

# Physiotherapy rehabilitation in patients with ankylosing spondylitis

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## Abstract

Ankylosing spondylitis (AS) is a chronic immune-mediated inflammatory disease, it is a form of arthritis characterized by an auto-immune and genetic etiology, included in the group of chronic inflammatory, autoimmune, and diseases.

One of the most frequent reasons for the long delay in diagnosis is represented by the AS main symptoms such as: chronic low back pain, very common in this kind of patients, followed by a diagnosis of degenerative disc pathologies, rheumatoid arthritis, and tuberculosis of the spine. Another reason is the quite late appearance of the radiographic signs in the sacroiliac region.

The pain symptomatology manifesting itself from the onset of the pathology is the cause of an analgic response. In this sense an early diagnosis is essential to avoid the establishment of deformities at the level of the spine and of the articular and peri-articular structures. Pharmacological treatment as well as a rehabilitation program are very important and effective in the early phase of the disease.

In the most advanced phases, the spine presents an increasing stiffening, with dorsal hyperkyphosis and the abolition of the lumbar lordosis determining the typical postural alterations characteristic of the disease. Early diagnosis and timely delivery to rehabilitation and physiotherapy can significantly reduce disability and complications. The international guidelines and recommendations suggest the pharmacological treatment as well as the rehabilitation and physiotherapy program during the different stages of the disease. In the 2016 update of the ASAS-EULAR recommen-

dations for axial AS, multidisciplinary, non-pharmacological (along with pharmacological) treatment is required to ensure optimal management of the disease.

US-based recommendations also suggest the relevance of non-pharmacological therapies, along with recommended patient education, active physiotherapy and regular physical activity.

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## Introduction

Ankylosing spondylitis (AS) is a common inflammatory rheumatic disease that predominantly affects the sacroiliac joints and spine, and even other joints leading to structural damage and functional impairments with a consequential decrease in quality of life. One of the most frequent reasons for the long delay in diagnosis is represented by the AS main symptoms such as: chronic low back pain, very common in this kind of patients, followed by a diagnosis of degenerative disc pathologies, rheumatoid arthritis, and tuberculosis of the spine. Pharmacological treatments as well as a rehabilitation program are very important and effective in the early phase of the disease. Both European and US international guidelines and recommendations encourage non-pharmacological therapies such as rehabilitation and physiotherapy program during the different stages of the disease.<sup>1-6</sup>

Between 20 and 40% of affected patients have extra articular problems, in particular anterior uveitis, chronic inflammatory bowel diseases, psoriasis, cardiac conduction disorders, aortic insufficiency, pulmonary involvement, renal involvement, osteoporosis and vertebral fractures. Cauda equina syndrome is a long-term complication of AS that affects the lumbo-sacral nerve roots.<sup>7</sup>

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## Epidemiology

Ankylosing spondylitis is a chronic inflammatory rheumatic disease with estimated prevalence per 10,000 of 23.8 in Europe, 16.7 in Asia, 31.9 in North America, 10.2 in Latin America, and 7.4 in Africa. Incidence of disease depends on ethnicity and classification criteria used in the diagnosis. The disease usually begins in subjects with ages between 20 and 40 and less than 5% of cases have an onset when they are over 45 years of age. The female/male ratio is 1/3. The disease is 10-20 times more frequent in first-degree relatives of subjects with AS than in the general population overall.

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## Physiotherapy and rehabilitation assessment

A precise diagnosis and an adequate pharmacological plan are

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the basis for the competent physiotherapist to agree a personalized treatment plan with the patient.

The first physio-therapeutic and rehabilitative evaluation allows the acquisition of basal parameters. The rheumatologist will plan a follow-up visit at short, medium and long term of the disease.<sup>8</sup>

The approach needs to be multidisciplinary, interdisciplinary and multimodal, with an analysis of the person and his/her deficits in all the domains identified by the International Classification of Functioning (ICF).<sup>9</sup>

The ICF proposal is to place the person with AS at the center of the therapeutic program, in order to take into consideration, not only the consequences of the pathological event on structures, functions and abilities, but also the psychological and personal behavior, the environmental context in which people with AS act and live, and at least their needs in their daily life.

The bio-psycho-social model of the state of health foresees the passage from a rehabilitation dedicated to the pathology to a rehabilitation aimed at the therapeutic function of the rehabilitation. This means to pay high attention to the peculiar situation where the person is a part of a general view.

Thanks to this approach, it is possible to investigate the personal priorities and agree with the patient accordingly. The physiotherapist identifies the most appropriate treatment strategies and outcome measures to create the necessary therapeutic alliance, in order to achieve maximum compliance and result.

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## Anamnesis

A person with AS needs to maintain a good standard of quality of life during the approach and diagnosis of illness, for this reason a correct handling by a cognitive investigation of daily life is very important.

The anamnesis initially involves a careful collection of anamnestic data, demographic aspects, education, and life vision. It includes the knowledge of the comorbidities as important, non-modifiable biological variables.

It is important to know the availability of people for a real therapeutic collaboration. In this sense, the communication between physiotherapist and patient assumes a specific competence, to guarantee the success of the treatment.

The personal examination precedes and frames the entire physical assessment, providing information on the person's ability to manage daily life, his symptomatic situation and, last but not least, work and social life. An important role is played by information regarding the course of the disease: inventory of disorders, results of other rehabilitative treatments, progression over time and repercussions on family, social, work life, and adaptation to the new health condition.

The consultation of the clinical history of the person pays particular attention to the assessment of pain, its location, intensity, extent, and characteristics of the symptomatology in the evolution over time.

An important role is played by the awareness of the person with respect to his/her problem and state of health, the expectations regarding the prognosis alongside the behavioral strategies and therapeutic choices he has implemented.

The collection of data relating to the person is important, since from their analysis the prognostic profile of health is prepared and the personalized rehabilitation project includes objectives, thera-

peutic strategies, frequency of sessions and outcomes measurements.

It is essential to integrate the perception of the person regarding his/her main problems with the vision of the rehabilitation team, which develops a prognosis on the evolution of the disease and disability.

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## Physical examination

The physiotherapeutic functional assessment includes a manual and instrumental evaluation with the use of anthropometric measurements, to quantify the peripheral, extra-articular and muscular joint commitment.

The physical examination precedes the rehabilitation intervention, it includes a district, global, postural, and functional analysis based on the functional diagnostic hypotheses formulated in the anamnesis.

The inspectorial examination collects information on the health of the musculoskeletal system with bone palpation and soft tissue.

The manual evaluation with the passive and active mobilization allows to highlight the limitations in articular excursions or specific movement difficulties.

The muscular examination allows to know the evolution of the disease, with a picture of hyposthenia and general hypotonia and the progressive loss of muscular strength, in the anti-gravity and respiratory muscles.

The instrumental evaluation allows the measurement of physical parameters and their variations over time; it can be performed through the goniometry and anthropometry.

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## Evaluation scales

The evaluation scales are different and consider different aspects. The Bath Ankylosing Spondylitis Metrology Index (BASMI) scale includes five anthropometric measurements: tragus-to-wall distance, modified Schober test, cervical rotation, lateral spinal flexion and intermalleolar distance. This is the most used scale to evaluate daily life quality and disability stage.

The Revised Leeds Disability Questionnaire (RLDQ) is designed and structured in a similar way to the Health Assessment Questionnaire (HAQ).

The European Quality of Life (EuroQoL) is a questionnaire easy to complete but not as easy to compute.

The Bath AS Disease Activity Index (BASDAI; 0-100) is used to assess the last week global level of aspects such as tiredness, fatigue, pain in the neck, back, or hips, pain in joints other than the neck, back or hip, discomfort-pain on contact and pressure, morning stiffness on waking, duration of morning stiffness after waking up (up to 120 min).<sup>10</sup>

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## Pain assessment

Pain is an important symptom during the course of the disease and for this reason it is important to monitor its progress, the most commonly used scale is Visual Analogue Scale (VAS).

## International guidelines

For several decades, the European League Against Rheumatism (EULAR) has developed recommendations for the management of the treatment of numerous rheumatic diseases based on the revision of literature.

The Assessments in Ankylosing Spondylitis International Society (ASAS) published in 2006, in 2010 and - in a 2012 update - list key points concerning the management of the disease from the pharmacological and non-pharmacological perspective.<sup>3</sup>

In 2005 the two organizations joined to draw up the first list of pharmacological and non-pharmacological recommendations for the management of AS.<sup>11</sup> These guidelines were updated in 2010 with a multidisciplinary scientific group composed of medical figures, health professionals and patient associations.<sup>12</sup> The new version includes four general principles in the management of the disease that are articulated in eleven key points.<sup>3</sup>

The indications of the international guidelines on the non-pharmacological treatment of AS denote that the rehabilitation project must be dedicated and agreed with the person based on his real needs and life expectancy.

The study by Elyan *et al.* supports the guidelines and concludes that, despite the advantages of drug therapy, physiotherapy is an essential part of the management of the disease, furthermore the author advises to propose, since the moment of diagnosis, a spine and breath program of exercises.<sup>13</sup>

Patient education and information include indications for correct lifestyles.

Vlieland and Li compared the non-pharmacological treatment of two inflammatory diseases such as rheumatoid arthritis (RA) and spondylitis AS, emphasizing that research in these years has privileged RA by paying less attention to AS.<sup>14</sup>

## Role of physiotherapy and rehabilitation in the treatment of ankylosing spondylitis

Rehabilitation is an integral part of medical therapy and plays a fundamental role at the level of tissues and musculoskeletal system; it intervenes in the different phases and at different stages of the disease. According to Mihai and colleagues, over 82% of experts in clinical care of AS expressed consensus over the efficacy of physiotherapy in its multiple applications for patients with axial and peripheral joint manifestation of ankylosing spondylitis.<sup>15</sup> From the Cochrane review by Dagfinrud and colleagues, it emerges that an individual home-based or supervised exercise program is better than no intervention, driving further evidence for the efficacy of different therapeutic methodologies.<sup>16</sup> The main aspects included in the rehabilitation treatment are information, education, a program of personalized exercises and indications of physical activities to be performed in groups and at home. Education to home self-care in the long term has proven its efficacy in the study conducted by Sweeney and colleagues, where a self-care and educational package composed by videos, educational booklets, progression charts and reminder stickers has shown results in improving self-efficacy for exercises, self-reported level of exercise and a positive trend for improvement in function.<sup>17</sup> Quality of life is an essential factor pertaining to the everyday management of the disease. Vesovic-Potic and colleagues showed how AS spinal mobility measures are associated with physical

function, general health, emotional role and mental health domains of quality of life.<sup>18</sup> A study conducted by Ozgül and colleagues showed that the most affected domains of lifestyle and quality of life for people affected by AS were physical role power, general health, and pain.<sup>19</sup> According to the survey conducted by Ward, the most prevalent quality of life concerns included stiffness (90.2%), pain (83.1%), fatigue (62.4%), poor sleep (54.1%), concerns about appearance (50.6%), worry about the future (50.3%), and medication side effects (41%).<sup>20</sup>

Improved mobility was shown in the study conducted by Viitanen and colleagues.<sup>21</sup>

A review conducted by van der Linden and colleagues provides evidence across different rehabilitation approaches of improvement with regards to quality of life-related measures, such as pain, mobility and overall disease management.<sup>22</sup>

Rehabilitation therapy develops in three different phases in the evolution of SA, initial or acute phase, remission and chronic one.

## Rehabilitation and physiotherapy of the person with ankylosing spondylitis

### Initial or acute phase

The initial or *acute* phase indicates an ongoing phlogistic activity. It is characterized by pain in the spine and morning stiffness. Physiotherapeutic treatment accompanies the medical one and assumes an exclusively preventive character.

The objectives can be outlined in primary and secondary. The first ones foresee the control of the diffuse and distressed pain symptoms due to joint stiffness. Achieving this goal is useful for preventing or delaying the evolution of ankylosis and maintaining axial and peripheral joint excursions.

Intervention on pain combined with pharmacological treatment prevents the establishment of compensatory postures. If the person has performed post-analgesic postural attitudes, the goal is to correct them by recovering joint stability, proprioception and restoring postural patterns and inhibited engines for pain.

In this phase the physiotherapist can play a fundamental role that goes beyond the correction of the analgesic posture. The rehabilitative work intervenes on postural imbalances, prior to the illness that the person has created over time as a result of his life history.

The therapeutic practice in this case places the patient at the center of the treatment path and thanks to a rehabilitative therapy allows him a correction that becomes a favoring situation of symptom management. The person, thanks to the acquisition of a body awareness related not only to his illness, but to other aspects related to his health, acquires the skills for a correct management. This process is a potential for a real take on at one's health status.

Secondary objective in this phase is to maintain the elasticity of the spine and pelvis, in order to guarantee a good respiratory function, necessary for a good quality of life.<sup>23</sup>

### Patient information and education

Information and education are the conditions to motivate the person to perform a specific physical activity. Studies conducted by Carr-Hill *et al.*<sup>24</sup> and by Viitanen *et al.*<sup>25</sup> highlight how limited information and education can cause poor adherence to run an exercise program.

A recent study by Sollini *et al.*<sup>26</sup> with people undergoing drug therapy, shows a better result in the group of patients who did the

exercises under the guidance of the physiotherapist than those who followed a program at home.

The result that emerged six months after the treatment start is important: both groups, if they did not carry out the exercise routine regularly, returned to their initial values.

The success or failure of exercise program, which requires participation, motivation and time, is determined by the compliance with the prescribed program, which can be checked using diaries filled in by the persons or protocols of the physiotherapists. Some of the studies reviewed in the review by Dagfinrud *et al.*<sup>16</sup> reported compliance with the exercise program, and only one of these studies provided sufficient information to assess the possible influence on compliance.

### Postural and gestural re-education

The rehabilitation of posture for the recovery of the gesture is useful to act on the secondary damage.

An exercise program for muscle chains shows great improvements over conventional exercise programs.

Fernandez-de-Las-Penas *et al.*<sup>27</sup> and Vanti *et al.*<sup>28</sup> positively assessed the impact of a protocol of strengthening and lengthening exercises with global postural re-education (GPR).

The last study with a twelve-month follow-up shows the BASMI and BASFI scores of the subjects who performed the exercises based on the GPR method. People maintained much of the clinical improvement compared to those who had performed conventional exercises (Figure 1).

### Group exercises

The literature indicates how group exercises play an important role on several aspects. The study by Cagliyan *et al.*<sup>29</sup> highlighted how column mobility, functional skills, depression and quality of life improve significantly in people who had performed group exercises. In addition, pain, illness and fatigue decreased.

Masiero *et al.*<sup>30</sup> demonstrate the importance of a group exercise program combined with personal education through a cognitive behavioral approach to be performed at home to maintain good health. It included stretching exercises, respiratory gymnastics, proprioceptive exercises, general strengthening. A cognitive-

behavioral approach to control pain intensity, anxiety, and psychophysiological symptoms has demonstrated its effects on the long term, providing evidence of positive outcomes at a 12-month follow-up.<sup>31</sup> Kraag *et al.*<sup>32</sup> demonstrate that an individual exercise program, combined with a person's education, after four months, significantly improves function but not pain, compared to the absence of treatment. The improvement achieved could be maintained with minimal physiotherapy performed constantly. The study also shows that the exercises performed with supervision are more effective than those performed independently at home (Figure 2).

### Physical activity in musculoskeletal pain

In subjects at an early stage of the illness, it is possible that the pain and stiffness are due more to inflammation than to mechanical factors and therefore improve rapidly with physical exercise. People can do the exercises more vigorously and therefore get a greater analgesic benefit due to systemic effects.

A study by Hidding *et al.*<sup>33</sup> shows that in the initial phases of the illness, exercises done individually for two hundred minutes a week are important to reduce pain.

Kraag *et al.*<sup>32</sup> reports, in their study, a 16.1% reduction in pain at four-month follow-up in people with early AS, after performing home exercises.

The study by Uhrin *et al.*<sup>34</sup> demonstrates a significant improvement and greater stability of the score relative to the HAQ questionnaire, in the case in which people performed exercises constantly unlike those who were discontinuous in following the program. From this result it emerges that the exercises for the spine, compared to the recreational ones, can give more specific advantages in maintaining functional abilities. They should be performed at least thirty minutes a day for a minimum of five days a week as, if practiced consistently for years, they can help stabilize or decrease the progression of functional disability. Other studies by Hidding *et al.*,<sup>35</sup> Helliwell *et al.*<sup>36</sup> and Analay *et al.*<sup>37</sup> highlight how the people who performed the exercises with supervision had a 50% improvement in the overall state of health, functional capacity, pain and stiffness compared to those performing home exercises without supervision (Figure 3).

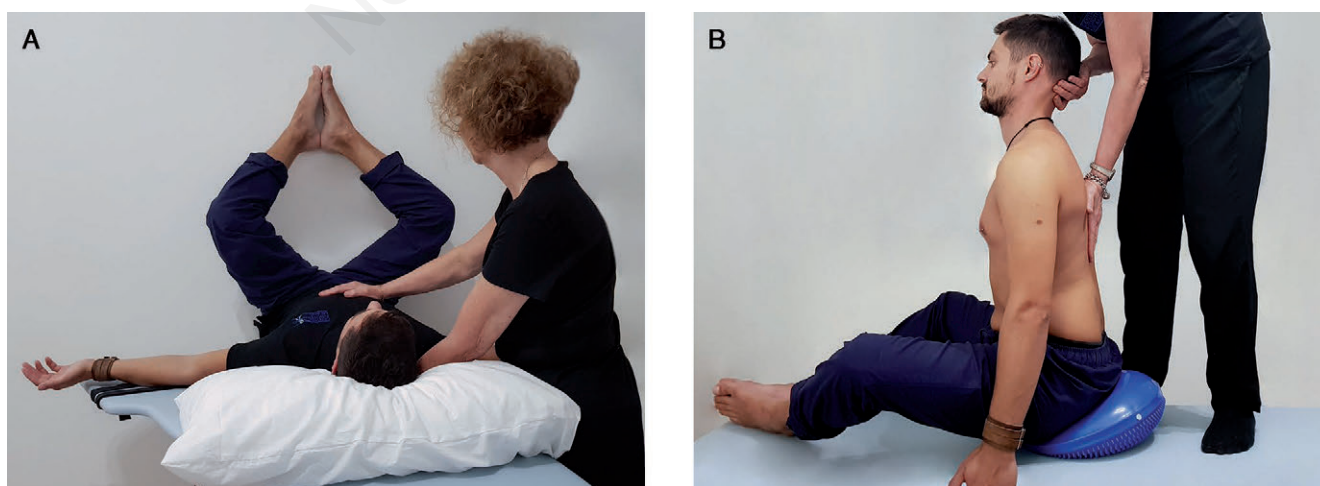


Figure 1. A) Global postural reeducation: exercise for unloading posterior muscle chains; B) Global postural reeducation: exercise for loading posterior muscle chains.

## Rehabilitation and physiotherapy

### Remission phase

The remission phase is characterized by the presence of pain, limitation of the mobility of the spine and of the peripheral joints if involved. The kyphotic attitude with lumbar flattening, sunken chest and protuberant abdomen is typical.



Figure 2. A) Exercises in pairs: lateral flexions; B) exercises in pairs: extension of the spine, strengthening of the extensor muscles and improvement of the balance reflexes.

The underlying pathology and the pain caused by it, influence the posture, which, deriving from a complex polysensory interaction, reacts to this situation, creating a new postural equilibrium; this is the cause of a change in the gestures over time, a process that takes place without conscious control, since a functional program on voluntary command predominates at the level of the central nervous system (CNS).

The objectives modulated to the needs of the person must be divided into short-term, medium-term objectives with the reduction of pain and improvement of bodily function, and long-term goals with pain control, improvement of general functionality, and quality of life.

Physiotherapeutic treatment includes prophylactic measures such as: prevention of flawed attitudes and incorrect postures, gait and balance control, to correct or limit clear compensations, consequent to pain.

Rehabilitation therapy intervenes initially with muscle relaxants such as fascial massage and lymph drainage. The study of Chunco *et al.*<sup>38</sup> shows the beneficial effects of massage on pain and fatigue. While the authors Masiero *et al.*<sup>30</sup> demonstrate how myofascial massage positively intervenes on muscle tension.

The following are other useful methods such as pompage, or passive joint mobilizations performed delicately.

The study by Santos *et al.*<sup>39</sup> indicates that subjects who performed exercises moderately, improved function and decreased disease activity, while those who performed the exercises intensively improved function but not disease activity.

Exercises for the mobility of the spine and for muscle strengthening with stretching of the retracted muscles accompanied by respiratory gymnastics can counteract hypotonia. This allows the improvement of general health conditions, to better cope with pain, both physically and psychologically.

The study by Levitola *et al.*<sup>40</sup> points out that, after twenty-one weeks of supervised exercises, there is a significant reduction in pain, an improvement in posture, lung expansion, and an increase in mobility.

Postural and gestural re-education are useful to recovery and to restore the correct movement patterns where possible.

Physiotherapy actively done, when possible, is always prefer-



Figure 3. Quadrupedal extension: antero-posterior oscillations and mobilizations of the spine.

able to passive physiotherapy, since it requires greater collaboration and participation of the person, allowing to better control pain. In this sense, home exercises become an essential part of the physiotherapy program.

The results of the study by Lim *et al.*<sup>41</sup> on the evaluation of the effect of exercises performed at home on a daily basis for eight weeks by young people with a sedentary lifestyle, are positive since there is an improvement in joint mobility and functional capacity and a decrease in pain and depression (Figure 4).

### Chronic phase

In the chronic phase there is the formation of widespread ankyloses, which can lead to an almost total rigidity of the spine, making the person assume a curved orthostatic posture. The structuring of joint deformities involves serious functional limitations, which can lead the person to lose the walking ability, especially in rhizomelic variants of the disease.

The primary objective of rehabilitation is to allow the person to maintain the residual abilities in order to guarantee him the greatest possible autonomy over time.

The physiotherapist should inform and educate the persons to involve them in an active therapeutic path, to make them aware of the usefulness of physiotherapy and the need to perform it daily at home or in small groups, in order to achieve the set goals.

The objectives to be met initially require individual sessions with an experienced physiotherapist who focuses his attention on the qualitative aspect of the execution compared to the quantitative one in order to allow the person to acquire a good conscience and knowledge of his own body. This aspect is a necessary condition to make people feel and understand the correct way to do the exercises.

In this phase, individual physiotherapy with manual therapy is the best therapeutic practice to help the person acquire the skills to continue the exercises at home.

Maddali-Bongi and colleagues conducted a pilot study on the

effectiveness of Feldenkrais-Core Integration methodology on AS, as a mind body therapy based on low impact exercises focusing on better body organization, postural re-education and balance improvement. The greatest improvements in percentage were recorded in pain, fatigue, self-perceived health status, functionality and tenderness on enthesal sites.<sup>42</sup> The Resseguier Method is also considered a valid option, especially during the active phase of the disease. This method aims to obtain patient awareness and control of bodily perceptions, thus reaching a modulation of responses to pain. In the study by Maddali-Bongi and colleagues, the Resseguier method provides evidence of efficacy on sleep improvement, movement quality and pain, along with the reduction of analgesics.<sup>43</sup>

The combination of ultrasound treatment and exercises provides better outcomes in patients with AS. The randomized, double-blind trial by Karamanlioğlu and colleagues provides evidence of improvement of BASMI, BASFI, tragus-wall distance, patient global assessment and quality of life after 2-6 weeks.<sup>44</sup>

### Home exercise program

The review of literature conducted by Sharan and colleagues showed that individuals with AS had beneficial effects from exercise programs compared to no exercise. Patient education, active involvement and motivation of individuals with AS played an important role in the overall treatment outcomes.<sup>45</sup>

Elyan *et al.* showed that home exercises improve symptoms, mobility, functional skills and overall quality of life.

Durmus *et al.* have evaluated the difference between the exercises performed daily at home for three months and drug therapy alone. For both groups, great improvements in quality of life, fatigue, depression, disease activity, and mobility were highlighted. The group that performed the exercises at home had higher rates of improvement. Ince and colleagues showed how a multimodal exercise program including aerobic, stretching, and pulmonary ex-



Figure 4. A) Loading exercise of spine extension with cushion; B) correct sitting posture at the PC.

ercises provided in conjunction with routine medical management yielded greater improvements in spinal mobility, work capacity, and chest expansion.<sup>46</sup>

According to Liang and colleagues, home-based exercise interventions can effectively improve the health-related quality of life in patients with AS.<sup>47</sup>

An example of a home-based exercise program was proposed in 2015 by the National Ankylosing Spondylitis Society (NASS) (Figure 5).

### Group exercises

According to the results emerged from the study conducted by Analay *et al.*,<sup>37</sup> the positive effects of group exercises derive above all from the encounter with other subjects with similar problems.

Helliwell confirmed that poor motivation negatively affected the effects of treatment. In this sense, the large number of dropouts in physiotherapy treatment could have been due to both the lack of motivation and the considerable duration of treatment not communicated to patients in advance.

The study by Hider *et al.*<sup>48</sup> conducted to assess whether participation in an exercise program has a positive effect on body image, concludes that in subjects with AS, psychological factors, rather than exercises, influence the body image. According to Holmes *et al.* the exercises have a positive influence on the body image. Karapolat and colleagues analyzed how Group and home-based exercise programs are efficient in improving symptoms, mobility, and qual-

ity of life in patients with AS, with no significant difference between home-based and group-based exercises.<sup>49</sup>

Physical exercise and related disciplines have revealed positive correlation with decreased disease activity levels and overall patient benefits. An example comes from Tai Chi practice: Lee and colleagues investigated the effects of Tai Chi on disease activity, flexibility and depression in patients with ankylosing spondylitis. The Tai Chi group performed 60 min of Tai Chi twice weekly for eight consecutive weeks and eight weeks of home-based Tai Chi, after which the group showed significant improvement in disease activity and flexibility compared to the control group.<sup>50</sup>

### Education and information

A first aspect is the importance of providing the person with useful indications and practical advice regarding the management of his health status in relation to work, home, hobbies and daily life with the joint economy, ergonomics and occupational therapy. The person and his family must be informed so that they could adopt correct habits, use aids, and maintain adequate positions alternating moments of rest with moments of activity or work. According to the study conducted by Spadaro *et al.*<sup>51</sup> in relation to occupational therapy, the efficacy on the people who have followed the treatment is greater than in the control group. Krauth and colleagues demonstrated how economic benefits of educational initiatives are much greater than the actual costs of setting up educational solutions.<sup>52</sup>

Bönisch and colleagues have published the results of the Ger-



Figure 5. A) Exercise in a sitting position: spinal rotations; B) Exercise in loading stretching and strengthening the upper limbs while extending the spine.

man Society of Rheumatology educational program for people affected by AS, consisting in a course of 6 modules each lasting 90 min. The efficacy has been proved in different levels as well as return to work, economic advantages have been shown. Particularly, patients with early spondyloarthritis and noticeable scores in the self-assessments.<sup>53</sup>

### Physical therapies

Physical therapies are a tool that can reduce pain and improve the patient's overall health. These specific therapies include the local application of heat and cold through various instruments, from hot paraffin baths to electromagnetic waves and ultrasounds.

An example is given by the German authors Van den Bjerg *et al.*,<sup>54</sup> Metzger *et al.*<sup>55</sup> and Albrecht *et al.*<sup>56</sup> who use cooled environments to counteract the acute phases in rheumatic diseases. In the study by Samborski *et al.*<sup>57</sup> patients found better spinal mobility after cryotherapy and worsening after thermotherapy, highlighting the beneficial effects of cold. The use of TENS in people with AS seems to have decreased pain, even if no scientific evidence has been reached on this.<sup>58</sup>

### Balneotherapy hydrotherapy and hydrokinesitherapy

The exercises associated with spa treatments and performed for three weeks are better than just group exercises performed once a week.

Balneotherapy or spa treatments are widespread in Europe and have positive effects in people with arthritis.<sup>59</sup> At the base of the analgesic effect of balneotherapy there are different mechanisms: the vasodilatory effect of heat on muscle relaxation and the indirect analgesic effect due to the decrease in muscle tone. In fact, by balneotherapy we mean baths in warm waters from mineral and thermal sources, between 34 and 35°C.

Treatment in thermal water with balneotherapy and hydrotherapy has proved to be a valid tool to integrate the rehabilitation program even in the acute phases.

The study by Altan *et al.*<sup>60</sup> compared the effects of balneotherapy on physical activity, quality of life, pain and stiffness to exercises in the short and medium term only. The results show that although balneotherapy improves disease activity and functional parameters in the short term, its positive effects are not significantly higher than those obtained with exercises alone.

The study by Van Tubergen *et al.*<sup>61</sup> highlights that balneotherapy, in addition to group physiotherapy, is better than group physiotherapy alone and moderately decreases pain and scores from BASFI and BASDAI.

Helliwell *et al.*<sup>36</sup> compared intensive physiotherapy, hydrotherapy associated with exercise at home, and exercises alone at home. The authors showed that, after six weeks, there was a significant improvement in the short term on pain and stiffness only in the group that had performed intensive physiotherapy. After six months there was no difference in the improvement achieved among the three groups.

In the Cochrane review by Dagfinrud and colleagues, results suggest that combined inpatient spa-exercise therapy followed by group physiotherapy is better than group physiotherapy alone.<sup>16</sup>

In the study conducted by Dundar and colleagues, they concluded that water-based exercises produced better improvement in pain score and quality of life of the patients with AS compared with home-based exercise.<sup>62</sup>

Thermal therapy, in combination with other therapeutic methodologies, has proven to have significant effects, especially in the short term. van Tubergen and colleagues highlighted how pa-

tients with AS can benefit from a 3-week course of combined spa-exercise therapy, in addition to drug treatment and weekly group physical therapy alone. These beneficial effects may last for at least 40 weeks.<sup>63</sup>

Yurtkuran and colleagues supported the relevance of balneotherapy in improving general well-being, decreasing pain and enhancing flexibility and functional movement.<sup>64</sup>

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