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Chapter

Resistance Exercises for Musculoskeletal Disorders

Azzam Alarab and Nadeen Taqatqa

Abstract

Musculoskeletal disorders or MSDs are injuries and disorders that affect the human body's movement or musculoskeletal system (i.e. muscles, tendons, ligaments, nerves, discs, blood vessels, etc.). Popular musculoskeletal disorders is Carpal Tunnel Syndrome. Musculoskeletal fitness is integration of several aspects involve to unite mission of muscle strength, muscle endurance, and muscle power to showing power against one's own body weight or an external resistance.

Keywords: musculoskeletal disorders, resistance exercises, physiotherapy, manual therapy, strength exercises

1. Introduction

Musculoskeletal disorders, or MSDs, are impairment and damage that attack motion of the human body or the musculoskeletal system (such as muscles, tendons, ligaments, nerves, discs, blood vessels, etc.) Musculoskeletal diseases can be weakened, hurt, its common health condition associated with aging. Main symptoms are ache, hardness, inability to move easily and dexterity long period of time. This conditions effect disability, death rate and mental health [1]. One of the main causes of illness worldwide is musculoskeletal problems, which also have a significant detrimental effect on quality of life in terms of overall health. Other names for MSDs include "overuse injury," "repetitive motion injury," "repetitive stress injury," and several others. This terminology links stress and repetition to a single factor that can harm the musculoskeletal system. This is limited because more and more research is pointing to multiple causative risk factors leading to MSDs [2].

Musculoskeletal disorders present a persistent and costly problem for society and contribute substantially to the global disease burden. The World Health Organization (WHO) reports that musculoskeletal disorders are the leading contributor to disablement globally in all sectors [3] at an estimated cost in 2019 of \$13.11 billion USD [4].

Conditions affecting the musculoskeletal system include those that impact the joints, such as osteoarthritis, rheumatoid arthritis, psoriatic arthritis, gout, and spondyloarthritis; the bones, including such osteoporosis and associated fractures; the muscles, such as sarcopenia; and multiple physical areas or systems, such as regional (such as back and neck pain) and pervasive (such as fibromyalgia) pain conditions, inflammatory diseases such as connective tissue diseases and vasculitis

that have musculoskeletal inflammatory diseases such as connective tissue diseases and vasculitis that have musculoskeletal manifestations, for example systemic lupus erythematosus, or amputation as a consequence of illness or trauma [5].

Musculoskeletal health is the result of a number of variables coming together. The joints and spine must be both solid and supple in order to support the body and perform a variety of activities to avoid Arthritis and Rheumatism [6].

A healthy neurological system is necessary to regulate all of this activity, providing cohesion and balance, while strong muscles and solid bones are necessary to supply the strength to move. Additionally, excellent mental health is necessary to provide the drive and motivation to engage in physical activity. Additionally, this entire process should be completed “without pain, stiffness, or exhaustion” [7].

2. Musculoskeletal disorders causes

Muscles, tendons, ligaments, joints, and bones can all be impacted by musculoskeletal pain. A fracture, for example, might result in immediate, excruciating pain. Pain may also be brought on by a chronic illness like arthritis. Contact with a medical professional if your normal activities are hampered by musculoskeletal pain. The correct medical care can reduce your pain. Musculoskeletal pain has the potential to be acute, or abrupt and severe [8].

Or the discomfort can be ongoing (long-term). Pain could be restricted to one part of your body or could spread across it. They advise focusing on the following three major groups:

Painful musculoskeletal disorders including osteoarthritis and back pain are among the most prevalent. Lack of physical activity, weight, and injury are risk factors. Osteoporosis and fragility fractures, including inflammatory disorders like rheumatoid arthritis, affect 50% of women and 20% of men over the age of 50. This group of ailments is substantially less typical. The three main causes of musculoskeletal disorders are as follows:

High task repetition: Numerous work tasks and cycles are repetitive in nature and frequently under the management of work processes and hourly or daily output targets. When paired with other risk factors including high force and/or uncomfortable postures, high task repetition might contribute to the development of MSD. A job is considered highly repetitive if the cycle time is 30 seconds or less.

Forceful exertions: Many work tasks require high force loads on the human body. High force demands cause muscles to work harder, which raises associated fatigue and can cause MSD.

Awkward postures that are repeated or maintained put too much pressure on joints and overburden the muscles and tendons surrounding the affected joint.

Body joints function most effectively when they are most to their mid-range motion. When joints are operated outside of this mid-range repeatedly or for extended periods of time without enough healing time, the risk of MSD increases.

Musculoskeletal diseases can also be brought on by direct hits to the muscles, bones, or joints, such as one fractures, joint dislocations (when something pulls a joint away from its natural position), and sprains and strains [9].

Inflammatory Conditions: Arthritis Research UK describe “The Inflammatory Arthritis Pathway”. It classifies inflammatory arthritis or autoimmune diseases as a group of conditions including rheumatoid arthritis, ankylosing spondylitis and psoriatic arthritis. The immune system attacks and destroys the joints and sometimes the

internal organs. These relatively uncommon conditions affect less than one per cent of the population [6]. Evidence based guidelines such as the UK NICE Clinical Guideline for Rheumatoid Arthritis advocate specialist multidisciplinary input including pharmacological management. It also states that “people with RA should have access to specialist physiotherapy, with periodic review to improve general fitness and encourage regular exercise, and learn exercises for enhancing joint flexibility, muscle strength and managing other functional impairments” [10].

3. Overview of musculoskeletal conditions

Mechanical back pain: Often called back strain or musculoskeletal back pain. The etiology encompasses numerous causes, but the diagnosis excludes anatomical sources of pain such as a herniated disc or spondylosis. Common sources are strain of the paraspinal muscles (the muscles along the spine), strain of ligaments of the spine, or generative facet joint disease (the joints between the bones of the spine) [11].

Sciatica: This condition is usually caused by irritation of a nerve root of the sciatic nerve, often from compression by a disc or degenerative disease. Pain radiates into the buttocks, back of the thigh, and often into the calf or foot [12].

Radiculopathy: Dysfunction of the nerve root by any cause. Symptoms include weakness, pain (sciatica), numbness, paresthesias (tingling), or a combination thereof [13].

Herniated disc: Also called disc rupture, disc prolapse, or herniated nucleus pulposus (the gelatinous inner core of the disc). The annulus fibrosis is the outer layer of the disc, which is the strongest portion of the disc and provides the strength to prevent disc herniations. With age or injury, the wall of the spinal discs can become damaged and the wall of the disc can weaken and protrude. Disc pain is often felt as a deep ache in sacroiliac can be in the same location and feel the same [14].

Spinal Stenosis: This is a narrowing of the spinal canal, typically in the neck (cervical stenosis) or lower back (lumbar stenosis). The narrowing is called spondylosis. The etiology can vary (degenerative, trauma, congenital), but the most common spondylosis is a degenerative disorder, occurring with age. The hallmark of lumbar stenosis is pain in the back and legs that is aggravated by standing or walking and relieved by sitting or forward bending [15].

Myofascial pain: Refers to soft-tissue pain usually arising from trauma, repetitive activities, or poor posture. It is usually associated with muscle spasm. Patients may complain of pain in the neck region or pain across the top of the shoulders and sometimes sleep difficulties or headaches [16].

Scoliosis: This condition is an abnormal curvature of the spine. It has many causes, but the most common type is adolescent idiopathic scoliosis. Females are affected 8 times as frequently as males. In general, most forms of scoliosis are not specifically painful but may depend on the degree of curvature of the spine and/or the presence of degenerative spinal changes. Patients with a curvature 30 degrees may have more back pain during their lifetime than a person with a straight spine [17].

Fibromyalgia: Literally means muscle/soft-tissue pain. Patients complain of generalized myalgia, stiffness, or soreness. The pain is disseminated and occurs in different areas of the body at different times. The pain can increase with menstrual cycle or with sudden weather changes. A key diagnostic feature is concurrent fatigue and sleep disorder, with disruption of stage 4 sleep (an alpha EEG anomaly). Pain appears to improve with medications, physical exercise, and efforts to promote normal sleep patterns. Patients may have neurological disturbances such as headaches, numbness,

weakness, difficulty concentrating, and lightheadedness. As many as 50% of patients have clinical depression in their lifetime [18].

4. Clinical features for musculoskeletal disorders

Symptoms of musculoskeletal illnesses might vary. One of the initial symptoms is chronic pain, albeit how it manifests itself differs from person to person. Some people experience pain throughout their bodies, while others may just pain occurs in a specific area. The typical symptoms are:

- Aching & stiffness joints.
- Pain that worsens with movement.
- Difficulty in moving.
- Fatigue.
- Inflammation.
- Tenderness.
- Swelling.
- Muscle spasm.
- Bruising and discoloration.
- Warmth.

Depending on the type of MSD that has occurred, different symptoms will appear. For instance, osteoarthritis results in stiff, tight joints and painful, spasm of muscles [19, 20].

5. Medical treatment for musculoskeletal disorders

Musculoskeletal pain is a serious medical issue in both its acute and chronic forms.

The problem is widespread in primary care settings, and it set of assets for the majority of people who visit pain clinics. The problem typically manifests as neck and back discomfort. However, it is typically impossible to provide a pathoanatomic diagnosis of the origin of pain. The majority of musculoskeletal pain problems are therefore classified anatomically as regional pain syndromes, including neck and back pain. Standard diagnostic labels for shoulder pain include frozen shoulder, subacromial bursitis, supraspinatus tendinitis, and many others. However, recent research has revealed that these disorders cannot be reliably or validly diagnosed using the traditional diagnostic methods [4–6]. As a result, even shoulder pain is classified as

a local musculoskeletal disorder Knee pain may result from injuries to the menisci or other intra-articular structures [21].

6. Evidence based practice for musculoskeletal disorders

There have been a few paradigm shifts in the field of physiotherapy and its practice as a result of EBP or scientific study.

Among them are the following:

1. **Bed rest for back pain:** Although bed rest has long been prescribed for back pain, its therapeutic value has just recently been examined. The most typical course of treatment for back pain and sciatica is to recommend rest, give analgesics, and treat acute bouts with bed rest. Although this advice is supported by orthopedic instruction, there are growing reservations and dissatisfactions about this kind of management [22]. Both important studies by Gilbert et al. and Deyo et al. demonstrated that longer periods of bed rest offer no advantages over shorter ones. The 1994 clinical guidelines suggest activity restriction and urge short, 2–4 day periods of bed rest [19]. Even brief intervals of relaxation have come under scrutiny more lately. Despite trying to produce a number of negative side effects as joint stiffness, muscle atrophy, loss of bone mineral density, pressure sores, and venous thromboembolism, bed rest did not significantly alleviate symptoms compared to other treatments [23].
2. **Early Mobilization in Intensive Care setting:** Early Mobilization in the Intensive Care Setting Attempts at full active mobilization are frequently postponed until the acute stage of the illness has passed. In particular, it is recognized that rehabilitation may not begin until after ICU discharge, that's because the patients are thought to be too ill to engage while undergoing mechanical breathing. These traditional practices are only the result of expert opinion and are not supported by solid research [24]. After conducting a systematic review of the literature on the impact of early mobilization, ***Joseph Adler and Daniel Malone (2012) came to the conclusion that physical therapy and early mobilization are both safe and effective interventions that can significantly improve patient symptoms and functional outcomes like muscle strength and functional mobility [25].

7. Physiotherapy protocol for musculoskeletal disorders

7.1 Joint protection/fatigue management

There is strong support for the claim that, when given as a behavioral group program, this lessens pain, early morning stiffness, maintains functional capacity, improves grip, and decreases the number of visits to a doctor for arthritis one year after receiving information about early RA [26].

7.2 Assistive devices

The use of assistive technology eases discomfort and makes daily chores easier (ADL). Nationwide, the availability is uneven (**Figure 1**) [27, 28].



Figure 1.
Assistive device, ACL brace with range of motion [29].



Figure 2.
Hand splinting, Cocup Splint [32].

7.3 Hand splinting

When worn, wrist splints lessen discomfort and enhance functionality.

Pain is lessened at night by resting splints [30]. There is currently no proof that splinting prevents deformity or long-term function maintenance. To ensure the most therapeutic benefit, staff who have been trained in their usage must accurately fit all splints, fully explain how to use them, and regularly review them (**Figure 2**) [31].

7.4 Exercises

1. For up to a year, comprehensive physiotherapy (education, exercise, and pain management modalities) reduces early morning stiffness [33–35].
2. Aerobic and strengthening exercise. Two systematic reviews conclude this leads to significant improvements in physical (muscle strength, aerobic capacity, endurance and function) and psychological status (self-efficacy and well-being) and does not exacerbate disease activity [36, 37]. People with arthritis should be taught an efficient exercise regimen that combines moderate strength training (50–80% of maximal voluntary contraction) twice to three times per week with moderate aerobic exercise (60–85% of maximum heart rate) three times per week for a total of 30 to 60 minutes.
3. Exercise on Prescription' schemes (i.e. free/reduced rate exercise facilities available in leisure centres following referral by a GP for health reasons) should also be available for people with arthritis.
4. Hand exercise (provided by both Occupational Therapist and Physiotherapist). For enhancing grip and pinch strength, reducing discomfort, and maintaining hand function, range of motion and strength exercises work better together than either range of motion or wax therapy alone (**Figures 3–6**) [33].



Figure 3.
Strengthening exercise for trunk stabilization [38].



Figure 4.
Strengthening exercise for gluteus muscles [38].



Figure 5.
Strengthening exercise for back muscles [38].



Figure 6.
Strengthening exercise for abdominal muscles [38].

7.5 Hydrotherapy

There is some indication that by maintaining activity levels, hospitalizations are not as necessary.

It costs a lot of money and is not widely available (**Figure 7**) [39].

7.6 Thermotherapy

Apart from temporary symptom relief, using heat and ice packs, using cryotherapy, or taking faradic baths does not have any substantial advantages.



Figure 7.
Hydrotherapy [40].



Figure 8.
Thermotherapy, paraffin wax [42].

Exercises and paraffin wax baths offer positive short-term effects for arthritic hands (**Figure 8**) [33, 41].

7.7 Electrical stimulation

Increases muscle strength and endurance training for patients who are unable to properly activate their muscles on their own. Only one short, high-quality study, however, has demonstrated how ES improves hand grip strength and fatigue resistance (**Figure 9**) [43].

7.8 Low level laser therapy and acupuncture

These have no other impacts other helping to quickly lessen pain. However, there aren't many small-scale trials (**Figures 10 and 11**) [45, 46].



Figure 9.
Electrical stimulation [44]



Figure 10.
Laser therapy [47].



Figure 11.
Acupuncture [48].

7.9 Multidisciplinary rehabilitation

For those with active RA or moderate-severe RA and various functional issues, coordinated intense multidisciplinary rehabilitation programs are crucial. Both inpatient rehabilitation and intensive medical care delivered in well-organized, coordinated day care are advantageous, with day care being marginally less expensive.

The most efficient way to deliver multidisciplinary care for patients with more severe difficulties is probably influenced by local geography and service characteristics [49–51].

8. Therapeutic agents for musculoskeletal disorders

The use of thermal, mechanical, electromagnetic, and light energy for therapeutic reasons is referred to as therapeutic modalities [52]. Physiotherapists frequently use these to assist their patients' or clients' therapy goals:

- Reduction or modification of pain
- Reduce inflammation,
- Enhance circulation,
- Promote tissue healing,
- Restructure scar tissue.
- Treatment for skin issues,
- An increase in range of motion,

- and improved muscular activation.
- Reduced or eliminated oedema,
- preservation of strength following injury or surgery, and reduction edema [53, 54].

For many years, physiotherapy has made use of therapeutic methods. Although there is some evidence that different patients may benefit from different modalities, it is suggested that they should not be used as a stand-alone treatment. Instead, they are frequently used in conjunction with other physiotherapy tools, such as exercise, manual techniques, and patient education [55, 56].

To refer to all therapies that have physiological therapeutic effects, the phrases “therapeutic modalities” and “electrophysical agents” are frequently mixed [52].

Therapeutic techniques include, for instance:

- Electrical stimulation/Iontophoresis.
- Biofeedback.
- Thermotherapy (superficial or deep).
- Cryotherapy.
- Ultrasound/Phonophoresis.
- Extracorporeal Shockwave Therapy (ESWT).
- Laser therapy.
- Magnetic therapy.
- Massage.
- Mechanical traction.

According to different grades of evidence, clinical guidelines support the use of therapeutic modalities [57].

However, the decision regarding which modality to use may be influenced by the patient’s requirements and goals, the clinician’s preferences, and the condition at hand [58].

9. Manual therapy for musculoskeletal disorders

Physical therapists have made significant achievements to the current diversity in manual therapy approaches and procedures. Manual therapy has a lengthy history within the physical therapy profession. In the past, mechanical justifications were employed to describe how manual therapy techniques functioned. Intricate neuro-physiologic mechanisms are also at work, according to recent study, and offering hands-on assessment and intervention has been shown to have positive psychological impacts [59].

- Physiological: positive placebo response.
- Biomechanical and physical: facilitates repair and tissue modeling
- Psychological benefits include pain alleviation by stimulation of the gating mechanism, muscular inhibition, a decrease in nociceptive activity, and a reduction in intraarticular or periarticular pressure [60].

9.1 Manual therapy frameworks: Maitland manual therapy

System of Prescription: Joints, muscles and nervous tissue in both the spine and peripheral joints. Area: Observing the symptoms and using the most effective therapy strategy are more crucial than figuring out the root cause of the dysfunction right away:

Additionally seeks to resolve a specific functional issue by eradicating discomfort, regaining joint mobility, and restoring normal muscle tension. Treatment Methods: Rhythmic, passive, painless movements introduced into the tissue (mobilizations) and rapid movements (manipulations) (**Figure 12**).

9.2 McKenzie manual therapy

System of Prescription: Spine-healing therapy utilizing patient movement that is active, supported by movement, and passive.

Area: Spine.

Treatment Approaches: The patient and the therapist are searching for a movement pattern that, after a few repetitions, shows a meaningful improvement (**Figure 13**).

9.3 Mulligan manual therapy

System of Prescription: Mulligan's therapy is based on patient movement that is both active and passively corrected by the physiotherapist holding the joint.

Area: Spine and limbs, with a focus on disorders that impact the periphery.

Methods of treatment:

- Pain free, effective compression of the articular surfaces with gravity.
- Active movement combined with passive movement in the plane of the articular surfaces.

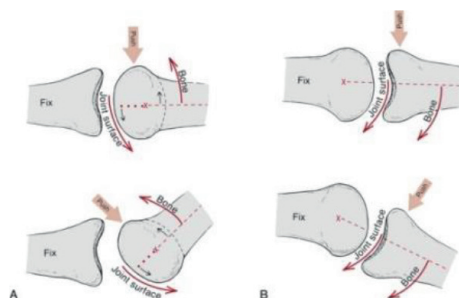


Figure 12.
Convex-Concave Rule for Maitland Mobilization [61].

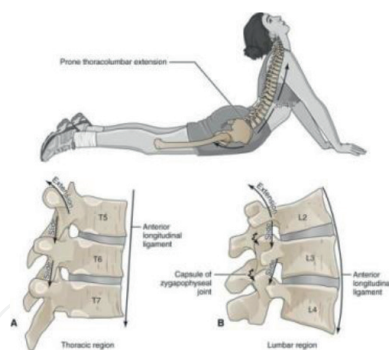


Figure 13.
McKenzie extension exercise [62].



Figure 14.
Mulligan Technique (MWMS) [64].

- Applying an acceptable number of repetitions.
- Applying overpressure at the limit of the pleasant movement range (**Figure 14**) [63].

10. Hydrotherapy for musculoskeletal disorders

Any activity done in the water to aid in healing and rehabilitation after a strenuous workout or significant injury is referred to as hydrotherapy (Aquatherapy) [65, 66]. It is a common method of treatment for people with musculoskeletal and neurologic disorders and involves activity in warm water [67]. Muscle relaxation, increased joint motion, and pain relief are the aims of this therapy [68]. This therapy is been used for thousands of years.

10.1 Physiological effects

The physiological outcomes of water therapy bring together the advantages of the exercises and the heated pool water. The duration of the treatment, the water's temperature, the type and intensity of the activity, and the magnitude of the effects all vary [69]. Exercise in the water has physiological consequences that are similar to those of exercise on land. With each chemical shift that takes place while the muscles contract, more blood is supplied to the active muscles, which in turn causes the muscles' temperature to rise. The muscles have a higher metabolic rate, which causes

a higher demand for oxygen and a higher output of carbon dioxide. This impact is a result of both these modifications and the equivalent modifications caused by the water's heat. Muscle power improves while the amount of joint motion is either maintained or expanded. The physiological effects of the soaking are less localized than those caused by any other source of heat. Since the body absorbs heat from the water and from all the contracting muscles used during activity, a rise in body temperature is unavoidable. The superficial blood vessels expand as the skin warms up, increasing the peripheral blood flow. By means of convection, the temperature of the underlying tissues rises as a result of the heated blood flowing through these capillaries [70].

10.2 Therapeutic effects

- Relieve pain and muscle spasm.
- To gain relaxation.
- To maintain or increase the range of joint movement.
- To re-educate paralyzed muscles.
- To strengthen weak muscles and to develop their power and endurance.
- To encourage walking and other functional and recreational activities.
- To increase blood flow (trophic condition of the skin).
- To boost the patient's morale by encouraging and reassuring him to perform his workouts [69, 70].
- By acting on temperature receptors and mechanoreceptors, the warmth of water inhibits nociception and affects spinal segmental processes [67].

11. Resistance exercises for musculoskeletal disorder

Muscles are forced to operate against a weight or force during strength training, commonly referred to as resistance exercise. Resistance exercise is an anaerobic exercise [71]. The use of free weights, weight machines, resistance bands, and your own body weight are a few examples of various forms of strength training. For the most benefit, a beginner should exercise two to three times each week. Before beginning a new

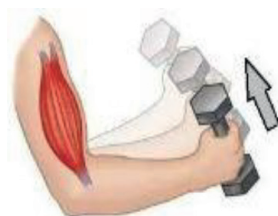


Figure 15.
Isotonic exercise [73].



Figure 16.
Isokinetic exercise [74].

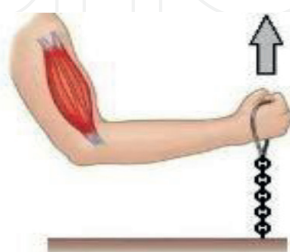


Figure 17.
Isometric exercise [73].

fitness program, the patient should undergo a pre-participation health examination and contact with professionals such as a doctor, exercise physiologist, physiotherapist, or licensed exercise professional. To enhance strength and growth increases, players should rest each muscle group for at least 48 hours. Vary workouts to help client push past a training plateau [72]. Comes in three forms: isotonic, isometric, and isokinetic.

- Isotonic consists of dynamic movements with a constant load (**Figure 12**).
- Isokinetic involves a constant velocity with variable load (**Figure 13**).
- Isometric involves muscle contraction that is static with no change in muscle length (**Figures 15–17**) [75].

12. Effects of strength training

Numerous advantageous neuromuscular changes that improve both physical and mental health are promoted by strength training.

Resistance exercise has several advantages for both mental and physical health, including:

- increased muscle tone and strength.
- Keeping your balance, mobility, and flexibility can let you age independently.
- Weight management and a higher muscle-to-fat ratio may be even more helpful for fat loss than aerobic exercise [71].
- Could aid in slowing or stopping cognitive decline in older persons.

- Greater stamina: You will not tire as easily as you do when you get stronger.
- avoidance or management of chronic illnesses like obesity, diabetes, depression, arthritis, vascular disease, and back pain.
- Pain relief,
- better posture
- lower risk of injury.
- increased bone strength and density, as well as a decreased chance of osteoporosis.
- Increased feeling of wellness — resistance training may improve mood, body image, and self-esteem.
- Better sleep and a reduction in insomnia.
- Improved blood lipid profiles
- reduced resting blood pressure
- increased gastrointestinal transit speed
- increased blood glucose utilization [72].

13. Comparison between resistance exercises and physical therapy

Strength training improves your capacity to overcome resistance by having you concentrate on lifting the most weight for the specified amount of repetitions. Physical therapy programs for the treatment of a variety of musculoskeletal problems always incorporate strength training. Moving the weight from point A to point B is the main concern [76]. With stronger muscles, almost every action becomes easier. Exercise treatment may provide benefits to patients with chronic low back pain through the voluntary contraction of specific muscle groups [77, 78].

14. International modern studies about treatment for musculoskeletal disorders

Musculoskeletal Disorders and Treatment focus on various aspects of Repetitive Motion Injuries, Repetitive Strain Injuries, Cumulative Trauma Disorders, Occupational Cervicobrachial Disorders, Overuse Syndrome, Regional Musculoskeletal Disorders, Soft Tissue Disorders, Work-Related Musculoskeletal Disorders, Musculoskeletal Disorders in the Elderly, Arthritis, Drug Interaction Checker, Fibromyalgia, Living Healthy, Lupus Osteoarthritis, Pill Identifier, Rheumatoid Arthritis, Sports Injuries, etc. Original Article, Reviews, Mini Reviews, Short Communications, Case Reports, Clinical Image, Perspectives/Opinions, Letters, Short Note and Commentaries are acceptable for publication [79].

14.1 Pain reduction

One trial with 40 individuals that produced very low quality data demonstrated a clinically significant advantage of exercise over standard therapy after around three months.

9 studies with 528 people produced very bad quality evidence that at >3 months, there was no clinically significant difference between exercise and conventional treatment. At >3 months, there was no clinically significant difference between exercise and usual care, according to very low quality evidence from 1 study with 95 participants.

14.2 Health related quality of life

Five studies with 372 participants and very low quality data each shown a clinically significant advantage of exercise over standard therapy after >3 months. One study with 54 participants found very low to low quality evidence that exercise had a clinically significant advantage over standard care after more than three months. Regular care was found to have a clinically significant advantage compared to exercise at about three months in one study with 95 individuals using very low to low quality data. 259 people in 2 studies with very low quality evidence demonstrated a clinically significant advantage of exercise compared to conventional treatment at >3 months. Very low quality evidence from 1 study 95 participants showed no clinically important difference between exercise and usual care at ≤ 3 months or at >3 months.

14.3 Physical function

Very low quality data from 2 studies with 155 people and 1 research with 95 participants indicated no clinically relevant difference between exercise and usual care at 3 months and no clinically important difference between exercise and usual care at >3 months, respectively.

Three studies with 169 participants and very low quality data each shown a clinically significant advantage of exercise over standard care after more than three months. Three studies with a total of 246 individuals produced very low quality evidence that exercise had a clinically significant advantage over standard care after more than three months.

14.4 Psychological distress

One trial with 60 individuals produced low quality evidence that exercise had a clinically significant advantage over standard therapy after about three months. A lack of clinically significant differences between exercise and usual care at >3 months was revealed by low quality data from 3 studies with 123 participants. At >3 months, there was no clinically significant difference between exercise and standard care, according to low quality data from 4 studies with 306 individuals. At >3 months, there was no clinically significant difference between exercise and standard care, according to low quality data from 4 studies with 320 participants. One trial with 50 individuals that had very low quality data found no clinically significant difference between usual treatment and exercise after more than three months. There was no clinically significant difference between exercise and standard treatment after >3 months, according to very low quality data from 1 research with 95 individuals [80].

15. Conclusion

Physical activity and exercise are crucial components of a healthy lifestyle. Exercises associated with daily living such as walking, housework and gardening can be enhanced with activities that are typically regarded exercise, such as sports activities and joining a gym. Enhancing physical exercise is frequently advised for those who suffer from chronic pain. Determining the sort and volume of exercise that would lessen the burden of pain on their lives, develop healthy exercise habits, and allow them to benefit from the wider range of health effects of leading an active lifestyle presents a problem for persons with pain. For those who are in discomfort, keeping the urge to keep working out could be more challenging. Exercises that increase the strength of particular muscles or muscle groups are known as strengthening exercises. The force and muscular overload promote growth and boost power. Weak muscles can increase the risk of injury to the joints and surrounding soft tissues. Patients with muscle illnesses are offered strengthening exercises as part of their treatment regimen since they are an essential component of physical therapy.

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Conflict of interest

The authors declare no conflict of interest.

Abbreviations

MSDs	musculoskeletal disorders
EBP	evidence based practice
RA	rheumatoid arthritis (RA)
ADL	activity daily life
GP	general practitioner
ES	electrical stimulation
ESWT	extracorporeal shock-wave therapy
MWMS	mobilization with movements

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References

- [1] GBD Cirrhosis Collaborators. The global, regional, and national burden of cirrhosis by cause in 195 countries and territories, 1990-2017: A systematic analysis for the Global Burden of Disease Study 2017. *Lancet Gastroenterology and Hepatology*. 2020;**5**(3):245-266. DOI: 10.1016/S2468-1253(19)30349-8
- [2] Liao CD, Chen HC, Huang SW, Liou TH. The role of muscle mass gain following protein supplementation plus exercise therapy in older adults with sarcopenia and frailty risks: A Systematic Review and Meta-Regression Analysis of Randomized Trials. *Nutrients*. 2019;**11**(8):1713. DOI: 10.3390/nu11081713
- [3] WHO. Musculoskeletal Conditions. 2019. Available from: <https://www.who.int/news-room/factsheets/detail/musculoskeletal-conditions>
- [4] Liberty Mutual. 2019 Liberty Mutual Workplace Safety Index. 2019. Available from: <https://business.libertymutualgroup.com/business-insurance/Documents/Services/DS200.pdf>
- [5] Cieza A, Causey K, Kamenov K, Hanson SW, Chatterji S, Vos T. Global estimates of the need for rehabilitation based on the Global Burden of Disease study 2019: A systematic analysis for the Global Burden of Disease Study 2019. *Lancet*. 2021;**396**(10267):2006-2017. DOI: 10.1016/S0140-6736(20)32340-0
- [6] Sammaritano LR, Bermas BL, Chakravarty EE, et al. 2020 American College of Rheumatology Guideline for the management of reproductive health in rheumatic and musculoskeletal diseases. *Arthritis & Rheumatology*. 2020;**72**(4):529-556. DOI: 10.1002/art.41191
- [7] Smith BE, Hendrick P, Bateman M, et al. Musculoskeletal pain and exercise-challenging existing paradigms and introducing new. *British Journal of Sports Medicine*. 2019;**53**(14):907-912. DOI: 10.1136/bjsports-2017-098983
- [8] Arthritis Research UK. Policy and Public Health document.
- [9] Akazawa N, Okawa N, Kishi M, Hino T, Tsuji R, Tamura K, et al. Quantitative features of intramuscular adipose tissue of the quadriceps and their association with gait independence in older inpatients: A cross-sectional study. *Nutrition*. 2020;**71**:110600. DOI: 10.1016/j.nut.2019.110600
- [10] Arthritis Research UK. Policy and Public Health document
- [11] National Institute for Health and Care Excellence (NICE). Low back pain and sciatica in over 16s: Assessment and management. 2020
- [12] NCD Risk Factor Collaboration (NCD-RisC). Heterogeneous contributions of change in population distribution of body mass index to change in obesity and underweight. *Elife*. 2021;**10**:e60060. DOI: 10.7554/eLife.60060
- [13] Park JS, Yoo JI, Na JB, Song HS. The prevalence and risk factors of musculoskeletal disorders in the hands of fishermen working as oyster shuckers. *International Journal of Occupational Medical Environmental Health*. 2021;**34**(5):603-615. DOI: 10.13075/ijomeh.1896.01752
- [14] Will JS, Bury DC, Miller JA. Mechanical low back pain. *American Family Physician*. 2018;**98**(7):421-428

- [15] Jensen RK, Kongsted A, Kjaer P, Koes B. Diagnosis and treatment of sciatica. *BMJ*. 2019;**367**:l6273. DOI: 10.1136/bmj.l6273
- [16] Carnevale JA, Goldberg JL, Schwarz J. Lumbar herniated disc. *World Neurosurgery*. 2022;**166**:52-53. DOI: 10.1016/j.wneu.2022.07.059
- [17] Katz JN, Zimmerman ZE, Mass H, Makhni MC. Diagnosis and management of lumbar spinal stenosis: A review. *Journal of the American Medical Association*. 2022;**327**(17):1688-1699. DOI: 10.1001/jama.2022.5921
- [18] Barbero M, Schneebeli A, Koetsier E, Maino P. Myofascial pain syndrome and trigger points: Evaluation and treatment in patients with musculoskeletal pain. *Current Opinion in Supportive and Palliative Care*. 2019;**13**(3):270-276. DOI: 10.1097/SPC.0000000000000445
- [19] Ceballos Laita L, Tejedor Cubillo C, Mingo Gómez T, Jiménez Del Barrio S. Effects of corrective, therapeutic exercise techniques on adolescent idiopathic scoliosis. A systematic review. *Efectos de las técnicas de ejercicio terapéutico correctivo en la escoliosis idiopática del adolescente. Revisión sistemática. Archivos Argentinos de Pediatría*. 2018;**116**(4):e582-e589. DOI: 10.5546/aap.2018.eng.e582
- [20] Siracusa R, Paola RD, Cuzzocrea S, Impellizzeri D. Fibromyalgia: Pathogenesis, mechanisms, diagnosis and treatment options update. *International Journal of Molecular Science*. 2021;**22**(8):3891. DOI: 10.3390/ijms22083891
- [21] Whale K, Gooberman-Hill R. The importance of sleep for people with chronic pain: Current insights and evidence. *JBMR Plus*. 2022;**6**(7):e10658. DOI: 10.1002/jbm4.10658
- [22] Corp N, Mansell G, Stynes S, Wynne-Jones G, Morsø L, Hill JC, et al. Evidence-based treatment recommendations for neck and low back pain across Europe: A systematic review of guidelines. *European Journal of Pain*. 2021;**25**(2):275-295. DOI: 10.1002/ejp.1679
- [23] Qaseem A, Wilt TJ, McLean RM, et al. Noninvasive treatments for acute, subacute, and chronic low Back pain: A Clinical Practice Guideline from the American College of Physicians. *Annals of Internal Medicine*. 2017;**166**(7):514-530. DOI: 10.7326/M16-2367
- [24] Lang JK, Paykel MS, Haines KJ, Hodgson CL. Clinical practice guidelines for early mobilization in the ICU: A systematic review. *Critical Care Medicine*. 2020;**48**(11):e1121-e1128. DOI: 10.1097/CCM.0000000000004574
- [25] Zhang L, Hu W, Cai Z, Liu J, Wu J, Deng Y, et al. Early mobilization of critically ill patients in the intensive care unit: A systematic review and meta-analysis. *PLoS One*. 2019;**14**(10):e0223185. DOI: 10.1371/journal.pone.0223185
- [26] Simpson E, Hock E, Stevenson M, Wong R, Dracup N, Wailoo A, et al. What is the added value of ultrasound joint examination for monitoring synovitis in rheumatoid arthritis and can it be used to guide treatment decisions? A systematic review and cost-effectiveness analysis. *Health Technology Assessment*. 2018;**22**(20):1-258. DOI: 10.3310/hta22200
- [27] Siegel P, Tencza M, Apodaca B, Poole JL. Effectiveness of occupational therapy interventions for adults with rheumatoid arthritis: A systematic review. *American Journal of Occupational Therapy*. 2017;**71**(1):7101180052p1-7101180050p11. DOI: 10.5014/ajot.2017.023176

- [28] Hammond A, Meesters J, Niedermann K, Tennant A, Vliet Vlieland T, Tyson S, et al. Cross-cultural adaptation and psychometric testing of the Dutch and German versions of the Evaluation of Daily Activity Questionnaire in people with rheumatoid arthritis. *Rheumatology International*. 2021;**41**(5):951-964. DOI: 10.1007/s00296-020-04657-7
- [29] Web. 1. Available from: <https://www.google.ps/url?sa=i&url=https%3A%2F%2Fwww.amazon.com%2FTANDCF-Adjustable-Immobilizer-Arthritis-Osteoarthritis%2Fdp%2FB0863CX9CK&psig=AOvVaw3apaOauMgDIWcFNn8dQkHP&ust=1673204510213000&source=images&cd=vfe&ved=0CBAQjRxqFwoTCJCE0dSStvwCFQAAAAAdAAAAABAE>
- [30] Gavin JP, Rossiter L, Fenerty V, Leese J, Hammond A, Davidson E, et al. The role of occupational therapy for the self-management of rheumatoid arthritis: A protocol for a mixed methods systematic review. *Musculoskeletal Care*. 2022;**2022**:1665. DOI: 10.1002/msc.1665
- [31] Rodziewicz TL, Houseman B, Hipskind JE. *Medical Error Reduction and Prevention*. Treasure Island (FL): StatPearls; 2022
- [32] Web 2. Available from: https://media-amazon.com/images/W/WEBP_402378-T2/images/I/615vTun4u5L._SL1327_.jpg
- [33] Fatoye F, Wright JM, Yeowell G, Gebrye T. Clinical and cost-effectiveness of physiotherapy interventions following total hip replacement: A systematic review and meta-analysis. *Rheumatology International*. 2020;**40**(9):1385-1398. DOI: 10.1007/s00296-020-04597-2
- [34] Nakagawa S, Nakaishi M, Hashimoto M, Ito H, Yamamoto W, Nakashima R, et al. Effect of medication adherence on disease activity among Japanese patients with rheumatoid arthritis. *PLoS One*. 2018;**13**(11):e0206943. DOI: 10.1371/journal.pone.0206943
- [35] Wollenhaupt J, Lee EB, Curtis JR, Silverfield J, Terry K, Soma K, et al. Safety and efficacy of tofacitinib for up to 9.5 years in the treatment of rheumatoid arthritis: Final results of a global, open-label, long-term extension study. *Arthritis Research Therapy*. 2019;**21**(1):89. DOI: 10.1186/s13075-019-1866-2
- [36] García-Morales JM, Lozada-Mellado M, Hinojosa-Azaola A, Llorente L, Ogata-Medel M, Pineda-Juárez JA, et al. Effect of a dynamic exercise program in combination with Mediterranean diet on quality of life in women with rheumatoid arthritis. *Journal of Clinical Rheumatology*. 2020;**26**(75):S116-S122. DOI: 10.1097/RHU.0000000000001064
- [37] Williams MA, Srikesavan C, Heine PJ, Bruce J, Brosseau L, Hoxey-Thomas N, et al. Exercise for rheumatoid arthritis of the hand. *Cochrane Database System Review*. 2018;**7**(7):CD003832. DOI: 10.1002/14651858.CD003832.pub3
- [38] Web 3. Available from: https://www.google.ps/url?sa=i&url=https%3A%2F%2Fwww.researchgate.net%2Ffigure%2FExercises-for-strengthening-and-stretching_fig1_326660726&psig=AOvVaw3zEe0wfU5oY0djE0hStxVw&ust=1673205000516000&source=images&cd=vfe&ved=0CBAQjRxqFwoTCJCwor2UtvwCFQAAAAAdAAAAABAE
- [39] García-Morales JM, Lozada-Mellado M, Hinojosa-Azaola A, Llorente L, Ogata-Medel M, Pineda-Juárez JA, et al. Effect of a dynamic

exercise program in combination with Mediterranean diet on quality of life in women with rheumatoid arthritis. *Journal of Clinical Rheumatology*. 2020;**26**(2):S116-S122. DOI: 10.1097/RHU.0000000000001064

[40] Web 4. Available from: <http://tado.co.uk/wp-content/uploads/2014/05/rg1.jpg>

[41] Peter WF, Swart NM, Meerhoff GA, Vliet Vlieland TPM. Clinical practice guideline for physical therapist management of people with rheumatoid arthritis. *Physical Therapy*. 2021;**101**(8):pzab127. DOI: 10.1093/ptj/pzab127

[42] Web 5. Available from: <https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.phoenixrehabgroup.com%2Fparaffin-wax-bath-hand-physiotherapy.html&psig=AOvVaw0fomILsTHORGjBEkthQgU&ust=1673205483747000&source=images&cd=vfe&ved=0CBAQjRxqFwoTCNi21KOWtwvCFQAAAAAdAAAAABAE>

[43] Romero-Morales C, Bravo-Aguilar M, Abuín-Porras V, Almazán-Polo J, Calvo-Lobo C, Martínez-Jiménez EM, et al. Current advances and novel research on minimal invasive techniques for musculoskeletal disorders. *Disease-a-Month*. 2021 Oct;**67**(10):101210. DOI: 10.1016/j.disamonth.2021.101210

[44] Web 6. Available from: <https://www.google.com/url?sa=i&url=https%3A%2F%2Fsolutionsphysicaltherapy.com%2Fphysical-therapy-treatments%2Felectrical-stimulation%2F&psig=AOvVaw15kimxwAQTvESyUoYGTmRY&ust=1673205533367000&source=images&cd=vfe&ved=0CBAQjRxqFwoTCNC7p7uWtwvCFQAAAAAdAAAAABAE>

[45] Guo Q, Lin XM, Di Z, Zhang QA, Jiang S. Electroacupuncture ameliorates

CUMS-induced depression-like behavior: Involvement of the glutamatergic system and apoptosis in rats. *Combinatorial Chemistry & High Throughput Screening*. 2021;**24**(7):996-1004. DOI: 10.2174/1386207323666201027121423

[46] Stausholm MB, Naterstad IF, Joensen J, Lopes-Martins RÁB, Sæbø H, Lund H, et al. Efficacy of low-level laser therapy on pain and disability in knee osteoarthritis: Systematic review and meta-analysis of randomised placebo-controlled trials. *BMJ Open*. 2019;**9**(10):e031142. DOI: 10.1136/bmjopen-2019-031142

[47] Web 7. Available from: https://www.google.com/url?sa=i&url=http%3A%2F%2Ffitptot.com%2Flaser-therapy%2F&psig=AOvVaw1SubwGhzff_tR2xU7d0ITr&ust=1673205587512000&source=images&cd=vfe&ved=0CBAQjRxqFwoTCMizotWWtwvCFQAAAAAdAAAAABAE

[48] Web 8. Available from: https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.forbes.com%2Fhealth%2Fbody%2Facupuncture-vs-acupressure%2F&psig=AOvVaw1B-brX-jjAZ68lfZ_AVQ0T&ust=1673205665562000&source=images&cd=vfe&ved=0CBAQjRxqFwoTCJi9svqWtwvCFQAAAAAdAAAAABAE

[49] Burmester GR, Álvaro-Gracia JM, Betteridge N, Calvo Alén J, Combe B, Durez P, et al. Evolving the comprehensive management of rheumatoid arthritis: Identification of unmet needs and development of practical and educational tools. *Clinical and Experimental Rheumatology*. 2020;**38**(6):1056-1067

[50] Lahiri M, Cheung PPM, Dhanasekaran P, Wong SR, Yap A,

Tan DSH, et al. Evaluation of a multidisciplinary care model to improve quality of life in rheumatoid arthritis: A randomised controlled trial. *Quality of Life Research*. 2022 Jun;**31**(6):1749-1759. DOI: 10.1007/s11136-021-03029-3

[51] Schulz M, Krohne B, Röder W, Sander K. Randomized, prospective, monocentric study to compare the outcome of continuous passive motion and controlled active motion after total knee arthroplasty. *Technology and Health Care*. 2018;**26**(3):499-506. DOI: 10.3233/THC-170850

[52] Bellew JW, Nolan T. *Michlovitz's Modalities for Therapeutic Intervention*. F. A. Davis Company; 2022

[53] Gunay Ucurum S, Kaya DO, Kayali Y, Askin A, Tekindal MA. Comparison of different electrotherapy methods and exercise therapy in shoulder impingement syndrome: A prospective randomized controlled trial. *Acta Orthopaedica et Traumatologica Turcica*. 2018;**52**(4):249-255. DOI: 10.1016/j.aott.2018.03.005

[54] Dantas LO, Salvini TF, McAlindon TE. Knee osteoarthritis: Key treatments and implications for physical therapy. *Brazilian Journal of Physical Therapy*. 2021;**25**(2):135-146. DOI: 10.1016/j.bjpt.2020.08.004

[55] Pieters L, Voogt L, Bury J, Littlewood C, Feijen S, Cavaggion C, et al. Rotator CUFF disorders: A survey of current physiotherapy practice in Belgium and the Netherlands. *Musculoskeletal Science & Practice*. 2019;**43**:45-51. DOI: 10.1016/j.msksp.2019.06.001

[56] Page P. Making the case for modalities: The need for critical thinking in practice. *International Journal of Sports Physical*

Therapy. 2021;**16**(5):28326. DOI: 10.26603/001c.28326

[57] Page P, Mistretta C, Thompson J, Brittain K. *Musculoskeletal Clinical Practice Guidelines Recommended Therapeutic Interventions*. Baton Rouge, LA: American Physical Therapy Association -Louisiana; 2021

[58] Zadro J, O'Keeffe M, Maher C. Do physical therapists follow evidence-based guidelines when managing musculoskeletal conditions? Systematic review. *BMJ Open*. 2019;**9**(10):e032329. DOI: 10.1136/bmjopen-2019-032329

[59] Hsu JR, Mir H, Wally MK, Seymour RB, Orthopaedic Trauma Association Musculoskeletal Pain Task Force. Clinical practice guidelines for pain management in acute musculoskeletal injury. *Journal of Orthopedic Trauma*. 2019;**33**(5):e158-e182. DOI: 10.1097/BOT.0000000000001430

[60] Ellingsen DM, Napadow V, Protsenko E, Mawla I, Kowalski MH, Swensen D, et al. Brain mechanisms of anticipated painful movements and their modulation by manual therapy in chronic low back pain. *Journal of Pain*. 2018;**19**(11):1352-1365. DOI: 10.1016/j.jpain.2018.05.012

[61] Web 9. Available from: <https://www.google.com/url?sa=i&url=https%3A%2F%2Fmusculoskeletalkey.com%2Fconcepts-of-joint-mobilization%2F&psig=AOvVaw1TW2thloMjNv8TvDdUOJMB&ust=1673205733585000&source=images&cd=vfe&ved=0CBAQjRxqFwoTCOjimJyXtvwCFQAAAAAdAAAAABAD>

[62] Web 10. Available from: <https://www.google.com/url?sa=i&url=https%3A%2F%2Faneskey.com%2Fmckenzie-method%2F&psig=AOvVaw1Na6kHFyY>

- RwnphwzETBRJI&ust=1673205802283000&source=images&cd=vfe&ved=0CBAQjRxqFwoTCNC_8LuXtvwCFQAAAAAdAAAAABAE
- [63] The Canadian Physio Student Manual Therapy in Physiotherapy Practice with Jesse Awenus. 2019. Available from: <https://www.youtube.com/watch?v=g36vqjx5N-Q&app=desktop> [Accessed: September 21, 2019]
- [64] Web 11. Available from: <https://www.google.com/url?sa=i&url=https://www.mulliganproducts.eu/about-mulligan&psig=AOvVaw0425PLYD1XUos5LN0vasVV&ust=1673205872559000&source=images&cd=vfe&ved=0CBAQjRxqFwoTCOiKlt6XtvwCFQAAAAAdAAAAABAJ>
- [65] Wellsandt E, Golightly Y. Exercise in the management of knee and hip osteoarthritis. *Current Opinion in Rheumatology*. 2018;**30**(2):151-159. DOI: 10.1097/BOR.0000000000000478
- [66] Zeng CY, Zhang ZR, Tang ZM, Hua FZ. Benefits and mechanisms of exercise training for knee osteoarthritis. *Frontiers in Physiology*. 2021;**12**:794062. DOI: 10.3389/fphys.2021.794062
- [67] Alcalde GE, Fonseca AC, Bôscua TF, Gonçalves MR, Bernardo GC, Pianna B, et al. Effect of aquatic physical therapy on pain perception, functional capacity and quality of life in older people with knee osteoarthritis: Study protocol for a randomized controlled trial. *Trials*. 2017;**18**(1):317. DOI: 10.1186/s13063-017-2061-x
- [68] Wang J, Chen X, Wang L, Zhang C, Ma J, Zhao Q. Does aquatic physical therapy affect the rehabilitation of breast cancer in women? A systematic review and meta-analysis of randomized controlled trials. *PLoS One*. 2022;**17**(8):e0272337. DOI: 10.1371/journal.pone.0272337
- [69] Azeez M, Clancy C, O'Dwyer T, Lahiff C, Wilson F, Cunnane G. Benefits of exercise in patients with rheumatoid arthritis: A randomized controlled trial of a patient-specific exercise programme. *Clinical Rheumatology*. 2020;**39**(6):1783-1792. DOI: 10.1007/s10067-020-04937-4
- [70] Lakomek HJ, Rudwaleit M, Hentschel A, Broge B, Abrolat J, Bessler F, et al. Qualität in der akutstationären Rheumatologie 2021 : Aktuelle Aspekte zum KOBRA-Qualitätslabel des Verbandes Rheumatologischer Akutkliniken (VRA e.V.) [Quality in acute inpatient rheumatology 2021 : Current aspects of the KOBRA quality label of the Association of Rheumatological Acute Care Clinics]. *Rheumatology*. 2021;**80**(8):758-770. DOI: 10.1007/s00393-021-01015-1
- [71] Angulo J, El Assar M, Álvarez-Bustos A, Rodríguez-Mañas L. Physical activity and exercise: Strategies to manage frailty. *Redox Biology*. 2020;**35**:101513. DOI: 10.1016/j.redox.2020.101513
- [72] Stefano SD. The Resistance Training Revolution: The no-Cardio Way to Burn Fat and Age-Proof your Body - in Only 60 Minutes a Week. Hachette Go; 2022
- [73] Web 12. Available from: https://www.google.com/imgres?imgurl=https://www.fisowalking.com/wp-content/uploads/2020/10/contraction_isometric.jpg&imgrefurl=https://www.fisowalking.com/faq&tbid=-3JXIfkKhZHRyM&vet=12ahUKEwjNt6yDmLb8AhW3UaQEHXEbCiIQMygCegUIARDoAQ..i&docid=hBje4Krs5loXTM&w=558&h=340&q=Isotonic%20Exercise&ved=2ahUKEwjNt6yDmLb8AhW3UaQEHXEbCiIQMygCegUIARDoAQ

[74] Web 13. Available from: <https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.iprsmediquipe.com%2Fproducts%2Fbiodex-isokinetic-system-4%2F&psig=AOvVaw2bFtvDpUNK9PIMI3yC0rYW&ust=1673206054890000&source=images&cd=vfe&ved=0CBAQjRxqFwoTCND2wLSYtvwCFQAAAAAdAAAAABAE>

[75] Ciprandi D, Zago M, Bertozzi F, Sforza C, Galvani C. Influence of energy cost and physical fitness on the preferred walking speed and gait variability in elderly women. *Journal of Electromyography and Kinesiology*. 2018 Dec;43:1-6. DOI: 10.1016/j.jelekin.2018.07.006

[76] Bosse C. Power training vs strength training - what is the difference between strength training and power training?. 2021. Available from: <https://christianbosse.com/power-training-vs-strength-training-what-is-the-difference/> [Accessed: November 1, 2022]

[77] Englund DA, Kirn DR, Koochek A, Zhu H, Trivison TG, Reid KF, et al. Nutritional supplementation with physical activity improves muscle composition in mobility-limited older adults, the VIVE2 study: A randomized, double-blind, placebo-controlled trial. *Journal of Gerontology A Biological Science Medical Science*. 2017;73(1):95-101. DOI: 10.1093/gerona/glx141

[78] Policy statement: Description of physical therapy. *World Physiotherapy*. (n.d.). Available from: <https://world.physio/policy/ps-descriptionPT> [Accessed: November 1, 2022]

[79] Bittermann A, Gao S, Rezvani S, Li J, Sikes KJ, Sandy J, et al. Oral ibuprofen interferes with cellular healing responses in a murine model of achilles tendinopathy. *Journal of Musculoskeletal*

Disorder Treatment. 2018;4(2):049. DOI: 10.23937/2572-3243.1510049

[80] National Guideline Centre (UK). Evidence review for exercise for chronic primary pain: Chronic pain (primary and secondary) in over 16s: Assessment of all chronic pain and management of chronic primary pain: Evidence review E. London: National Institute for Health and Care Excellence (NICE); 2021