CHAPTER 2

Therapeutic Modalities

Cryotherapy

Description	Cryotherapy is the use of cold to achieve therapeutic results.
Indications	Cryotherapy is typically used for pain management, anti-inflammation, edema control, decrease of muscle guarding/spasm, spasticity management.
Administration Techniques	**Ice massage:** Ice massage can easily and quickly anesthetize a local region of the skin. It is typically applied using an "ice pop" or water frozen in a paper cup. The ice is applied directly to the skin over the target area. **Cold packs:** Cold packs are typically applied to relatively large surface areas and around joints. They are helpful in reducing inflammation and pain. Cold packs are not applied directly to the skin. A moist towel between the cold pack and skin maximizes heat transfer. **Cooling + compression devices:** There are several devices on the market that combine compression and cooling by circulating chilled water through a compression cuff wrapped around a joint or limb segment. Edema control is

continues

Cryotherapy, *continued*

	provided via the compression. The closed insulated environment containing the chilled water minimizes warming and therefore provides a more consistent and prolonged cooling.
Treatment Considerations	Patient sensation tolerance to cryotherapy is quite variable. The clinician must be very attentive to patient reports. Typical sensation progression during cryotherapy includes cold → stinging → aching → anesthesia. Often patients do not tolerate the aching stage. It is important to specifically target the desired tissue to ensure effectiveness. Treatment time is typically from 10 to 15 minutes.
Critical Assessment Parameters	Pretreatment assessment of skin condition and careful assessment of skin reaction should be undertaken. Normal response to cryotherapy includes mild to moderate skin erythema. Signs and symptoms of too much cooling include severe pain, skin discoloration, itching and burning, blistering, and edema.
Effective Documentation Practices	Effective documentation includes careful description of the cryotherapy technique used, treatment location, length of treatment, and patient tolerance and reaction. If being used to manage pain, pre- and posttreatment pain scales should be documented.
Precautions and Contraindications	Cryotherapy should be cautiously used on patients with sensory deficits, circulatory impairment, cold hypersensitivity, and hypertension.

Fluidotherapy

Description	Fluidotherapy is a superficial heating modality that transfers heat by convection. Dried corn husks or other cellulose material are suspended by warmed circulating air. The specific heat of the suspended material and the air allow for higher therapeutic temperatures to be achieved.
Indications	Fluidotherapy is practically used when moderate to vigorous heating of the wrist and hand is indicated. It can also be used for the ankle and foot. Clinical indications include arthritis, chronic tendonitis, postoperative conditions, postfracture management, and Raynaud's syndrome.
Administration Techniques	The fluidotherapy machine must be preheated to the desired temperature. When at room temperature, it could take up to 40 minutes for the machine to reach the desired therapeutic temperature. The distal limb is placed inside of the fluidotherapy cabinet. Turbulence of the suspended particles can be controlled. Treatment time is typically from 15 to 20 minutes.
Treatment Considerations	Clinician must account for potentially long preheating period. This heating modality allows for simultaneous heating and range of motion activities. The patient can manipulate nonmetal therapeutic devices such as rubber balls while receiving treatment. Additional entry ports allow the clinician to enter the cabinet and provide passive range of motion.

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Fluidotherapy, *continued*

Critical Assessment Parameters	Pretreatment assessment of skin condition and careful assessment of skin reaction should be undertaken. Objective assessment of pain (pain scales) and range of motion is critical in gauging effectiveness. Posttreatment skin condition and patient response should be noted.
Effective Documentation Practices	Treatment time, temperature, and treatment area should be carefully documented. Objective documentation of the patient's report of pain, goniometric assessment, and skin condition is important. Subjective response related to "stiffness", other symptoms, and the patient's response to treatment should be documented.
Precautions and Contraindications	Fluidotherapy should be cautiously used in the presence of open wounds. Open wounds must be covered with a plastic barrier to prevent cellulose particles from entering the wound.

Hydrotherapy/Aquatic Therapy

Description	Hydrotherapy is one method used to deliver heat or cold, manage open wounds, and manage pain. Hydrotherapy utilizes water tanks of various sizes such as whirlpool and Hubbard tanks. Turbines mix air and water to agitate the water. The agitation plays a role in cleansing wounds as well as in activating mechanoreceptors to facilitate pain relief. When water is used in large pools for group or individual therapeutic exercises, it is referred to as aquatic therapy. Aquatic therapy takes advantage

Hydrotherapy/Aquatic Therapy, *continued*

	of the physical characteristics of water, including viscosity and buoyancy, to facilitate either therapeutic resistance or assistance activities.
Indications	Hydrotherapy for the delivery of heat or cold is best indicated for the treatment of irregular surfaces associated with the distal extremities. It is also indicated for the cleansing and mechanical debridement of distal open wounds secondary to vascular, surgical, and traumatic conditions. Aquatic therapy is best indicated in conditions in which off-weight bearing, due to the effects of buoyancy, is beneficial. Such conditions may include arthritis, multiple sclerosis, muscular dystrophy and other neuro-myopathies, spinal cord injuries, and other orthopedic conditions.
Treatment Considerations (Temperature Definitions)	It is not unusual for a plan of care to refer to water temperatures using temperature range labels rather than specific temperatures. It is important that the PTA is familiar with the temperatures associated with each range label. Cold: 50°F (10°C)–66°F (19°C); management of acute inflammation Cool: 67°F (20°C)–79°F (26°C); decrease spasticity Tepid: 80°F (27°C)–91°F (33°C); therapeutic exercise (ideal for aquatic therapy) Neutral: 92°F (33°C)–93°F (34°C); management of circulatory disorders Warm: 94°F (34°C)–99°F (37°C); open wound management/debridement Hot: 100°F (38°C)–109°F (43°C); range of motion (ROM) management/improvement Very hot: 110°F (43°C); pain management

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Hydrotherapy/Aquatic Therapy, *continued*

Critical Assessment Parameters	Objective assessment of the wound (e.g., size, color, odor) is critical in gauging effectiveness. Objective measures of pain and ROM are important.
Effective Documentation Practices	Precise documentation of water temperature is critical. Documentation of direction and force of agitation may be important. Depth of immersion during therapeutic exercise/gait is important in documenting buoyancy off-weight-bearing effects.
Precautions and Contraindications	General heat and cold precautions and contraindications apply. During aquatic therapy activities, clinician must watch for signs of overexertion or excessive loss of body heat.

Interferential Current (IFC)

Description	IFC uses two wave kilohertz frequencies and creates interference between them, resulting in a unique current. At times, the currents intersect and the amplitudes summate. At other times, they do not intersect and the amplitude is the difference of the two frequencies.
Indications	IFC is used for pain management, edema reduction, and muscle spasm reduction.
Administration Techniques	IFC settings may differ from machine to machine. **Beat frequency** (the interference frequency): 1–200 Hz

Interferential Current (IFC), *continued*

	Carrier frequency: 1,000–5,000 Hz (some machines are set at 4,000 Hz) **Linear sweep:** continuously modulating from maximum to minimum frequency **Peak to peak:** alternately modulating between maximum and minimum frequency
Treatment Considerations	IFC uses four electrodes set up so that the two wave currents intersect on one another perpendicularly. Because it is unclear where to predict the currents will intersect exactly, some machines offer a **vector scan**. A vector scan is a modulation of amplitude that changes the position of the interference pattern in a rhythmical way. The vector scan is used to cover a larger treatment area. Intensity is increased to patients' tolerance. Patients should feel a comfortable tingling sensation.
Critical Assessment Parameters	Objective assessment of pain (pain scales), circumferential measurements, and ROM is critical in gauging effectiveness.
Effective Documentation Practices	Documentation of specific targeted tissue, treatment time, electrode placement, frequency, type of sweep modulation, and vector scan (if appropriate) is critical for enhancing reproducibility.
Precautions and Contraindications	IFC should not be set up with electrodes that are designed to intersect over the thoracic cavity. IFC electrode interface tends to dry out quickly; interface material needs to be moistened enough to last the entire treatment time.

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Interferential Current (IFC), *continued*

Electrical stimulation is generally contraindicated in pregnancy.

It is also contraindicated in the presence of a cardiac pacemaker or other implanted electrical stimulators.

Due to the risk of metastasis, electrical stimulation is contraindicated in the presence of cancer.

Other contraindications include the presence of active tuberculosis, in an area of thrombophlebitis or thrombosis, over the carotid sinus, or in areas of active hemorrhage.

Precautions include obesity, impaired sensation, over superficial metal implants, and impaired cognitive abilities.

Iontophoresis

Description

Iontophoresis is a continuous direct current is used to transmit ions through the skin.

Indications

Iontophoresis is typically used for pain management, anti-inflammation, scar lysis, and enhanced healing.

Administration Techniques

For safety purposes, iontophoresis is best provided using a device specifically designed for ion transfer. Many of these devices automatically adjust treatment time as current intensity changes.

Current intensity is typically measured in milliamps. Iontophoresis uses two electrodes: one active and one dispersive.

The clinician determines the polarity of the active electrode based upon the charge of the ions to be transferred.

Iontophoresis, *continued*

	Negative ions are transferred under the negative electrode and positive ions under the positive electrode. Dosage is expressed in milliamp-minutes (mA-min). For example, a dosage of 20 mA-min may be provided with an intensity of 4 mA applied for 5 minutes. The same dosage may be achieved with an intensity of 2 mA for 10 minutes. Typical dosages range from 20 to 40 mA-min with dosages dependent on the ion being transferred. Many treatment protocols exist.
Treatment Considerations	Iontophoresis is best applied to a specific, localized, and relatively superficial target tissue. Such tissues include rotator cuff tendons, common wrist/finger/hand flexor and extensor origins, patella ligament, Achilles tendon, etc. Given the somewhat caustic nature of continuous direct current, the clinician should gradually increase intensity and remain within the patient's tolerance. The patient should only experience a mild tingling sensation. The goal of the treatment should be kept in mind and appropriate assessment parameters established. The patient should be instructed to report any delayed posttreatment skin irritation immediately.
Critical Assessment Parameters	Depending on the pathology, goals, and ion being transferred, if effective, positive results should be noted in one to three treatment sessions. Objective assessment of pain includes the use of questionnaires and visual analog scales.

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Iontophoresis, *continued*

Effective Documentation Practices	Careful notation of dosage, current intensity, ionic substance, and active electrode polarity is crucial. Specific descriptions of electrode placement are necessary. Documentation should also include description of pre- and posttreatment skin condition, patient's sensory tolerance, and posttreatment efficacy (using the most objective measures possible).
Precautions and Contraindications	Iontophoresis is contraindicated in areas with bruises, cuts, or otherwise broken skin. It is also contraindicated in acute injuries and over sites of active hemorrhage. General contraindications for electrical stimulation apply. Iontophoresis should be very cautiously applied in areas of impaired sensation.

Low-Level Laser Therapy

Description	Low-level laser therapy uses light energy to facilitate therapeutic effects at the cellular level. Though used extensively in Europe, it is an emerging modality in the United States. Lasers in the United States use helium neon (HeNe) gas or gallium arsenide (GaAs) as lasing mediums.
Indications	The Food and Drug Administration has specifically approved the sale of laser devices for the treatment of pain in carpal tunnel syndrome. Laser therapy has been found to be effective in wound healing, the treatment of tendon and ligament injuries, edema control, and scar tissue inhibition.
Administration Techniques	**Gridding technique:** The treatment area is divided into a grid of square centimeters. The tip

Low-Level Laser Therapy, *continued*

	of the applicator is placed in light contact with the skin. Each grid is stimulated for a specified period of time. A sterile plastic grid sheet may be placed over open wounds to allow for applicator contact. **Scanning technique:** This technique is the same as gridding except the applicator does not make contact with the treatment site.
Treatment Considerations	Treatment protocols are not well defined. More research is required to determine optimal and standardized dosages.
Critical Assessment Parameters	Assessment is dictated by the goals of the treatment. Careful documentation of pain using pain scales is critical. Pre- and posttreatment circumferential measurements assess edema control effectiveness.
Effective Documentation Practices	Dosage must be carefully documented. Lasing technique must also be clearly indicated.
Precautions and Contraindications	There are apparently very few adverse effects of low-level laser. When applied to the head or neck, the patient should wear protective goggles. For safety purposes, the clinician should wear protective goggles. The modality should not be applied during the first trimester of pregnancy or over cancerous cells.

Mechanical Intermittent Compression

Description	Intermittent compression techniques use gravity and compressed air to facilitate lymphatic and general venous flow in the treatment of joint swelling and lymphedema.

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Mechanical Intermittent Compression, *continued*

Indications	Intermittent compression can be used to treat lymphedema, traumatic and chronic edema, and stasis ulcers.
Administration Techniques	Intermittent compression used various inflatable extremity sleeves that are alternately filled and emptied of air exerting external pressure on an extremity. These are several parameters under clinician control. They include: **Inflation pressure:** Inflation pressures are administered between 30 mm Hg and 80 mm Hg dependent upon treatment goals and target extremity. Pressure dosage is closely correlated with blood pressure and patient comfort. **On/off cycle:** On/off cycles may be variable and are protocol specific. On/off cycle refers to the amount of time the pressure is exerted versus the amount of time it is relieved. **Treatment time:** Typical treatment time is from 30 to 40 minutes.
Treatment Considerations	The limb should be elevated during treatment. The patient should have intact sensation and a reliable mental status. Blood pressure should be taken prior to treatment. Pressures should not exceed systolic pressure.
Critical Assessment Parameters	Volumetric or limb girth measures effectively access edema reductions.
Effective Documentation Practices	Circumferential measurements must be carefully documented. Measurement areas should be identified by referring to distances from bony landmarks.

Mechanical Intermittent Compression, *continued*

	Documentation of edema as a percentage comparison to the uninvolved extremity is effective. Specific documentation of dosage, on/off cycle, and treatment time is required.
Precautions and Contraindications	Contraindications include deep-vein thrombosis, local infection, congestive heart failure, acute pulmonary edema, and displaced fractures.

Mechanical Spinal Traction

Description	Mechanical spinal traction is an intervention that uses pulleys, ropes, and harnesses appropriately attached to machinery that, when externally integrated with a patient's spinal column, causes changes in the spinal column length and the amount of space between each vertebra.
Indications	Mechanical traction is indicated in the management of spinal pain when decompression of nervous, vascular, or articular structures is sought; the reduction of intervertebral disk herniation is desired; or muscular relaxation is required.
Administration Techniques	**Intermittent versus sustained:** The physical therapy plan of care should indicate whether the traction should be applied in an intermittent or sustained fashion. Intermittent traction is applied with set traction on/off cycles. Often times during the "off" cycle, traction is reduced to a preset minimum that is not necessarily zero. Therefore, during

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Mechanical Spinal Traction, *continued*

intermittent traction there may always be some applied force throughout the treatment. The on/off time or duty cycle should be included in the physical therapy plan of care.

Treatment duration: Treatment time for mechanical traction is relatively short. Treatment time is typically between 10 and 30 minutes. Treatment time should always be reduced if symptoms appear to increase immediately following intervention. Treatment duration should be included in the physical therapy plan of care.

Dosage: Ideal dosages for mechanical traction are not well researched. Lumbar mechanical traction dosages may range from 25% to 75% of body weight. Cervical dosages range from about 20 to 50 pounds. Changes in dosage are symptom dependent. Traction dosage should be included in the physical therapy plan of care.

Pelvic and thoracic harness placement: Most commercial mechanical traction units require the use of a stabilization thoracic harness and a traction pelvic harness. It is crucial that these harnesses be effectively placed on the patient. It is more effective to place the harness on the patient while in standing position. This eliminates some of the awkward and potentially painful alterations that may be required if attempted in supine position.

The pelvic harness should be placed so that its superior edge is just above the iliac crest. The thoracic harness should be placed over the lower rib cage. Both harnesses should be snuggly secured once the patient is positioned on the traction table.

Mechanical Spinal Traction, *continued*

	Cervical traction: Cervical traction is most often applied using devices that exert traction force exclusively at the occiput. About 25° of cervical flexion should be maintained; however, position may change based on therapeutic goals.
Critical Assessment Parameters	The assessment parameters are goal oriented. If the goal of the treatment is to reduce or change the behavior of pain symptoms, the clinician must use pre- and postintervention pain measures such as analog scales, pain maps, and descriptive questionnaires to best monitor and document efficacy.
Effective Documentation Practices	Accurate documentation of dosage (e.g., time, duty cycle, traction force, intermittent/static) is critical to effective application. Pre- and postobjective documentation of pain using visual analog scales or other measures is essential.
Precautions and Contraindications	Contraindications include spinal infection, rheumatoid arthritis, spinal cancers/neoplasms, osteoporosis, and evidence of spinal cord pressure. Precautions include acute inflammation, joint hypermobility, and pregnancy.

Microelectrical Neuromuscular Stimulation (MENS)

Description	MENS, also known as low-volt pulsed current (LVPC) or microelectrical stimulation (MES), uses a microcurrent waveform stimulator. MENS utilizes DC or monophasic pulsed current. Amplitude is less than 1 mA.
Indications	MENS is used in wound healing.

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Microelectrical Neuromuscular Stimulation (MENS), *continued*

Administration Techniques	Typical **pulse duration** is 500 msec, and **frequency** varies from 1 to 1,000 Hz.
Treatment Considerations	MENS utilizes an anode over the treatment area and a cathode placed nearby. Treatment time may vary from minutes to hours.
Critical Assessment Parameters	Objective assessment of the wound (e.g., size, color, odor) is critical in gauging effectiveness.
Effective Documentation Practices	Pulse duration, frequency, and treatment time should be documented in order to effectively reproduce treatment. Careful pre- and postintervention measurements and wound descriptions are important.
Precautions and Contraindications	Electrical stimulation is generally contraindicated in pregnancy. It is also contraindicated in the presence of a cardiac pacemaker or other implanted electrical stimulators. Due to the risk of metastasis, electrical stimulation is contraindicated in the presence of cancer. Other contraindications include the presence of active tuberculosis, in an area of thrombophlebitis or thrombosis, over the carotid sinus, or in areas of active hemorrhage. Precautions include obesity, impaired sensation, over superficial metal implants, and impaired cognitive abilities.

Neuromuscular Electrical Stimulation (NMES)

Description	NMES uses electrical stimulation to activate muscle by stimulating an intact or partially intact peripheral nerve.

Neuromuscular Electrical Stimulation (NMES), *continued*

	Functional electrical stimulation (FES) is a form of NMES. It is used as a substitute for an orthosis to stimulate paralyzed or paretic muscle. NMES can be accomplished with a variety of electrical stimulators, including low-voltage alternating current and high-voltage galvanic current stimulators.
Indications	NMES is typically used to treat muscle atrophy, muscle weakness, peripheral neuropathy, and muscle spasm.
Administration Techniques	**Bipolar technique:** This technique concentrates current in the target area. It tends to facilitate an effective contraction of the target muscle group. It is appropriate when targeting muscle groups such as the quadriceps, wrist flexors/extensors, ankle dorsiflexors, etc. One active electrode and an equal-sized dispersive electrode are placed over the target musculature. **Monopolar technique:** This technique concentrates current in a small, local target area. It is more appropriate when targeting a specific muscle rather than a group of muscles. This technique uses a single, small active or stimulating electrode placed over the target muscle. A second larger dispersive electrode is placed on the same side of the body away from the target area.
Treatment Considerations	**Pulse amplitude/intensity:** The strength or intensity of the current is one treatment parameter that influences the quality of the facilitated muscle contraction. Pulse amplitude

continues

Neuromuscular Electrical Stimulation (NMES), *continued*

is gradually increased within the patient's sensory tolerance limits. As physiological accommodation occurs, the patient usually can tolerate increased intensity. Sometimes it may take one to two sessions for patients to tolerate their maximal intensity.

Measured in amperes (A)—low voltage and milliamperes (mA)—low/high voltage.

Pulse rate/frequency: Generally, smooth, tetanic contractions are achieved with pulse rates greater than 35–50 pulses per second. Pulse rates will differ depending on the goal of the treatment. Because higher frequencies influence sensory perception and levels of muscle fatigue, the clinician should select the lowest frequency that achieves the desired results.

Measured in pulses per second (pps) and hertz (Hz).

Pulse duration/width: An inverse relationship exists between pulse duration and amplitude. Therefore, less amplitude is required with longer pulse widths. This relationship is helpful in achieving desired results within the patient's sensory limits.

Measured in milliseconds (msec).

Duty cycle: Duty cycle refers to the stimulation on/off ratio. This parameter is important in preventing muscle fatigue. Typically, clinical duty cycles are 1:3 (such as 5 seconds on and 15 seconds off) or 1:5 (such as 10 seconds on and 50 seconds off). On times rarely exceed 10 seconds.

Ramp: Ramp refers to the rate of rise to maximum pulse intensity or pulse width. Ramp

Neuromuscular Electrical Stimulation (NMES), *continued*	
	may also include the rate of declination of intensity or width. In other words, the ramp function provides for a gradual change in pulse intensity or width rather than an instantaneous change. This parameter affects the quality of muscle contraction and sensory perception. Measured in milliseconds (msec).
Critical Assessment Parameters	It is difficult to practically and objectively assess an electrically induced muscle contraction. Special emphasis should be placed on describing the quality of the muscle contraction, including smoothness and specificity of joint motion achieved.
Effective Documentation Practices	Effective documentation includes a careful description of all parameters (intensity, width, etc.) Total treatment time should be noted. The use of tape measures and surface anatomy sites should be used in order to accurately document electrode placement.
Precautions and Contraindications	Electrode stimulation is generally contraindicated in pregnancy. It is also contraindicated in the presence of a cardiac pacemaker or other implanted electrical stimulators. Due to the risk of metastasis, electrical stimulation is contraindicated in the presence of cancer. Other contraindications include in the presence of active tuberculosis, in an area of thrombophlebitis or thrombosis, over the carotid sinus, or in areas of active hemorrhage. Precautions include obesity, impaired sensation, and over relatively superficial metal implants.

Paraffin Bath

Description	Paraffin baths provide superficial heat by coating the target area with solution of melted paraffin wax and mineral oil.
Indications	Paraffin is typically used for the treatment of chronic arthritis of the hand and foot. It may also be used in the treatment of various distal extremity conditions to increase ROM and to manage pain.
Administration Techniques	The most popular and safer technique for the administration of paraffin treatment is called the dip technique. In this technique, the distal extremity is coated with 8 to 12 coats of paraffin. The distal extremity is then wrapped in plastic and then a terry towel. The patient is positioned so that the extremity is elevated. The paraffin glove remains in place for from 15 to 20 minutes.
Treatment Considerations	Paraffin provides heat at temperatures between 126°F and 128°F. This high temperature increases the risk of burn. The lower specific heat of paraffin allows for the higher therapeutic temperatures. Some patients are unable to tolerate the high therapeutic temperatures. Paraffin does not allow for inspection of the skin during the treatment.
Critical Assessment Parameters	Objective assessment of pain (pain scales), skin condition/response, and ROM is critical in gauging effectiveness.
Effective Documentation Practices	Documentation must include pre- and posttreatment skin condition, objective pain and range of motion parameters, and patient's subjective reports.

Paraffin Bath, *continued*

	Careful documentation of circumferential measurements, including descriptions of distances from bony landmarks, is important.
Precautions and Contraindications	All general precautions and contraindications to heat apply to paraffin. Paraffin is clearly contraindicated in the presence of open wounds.

Transcutaneous Electrical Nerve Stimulation (TENS)

Description	Typically, TENS is used to stimulate sensory and/or motor nerves in an effort to manage pain. It is thought that this modality is effective through the application of the gate control theory of pain, the stimulation of the release of endogenous opiates, and/or the central biasing theory. Although TENS is associated with specific compact portable units, its pain relief effects can be achieved using a variety of electrical stimulators.
Indications	Indications include chronic pain syndrome, spinal radiculopathy, low back pain, reflex sympathetic dystrophy, etc.
Administration Techniques	**Gate control:** This technique uses high pulse rate and low pulse width. **Endogenous opiates:** This technique uses high intensity, low pulse width, and low pulse rate. **Central biasing:** This technique uses very high intensity, high pulse width, and high pulse rate.

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Transcutaneous Electrical Nerve Stimulation (TENS), *continued*

Treatment Considerations	TENS is principally designed as an ambulatory modality. Patients should be allowed to ambulate, perform activities of daily living (ADL), and occupational tasks while the modality is administered. If one of these techniques is not effective, clinician should systematically trial an alternative technique. Effectiveness may also be dependent on electrode placement, which may include several configurations. If effective, pain modulation is apparent within from 2 to 30 minutes of administration. Sensory accommodation may decrease effectiveness. In an effort to minimize physiological accommodation, many TENS units have an optional modulation mode that alternately changes treatment parameters, thereby decreasing accommodation potential.
Critical Assessment Parameters	Careful attempts to objectively assess pain are critical in determining effectiveness. The use of pain ratings, visual analogs, and questionnaires provide the basis for pre- and posttreatment assessments.
Effective Documentation Practices	Effective documentation practices include specific notation of technique, frequency, pulse width, intensity changes, electrode placement, and treatment time. Pre- and posttreatment pain assessments should be carefully noted.

Transcutaneous Electrical Nerve Stimulation (TENS), *continued*	
Precautions and Contraindications	TENS may interfere with demand-type pacemakers and therefore is contraindicated in their presence. It should not be administered over the carotid sinus, a pregnant uterus, or the head and neck of epileptics.

Ultrasound	
Description	Ultrasound is a deep heating modality. Sound waves are extremely low intensity and very high frequency are introduced to tissue, producing thermal and nonthermal effects.
Indications	Ultrasound is used to increase the extensibility of collagen fibers in tendons and joint capsules, reduce muscle spasm, and modulate pain. Nonthermal effects may positively affect healing in damaged tissue by altering the permeability of cells.
Administration Techniques	Several ultrasound treatment parameters are under clinician control. They include intensity, frequency, treatment time, and waveform. **Typical intensity:** 0.75–1.5 W/cm^2 **Frequency:** 1 MHz for deep penetration or 3 MHz for less deep penetration **Treatment time:** 5–10 minutes **Waveform:** Continuous wave for thermal and nonthermal effects or pulsed for primarily nonthermal effects.
Treatment Considerations	Liberal use of conducting gel is required. Underwater technique should be used when treating uneven surfaces.

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Ultrasound, *continued*

	Specific and limited treatment area should be identified. Larger areas require longer treatment times. The sound head must remain in full contact with the gel at a 90° angle to the skin. When applying ultrasound to increase ROM, position the patient for simultaneous stretching, if possible. The patient should not perceive heat. If the sound head becomes excessively warm, the clinician should add additional gel and maintain good skin contact. If the problem persists, the unit should be checked by a biomedical technician. Sign of overdose is the patient's complaint of sudden and sharp pain in the treatment area. Some patients complain of a gradually increasing ache.
Critical Assessment Parameters	Objective assessment of pain (pain scales) and ROM is critical in gauging effectiveness.
Effective Documentation Practices	Documentation of specific target tissue, intensity, treatment time, and waveform is critical for enhancing reproducibility.
Precautions and Contraindications	Ultrasound is contraindicated in areas of decreased circulation or impaired sensation and over the reproductive organs or eyes. It is also contraindicated over a pregnant uterus, pacemaker, or in the presence of malignancy. Ultrasound may be contraindicated over total joint replacements and active epiphyseal growth plates.

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