* Modalities in Rehab
* Faizan zaffar kashoo
* **most commonly used**
* **cryotherapy**
* **thermotherapy**
* **electrical stimulation**
* **iontophoresis**
* **traction**
* **ultrasound**
* Modalities in Rehab
* **modalities are adjuncts to treatments not sole treatments.**
* **most have limited evidence to support its use.**
* **lots of anecdotal evidence**
* **parameters in the literature are very variable resulting in wide ranges**
* **Cryotherapy**
* **Indications**
* **Acute or chronic pain, or muscle spasm**
* **Acute inflammation**
* **Post surgical pain or edema**
* **Facilitate mobilization**
* **Cryotherapy**
* **Heat Abstraction**
* **Depth of 5cm can be cooled**
* **Change in Temperature depends on:**
* **Type of Agent**
* **Temp. difference between agent and tissue**
* **Amount of insulation**
* **Thermal Conductivity**
* **Limb circumference**
* **Duration of application**
* **Cryotherapy**
* **Leads to vasoconstriction**
* **Decreases tissue metabolism**
* **Decreases tissue permeability**
* **Decreases capillary permeability**
* **Decreases pain**
* **Decreases spasms**
* **Analgesic relief of pain**
* **Types of Cryotherapy Applications**
* **Ice Massage**
* **Ice Packs**
* **Cryocuffs**
* **Ice Immersion (Whirlpool)**
* **Commercial Gel and Chemical Packs**
* **Controlled Cold-Compression Units**
* **Vapocoolant sprays**
* **Thermotherapy**
* Increases circulation
* Increases cellular metabolism
* Produces analgesic or sedative effect
* Helps resolve pain and muscle spasm
* Vasodilatation:
* Promotes Healing
* Increases Oxygen concentration
* Removes debris and waste products
* **Thermotherapy**
* **Types of Applications**
* **Moist heat packs**
* **Ultrasound**
* **Paraffin baths- hands (OT)**
* **Diathermy heat –not used clinically anymore**
* **Whirlpools - training rooms**
* **Hot tubs – training rooms**
* **Electro Therapy**
* **TENS**
* **Conventional**
* **Low Rate**
* **Conventional / High Rate TENS**

***Indications:***

* **Any painful condition**
* **Chronic typically**
* **If Muscle contraction:**
* **increases pain**
* **contraindicated**
* **Post-op management of pain**

*Contraindications:*

* **Known myocardial problems, pacemakers**
* **Stimulation over anterior neck**
* **Thrombophlebitis**
* **Superficial skin lesions**
* **Conventional / High Rate TENS**
* **Low Rate TENS**
* **Mechanism of action equated with acupuncture**
* **More vigorous than high-rate**
* **Used to treat sub-acute, chronic pain and trigger points**
* **Pain modulation:**
* **neurochemical inhibitory mechanisms**
* **motor level pain modulation**
* **Beta-endorphins!**
* **Low Rate TENS**
* ***Indications:***
* **pain, now tolerates muscle contraction**
* **trigger points**
* **muscle guarding**
* ***Contraindications:***
* **same as for conventional TENS**
* **Therapeutic Electrically Induced Muscle Contraction**
* **Therapeutic gains:**
* **muscle reeducation**
* **muscle pump contractions**
* **muscle strengthening**
* **Muscle Reeducation**
* **Primary indication: inhibition after injury or surgery**
* **Theory for inhibition related to sensorimotor dysfunction**
* **ES induces involuntary muscle contraction which increases sensory input from that muscle**
* **A modified NM Elect Stim protocol for quad strength trning following ACL reconstruction**
* **Muscle Strengthening**
* **Effectiveness with ES for weakness (post-surg).**
* **More rapid recovery and greater gains than exercise alone (Snyder-Mackler 1995, Delitto 1988, Eriksson 1979, Godfrey 1979)**
* **Mechanism:**
* **Specificity: preferential recruitment of type II muscle fibers**
* **Overload principle:**
* **e-stim with ex – NO improved strength than either one alone (Alon 1987)**
* **Kots (1977) reported significant strength gains in healthy individuals using ES**
* **Russian Current**
* **Russian Current**
* **1977 Yakov Kots**
* **report during Canadian-Soviet exchange symposium on electrostimulation of skeletal muscle**
* **3 revolutionary claims**
* **generates 30% more force than max vol contraction**
* **painless current**
* **lasting gains up to 40% strength increase in normals**
* **Commercial reaction**
* **production of “Russian” current stimulators**
* **Indications for  
  “Russian” current**
* **Post knee lig surgery (Curwin et al, Can Ath J, 1980)**
* **Post arthroscopic knee surgery (Williams et al, JOSPT, 1986)**
* **ACL sprain (increase quad force during immobilization) (Nitz, PT, 1987)**
* **“PRIME” indication: strengthen the muscular apparatus of HEALTHY population**
* **Muscle Pump Contractions  
  Edema Reduction**
* **ES to induce muscle contractions (pumping action)**
* **Duplicates normal muscle pumping contractions**
* **Stimulates circulation thru venous and lymphatic channels**
* **Induce circulatory changes while protecting limb**
* **Edema Reduction**
* **Sensory level stimulation may be used for edema control**
* **increase ionic movement**
* **reported to decrease edema *in vitro***
* **effectiveness not found in humans *in vivo***
* Interferential Current
* **Interferential  
  Biophysical Characteristics**

**Methods of delivery**

quadripolar**: 4 electrodes, each pair to separate channel**

**Interference at level of TREATMENT AREA**

**“4 leaf clover” shaped field**

* **Interferential  
  Biophysical Characteristics**

**Methods of delivery (cont)**

quadripolar

Target

sweep: **enlarge field**

Vector scan

* **Electrical Stimulation for Denervated Muscle**
* **ES for Denervated Muscle**
* **Utilized in PT for decades**
* **Purpose: minimize atrophy during regeneration**
* **Parameters depend on generator:**
* **Can be DC or AC**
* **ES for Denervated Muscle**
* **Controversy over efficacy produced several *in vitro* studies in mid 80’s (Girlanda 1982 Exp Neurol; Pachter Arch Phys Med Rehabil, 1982)**
* **Does Not effect improvement in rate of regeneration**
* **Difficult to reach a consensus whether to use ES to treat denervated muscle b/c:**
* **animal vs. human studies**
* **variety of methods used**
* **animals: no treatment has lasted more than 2 months**
* **ES for Denervated Muscle**

**More controversy: (*in vitro* studies)**

* **Rats. Estim may retard motor nerve sprouting and reinnervation (Schimrigk 1977)**
* **Delay of functional return from interference with reinnervation**
* **ES induced contraction disrupts regenerating NMJ**
* **this retards reinnervation**
* **Trauma to regenerating cell body ??**
* **Definitely more research needed!**
* **Iontophoresis**
* **Introduction**
* **Transcutaneous drug delivery has been used for centuries**
* **herbal plasters, medicated baths, etc.**
* **Iontophoresis -- the use of an electrical current for the transcutaneous delivery of ions into the body**
* **Introduction**
* **Fairly widespread use of iontophoresis past 20-30 years**
* **Very commonly used now in PT clinics**
* **Iontophoresis offers a safe and painless way of “injecting” drugs through the skin into underlying target tissues**
* **Alternative to oral or injection methods of drug delivery**
* **Basic Principles of Application**
* **Electrostatic repulsion of like charges is the driving force for iontophoresis**
* **Knowledge of a drug’s or ion’s polarity is critical – dictates the polarity of the electrode needed to drive the drug to underlying Rx area**
* **IontoPatch™**
* **“Patch” is both a current generator and electrodes**
* **Applied in the clinic and the patient wears the patch home**
* **Delivers a very low amplitude of current (0.1 mA) that is worn for 12-24 hours**
* **Manufacturer states that the low intensity current reduces the risk of skin irritation and burns**
* **Common Medications Used in Iontophoresis**
* **Does it Work ??**
* **Experimental evidence does exist to show that iontophoresis does enhance the transcutaneous delivery of ions into tissues**
* **Limited depth of penetration (1 cm ≈ 1/2 in)**
* **Lack of high-quality clinical evidence to support its use, but**
* **Sufficient evidence from case studies and commentaries that suggest clinicians should consider iontophoresis for the treatment of superficial inflammatory conditions**
* **Traction**
* **Indications**
* **Herniated disc**
* **Spinal nerve impingement**
* **Spinal nerve inflammation**
* **Joint hypo-mobility**
* **Narrowing of intervertebral foramen**
* **Degenerative joint disease**
* **Joint pain**
* **Contraindications**
* **Unstable vertebrae**
* **Gross emphysema**
* **Temperomandibular joint dysfunction**
* **Patient discomfort**
* **Ultrasound**

**COL Josef H. Moore, PhD, PT, SCS, ATC**

* **Introduction**
* **Ultrasound uses:**
* **Diagnostic (low intensity)**
* **Surgical (high intensity)**
* **Therapeutic**
* **Therapeutic US widely used for deep heat**
* **Introduction**
* **Primary clinical use:**
* **Soft tissue repair**
* **Pain relief (analgesia)**
* **Effective Radiating Area (ERA)**
* **Total area on surface of transducer producing soundwave**
* **Ideally ERA should match size of transducer**
* **Treatment area should not exceed 2-3 times ERA**
* **Frequency of Ultrasound**
* **Determined by number of times crystal deformed/sec.**
* **2 most common utilized in U.S.**
* **1.0 MHz**
* **3.0 MHz**
* **Determines depth of penetration, unlike ES**
* **Frequency of Ultrasound**
* **Inverse relationship between frequency and depth of penetration**
* **Penetrating depths:**
* **1.0 MHz: 2-5 cm**
* **3.0 MHz: 1-2 cm**
* **Absorption rate increases with higher frequency**
* **Pulsed vs Continuous**
* **Most new generators produce both**
* **Both produce thermal & nonthermal effects**
* **Pulsed vs Continuous**
* **Continuous:**
* **Sound intensity remains the same**
* **Commonly used for thermal effects**
* **Pulsed vs Continuous**
* **Pulsed:**
* **Intensity periodically interrupted**
* **Average intensity reduced over time**
* **Physiological Effects   
  of Ultrasound**
* **Thermal effects**
* **Non-thermal effects**
* **Cavitation**
* **Acoustic microstreaming**
* **Thermal Effects**
* **Clinical effects:**
* **Increased extensibility of collagen fibers**
* **tendons**
* **joint capsule**
* **Decreased joint stiffness**
* **Thermal Effects**
* **Clinical effects:**
* **Reduction in muscle spasm**
* **Pain modulation**
* **Increased blood flow**
* **Increased nerve conduction**
* **Thermal Effects**
* **Primary advantage of US**
* **Selective heating of tissues high in collagen**
* **Non-thermal effects are occurring**
* **Non-thermal (Mechanical) Effects**
* **Primary physiological effects are cavitation and acoustic microstreaming**
* **Cavitation:**
* **Formation of gas-filled bubbles in tissue fluids**
* **Expansion/compression of bubbles either stable or unstable**
* **Non-thermal (Mechanical) Effects**
* **Acoustic microstreaming:**
* **Unidirectional movement of fluids along cell membrane boundaries**
* **Produces high viscous stresses**
* **Alters membrane structure & function**
* **Increased permeability to ionic influx**
* **Non-thermal (Mechanical) Effects**
* **Potential therapeutic effects from cavitation & microstreaming**
* **Stim. of fibroblast activity increases protein synthesis & tissue repair**
* **Increased blood flow**
* **bone healing & repair of non-union fractures**
* **Ultrasound**
* **Indications**
* **Increase deep tissue heat**
* **Decrease inflammation**
* **Decrease muscle spasms**
* **Decrease pain**
* **Increase extensibility of collagen tissue**
* **Decrease pain of neuromas**
* **Decrease joint adhesions**
* **Treat myositis ossificans**
* **Contraindications**
* **Hemorrhage**
* **Infection**
* **Thrombophlebitis**
* **Suspected malignancy**
* **Impaired circulation or sensation**
* **Stress fracture sites**
* **Epiphyseal growth plates**
* **Over the Eyes, Heart, Spine, or genitals**
* **Phonophoresis**
* **Ultrasound with drugs, used to increase absorption and penetration of drugs**
* **Anti-inflammatory’s**
* **Cortisol**
* **Dexamethasone**
* **Salicylates**
* **Analgesics**
* **Lidocaine**
* **Phonophoresis**
* **in theory phonophoresis increases the permeability of the stratum corneum allowing better penetration of drug**
* **Summary**
* **modalities are best utilized as adjuncts not primary treatment**
* **limited evidence**
* **plenty of anecdotal proof**
* **variable parameters**
* **most utilized are ionto, traction heat/cold, and estim**
* **Questions????**