improvement: mean difference/mean of pooled control groups; each variable is measured on a scale of 0 to 100, with lower scores being better. RCT: randomized controlled trials, VAS: visual analog scale, FIQ: Fibromyalgia Impact Questionnaire; SF-36: Short Form (36) Health Survey*