

## REVIEW

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# Rehabilitation of patients with spondyloarthritis: a narrative review

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### ABSTRACT

Nonpharmacological interventions are one of the mainstays of treatment for patients with spondyloarthritis (SpA). They include education, measures regarding joint protection, posture and rest, therapeutic exercise, physical therapy modalities, orthoses, and acupuncture. A key component in the rehabilitation of patients with SpA entities is therapeutic exercise, which can be performed as land-based or water-based. Positive effects of the exercises are manifested in reducing pain, maintaining mobility, improving posture, increasing aerobic capacity and improving quality of life. The best effects can be obtained when exercise is performed under the supervision of a physiotherapist at a health institution. The majority of studies on therapeutic exercise in SpA are related to ankylosing spondylitis (AS), while there is a paucity of studies devoted to other conditions. Although progress has been made in the quantity and quality of research on this topic, there are still issues regarding the quality of studies and considerable variability among them, which makes it difficult to compare different methods and harmonize and develop rehabilitation protocols according to evidence-based medicine.

**Key words:** exercise, physical therapy modalities, rehabilitation, spondyloarthritis rehabilitation

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## INTRODUCTION

Spondyloarthritis (formerly *spondyloarthropathies*) (abbreviation SpA) is a group of heterogeneous inflammatory rheumatic diseases sharing similar genetic, clinical and radiological features. The group includes ankylosing spondylitis (AS), psoriatic arthritis (PsA), reactive arthritis, enteropathic or arthritis associated with inflammatory bowel disease and undifferentiated spondyloarthritis (1). The most prominent common features in these entities are: negative rheumatoid factor, familial aggregation and high prevalence of HLA B-27 antigen, clinical features which include the involvement of axial skeleton (spine and sacroiliac joints) or asymmetrical and oligoarticular affection of peripheral joints, enthesitis, dactylitis and extra-articular manifestations such as uveitis, psoriasis, and inflammatory bowel disease. Depending on the clinical and radiographic characteristics, SpA may be classified either as axial or peripheral, and newer classification criteria have expanded the spectrum by including early (non-radiographic) forms of axial disease detectable on magnetic resonance imaging (MRI) (2, 3). Prevalence of SpA in the world population ranges from 0.2% to 1.61%, bearing in mind that some of the differences might be the result of the different definition and methodology used in these studies (4).

Patients with SpA have reduced physical ability and quality of life (QoL) (5). For instance, self-care and mobility are impaired in more than half of patients with AS (6). Working capacity is also reduced in these patients, resulting in an increased economic burden on the patient and the health system (7). Depending on the study, working incapacity for patients with AS ranged between 3% and 50% (8,9).

In PsA, alongside physical impairment, the presence of psoriasis carries a great psychological and social burden, too. The disease negatively affects the quality of life and leads to an increased incidence of sleep disorders, exhaustion, stress, and depression, creating a negative body image and leading to a decrease in work productivity (10). It was shown that the risk of depression is significantly increased in patients with AS and PsA (11, 12). In one study, factors associated with deterioration or improvement of self-reported depression were fatigue, general

health, QoL, level of functioning, disease activity and self-efficacy (13).

The prerequisite of an adequate plan for rehabilitation interventions is an evaluation of a patient in regard to the disease activity and functional ability (biomedical aspect) as well as the biopsychosocial aspect (biometric evaluation). In the last 20 years, validated questionnaires for measuring disease activity and functional ability were designed for AS and PsA. These instruments consist of questions reported by the patients themselves (Patient Reported Outcomes - PRO-s) and some are combining PRO-s with some objective measures, e.g. CRP. Some of the most known examples for AS are Bath Ankylosing Spondylitis Functional Index (BASFI), Bath Ankylosing Spondylitis Disease Activity Index (BASDAI) or Ankylosing Spondylitis Disease Activity Score (ASDAS), while examples of instruments developed for PsA are Psoriatic Disease Activity Index (CPDAI), Disease Activity in Psoriatic Arthritis (DAPSA), and Psoriatic Arthritis Disease Activity Score (PASDAS) (14, 15). It is worth mentioning that due to its heterogeneity, tools for PsA are not generally accepted and various instruments are in use, most commonly those “borrowed” from rheumatoid arthritis (RA) and AS (15).

From the point of view of physical and rehabilitation medicine, main health issues of SpA patients are encompassed by the International Classification of Functioning, Disability, and Health (ICF), which is based on the biopsychosocial principle (16, 17). As a universal conceptual framework ICF covers the whole spectrum of issues in the musculoskeletal diseases and is useful for structured identification of disability in a particular condition and for the particular patient, as the diagnosis itself does not reveal what the patient can do, what is his/her prognosis or what are the costs of rehabilitation. ICF includes domains of body functions and structure, activities and participation and environmental factors. Among SpA entities, Comprehensive and Short Core Set of ICF was developed for AS, but not for other SpA entities (18).

## GENERAL PRINCIPLES

The primary objective of any intervention in SpA is to achieve best possible long-term health-related quality of life (HR-QoL) through the control of symptoms, prevention of structural damage

progression and preservation and improvement of functionality and social participation (19, 20). In accordance with these goals, adequate assessment and regular patient follow-up are required, ideally within a multidisciplinary team. The number of team members can be expanded or reduced as needed, but it usually consists of physicians (specialist in physical and rehabilitation medicine and, if necessary, other specialties), physiotherapists, occupational therapists, nurses, occasionally accompanied by orthopaedic technicians, social workers, and clinical psychologists. This approach in the rehabilitation of chronic illness, such as SpA, encourages the patient to participate more actively in the treatment and to take responsibility for the decisions related to his/her condition. Non-pharmacological non-surgical interventions, as the mainstream of rehabilitation, are recognized as extremely important in patients with SpA (21,22). In that regard, therapeutic exercises have a crucial role, especially in patients with axial SpA (axSpA) (21,22). Other methods used in a non-pharmacological non-surgical approach for patients with SpA usually include education of patients and their families, occupational therapy, use of different physical modalities and in some instances use of orthoses and walking aids (22).

## **EDUCATION**

Patient education is included in the domain of self-help, along with social learning and cognitive-behavioural therapy (22).

Educational programs include informing patients and their families about nature and course of the disease, possibilities of self-treatment, conservative and surgical treatment and the importance of modifying habits and professional activities, including the use of aids. Studies have shown the efficacy of education in improving the functionality of patients with AS, and better results of these programs can be achieved if they are applied at an early stage of the disease (23). Level of patient involvement in decision-making is important, as it was shown in patients with PsA, where the low level of their involvement resulted in lower satisfaction with the treatment (24). Patients should realize, accept and implement that investing time and energy in these non-pharmacological interventions results in a reduction of disability and improvement of the quality of life (25). Possibi-

lities of sport and recreational activities that can contribute to the improvement of their functional status should be communicated to these patients, too. For example, backstroke swimming, skiing, basketball, badminton or volleyball can be recommended for patients with AS/axSpA, while sports and recreational activities that are increasing the load on pectoral muscles and worsening thoracic spine kyphosis, such as breaststroke swimming, cycling, rowing, hockey, high or long jump and contact sports (e.g. boxing) cannot (26).

Apart from the individual face to face approach patients can get information through support groups, printed materials (e.g. booklets, magazines), websites, lectures or public campaigns. A study which evaluated the significance of specific advice given to AS patients showed that the most valuable for them were those about the importance of daily exercise routine (69%), followed by the advice about the importance of maintaining mobility (55%). Other advices perceived to be important referred to sleeping on a hard mattress (53%), avoiding the use of large pillows (42%), maintaining good posture (38%) and participating in sports activities (36%) (27).

Among others, smoking cessation is frequently recommended, especially for patients with AS, as it was shown that smoking increases disease activity, inflammatory activity visible on magnetic resonance imaging and spondylophyte formation (28,29). Despite that, the effect of smoking cessation on signs and symptoms in AS/axSpA has not been proven.

Interventions based on social learning through the observation of other patients' behaviour are also included, and for this purpose, problem-solving and goal-achieving techniques such as bio-feedback, relaxation, cognitive restructuring and encouragement of social participation are applied (22). One should always consider a question of effect-size and cost-effectiveness of these interventions in a specific socio-economic environment (30-32).

## **JOINT PROTECTION, POSTURE AND REST**

Certain positions and motions in SpA patients can increase the risk of experiencing pain and further damage. Joint protection is based on learning to position a joint in the least painful way with the smallest functional deficit. Studies have provided

strong evidence on the efficacy and long-term effectiveness of joint protection programs, which should be done under the supervision of an adequate professional, mostly occupational therapist (33, 34). Maintaining proper posture is especially important for patients with AS/axSpA. In the initial stage of the disease, lumbar lordosis is reduced, followed by the increase of the thoracic kyphosis and the reduction of the cervical lordosis, while in the later stage of the disease, a hip contracture can occur, which, in order to maintain the balance, results in compensatory knee flexion. This type of posture is called “skier’s stance”. In biomechanical sense, it is rather ineffective in maintaining proper balance because even in the early stage of the disease it shifts the gravitational centre forward (35). Therefore, patients should be advised not to spontaneously stand (or sit) in a flexion posture, even though it reduces pain. Implementing ergonomic rules at home, workplace and during recreational activities will improve the long-term functional outcome of the disease. In order to minimize long-term consequences, regular change of body position, stretching and postural control are recommended. When working in an upright position, the working surface should be at a height that allows working without bending. A chair should provide support for the entire spine, including the neck, while the hips and knees should be positioned at 90 degrees, foot pads should be used if feet do not reach the floor, while armrests help to reduce the strain on the cervical muscles. For people who spend more time working at the computer, a simple adaptation of the height of the screen and the chair can make a significant difference (34). Car seats should support the neck and spine, and headrest should be at least 7 cm higher than the eye level. Specially designed rear view mirrors can increase the field of vision (36).

Since the lack of energy and fatigue are important symptoms of inflammatory rheumatic diseases, patients should be advised on resting, and the resting position should prevent the development of the contractures. Patients with AS/axSpA are recommended to lie supine but should have a pillow under the head, which should be as small as possible. Hip flexion contractures can be prevented by laying prone twice a day for 20-30 minutes or, when lying supine, by suspending the leg over the edge of the bed, thus stretching the hips (37).

## THERAPEUTIC EXERCISE

Therapeutic exercise is the most important non-pharmacological intervention in patients with SpA, having a preventive and therapeutic purpose. General positive effects of exercise are well known, and they include reducing the risk of cardiovascular and metabolic diseases (38, 39), maintaining cognitive functions (40), improving strength, mobility, balance and coordination (41), reducing the risk of fall (42), increasing bone density (43), and improving mental health (44). Therapeutic exercise can be performed in health facilities or at home, individually or in groups and it can be land-based or water-based.

In the past two decades, new insights have emerged regarding the role of therapeutic exercise in inflammatory rheumatic diseases, therefore modifying the present paradigm. Studies have shown that exercise has a significant anti-inflammatory effect. The contraction of the muscle, which acts as a secretory organ, stimulates the production, excretion, and expression of cytokines and other peptides, called myokines, derived from the muscle fibres. Interleukin – 6 (IL-6) that comes from the same family as proinflammatory IL-6, is considered to be the most important myokine (45). It inhibits the production of tumor-necrosis factor – alpha (TNF- $\alpha$ ) and stimulates the production of anti-inflammatory cytokines IL-1 receptor antagonist and IL-10 (45-47). Therefore, contrary to the previous belief that exercise is contraindicated in the acute phase of inflammation, therapeutic exercise is now viewed as a potential remedy for patients with inflammatory rheumatic diseases. This can also explain some of the positive effects of exercise in other chronic diseases (48).

Therapeutic exercise should be prescribed individually for each patient, depending on the current disease activity and functional status. Generally, it is important to start such a program at low levels of load, gradually, increasing its intensity and duration. Although the beneficial effects of physical activity and exercise are well-known, no specific guidelines on the required type and dosage for patients with arthritis were available until 2018., when EULAR published recommendations for physical activity in people with inflammatory arthritis and osteoarthritis. Given the evidence of its effectiveness, feasibility and safety, physical activity is advocated as an integral part of standard care throughout the

course of these rheumatic diseases (49). One should be aware of contraindications for therapeutic exercise, and the usual ones for patients with axSpA/AS are atlanto-axial dislocation, active uveitis, and discitis. In inflammatory rheumatic diseases, SpA included, pain can increase with rest and decrease with motion, but one should keep in mind that it can also increase at the start of the exercise cycle (50, 51). Overall, long-term results in patients with SpA are positive not only regarding the improvement in physical performances and aerobic capacity but also in the reduction of fatigue and improvement in mental health (52). The majority of studies on the effects of therapeutic exercise in SpA refer to AS. A recent meta-analysis has confirmed the effectiveness of therapeutic exercise on disease activity and function in these patients, as was seen by a decrease in BASDAI and BASFI (53). For AS patients, especially younger and working individuals, home-based exercise is more practical and time-efficient. In a work of Aytekin et al. regular exercise at home (at least 5 times a week with a minimum duration of 30 minutes a day) reduced pain and stiffness of the spine and improved chest expansion and quality of life (54). A recent meta-analysis has confirmed that home-based exercise improves health-related quality of life (55). Despite that, studies have shown that health facility-based exercise supervised by a physiotherapist was more effective than home-based exercise in terms of both alleviating symptoms and improving mobility (56, 57). Reasons for this could be better exercise technique and better motivation, social contact, and communication with other patients. According to some studies, the duration of the disease is not crucial in achieving a positive result, i.e. it is possible to prevent further decrease of spinal function and improve general condition in short or long-lasting disease (58, 59). A recent study on the effects of therapeutic exercise in non-radiographic axSpA compared to established AS patients showed equal effectiveness of intensive exercise program on spinal mobility and serum calprotectin level, as a marker of disease activity (60).

There are different types of exercise that are used and consequently were evaluated in patients with axSpA/AS. They include stretching, range of motion, strengthening and endurance (especially paravertebral, abdominal and chest muscles), exercises for improving posture, breathing exercises and aerobic exercises (50, 61).

In AS, shortening and tension of muscles are most prominent in the sternocleidomastoid and trapezius muscles, shoulder adductors and flexors, hip adductors and flexors, hamstrings and m. triceps surae. Stretching improves a range of motion and posture. It can be preceded or carried out simultaneously with thermal physical procedures. A technique used in the context of stretching is the proprioceptive neuromuscular facilitation (62). It is usually performed in a way that a muscle is placed in a maximally stretched position and isometrically contracted for 3 seconds, followed by 2 seconds of muscle relaxation, then actively or passively stretched for further 6 seconds.

In patients with AS, range of motion exercises include spinal, chest and limb mobilization techniques, and for the latter emphasis is put on hips and shoulders. Spinal mobilization exercises can be performed from a supine, crawling or seated position. Chest mobilization is especially important in patients with AS, and in addition to breathing exercises, activities such as singing or playing a wind instrument are also encouraged. Studies evaluating the effect of therapeutic exercises on pulmonary function in patients with AS have shown positive results in multiple pulmonary function outcomes, including chest expansion, maximal inspiratory pressure, maximal expiratory pressure and overall pulmonary function (63). A study by Basakci Calik et al. investigated the effects of inspiratory muscle training and showed that this type of exercise in addition to conventional exercises increased inspiratory muscle strength, functional exercise capacity and positively affected disease activity (64).

Strengthening exercises are also an important part of SpA rehabilitation because the disease leads to loss of muscle strength due to both inactivity and the inflammatory process itself (65, 66). In axSpA/AS patients special attention should be given to the strengthening of the antigravity muscles - spine extensors and gluteal muscles, although lateral trunk flexors and trunk rotators should not be neglected (50, 61). Caution is required in the mobilization of the joints with active inflammation or in more mechanically impaired joints when gentle active assisted exercises or isometric exercises can be preferred because of their minimal effect on joint load (67).

As postural stability is deteriorating with the progression of axSpA/AS, exercises for balance and posture should be included in the rehabilitation program. Demonitis et al. demonstrated positive effects of the supervised rehabilitation program and home-based rehabilitation program on balance and postural stability (68). In the study by Gunay et al. balance and postural stability exercises in addition to a spa-based rehabilitation program increased the duration of maintaining balance (69). For AS patients, special exercise programs such as the Global Posture Reeducation method have been developed. This method is based on exercises for shortened muscular chains, such as the posterior chain, anterior diaphragmal chain, anteromedial pelvic chain and the scapular chain (70, 71). Some studies have shown that this type of exercise is better than a conventional exercise in outcomes such as forced vital capacity, forced expiratory volume in one second and peak expiratory flow (71-73).

Aerobic exercises are very beneficial in patients with AS. One type of aerobic exercise often recommended to AS patients is swimming, though evidence of its overall effectiveness is limited. A study by Karapolat et al. showed significant improvement in exercise tolerance and pulmonary capacity by combining swimming and walking (74). In the study of Jennings et al. aerobic training led to improvements in aerobic capacity and maximum walking distance but did not have an impact on functional capacity, mobility, disease activity, quality of life and blood lipid levels (75). Although morbidity and mortality of cardiovascular diseases in SpA patients are increasing, benefits of aerobic exercise in the reduction of cardiovascular risk have not yet been adequately studied in this population (76).

Pilates, Tai-chi, Yoga and similar techniques are becoming increasingly attractive for various conditions, SpA included. Altan et al. evaluated the effect of Pilates exercise in patients with AS, and the results showed an increase in functionality, measured by BASFI (77). Rosu et al. demonstrated the benefits of multimodal exercise program combining Pilates, McKenzie, and Heckscher techniques with significant improvement in pain, lumbar spine mobility (modified Schober test, fingertips-floor distance), BASFI, BASDAI, BASMI and chest expansion (78). There is only one

study that investigated the efficacy of Tai-chi in SpA conditions, and the results suggested that this type of exercise can decrease disease activity and improve flexibility in patients with AS, although the possibility of the placebo effect could not be discounted (79). Yoga seems to be effective in decreasing pain and inflammation while increasing QoL in patients with RA (80), but despite the increasing acceptance and its use as an effective mind-body technique, there are no studies about its effect in patients with SpA (81).

As the treatment of AS with TNF- $\alpha$  inhibitors is becoming more widespread, a number of studies analysed the effect of the combination of TNF- $\alpha$  inhibitors and therapeutic exercises. Meta-analysis has shown that this combination has improved outcomes measuring disease activity (BASDAI) and range of motion (BASMI) (82).

The effects of rehabilitation modalities, therapeutic exercise included, in PsA, as well as other SpA-s, have not been sufficiently evaluated so far. Nevertheless, the international society of experts on psoriasis and PsA (Group for Research and Assessment of Psoriatic and Psoriatic Arthritis - GRAPPA) considers rehabilitation to be an important component of treatment for these patients (21). Physical therapy has been particularly effective in the axial form of the disease and in the treatment of enthesitis (83). A recent study by Roger-Silva et al. observed positive effects of resistance training in PsA patients in the sense of improvement in functional capacity and quality of life, as well as in the reduction of disease activity (measured by BASDAI), although no significant increase in muscle strength was observed (84).

Adherence is one of the most important factors in the success of the therapeutic exercise. According to some studies, adherence for supervised short-term programs (1-12 months) was found to be 68-93%, while long-term adherence requiring significant lifestyle changes was 25-50% (85, 86). Adherence was better if exercise technique and purpose had been clearly explained and if they could be performed in a safe environment under the supervision of a physiotherapist. One should bear in mind that disease activity reduces adherence (87). A study by Barlow et al. in AS patients found that the most important obstacles for exercise were: pain, fatigue, boredom, lack of time, inadequate education on the safety of exercise, lack of support from family and

friends, inadequate equipment and stigma during a group exercise (88). Solutions proposed for these problems include diversity in exercise programs, group exercise, better social support and pain management, establishing therapeutic exercise as a form of everyday activity and increasing the confidence in the safety of exercises (88). Swinnen et al. aimed to determine whether fear of movement and (re)injury [FOM/(R)I] beliefs, measured with the Tampa Scale for Kinesiophobia 11-item version (TSK-11), influenced activity limitations and mediated the relationship between pain severity and activity limitations in axSpA (89). The results showed that TSK-11 partially mediated the BASDAI/pain/BASFI relationship and that FOM/(R)I could be a novel treatment target in these patients (89). A study by Santos et al. showed that adherence in AS was most related to rheumatologist follow-up belief in the benefits of therapeutic exercise and a higher degree of education (90). Also, in a study by Passalent et al. the majority of patients stated that they did not exercise regularly (more than 3 times a week) despite knowledge of the positive effects of exercise. Fatigue was identified as the most important interference factor, and adherence decreased with the duration of the disease, too (91). Considering the aforementioned studies, besides the education on the positive effects of exercise, it is important to include exercise in the daily routine and create diverse and interesting programs. In that context patient's preferences, expectations and attitudes should be especially respected (51).

Regarding the quality of evidence presented in the studies of therapeutic exercise in SpA, the comparison between studies is hampered by high variability of techniques, duration, frequency and number of repeats of exercise.

#### **HYDROTHERAPY AND BALNEOTHERAPY**

Hydrotherapy and balneotherapy are traditionally used in the treatment of patients with different musculoskeletal conditions including diseases from the spectrum of SpA. A water-based exercise program should be well designed and adjusted to the condition of the patient because in the water the patient is feeling freer so there is an increased risk of effects of compensatory movements on the weaker parts of the kinetic chain. As for the swimming techniques in AS, backstroke swimming has a good effect on the stretching

of the pectoral muscles and should be preferred to the breaststroke, although breaststroke has a good effect on the increase of the cervical lordosis, which is often reduced in these patients (92). In spite of its widespread use in clinical practice, effects of hydrotherapy and balneotherapy in rheumatic conditions are still a matter of debate. A water-based exercise program can improve circulation, muscle strength, flexibility and range of motion, coordination, cardiovascular and respiratory conditioning and reduction of pain and muscle spasm (62, 93). As for AS, several studies showed a positive effect of hydrotherapy (therapeutic exercise included) and balneotherapy in these patients. A meta-analysis in AS patients showed that the effect of combined hydrotherapy and land-based therapy was better than land-based therapy alone in terms of pain reduction, improvement in physical function and global health assessment (94). A study by Olah et al. compared the effect of hydrotherapy in pipe water and in mineral water and observed that mineral water had a better effect on some inflammatory markers and serum lipid levels (95). Assessing the results of 16 randomized controlled studies, Françon and Forestier concluded that balneotherapy resulted in long-term pain reduction, decreased use of nonsteroidal anti-inflammatory drugs (NSAIDs) and improvement in functional ability and/or quality of life in AS and RA patients (96). Ciprian et al. evaluated the effect of balneotherapy in AS patients treated with TNF inhibitors, and found a greater improvement in functional status (measured by BASFI), disease activity reduction (measured by BASDAI), range of motion increase (measured by BASMI), pain reduction (measured by VAS) and functional improvement (measured by HAQ) in a combination of TNF inhibitor therapy and balneotherapy than when the TNF inhibitors were used alone. The improvement was maintained after 3 and 6 months (97).

Only a small number of studies evaluated the effects of balneotherapy and hydrotherapy in other SpA entities. Mustur et al. conducted 4-week spa rehabilitation study in patients with PsA and concluded that such a program significantly reduced disease activity parameters (number of pain and swollen joints, level of pain, duration of morning stiffness, and composite disease activity index DAS28) (98).

## PHYSICAL THERAPY MODALITIES

Different physical therapy modalities are used in clinical practice. However, there is a very limited number of quality studies on their efficacy in SpA conditions. So, their use in clinical practice is mainly based on experience in treating other musculoskeletal disorders (99).

In a study by Gemignani et al. transcutaneous electrical nerve stimulation (TENS) in AS patients provided short-term pain reduction, but it was not significant compared to placebo (100). In a recent study by Chen et al. TENS had no effect on pain reduction, functional improvement or quality of life in patients with AS (101).

A study by Turan et al. has shown some positive effects of magnetotherapy in AS patients, but without significant short-term or long-term effects on crucial outcomes such as pain, fatigue, morning stiffness, functional indices and quality of life (102). A study by Karamanlioglu et al. evaluated the effect of therapeutic ultrasound in AS patients (103). It improved the effect of exercise and reduced pain, stiffness and disease activity and improved mobility of the lumbar spine and the quality of life (103).

Oosterveld et al. observed positive effects of infrared sauna in AS patients, regarding significant reduction in pain and stiffness, but only immediately after the application of the therapy, with the effects not lasting for 4 weeks after the intervention (104).

Straburzyńska-Lupa et al. evaluated the effect of whole-body cryotherapy (WBC) at  $-110^{\circ}\text{C}$  and  $-60^{\circ}\text{C}$  on disease activity, selected pro-inflammatory cytokines, and oxidative stress in patients with AS. The results showed a significantly lower disease activity (measured by BASDAI score) after WBC at  $-110^{\circ}\text{C}$  compared to the non-WBC group which performed exercise therapy (105).

## ORTHOSES

In axSpA/AS patients orthoses can be used to stabilize the unstable spinal segment, especially in the case of advanced manifestations of the disease, such as atlantoaxial dislocation with present or potential major neurologic deficit or in the case of complications such as vertebral fracture. Sometimes a brace is applied in severe exacerbation of pain, usually for a very short period, although there are no studies supporting its use

for this purpose. In the peripheral forms of SpA conditions, orthoses are sometimes used for reducing joint load and preventing deformation and contracture, while orthopaedic shoes can be beneficial in the case of major foot deformities (22). It should be noted that there are no studies on the use of orthoses in SpA conditions. However, from the data in the studies of RA it can be concluded that, for example, finger orthoses can be effective in correcting deformations and increasing stability and dexterity, while foot orthoses can be effective in reducing pain, improving function and delaying the development of bunion (106). Also, a systematic review has shown the efficacy of special shoes in reducing pain and improving function (107).

It is important to note that orthoses should be prescribed for a shortest possible period and always combined with active therapeutic exercise, due to possible negative effects of prolonged immobilization.

Prescription of mobility aids, such as crutches, cane, walker or wheelchair is also an important part of rehabilitation interventions in patients with SpA conditions, especially in cases of severe disability.

## MANUAL THERAPY

Manual therapy is a traditional method of treatment, practiced in clinics, although there is a lack of quality studies which could confirm its effectiveness, SpA patients included. Widberg et al. conducted a small study on a cohort of patients with AS ( $n = 32$ ) who were randomized for self-mobilization and manual spinal mobilization for 8 weeks and compared to a control group (108). Manual therapy group showed a significant improvement in chest expansion index, posture, spinal mobility and functionality, with improvement in posture, spinal mobility and functionality maintained for 6 months (108).

## ACUPUNCTURE

Acupuncture is increasingly becoming a part of treatment in rheumatic conditions (109). A meta-analysis that evaluated the efficiency of acupuncture in AS patients demonstrated that it can further improve the clinical effect, including functional measures such as occiput-wall distance, chest expansion index and fingertip-to-floor



distance, as well as decrease acute phase reactants when used alongside with conventional synthetic disease-modifying drugs (csDMARDs) compared to csDMARDs alone (110). However, these results require a careful interpretation due to the poor methodological quality of the studies. In conclusion, although we are witnessing the increasing availability of potent drugs for the treatment of patients with SpA conditions, non-pharmacological/non-surgical approach still has an essential role in the treatment and rehabilitation of these patients. The most important component

of such an approach is therapeutic exercise, which demonstrated efficacy in reducing pain, improving functionality and quality of life. Although the number of high-quality studies is increasing, further research is needed to determine the effective rehabilitation protocols for these patients.

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