2 Physical Medicine and Rehabilitation in Knee Osteoarthritis

Juan M. Román-Belmonte,
Hortensia De la Corte-Rodríguez,
and E. Carlos Rodríguez-Merchán

2.1 Introduction

Knee osteoarthritis is the most common cause of disability in the elderly, and its prevalence is increasing worldwide [1]. Approximately 40% of individuals over the age of 65 years have some form of symptomatic osteoarthritis [2]. The highest prevalence of osteoarthritis is found in the hips, followed by the hands and the knees. In the USA, approximately 9% of individuals over the age of 60 years present symptomatic knee osteoarthritis [3], and it has been estimated that 25% of the US population will experience osteoarthritis by 2030 [4]. An observational study of a Chinese population found that the prevalence of symptomatic knee osteoarthritis was 8.1%. Given the progressive aging of the population, these figures are of significant concern [5].

Due to its chronic nature and high treatment costs, knee osteoarthritis is becoming a significant economic burden on society [6]. The main symptoms of knee osteoarthritis include pain, stiffness, and functional limitation, which can affect quality of life [7] and result in impaired walking, inability to climb stairs, and inability to perform everyday tasks [8].

When knee osteoarthritis causes severe joint impairment and symptoms, the only complete solution currently available is joint replacement [9]. There is therefore significant interest in treatment techniques that delay osteoarthritis progression and alleviate the symptoms.

Rehabilitation for knee osteoarthritis seeks to control pain and recover joint amplitude, strength, proprioception, and gait; in short, rehabilitation seeks to improve functionality and quality of life. To this end, rehabilitation has various treatment options such as oral medication, infiltrations, orthoses, technical aids, and various physical techniques. In this chapter, we cover the physical techniques and technical aids; other elements will be covered in later chapters. The physical treatments for knee osteoarthritis can be classified according to the physical principle on which they are based (Table 2.1).

Multidisciplinary teams play a fundamental role in knee osteoarthritis rehabilitation. Rehabilitation physicians coordinate with other medical specialists, such as physiotherapists, occupational therapists, orthopedic technicians, nurses, and social workers, to provide comprehensive care and achieve maximum clinical benefits.

J. M. Román-Belmonte
Department of Physical Medicine and Rehabilitation, "Cruz Roja San José y Santa Adela" University Hospital, Madrid, Spain

H. De la Corte-Rodríguez
Department of Physical Medicine and Rehabilitation, "La Paz" University Hospital, Madrid, Spain

E. C. Rodríguez-Merchán (✉)
Department of Orthopedic Surgery, "La Paz" University Hospital, Madrid, Spain

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Table 2.1 Description of the physical methods employed in rehabilitation

Thermotherapy	Employs temperature changes in a body area
Electrotherapy	Employs different types of nonionizing radiation
Ultrasound therapy	Therapeutic use of mechanical waves
Kinesiotherapy	Use of physical exercise or movement on the body

2.2 Clinical Assessment

Before prescribing a rehabilitation treatment, a correct clinical and functional evaluation should be conducted to assess the type and degree of injury, the presence of comorbidities, the previous treatments, the functional limitations, and the level of pain and inflammation.

The physical examination should be performed according to the patient's clinical situation. Ideally, clinicians should assess the patients' postural statics, external signs, pain, neurovascular status, gait, and joint and muscle balance. A complete assessment should be performed of the patient's current injury and characteristics (e.g., age, immobility, cognitive status, cardiorespiratory problems, previous sequelae, and drug use).

Validated scales can be helpful for quantifying patients' functional state, measuring the intervention's effectiveness and assessing their progress. The Hip and Knee Outcomes Questionnaire may be employed to assess the legs as a whole, while the Knee Society Score (KSS) may be employed specifically for the knee. The generic life scales include the Short Form-36 (SF-36), the SF-12, the Nottingham Health Profile, and the EuroQol [10].

The following sections described the most relevant psychosocial factors and comorbidities that influence knee osteoarthritis rehabilitation.

2.3 Psychosocial Factors

Psychosocial factors play an important role in the chronic musculoskeletal pain caused by knee osteoarthritis [11]. Somatization, catastrophization, and poor self-efficacy can worsen the clinical picture and negatively affect the results of the rehabilitation techniques.

Knee osteoarthritis worsens a patient's quality of life, limiting social interactions, reducing the quality of sleep, and impairing cognitive processes [12]. Therapeutic physical exercise (alone or combined with other interventions) appears to be effective in improving the quality of life and psychosocial factors related to knee osteoarthritis. The use of cognitive-behavioral techniques combined with these therapeutic physical exercise programs is recommended [13].

2.4 Comorbidities

The clinical presentation of knee osteoarthritis varies, and many factors can influence the treatment response and disease progression [14]. Many patients with knee osteoarthritis also present other diseases, which can worsen the disease prognosis by accelerating the symptoms' progression. Fifty percent of patients with knee osteoarthritis experience other musculoskeletal pain such as mechanical low back pain. Forty percent of these patients have cardiovascular disease, while 14% have diabetes, probably in the context of obesity and metabolic syndrome. Depression has also been implicated as a prevalent condition in knee osteoarthritis [15].

There appears to be a significant relationship between heart disease and hypertension on one hand and lower performance-based and self-reported physical functioning on the other [15]. There also appears to be a strong relationship between diabetes and increased joint pain intensity. A number of authors have suggested that synovitis could explain this increase in knee osteoarthritis pain in patients with diabetes. Approximately 10–20% of patients with diabetes can develop painful neuropathies in the extremities, which can have an additive effect on clinical pain [16].

Low back pain concomitant with knee osteoarthritis is associated with poorer overall physical functioning. However, there does not seem to be a relationship between depression and clinical

worsening of knee osteoarthritis [15]. Generally speaking, experienced a comorbidity concomitantly with knee osteoarthritis can aggravate the symptoms and worsen the disease's clinical course [15].

2.5 Rehabilitation Treatment for Knee Osteoarthritis

There is no known cure for knee osteoarthritis; however, there are factors related to this disease (such as decreased muscle strength and physical deconditioning) that are amenable to improvement with training programs [17]. Regular exercise can also help reduce body fat [18].

Treatment of knee osteoarthritis involves significant costs, and therefore treatments need to be investigated that can efficiently reduce knee osteoarthritis severity and slow the disease's progression. Therapeutic physical exercise has been shown to be a highly cost-effective treatment.

2.5.1 General Measures: Education and Changing Habits

Patients with knee osteoarthritis often have a lower level of physical activity than the general population. In fact, 37% of patients with osteoarthritis live a sedentary lifestyle, which is associated with low educational levels, advanced age, functional limitations, lack of access to gyms, and various anxiety disorders [19].

The combination of therapeutic physical exercise and educational measures, with an emphasis on weight loss, can be considered a first-line treatment for symptomatic knee osteoarthritis. Educational measures improve treatment adherence, help reduce pain, and contribute to improved quality of life. Weight loss coupled with therapeutic exercise results in functional improvement and reduced pain (grade A evidence) [9]. Lifestyle changes are recommended as part of the therapeutic strategies for addressing knee osteoarthritis, given the need for addressing sedentary lifestyles and weight gain [9].

Assessing the weight loss of patients with knee osteoarthritis is important, given that their body weight needs to be reduced by at least 15% to achieve improved physical function with an intervention based solely on dietary changes. For interventions that combine diet and exercise, a weight loss of 6–8% is required to improve function and decrease pain [20].

Isolated dietary changes for patients with knee osteoarthritis do not appear to reduce pain (moderate quality evidence), and there is inconsistent evidence regarding the influence of diet on inflammatory biomarkers, with diet having only a mild effect on reducing interleukin-6 (IL-6) levels [20].

The treatment for knee osteoarthritis is complex, and the pain resulting from knee osteoarthritis is often multifactorial in nature, which probably explains why interventions based solely on dietary changes (without combining physical exercise) are ineffective.

2.5.2 Physical Exercise

Therapeutic physical exercise is a nonpharmacological treatment that can improve muscle strength and decrease pain, stiffness, and the progressive deterioration in physical function [21].

Therapeutic physical exercise (alone or combined with other interventions) appears to be effective in improving quality of life and psychosocial factors related to knee osteoarthritis. The use of cognitive-behavioral techniques combined with therapeutic physical exercise programs is recommended [13].

There are various types of physical exercise including strengthening exercises (Fig. 2.1), aerobic exercises, and proprioceptive exercises. The vast majority of exercise types can produce clinical benefits for patients with knee osteoarthritis [22], with the majority of clinical guidelines recommending muscle strengthening exercises and aerobic exercises as the most effective [21].

Increasing knee muscle strength can improve the joint biomechanics, reducing knee loading and joint cartilage stress [21]. Physical exercise can thereby slow the progression of joint disease.

Fig. 2.1 Strengthening exercise with quadriceps bench, which is employed to improve various parameters at a musculoskeletal level, such as strength, power, and resistance

Increased quadriceps strength has been associated with a reduced risk of symptomatic knee osteoarthritis [23] and reduced joint space [24]. Maintaining adequate strength in the quadriceps and the muscles involved in the kinetic chain of the osteoarthritic joint is critical [25]. Peak muscle mass is usually reached around age 30, with a 3–8% decrease per decade thereafter, with the most pronounced loss after 60 years of age. In patients with knee osteoarthritis, sarcopenia contributes to a greater loss of autonomy [26].

Leg strengthening can reduce the forces to which the osteoarthritis knee is subjected, reducing pain and improving physical function. An improved physical condition can also facilitate the performance of daily living activities, increasing the quality of life. Strengthening exercises with a load of 70% of maximum repetition (1RM) are needed to achieve improvements in muscle strength and hypertrophy [27, 28]. Low-load exercise programs, performed 3 times a week for 6–8 weeks, also produce improved muscle strength and hypertrophy. However, these benefits are not as large as those achieved with high-load training [29].

A Cochrane systematic review [30] studied the role of land-based exercise in knee osteoarthritis by analyzing 54 studies and collecting pain data from 5362 patients and physical function data from 5222 patients. The review concluded that therapeutic physical exercise provides immediate benefits for knee osteoarthritis in terms of pain, physical function, and quality of life and that the benefits for pain and physical function were moderate. The benefits for quality of life, however, can be considered small. The improvements in pain reduction decrease from 2–6 months after exercise and were lost beyond 6 months. With regard to physical function, a small but significant benefit was maintained from 2 to 6 months after exercise. The benefits in physical function can therefore be considered to remain more stable.

The improvement in pain reduction provided by therapeutic physical exercise for patients with knee osteoarthritis is similar to that provided by the use of analgesics and nonsteroidal anti-inflammatory drugs (NSAIDs) [31].

Another study found no conclusive differences between a muscle strengthening exercise program and aerobic walking, probably due to the study's low statistical power [32]. Other studies have compared different strengthening programs but did not find an obvious difference between a weight-bearing and a nonweight-bearing quadriceps exercise regimen [33]. Similarly, there was no significant difference between an isometric and a concentric-eccentric strengthening program [34].

The effects of training on body composition appear to be similar for young and elderly patients. Thus, age does not appear to reduce the gains in strength and muscle mass that exercise produces. Strengthening increases the cross-sectional area of both types I and II muscle fibers; however, the percentage of slow-contracting muscle fibers does not change with training. With physical exercise, there is an increase in type IIa fibers and a decrease in type IIb fibers. The benefit recorded with aerobic training in the elderly is mainly due to an increase in oxidative capacity, which also occurs in healthy people, regardless of age, physical condition, and sex. Given these physiological adaptations, a physical exercise program involving strength and endurance exercises is recommended and can result in improved functional capacity and decreased pain in patients

with knee osteoarthritis [35]. However, the presence of sarcopenia can reduce muscle sensitivity to anabolic stimulus such as resistance exercises [36].

Less conventional physical exercise programs such as tai chi and regimes based primarily on stretching or balance have been evaluated and appear to only slightly reduce pain and improve physical function and are less effective than strengthening and aerobic exercises [30].

Exercise dosage is mentioned in the literature and refers to the duration of the therapy program and the frequency and intensity of the various exercises. Prescribing a specific dosage is difficult because it depends on individual effort. The intensity of the physical exercise performed therefore varies according to each patient's characteristics. However, there appears to be no clinical differences in short-term pain and physical function outcomes between low and high-intensity exercise programs [37].

Nearly 50% of patients with knee osteoarthritis have difficulty exercising due to pain [38]. Excessive exercise can worsen the symptoms of osteoarthritis by increasing the joint load. Long-term adherence to physical exercise programs is therefore problematic.

Current literature suggests that most patients with knee osteoarthritis need to be continuously monitored or at least supervised to optimize the results of therapeutic exercise programs. The reduction in pain and increased physical function with exercise programs increase with the number of visits to healthcare professionals [30].

Backward Walking

Backward walking is a re-education technique that aims to improve walking patterns by improving mobility and decreasing functional limitations (Fig. 2.2). The technique should not be used in isolation but should be integrated into a combined physical treatment strategy.

The standard method for gait retraining involves forward walking on various surfaces or on a treadmill, with or without partial weight-bearing systems [39].

Reverse travel is regulated by the same central mechanisms that regulate forward travel.

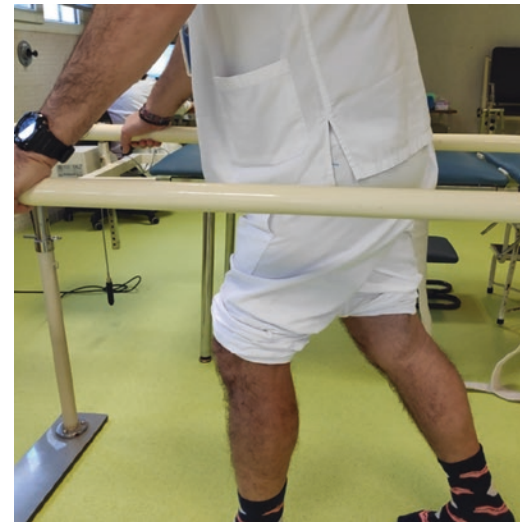

Fig. 2.2 Backward walking, which produces a lower compression force on the patellofemoral joint and the medial compartment of the knee

However, reverse travel differs from normal travel in that there is no contact with the heel in the initial phase of support, and therefore less compression force is produced on the patellofemoral joint and in the medial compartment [40].

The reverse pattern results in increased activation and recruitment of motor units. In the absence of visual information during this type of walking, the spatial parameters of the pattern increase and the temporal parameters decrease [41].

Adding a reverse gear to conventional physical treatment appears to be effective in reducing pain, improving functional limitation, and increasing quadriceps muscle strength in patients with knee osteoarthritis [42].

Proprioceptive Exercises

Proprioception is a kinesthetic skill that involves a complex neuromuscular and joint process in which sensory afferences and motor efferences are integrated. Proprioception attempts to provide static and dynamic stability to a complex joint, optimizing energy consumption during movement.

Proprioception is achieved thanks to the action of receptors in the muscle, tendon, and articular capsule [43]. Osteoarthritis causes deterioration

Fig. 2.3 Proprioceptive exercise with Bohler plate, which seeks to stabilize a joint complex statically and dynamically

of the various joint structures, which can affect the proprioceptive state and contribute to knee osteoarthritis symptoms [8].

Proprioceptive training appears to improve pain and increase walking speed in patients with knee osteoarthritis. Although there are various proprioceptive training regimes, the protocols with the most evidence of effectiveness involve neuromuscular control exercises and programs that include functional elements, with and without weight bearing [44].

Proprioceptive exercises can also play a role in pain relief in patients with knee osteoarthritis (Fig. 2.3). A program with foot-stepping exercises in various directions performed with loading and unloading (sitting) 3 times a week for 30–40 min/session can have an analgesic effect on knee osteoarthritis [45]. Proprioceptive training with moderate frequency and intensity can also decrease joint stiffness [44].

Blood Flow Restriction Strengthening During Exercise

The combination of low-load exercise [up to 30% of 1 repetition maximum (1RM)] and blood flow restriction can improve the benefits in terms of strength gains and muscle hypertrophy, gains comparable to those obtained with high-load training programs [46].

For individuals who cannot tolerate high-load exercise, as is often the case for patients with knee osteoarthritis, strengthening with blood flow restriction can be an effective option. However, the gain in strength from a combination of low-load training and blood flow restriction appears to be less than that achieved with high-load training. Blood flow restriction could therefore act as a therapy that bridges the gap between low-load training and high-load training [46].

Adding blood flow restriction to a low-load exercise program could result in 69% of patients gaining more muscle strength. However, 76% of patients would have greater strength gains with a high-load program than with a low-load program combined with blood flow restriction [47]. Blood flow restriction added to a low-load program also results in increased muscle hypertrophy. In this case, high-load training would result in hypertrophy similar to that obtained with the combined low-load/blood flow restriction program [46].

There is conflicting data regarding the duration of blood flow restriction training required to achieve benefits in hypertrophy and strength. A number of authors found improvements in these parameters with only 6 days of training [48], while others saw the improvement in 4 weeks [49]. Still other authors found no improvement in strength after 4 weeks of training [50], thereby indicating that longer programs might be needed. Another important issue is that exercise load (1RM) needs to be adjusted as muscle function progresses with training.

Two or three blood flow restriction training sessions per week might be sufficient to improve strength [51]. Most studies have not individualized the occlusive stimulus or training load. Despite this, hardly any adverse effects have been reported with blood flow restriction strengthening. Overall, blood flow restriction training is not thought to present a greater risk than conventional training methods [52]. However, a study recently reported a case of rhabdomyolysis after performing blood flow restriction training [53]. That is why precautions should be taken when there is marked disuse atrophy. One option would

be to include analytical parameters of muscle damage, such as serum creatine kinase levels, during the training period.

Blood flow restriction does not appear to worsen joint pain in women with symptomatic knee osteoarthritis after 4 weeks of low-load (30% 1RM) training [54]. A similar study in men also found no worsening of knee pain with training [50].

2.5.3 Hydrotherapy

Hydrotherapy is the performance of physical exercise in water, a technique that has been employed for some time for treating numerous conditions. By employing the principle of buoyancy, hydrotherapy reduces the weight load on the arthritic knee, thereby protecting the joint and decreasing the chances of further injury. Due to the constant water temperature and hydrostatic pressure, blood circulation can also be facilitated, reducing muscle fatigue and osteoarticular discomfort. Given the water resistance, which acts in opposition to body movements, greater activity of the musculature is required, resulting in greater strengthening. Hydrotherapy thereby provides a safe and comfortable means for patients with knee osteoarthritis to perform therapeutic exercise programs [55].

In knee osteoarthritis, hydrotherapy can reduce joint pain, improve physical function, and increase quality of life [56], although there is disagreement as to the more effective treatment: hydrotherapy or land-based. Two systematic reviews found no significant differences in the two short-term interventions for all variables analyzed. In the long term, hydrotherapy appears to be comparable to land-based exercises for treating knee osteoarthritis [57, 58].

The term hydrotherapy describes an environment for performing physical activity in a structured and therapeutic manner, rather than a specific program or type of exercise [59], and it is unclear which type of exercise, intensity, duration, frequency, and optimal water parameters (depth and temperature) are the most appropriate.

A temperature range of 33.5–35.5 °C is probably the most appropriate, as it allows prolonged immersion and thereby facilitates a sufficiently long exercise program [60].

Water depth has a significant effect on joint load due to buoyancy. When the water is at xiphoid level (at about the level of the sternum), there is a 50% reduction in stress. A typical depth for exercise is between 1.15 m and 1.5 m [55].

2.6 Therapeutic Modalities

Various physical treatment modalities based on different physical principles are employed for treating knee osteoarthritis. The most commonly employed techniques in the clinic are described in the following sections.

2.6.1 Thermotherapy

Thermotherapy involves temperature changes; however, the term “thermotherapy” is usually reserved for increase in temperature, while the term “cryotherapy” is reserved for the use of cold environments.

There are various forms of applying heat and cold. Cold can be administered using bags or covers filled with ice, cold pads (also called cold packs, which contain a silica or cellulose gel to maintain the cold), and cooling sprays (usually ethyl chloride, which produces very rapid skin cooling).

There are various options for increasing the temperature. Superficial heating is employed mainly to warm the skin, while deep heating is employed for heating the muscle plane. This deep thermotherapy (also called diathermy) is usually achieved by applying energy (electromagnetic or vibratory) that, when absorbed, is transformed into heat.

There are numerous methods for applying superficial heat, including compresses (cloth strips soaked in hot liquid that are applied after being drained), paraffin (a mixture of heated solid paraffin and paraffin oil), and infrared heaters.

Heat and cold have both differing and similar effects and can therefore be employed on the same patient depending on their progress and clinical circumstance. Both forms can be analgesic, although cold provides more pain relief due to its anti-inflammatory effect.

Given the insufficient evidence for assessing the use of thermotherapy in knee osteoarthritis, its therapeutic effect on this disease is not well established [61]. However, applying cold to a physical exercise or manual therapy program for knee osteoarthritis can decrease pain, increase joint range, improve functional capacity, and increase quality of life [62].

2.6.2 Electrotherapy

Electrotherapy is based on the physiological effects of passing an electric current through the body and can be categorized by the number of cycles per second (measured in hertz) achieved during the application of the electric current. Table 2.2 describes the various types of electrotherapy and their effects.

Transcutaneous electrical nerve stimulation (TENS) is a frequently applied type of electrotherapy, which employs low frequency electric currents for a mainly analgesic effect. TENS employs symmetrical and compensated pulses with varying shapes, which can be administered as single pulses or pulse trains or bursts, the latter of which are usually better tolerated.

Due to the heterogenicity and small number of published studies, there is no strong recommendation for using electrotherapy as an analgesic agent in knee osteoarthritis. However, interferential currents offer the most promising results [63].

An electric current pulse, applied to a muscle with sufficient intensity, can have an excitomotor effect called neuromuscular electrostimulation (NMES). Electrically induced muscle contraction differs from voluntary contraction. When a pulse is applied, the phasic fibers contract first, and no spatial or temporal summation is achieved. The administration of pulses in succession increases the contraction time. Combining electrostimulation with voluntary muscle contraction is therefore more effective. However, there is inconsistent evidence regarding the effect of electrostimulation in improving quadriceps strength in patients with knee osteoarthritis [64].

Table 2.2 Types of electrotherapy employed in rehabilitation

	Effects	Examples
Low frequency currents (<1 kHz)	Analgesic and excitomotor	Transcutaneous electrical nerve stimulation (TENS)
Medium frequency currents (1–10 kHz)	Analgesic	Interferential
High frequency currents (>10 kHz)	Thermal, analgesic, and anti-inflammatory	Shortwave and microwave

Short wave is a type of high frequency electrotherapy that can be applied in a pulsed form, favoring its athermal effect, or in a continuous form, producing a diathermic effect. Short-wave electrotherapy can produce benefits in terms of pain in knee osteoarthritis, especially in the pulsed mode. Combined with an isokinetic strengthening program, short-wave electrotherapy can improve knee extension strength [65].

2.6.3 Magnetic Therapy

Magnetic therapy is based on the use of low frequency magnetic fields (10–100 Hz) for therapeutic purposes and has no thermal effect. Although magnetic therapy has some analgesic and anti-inflammatory action, its most common effects are to improve the healing reaction and promote osteoformation [66]. The use of magnet therapy in knee osteoarthritis can have a moderate analgesic effect (Fig. 2.4); however, it does not appear to improve quality of life, physical function, or radiographic progression of the disease [67].

2.6.4 Ultrasound Therapy

Therapeutic ultrasound (as opposed to ultrasound employed for diagnostic purposes) is based on a

Fig. 2.4 Magnetic therapy device, which has an analgesic, anti-inflammatory, and osteoforming effect and facilitates scar repair

succession of waves produced by non-audible acoustic vibrations. Therapeutic ultrasound can be used in continuous mode with a thermal effect or in pulsed mode (with periods of emission and pauses) with an athermal effect.

The continuous mode produces diathermic effects, while the pulsed mode produces effects based exclusively on mechanical changes, achieving an analgesic, anti-inflammatory, osteoforming, and collagen fiber reordering effects.

Pulsed ultrasound for treating knee osteoarthritis appears to reduce pain and increase functional recovery without adverse effects [68]. However, the benefits observed with the use of ultrasound are not sustained in the long term [69].

Wearable devices have recently been developed that enable ultrasound to be administered for prolonged periods in knee osteoarthritis. Administering ultrasound (3 MHz, 0.132 W/cm^2, 1.3 W) 4 h daily for 6 weeks has been reported to result in reduced pain and improved function at 6 weeks [70].

Ultrasound also helps drugs penetrate the skin, a process known as sonophoresis or phonophoresis; however, its mechanism of action is fully understood. Although NSAIDs and lidocaine have often been employed in this process for treating knee osteoarthritis, there is no strong evidence to support their use [71].

2.6.5 Laser Therapy

Varying power levels have been employed for administering laser therapy to patients with knee osteoarthritis; however, the most commonly applied setting is medium power (less than 100 mW).

The effects of laser therapy include its minimal thermal action, due to the scare and superficial heat it produces. The therapeutic action is due to a photochemical effect, which accelerates the body's physiological processes by stimulating metabolic reactions at a cellular level. Laser therapy is mostly employed for analgesic and anti-inflammatory purposes and for improving tissue repair mechanisms [72].

The use of lasers for treating knee osteoarthritis does not appear to produce any benefit in terms of pain, rigidity, and functional limitation. Therefore, the current state of evidence does not recommend its use in patients with knee osteoarthritis [73].

2.6.6 Orthoses

An orthosis is as a device applied externally to the human body to modify the structural or functional characteristics of the neuromusculoskeletal system. Various types of braces are

employed for treating knee osteoarthritis, and depending on the joint movement they allow, are classified as static (do not allow movement and used to immobilize or stabilize) or dynamic (allow movement and are usually employed to facilitate joint movement).

The functions of braces include… [74]

a. Blocking unwanted joint movement
b. Immobilizing the limb to facilitate healing or consolidation
c. Correcting deformities
d. Increasing joint range of movement
e. Generating traction to produce joint decoaptation
f. Assisting in limb function
g. Facilitating the use of technical aids
h. Unloading, transferring the load from one body segment to another more capable of supporting that weight

There are also mixed braces, which combine the functions of the various types of braces.

In patients with knee osteoarthritis and varus deformity, the use of a valgus orthosis can reduce pain and stiffness and improve function and quality of life (mild evidence) [75]. These braces' mechanism of action is to unload the joint's medial compartment by reducing the knee adduction moment. However, it is unclear what type of brace should be recommended for treating knee osteoarthritis.

A systematic review showed evidence that unloader braces decrease the knee adduction moment for tricompartmental osteoarthritis [75]. These braces also decrease the knee adductive moment for medial compartment arthrosis. In patients with varus osteoarthritis in the medial compartment, knee braces are beneficial for pain, stiffness, function, and quality of life (low degree of evidence). For patients with patellofemoral osteoarthritis, the use of a patellofemoral brace does not provide additional benefits.

The use of lateral wedge insoles has been proposed because they can produce calcaneal valgus, thereby resulting in a shock on the medial compartment of the knee. However, such insoles do not appear to result in significant structural changes and have not been shown to produce a clinical benefit. Their use in knee osteoarthritis is therefore not recommended [75]. The ideal brace for knee osteoarthritis has yet to be determined.

2.6.7 Other Therapies

Manual Therapy

As its name implies, manual therapy is a treatment performed by physical therapists with their own hands. Within this intervention, various joint movements can be performed, which can vary both in direction and speed (joint mobilization and manipulation). Massage techniques performed on soft tissues also fall into this category [76].

Manual therapy could have an effect on improving certain deficient aspects of joint kinematics in arthritic knees, including loss of joint flexibility, presence of capsular stiffness, and increased intracapsular pressure. The therapeutic effect likely results from stimulating type II mechanoreceptors and inhibiting type IV nociceptors [77]. Joint mobilization can also stimulate the Golgi tendon organ, producing muscle relaxation through an inhibitory reflex [78]. Manual therapy can also decrease muscle tension in periarticular tissues, thereby reducing pain [79]. However, concrete studies confirming these theoretical effects are needed to better understand the physiological mechanisms behind this group of techniques.

When assessing the effects of manual therapy on knee osteoarthritis treatment, the evidence is inconclusive [80]. A number of studies have shown effects in reducing pain and improving function; however, as this intervention is often performed in conjunction with other techniques, its effect in isolation has not been well determined [81].

In knee osteoarthritis, adding manual therapy to therapeutic physical exercise, compared with an isolated physical exercise program, can provide a short-term benefit in pain and function, as well as shorten the time required to climb and descend stairs. Manual therapy techniques can

therefore be recommended as an adjunct to therapeutic physical exercise [82].

Kinesio Tape

Kinesio tape is a technique in which an adhesive band is applied to a muscle segment. The adhesive band is stuck directly to the skin by a doctor, therapist, or by the patient. There are several types of tapes (elastic or rigid) and application methods depending on the traction direction (upper, lower, medial, lateral, rotational, and nontractional). As the kinesio tape adhesive lasts for approximately 3–5 days, this technique could provide extended benefits [83].

However, there is no evidence that the use of kinesio tape improves lower limb strength or function in people without disease. The role of kinesio tape in treating knee osteoarthritis is controversial. A number of authors have suggested that this adhesive can be effective in reducing pain and improving knee flexion in patients with knee osteoarthritis [84], while other authors have found no benefit in terms of pain, disability, quality of life, return to work, and overall impression of recovery when using kinesio tape [85].

There is also insufficient evidence to assess the effect of kinesio tape on leg function in patients with certain conditions such as chronic musculoskeletal disease or following orthopedic interventions [86]. In any case, the role of kinesio tape would be to complement other more complete therapies such as therapeutic physical exercise.

2.7 Conclusions

Knee osteoarthritis is a disease with increasing prevalence that affects patients' quality of life and represents a high cost to society. Physical exercise is the most effective therapy for controlling symptoms and can delay disease progression and thus the need for joint replacement. Strengthening and aerobic exercises seem to be the most effective. Backward walking, blood flow restriction, and hydrotherapy can improve tolerance to training programs. Physical exercise should be combined with educational programs and habit changing measures. Within the therapeutic modalities, magnet therapy and ultrasound therapy seem to be the most effective for knee osteoarthritis. In cases of varus deformity in knee osteoarthritis, the use of braces with medial knee compartment relief could be beneficial.

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