Physical modality

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Physical modality

- Heat
- Cold
- Water
- Electromagnetic waves
- Electricity
- Pressure
- Traction, manipulation, massage

Always used as **adjuncts therapy***
Factor to consider in Modality selection

• Target tissue
• Depth of heating or cooling desired
• Intensity of heating or cooling desired
• Body habitus
• Co-morbid conditions
• Specific patient features
• Age
• Sex
Heat
Physiologic effects of Heat

• Hemodynamic
  – Increase blood flow
  – Decrease chronic inflammation
  – Increase edema
  – Increase bleeding

• Joint and connective tissue
  – Increase tendon extensibility
  – Increase collagenase activity
  – Decrease joint stiffness

• Miscellaneous effects
  – Decreased pain
  – General relaxation effect

Therapeutic heat 40-45 °C
General use of Heat

- Musculoskeletal conditions
- Pain
- Arthritis
- Contracture
- Muscle relaxation
- Chronic inflammation
General precautions for the use of Heat

- Acute trauma, inflammation
- Impaired circulation
- Bleeding diathesis
- Edema
- Large scars
- Impaired sensation
- Malignancy
- Cognitive or communication deficits that preclude reporting of pain
# Classification of various types of Heating

<table>
<thead>
<tr>
<th>Type</th>
<th>Method</th>
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</thead>
<tbody>
<tr>
<td>Superficial</td>
<td>Conduction</td>
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<tr>
<td>Superficial</td>
<td>Conduction</td>
</tr>
<tr>
<td>Superficial</td>
<td>Radiation</td>
</tr>
<tr>
<td>Deep</td>
<td>Conversion</td>
</tr>
<tr>
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<td>Conversion</td>
</tr>
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<td>Conversion</td>
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</table>
Superficial heat
Hot packs or Hydrocollator packs

- Silicon dioxide encased in a canvas pack
- Moist heat
- Treatment time 20-30 min.
Effect on target tissue temperature after applied hot pack for 30 minute

• At posterior thigh: 3.3 and 1.3°C rise at 1- and 2-cm depth, respectively
• At Brachioradialis muscle: 1.1°C rise at 4cm depth
• Intra-articular (Knee): 1.2°C increase
Paraffin baths

• Paraffin wax : Mineral oil
  = 7:1 or 6:1

• Treatment temperature are 52.2 to 54.4 °C but low heat conductivity

• Treatment time 20 minutes
Paraffin bath is useful in

- Irregular surface organ such as distal limbs
- Rheumatoid arthritis at hand or foot
- Contracture at hand or foot

Contraindication

- Fresh wound or un-heal wound
- Skin infection
- Impaired sensation
- Allergy to Paraffin
Deep heat
Ultrasound

- Depth $\rightarrow$ muscle-bone interface

- Effects of ultrasound
  - Thermal effect
  - Nonthermal effect

- Duration 5-10 min/field
Clinical use in thermal effect

• Soft tissue and tendon shortening
• Pain control
• Reduce muscle spasm
• Subacute to chronic phase of healing or inflammation
• Tendon injuries
• Resorption of calcium deposits
• Plantar warts
Clinical use in non-thermal effect

- Soft tissue repair
- Tissue regeneration
- Dermal Ulcers
- Surgical skin incisions
- Bone healing
- Phonophoresis
- Acute tendon injury
- Herpes Zoster infection
Ultrasound precaution

1. General heat precautions
2. Near Brain, eyes, reproductive organs
3. Near gravid or menstrual uterus
4. Near pacemaker
5. Near spine, Laminectomy sites
6. Skeletal immaturity
7. Methyl methacrylate or highly cross link polyethylene
Short wave diathermy

• Conversion of electromagnetic energy to thermal energy

• Increased temp. 4-6 °C

• Depth 4-5 CM in muscle***

• Treatment time 20-30 min
Shortwave diathermy
Physiologic effects

- **Thermal effect**: vasodilate, rate of NCV, elevation of pain threshold, alter m. strength, accelerate enzymatic activity, soft tissue extensibility

- **Nonthermal effect**: microvascular perfusion, alter cell membrane function & cellular activity, growth factor activation, macrophage activation
Clinical use in thermal diathermy

- Pain control
- Accelerated healing
- Decreased joint stiffness or contracture
- Increase joint ROM if apply with stretching

Clinical use in non-thermal diathermy

- Control pain and edema
- Wound healing
- Nerve and bone healing (acute)
Precautions

1. General heat precautions

2. Metal (jewelry, pacemakers, intrauterine devices, surgical implants, etc.)

3. Contact lens, eyes, testes

4. Gravid or Menstrual uterus

5. Skeletal immaturity
## Comparison between US and SWD

<table>
<thead>
<tr>
<th></th>
<th>Ultrasound diathermy</th>
<th>Short wave diathermy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
<td>Acoustic vibration</td>
<td>Electromagnetic</td>
</tr>
<tr>
<td><strong>Target tissue</strong></td>
<td>Deep muscle, deep joint</td>
<td>Superficial muscle, superficial joint</td>
</tr>
<tr>
<td><strong>Area</strong></td>
<td>Small</td>
<td>Large</td>
</tr>
<tr>
<td><strong>Time</strong></td>
<td>5-20 min.</td>
<td>20-30 min.</td>
</tr>
<tr>
<td><strong>Intensity indicator</strong></td>
<td>Therapist (0.5-2 watt/cm²)</td>
<td>Patient perception</td>
</tr>
<tr>
<td><strong>Serious precaution</strong></td>
<td>Methyl methacrylate Laminectomy</td>
<td>Metal implant Cardiac pacemaker</td>
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</table>
Cold
Physiological effects of Cold

- **Hemodynamic**
  - Immediate cutaneous vasoconstriction
  - Delayed reactive vasodilatation
  - Decreased acute inflammatory response

- **Neuromuscular**
  - Slowing of nerve conduction velocity
  - Decreased group Ia, Ib, II fiber firing rates
  - Decreased muscle stretch reflex amplitudes
  - Decreased muscle fatigue
Physiological effects of Cold

• Joint and connective tissue
  – Increased joint stiffness
  – Decreased tendon flexibility
  – Decreased collagenase activity

• Metabolic effects
  – Decrease metabolic rate

• Miscellaneous
  – Decreased pain
  – General relaxation
## Classification of various types of Cooling

<table>
<thead>
<tr>
<th>Method</th>
<th>Depth</th>
<th>Main form of energy transfer</th>
</tr>
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<tbody>
<tr>
<td>Cold packs</td>
<td>Superficial</td>
<td>Conduction</td>
</tr>
<tr>
<td>Ice massage</td>
<td>Superficial</td>
<td>Conduction</td>
</tr>
<tr>
<td>Cold water immersion</td>
<td>Superficial</td>
<td>Conduction</td>
</tr>
<tr>
<td>Cryotherapy-compression units</td>
<td>Superficial</td>
<td>Conduction</td>
</tr>
<tr>
<td>Vapocoolant spray</td>
<td>Superficial</td>
<td>Evaporation</td>
</tr>
<tr>
<td>Whirlpool baths</td>
<td>Superficial</td>
<td>Convection</td>
</tr>
</tbody>
</table>
General Uses

• Acute traumatic condition
• Musculoskeletal conditions
• Acute and chronic pain
• Acute swelling
• Myofascial pain
• Following certain orthopedic surgeries
• Component of spasticity management
• Emergent treatment of minor burns
General Precautions

• Cold intolerance
• Cold hypersensitivity
• Cryotherapy-induced neurapraxia/axonotmesis

Cryopathies
• Cryoglobulinemia
• Paroxysmal cold hemoglobinuria
• Raynauld’s disease/phenomenon
• Arterial insufficiency
• Impaired sensation
• Cognitive or communication deficits that preclude reporting of pain
Cold packs

- Hydrocollator pack, Endothermic chemical gel pack, Ice pack
- Depth 2 cm.
- Decrease temp in skin 10 °C, in muscle 5°C
- Duration is 20-30 min
Ice massage

- Directed application of ice to the skin using gentle stroking motions
- Use for localizing symptoms
- Treatment time depend on the amount of subcutaneous tissue
Cryotherapy-compression units

• A cuff or boot and pneumatically compressed

• 10-25°C

• Use in acute musculoskeletal injury with soft tissue swelling

• After some surgical procedures
Vapocoolant Spray

• Used by some practitioners to treat myofascial and musculoskeletal pain syndromes
Hydrotherapy
Hydrotherapy application

- Orthopedic problems
  - Decreased weight bearing
  - Velocity-dependent resistant
  - Closed or open chain exercise
  - Slowed bone density loss
Hydrotherapy application

- **Spine rehabilitation**
  - Cannot tolerate axial or gravitational load
  - Increase support in strength or proprioceptives deficit
  - ↓ Risk of compression fracture
  - Transition from a wet to dry environment if patient are doing well in water to meet functional training

- **Neurologic disorders**
  - Cerebral palsy
  - Multiple sclerosis
Hydrotherapy application

- **Cleansing effects**
  - Soften and remove debris in wound
  - Controllable force by rate of flow
  - Quickly & easily get into & out of contoured areas
  - Antimicrobials
  - Surfactant

- **Psychological effects**
  - Warm water
  - Cold water
Form of Hydrotherapy

- Whirlpool
- Hubbard tank
- Contrast bath
- Non-immersion irrigation device
- Exercise pool
Whirlpool bath

- **Used for**
  - Open wounds, exercise, control pain in limited areas of body
  - 33-36°C in chronic wound
  - 40-43°C in joint stiffness, RA
  - 20-30 min
Hubbard Tank

- Full body immersion
- Temperature 34-36°C
- Use for
  - Large area of burns, other painful conditions that affect large areas
  - ROM exercise for multiple areas
  - Ambulation
Contrast Bath

- Alternately immersing in hot (42-45°C) and then cold (8.5-12.5°C) water
- 30 min, begin with 10-min immersion in hot, 1 min cold and 4 min hot
Contrast Bath

• **Effect**
  - Control edema
  - Desensitization

• **Used for**
  - Rheumatologic disease
  - Neuropathic pain
  - Chronic pain syndrome such as CRPS
Non-immersion Irrigation Device

• Shower cart, hand-held showers, syringes, electric pulsatile irrigation devices

• Treatment of open wounds
Full body immersion form

• Contraindication
  – Cardiac instability
  – Infection condition
  – Bowel incontinence
  – Severe epilepsy
  – Suicidal patient
Full body immersion form

• Adverse effect
  – Drowning
  – Burn: (hot water)
  – Fainting: (hot water)
  – Bleeding
  – Hyponatremia
  – Infection
  – Aggravation edema (hot water)
Resist the temptation
Electricity
Uses of Electrical Currents

- Innervated muscle stimulation
- Denervated muscle stimulation
- Pain control (TENS)
- Tissue healing
- Iontophoresis
Innervated muscle

- **NMES**
  - Strengthening
  - ROM
  - Facilitate voluntary control
  - Spasticity

- **FES**
  - Scoliosis
  - Hemiplegia
  - CP
  - SCI
Denervated muscle

- Decreasing muscle atrophy
- Enhancing nerve regeneration and muscle reinnervation
Pain control
Transcutaneous Electrical Nerve Stimulation (TENS)

• Gate Control theory
• Opiate-mediated Control
• Enhancement of tissue healing
• Modification of the flow of energy in acupuncture meridians
• Placebo effects
TENS

Common uses
1. Musculoskeletal pain
2. Post traumatic pain
3. Post surgical pain
4. Peripheral nerve injury
5. Peripheral neuropathy
6. Phantom limb pain
7. CRPS

Contraindications
1. Stimulation over carotid sinus
2. Pace makers or implanted cardiac defibrillator
3. Pregnancy
4. Allergic to the electrodes or gel
5. Skin infection, open wound or vasculitis at applying area
Adverse Effect

• Depend on the current amplitude and voltage
• Excessive heating of tissues
• Electrochemical burn (from DC)
• Ventricular fibrillation $\sim$100 mA
• Respiratory arrest
• Death
Pressure
Pneumatic pump

• Effective in edema control
• Should be used if elevation or compressive wrap alone are ineffective

• Contraindication
  1. Deep vein thrombosis
  2. Cellulitis
  3. Compromised perfusion
  4. Severely impaired sensation
Traction
Traction

Physiologic effects

• Elongation of C-spine
• Elongation of L-spine
• Relaxing muscle spasm
• Retraction of herniated disc

Technique

• Manual
• Electrical motorized device
• Free-weight-and-pulley-system
• Inversion traction
Traction

- Intermittent or continuous traction

- Weight
  - C-spine = 25-50 lbs
    (1/10-1/7 of BW)
  - L-spine = 50-100 lbs
    (1/3-1/2 of BW)

- Duration: 20 minutes
Indications

1. Any condition involving irritation or compression of nerve root
   • Radiculopathy
   • Herniated nucleus pulposus

2. Muscle relaxation
   • Nonspecific low back pain
   • Acute cervical/lumbar strain
General Contraindications

• Osteomyelitis/discitis/infection
• Spinal cord tumor
• Unstable fracture
• Severe osteoporosis
• Untreated HT (for inversion traction)
• Primary/metastatic bone tumor
• Clinical signs of myelopathy
• Coronary artery disease
• Severe anxiety
• Inadequate expertise
Contraindications

Cervical
- Central intervertebral disc herniation
- RA & other CNT diseases
- Carotid or vertebral a. insufficiency

Lumbar
- Pregnancy
- Cauda equina compression
- Restrictive pulmonary diseases/other respiratory problems
Manipulation
Manipulation

• “The use of the hands in the patient management process using instructions and maneuvers to maintain maximal, painless movement of the musculoskeletal system in postural balance”

• Goals
  – To improve motion in restricted areas
  – To help maintain optimal body mechanics
Indication

• Any musculoskeletal problems demonstrating **somatic dysfunction**
• Impaired or altered function of related components of the somatic (body network) system
Indications

- Acute or chronic neck pain
- Thoracic pain
- Rib pain
- Functional & mechanical low back pain
- Chronic low back pain
- Bulging intervertebral discs
- Facet syndrome
- Piriformis syndrome
- Sciatica
- Headache
- Sacroiliac syndrome
Contraindications

- Vertebral malignancy
- Infection
- Inflammation
- Cauda equina syndrome
- Myelopathy
- Multiple adjacent radiculopathies
- Joint instability (Fx, dislocation)
- Cervical rheumatoid disease
- Inadequate expertise
Side Effects

• Transient discomfort 6-72 hrs.
• Minor autonomic effects: ↑perspiration, early/↑menstruation, etc.
Complications

- Mostly from contraindicated procedures
- Thrust maneuver in cervical region → vascular insult to vertebrobasilar system or spinal cord
- Lumbosacral → very rare
- Some with craniosacral therapy
- No report from other non-thrust techniques
- Stroke, SCI, cardiac arrest, death
Massage
Massage

A group of procedures which are usually done with the hands, such as friction, kneading, rolling and percussion of the external tissues of the body in variety ways, either with a curative, palliative, or hygienic view.
Effects of Massage

- Mechanical effects
- Reflexive effects
- Neurologic effects
- Psychological effects
Indication of massage

• Indication
  – Low back pain
  – Neck pain
  – Fibromyalgia
  – Arthritis, bursitis, tendinitis, fascitis
  – Neuromas
  – Complications associated with MS, CP, hemiplegia, SCI, RSD, contracture, etc.
Types of Massage

• Basic Western Massage Procedure
  “Swedish system”
  a) Effleurage (Stroking)
  b) Petrissage (Compression)
  c) Tapotement (Percussion)
  d) Friction (Deep friction)

• Others: Acupressure, Shiatsu, reflexology & Auriculotherapy, etc.
Contraindications of massage

- Malignancy
- Cellulitis
- Lymphangitis
- Area of recent trauma or bleeding
- Open area
- DVT
- Caution: anticoagulant
- Special care: osteoporosis
Other modality
Laser
Monochromatic infrared photo energy
Magnetic stimulation
Hyperbaric oxygen therapy
Physical modality

• Therapy that uses physical forces to speed healing and lessen pain

• Seldom uses in isolation

• Almost always used as **adjuncts therapy**
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