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Physical Therapy

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Policy

Aetna considers physical therapy (PT) medically necessary when this care is prescribed by a chiropractor, DO, MD, nurse practitioner, podiatrist or other health professional qualified to prescribe physical therapy according to State law in order to significantly improve, develop or restore physical functions lost or impaired as a result of a disease, injury or surgical procedure, and the following criteria are met:

- The member’s participating physician or licensed health care practitioner has determined that the member’s condition can improve significantly based on physical measures (eg, active range of motion (AROM), strength, function or subjective report of pain level) within one month of the date that therapy begins or the therapy services proposed must be necessary for the establishment of a safe and effective maintenance program that will be performed by the member without ongoing skilled therapy services. These services must be proposed for the treatment of a specific illness or injury; *and*
- The PT services provided are intended to cover only episodes of therapy for situations where there must be a reasonable expectation that a member’s condition will improve significantly in a reasonable and generally predictable period of time; *and*

Policy History

[Last Review](#)

06/04/2020

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[Review History](#)

[Definitions](#)

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- PT services must be ordered by a physician or other licensed health care practitioner and performed by a duly licensed and certified, if applicable, PT provider. All services provided must be within the applicable scope of practice for the provider in their licensed jurisdiction where the services are provided; *and*
- The services provided must be of the complexity and nature to require that they are performed by a licensed professional therapist or provided under their direct supervision by a licensed ancillary person as permitted under state laws. Services may be provided personally by physicians and performed by personnel under their direct supervision as permitted under state laws. As physicians are not licensed as physical therapists, they may not directly supervise physical therapy assistants; *and*
- PT must be provided in accordance with an ongoing, written plan of care that is reviewed with and approved by the treating physician in accordance with applicable state laws and regulations. The PT plan of care should be of such sufficient detail and include appropriate objective and subjective data to demonstrate the medical necessity of the proposed treatment (see appendix for documentation requirements).

Physical therapy in asymptomatic persons or in persons without an identifiable clinical condition is considered not medically necessary.

Physical therapy in persons whose condition is neither regressing nor improving is considered not medically necessary.

Once therapeutic benefit has been achieved, or a home exercise program could be used for further gains, continuing supervised physical therapy is not considered medically necessary.

Notes:

Physical therapy may require precertification in some plan designs. Subject to plan benefit descriptions, physical therapy may be a limited benefit.

Typically, in Aetna HMO plans, the physical therapy benefit is limited to a 60-day treatment period. When this is the case, the treatment period of 60 days applies to a specific condition. In some plan designs this limitation is applied on a calendar year or on a contract-year basis. In others it is a lifetime limitation. Please check benefit plan descriptions for details. Regardless, it is possible for a member to receive more than one 60-day treatment course of physical therapy as treatment of separate conditions. For example, a surgical procedure causing the need for physical therapy is considered to be the initiation of a new or separate condition in a person who previously received physical therapy for another indication, and so qualifies the member to receive coverage for an additional course of physical therapy as outlined above. An exacerbation or flare-up of a chronic illness is not considered a new incident of illness.

In some plans, the available physical therapy benefit is defined by a number of treatment sessions covered per year regardless of the condition or number of courses of therapy indicated.

Standard Aetna policies exclude coverage for educational training or services. Under plans with this exclusion, physical therapy is not covered when provided in educational settings. Please check benefit plan descriptions for details.

Home-Based Physical Therapy

Aetna considers home-based physical therapy medically necessary in selected cases based upon the member's needs (i.e., the member must be homebound). This may be considered medically necessary in the transition of the member from hospital to home, and may be an extension of case management services.

Note: In Aetna HMO, QPOS, Health Network Only, and Health Network Option plans, such short-term physical therapy accumulates towards the 60-day limit or other applicable rehabilitation benefit limits. Please check benefit plan descriptions for details.

Sports Rehabilitation

Sports rehabilitation refers to continued treatment for sports related injuries in an effort to improve above and beyond normal ability to perform activities of daily living (ADLs). Sports-related rehabilitation or other similar avocational activities is not covered because it is not considered treatment of disease. This includes, but is not limited to: baseball pitching/throwing, cheerleading, golfing, martial arts of all types, organized football, baseball, basketball, soccer, lacrosse, swimming, track and field, etc. at a college, high school, other school or community setting, professional and amateur tennis, professional and amateur/hobby/academic dance, and competitive weightlifting and similar activities.

The Interactive Metronome Program

Aetna considers the Interactive Metronome program experimental and investigational because there is insufficient evidence to support its effectiveness.

Augmented Soft Tissue Mobilization

Aetna considers augmented soft tissue mobilization experimental and investigational because it has not been proven to be more effective than standard soft tissue mobilization. There is no reliable evidence that outcomes of soft tissue mobilization (myofascial release) are improved with the use of hand-held tools (so-called "augmented soft tissue mobilization"; e.g., the Dynatronics ThermoStim probe).

Note: The ThermoStim probe also allows delivery of electrical stimulation, and would be covered for electrical stimulation as a modality.

Kinesio Taping/McConnell Taping/Taping

Aetna considers Kinesio taping/taping for back pain, radicular pain syndromes, and other back-related conditions experimental and investigational because its clinical value has not been established.

Aetna considers Kinesio taping experimental and investigational for lower extremity spasticity, meralgia paresthetica, post-operative subacromial decompression, wrist injury, prevention of ankle sprains and all other

indications because its effectiveness for these indications has not been established.

Aetna considers McConnell taping for knee pain, low back pain and all other indications experimental and investigational because its clinical value has not been established.

MEDEK Therapy

Aetna considers MEDEK therapy experimental and investigational because its clinical value has not been established.

Hands-Free Ultrasound and Low-Frequency Sound (Infrasound)

Aetna considers "hands-free" ultrasound and low-frequency sound (infrasound) experimental and investigational because their clinical values have not been established.

Hivamat Therapy (Deep Oscillation Therapy)

Aetna considers Hivamat therapy (deep oscillation therapy) experimental and investigational because its clinical value has not been established.

Applied Functional Science

Aetna considers Applied Functional Science experimental and investigational because its clinical value has not been established.

McKenzie Method of Mechanical Diagnosis and Therapy

There is insufficient evidence that the McKenzie Method of mechanical diagnosis and therapy is superior to other standard methods of physical therapy.

Postural Restoration Form of Physical Therapy

There is insufficient evidence that the postural restoration form of physical therapy is superior to other standard methods of physical therapy.

Background

Physical therapy (PT) treatment consists of a prescribed program to relieve symptoms, improve function and prevent further disability for individuals disabled by chronic or acute disease or injury. Treatment may include various forms of heat and cold, electrical stimulation, therapeutic exercises. For medical necessity criteria, see, ambulation training and training in functional activities.

Physical therapy is the treatment of disorders or injuries using physical methods or modalities. A PT modality is often defined as any physical agent applied to produce therapeutic changes to biologic tissues.

Modalities that are generally accepted for use include exercises, thermal, cold, ultrasonic or electric energy devices. Due to the passive nature of therapeutic modalities, they are generally used to enable the patient to take part in active aspects of therapy.

Physical therapy may be indicated for treatment of muscle weakness, limitations in the range of motion, neuromuscular conditions, musculoskeletal conditions, lymphedema and for selected training of patients in specific techniques and exercises for their own continued use at home.

Therapeutic procedures are intended as a means of effecting change using clinical skills and/or techniques and/or services whose goal is the improvement of function. PT procedures in general include therapeutic exercises and joint mobilization. These have generally been shown to be one set of effective means of treating aspects of many musculoskeletal conditions.

Medically necessary physical therapy services must be restorative or for the purpose of designing and teaching a maintenance program for the patient to carry out at home. The services must also relate to a written treatment plan and be of a level of complexity that requires the judgment, knowledge and skills of a physical therapist (or a medical doctor/doctor of osteopathy) to perform and/or supervise the services. The amount, frequency and duration of the physical therapy services must be

reasonable, the services must be considered appropriate and needed for the treatment of the disabling condition and must not be palliative in nature.

A qualified physical therapist for benefit coverage purposes is a person who is licensed as a physical therapist by the state in which he or she is practicing. A physical therapy assistant (PTA) is a person who is licensed as a PTA, if applicable, by the state in which he or she is practicing. The services of a PTA must be supervised by a licensed physical therapist at a level of supervision determined by state law or regulation. The services of a PTA cannot be provided incidental to a physician/appropriately licensed other practitioner as they are not specifically qualified as licensed physical therapists

Physical therapy is generally covered for members with eligible conditions that require improvement in the activities of daily living (ADLs). These include, but may not be limited to : bathing, communication, dressing, feeding, grooming, mobility, personal hygiene, self maintenance, skin management, and toileting.

Treatments and/or therapies that are intended to specifically improve what are known as Instrumental Activities of Daily Living (IADL) are not covered because they are not considered treatment of disease. These include, but are not limited to: community living skills including balancing a checkbook, use of public transportation; home management skills including meal preparation, laundry; leisure activities including hobbies, sports or recreation of all types even if suggested as part of a PT treatment plan; motor vehicle driving evaluations and driving instruction - this includes automobiles, trucks, motorcycles and bicycles; or personal safety preparedness.

Physical therapy for members whose condition is neither regressing nor improving, is not medically necessary. An exacerbation or flare-up of a chronic condition or illness is not considered a new illness or condition. It is the intent of the PT coverage to have the member receive those services that are medically necessary, who show demonstrated improvement over a reasonable period of time, consistent with the condition under treatment and to achieve the stated treatment goals.

Non-skilled services are certain types of treatment that do not generally require the skills of a qualified physical therapist. Non-skilled services include, but are not limited to, (1) passive range of motion (PROM) treatment which is not specifically part of a restorative program related to a loss of function and (2) services which maintain function by using routine, repetitive and reinforced procedures after initial teaching of the patient has taken place. These also include most situations where general conditioning, recovery from an acute medical/surgical illness that caused deconditioning or increased general ability to exercise or walk are undertaken. Services that can be safely and effectively furnished by non-skilled (non-licensed physical therapists or their assistants under appropriate supervision) personnel are non-skilled services.

Maintenance care consists of activities that generally are intended to preserve the patient's present level of function and/or prevent regression of that level of function. Maintenance begins when the therapeutic goals of the treatment program are achieved or when no further significant progress is made or reasonably seen as occurring. Specifically, these include continued activities for patients who have achieved generally accepted levels of function and/or muscle strength and are at a plateau or have reached "normal" levels. A plateau is a period of four weeks or dependent on the specific condition and/or patient situation, a lesser period of time that is seen as generally accepted.

Below is a description and medical necessity criteria for different treatment modalities and therapeutic procedures.

1. Activities of Daily Living (ADL) Training -- Training of severely impaired individuals in essential ADL, including bathing; feeding; preparing meals; toileting; walking; making bed; and transferring from bed to chair, wheelchair or walker. This procedure is considered medically necessary to enable the member to perform essential ADL related to the patient's health and hygiene, within or outside the home, with minimal or no assistance from others. This procedure is considered medically necessary only when it requires the professional skills of a provider, is designed to address specific needs of the member, and must be part of an active treatment

plan directed at a specific outcome. The member must have the capacity to learn from instructions. Standard medical treatment may generally require up to 12 visits in 4 weeks. Services provided concurrently by physicians, physical therapists and occupational therapists may be considered medically necessary if there are separate and distinct functional goals.

2. Aquatic Therapy/Hydrotherapy/Hubbard Tank -- Hubbard tank involves a full-body immersion tank for treating severely burned, debilitated and/or neurologically impaired individuals. Pool therapy (aquatic therapy, hydrotherapy) is provided individually, in a pool, to severely debilitated or neurologically impaired individuals. (The term is not intended to refer to relatively normal individuals who exercise, swim laps or relax in a hot tub or Jacuzzi). Develops and/or maintains muscle strength including range of motion by eliminating forces of gravity through total body immersion (except for head) -- requires constant attention. It is not considered medically necessary to provide more than 1 type of hydrotherapy on the same day (e.g., whirlpool, Hubbard tank, hydrotherapy). For medical necessity criteria, see [CPB 0174 - Pool Therapy, Aquatic Therapy or Hydrotherapy \(./100_199/0174.html\)](http://100_199/0174.html).

3. Cognitive skills development -- This procedure is considered medically necessary for persons with acquired cognitive defects resulting from head trauma, or acute neurologic events including cerebrovascular accidents. It is not appropriate for persons with chronic progressive brain conditions with no potential for restoration. Occupational/speech therapists or clinical psychologists with specific training in these skills are typically the providers. This procedure should be aimed at improving or restoring specific functions which were impaired by an identified illness or injury. The goals of therapy, expected outcomes and expected duration of therapy should be specified.

4. Contrast Baths -- Blood vessel stimulation with alternate hot and cold baths -- constant attendance is needed. This modality may be considered medically necessary to treat extremities affected by

reflex sympathetic dystrophy, acute edema resulting from trauma, or synovitis/tenosynovitis. It is generally used as an adjunct to a therapeutic procedure. Standard treatment is 3 to 4 treatments per week for 1 month.

5. Crutch/Cane Ambulation -- Ambulation training and re-education with the use of assistive devices such as cane or crutches.

Considered medically necessary for persons who meet medical necessity criteria for ambulatory assist devices. See

[CPB 0505 - Ambulatory Assist Devices: Walkers, Canes and Crutches](#) [\(../500_599/0505.html\)](#)

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6. Diathermy (e.g., microwave) -- Deep, dry heat with high frequency current or microwave to relieve pain and increase movement -- supervised. The objective of diathermy is to cause vasodilatation and relieve pain from muscle spasm. Diathermy using deep dry heat with high-frequency achieves a greater rise in deep tissue temperature than does microwave. Considered medically necessary as a heat modality for painful musculoskeletal conditions. Considered experimental and investigational as a treatment for asthma, bronchitis or other pulmonary conditions.

7. Electrical Stimulation -- For medical necessity criteria, see

[CPB 0011 - Electrical Stimulation for Pain](#) [\(../1_99/0011.html\)](#);

[CPB 0677 - Functional Electrical Stimulation and Neuromuscular Electrical Stimulation](#) [\(../600_699/0677.html\)](#)

; and

[CPB 0680 - Electrical Stimulation for Chronic Ulcers](#) [\(../600_699/0680.html\)](#)

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8. Gait Training -- Teaching individuals with severe neurological or musculoskeletal disorders to ambulate in the face of their handicap or to ambulate with an assistive device. Gait training is considered medically necessary for training individuals whose walking abilities have been impaired by neurological, muscular or skeletal abnormalities or trauma. Gait training is not considered medically necessary when the individual's walking ability is not

expected to improve. Provider supervision of repetitive walk-strengthening exercise for feeble or unstable patients is not considered medically necessary. Gait training is not considered medically necessary for relatively normal individuals with minor or transient abnormalities of gait who do not require an assistive device; these minor or transient gait abnormalities may be remedied by simple instructions to the individual.

9. Hot/Cold Packs -- Hot packs increases blood flow, relieves pain and increases movement; cold packs decreases blood flow to an area to reduce pain and swelling immediately after an injury. These are used in Contrast Therapy under supervision. Considered medically necessary as thermal modalities (hot or cold) for painful musculoskeletal conditions and for acute injuries. See also [CPB 0297 - Cryoanalgesia and Therapeutic Cold \(./200_299/0297.html\)](http://200_299/0297.html).

10. Infrared Light Therapy -- Dry heat with a special lamp to increase circulation to an area under supervision. The objective is to cause vasodilatation and relieve pain from muscle spasm. Considered medically necessary as a heat modality for musculoskeletal indications. See also [CPB 0540 - Heating Devices \(./500_599/0540.html\)](http://500_599/0540.html); and [CPB 0604 - Infrared Therapy \(./600_699/0604.html\)](http://600_699/0604.html).

11. Iontophoresis -- Electric current used to transfer certain chemicals (medications) into body tissues. For medical necessity criteria, see [CPB 0229 - Iontophoresis \(./200_299/0229.html\)](http://200_299/0229.html).

12. Kinetic Therapy -- Use of dynamic activities to improve functional performance. Considered medically necessary when there are major impairments or disabilities which preclude the individual performing the activities and exercises that are ordinarily prescribed. In kinetic therapy, considerable time is spent developing specific, individualized therapeutic exercises and instructing the patient in how to perform them. The term kinetic therapy is not intended to apply to instructions in routine exercises.

13. **Massage Therapy** -- Massage involves manual techniques that include applying fixed or movable pressure, holding and/or causing movement of or to the body, using primarily the hands. These techniques affect the musculoskeletal, circulatory-lymphatic, nervous, and other systems of the body with the intent of improving a person's well-being or health. The most widely used forms of massage therapy include Swedish massage, deep-tissue massage, sports massage, neuromuscular massage, and manual lymph drainage. Massage therapy is considered medically necessary as adjunctive treatment to another therapeutic procedure on the same day, which is designed to restore muscle function, reduce edema, improve joint motion, or for relief of muscle spasm. Massage therapy is not considered medically necessary for prolonged periods and should be limited to the initial or acute phase of an injury or illness (i.e., an initial 2-week period).

14. **Myofascial Release** -- Soft tissue mobilization through manipulation. Skilled manual techniques (active and/or passive) are applied to soft tissue to effect changes in the soft tissues, articular structures, neural or vascular systems. Examples are facilitation of fluid exchange, restoration of movement in acutely edematous muscles, or stretching of shortened connective tissue. This procedure is considered medically necessary for treatment of restricted motion of soft tissues in involved extremities, neck, and trunk.

15. **Neuromuscular Reeducation** -- This therapeutic procedure is provided to improve balance, coordination, kinesthetic sense, posture, and proprioception to a person who has had muscle paralysis and is undergoing recovery or regeneration. Goal is to develop conscious control of individual muscles and awareness of position of extremities. The procedure may be considered medically necessary for impairments which affect the body's neuromuscular system (e.g., poor static or dynamic sitting/standing balance, loss of gross and fine motor coordination, hypo/hypertonicity) that may result from disease or injury such as

severe trauma to nervous system, cerebral vascular accident and systemic neurological disease. Standard treatment is 12 to 18 visits within a 4- to 6-week period.

16. Orthotic Training -- Training and re-education with braces and/or splints (orthotics). Considered medically necessary for persons who meet criteria for a brace or splint. See [CPB 0009 - Orthopedic Casts, Braces and Splints \(./199/0009.html\)](http://199/0009.html).
. There should be distinct treatments rendered when orthotic training for a lower extremity is done during the same visit as gait training, or self-care/home management training. It is unusual to require more than 30 mins of static orthotics training. In some cases, dynamic training may require additional time.
17. Paraffin Bath -- Also known as hot wax treatment, this involves supervised application of heat (via hot wax) to an extremity to relieve pain and facilitate movement. This is considered medically necessary for pain relief in chronic joint problems of the wrists, hands or feet. One or 2 visits is usually sufficient to educate the individual in home use and to evaluate effectiveness. See also [CPB 0540 - Heating Devices \(./500599/0540.html\)](http://500599/0540.html).
18. Prosthetic checkout -- These assessments are considered medically necessary when a device is newly issued or there is a modification or re-issue of the device. These assessments are considered medically necessary when member experiences loss of function directly related to the orthotic or prosthetic device (e.g., pain, skin breakdown, or falls. Usually, no more than 30 mins of time is necessary.
19. Prosthetic Training -- Training and re-education with artificial devices (prosthetics). Considered medically necessary for persons with a medically necessary prosthetic. There should be distinct goals and services rendered when prosthetic training for a lower extremity is done during the same visit as gait training or self care/home management training. Periodic revisits beyond the 3rd month may be reviewed for medical necessity. It is unusual to require more than 30 mins of prosthetic training on a given date.

20. Therapeutic activities -- This procedure involves using functional activities (e.g., bending, lifting, carrying, reaching, pushing, pulling, stooping, catching and overhead activities) to improve functional performance in a progressive manner. The activities are usually directed at a loss or restriction of mobility, strength, balance or coordination. They require the professional skills of a provider and are designed to address a specific functional need of the member. This intervention may be appropriate after a patient has completed exercises focused on strengthening and range of motion but need to be progressed to more function-based activities. These dynamic activities must be part of an active treatment plan and directed at a specific outcome.

21. Therapeutic Exercises -- Instructing a person in exercises and directly supervising the exercises. Purpose is to develop and/or maintain muscle strength and flexibility including range of motion, stretching and postural drainage. Therapeutic exercise is performed with a patient either actively, active-assisted, or passively (e.g., treadmill, isokinetic exercise lumbar stabilization, stretching, strengthening). Therapeutic exercise is considered medically necessary for loss or restriction of joint motion, strength, functional capacity or mobility which has resulted from disease or injury. Standard treatment is 12 to 18 visits within a 4- to 6-week period. Note: Exercising done subsequently by the member without a physician or therapist present and supervising would not be covered.

22. Traction -- Manual or mechanical pull on extremities or spine to relieve spasm and pain -- supervised. Considered medically necessary for chronic back or neck pain. This modality, when provided by physicians or physical therapists, is typically used in conjunction with therapeutic procedures, not as an isolated treatment. Standard treatment is to provide supervised mechanical traction up to 4 sessions per week. For cervical radiculopathy, treatment beyond 1 month can usually be accomplished by self-administered mechanical traction in the home. See also

[CPB 0453 - Cervical Traction Devices \(../400_499/0453.html\)](#), and
[CPB 0569 - Lumbar Traction Devices \(../500_599/0569.html\)](#).

23. Ultrasound -- Deep heat by high frequency sound waves to relieve pain, improve healing -- constant attendance. This modality is considered medically necessary to treat arthritis, inflammation of periarticular structures, neuromas, and to soften adhesive scars. Standard treatment is 3 to 4 treatments per week for 1 month. Considered experimental and investigational as a treatment for asthma, bronchitis or other pulmonary conditions.

24. Vasopneumatic Device -- Pressure application by special equipment to reduce swelling -- supervised. It may be considered necessary to reduce edema after acute injury. Education for use of lymphedema pump in the home usually requires 1 or 2 sessions. Further treatment of lymphedema by the provider after the educational visits are generally not considered medically necessary. See also [CPB 0062 - Burn Garments \(./1_99/0062.html\)](#), and [CPB 0069 - Lymphedema \(./1_99/0069.html\)](#).

25. Wheelchair management training -- This procedure is considered medically necessary only when it requires the professional skills of a provider, is designed to address specific needs of the member, and must be part of an active treatment plan directed at a specific goal. The member must have the capacity to learn from instructions. Typically, 3 to 4 total sessions are sufficient.

26. Whirlpool -- These modalities involve supervised use of agitated water in order to relieve muscle spasm, improve circulation, or cleanse wounds e.g., ulcers, exfoliative skin conditions. Considered medically necessary to relieve pain and promote relaxation to facilitate movement in persons with musculoskeletal conditions. Also considered medically necessary for wound cleansing. It is not considered medically necessary to provide more than 1 hydrotherapy modality (e.g., whirlpool, Hubbard tank, aquatic therapy) performed on the same day. See also [CPB 0450 - Fluidized Therapy \(Fluidotherapy\) \(./400_499/0450.html\)](#);

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[CPB 0429 - Bathroom and Toilet Equipment and Supplies \(./400_499/0429.html\)](#)

; and

[CPB 0699 - Dry Hydrotherapy \(Hydromassage, Aquamassage, Water Massage\)\(../600_699/0699.html\)](#).

Certain physical medicine modalities and therapeutic are considered duplicative in nature and it would be inappropriate to perform or bill for these services during the same session, such as:

1. Functional activities and ADL
2. Infrared and ultraviolet
3. Massage therapy and myofascial release
4. Microwave and infrared
5. Orthotics training and prosthetic training
6. Whirlpool and Hubbard tank.

The medical necessity of neuromuscular re-education, therapeutic exercises, kinetic activities, and/or therapeutic activities, performed on the same day, must be documented in the medical record.

Only 1 heat modality would be considered medically necessary during the same treatment session. An exception to this is ultrasound (a deep heat), which may be considered medically necessary with 1 superficial heat modality but is not considered medically necessary with other deep heat modalities.

The Interactive Metronome Program

The Interactive Metronome (IM) program is designed for processing speed, focus, as well as coordination. Trainees wear headphones and hear a fixed, repeating reference beat; they press against a hand or foot sensor to try to match it, while receiving visual and auditory feedback. The IM program has been promoted as a treatment for children with attention-deficit hyperactivity disorder (ADHD) and for other special needs children to increase concentration, focus, and coordination. It has also been promoted to improve athletic performance, to assess and improve academic performance of normal children, and to improve children's performance in the arts (e.g., dance, music, theater, creative arts). Furthermore, the IM program has also been implemented as part of a

therapy program for patients with balance disorders, cerebrovascular accident, limb amputation, multiple sclerosis, Parkinson's disease, and traumatic brain injury.

Schaffer et al (2001) examined the effects of the IM program on selected aspects of motor and cognitive skills in a group of children with ADHD. The study included 56 boys who were 6 years to 12 years of age and diagnosed before they entered the study as having ADHD. The participants were pre-tested and randomly assigned to one of three matched groups. A group of 19 participants receiving 15 hours of IM training exercises were compared with a group receiving no intervention and a group receiving training on selected computer video games. A significant pattern of improvement across 53 of 58 variables favoring the IM program was found. Additionally, several significant differences were found among the treatment groups and between pre-treatment and post-treatment factors on performance in areas of attention, motor control, language processing, reading, and parental reports of improvements in regulation of aggressive behavior. The authors concluded that the IM program appears to facilitate a number of capacities, including attention, motor control, and selected academic skills, in boys with ADHD.

In a case report, Bartscherer and Dole (2005) described the use of the IM program for improving timing and coordination in a 9-year old boy who had difficulties in attention and developmental delay of unspecified origin. The subject underwent a 7-week training with the program. Before, during, and after training, timing accuracy was evaluated with testing procedures consistent with the IM training protocol. Before and after training, the subject's gross and fine motor skills were examined with the Bruininiks-Oseretsky Test of Motor Proficiency (BOTMP). The child exhibited marked change in scores on both timing accuracy and several BOTMP subtests. Additionally his mother relayed anecdotal reports of changes in behavior at home. This child's participation in a new intervention for improving timing and coordination was associated with changes in timing accuracy, gross and fine motor abilities, and parent reported behaviors. The authors noted that these findings warrant further study.

Cosper et al (2009) examined the effectiveness of IM (Interactive Metronome, Sunrise, FL) training in a group of children with mixed attentional and motor coordination disorders to further explore which subcomponents of attentional control and motor functioning the training influences. A total of 12 children who had been diagnosed with ADHD, in conjunction with either developmental coordination disorder (n = 10) or pervasive developmental disorder (n = 2), underwent 15 1-hr sessions of IM training over a 15-week period. Each child was assessed before and after the treatment using measures of attention, coordination, and motor control to determine the effectiveness of training on these cognitive and behavioral realms. As a group, the children made significant improvements in complex visual choice reaction time and visuomotor control after the training. There were, however, no significant changes in sustained attention or inhibitory control over inappropriate motor responses after treatment. These results suggested IM training may address deficits in visuomotor control and speed, but appears to have little effect on sustained attention or motor inhibition.

In a review on autism, Levy and colleagues (2009) stated that popular biologically based treatments include anti-infectives, chelation medications, gastrointestinal medications, hyperbaric oxygen therapy, and intravenous immunoglobulins. Non-biologically based treatments include auditory integration therapy, chiropractic therapy, cranio-sacral manipulation, facilitated communication, IM, and transcranial stimulation. However, few studies have addressed the safety and effectiveness of most of these treatments.

Currently, there is insufficient evidence in the peer-reviewed medical literature to support the effectiveness of the IM program. Randomized controlled studies are needed to establish the clinical value of this program.

Augmented Soft Tissue Mobilization

Augmented soft tissue mobilization (ASTM), a non-invasive mobilization technique, is used by chiropractors as well as massage, occupational, and physical therapists to treat chronic musculoskeletal disorders that result from scarring and fibrosis. It entails the use of hand-held tools made from bone or stone or metal and a lubricant on the skin to scrape

and mobilize scar tissue. Scraping is done to promote circulation, thus, promoting healing. Manual and other treatments may also be used with exercise to guide the healing process. Treatments with ASTM are often administered on non-consecutive days, 1 to 2 times per week. A typical 30-min session usually includes 15 mins of treatment and 15 mins of exercise and assessment. Less severe conditions reportedly can respond well in 2 to 4 sessions whereas difficult chronic cases may require 8 to 16 sessions. However, there is insufficient evidence to support the effectiveness of ASTM.

In a case report, Melham et al (1998) described their finding on the use of ASTM in the treatment of excessive scar tissue around an athlete's injured ankle. Surgery and several months of conventional physical therapy failed to alleviate the athlete's symptoms. As a final resort, ASTM was administered. It used ergonomically designed instruments that assist therapists in the rapid localization and effective treatment of areas exhibiting excessive soft tissue fibrosis; followed by a stretching and strengthening program. Upon the completion of 6 weeks of ASTM, the athlete had no pain and had regained full range of motion and function.

The Dynatronics ThermoStim probe is a hand-held device intended to deliver soft tissue mobilization and electrical stimulation. There are no data demonstrating that such a hand-held device provides effective soft tissue mobilization. The ThermoStim probe also allows delivery of electrical stimulation, and would be covered for electrical stimulation as a modality.

Ostrowski and colleagues (2019) noted that the ThermoStim Probe (TSP) has recently joined the market as a superficial heating modality. Although there is limited research into the intra-muscular (IM) heating capability of superficial heating modalities in general (moist hot pack [MHP], paraffin, warm whirlpool), no previous research has examined IM heating capability of TSP. In a repeated-measures, counter-balanced, multi-center study, these investigators examined rate and magnitude of IM heating via TSP compared with hydrocollator MHP, and examined if TSP could increase tissue temperature 3°C to 4°C (vigorous heating range). Participants included 18 healthy college-aged subjects (11 females and 7 males, age of 23.0 [2.1] years, weight of 74.64 [18.64] kg, height of 168.42 [9.66] cm, subcutaneous adipose: 0.71 [0.17] cm) with calf

subcutaneous adipose of less than 1.2 cm. MHP and TSP were applied to the posterior aspect of the non-dominant calf for 20 mins; participants underwent each treatment in a counter-balanced order. Muscle temperature at a depth of 1.5 cm was measured via 21-G catheter thermocouple. Temperatures were recorded at baseline and during the 20-min treatment. There was a significant treatment-by-time interaction during the treatment period ($F_{5,85} = 14.149$, $p < 0.001$), as well as significant main effects for treatment ($F_{1,17} = 7.264$, $p = 0.02$) and for time ($F_{5,85} = 34.028$, $p < 0.001$). Muscle temperature increased an average of 1.7° (0.9°) for the MHP and 0.6° (1.0°) for the TSP. Pair-wise comparisons of the interaction (using least significant difference adjustment for multiple comparisons) indicated that MHP heated faster than TSP at 12-min ($p = 0.02$), 16-min ($p = 0.002$), and 20-min ($p = 0.001$). There was no significant correlation between subcutaneous adipose thickness and maximum temperature increase obtained with either MHP ($r = -0.033$, $p = 0.90$) or TSP ($r = -0.080$, $p = 0.75$). The authors concluded that MHP increased IM temperature significantly more than TSP; however, neither modality was capable of producing a 3°C to 4°C temperature increase associated with increased tissue extensibility.

Kinesio Taping / McConnell Taping / Taping

Kinesio taping is a method of taping utilizing a specialized type of tape. It differs from traditional white athletic tape in the sense that it is elastic and can be stretched to 140 % of its original length before being applied to the skin. It subsequently provides a constant pulling (shear) force to the skin over which it is applied unlike traditional white athletic tape. The fabric of this specialized tape is air permeable and water resistant and can be worn for repetitive days. Kinesio tape is being used immediately following injury and during the rehabilitation process. However, its effectiveness has yet to be established.

Halseth et al (2004) examined if Kinesio taping the anterior and lateral portion of the ankle would enhance ankle proprioception compared to the untaped ankle. A total of 30 subjects (15 men, 15 women, aged 18 to 30 years) participated in this study. Exclusion criteria: included ankle injury less than 6 months prior to testing, significant ligament laxity as determined through clinical evaluation, or any severe foot abnormality. Experiment utilized a single group, pre-test and post-test. Plantar flexion

and inversion with 20° of plantar flexion reproduction of joint position sense (RJPS) was determined using an ankle RJPS apparatus. Subjects were bare-footed, blind-folded, and equipped with headphones playing white noise to eliminate auditory cues. They had 5 trials in both plantar flexion and inversion with 20° plantar flexion before and after application of the Kinesio tape to the anterior/lateral portion of the ankle. Constant error and absolute error were determined from the difference between the target angle and the trial angle produced by the subject. The treatment group (Kinesio taped subjects) showed no change in constant and absolute error for ankle RJPS in plantar flexion and 20° of plantar flexion with inversion when compared to the untaped results using the same motions. The application of Kinesio tape does not appear to enhance proprioception (in terms of RJPS) in healthy individuals as determined by measures of RJPS at the ankle in the motions of plantar flexion and 20° of plantar flexion with inversion. The authors stated that in order to fully understand the effect of Kinesio tape on proprioception, further research needs to be conducted on other joints, on the method of application of Kinesio tape, and the health of the subject to whom it is applied. In addition, further research may provide vital information about a possible benefit of Kinesio taping during the acute and sub-acute phases of rehabilitation, thus facilitating earlier return to activity participation.

In a pilot study, Yasukawa and colleagues (2006) described the use of the Kinesio taping method for the upper extremity in enhancing functional motor skills in children admitted into an acute rehabilitation program. A total of 15 children (10 females and 5 males; 4 to 16 years of age), who were receiving rehabilitation services at the Rehabilitation Institute of Chicago participated in this study. For 13 of the inpatients, this was the initial rehabilitation following an acquired disability, which included encephalitis, brain tumor, cerebral vascular accident, traumatic brain injury, and spinal cord injury. The Melbourne Assessment of Unilateral Upper Limb Function (Melbourne Assessment) was used to measure upper-limb functional change prior to use of Kinesio tape, immediately after application of the tape, and 3 days after wearing tape. Children's upper-limb function was compared over the three assessments using analysis of variance. The improvement from pre- to post-taping was statistically significant, $F(1, 14) = 18.9; p < 0.02$. The authors concluded that these results suggested that Kinesio tape may be associated with improvement in upper-extremity control and function in the acute pediatric

rehabilitation setting. The use of Kinesio Tape as an adjunct to treatment may assist with the goal-focused occupational therapy treatment during the child's inpatient stay. Moreover, they stated that further study is recommended to test the effectiveness of this method and to determine the lasting effects on motor skills and functional performance once the tape is removed.

In a pilot study, Fu and associates (2008) examined the possible immediate and delayed effects of Kinesio taping on muscle strength in quadriceps and hamstring when taping is applied to the anterior thigh of healthy young athletes. A total of 14 healthy young athletes (7 males and 7 females) free of knee problems were enrolled in this study. Muscle strength of the subject was assessed by the isokinetic dynamometer under three conditions: (i) without taping; (ii) immediately after taping; (iii) 12 hours after taping with the tape remaining in situ. The result revealed no significant difference in muscle power among the three conditions. Kinesio taping on the anterior thigh neither decreased nor increased muscle strength in healthy non-injured young athletes.

In a prospective, randomized, double-blinded, clinical study using a repeated-measures design, Thelen et al (2008) determined the short-term clinical efficacy of Kinesio tape when applied to college students with shoulder pain, as compared to a sham tape application. A total of 42 subjects with clinically diagnosed rotator cuff tendonitis and/or impingement were randomly assigned to 1 of 2 groups: therapeutic Kinesio tape group or sham Kinesio tape group. Subjects wore the tape for 2 consecutive 3-day intervals. Self-reported pain and disability and pain-free active ranges of motion (ROM) were measured at multiple intervals to evaluate for differences between groups. The therapeutic Kinesio tape group showed immediate improvement in pain-free shoulder abduction (mean +/- SD increase, 16.9 degrees +/- 23.2 degrees ; $p = 0.005$) after tape application. No other differences between groups regarding ROM, pain, or disability scores at any time interval were found. The authors concluded that Kinesio tape may be of some assistance to clinicians in improving pain-free active ROM immediately after tape application for patients with shoulder pain. Utilization of Kinesio tape for decreasing pain intensity or disability for young patients with suspected shoulder tendonitis/impingement is not supported.

McConnell (2002) noted that the management of chronic low back pain (LBP) and leg pain has always provided a challenge for therapists. This researcher examined the influence of a repetitive movement such as walking as a possible causative factor of chronic LBP. Diminished shock absorption as well as limited hip extension and external rotation are hypothesized to affect the mobility of the lumbar spine resulting in lumbar spine dysfunction. Treatment must therefore be directed not only at increasing the mobility of the hips and thoracic spine, but also the stability of the lumbar spine. However, the symptoms can sometimes be exacerbated by treatment, so the neural tissue needs to be unloaded to optimize the treatment outcome. This can be achieved by taping the buttock and down the leg following the dermatome to shorten the inflamed tissue.

While taping has a role in the management of musculoskeletal pain and injuries, its use in the management of LBP has not been established. In a review of LBP in athletes, Baker and Patel (2005) stated that most of the adult population experiences LBP at some time in life. Athletes may be at increased risk, but outcomes are good. The majority of LBP in adult athletes is mechanical in nature. Herniated discs, spinal stenosis, sacroiliitis, and sacral stress fractures can also cause LBP in these individuals. Low back conditions mentioned above may be treated with rest, medication, as well as specific exercise programs. Surgery is indicated for severe spinal stenosis, pain with evidence of neurological compromise, and some painful deformities. Newer treatments for back pain are emerging, but few controlled clinical trials are available. Taping was not mentioned as an option for managing individuals with LBP. Additionally, in a review of current concepts in the diagnosis and treatment of spondylolysis, McCleary and Congeni (2007) noted that treatment usually consists of rest and/or bracing to allow healing to occur, followed by rehabilitation that includes core strengthening. They stated that more large-scale controlled studies are needed to clarify the most effective diagnostic and therapeutic protocols. Furthermore, in reviews of treatment for subacute and chronic LBP (Chou, 2009) and occupational LBP (Kraeciw and Atlas, 2009), as well as review of rehabilitation program for the low back (Sheon and Duncombe, 2009), taping is not mentioned as an option.

Greig et al (2008) noted that greater thoracic kyphosis is associated with increased biomechanical loading of the spine which is potentially problematic in individuals with osteoporotic vertebral fractures. Conservative interventions that reduce thoracic kyphosis warrant further investigation. These researchers examined the effects of therapeutic postural taping on thoracic posture. Secondary aims explored the effects of taping on trunk muscle activity and balance. A total of 15 women with osteoporotic vertebral fractures participated in this within-participant design study. Three taping conditions were randomly applied: (i) therapeutic taping, (ii) control taping, and (iii) no taping. Angle of thoracic kyphosis was measured after each condition. Force plate-derived balance parameters and trunk muscle electromyographic activity (EMG) were recorded during 3 static standing tasks of 40-second duration. There was a significant main effect of postural taping on thoracic kyphosis ($p = 0.026$), with a greater reduction in thoracic kyphosis after taping compared with both control tape and no tape. There were no effects of taping on EMG or balance parameters. The authors concluded that these findings showed that the application of postural therapeutic tape in a population with osteoporotic vertebral fractures induced an immediate reduction in thoracic kyphosis. They stated that further research is needed to investigate the underlying mechanisms associated with this decrease in kyphosis.

The American College of Occupational and Environmental Medicine's practice guidelines on "Evaluation and management of common health problems and functional recovery in workers" (Hegmann, 2007) did not recommend taping or kinesiotaping for acute, subacute, or chronic LBP, radicular pain syndromes or other back-related conditions.

González-Iglesias et al (2009) examined the short-term effects of Kinesio taping, applied to the cervical spine, on neck pain and cervical ROM in individuals with acute whiplash-associated disorders (WADs). A total of 41 patients (21 females) were randomly assigned to 1 of 2 groups: (i) the experimental group received Kinesio taping to the cervical spine (applied with tension) and (ii) the placebo group received a sham Kinesio taping application (applied without tension). Both neck pain (11-point numerical pain rating scale) and cervical ROM data were collected at baseline, immediately after the Kinesio tape application, and

at a 24-hr follow-up by an assessor blinded to the treatment allocation of the patients. Mixed-model analyses of variance (ANOVAs) were used to examine the effects of the treatment on each outcome variable, with group as the between-subjects variable and time as the within-subjects variable. The primary analysis was the group-by-time interaction. The group-by-time interaction for the 2-by-3 mixed-model ANOVA was statistically significant for pain as the dependent variable ($F = 64.8$; $p < 0.001$), indicating that patients receiving Kinesio taping experienced a greater decrease in pain immediately post-application and at the 24-hr follow-up (both, $p < 0.001$). The group-by-time interaction was also significant for all directions of cervical ROM: flexion ($F = 50.8$; $p < 0.001$), extension ($F = 50.7$; $p < 0.001$), right ($F = 39.5$; $p < 0.001$) and left ($F = 3.8$, $p < 0.05$) lateral flexion, and right ($F = 33.9$, $p < 0.001$) and left ($F = 39.5$, $p < 0.001$) rotation. Patients in the experimental group obtained a greater improvement in ROM than those in the control group (all, $p < 0.001$). The authors concluded that patients with acute WAD receiving an application of Kinesio taping, applied with proper tension, exhibited statistically significant improvements immediately following application of the Kinesio tape and at a 24-hr follow-up. However, the improvements in pain and cervical ROM were small and may not be clinically meaningful. They stated that future studies should investigate if Kinesio taping provides enhanced outcomes when added to physical therapy interventions with proven efficacy or when applied over a longer period.

In a single-center, randomized, and double-blind study, Karadag-Saygi and colleagues (2010) evaluated the effect of kinesiointaping as an adjuvant therapy to botulinum toxin A (BTX-A) injection in lower extremity spasticity. A total of 20 hemiplegic patients with spastic equinus foot were enrolled into the study and randomized into 2 groups. The first group ($n = 10$) received BTX-A injection and kinesiointaping, and the second group ($n = 10$) received BTX-A injection and sham-taping. Clinical assessment was done before injection and at 2 weeks and 1, 3, and 6 months. Outcome measures were modified Ashworth scale (MAS), passive ankle dorsiflexion, gait velocity, and step length. Improvement was recorded in both kinesiointaping and sham groups for all outcome variables. No significant difference was found between groups other than passive range of motion (ROM), which was found to have increased more in the

kinesiotaping group at 2 weeks. The authors concluded that there is no clear benefit in adjuvant kinesiotaping application with botulinum toxin for correction of spastic equinus in stroke.

In a pilot, feasibility study, Kalichman and colleagues (2010) evaluated the effect of Kinesio taping treatment approach on meralgia paresthetica (MP) symptoms. Men (n = 6) and women (n = 4) with clinically and electromyographically diagnosed MP received application of Kinesio tape, twice-weekly for 4 weeks (8 treatment sessions in total). Main outcome measures were visual analog scale (VAS) of MP symptoms (pain/burning sensation/paresthesia), VAS global quality of life (QOL); and the longest and broadest parts of the symptom area were measured. All outcome measures significantly improved after 4 weeks of treatment. Mean VAS QOL +/- SD decreased from 69.0 +/- 23.4 to 35.3 +/- 25.2 (t = 4.3; p = 0.002). Mean VAS of MP symptoms +/- SD decreased from 60.5 +/- 20.8 to 31.4 +/- 26.6 (t = 5.9; p > 0.001). Length and width of affected area decreased from 25.5 +/- 5.5 to 13.7 +/- 6.7 (t = 5.1; p > 0.001) and 15.3 +/- 2.1 to 7.4 +/- 4.3 (t = 5.3; p > .001), respectively. The authors concluded that Kinesio taping can be used in the treatment of MP. Moreover, they stated that future randomized, placebo-controlled trials should be designed with patients and assessors blind to the type of intervention.

Kaya et al (2011) compared the effectiveness of Kinesio tape and physical therapy modalities in patients with shoulder impingement syndrome. Patients (n = 55) were treated with Kinesio tape (n = 30) 3 times by intervals of 3 days or a daily program of local modalities (n = 25) for 2 weeks. Response to treatment was evaluated with the Disability of Arm, Shoulder, and Hand scale. Patients were questioned for the night pain, daily pain, and pain with motion. Outcome measures except for the Disability of Arm, Shoulder, and Hand scale were assessed at baseline, first, and second weeks of the treatment. Disability of Arm, Shoulder, and Hand scale was evaluated only before and after the treatment. Disability of Arm, Shoulder, and Hand scale and VAS scores decreased significantly in both treatment groups as compared with the baseline levels. The rest, night, and movement median pain scores of the Kinesio taping (20, 40, and 50, respectively) group were statistically significantly lower (p values were 0.001, 0.01, and 0.001, respectively) at the first week examination as compared with the physical therapy group (50, 70,

and 70, respectively). However, there was no significant difference in the same parameters between the two groups at the second week (0.109, 0.07, and 0.218 for rest, night, and movement median pain scores, respectively). Disability of Arm, Shoulder, and Hand scale scores of the Kinesio taping group were significantly lower at the second week as compared with the physical therapy group. No side effects were observed. Kinesio tape has been found to be more effective than the local modalities at the first week and was similarly effective at the second week of the treatment. The authors stated that Kinesio taping may be an alternative treatment option in the treatment of shoulder impingement syndrome especially when an immediate effect is needed. The findings of this small study need to be validated by well-designed studies.

Ankle sprains are common in sports and the fibularis muscles play a role in providing functional stability of the ankle. Prophylactic ankle taping with non-elastic sports tape has been used to restrict ankle inversion, while Kinesio tape is elastic and has not been studied for that purpose. In a controlled study, Briem and colleagues (2011) examined the effect of 2 adhesive tape conditions compared to a no tape condition on muscle activity of the fibularis longus during a sudden inversion perturbation in male athletes (soccer, team handball, basketball). A total of 51 male premier-league athletes were tested for functional stability of both ankles with the Star Excursion Balance Test. Based on the results, those with the 15 highest and those with the 15 lowest stability scores were selected for further testing. Muscle activity of the fibularis longus was recorded with surface electromyography during a sudden inversion perturbation. Each participant was tested under 3 conditions: (i) with the ankle taped with non-elastic, white sports tape, (ii) Kinesio tape, and (iii) with no tape. Differences in mean muscle activity were evaluated with a 3-way mixed model ANOVA for the 3 conditions across four 500-ms time-frames (within subject factors) and between the 2 groups of stable versus unstable participants (between subjects factor). Differences in peak muscle activity and in the time to peak muscle activity were evaluated with a 2-way mixed model ANOVA for the 3 conditions (within subjects factor), between the 2 groups (between subjects factor). Significantly greater mean muscle activity was found when ankles were taped with non-elastic tape compared to no tape, while Kinesio tape had no significant effect on mean or maximum muscle activity compared to the

no tape condition. Neither stability level nor taping condition had a significant effect on the amount of time from perturbation to maximum activity of the fibularis longus muscle. The authors concluded that non-elastic sports tape may enhance dynamic muscle support of the ankle. The efficacy of Kinesio tape in preventing ankle sprains via the same mechanism is unlikely as it had no effect on muscle activation of the fibularis longus.

Pfeiffer et al (2004) evaluated the effectiveness of McConnell medial glide taping after exercise using an MRI extremity scanner. A total of 18 healthy women (mean age of 22.28 +/- 2.02 years) participated in the study. The patello-femoral joint was imaged at 4 knee flexion angles (0 degrees, 12 degrees, 24 degrees, and 36 degrees) in 3 conditions (no tape, with McConnell taping-medial glide, and with tape after exercise). Effectiveness was determined by measuring lateral patellar displacement. ANOVA and post-hoc paired t tests were used to test for changes in lateral patellar displacement at each knee angle and condition. Statistical analysis revealed significant differences in lateral patellar displacement at all test angles, between the tape and no tape and between tape and tape after exercise conditions. The authors concluded that McConnell medial glide taping resulted in significant medial glide of the patello-femoral joint at all 4 knee angles before but not after exercise. However, McConnell medial glide taping may be effective under controlled rehabilitation conditions in which exercise is less intense.

Aminaka and Gribble (2005) examined the effectiveness of patellar taping on pain control, patellar alignment, and neuromuscular control (i.e., vastus medialis oblique activation, knee extensor moment, etc.) in subjects with patello-femoral pain syndrome (PFPS). These investigators searched MEDLINE, SPORT Discus, PEDro, and CINAHL through December 2004, using the key words patellar taping, therapeutic taping, McConnell taping, taping, chronic injury, patello-femoral pain, and knee. Criteria for inclusion criteria were studies that exclusively recruited patients diagnosed with PFPS or anterior knee pain and outcome measures specific to pain reduction, neuromuscular control, and patellar positioning. These researchers identified and reviewed 16 studies with an average PEDro score of 4.25/10. Articles were divided into 3 categories based on primary outcome measures: 4 randomized controlled trials on treatment methods and pain, 9 studies on neuromuscular control,

and 3 on patellar positioning. The authors concluded that although patellar taping seems to reduce pain and improve function in people with PFPS during activities of daily living and rehabilitation exercise, strong evidence to identify the underlying mechanisms is still not available.

Derasari et al (2010) quantified the changes in the 6-degrees-of-freedom patello-femoral kinematics due to taping in patients with PFPS. A within-subject design and a sample of convenience were used. A total of 14 volunteers (19 knees) who were diagnosed with patello-femoral pain that was present for 1 year or longer were included in this study. Each knee had to meet at least 1 of the following inclusion criteria: Q-angle of greater than or equal to 15 degrees, a positive apprehension test, patellar lateral hypermobility (greater than or equal to 10 mm), or a positive "J sign". Each knee underwent 2 randomly ordered testing conditions (un-taped and taped). A full fast-phase contrast (PC) magnetic resonance image set was acquired for each condition while the participants volitionally extended and flexed their knee. Three-dimensional displacements and rotations were calculated through integration of the fast-PC velocity data. Statistical comparisons between baseline patello-femoral kinematics and the change in kinematics due to taping were performed using a 2-tailed paired Student t test. Correlations between baseline patello-femoral kinematics and the change in kinematics due to taping also were quantified. Patellar taping resulted in a significant patello-femoral inferior shift. The strongest correlation existed between the change in lateral-medial displacement with taping and baseline ($r = -0.60$). The authors concluded that the inferior shift in patellar displacement with taping partially explains the previously documented decrease in pain due to increases in contact area. The lack of alteration in 5 of the 6 kinematic variables with taping may have been due to the fact that post-taping kinematic alterations are sensitive to the baseline kinematic values.

Chang and colleagues (2015) performed a systematic review comparing the effects of Kinesio taping with McConnell taping as a method of conservative management of patients with PFPS. Medline, PubMed, Embase, AMED, and the Cochrane Central Register of Control Trials electronic databases were searched through July 2014. Controlled studies evaluating the effects of Kinesio or McConnell taping in PFPS patients were retrieved. A total of 91 articles were selected from the articles that were retrieved from the databases, and 11 articles were

included in the analysis. The methods, evaluations, and results of the articles were collected, and the outcomes of patellar tapings were analyzed. Kinesio taping can reduce pain and increase the muscular flexibility of PFPS patients, and McConnell taping also had effect in pain relief and patellar alignment. Meta-analysis showed small effect in pain reduction and motor function improvement and moderate effect in muscle activity change among PFPS patients using Kinesio taping. The authors concluded that Kinesio taping and McConnell taping are 2 types of patellar taping used to treat patients with PFPS. Kinesio taping could be applied to muscles to relieve pain, but there was a lack of evidence on effect of the effects of taping on patellar alignment correction. McConnell taping could adjust patellar alignment and tracking but did not improve proprioception and motor function for PFPS. Based on the current review study, both types of taping significantly improved muscle activity, motor function, and QOL, benefits which are possibly facilitated by pain relief. Moreover, they stated that further research examining the mechanism of pain relief is needed.

Leibbrandt and Louw (2015) reviewed the available evidence for the effect of McConnell taping on knee biomechanics in individuals with anterior knee pain. The PubMed, Medline, Cinahl, SPORTDiscus, PEDro and ScienceDirect electronic databases were searched from inception until September 2014. Experimental research on knee biomechanical or EMG outcomes of McConnell taping compared with no tape or placebo tape were included. Two reviewers completed the searches, selected the full text articles, and assessed the risk of bias of eligible studies. Authors were contacted for missing data. A total of 8 heterogeneous studies with a total sample of 220 were included in this review. All of the studies had a moderate-to-low risk of bias. Pooling of data was possible for 3 outcomes: average knee extensor moment, average VMO/VL ratio and average VMO-VL onset timing. None of these outcomes revealed significant differences. The authors concluded that the evidence is currently insufficient to justify routine use of the McConnell taping technique in the treatment of anterior knee pain. They stated that there is a need for more evidence on the etiological pathways of anterior knee pain, level I evidence, and studies investigating other potential mechanisms of McConnell taping.

The 2016 Patellofemoral pain consensus statement from the 4th International Patellofemoral Pain Research Retreat, Manchester (Crossley et al, 2016) stated that “Whether patellar taping should be first-line treatment for patellofemoral pain was unclear to this expert panel.

This conclusion was consistent with the ‘Best Practice Guide’13 findings. Patellar taping approaches vary considerably with respect to the type and duration of taping, and the systematic reviews that synthesize these studies have dealt with the variability inconsistently. Lack of clarity from systematic reviews may partially explain the uncertainty around the consensus voting and associated recommendations to support patellar taping. Uncertainty around the recommendations for taping might also reflect that greater consideration of individual patient needs may be required. For example, in Barton et al (2015)’s synthesis, the experts described that targeting the taping to suit individual patient presentations was an important consideration. Patellar taping and bracing could play a role in patellofemoral pain management in combination with other treatments (i.e., as part of a combined intervention as described above), but their role in isolation is yet to be fully determined. Other adjunctive treatments, such as joint mobilizations (patella, knee, lumbar), and electrophysical agents were not recommended for use in patellofemoral pain”.

Ho and co-workers (2017) examined the effects of 2 taping approaches (Kinesio and McConnell) on patellofemoral joint (PFJ) alignment and contact area. A total of 14 female subjects with patello-femoral pain and PFJ mal-alignment participated. Each subject underwent a pre-taping magnetic resonance imaging (MRI) scan session and 2 MRI scan sessions after the application of the 2 taping techniques, which aimed to correct lateral patellar displacement. Subjects were asked to report their pain level prior to each scan session. During MRI assessment, subjects were loaded with 25 % of body weight on their involved/more symptomatic leg at 0°, 20°, and 40° of knee flexion. The outcome measures included patellar lateral displacement (bisect-offset [BSO] index), medio-lateral patellar tilt angle, patellar height (Insall-Salvati ratio), contact area, and pain. Patello-femoral joint alignment and contact area were compared among the 3 conditions (no tape, Kinesio, and McConnell) at 3 knee angles using a 2-factor, repeated-measures analysis of variance. Pain was compared among the 3 conditions using the Friedman test and post-hoc Wilcoxon signed-rank tests. The results

did not reveal any significant effects of either McConnell or Kinesio taping on the BSO index, patellar tilt angle, Insall-Salvati ratio, or contact area across the 3 knee angles, whereas knee angle had a significant effect on the BSO index and contact area. A reduction in pain was observed after the application of the Kinesio taping technique. The authors concluded that in a weight-bearing condition, this preliminary study did not support the use of PFJ taping as a medial correction technique to alter the PFJ contact area or alignment of the patella.

MEDEK Therapy

MEDEK, a form of physiotherapy, refers to Metodo Dinamico de Estimulacion Kinesica or Dynamic Method for Kinetic Stimulation. It was developed by a Chilean physical therapist in the 1970s. MEDEK is used for developing gross motor skills in children with physical disabilities and movement disorders (e.g., cerebral palsy, Down syndrome, hypotonia, muscular dystrophy, and developmental motor delay). It does not focus on modifying muscle tone, primitive reflexes or abnormal patterns of movement. It focuses on training movements leading to sitting, standing, and walking. Muscles are trained in postural and functional tasks rather than in isolation. Tight muscles are stretched in dynamic situations. The motor developmental sequence is not used. MeDEK assumes that different skills require different movement strategies. Unlike other interventions, tasks are performed without the child's attention, conscious thought or co-operation. It is assumed that motivation will increase temporary performance only but will not create a permanent change. The therapist's task is to provoke automatic postural reactions that contribute to the postural control needed for functional tasks. Well-designed clinical studies are needed to ascertain the effectiveness of MEDEK.

Hands-Free Ultrasound

Gulick (2010) noted that a "hands-free" ultrasound (US) device was recently introduced by Rich-Ma, Inc. This unit allows the clinician to choose the mode of US delivery, using either a hand-held (manual) transducer or a hands-free device that pulses the US beam through the transducer. However, the Center for Medicare and Medicaid Services has deemed delivery of US via a hands-free unit to be investigational. This investigator examined the effectiveness of tissue heating with a hands-

free US technique compared to a hand-held US transducer using the Rich-Mar AutoSound unit. A total of 40 volunteers over 18 years of age participated. Treatment was provided at a 3-MHz US frequency. Muscle temperature was measured with 26-gauge, 4-cm Physiotemp thermistors placed in the triceps surae muscle. The depth of thermistor placement was at 1-cm and 2-cm deep. One calf was treated with a manual transducer (5-cm²) US head at 3 times the effective radiating area [ERA]), and one calf was treated with the hands-free transducer (14-cm² [ERA]). Both methods used a 1.5 W/cm² intensity for 10 mins. The manual technique used an overlapping circular method at 4 cm/sec, and the hands-free method used a sequential pulsing at 4 cm/sec. Tissue temperatures were recorded at baseline and every 30 seconds. The hands-free technique resulted in a tissue temperature increase from 33.68 to 38.7 degrees C and an increase from 33.45 to 40.1 degrees C using the manual technique at 1-cm depth. The tissue temperature increase at the 2-cm depth was from 34.95 to 35.44 degrees C for the hands-free device and 34.44 to 38.42 degrees C for the manual device. Thus, there was a significant difference between the hands-free and the manual mode of US delivery for the 3-MHz frequency (5.02 degrees C versus 6.65 degrees C at 1 cm and 1.49 degrees C versus 3.98 degrees C at 2 cm). In this study, the "hands-free" device did not result in the same level of tissue heating as the manual technique. The hands-free device has the advantage of not needing a clinician present to deliver the modality but a therapeutic level of heating was not achieved at the 2-cm tissue depth. Thus, the effectiveness of the "hands-free" treatment is in question.

Hivamat Therapy (Deep Oscillation Therapy)

Hivamat therapy (deep oscillation therapy) utilizes an intermittent electrostatic field via a Hivamat machine. It supposedly penetrates deeper into the body tissue than manual methods, allowing previously "untreatable" injuries to be manipulated with a minimum of physical pressure. Electrostatic waves create a kneading effect deep within the damaged tissues, restoring flexibility and blood supply to the affected area.

Aliyev (2009) noted that in Germany approximately 2 million sports injuries occur per year. Most common are distortions and ligamentous injury going along with post-traumatic lymphedema. Deep oscillation therapy provided very good results in lymph drainage and in other indications. The purpose of this experimental study was the evaluation of the effects of deep oscillation therapy in immediate therapy and after-care of different sports injuries in addition to usual care (complex physical and medical therapy). Two soccer teams were supported by a sports medicine section of a rehabilitation hospital. In 14 people (mean age of 23.9 years), 49 sports injuries of different kind were treated. Subjective rating of the symptoms by VAS improved significant ($p = 0.001$) from 8.7 (baseline) to 2.1 points (post-treatment). Objective rating by the attending physician according to different clinically relevant parameters lead to "very good" or "good" results in 90 % of the patients. The authors concluded that deep oscillation therapy is an easy to use and comparably cost-effective adjuvant therapy option. These investigators already had good experience with it in other indications concerning re-absorption of edema, reducing pain, anti-inflammatory effect, promotion of motoricity, promotion of wound healing, anti-fibrotic effect and improvement in trophicity and quality of the tissue. All these mentioned effects can be confirmed in the treatment of patients with acute sports injury and trauma. The soft mode of action is the reason that in contrast to other electric and mechanical therapies it is no contraindication in immediate therapy. In general the authors noted no side effects; patients were highly compliant and rated this therapy as very good. Limitations of this small study ($n = 14$) were its retrospective and uncontrolled nature; findings were also confounded by the concomitant use of usual care.

Applied Functional Science

Applied Functional Science (AFS) combines physical sciences, biological sciences, and behavioral sciences to create a system for functional assessment, rehabilitation, training and conditioning, as well as injury prevention. The advocates of AFS note that these principles, integrated with neuromusculoskeletal Chain Reaction™ biomechanics, lead to strategies that guide the decision-making process. However, there is a lack of evidence regarding the clinical value of this approach.

Myofascial Physical Therapy for Pelvic Pain Syndromes

Fitzgerald et al (2013) determined the feasibility of conducting a randomized clinical trial designed to compare 2 methods of manual therapy (myofascial physical therapy and global therapeutic massage) in patients with urological chronic pelvic pain syndromes. They recruited 48 subjects with chronic prostatitis/chronic pelvic pain syndrome or interstitial cystitis/painful bladder syndrome at 6 clinical centers. Eligible patients were randomized to myofascial physical therapy or global therapeutic massage and were scheduled to receive up to 10 weekly treatments of 1-hour each. Criteria to assess feasibility included adherence of therapists to prescribed therapeutic protocol as determined by records of treatment, adverse events during study treatment and rate of response to therapy as assessed by the patient global response assessment. Primary outcome analysis compared response rates between treatment arms using Mantel-Haenszel methods. There were 23 (49 %) men and 24 (51 %) women randomized during a 6-month period. Of the patients 24 (51 %) were randomized to global therapeutic massage, 23 (49 %) to myofascial physical therapy and 44 (94 %) completed the study. Therapist adherence to the treatment protocols was excellent. The global response assessment response rate of 57 % in the myofascial physical therapy group was significantly higher than the rate of 21 % in the global therapeutic massage treatment group ($p = 0.03$). The authors concluded the preliminary findings of a beneficial effect of myofascial physical therapy warrants further study. They stated that they are conducting a second small study comparing myofascial physical therapy and global therapeutic massage (with a sample size of approximately 90 at 11 sites).

Pontari and Giusto (2013) described new developments in the diagnosis and treatment of chronic prostatitis/chronic pelvic pain syndrome (CPPS). Symptoms in men with chronic prostatitis/CPPS appear to cluster into a group with primarily pelvic or localized disease, and a group with more systemic symptoms. Several other chronic pain conditions can be associated with chronic prostatitis/CPPS, including irritable bowel syndrome, fibromyalgia, and chronic fatigue syndrome. Markers of neurologic inflammation and autoimmune disease parallel changes in symptoms after treatment. Treatment options include new alpha-blockers, psychological intervention, and prostate-directed therapy. The areas of acupuncture and pelvic floor physical therapy/myofascial release have received increased recent attention and appear to be good options in these patients. Future therapy may include antibodies to mediators of

neurogenic inflammation and even treatment of bacteria in the bowel. The authors concluded that the diagnosis of chronic prostatitis/CPSP must include conditions traditionally outside the scope of urologic practice but important for the care of men with chronic pelvic pain. The treatment is best done using multiple simultaneous therapies aimed at the different aspects of the condition.

Fitzgerald et al (2013) determined the feasibility of conducting a randomized clinical trial designed to compare 2 methods of manual therapy (myofascial physical therapy and global therapeutic massage) in patients with urological CPSP. These researchers recruited 48 subjects with chronic prostatitis/CPSP or interstitial cystitis/painful bladder syndrome at 6 clinical centers. Eligible patients were randomized to myofascial physical therapy or global therapeutic massage and were scheduled to receive up to 10 weekly treatments of 1 hour each. Criteria to assess feasibility included adherence of therapists to prescribed therapeutic protocol as determined by records of treatment, adverse events during study treatment and rate of response to therapy as assessed by the patient global response assessment. Primary outcome analysis compared response rates between treatment arms using Mantel-Haenszel methods. There were 23 (49 %) men and 24 (51 %) women randomized during a 6-month period. Of the patients 24 (51 %) were randomized to global therapeutic massage, 23 (49 %) to myofascial physical therapy and 44 (94 %) completed the study. Therapist adherence to the treatment protocols was excellent. The global response assessment response rate of 57 % in the myofascial physical therapy group was significantly higher than the rate of 21 % in the global therapeutic massage treatment group ($p = 0.03$). The authors concluded that they judged the feasibility of conducting a full-scale trial of physical therapy methods and the preliminary findings of a beneficial effect of myofascial physical therapy warrants further study.

The European Association of Urology's guidelines on chronic pelvic pain (Engeler et al, 2012) stated that "There are insufficient data on the effectiveness of myofascial physical therapy for the treatment of PPS (prostate pain syndrome)".

Krauss et al (2011) stated that hip osteoarthritis (OA) is a disease with a major impact on both national economy and the patients themselves.

Patients suffer from pain and functional impairment in ADL that are associated with a decrease in QOL. Conservative therapeutic interventions such as physical exercises aim at reducing pain and increasing function and health-related QOL. However, there is only silver level evidence for efficacy of land-based physical exercise in the treatment of hip OA. The purpose of this randomized controlled trial (RCT) is to examine if the specific 12-week exercise regime "Hip School" can decrease bodily pain and improve physical function and QOL in subjects with hip OA. A total of 217 participants with hip OA, confirmed using the clinical score of the American College of Rheumatology, are recruited from the community and randomly allocated to one of the following groups: (i) exercise regime "Hip School", n = 70; (ii) non-intervention control group, n = 70; (iii) "sham" ultrasound group, n = 70; and (iv) ultrasound group, n = 7. The exercise regime combines group exercises (1/week, 60 to 90 mins) and home-based exercises (2/week, 30 to 40 mins). Sham ultrasound and ultrasound are given once-weekly (15 mins). Measures were taken directly prior to (M1) and after (M2) the 12-week intervention period. Two follow-ups are conducted by phone 16 and 40 weeks after the intervention period. The primary outcome measure is the change in the subscale bodily pain of the SF36 from M1 to M2. Secondary outcomes comprise the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score, SF36, isometric strength of hip muscles, spatial-temporal and discrete measures derived from clinical gait analysis, and the length of the center of force path in different standing tasks. An intention-to-treat analysis will be performed using multi-variate statistics (group \times time). The authors concluded that results from this trial will contribute to the evidence regarding the effect of a hip-specific exercise regime on physical function, pain, and health-related QOL in patients with hip OA.

French et al (2013) determined the effectiveness of exercise therapy (ET) compared with ET with adjunctive manual therapy (MT) for people with hip OA; and identified if immediate commencement of treatment (ET or ET+MT) was more beneficial than a 9-week waiting period for either intervention. Patients (n = 131) with hip OA recruited from general practitioners, rheumatologists, orthopedic surgeons, and other hospital consultants were randomized to 1 of 3 groups: ET (n = 45), ET+MT (n = 43), and wait-list controls (n = 43). Participants in both the ET and

ET+MT groups received up to 8 treatments over 8 weeks. Control group participants were re-randomized into either ET or ET+MT groups after 9 week follow-up. Their data were pooled with original treatment group data: ET (n = 66) and ET+MT (n = 65). The primary outcome was the WOMAC physical function (PF) subscale. Secondary outcomes included physical performance, pain severity, hip ROM, anxiety/depression, QOL, medication usage, patient-perceived change, and patient satisfaction. There was no significant difference in WOMAC PF between the ET (n = 66) and ET+MT (n = 65) groups at 9 weeks (mean difference of 0.09; 95 % confidence interval [CI]: -2.93 to 3.11) or 18 weeks (mean difference of 9.42; 95 % CI: -4.41 to 5.25), or between other outcomes, except patient satisfaction with outcomes, which was higher in the ET+MT group ($p = 0.02$). Improvements in WOMAC, hip ROM, and patient-perceived change occurred in both treatment groups compared with the control group. The authors concluded that self-reported function, hip ROM, and patient-perceived improvement occurred after an 8-week program of ET for patients with OA of the hip; MT as an adjunct to exercise provided no further benefit, except for higher patient satisfaction with outcome.

Bennell et al (2014) stated that there is limited evidence supporting use of physical therapy for hip OA. These investigators examined the effectiveness of physical therapy on pain and physical function in patients with hip OA. Randomized, placebo-controlled, participant- and assessor-blinded trial involving 102 community volunteers with hip pain levels of 40 or higher on a VAS of 100 mm (range of 0 to 100 mm; 100 indicates worst pain possible) and hip OA confirmed by radiograph were included for analysis. A total of 49 patients in the active group and 53 in the sham group underwent 12 weeks of intervention and 24 weeks of follow-up (May 2010 to February 2013). Participants attended 10 treatment sessions over 12 weeks. Active treatment included education and advice, manual therapy, home exercise, and gait aid if appropriate. Sham treatment included inactive ultrasound and inert gel. For 24 weeks after treatment, the active group continued unsupervised home exercise while the sham group self-applied gel 3 times weekly. Primary outcomes were average pain (0 mm, no pain; 100 mm, worst pain possible) and physical function (WOMAC, 0 no difficulty to 68 extreme difficulty) at week 13. Secondary outcomes were these measures at week 36 and impairments, physical performance, global change, psychological status, and QOL at weeks 13 and 36. A total of 96 patients (94 %) completed week 13

measurements and 83 (81 %) completed week 36 measurements. The between-group differences for improvements in pain were not significant. For the active group, the baseline mean (SD) VAS score was 58.8 mm (13.3) and the week-13 score was 40.1 mm (24.6); for the sham group, the baseline score was 58.0 mm (11.6) and the week-13 score was 35.2 mm (21.4). The mean difference was 6.9 mm favoring sham treatment (95 % CI: -3.9 to 17.7). The function scores were not significantly different between groups. The baseline mean (SD) physical function score for the active group was 32.3 (9.2) and the week-13 score was 27.5 (12.9) units, whereas the baseline score for the sham treatment group was 32.4 (8.4) units and the week-13 score was 26.4 (11.3) units, for a mean difference of 1.4 units favoring sham (95 % CI: -3.8 to 6.5) at week 13. There were no between-group differences in secondary outcomes (except greater week-13 improvement in the balance step test in the active group); 19 of 46 patients (41 %) in the active group reported 26 mild adverse effects and 7 of 49 (14 %) in the sham group reported 9 mild adverse events ($p = 0.003$). The authors concluded that among adults with painful hip OA, physical therapy did not result in greater improvement in pain or function compared with sham treatment, raising questions about its value for these patients.

Yim et al (2015) reviewed the current literature on the effect of physical therapy on healing and QOL outcomes in patients with venous leg ulcers (VLUs) and identified research gaps that warrant further investigation. PubMed (MEDLINE), CINHAHL, and Cochrane databases were searched in April 2014. These researchers found 10 articles, consisting of RCTs and single-arm cohort studies with small sample sizes that used physical therapy or exercise for patients with open or healed VLUs. Although there is evidence that exercise strengthens the calf muscle pump and improves ankle ROM, few studies have investigated the effect of these interventions on QOL and healing, and few involved the supervision of a physical therapist. The authors concluded that the lack of evidence and RCTs suggested the need for further investigation on physical therapy-oriented exercise on wound healing and QOL. In addition, more studies are needed to investigate sustainability of the increased ankle ROM after physical therapy has ended or if VLU reoccurrences are prevented.

De Groef et al (2015) reviewed the effectiveness of various post-operative physical therapy modalities and timing of physical therapy following treatment of breast cancer on pain and impaired ROM of the upper limb. These modalities include passive mobilizations, manual stretching, myofascial therapy and active exercises. These investigators searched the following databases: PubMed/MEDLINE, CINAHL, EMBASE, PEDro and Cochrane; articles published until October 2012 were included. Only (pseudo-) RCTs and non-randomized experimental trials investigating the effectiveness of passive mobilizations, manual stretching, myofascial therapy and/or exercise therapy and timing of physical therapy, following treatment for breast cancer, were reviewed. Primary outcomes were pain of the upper limb and/or ROM of the shoulder. Secondary outcomes are decreased shoulder strength, arm lymphedema, limitations in ADL, decreased quality of life and wound drainage volume. Physical therapy modalities had to be started in the first 6 weeks following surgery. Articles were selected by 2 independent researchers in 3 phases and compared for consensus. First the titles were analyzed, then the selected abstracts and finally the full texts. A total of 18 RCTs were included in the review. Three studies investigated the effect of multi-factorial therapy: 2 studies proved that the combination of general exercises and stretching is effective for the treatment of impaired ROM; another study showed that passive mobilizations combined with massage had no beneficial effects on pain and impaired ROM. Fifteen studies investigated the effectiveness of a single physical therapy modality. One study of poor quality found evidence supporting the beneficial effects of passive mobilizations. The only study investigating the effect of stretching did not find any beneficial effects. No studies were found about the effectiveness of myofascial therapy in the post-operative phase. Five studies found that active exercises were more effective compared to no therapy or compared to information on the treatment of impairments of the upper limb. Three studies supported the early start of exercises for recovery of shoulder ROM, while 4 studies supported the delay of exercises to avoid prolonged wound healing. The authors concluded that multi-factorial physical therapy (i.e. stretching and exercises) and active exercises were effective to treat post-operative pain and impaired ROM following treatment for breast cancer. Moreover, they stated that high-quality studies are needed to prove the effectiveness of passive mobilizations, stretching and

myofascial therapy as part of the multi-factorial treatment. In addition, the appropriate timing and content of the exercise programs need to be further investigated.

Michaleff et al (2014) examined the effectiveness of a comprehensive exercise program delivered by physiotherapists compared with advice in people with a chronic whiplash-associated disorder. PROMISE was a 2-group, pragmatic RCT in patients with chronic (greater than 3 months and less than 5 years) grade 1 or 2 whiplash-associated disorder.

Participants were randomly assigned by a computer-generated randomization schedule to receive either the comprehensive exercise program (20 sessions) or advice (1 session and telephone support). Sealed opaque envelopes were used to conceal allocation. The primary outcome was pain intensity measured on a 0 to 10 scale. Outcomes were measured at baseline, 14 weeks, 6 months, and 12 months by a masked assessor. Analysis was by intention-to-treat, and treatment effects were calculated with linear mixed models. A total of 172 participants were allocated to either the comprehensive exercise program (n = 86) or advice group (n = 86); 157 (91 %) were followed up at 14 weeks, 145 (84 %) at 6 months, and 150 (87 %) at 12 months. A comprehensive exercise program was not more effective than advice alone for pain reduction in the participants. At 14 weeks the treatment effect on a 0 to 10 pain scale was 0.0 (95 % CI: -0.7 to 0.7), at 6 months 0.2 (-0.5 to 1.0), and at 12 months -0.1 (-0.8 to 0.6). Central nervous system hyper-excitability and symptoms of post-traumatic stress did not modify the effect of treatment. These researchers recorded no serious adverse events. The authors concluded that simple advice is equally as effective as a more intense and comprehensive physiotherapy exercise program in the treatment of whiplash-associated disorder. They stated that the need to identify effective and affordable strategies to prevent and treat acute through to chronic whiplash associated disorders is an important health priority; future avenues of research might include improving understanding of the mechanisms responsible for persistent pain and disability, investigating the effectiveness and timing of drugs, and study of content and delivery of education and advice.

Miscellaneous Information

Zhou et al (2015) noted that management of chronic wounds remains unsatisfactory in terms of treatment cost and time required for complete wound closure (CWC). These investigators calculated the healing rates, estimated cost, and time required for CWC in wounds; compare estimated wound care costs between healing and non-healing wounds; and compared cost effectiveness between venous leg ulcer (VLU) and non-VLU. This was a retrospective cohort study performed at a physical therapy (PT) wound care clinic. De-identified patient data in the electronic medical database from September 10, 2012 to January 23, 2015 were extracted. Among 159 included patients with wounds, 119 (74.84 %) patients were healed with CWC. The included patients were treated for 109.70 ± 95.70 days, 29.71 ± 25.66 visits, and at the costs per treatment episode of $\$1,629.65 \pm 1,378.82$ per reimbursement rate and $\$2,711.42 \pm 2,356.81$ per breakeven rate. For patients with CWC (healing group), the treatment duration was 98.01 ± 76.12 days with the time for CWC as 72.45 ± 64.21 days; the cost per treatment episode was $\$1,327.24 \pm 1,143.53$ for reimbursement rate and $\$2,492.58 \pm 2,106.88$ for breakeven cost. For patients with non-healing wounds, treatment duration was found to be longer with costs significantly higher ($p < 0.01$ for all). In the healing group, no differences were found between VLU and non-VLU in treatment duration (95.46 days versus 100.88 days, $p = 0.698$), time for CWC (68.06 days versus 77.38 days, $p = 0.431$), and cost ($\$2,756.78$ versus $2,397.84$ for break-even rate, $p = 0.640$) with the exception of wound dressing costs ($\$329.19$ versus 146.47 , $p = 0.001$). Healing rates may be affected with patient exclusions. Costs at physicians' offices were not included. Incorporation of PT in wound care appeared to be cost-effective. The authors concluded that PT may thus be a good referral option for patients with wounds; however, these findings should be interpreted cautiously and further studies are needed.

Moss and colleagues (2016) stated that early PT interventions may benefit patients with acute respiratory failure by preventing or attenuating neuromuscular weakness. However, the optimal dosage of these interventions is currently unknown. These researchers examined if an intensive PT program significantly improves long-term physical functional performance when compared to a standard of care PT program. Patients who required mechanical ventilation for at least 4 days were eligible. Enrolled patients were randomized to receive PT for up to 4 weeks delivered in an intensive or standard of care manner. Physical functional

performance was assessed at 1, 3, and 6 months in survivors who were not currently in an acute or long-term care facility. The primary outcome was the Physical Functional Performance Test score at 1 month. A total of 120 patients were enrolled from 5 hospitals. Patients in the intensive PT group received 12.4 ± 6.5 sessions for a total of 408 ± 261 minutes compared to only 6.1 ± 3.8 sessions for 86 ± 63 minutes in the standard of care group ($p < 0.001$ for both analyses). Physical function assessments were available for 86 % of patients at 1 month, 76 % at 3 months, and 60 % at 6 months. In both groups, physical function was reduced yet significantly improved over time between 1, 3, and 6 months. When comparing the 2 interventions, there were no differences in the total PFP-10 scores at all 3 time-points ($p = 0.73, 0.29, \text{ and } 0.43$ respectively), or the total PFP-10 score trajectory ($p = 0.71$). The authors concluded that an intensive PT program did not improve long term physical functional performance when compared to a standard of care program.

McKenzie Method of Mechanical Diagnosis and Therapy

Flavell et al (2016) noted that physiotherapists use musculo-skeletal classification systems for patient assessment. Since its early development, the McKenzie lumbar spine assessment (MK) has been incorporated into examination algorithms and combined with a series of patho-anatomical diagnostic tests. No previous studies have used a MK and a combined examination (MK-C) to provide a detailed profile of patients, report and compare the classification characteristics of a chronic LBP (CLBP) population. In a prospective, cross-sectional study, these investigators reported the classification characteristics of a CLBP population using MK and MK-C examinations, and conducted inter-classification comparison of the MK-C for demographics, the Oswestry Disability Index (ODI), Roland Morris Disability Index (RM), Modified Somatic Perceptions Questionnaire (MSPQ), symptom duration and intensity. Results were obtained in 150 patients. Using MK, 31 % ($n = 47$) of participants were classified as inconclusive. Following MK-C only 6 % of participants remained inconclusive ($n = 9$). The most frequent MK-C classification was facet joint syndrome (FJS) (49 %). Participants with FJS were significantly older than those classified as discogenic ($p < 0.001$; 95 % CI: 3.96–to 19.74), or mixed ($p < 0.001$; 95 % CI: 5.98–to 36.41). Participants classified as discogenic had significantly higher RM

($p = 0.022$) and MSPQ ($p = 0.005$) scores than FJS. The authors concluded that results indicated that 94 % of CLBP patients could be classified using a MK-C. The most common presentation in CLBP was facet joint syndrome. Age, RM and MSPQ appeared to be distinguishing characteristics of this population. Moreover, they stated that future studies should be conducted to establish the validity and reliability of the MK-C.

Clare et al (2004) performed a systematic review of randomized clinical trials to investigate the effectiveness of McKenzie therapy in the treatment of spinal pain. Databases searched included DARE, CINAHL, CENTRAL, Embase, Medline and PEDro. To be eligible for inclusion trials had to provide treatment according to McKenzie principles and reported on 1 of the following outcomes: pain, disability, quality of life, work status, global perceived effect, medication use, health care contacts, or recurrence. A total of 6 trials were found to be eligible, all comparing McKenzie therapy to a comparison treatment. These included NSAIDs, educational booklet, back massage and back care advice, strength training, and spinal mobilization and general exercises. The data from 5 lumbar trials were pooled at short-term (less than 3 months) and from 3 at intermediate (3 to 12 months) follow-up. At short term follow-up the McKenzie therapy provided a mean 8.6 point greater pain reduction on a 0 to 100 point scale (95 % confidence interval [CI]: 3.5 to 13.7) and a 5.4 point greater reduction in disability on a 0 to 100 point scale (95 % CI: 2.4 to 8.4) than comparison. At intermediate follow-up, relative risk of work absence was 0.81 (0.46 to 1.44) favoring McKenzie, however the comparison treatments provided a 1.2 point greater disability reduction (95 % CI: -2.0 to 4.5). In the 1 cervical trial, McKenzie therapy provided similar benefits to an exercise program. The results of this review showed that for low back pain (LBP) patients McKenzie therapy resulted in a greater decrease in pain and disability in the short-term than other standard therapies. The authors concluded that making a firm conclusion on LBP treatment effectiveness is difficult because there are insufficient data on long-term effects on outcomes other than pain and disability, and no trial has yet compared McKenzie to placebo or no treatment. They stated that there are also insufficient data available on neck pain patients.

In a meta-analysis of randomized controlled trials (RCTs), Machado et al (2006) evaluated the effectiveness of the McKenzie method for LBP. Medline, Embase, PEDro, and LILACS were searched up to August 2003. Two independent reviewers extracted the data and assessed methodological quality. Pooled effects were calculated among homogeneous trials using the random effects model. A sensitivity analysis excluded trials reporting on generic McKenzie. A total of 11 trials of mostly high quality were included. McKenzie reduced pain (weighted mean difference [WMD] on a 0- to 100-point scale, -4.16 points; 95 % CI: -7.12 to -1.20) and disability (WMD on a 0- to 100-point scale, -5.22 points; 95 % CI: -8.28 to -2.16) at 1 week follow-up when compared with passive therapy for acute LBP. When McKenzie was compared with advice to stay active, a reduction in disability favored advice (WMD on a 0- to 100-point scale, 3.85 points; 95 % CI: 0.30 to 7.39) at 12 weeks of follow-up. Heterogeneity prevented pooling of studies on chronic LBP as well as pooling of studies included in the sensitivity analysis. The authors concluded that there is some evidence that the McKenzie method is more effective than passive therapy for acute LBP; however, the magnitude of the difference suggested the absence of clinically worthwhile effects. They stated that there is limited evidence for the use of McKenzie method in chronic LBP; and the effectiveness of classification-based McKenzie is yet to be established.

Hosseinifar et al (2013) compared the effectiveness of stabilization and McKenzie exercises on pain, disability, and thickness of the transverse abdominis and multifidus muscles in patients with non-specific chronic LBP. A total of 30 patients were randomly assigned into 2 groups: (i) the McKenzie and (ii) stabilization exercise groups. Before and after intervention, pain, disability, and thickness of the transverse abdominis and multifidus muscles were evaluated by visual analog scale (VAS), functional rating index, and sonography, respectively. The training program was 18 scheduled sessions of individual training for both groups. After interventions, the pain score decreased in both groups. The disability score decreased only in the stabilization group. The thickness of the left multifidus was significantly increased during resting and contracting states in the stabilization group. The thickness of the right transverse abdominis during the abdominal draw-in maneuver, and thickness of the left transverse abdominis during the active straight leg

raising maneuver were significantly increased in the stabilization group. The intensity of pain, disability score, thickness of the right transverse abdominis during the abdominal draw-in maneuver, and thickness of the left transverse abdominis during active straight leg raising in the stabilization group were greater than those on the Mackenzie. The authors concluded that stabilization exercises were more effective than McKenzie exercises in improving the intensity of pain and function score and in increasing the thickness of the transverse abdominis muscle.

Werneke et al (2014) examined the association between therapists' level of formal pre-credential McKenzie post-graduate training and agreement on the following McKenzie classification variables for patients with LBP: main McKenzie syndromes, presence of lateral shift, derangement reducibility, directional preference, and centralization. Raters (n = 47) completed multiple sets of 2 independent successive examinations at 3 different stages of McKenzie post-graduate training (levels parts A and B, part C, and part D). Agreement was assessed with κ coefficients and associated 95 % CIs. A minimum κ threshold of 0.60 was used as a pre-determined criterion for level of agreement acceptable for clinical use. Raters examined 1,662 patients (mean age of 51 ± 15 ; range of 18 to 91; females, 57 %). Data distributions were not even and were highly skewed for all classification variables. No training level studied had acceptable agreement for any McKenzie classification variable. Agreements for all levels of McKenzie post-graduate training were higher than expected by chance for most of the classification variables except parts A and B training level for judging lateral shift and centralization and part D training level for judging reducibility. Agreement between training levels parts A and B, part C, and part D were similar with overlapping 95 % CIs. The authors concluded that results indicated that level of inter-rater chance-corrected agreement of McKenzie classification system was not acceptable for therapists at any level of formal McKenzie post-graduate training. They stated that this finding raised concerns about the clinical utility of the McKenzie classification system at these training levels. They stated that additional studies are needed to assess agreement levels for therapists who receive additional training or experience at the McKenzie credentialed or diploma levels.

Hahn et al (2014) analyzed which tests, measures, and interventions are most commonly selected by physical therapists (PTs) holding a credential from the McKenzie Institute and those holding the McKenzie credential plus the credential of Fellow of the American Academy of Orthopaedic Manual Physical Therapy (FAAOMPT). Their responses were based on a simulated case vignette involving a patient with a presentation of cervical spine disk derangement. A survey administered through Survey Monkey was sent to 714 members of the McKenzie Institute who are certified or hold a diploma in mechanical diagnosis and therapy (MDT) or these credentials with the addition of Fellowship credentialing (MDT+FAAOMPT). Of the 714 surveyed PTs, 83 completed the survey for a response rate of 11.6 %. As the PTs were given further information regarding the patient, they were asked to progress through a clinical decision-making process by indicating their sequence of examination techniques, and then indicating which interventions would be performed based on the results of the examination. A descriptive analysis was conducted to determine the most common sequences chosen by the PTs based on their training. To perform the analysis, only respondents who completed the survey were included: clinicians with MDT credentials, (n=77), and clinicians with both the MDT and FAAOMPT credentials (MDT+FAAOMPT), (n=6). Initially, the most common examination chosen regardless of credential was postural analysis. After receiving additional information regarding the patient's posture, the majority of clinicians in each of the 3 groups then chose active range of motion (AROM). However, after additional information was given, the majority of the MDT group chose repeated end range cervical movements as their next examination measure, and the FAAOMPT group varied. The majority of the FAAOMPT group continued to assess the patient through an entire examination sequence, while the majority of the MDT group discontinued testing. A descriptive analysis of the intervention sequences depicted a trend toward direction of preference (DP) exercises for the MDT group (80.3 %), and passive movements or mobilization exercises for the FAAOMPT group. The authors concluded that the results of this study suggested that PTs with post-graduate training through the McKenzie Institute or through Orthopaedic Manual Physical Therapy (OMPT) Fellowship training may demonstrate an inherent bias toward their advanced training in the assessment and treatment of acute cervical

derangement. They stated that although no significant findings can be reported secondary to sample size limitations, future studies may be performed to further explore this topic.

Garcia et al (2015) noted that although the McKenzie method has been compared with several other interventions, it is not yet known whether this method is superior to placebo in patients with chronic LBP. This proposed trial will evaluate the effectiveness of the McKenzie method in patients with chronic non-specific LBP. It is an assessor-blinded, 2-arm, randomized, placebo-controlled trial. The participants will be 148 patients seeking care for chronic non-specific LBP. Participants will be randomly allocated to 1 of 2 treatment groups: (i) McKenzie method, or (ii) placebo therapy (detuned ultrasound and shortwave therapy). Each group will receive 10 sessions of 30 minutes each (2 sessions per week over 5 weeks). The clinical outcomes will be obtained at the completion of treatment (5 weeks) and at 3, 6, and 12 months after randomization. The primary outcomes will be pain intensity (measured with the Pain Numerical Rating Scale) and disability (measured with the Roland-Morris Disability Questionnaire) at the completion of treatment. The secondary outcomes will be pain intensity; disability and function; kinesiophobia and global perceived effect at 3, 6, and 12 months after randomization; and kinesiophobia and global perceived effect at completion of treatment. The data will be collected by a blinded assessor. The authors stated that this will be the 1st trial to compare the McKenzie method with placebo therapy in patients with chronic non-specific LBP.

In a randomized, blinded trial with a 12-month follow-up, Halliday et al (2015) will examine if McKenzie exercises when applied to a cohort of patients with chronic LBP who have a directional preference demonstrate improved recruitment of the transversus abdominis compared to motor control exercises when measurements were assessed from ultrasound images. A total of 70 adults with greater than 3-month history of LBP who have a directional preference will be included in this study. Interventions are McKenzie techniques or motor control exercises for 12-sessions over 8 weeks. Main outcome measures are transversus abdominis thickness measured from real time ultrasound images, pain, global perceived effect and capacity to self-manage. This study will be the 1st to investigate the possible mechanism of action that McKenzie therapy and motor control

exercises have on the recruitment of the transversus abdominus in a cohort of LBP patients sub-classified with a directional preference. Patients receiving matched exercises according to their directional preference are believed to have better outcomes than those receiving unmatched exercises. A better understanding of the mechanism of action that specific treatments such as motor control exercises or McKenzie exercises have on patients classified with a directional preference will allow therapist to make a more informed choice about treatment options.

Petersen et al (2015) identified characteristics of patients with a changeable lumbar condition, i.e., presenting with centralization or peripheralization, that were likely to benefit the most from either the McKenzie method or spinal manipulation. A total of 350 patients with chronic LBP were randomized to either the McKenzie method or manipulation. The possible effect modifiers were age, severity of leg pain, pain-distribution, nerve root involvement, duration of symptoms, and centralization of symptoms. The primary outcome was the number of patients reporting success at two months follow-up. The values of the dichotomized predictors were tested according to the pre-specified analysis plan. No predictors were found to produce a statistically significant interaction effect. The McKenzie method was superior to manipulation across all subgroups, thus the probability of success was consistently in favor of this treatment independent of predictor observed. When the 2 strongest predictors, nerve root involvement and peripheralization, were combined, the chance of success was relative risk 10.5 (95 % CI: 0.71 to 155.43) for the McKenzie method and 1.23 (95 % CI: 1.03 to 1.46) for manipulation ($p = 0.11$ for interaction effect). The authors concluded that they did not find any baseline variables which were statistically significant effect modifiers in predicting different response to either McKenzie treatment or spinal manipulation when compared to each other. However, they did identify nerve root involvement and peripheralization to produce differences in response to McKenzie treatment compared to manipulation that appear to be clinically important. They stated that these findings need testing in larger studies.

Kim et al (2015) examined the effect of a pelvis-concentrated exercise program and walking on the changes in body shape and foot base pressure. A total of 30 adults were randomly divided into the Swiss-ball exercise group and McKenzie exercise group, and they conducted

exercise for 40 minutes 3 times a week for 6 weeks. Global postural system results and foot base pressure significantly decreased in both groups. A comparison of foot base pressure after the intervention between the 2 groups revealed that the Swiss-ball exercise group exhibited a greater reduction than the McKenzie exercise group. The authors concluded that the findings of this study indicated that the Swiss-ball exercise may improve posture and foot base pressure in male adults.

In a case report, Bowser and Swanson (2016) demonstrated the assessment, intervention, and clinical outcomes of a subject classified as having a shoulder derangement syndrome using the McKenzie Method of mechanical diagnosis and therapy (MDT) methodology. The subject was a 52-year old female with a 4-week history of insidious onset left shoulder pain, referred to physical therapy with a medical diagnosis of adhesive capsulitis. She presented with pain (4 to 7/10 on the VAS) and decreased shoulder ROM that limited her ADL and work capabilities (Upper Extremity Functional Index (UEFI) score: 55/80); AROM/PROM) were limited in all planes. Repeated motion testing was performed, with an immediate reduction in pain and increased shoulder motion in all planes following repeated shoulder extension. As a consequence, her MDT classification was determined to be derangement syndrome. Treatment involved specific exercises, primarily repeated motions, identified as symptom alleviating during the evaluation process. The author noted that the subject demonstrated significant improvements in the UEFI (66/80), VAS (0 to 2/10), and ROM within 6 visits over 8 weeks. At the conclusion of treatment, AROM/PROM was observed to be equal to the right shoulder without pain. The authors concluded that the patient demonstrated improved symptoms and functional abilities following evaluation and treatment using MDT methodology. Moreover, they stated that while a cause-effect relationship cannot be determined with a single case, MDT methodology may be a useful approach to the examination, and potentially management, of patients with shoulder pain. These researchers stated that more research is needed to compare the outcomes of individuals treated with MDT methodology versus those treated with traditional therapy methods, and to determine if this is a valid approach for treatment of the extremities.

In a RCT, Waqqar et al (2016) compared the effects of McKenzie extension exercises program (EEP) versus Mulligan Sustained Natural

Apophyseal Glides (SNAGs) for chronic mechanical LBP (CMLBP). The inclusion criteria were patients of both gender and age range of 30 to 70 years with minimum 4 weeks history of CMLBP. A total of 37 patients were screened out as per inclusion criteria and randomly placed into 2 groups: (i) 20 patients in group A were treated with Mulligan SNAGs, and (ii) 17 patients in group B with McKenzie EEP for 4 weeks at 2 session per week and single session per day; VAS, Oswestry Disability Scale (ODI) and lumbar ROM were used as an assessment tools and were measured at baseline and at the completion 4 weeks intervention. The data was analyzed with SPSS to draw the statistical and clinical significance of both interventions. At the completion of 4 weeks intervention the pre- and post- statistical analysis revealed that clinically the McKenzie EEP improved pain (mean 9.12 to 1.46) and disability (73.82 to 6.24) slightly more than Mulligan SNAGs (pain: from 8.85 to 2.55, disability 73.75 to 7.05), while the Mulligan SNAGs improved lumbar ROM more effectively than McKenzie EEP in all directions including flexion, extension, side bending and rotation. Statistically there was no significant difference between the effects of 2 interventions in managing pain and disability, and improving Lumbar ROM. The authors concluded that the McKenzie EEP is clinically slightly more effective in the management of pain and disability as compared with Mulligan SNAGs, while Mulligan SNAGs are more effective in the improvement of lumbar ROM as compared with Mechanize EEP in the management of CMLBP. Moreover, these researchers stated that their recommendations are to conduct further studies with large sample size and long duration of intervention for the investigation of long-term effects of both interventions in chronic mechanical and other types of LBP.

Furthermore, an UpToDate review on “Physical therapy and other rehabilitation issues in the palliative care setting” (Montagnini and Javier, 2017) does not mention McKenzie exercises/physical therapy.

Manual Physical Therapy for Hip Pain

In a retrospective, chart-review study, Galleher and colleagues (2017) evaluated the benefit of adding manual therapy (MT) to PT care in pediatric patients with anterior hip pain; assessed the relative risk of adverse reactions when MT was used; and reported the types of MT used. This study included patients who were treated in a hospital-based

sports medicine clinic. The charts of 201 patients (mean age of 14.23 ± 2.15 years) met the inclusion criteria and were reviewed. Patients were grouped into those who received MT during their episode of care, and those who did not. Pain efficiency (change in pain/number of visits), number and type of adverse reactions, as well as frequency and type of manual therapy interventions used, were the main health outcomes. The mean pain efficiency was significantly less if MT was carried out (MT = 0.60 [95 % CI: 0.47 to 0.72], no MT = 0.80 [95 % CI: 0.71 to 0.90] $p = 0.01$). There was no significant difference between groups in risk of adverse reactions (MT = 5, no MT = 5). The number of visits was significantly different between groups (MT = 9.43 ± 3.9 sessions, and no MT = 7.6 ± 5.2 sessions). The authors concluded that MT did not increase the risk of an adverse reaction in pediatric patients with anterior hip pain. However, while it appeared to be a safe intervention, it did not improve pain efficiency or patient adherence. They stated that future research should be performed to evaluate the effectiveness of MT, when performed by skilled therapists, in pediatric patients with hip pain in a controlled manner. Level of Evidence = IIIb.

Physical Therapy for Femoro-Acetabular Impingement Syndrome

Mansell and associates (2018) noted that arthroscopic hip surgery has risen 18-fold in the past decade; however, there is a dearth of clinical trials comparing surgery with non-operative management. In a RCT, these researchers determined the comparative effectiveness of surgery and physical therapy for femoro-acetabular impingement (FAI) syndrome. Patients were recruited from a large military hospital after referral to the orthopedic surgery clinic and were eligible for surgery. Of 104 eligible patients, 80 elected to participate, and the majority were active-duty service members (91.3 %). No patients withdrew because of adverse events (AEs). These investigators randomly selected patients to undergo either arthroscopic hip surgery (surgery group) or PT (rehabilitation group). Patients in the PT group began a 12-session supervised clinic program within 3 weeks, and patients in the surgery group were scheduled for the next available surgery at a mean of 4 months after enrollment. Patient-reported outcomes of pain, disability, and perception of improvement over a 2-year period were collected. The primary outcome was the Hip Outcome Score (HOS; range of 0 to 100 [lower scores indicating greater disability]; 2 subscales: activities of daily living

and sport). Secondary measures included the International Hip Outcome Tool (iHOT-33), Global Rating of Change (GRC), and return to work at 2 years. The primary analysis was on patients within their original randomization group. Statistically significant improvements were seen in both groups on the HOS and iHOT-33, but the mean difference was not significant between the groups at 2 years (HOS activities of daily living, 3.8 [95 % CI: -6.0 to 13.6]; HOS sport, 1.8 [95 % CI: -11.2 to 14.7]; iHOT-33, 6.3 [95 % CI: -6.1 to 18.7]). The median GRC across all patients was that they "felt about the same" (GRC = 0). Two patients assigned to the surgery group did not undergo surgery, and 28 patients in the PT group ended up undergoing surgery. A sensitivity analysis of "actual surgery" to "no surgery" did not change the outcome; 20 (33.3 %) patients who underwent surgery and 4 (33.3 %) who did not undergo surgery were medically separated from military service at 2 years. The authors concluded that there was no significant difference between the groups at 2 years. Most patients perceived little to no change in status at 2 years, and 1/3 of military patients were not medically fit for duty at 2 years. Drawbacks of this study included a single hospital, a single surgeon, and a high rate of cross-over. Level of Evidence = I.

Physical Therapy for Lumbar Spinal Stenosis

Minetama and co-workers (2018) stated that the efficacy of PT for patients with lumbar spinal stenosis (LSS) has been reported only for the short-term, and few reports have compared outcomes of surgical treatment with non-surgical treatment after PT. These researchers evaluated 2-year outcomes of LSS patients treated with surgery or under follow-up observation after PT for 6 weeks. Patients presenting with neurogenic claudication, radiologically-confirmed central LSS affecting both legs and refractory symptoms to pharmacotherapy of more than 3 months were enrolled. Patients were treated with MT, stretching and strengthening exercises, and body weight-supported treadmill walking once-weekly for 6 weeks. Clinical outcomes were measured using the Zurich Claudication Questionnaire (ZCQ), VAS of LBP, leg pain, and numbness, the Japanese Orthopedic Association Back Pain Evaluation Questionnaire and the SF-36. Two years after PT, patients were classified into the observation group (Group I) or the surgery group (Group II), whose patients failed to respond to PT and wanted to undergo surgery. A total of 38 patients were enrolled; 28 had complete data at 2

years: 21 and 7 in Groups I and II, respectively. Group II had a higher body mass index (BMI) than Group I. There were no significant differences in clinical outcomes at baseline. Six weeks after PT, Group I had significantly better outcomes for symptom severity and physical function on the ZCQ subscales, physical functioning and bodily pain on the SF-36 subscales. These outcomes in Group I were maintained or improved and did not differ significantly between groups at 2-years.

However, the physical function on the ZCQ subscales was improved in Group II more than those in Group I (MD of -0.6; 95 % CI: -1.2 to -0.03, $p < 0.05$) at 2 years. The authors concluded that at 2 years, the outcomes except for the change in physical function score in the ZCQ subscale did not differ significantly between patients who had undergone surgery and those who avoided surgery.

Early Surgery versus Physical Therapy on Knee Function Among Patients With Non-Obstructive Meniscal Tears

van de Graaf and colleagues (2018) stated that despite recent studies suggesting arthroscopic partial meniscectomy (APM) is not more effective than PT, the procedure is still frequently performed in patients with meniscal tears. In a multi-center, randomized clinical trial, these investigators examined if PT is non-inferior to APM for improving patient-reported knee function in patients with meniscal tears. This study was conducted in 9 hospitals in the Netherlands. Participants were aged 45 to 70 years with non-obstructive meniscal tears (i.e., no locking of the knee joint). Patients with knee instability, severe OA, and BMI greater than 35 were excluded. Recruitment took place between July 17, 2013, and November 4, 2015. Participants were followed-up for 24 months (final participant follow-up was October 11, 2017). A total of 321 subjects were randomly assigned to APM ($n = 159$) or a pre-defined PT protocol ($n = 162$). The PT protocol consisted of 16 sessions of exercise therapy over 8 weeks focused on coordination and closed kinetic chain strength exercises. The primary outcome was change in patient-reported knee function on the International Knee Documentation Committee Subjective Knee Form (range of 0 to 100; from worse to best) from baseline over a 24-month follow-up period. The non-inferiority margin was defined as a difference between treatment groups of 8 points and was assessed with a 1-sided α of 0.025. The primary analysis followed the intention-to-treat (ITT) principle. Among 321 patients who were randomized (mean [SD]

age of 58 [6.6] years; 161 women [50 %]), 289 (90 %) completed the trial (161 women and 158 men). In the PT group, 47 participants (29 %) had APM during the 24-month follow-up period, and 8 participants randomized to APM (5 %) did not have APM. Over a 24-month follow-up period, knee function improved in the APM group by 26.2 points (from 44.8 to 71.5) and in the PT group by 20.4 points (from 46.5 to 67.7). The overall between-group difference was 3.6 points (97.5 % CI: -∞ to 6.5; p value for non-inferiority = 0.001); AEs occurred in 18 participants in the APM group and 12 in the PT group. Repeat surgery (3 in the APM group and 1 in the PT group); and additional out-patient visits for knee pain (6 in the APM group and 2 in the PT group) were the most frequent AEs. The authors concluded that among patients with non-obstructive meniscal tears, PT was non-inferior to APM for improving patient-reported knee function over a 24-month follow-up period. These investigators stated that based on these results, PT may be considered an alternative to surgery for patients with non-obstructive meniscal tears.

Hip-Targeted Physical Therapy on Low Back Pain

In a systematic review and meta-analysis, Bernet and colleagues (2019) examined the effects of PT interventions of the hip on outcomes of pain and disability in patients with LBP. PubMed, CINAHL, Scopus, Web of Science, and SPORTDiscus were searched from inception to April 18, 2018. The following inclusion criteria were required to be met: RCTs; populations with diagnosed LBP; and interventions that target the hip joint; 2 researchers independently screened titles, abstracts, and full texts for inclusion. Data were extracted for information related to patient demographics, specific interventions, and outcomes assessed. When studies demonstrated homogeneity on outcome measures, the MDs or SMDs with 95 % CI were calculated and pooled in a meta-analysis. A total of 6 articles with a total of 387 participants were included in the review and meta-analysis. Specific intervention categories that were found in the search included: hydrotherapy (n = 1); exercise therapy (n = 4); and manual therapy (n = 2). Trivial effect size was found for the pain outcomes and small effect size was found for disability. All of these studies were found to have high risk of bias according the Cochrane Risk of Bias tool. The authors concluded that the findings of this meta-

analyses from the pooled studies did not result in statistically significant reductions in either pain or disability with the addition of hip-targeted PT interventions to patients with LBP.

Home-Based Physical Therapy for Rehabilitation of the Elderly After Hip Fracture

Magaziner and colleagues (2019) noted that disability persists after hip fracture in older persons. Current rehabilitation may be insufficient to restore ability to walk in the community. In a parallel, 2-group, randomized clinical trial conducted at 3 U.S. clinical centers, these investigators compared a multi-component home-based PT intervention (training) with an active control on ability to walk in the community. Randomization began on September 16, 2013, and ended on June 20, 2017; follow-up ended on October 17, 2017. Patients aged 60 years and older were enrolled after non-pathologic, minimal trauma hip fracture, if they were living in the community and walking without human assistance before the fracture, were assessed within 26 weeks of hospitalization, and were not able to walk during daily activities at the time of enrollment. A total of 210 subjects were randomized and re-assessed 16 and 40 weeks later. The training intervention (active treatment) (n = 105) included aerobic, strength, balance, and functional training. The active control group (n = 105) received transcutaneous electrical nerve stimulation (TENS) and AROM exercises. Both groups received 2 to 3 home visits from a physical therapist weekly for 16 weeks; nutritional counseling; and daily vitamin D (2,000 IU), calcium (600 mg), and multi-vitamins. The primary outcome (community ambulation) was defined as walking 300 m or more in 6 mins at 16 weeks after randomization. The study was designed to test a 1-sided hypothesis of superiority of training compared with active control. Among 210 randomized participants (mean age of 80.8 years; 161 women [76.7 %]), 197 (93.8 %) completed the trial (187 [89.0 %] by completing the 6-min walk test (6MWT) at 16 weeks and 10 [4.8 %] by adjudication of the primary outcome). Among these, 22 of 96 training participants (22.9 %) and 18 of 101 active control participants (17.8 %) (difference, 5.1% [1-sided 97.5 % CI: $-\infty$ to 16.3 %]; 1-sided p = 0.19) became community ambulators; 17 training participants (16.2 %) and 15 control participants (14.3 %) had 1 or more reportable AEs during the intervention period. The most common reportable AEs were falls (training: 6 [5.7 %], control: 4 [3.8 %]), femur/hip fracture (2 in each

group), pneumonia (training: 2, control: 0), urinary tract infection (training: 2, control: 0), dehydration (training: 0, control: 2), and dyspnea (training: 0, control: 2). The authors concluded that among older adults with a hip fracture, a multi-component home-based PT intervention compared with an active control that TENS and AROM exercises did not result in a statistically significant improvement in the ability to walk 300 m or more in 6 mins after 16 weeks.

Postural Restoration Form of Physical Therapy

Postural restoration is a posture-based approach to physical therapy, which claims that it improves postural adaptations, the function of the respiratory system and asymmetrical patterns. Postural restoration supposedly re-position the musculo-skeletal system, correct movement imbalance, restore normal tonicity to muscles and strengthen efficient, balanced, functional activity. Physical therapists who administer postural restoration would initiate a process of rehabilitation that begins with re-positioning; and re-positioning therapeutic activities are carefully constructed exercises to restore neutral alignment to the musculo-skeletal system. Once neutral alignment is attained, it must be maintained and integrated into the movement patterns individuals use in daily activities. A personalized exercise program is designed to improve strengthening from lying to sitting to standing and finally back into up-right movement in a more balanced way. In summary, postural restoration physical therapy create a more balanced / less stressed physical foundation for life activities, sports activities and for rehabilitation following trauma or surgery. [Postural Restoration \(https://advance-physicaltherapy.com/postural-restoration/\)](https://advance-physicaltherapy.com/postural-restoration/)

However, there is no published data on the clinical value of postural restoration form of physical therapy.

Appendix

Physical therapy should be provided in accordance with an ongoing, written plan of care. The purpose of the written plan of care is to assist in determining medical necessity and should include the following:

The written plan of care should be sufficient to determine the medical necessity of treatment, including:

I. The diagnosis along with the date of onset or exacerbation of the disorder/diagnosis

- A. A reasonable estimate of when the goals will be reached;
- B. Long-term and short-term goals that are specific, quantitative and objective;
- C. Physical therapy evaluation;
- D. The frequency and duration of treatment; and
- E. The specific treatment techniques and/or exercises to be used in treatment.

II. Signatures of the patient's attending physician and physical therapist

The plan of care should be ongoing, (i.e., updated as the patient's condition changes), and treatment should demonstrate reasonable expectation of improvement (as defined below):

- A. Physical therapy services are considered medically necessary only if there is a reasonable expectation that physical therapy will achieve measurable improvement in the patient's condition in a reasonable and predictable period of time.
- B. The patient should be reevaluated regularly (at least monthly), and there should be documentation of progress made toward the goals of physical therapy.

The treatment goals and subsequent documentation of treatment results should specifically demonstrate that physical therapy services are contributing to such improvement.

CPT Codes / HCPCS Codes / ICD-10 Codes

Information in the [brackets] below has been added for clarification purposes. Codes requiring a 7th character are represented by "+".

Code Code	Code Description Code Description
CPT codes covered if selection criteria are met:	
97010	Application of a modality to 1 or more areas; hot or cold packs
97012	traction, mechanical
97014	electrical stimulation (unattended)
97016	vasopneumatic devices
97018	paraffin bath
97022	whirlpool
97024	diathermy (eg, microwave)
97026	infrared
97028	ultraviolet
97032	Application of a modality to one or more areas; electrical stimulation (manual), each 15 minutes
97033	iontophoresis, each 15 minutes
97034	contrast baths, each 15 minutes
97035	ultrasound, each 15 minutes
97036	Hubbard tank, each 15 minutes
97110	Therapeutic procedure, one or more areas, each 15 minutes; therapeutic exercises to develop strength and endurance, range of motion and flexibility
97112	neuromuscular reeducation of movement, balance, coordination, kinesthetic sense, posture, and/or proprioception for sitting and/or standing activities
97113	aquatic therapy with therapeutic exercise
97116	gait training (includes stair climbing)
97124	massage, including effleurage, petrissage and/or tapotement (stroking, compression, percussion)

Code	Code Description
97129	Therapeutic interventions that focus on cognitive function (eg, attention, memory, reasoning, executive function, problem solving, and/or pragmatic functioning) and compensatory strategies to manage the performance of an activity (eg, managing time or schedules, initiating, organizing, and sequencing tasks), direct (one-on-one) patient contact; initial 15 minutes
+97130	each additional 15 minutes (List separately in addition to code for primary procedure)
97140	Manual therapy techniques (e.g., mobilization/manipulation, manual lymphatic drainage, manual traction), one or more regions, each 15 minutes
97161 - 97164	Physical therapy evaluation or reevaluation
97530	Therapeutic activities, direct (one on one) patient contact (use of dynamic activities to improve functional performance), each 15 minutes
97535	Self care/home management training (e.g., activities of daily living [ADL] and compensatory training, meal preparation, safety procedures, and instructions in use of assistive technology devices/adaptive equipment) direct one-on-one contact by provider, each 15 minutes
97537	Community/work reintegration training (e.g., shopping, transportation, money management, avocational activities and/or work environment/modification analysis, work task analysis, use of assistive technology device/adaptive equipment), direct one-on-one contact by provider, each 15 minutes
97542	Wheelchair management (e.g., assessment, fitting, training), each 15 minutes
97760	Orthotic(s) management and training (including assessment and fitting when not otherwise reported), upper extremity(s), lower extremity(s), and/or trunk, each 15 minutes
97761	Prosthetic training, upper and/or lower extremity(s), each 15 minutes

Code	Code Description
97762	Checkout for orthotic/prosthetic use, established patient, each 15 minutes
97763	Orthotic(s)/prosthetic(s) management and/or training, upper extremity(ies), lower extremity(ies), and/or trunk, subsequent orthotic(s)/prosthetic(s) encounter, each 15 minutes
99509	Home visit for assistance with activities of daily living and personal care
Other CPT codes related to the CPB:	
97039	Unlisted modality (specify type and time if constant attendance)
97139	Unlisted therapeutic procedure (specify)
97150	Therapeutic procedure(s), group (2 or more individuals)
HCPCS codes covered if selection criteria are met:	
G0151	Services performed by a qualified physical therapist in the home health or hospice setting, each 15 minutes
G0159	Services performed by a qualified physical therapist, in the home health setting, in the establishment or delivery of a safe and effective therapy maintenance program, each 15 minutes
S9131	Physical therapy; in the home, per diem
HCPCS codes not covered for indications listed in the CPB:	
<i>Dynatronics ThermoStim probe - no specific code</i>	
Other HCPCS codes related to the CPB:	
G0152	Services performed by a qualified occupational therapist in the home health or hospice setting, each 15 minutes
G0153	Services performed by a qualified speech-language pathologist in the home health or hospice setting, each 15 minutes
G0157	Services performed by a qualified physical therapist assistant in the home health or hospice setting, each 15 minutes
G2168	Services performed by a physical therapist assistant in the home health setting in the delivery of a safe and effective physical therapy maintenance program, each 15 minutes
S9128	Speech therapy, in the home, per diem
S9129	Occupational therapy, in the home, per diem
<i>Kinesio taping, McConnell taping:</i>	

Code	Code Description
No specific code	
Other HCPCS codes related to the CPB:	
A4450	Tape, non-waterproof, per 18 square inches
A4452	Tape, waterproof, per 18 square inches

The above policy is based on the following references:

1. Aliyev R. Clinical effects of the therapy method deep oscillation in treatment of sports injuries. *Sportverletz Sportschaden*. 2009;23(1):31-34.
2. Aminaka N, Gribble PA. A systematic review of the effects of therapeutic taping on patello-femoral pain syndrome. *J Athl Train*. 2005;40(4):341-351.
3. Arnold E, La Barrie J, DaSilva L, et al. The impact of timing of physical therapy for acute low back pain on health services utilization: A systematic review. *Arch Phys Med Rehabil*. 2019;100(7):1324-1338.
4. Azadina F, Ebrahimi-Takamjani I, Kamyab M, et al. A RCT comparing lumbosacral orthosis to routine physical therapy on postural stability in patients with chronic low back pain. *Med J Islam Repub Iran*. 2017;31:26.
5. Baker RJ, Patel D. Lower back pain in the athlete: Common conditions and treatment. *Prim Care*. 2005;32(1):201-229.
6. Baquie P. Taping. General principles. *Aust Fam Physician*. 2002;31(2):155-157.
7. Barton CJ, Lack S, Hemmings S, et al. The 'Best practice guide to conservative management of patellofemoral pain': Incorporating level 1 evidence with expert clinical reasoning. *Br J Sports Med*. 2015;49(4):923-934.
8. Bartscherer ML, Dole RL. Interactive metronome training for a 9-year-old boy with attention and motor coordination difficulties. *Physiother Theory Pract*. 2005;21(4):257-269.

9. Bennell KL, Egerton T, Martin J, et al. Effect of physical therapy on pain and function in patients with hip osteoarthritis: A randomized clinical trial. *JAMA*. 2014;311(19):1987-1997.
10. Bernet BA, Peskura ET, Meyer ST, et al. The effects of hip-targeted physical therapy interventions on low back pain: A systematic review and meta-analysis. *Musculoskelet Sci Pract*. 2019;39:91-100.
11. Bonica, J. *Physical Therapy and Rehabilitation Medicine*. In: *The Management of Pain*. Vol II. 2nd ed. Philadelphia, PA: Lea & Febiger; 1990.
12. Bowser A, Swanson BT. Evaluation and treatment of a patient diagnosed with adhesive capsulitis classified as a derangement using the Mckenzie method: A case report. *Int J Sports Phys Ther*. 2016;11(4):627-636.
13. Briem KE, Eythorsdóttir H, Magnúsdóttir RG, et al. Effects of Kinesio tape compared with non-elastic sports tape and the untaped ankle during a sudden inversion perturbation in male athletes. *J Orthop Sports Phys Ther*. 2011;41(5):328-335.
14. Bronfort G. Spinal manipulation: current state of research and its indications. *Neurol Clin*. 1999;17(1):91-111.
15. Cejudo P, Bautista J, Montemayor T, et al. Exercise training in mitochondrial myopathy: A randomized controlled trial. *Muscle Nerve*. 2005;32(3):342-350.
16. Centers for Medicare & Medicaid Services (CMS). NCD for Heat Treatment, Including the Use of Diathermy and Ultra-Sound for Pulmonary Conditions (240.3). Medicare Coverage Database. Baltimore, MD: CMS; updated.
17. Chang WD, Chen FC, Lee CL, et al. Effects of Kinesio taping versus McConnell taping for patellofemoral pain syndrome: A systematic review and meta-analysis. *Evid Based Complement Alternat Med*. 2015;2015:471208.
18. Chou R. Subacute and chronic low back pain: Pharmacologic and noninterventional treatment. *UpToDate* [online serial]. Waltham, MA: UpToDate; reviewed September 2009.
19. Clare HA, Adams R, Maher CG. A systematic review of efficacy of McKenzie therapy for spinal pain. *Aust J Physiother*. 2004;50(4):209-216.
20. Cospér SM, Lee GP, Peters SB, Bishop E. Interactive Metronome training in children with attention deficit and developmental

- coordination disorders. *Int J Rehabil Res.* 2009;32(4):331-336.
21. Crossley KM, van Middelkoop M, Callaghan MJ, et al. 2016 Patellofemoral pain consensus statement from the 4th International Patellofemoral Pain Research Retreat, Manchester. Part 2: Recommended physical interventions (exercise, taping, bracing, foot orthoses and combined interventions). *Br J Sports Med.* 2016;50(14):844-852.
 22. De Groef A, Van Kampen M, Dieltjens E, et al. Effectiveness of postoperative physical therapy for upper limb impairments following breast cancer treatment: A systematic review. *Arch Phys Med Rehabil.* 2015;96(6):1140-1153.
 23. DeLisa J. *Rehabilitation Medicine, Principles and Practice.* Philadelphia, PA: J.B. Lippincott; 1988.
 24. Derasari A, Brindle TJ, Alter KE, Sheehan FT. McConnell taping shifts the patella inferiorly in patients with patello-femoral pain: A dynamic magnetic resonance imaging study. *Phys Ther.* 2010;90(3):411-419.
 25. Ernst E, Fialka V. Conservative therapy of backache. Part 3: Physical therapy. *Fortschr Med.* 1993;111(20-21):347-349.
 26. Fink E. The Medek therapy, an alternative physiotherapy intervention [website]. Toronto, ON: The Canadian Medek Centre; 2001. Available at: <http://www.medek.ca/article.htm>. Accessed March 15, 2010.
 27. Fischbacher C. Outpatient physiotherapy services for low back pain. STEER: Succint and Timely Evaluated Evidence Reviews. Bazian, Ltd., eds. London, UK: Wessex Institute for Health Research and Development, University of Southampton; 2002;2(3):1-8.
 28. Fitzgerald MP, Anderson RU, Potts J, et al; Urological Pelvic Pain Collaborative Research Network. Randomized multicenter feasibility trial of myofascial physical therapy for the treatment of urological chronic pelvic pain syndromes. *J Urol.* 2013;189(1 Suppl):S75-S85.
 29. Flavell CA, Gordon S, Marshman L. Classification characteristics of a chronic low back pain population using a combined McKenzie and patho-anatomical assessment. *Man Ther.* 2016;26:201-207.
 30. French HP, Cusack T, Brennan A, et al. Exercise and manual physiotherapy arthritis research trial (EMPART) for osteoarthritis

- of the hip: A multicenter randomized controlled trial. *Arch Phys Med Rehabil.* 2013;94(2):302-314.
31. Fu TC, Wong AM, Pei YC, et al. Effect of Kinesio taping on muscle strength in athletes-a pilot study. *J Sci Med Sport.* 2008;11(2):198-201.
 32. Galleher M, Crowe B, Selhorst M. The effectiveness of manual physical therapy interventions in pediatric patients with anterior hip pain: A retrospective study. *J Man Manip Ther.* 2017;25(5):288-293.
 33. Garcia AN, Costa Lda C, Hancock MJ, et al. Efficacy of the McKenzie method in patients with chronic nonspecific low back pain: A protocol of randomized placebo-controlled trial. *Phys Ther.* 2015;95(2):267-273.
 34. González-Iglesias J, Fernández-de-Las-Peñas C, Cleland JA, et al. Short-term effects of cervical kinesio taping on pain and cervical range of motion in patients with acute whiplash injury: A randomized clinical trial. *J Orthop Sports Phys Ther.* 2009;39(7):515-521.
 35. Greig AM, Bennell KL, Briggs AM, Hodges PW. Postural taping decreases thoracic kyphosis but does not influence trunk muscle electromyographic activity or balance in women with osteoporosis. *Man Ther.* 2008;13(3):249-257.
 36. Gulick DT. Comparison of tissue heating between manual and hands-free ultrasound techniques. *Physiother Theory Pract.* 2010;26(2):100-106.
 37. Hahn T, Kelly C, Murphy E, et al. Clinical decision-making in the management of cervical spine derangement: A case study survey using a patient vignette. *J Man Manip Ther.* 2014;22(4):213-219.
 38. Halliday MH, Ferreira PH, Hancock MJ, Clare HA. A randomized controlled trial comparing McKenzie therapy and motor control exercises on the recruitment of trunk muscles in people with chronic low back pain: A trial protocol. *Physiotherapy.* 2015;101(2):232-238.
 39. Halseth T, McChesney JW, DeBeliso M, et al. The Effects of Kinesio Taping on proprioception at the ankle. *J Sports Sci Med.* 2004;3:1-7.
 40. Handoll HHG, Sherrington C. Mobilisation strategies after hip fracture surgery in adults. *Cochrane Database Syst Rev.* 2007; (1):CD001704.

41. Hegmann KT, ed. Low back disorders. In: Glass LS, editor(s). Occupational medicine practice guidelines: Evaluation and management of common health problems and functional recovery in workers. 2nd ed. Elk Grove Village, IL: American College of Occupational and Environmental Medicine (ACOEM); 2007.
42. Hicks JE. Role of rehabilitation in the management of myopathies. *Curr Opin Rheumatol*. 1998;10(6):548-555.
43. Ho KY, Epstein R, Garcia R, et al. Effects of patellofemoral taping on patellofemoral joint alignment and contact area during weight bearing. *J Orthop Sports Phys Ther*. 2017;47(2):115-123.
44. Hosseinifar M, Akbari M, Behtash H, et al. The effects of stabilization and Mckenzie exercises on transverse abdominis and multifidus muscle thickness, pain, and disability: A randomized controlled trial in nonspecific chronic low back pain. *J Phys Ther Sci*. 2013;25(12):1541-1545.
45. Interactive Metronome Inc. Interactive Metronome Home Page [website]. Weston, FL: Interactive Metronome Inc.; 2002. Available at: <http://www.interactivemetronome.com/home/index.asp>. Accessed October 17, 2002.
46. Jansen M, de Groot IJ, van Alfen N, Geurts ACh. Physical training in boys with Duchenne muscular dystrophy: The protocol of the No Use is Disuse study. *BMC Pediatr*. 2010;10:55.
47. Kalichman L, Vered E, Volchek L. Relieving symptoms of meralgia paresthetica using Kinesio taping: A pilot study. *Arch Phys Med Rehabil*. 2010;91(7):1137-1139.
48. Kaplan SL, Coulter C, Fetters L. Physical therapy management of congenital muscular torticollis: An evidence-based clinical practice guideline: From the Section on Pediatrics of the American Physical Therapy Association. *Pediatr Phys Ther*. 2013;25(4):348-394.
49. Karadag-Saygi E, Cubukcu-Aydoseli K, Kablan N, Ofluoglu D. The role of kinesiotope combined with botulinum toxin to reduce plantar flexors spasticity after stroke. *Top Stroke Rehabil*. 2010;17(4):318-322.
50. Katalinic OM, Harvey LA, Herbert RD. Effectiveness of stretch for the treatment and prevention of contractures in people with

- neurological conditions: A systematic review. *Phys Ther*. 2011;91(1):11-24.
51. Katz JN, Brophy RH, Chaisson CE, et al. Surgery versus physical therapy for a meniscal tear and osteoarthritis. *N Engl J Med*. 2013;368(18):1675-1684.
 52. Kaya E, Zinnuroglu M, Tugcu I. Kinesio taping compared to physical therapy modalities for the treatment of shoulder impingement syndrome. *Clin Rheumatol*. 2011;30(2):201-207.
 53. Kim TH, Lee CW, Kim SG, An BW. The effect of a pelvis-concentrated exercise program on male college students' body alignment and foot base pressure. *J Phys Ther Sci*. 2015;27(4):1165-1167.
 54. Klugarova J, Klugar M, Mareckova J, et al. The effectiveness of inpatient physical therapy compared to outpatient physical therapy in older adults after total hip replacement in the post-discharge period: A systematic review. *JBHI Database System Rev Implement Rep*. 2016;14(1):174-209.
 55. Kraeciw D, Atlas SJ. Occupational low back pain: Treatment. *UpToDate* [online serial]. Waltham, MA: UpToDate; reviewed September 2009.
 56. Krauss I, Steinhilber B, Haupt G, et al. Efficacy of conservative treatment regimes for hip osteoarthritis -- evaluation of the therapeutic exercise regime "Hip School": A protocol for a randomised, controlled trial. *BMC Musculoskelet Disord*. 2011;12:270.
 57. LaBan MM, Martin T, Pechur J, et al. Physical and occupational therapy in the treatment of patients with multiple sclerosis. *Phys Med Rehabil Clin N Am*. 1998;9(3):603-614, vii.
 58. Leibbrandt DC, Louw QA. The use of McConnell taping to correct abnormal biomechanics and muscle activation patterns in subjects with anterior knee pain: A systematic review. *J Phys Ther Sci*. 2015;27(7):2395-2404.
 59. Levy SE, Mandell DS, Schultz RT. Autism. *Lancet*. 2009;374(9701):1627-1638.
 60. Machado LA, de Souza Mv, Ferreira PH, Ferreira ML. The McKenzie method for low back pain: A systematic review of the literature with a meta-analysis approach. *Spine (Phila Pa 1976)*. 2006;31(9):E254-E262.

61. Magaziner J, Mangione KK, Orwig D, et al. Effect of a multicomponent home-based physical therapy intervention on ambulation after hip fracture in older adults: The CAP randomized clinical trial. *JAMA*. 2019;322(10):946-956.
62. Mansell NS, Rhon DI, Meyer J, et al. Arthroscopic surgery or physical therapy for patients with femoroacetabular impingement syndrome: A randomized controlled trial with 2-year follow-up. *Am J Sports Med*. 2018;46(6):1306-1314.
63. McCleary MD, Congeni JA. Current concepts in the diagnosis and treatment of spondylolysis in young athletes. *Curr Sports Med Rep*. 2007;6(1):62-66.
64. McConnell J. Recalcitrant chronic low back and leg pain -- a new theory and different approach to management. *Man Ther*. 2002;7(4):183-192.
65. Melham TJ, Sevier TL, Malnofski MJ, et al. Chronic ankle pain and fibrosis successfully treated with a new noninvasive augmented soft tissue mobilization technique (ASTM): A case report. *Med Sci Sports Exerc*. 1998;30(6):801-804.
66. Michaleff ZA, Maher CG, Lin CW, et al. Comprehensive physiotherapy exercise programme or advice for chronic whiplash (PROMISE): A pragmatic randomised controlled trial. *Lancet*. 2014;384(9938):133-141.
67. Minetama M, Kawakami M, Nakagawa M, et al. A comparative study of 2-year follow-up outcomes in lumbar spinal stenosis patients treated with physical therapy alone and those with surgical intervention after less successful physical therapy. *J Orthop Sci*. 2018;23(3):470-476.
68. Minor MA, Sanford MK. The role of physical therapy and physical modalities in pain management. *Rheum Dis Clin North Am*. 1998;25(1):233-248, viii.
69. Montagnini M, Javier NM. Physical therapy and other rehabilitation issues in the palliative care setting. *UpToDate* [online serial]. Waltham, MA: UpToDate; reviewed January 2017.
70. Mooney V. Understanding, examining for, and treating sacroiliac pain. *J Musculoskel Med*. 1993;37-49.
71. Moss M, Nordon-Craft A, Malone D, et al. A randomized trial of an intensive physical therapy program for acute respiratory failure patients. *Am J Respir Crit Care Med*. 2016;193(10):1101-1110.

72. National Heritage Insurance Company (NHIC). Physical medicine and rehabilitation. Medicare Part B Local Medical Review Policy. Policy No. 97-2.1. Chico, CA: NHIC; revised January 1, 2002.
73. Nelson B. A rational approach to the treatment of low back pain. *J Musculoskel Med.* 1993;67-82.
74. Nordin M, Campello M. Physical therapy: exercises and the modalities: when, what, and why? *Neurol Clin.* 1999;17(1):75-89.
75. Ojha H, Masaracchio M, Johnston M, et al. Minimal physical therapy utilization compared with higher physical therapy utilization for patients with low back pain: A systematic review. *Physiother Theory Pract.* 2019 Feb 9:1-22 [Epub ahead of print].
76. Ostrowski J, Herb CC, Scifers J, et al. Comparison of muscle temperature increases produced by moist hot pack and ThermoStim probe. *J Sport Rehabil.* 2019;28(5):459-463.
77. Petersen T, Christensen R, Juhl C. Predicting a clinically important outcome in patients with low back pain following McKenzie therapy or spinal manipulation: A stratified analysis in a randomized controlled trial. *BMC Musculoskelet Disord.* 2015;16:74.
78. Pfeiffer RP, DeBeliso M, Shea KG, et al. Kinematic MRI assessment of McConnell taping before and after exercise. *Am J Sports Med.* 2004;32(3):621-628.
79. Philadelphia Panel. Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions: Overview and methodology. *Phys Ther.* 2001;81(10):1629-1640.
80. Philadelphia Panel. Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for low back pain. *Phys Ther.* 2001;81(10):1641-1674.
81. Philadelphia Panel. Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for knee pain. *Phys Ther.* 2001;81(10):1675-1700.
82. Philadelphia Panel. Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for neck pain. *Phys Ther.* 2001;81(10):1701-1717.
83. Philadelphia Panel. Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for shoulder pain. *Phys Ther.* 2001;81(10):1719-1730.
84. Podesta L, Podesta G. Rehabilitation of the anterior cruciate ligament. *J Musculoskel Med.* 1994;54-64.

85. Pollock A, Baer G, Pomeroy V, Langhorne P. Physiotherapy treatment approaches for the recovery of postural control and lower limb function following stroke. *Cochrane Database Syst Rev.* 2007;(1):CD001920.
86. Pontari M, Giusto L. New developments in the diagnosis and treatment of chronic prostatitis/chronic pelvic pain syndrome. *Curr Opin Urol.* 2013;23(6):565-569.
87. Rakel R. *Conn's Current Therapy.* Philadelphia, PA: W.B. Saunders Company; 1999.
88. Shaffer RJ, Jacokes LE, Cassily JF, et al. Effect of interactive metronome training on children with ADHD. *Am J Occup Ther.* 2001;55(2):155-162.
89. Sheon RP, Duncombe AM. Rehabilitation program for the low back. *UpToDate [online serial].* Waltham, MA: UpToDate; reviewed September 2009.
90. Sinaki M. *Basic Clinical Rehabilitation Medicine.* 2nd ed. St. Louis, MO: Mosby; 1993.
91. St Pierre P, Miller MD. Posterior cruciate ligament injuries. *Clin Sports Med.* 1999;18(1):199-221, vii.
92. Thelen MD, Dauber JA, Stoneman PD. The clinical efficacy of kinesio tape for shoulder pain: A randomized, double-blinded, clinical trial. *J Orthop Sports Phys Ther.* 2008;38(7):389-395.
93. Tisdell CL, Donley BG, Sferra JJ. Diagnosing and treating plantar fasciitis: A conservative approach to plantar heel pain. *Cleve Clin J Med.* 1999;66(4):231-235.
94. Trenell MI, Sue CM, Kemp GJ, et al. Aerobic exercise and muscle metabolism in patients with mitochondrial myopathy. *Muscle Nerve.* 2006;33(4):524-531.
95. Urological aspects of chronic pelvic pain. In: Engeler D, Baranowski AP, Elneil S, et al. *Guidelines on chronic pelvic pain.* Arnhem, The Netherlands: European Association of Urology (EAU); February 2012.
96. van de Graaf VA, Noorduy JCA, Willigenburg NW, et al; ESCAPE Research Group. Effect of early surgery vs physical therapy on knee function among patients with nonobstructive meniscal tears: The ESCAPE randomized clinical trial. *JAMA.* 2018;320(13):1328-1337.
97. Veerbeek JM, van Wegen E, van Peppen R, et al. What is the evidence for physical therapy poststroke? A systematic review

- and meta-analysis. PLoS One. 2014;9(2):e87987.
98. Vickers A, Ohlsson A, Lacy JB, Horsley A. Massage for promoting growth and development of preterm and/or low birth-weight infants. Cochrane Database Syst Rev. 2004;(2):CD000390.
 99. Waqqar S, Shakil-Ur-Rehman S, Ahmad S. McKenzie treatment versus mulligan sustained natural apophyseal glides for chronic mechanical low back pain. Pak J Med Sci. 2016;32(2):476-479.
 100. Werneke MW, Deutscher D, Hart DL, et al. McKenzie lumbar classification: Inter-rater agreement by physical therapists with different levels of formal McKenzie postgraduate training. Spine (Phila Pa 1976). 2014;39(3):E182-E190.
 101. Yasukawa A, Patel P, Sisung C. Pilot study: Investigating the effects of Kinesio Taping in an acute pediatric rehabilitation setting. Am J Occup Ther. 2006;60(1):104-110.
 102. Yim E, Kirsner RS, Gailey RS, et al. Effect of physical therapy on wound healing and quality of life in patients with venous leg ulcers: A systematic review. JAMA Dermatol. 2015;151(3):320-327.
 103. Zhou K, Krug K, Brogan MS. Physical therapy in wound care: A cost-effectiveness analysis. Medicine (Baltimore). 2015;94(49):e2202.



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