

USING THERAPEUTIC MODALITIES

- Incorporated into rehabilitation program as adjuncts to exercise
- Electrical Modalities
 - Electrical Stimulating Currents
 - Depth of Penetration= between the pads; very superficial
- Acoustic Modalities
 - Ultrasound
 - Depth of Penetration= 3 to 5 cm
- Infrared Modalities
 - Cryotherapy (ice) and Thermotherapy (heat)
 - Depth of Penetration= 1 cm
- Mechanical Modalities
 - Massage (deep tissue)-also a form of heat
 - Depth of Penetration= based on pressure applied
 - Analgesics (pain relieving cream/ gel/ ointment)

Purpose of Cryotherapy

- Reduce blood flow (circulation)
- Reduce swelling and inflammation
- Reduce pain

Sensation Stages of Cryotherapy:

Cold, Pain, Burn/Sting, Numb

Cryotherapy Options:

- Ice Bag- 15 to 20 minutes
- Cold Spray- 10 to 15 seconds
- Cold Whirlpool- (50-55°) 8 to 10 minutes
- Ice Massage/Ice Cup- 5 to 8 minutes

Contraindications for Cryotherapy

- ▣ Do not use a cold treatment if the patient has the following situations:
 - Allergy to cold
 - Circulatory impairments
 - Wound healing (open wounds/skin conditions)
 - Hypertension- high blood pressure
 - Skin anesthesia

Purpose of Thermotherapy

- Increase blood flow (circulation)
- Reduce muscle stiffness
- Increase muscular relaxation

Thermotherapy Options:

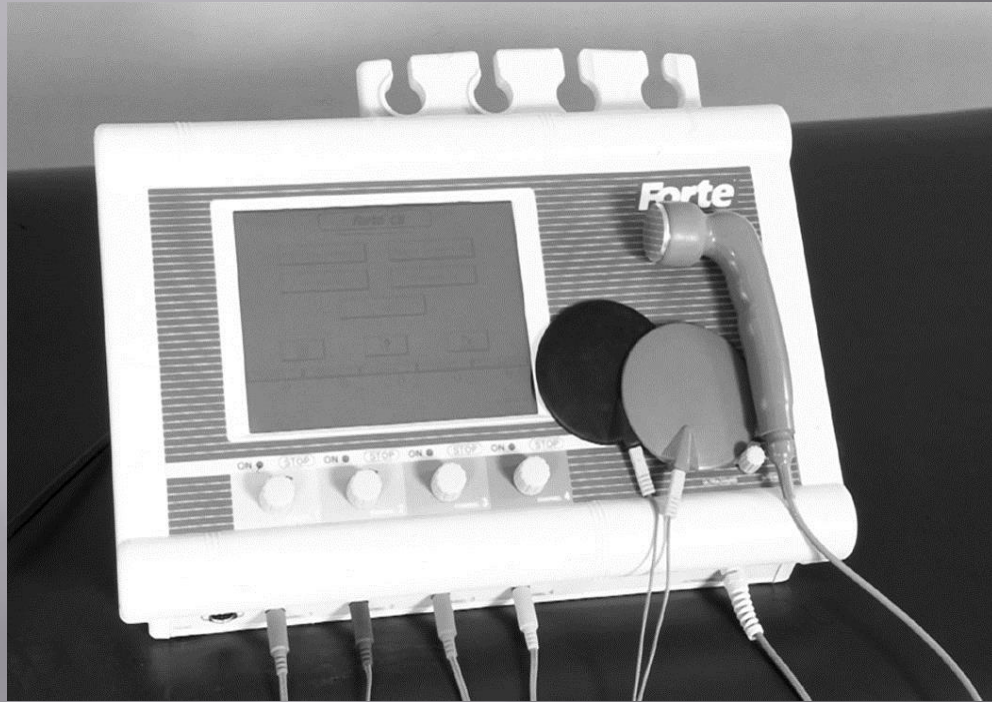
- Hydrocollator Pads-10 minutes
- Hot Whirlpool (104)- 8 to10 minutes
- Massage- 8 to 10 minutes/ + 30 minutes

Contraindications for Thermotherapy:

- ▣ Do not use a heat treatment if the patient has the following situations:
 - Acute and post acute trauma
 - Poor circulation
 - Malignancy (open wounds or skin conditions)
 - Skin anesthesia

Ultrasound

- ▣ Ultrasound is defined as inaudible, acoustic vibrations of high frequency that may produce either thermal or non thermal physiological effects.
- ▣ This modality stimulates repair of soft tissue and pain relief.
- ▣ It is a form of acoustic energy used for deep tissue heating.
 - Depth of penetration= 3 to 5 cm



▣ Equipment

- High frequency generator which provides electrical current through a coaxial cable to a transducer applicator
 - Through piezoelectric effect electrical current is transformed into acoustic energy through contraction and expansion of piezoelectric crystals
- Frequency range between .75 and 3.0 MHz
 - 1 MHz ultrasound allows for deeper penetration while 3 MHz is absorbed more superficially
- Area of transducer that produces sound is the effective radiating area
- Intensity is determined by amount of energy delivered to the sound head (W/cm^2)
- Can be delivered as either pulsed or continuous ultrasound

Indications for Ultrasound

- Produces thermal and non-thermal effects
 - Generally used for tissue heating (must increase tissue temp between 104° and 113°F)
 - Non-thermal effects impacts tissue permeability and fluid movement
 - For solely non-thermal effects, intensity must remain below $.2 \text{ W/cm}^2$
- Acute conditions require more treatments over a shorter period and chronic conditions require fewer treatments over a longer period

▣ Application

- Direct skin application
 - ▣ Requires a coupling medium to provide airtight contact w/ skin and a low friction surface
- Underwater application
 - ▣ Used for irregularly shaped structures
 - ▣ Body part is submerged in water, ultrasound head is placed 1" from surface
- Bladder technique
 - ▣ Used when body part can not be immersed in water
 - ▣ Balloon filled w/ gel or water to allow for transmission --coated with gel to enhance contact surface

- Moving the transducer
 - Leads to more even distribution of energy, reducing likelihood of hot spots
 - Should be moved at a rate of 4cm/second
 - Must maintain contact of transducer with surface of skin
 - Circular or stroking patterns should be used

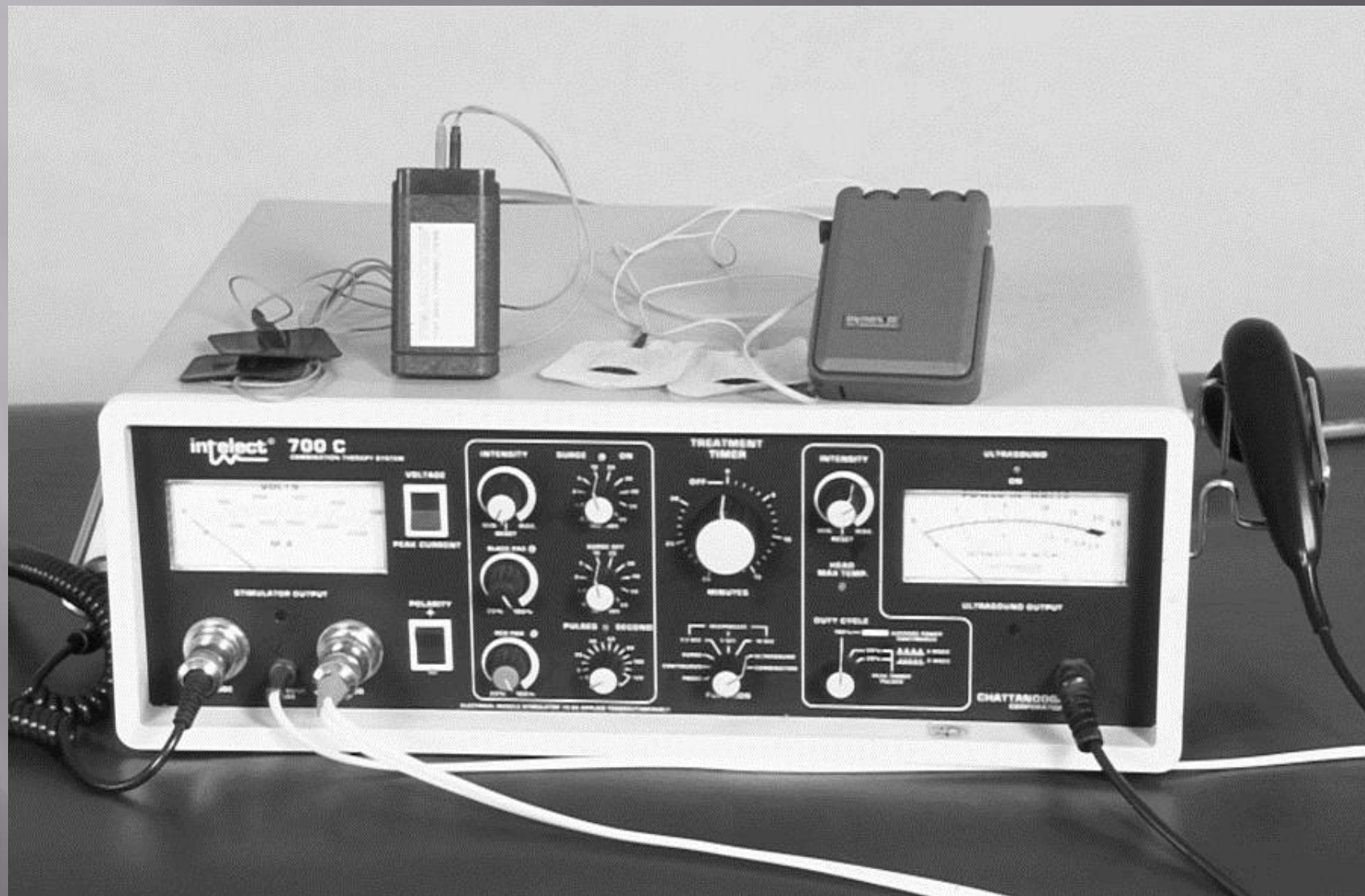
- Dosage and Time
 - Varies according to depth of tissue to be treated and the state of injury
 - Duration tends to last 5-10 minutes
 - Intensity varies
 - Low 0.1-0.3 W/cm²
 - Medium 0.4 - 1.5 W/cm²
 - High 1.5 - 3.0 W/cm²
- Special Considerations/Contraindications
 - While it is a relatively safe modality, precautions still must be taken
 - Be careful with anesthetized areas, reduced circulation
 - Avoid high fluid regions of the body, acute injuries, and epiphyseal areas of children

Electric Muscle Stimulator

- ▣ Characteristics of Electromagnetic Modalities
 - Transmitted w/out medium for support
 - Travel at 300 million meters/second in a vacuum
 - Energy forms travel in a straight line
 - Can be reflected, refracted, absorbed or transmitted
 - Operate at specific wavelengths and frequencies

▣ Physical Principles

- Electricity displays magnetic, chemical, mechanical, and thermal effects on tissue
 - ▣ Volume of current (ampere)
 - ▣ Rate of flow of 1 amp = 1 coulomb
 - ▣ Resistance = ohms
 - ▣ Force that current moves along = voltage
- Electricity is applied to nerve tissue at certain intensities and duration to reach tissue excitability thresholds resulting in membrane depolarization
 - ▣ Target sensory, motor, and pain nerve fibers in an effort to produce specific physiological effects



▣ Electrical Stimulating Units

- Three types of units
 - ▣ TENS - transcutaneous electrical nerve stimulators
 - ▣ NMES/EMS - neuromuscular electrical stimulators or electrical muscle stimulators
 - ▣ MENS/LIS - microcurrent electrical nerve stimulators or low-intensity stimulators
- Electricity is applied to nerve tissue at certain intensities and duration to reach tissue excitability thresholds resulting in membrane depolarization
 - ▣ Target sensory, motor, and pain nerve fibers in an effort to produce specific physiological effects
- Purpose for using E-stim
 - Useful in pain modulation and muscle contractions

- Modulation
 - Ability of stim unit to change or alter the magnitude and duration of a waveform
 - May be continuous, interrupted or surged
- Intensity
 - Voltage output of stimulating unit
 - High and low voltage units
- Duration(pulse width or pulse duration)
 - Refers to the length of time that current is flowing
 - Pre-set on most high voltage DC units
- Frequency
 - Number of waveform cycles per second
- Polarity
 - Direction of flow -- either positive or negative

- Electrode Set-up

- Use of moist electrodes fixed to the skin
- Can include monopolar (active and dispersive pad) or bipolar set-up
- Current generally felt under and between both pads unless monopolar set-up is used --then current is felt under the smaller active pad

▣ Indications

- Pain Modulation- 80 pps
- Muscle Contraction
 - ▣ Muscle pump
 - High-volt, DC stimulator; 20-40 pps; surge mode (on/off 5 seconds each; elevation w/ active contraction)
 - ▣ Muscle strengthening
 - High frequency AC current; 50-60 pps; 10:50 seconds on/off ratio; 10 repetitions 3x per week; perform with active contractions
 - ▣ Retardation of atrophy
 - High frequency AC current 30-60 pps; w/ voluntary muscle contraction encouraged; 15-20 minutes
 - ▣ Muscle re-education
 - Level of comfortable contraction -- 30-50 pps; w/ either interrupted or surge current
 - Athlete should attempt to contract muscle along w/ stim
 - Treatment time 15-20 minutes and repeated multiple times over the course of a week

Massage

- ▣ Systematic manipulation of soft tissues of the body
- ▣ Involves gliding, compressing, stretching, percussing, and vibrating
 - Produce specific responses in athlete
- ▣ Causes mechanical, physiological, and psychological responses

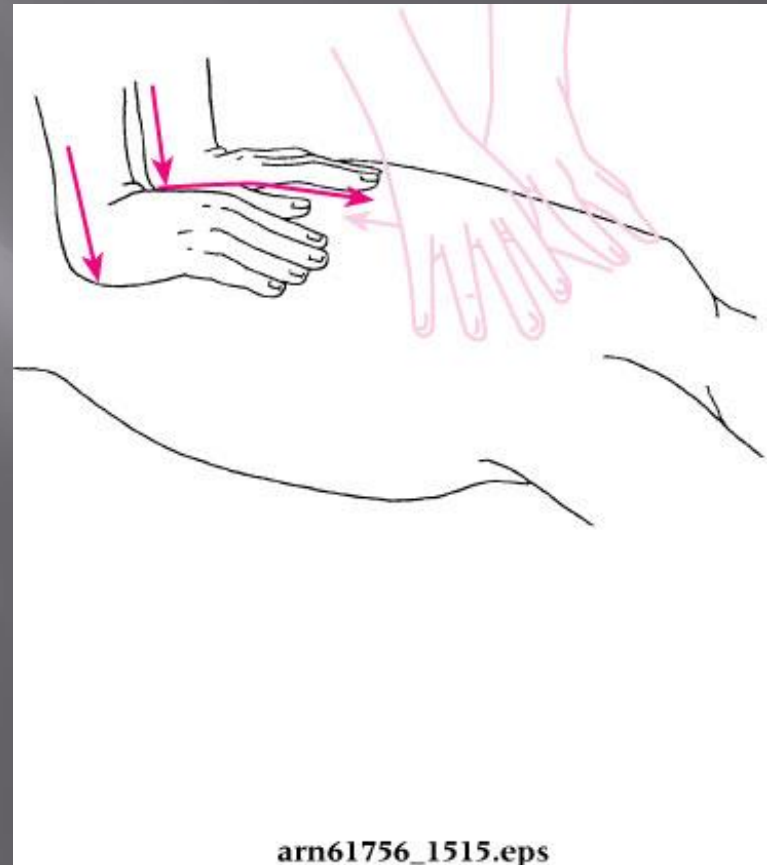
- ▣ Mechanical responses are direct result of graded pressures and movements of the hand on the body
- ▣ Uses:
 - Encourage lymph drainage
 - Stretch superficial scar tissue
 - Stretch connective tissue (friction massage)
 - Increase circulation – due to increased metabolism
 - ▣ Helps to remove lactic acid or edema
 - ▣ Assist normal venous blood return to heart
 - Relaxation

- Psychological Responses

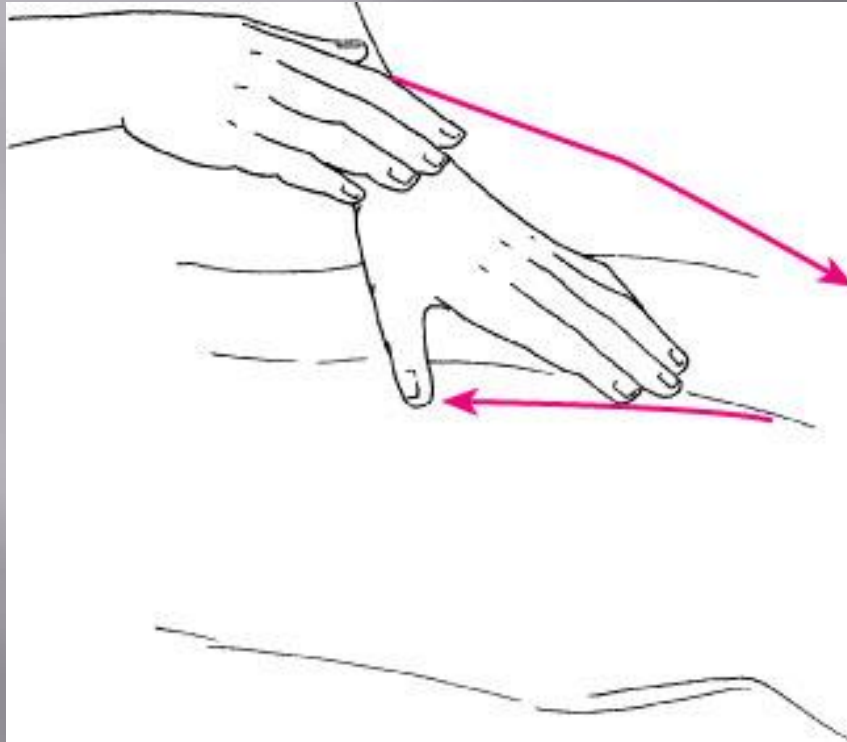
- Tactile system is one of the most sensitive systems of the body
- Because the laying on of hands is used w/ massage it can be an important means of creating a bond of confidence between the athlete and the ATC

Massage Strokes

- ▣ Effleurage
 - Stroking divided into light and deep
 - Can be used as a sedative or to move fluids
 - Multiple stroking variations exist
 - Pressure variations



Stroking Variations

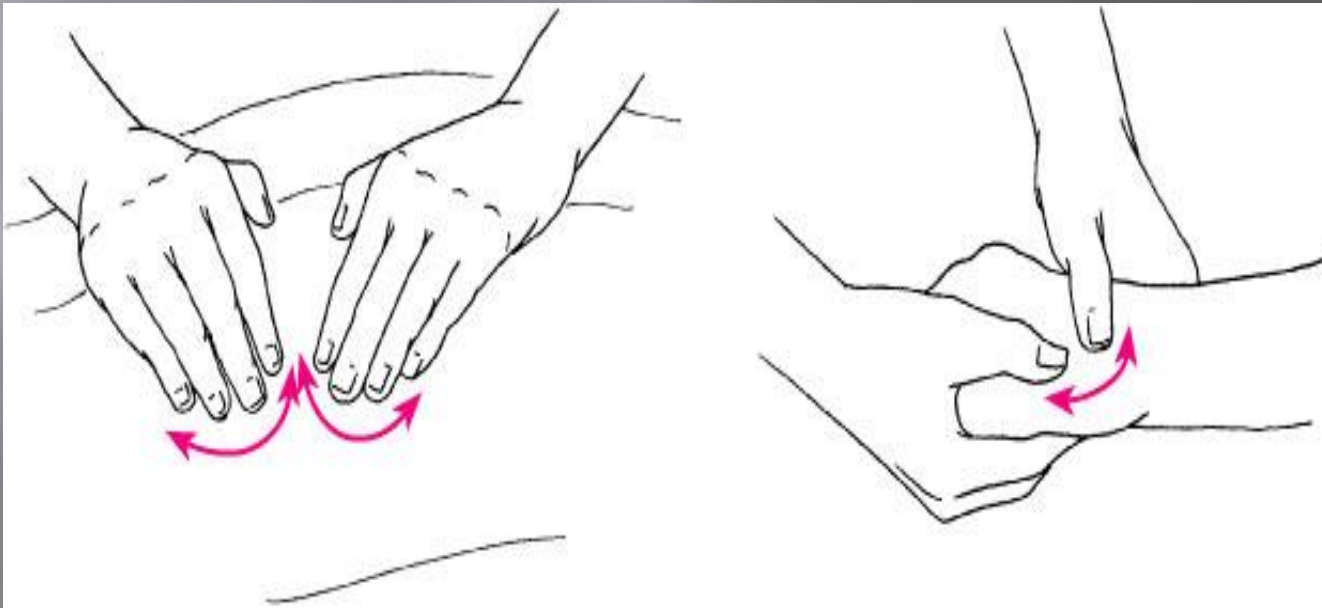


- ▣ Petrissage
 - Kneading
 - Involves picking up skin between thumb and forefinger, rolling and twisting in opposite directions
 - Used for deep tissue work

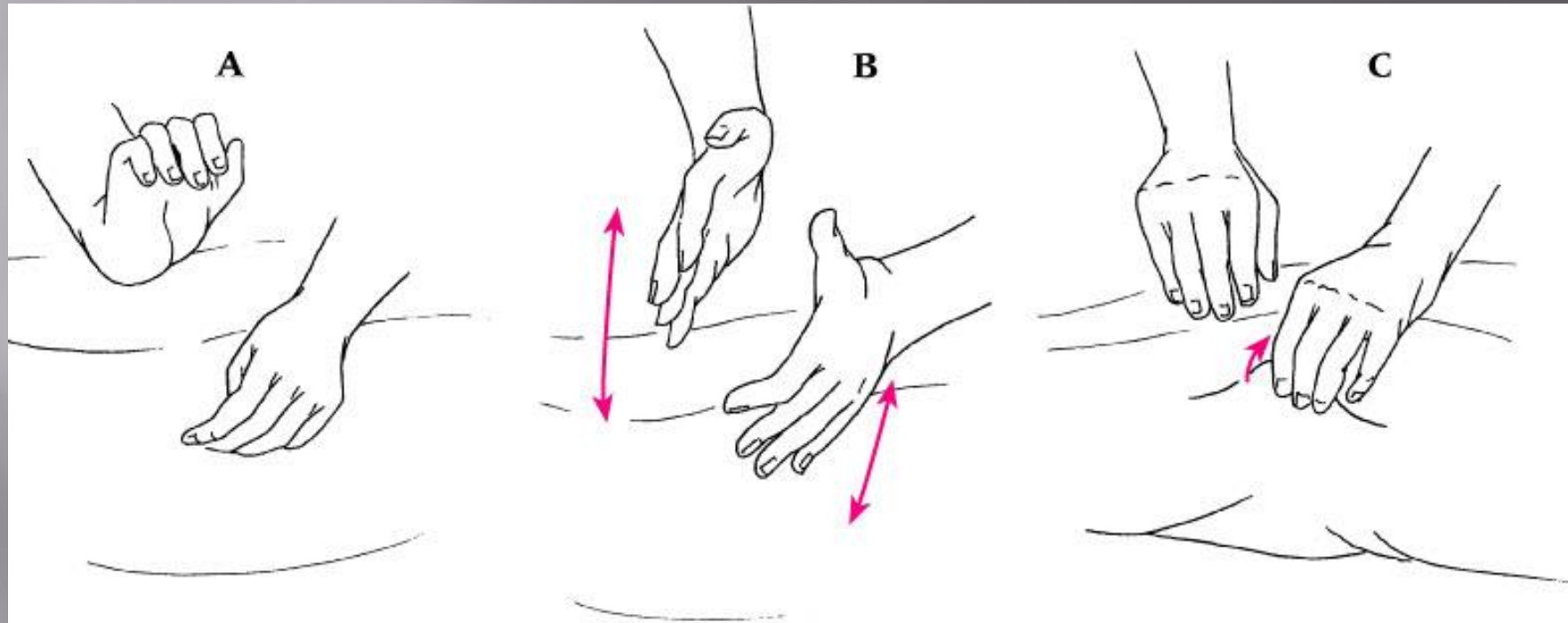


▣ Friction

- Used around joints and in areas where tissue is thin
- Areas w/ underlying scarring, adhesions, spasms and fascia
- Goal is to stretch underlying tissue, develop friction and increase circulation



- Tapotement
 - Cupping
 - Produces invigorating and stimulating sensation
 - Series of percussion movements rapidly duplicated at a constant tempo
 - Hacking
 - Used to treat heavy muscle areas, similar to cupping
 - Pinching
 - Lifting of small amounts of tissue between thumb and first finger in quick, gentle pinching movements
- Vibration
 - Rapid movement that produces quivering or trembling effect to tissue
 - Used to relax and soothe



▣ Guidelines for an Effective Massage

- Make the athlete comfortable
 - Positioning, padding, temperature, privacy
- Develop confident, gentle approach to massage
 - Good body positioning (clinician and athlete) and develop good technique
- Stroke towards heart to enhance lymphatic and venous drainage
- Know when to avoid massage
 - Acute conditions and skin conditions

▣ Deep Transverse Friction Massage

- It is used to treat muscle, tendon, ligaments and joint capsules
- Goal is mobilization of soft tissue
- Generally precedes activity
- Movement is across the grain of the affected tissue
- Avoid treatment with acute injuries
- Treatment will produce numbing effect allowing for exercise mobilization

