Therapeutic Modalities
Modalities

• The treatment of injuries, including heating, cooling, and mechanical/electrical methods.

• Effective application of physical modalities is an important aspect of athletic training, and the appropriate care of athletes.
Legal Concerns

- Specific laws governing the use of therapeutic modalities vary considerably from state to state.
The Science of Therapeutic Modalities

- **Electromagnetic energy**: Therapeutic agents that emit or produce similar types of radiation (electrical stimulating currents, hot packs, ice packs, ultraviolet therapy and low-powered laser)
- **Acoustic energy**: Ultrasound therapy
Transmission of Thermal Energy

- **Conduction**
  A. Heat is transferred from a warmer object to a cooler one
  B. Rate of heat exchange is dependent upon the temperature and exposure time
  C. Moist hot packs, paraffin baths, electric heating pads, ice packs, and cold packs.

- **Convection**
  A. Transference of heat through the movement of fluids or gases.
  B. Whirlpool baths
Transmission of Thermal Energy

• **Radiation**
  A. Heat energy is transferred from one object through space to another object

• **Conversion**
  A. Generation of heat from another energy form such as sound, electricity, and chemical agents.
  B. Ultrasound therapy, chemical agents (liniments and balms)
Cryotherapy

- **Physical Principles**
  A. Classified as infrared radiation, cold transfer occurs due to conduction.
  B. Extent to which tissue is cooled depends on the cold medium applied, length of cold exposure, and conductivity of the area being cooled.
Cryotherapy

- Physiological Effects of Cold
  A. Vasoconstriction of blood vessels in area occurs
  B. Immediate use of ice after injury decreases the extent of injury to those cells on the periphery of the primary injury - swelling will be reduced in the acute inflammatory response.
  C. Use ice on acute injuries. Typically will use ice for at least the first 48-72 hours after acute injury. May be longer depending on amount of swelling
Cryotherapy (cont.)

D. Decrease muscle spasm by slowing metabolism in the area—decreasing waste products that act as muscle irritants and cause spasm.

E. Analgesia caused by raising the nerve’s threshold

F. Cold is more penetrating than heat, decreases muscle fatigue and increases and maintains muscular contraction
Cryotherapy (cont.)

F. Hunting Response: Reaction against tissue damage from too much cold exposure

- Special Considerations
  A. Raynaud’s phenomenon: Vasospasm of digital arteries lasting from minutes to hours, which could lead to tissue death.
  B. Nerve Palsy
Cryotherapy (cont.)

- Cryotherapy techniques
  - A. Ice massage — 5-10 mins per treatment
  - B. Cold or Water Immersion — 10-15 mins per treatment. 55-64 degrees
Cryotherapy (cont.)

- C. Ice packs (bags)—Most commonly used form of cryotherapy. Typically will apply ice bag for 15-20 mins of each hour.

D. Vapocoolant sprays
Thermotherapy (Heat)

- **Physiological Effects of Heat**
  Desired effect is a vasodilatation of the blood vessels to increase blood flow.

- **Heat must be absorbed into the tissues for physiological response to occur**
  A. Desired therapeutic effects: increased extensibility of collagen tissue, decreased joint stiffness, reduced pain, relieved muscle spasm, reduced inflammation, edema and exudates in the post-acute phase of healing and increased blood flow.

- **Superficial Heat** (moist hot packs, dry hot packs)
Thermotherapy (cont.)

- **Special Considerations in the Use of Superficial Heat**
  A. Never apply in area of lost sensation
  B. Never apply immediately after an injury
  C. Never apply in area of decreased arterial circulation
  D. Never apply directly to the eyes or genitals
  E. Never apply to the abdomen during pregnancy
  F. Never apply to areas exhibiting acute inflammation

- **Moist Heat Therapies**
  A. Moist heat packs
  B. Whirlpool Baths
  C. Paraffin Bath
  D. Contrast Bath
Ultrasound Therapy

- **Ultrasound as therapeutic tool**
  A. *Deep heating modality*- Stimulates the repair of soft tissue injuries and relieves pain
  B. Form of acoustic rather than electromagnetic energy
  C. May produce thermal and non-thermal physiological effects

- **Equipment**
  A. *Piezoelectric Effect*: causes expansion and contradiction of the crystals in the soundhead which produces oscillation voltage (vibration)
  B. *1 MHZ Frequency*: transmits through superficial tissues and is absorbed in the deeper tissues and is absorbed in the deeper tissues at depths of 3-5 cm. Useful in individuals with high percent of body fat and to reach deeper structures.
  C. *3 MHZ Frequency*: energy absorbed in superficial tissues (1-2 cm)
Ultrasound Therapy (cont.)

- **Ultrasound Beam**
  A. *Effective Radiating Area*: portion of the surface of the ultrasound transducer that produces the sound wave

- **Intensity**
  A. Determined by the amount of energy delivered to the sound head (applicator).
     * W/Cm²
     (watts per square centimeter)

- **Pulsed vs. Continuous Ultrasound**
  A. *Continuous*: Intensity remains constant throughout the treatment and the energy is produced 100% of the time: used for thermal effects
  B. *Pulsed*: Intensity is periodically interrupted and no ultrasound energy is produced during the off period.
  C. *Duty Cycle*: percentage of time that ultrasound is generated
Ultrasound Therapy (cont.)

- **Indications**
- **Application**
  A. Direct skin application
  B. Underwater application
  C. Moving the transducer
  D. Dosage and treatment time
- **Special Considerations**
  A. Never use over eyes, ears, heart, or genitals
  B. Reproductive areas or pregnant women
  C. Growth plate areas should have minimal exposure
  D. Acute injuries
Ultrasound Therapy (cont.)

- Ultrasound in Combination with other Modalities
- Phonophoresis
  A. Method of transporting medication through the skin using the mechanical vibration of the ultrasound
  B. Effectiveness is questionable and needs further research
Electrotherapy

**Physical Principles**

A. Implies a flow of electrons between two points

B. An electrical current applied to nerve tissue at a sufficient intensity and duration to reach that tissue’s excitability threshold will result in firing of the nerve.
Electrotherapy

C. Three types of nerve fibers: Sensory, motor, and pain

D. Threshold of depolarization reaches sensory fibers first, then motor fibers, then pain fibers
Electrotherapy

- Electrical Stimulating Units
  A. Monophasic (Direct) Current
     1. Flows in one direction from positive pole to negative pole
     2. May be used for pain modulation or muscle contraction
Electrotherapy (cont.)

b. Biphasic (alternating) Current
   1. Direction of flow reverses itself once during each cycle
   2. Used for pain modulation or muscle contraction
Electrotherapy (cont.)

C. Polyphasic (Pulsatile) Current
1. Contain three or more pulses grouped together
2. Pulses are interrupted for short periods of time and repeat themselves at regular intervals
3. Used in interferential and Russian currents
Electrotherapy (cont.)

• **Indications**
  
  A. Pain modulation
  
  1. *Gate Control*: stimulation of the sensory nerves will evoke the gate control mechanism and decrease awareness of painful stimuli.
  
  2. *Descending Pain Control*: intense stimulation of the smaller pain fibers at trigger and acupuncture points for short period of time causes stimulation of descending neurons which affect transmission of pain by closing the gate at the spinal cord level.
Electrotherapy (cont.)

B. Muscle Contraction
   1. **Muscle pumping**: used to stimulate circulation
   2. **Muscle Strengthening**: Used to facilitate strength gain
   3. **Retardation of Atrophy**: used to minimize atrophy and loss of muscle function that occurs with immobilization
   4. **Muscle Re-education**: Used to reduce muscle inhibition after surgery or injury
Iontophoresis

Chemical ions are transported through the intact skin using an electrical current.