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UWS care pathways and protocols provide evidence-informed, consensus-based guidelines to inform clinical decision making. To best meet a patient's healthcare needs, variation from these guidelines may be appropriate based on more current information, clinical judgment of the practitioner, and/or preferences of the patient.

Physical Therapy Modalities

This protocol is intended as a quick reference for the application of a variety of physical therapy modalities, including cryotherapy, thermotherapy, ultrasound and electrotherapy. The modalities are presented in alphabetical order.

Many physical therapy modalities are aimed at controlling pain and/or inflammation. As a general principle, these modalities should be used on a brief and limited basis as part of initial treatment of the acute patient or during acute flare-ups. The clinician should understand that certain patients—especially those with more chronic problems—may become inappropriately dependent on these passive modalities.

The majority of modalities do not have well-controlled outcome studies for most conditions. Consult specific care pathways and protocols for additional information regarding efficacy and application to a particular condition. There is usually little evidence that one modality is more effective than another.

Once the clinician identifies the desired therapeutic effect (e.g., reduce inflammation, control acute or chronic pain, promote healing), the choice of the modality may well depend on availability, the clinician's preference, and the individual patient's preference and response.

PARQ

As is true for all patient interventions, it is important that a *Procedure, Alternatives, Risks and Questions* (PARQ) conference be completed before administering even acute care. In the case of electrotherapy and heat/cold applications, the patient should be alerted to the risks of burns. In cases of home care, patients need to be clear about duration of treatment and precautions, such as skin reaction and/or irritation.

Modalities discussed in this protocol:

Treatment Warnings

1. **Contraindication** - a specific situation in which a procedure or modality should *not* be used because it may be harmful to the patient.

2. **Local Contraindication** - a situation in which the application of a modality (e.g., electrotherapy agent) over a specific location or region of the body could be harmful and thus should not be used at this location/region. In this protocol local contraindications are specifically indicated by a phrase such as "*contraindication…over the gravid uterus*").

3. **Precaution** - a situation in which a patient is at some risk of experiencing an adverse event. In this case treatment should proceed with caution. Proactive measures should be taken to reduce the risk of harm; such measures might include adjusting treatment parameters (lower intensity) or treatment schedule (treatment duration or frequency of application) and/or closer monitoring of patient response to the treatment.

GENERAL GUIDELINES
CRYOTHERAPY

- The patient should be placed in a comfortable position.
- The temperature of the environment should be comfortable.
- The patient should be provided with a way to alert the doctor if he/she thinks the cryotherapy is causing discomfort.

Contraindications

- Confused or unreliable patients
- Cold-Induced Urticaria: raised patches (wheals), severe itching and/or systemic reactions such as sneezing and dysphasia.
- Cold intolerance: severe pain, numbness and color changes in response to cold.
- Raynaud's disease/phenomenon
- Cryoglobulinemia: (uncommon) serum protein precipitates/gels at cold temperatures; proteins may aggregate in small blood vessels and cause local ischemia; may be idiopathic or seen in rheumatoid arthritis, multiple myeloma, lupus and leukemia.
- Paroxysmal Cold Hemoglobinuria: release of hemoglobin into the urine from the rapid breakdown (lysis) of blood cells in response to exposure to cold.

Precautions

- Frostnip: superficial tissue damage. Skin blanching tingling and burning. Reversible with slow gentle warming using superficial heat.
- When using gel packs, apply a layer of insulation (e.g., towels) between the patient and the pack to avoid frost nip.
- Do not compress gel packs; increased likelihood of frostbite.
- Muscle strength change: transient reduction of muscle force may occur, affecting motor performance. Use caution in returning the patient to activity immediately after cryotherapy.
- Elderly patients: thermoregulatory system is compromised and may lose ability to shiver and produce heat.
- Children less than 4 years old: thermoregulatory mechanisms may not adapt like adults and they may not communicate their sensation of cold or pain.
- Over superficial nerves application may cause transient neuropathies.

GENERAL GUIDELINES
ELECTROTHERAPY

- Whenever possible, procedures should be done on a wooden bench.
- If electrotherapies are used on a chiropractic table with metal parts, the patient should be cautioned against touching anything metallic.
- All tables should be unplugged.
- Note throughout the document: Pulse per second (pps) and Hertz (Hz) are interchangeable.
- Be sure that the pads are not too small. Pad size should be proportional to the treatment area.
- Sponge pads should be sufficiently wet and carbonized rubber pads should have sufficient gel applied. Self-adhesive pads should be not reused on other patients.

Contraindications

- Pacemaker
- Over the carotid sinus
- Within 20 feet of an operating diathermy
- Over the gravid uterus
- Through the heart
- Over areas of hemorrhage, infection, or malignancy, deep vein thrombosis or thrombophlebitis
- Over an active epiphysis/apophysis (generally 16 years old or younger, although the plate may not close in some individuals until between ages 18 and 25).[1]

Precautions

- On patients with circulatory, sensory, or mental impairment

[1] Although Houghton (2010) categorizes this only as a precaution, we recommend that the epiphysis be avoided in this age group (Bazin 2006, Robertson 2001).

GENERAL GUIDELINES
THERMOTHERAPY

- The patient should be placed in a comfortable position and the temperature of the environment should be comfortable.

- Thermotherapy should **not** be applied over the patient's clothing, as clothing impedes the provider's ability to evaluate the treated region prior to and during application.

- The patient should be provided with a way to alert the provider if he/she thinks the thermotherapy feels too hot or is causing discomfort.

- Patients receiving hot packs should be closely monitored (initially 5-minute intervals).

Contraindications

- Do not use packs over genitals, eyes, a pregnant abdomen/pelvis, or if the patient has decreased sensation or decreased arterial flow, acute inflammation or edema, malignancy, acute tuberculosis, multiple sclerosis, hemorrhage, infection, deep vein thrombosis or thrombophlebitis.
- Confused or unreliable patients

Precautions

- Placing a patient's body weight on top of a hot moist pack presents particular challenges and warrants specific precautions due to the increased potential for burns. In this circumstance, additional layers of insulating toweling should be added to compensate for compression of the towels and body tissues, and the patient should be monitored closely.
- Over areas with superficial metal implants.
- Home treatment: To avoid excessive treatment time in cases where a patient may fall asleep, set an alarm to wake up patient.
- Elderly patients and children less than 4 years old have unreliable thermoregulatory systems and may develop fever from heat treatment.

Contrast Therapy

Effect: Used in the subacute stage to aid in flushing inflammatory exudates from the injured area; used in the chronic stage to flush edema.

Technique: Treatment time should be 20-30 minutes. Begin with heat (pack or bath) over the area for 4 minutes. Follow immediately with cold (packs, bath or ice) for 2 minutes. Repeat hot and cold again, and then finish with hot for 4 minutes.

Note: Active movement of the target area while receiving hot and cold is the best way to mobilize venous and lymph circulation to reduce edema.

Contraindications: See contraindications for cryotherapy and thermotherapy, pp. 3, 5.

Cryotherapy

This modality is used in the acute and inflammatory stages.

Effect: Anesthesia; reduces inflammation; in acute stage decreases tissue destruction and edema. The stages of numbness in response to cryotherapy include cooling, burning, aching and numbness (CBAN).

Techniques of Application

1. **Ice packs:** Home-made ice packs do not require an insulator (towel). In the case of gel packs, however, a thin towel is placed between the treated area and the gel pack. Mold the ice pack so that it conforms to the treated area. Use a compression wrap to secure the pack. Be aware that compression wraps should be used with caution and only on populations that can tolerate more aggressive cooling. Apply for 20-30 minutes to reduce inflammation, edema, pain and muscle spasm.

   Note: When the goal of the ice pack is to create numbness before an aggressive or painful procedure (such as deep soft tissue massage, transverse friction massage, trigger point therapy, exercise or stretching), the patient should be advised to indicate when numbness has been achieved, at which point the ice pack can be discontinued.

   Note: Electrotherapy may be used in conjunction with either ice or gel packs.

2. **Ice massage:** Use a small paper or Styrofoam cup filled with ice. Tear the edges of the cup to expose the ice. Use a towel to catch the dripping water. Ice massage the inflamed area for 5-10 minutes or until numbness is achieved.

3. **Cryokinetics:** This technique combines the use of cryotherapy and exercise. The goal is to numb the inflamed area to the point of analgesia (20-30 minutes) and then work to achieve normal range of motion. The exercises are continued until a sensation of pain returns. The area is again iced for 5 minutes and the exercise is continued. This therapy aids in an early return to activity and simultaneously stimulates circulation through exercise. However, this type of therapy is not appropriate in all cases, for example, for injuries where analgesia may lead to joint injury or dysfunction (i.e., labral tear, unstable joints, muscle and tendon strain).

Contraindications: Raynaud's disease/phenomenon; sensitivity or allergy to cold; over regenerating peripheral nerve, superficial nerves or areas with circulatory compromise. Also see contraindications for cryotherapy, p. 3.

Precautions: When treating previously frostbitten areas, areas of decreased sensation, infants, young children, or the elderly who have diminished thermoregulatory abilities, it is not advisable to leave the patient unattended.

High Voltage Pulsed Current
(AKA, High Volt Therapy or High Volt Galvanism)

Pads are placed in series on the muscle involved.

Effect: Reduce pain

Technique:
- Intensity:
  - Sensory level (acute pain)
  - Motor or Nociception level (chronic pain)
- Frequency:
  - 80 pps (acute pain)
  - 1-10 pps (chronic pain)
- Polarity:
  - Positive (+) for acute pain
  - Negative (-) for chronic pain
- Time: 20-30 minutes

Effect: Reduce inflammation and edema

Technique:
- Intensity: Sensory level
- Frequency: 100 pps
- Polarity: Negative (-)
- Time: 20-30 minutes

Effect: Muscle strengthening/rehabilitation

Technique:
- Intensity: Motor level
- Frequency: 50 pps
- Polarity: Negative (-)
- Time: 15-20 minutes (15-20 repetitions)
- Pads: Apply one pad to muscle motor point or muscle belly and the other pad either proximal or distal on the muscle belly.

Continued on next page...

Effect: Reduce muscle hypertonicity, spasm or spasticity

Technique #1:

- Pad placement: Apply one pad to muscle motor point or muscle belly and the other pad either proximal or distal on the muscle belly.
- Intensity: Motor level
- Frequency: 80-150 pps (to tetanic contraction)
- Setting: continuous
- Time: 15-20 minutes

Technique #2:

- Pad placement: Apply one pad to muscle motor point or muscle belly and the other pad either proximal or distal on the muscle belly.
- Intensity: Motor level
- Frequency: 40-60 pps (to tetanic contraction)
- Setting: Surge 5 sec on/2.5 sec off *or* 7.5 sec on/2.5 sec off.
- Time: 15-20 minutes

Contraindications: See contraindications for electrotherapy, p. 4.

Interferential Current: Quadrapolar Technique

Effect: Reduce pain

Technique:

- Intensity:
  - Gate Mechanism: Sensory level
  - Opiate Release: Mild motor level
- Frequency: Sweep
  - Gate Mechanism: 80 to 120 bps[†]
  - Opiate Release: 1 to 10 bps
- Pads: (4) Crisscrossed. Treatment affects superficial tissue when pads are placed close together, the deeper tissue with pads farther apart. Pads may be secured with elastic bands, weights, weight bags, hot packs, ice packs, or may be individual use self-sticking pads.
- Vector scan: on
- Time: 20 to 30 minutes

Effect: Nerve block for acute or chronic pain

Technique:

- Intensity: Sensory level to patient tolerance
- Frequency: 4000 Hz
- Pads: (2) not crisscrossed
- Time: 8-10 minutes

Effect: Reduce edema and/or promote tissue healing.

Technique:

- Intensity: Sensory level or to patient tolerance
- Frequency: Sweep, 80-120 bps
- Pads: (4) crisscrossed
- Vector scan: on
- Time: 20-30 minutes

Contraindications: See contraindications for electrotherapy, p. 4.

[†] bps = beats per second

Iontophoresis
(AKA, Low Volt Galvanism)

Effect: Relieve pain; decrease inflammation; decrease calcific deposits and scar tissue; relax muscle hypertonicity

Positive pole (+) Positive charge repels positive ions of medicinal substance, providing their therapeutic effect.

Negative pole (-) Negative charge repels negative ions of medicinal substance, providing their therapeutic effect.

Technique:

- **Active pad:** The smaller pad, which is the active one and the same charge as the ions in the solution being phoresed, is placed directly over the target tissue.

  Use several 4x4 gauze sponges with a total thickness of approximately ½ inch and soak them in the medicinal solution and place them on the active pad. For ointments and creams, soak gauze in saline solution, rub cream/ointment into skin and place gauze over cream/ointment.

  Note: Treatment should be discontinued immediately if the patient experiences warmth or discomfort (this may indicate burning).

- **Dispersive pad:** Place large dispersive pad on a broad flat area away from the active pad (at least 6-8 inches). The dispersive pad should be twice the size of the active pad.

OTC ONLY

Hydrocortisone 0.5% cream
- Polarity: positive (+)
- Effect: anti-inflammatory

Magnesium sulfate 2% solution (Epsom salt)
- Polarity: positive (+)
- Effect: analgesic; antispasmodic

Sodium salicylate 2% solution
- Polarity: negative (-)
- Effect: analgesic; decongestive

Copper sulfate 2% solution
- Polarity: positive (+)
- Effect: Antiseptic, anti-fungal, astringent
- Mode: Continuous current is used.

Xylocaine 5% ointment (LMX 4%, available OTC/web)
- Polarity: positive (+)
- Effect: analgesic; anesthetic

Potassium iodide 2% solution
- Polarity: negative (-)
- Effect: analgesic; sclerolytic; helps decrease calcific deposits and scar tissue

- Intensity: Increase to patient comfort or until limited by the milliamperage rule. (Never exceed one milliamp for each square inch of active electrode.) Usually, the maximum is 5 to 10 milliamps. (See dosage below.)

  Note: The risk of causing an electrical burn must be recognized. If the patient experiences discomfort during the treatment, lower the amperage or discontinue the therapy.

- Dosage: 40 mA•min (milliamps x minutes)

- Time: Initial treatment time is 3-4 minutes. Check for patient tolerance to the low volt galvanism and to the substance being phoresed. After the initial treatment time of 3-4 minutes, the amount of milliamps delivered multiplied by the number of minutes of application should equal 40 mA•min.

- Frequency: 3 times per week for 2 weeks or until therapeutic goal has been achieved.

Contraindications: See contraindications for electrotherapy, p. 4.

Low Level Laser Therapy (LLLT)
(AKA, Cold Laser)

Effect: To aid in wound and soft tissue healing; reduce pain

Technique:

- Dosage: generally 4-20 J/cm^2 (varies with protocol)
- Laser probe: position at 90° angle to target tissue with firm pressure
- Frequency: Daily or every other day
- Areas to treat:
    - Injured or affected area
    - Trigger or tender points
    - Referred areas
    - Nerve roots and superficial nerves
    - Acupuncture points

Treatment Considerations:

- Darker skin pigmentation: absorbs photo energy, therefore use higher dose.
- Small stature and frail patients: start at lower dose (e.g., elderly, children).
- Deeper target tissue requires higher dose.
- Tissue type: adipose does *not* absorb photo energy, while muscle does absorb photo energy.
- Anti-inflammatory medications may potentially decrease effectives of LLLT. Consider reducing or discontinuing anti-inflammatory medications.
- Recent steroid injections (within 72 hours): may be counterproductive to LLLT; treat one week post injection.

Note: Acute conditions may show response in 2-6 treatments (maximum 15). Chronic conditions may show response in 3-10 treatments (maximum 25).

Contraindications:

- Direct irradiation of the eyes
- Areas of hemorrhage
- Over the thyroid gland
- Over malignancy
- Over low back or abdomen during pregnancy or menstruation
- Along the cervical sympathetic ganglion (i.e., do not treat within the medial margins of the SCMs)
- Over heart or vagus nerve of cardiac patients
- Over recently irradiated tissue for 4-6 months (or until the patient has recovered)
- Over photosensitive skin areas
- Over areas of decreased sensation

Precautions:

- Over an infected area: laser radiation may either stimulate or inhibit bacterial action.

Not Contraindicated:

- Pacemakers
- Implants: metal, plastic, joints
- Over boney prominences
- Peripheral vascular disease with decreased sensation
- When heat is contraindicated (e.g. acute injury)

Low Voltage Alternating Current
(AKA, Biphasic or Sine-wave)

Effect: Muscle strengthening/re-education

Technique:
- Pad placement: Apply one pad to muscle motor point or muscle belly and the other pad either proximal or distal on the muscle belly.
- Intensity: Motor level
- Frequency: 50 pps (to tetanic contraction)
- Setting:
  - *Surging* for muscle strengthening
  - *Reciprocal* for muscle re-education (electrodes on agonist/antagonist)

Effect: Reducing muscle hypertonicity, spasm or spasticity.

Technique #1:
- Pad placement: Apply one pad to muscle motor point or muscle belly and the other pad either proximal or distal on the muscle belly.
- Intensity: Motor level
- Frequency: 80-150 pps (to tetanic contraction)
- Setting: continuous
- Time: 15-20 minutes

Technique #2:
- Pad placement: Apply one pad to muscle motor point or muscle belly and the other pad either proximal or distal on the muscle belly.
- Intensity: Motor level
- Frequency: 40-60 pps (to tetanic contraction)
- Setting: Surge 5 sec on/2.5 sec off *or* 7.5 sec on/2.5 sec off.
- Time: 15-20 minutes

Contraindications: See contraindications for electrotherapy, p. 4.

Microcurrent

Note: Treatment can be applied through 2-4 pads on either side of the lesion, 2 probes or 1 probe and 1 pad. With home units, treatment can be applied up to 23 hours a day.

Hand-held probes may be used instead of pads for specific point stimulation (e.g., acupuncture points). Stimulation is typically applied for 15-30 seconds per point.

Effect: To reduce pain

Technique:

- Intensity: 25-100 µamps
- Frequency: 3 or 80 or 130 pps
- Polarity: Early treatment (1-24 hours post-injury) positive (+). Later treatment, negative polarity (-). Biphasic has also been successful.
- Wave slope: High end of range (sharp ramp)
- Time: 20-30 minutes (home care: 6-8 hours at a time for up to 23 hours a day)

Effect: To reduce swelling, edema

Technique:

- Intensity: 20-100 µamps
- Frequency: 20-40 pps
- Polarity: Biphasic
- Wave slope: high end of range (sharp ramp)
- Time: 20-30 minutes (home care: 6-8 hours at a time for up to 23 hours a day)

Effect: Tissue healing

Technique:

- Intensity: 20-50 µamps
- Frequency: 0.3 or 0.5 pps
- Polarity: Biphasic
- Wave slope: low end (shallow ramp)
- Pad placement: On either side, directly over the lesion or along acupuncture points.
- Time: 20-30 minutes (home care: 6-8 hours at a time for up to 23 hours a day)

Contraindications: See contraindications for electrotherapy, p. 4.

Russian Muscle Stimulation

Effect: Muscle rehabilitation and strengthening

Technique:

- Patient isometrically contracts the muscle against resistance during the on-cycle of stimulation; usually to 10-20 repetitions with 10-second isometric hold.
- Pad placement: Both pads on the muscle belly[*].
- Intensity: Motor level to tolerance
- Frequency: 50 bups[‡]
- Duty cycle: 1:5 ratio; 10 seconds on and 50 seconds off
- Ramp times: 1-2 seconds
- Time: 10-20 minutes
- Treatment schedule: Every other day; (3 times per week) for 2 weeks, then re-evaluate.

Contraindications: See contraindications for electrotherapy, p. 4.

[*] There are three ways to place pads on the muscle when doing Russian current: 1) One channel (two pads) on the muscle belly; 2) two channels (4 pads) simultaneously on two different (maybe bilateral) muscle groups (co-continuous); 3) two channels (4 pads) simultaneously on antagonistic muscle groups (reciprocal)

[‡] bups = bursts per second

Short-wave Diathermy

Effect: To aid in tissue healing, increase circulation, reduce pain, and create a deep heating effect. Conditions treated with this modality include bronchitis, degenerative joint disease, and chronic pelvic pain (but not during the acute phase of a PID).

Technique:

- Applicators:
  - Condenser plates or pads using co-planar or longitudinal placement; single layer of thick toweling on patient.
  - Induction drum; single layer of thick toweling on patient.
- Dose: The level where the patient receives a comfortable sensation of warmth—NEVER HOT
- Time: 20-30 minutes

Contraindications:

See contraindications for thermotherapy, p. 5.

- Over metal in the treatment area or over metal implants
- Implanted or transcutaneous neural stimulators
- Pregnancy or menstruation
- On patients with peripheral vascular disease
- On patients with systemic edema
- Over testicles
- On patients with sensory or mental deficits
- Over epiphyseal plates in children

Special Precautions:

- Within 15 feet of an operating electrotherapy modality or electrical devices (e.g., hearing aid)
- Synthetic materials must be insulated from the cables by toweling.
- Avoid moist areas or over the vicinity of casts, skin folds, fluid-filled cysts, and amniotic fluid.
- Remove contact lenses.
- Osteoporosis: avoid or use sparingly due to possibility of further demineralization (hyperemic decalcification).

TENS Units

Effect: Reduce pain

Pads: (4)
a. crisscrossed over the lesion*
b. along distribution of involved nerve
c. over acupuncture points, trigger points, or motor points
d. over dermatomal pain pattern

Conventional TENS (AKA, High-TENS)

Technique
- Intensity: Sensory level (comfortable paresthesia)
- Frequency: 75-100 pps
- Pulse width: 50-100 μseconds
- Modulation: Burst or modulate
- Time: 20 minutes to several hours†

Low Frequency TENS (AKA, Lo-TENS or Acupuncture-like TENS)

Technique
- Intensity: Motor level (to patient comfort)
- Frequency: 1-5 pps
- Pulse width: 200-300 μseconds
- Modulation: Burst or modulate
- Time: 20-45 minutes

Contraindications: See contraindications for electrotherapy, p. 4.

* There are several approaches for TENS pad placement. One approach is to place the pads in series. Another approach is to crisscross them so they set up an electromagnetic field between the pads. There are several other approaches as well. The literature is clear that one approach does not have any better effect than another, so we end up with trial and error placements.

† There is no consensus about treatment time. Relief may be acquired in as little as 20 minutes. Some practitioners apply TENs for a few hours and some apply it for longer times.

Thermotherapy

Effect: Increases blood flow; reduces pain; decreases muscle hypertonicity

Techniques of Application

- **HOT MOIST PACKS:**
  Temperature: 165°F-170°F (74°C-77°C)

  Place 6-8 layers of thick towels over the area to be treated. An integral part of preparing a hot pack is wrapping it with terry cloth toweling (in addition to a commercial cover) to trap the steam and prevent burns. The towels and covering are removed for laundering after each use.

  Place the hot moist pack directly over the towels. A compression wrap or weight is not necessary to secure the hot pack; the weight of the pack is enough.

  - A commercial hot pack cover is the equivalent of 4 layers of thick toweling. Therefore only 2-4 additional layers of towels are required when using a commercial hot pack cover.
  - Optimal treatment time is about 20 minutes. The patient should feel a comfortable warmth.
  - The patient should be evaluated for overdose after 5 minutes of treatment.
  - Electrical modalities may be used in conjunction with heat therapy.

NOTE: A patient's body weight should not be placed on top of a hot moist pack without specific permission from a clinical supervisor. Placing a patient's body on top of a hot moist pack presents particular challenges and warrants specific precautions due to the increased potential for burns. In this circumstance additional layers of insulating toweling should be added to compensate for compression of the towels and body tissues. The patient should be closely monitored.

Note: Hot moist packs should not be placed on top of the patient's clothing, as clothing impedes the provider's ability to evaluate the treated region prior to and during application.

- **WHIRLPOOL:** Patient soaks in a whirlpool for 15-20 minutes.

  Temperature:
  - Extremity: 98°F-104°F (37°C-40°C)
  - Full Immersion: 98°F-102°F (37°C-39°C)

- **PARAFFIN BATHS:** Temperature: 124°F-129°F (51°C-54°C)

A mixture of paraffin and mineral oil (6-7:1) is a means of delivering superficial heat to areas that are difficult to reach. Structures around superficial joints can be reached and paraffin is especially useful for the distal extremities.

Contraindications Specific to Paraffin Baths *(in addition to contraindications, p. 5)*:
- Open wounds
- Infections
- New burns
- Skin conditions and contagions (e.g., acute dermatitis, eczema)

Indications for Paraffin Baths
- Non-acute rheumatoid arthritis
- Osteoarthritis
- Dupuytren's contractures
- Raynaud's disease/phenomenon
- Migraine headaches (hands are immersed)

General Instructions
- Have the patient remove all jewelry from the treatment area.
- Wash the part thoroughly and inspect it for temperature sensation and skin integrity.

WARNING: Paraffin can provide approximately 6 times the amount of heat as water (specific heat of paraffin is 0.5-0.65 compared to 1.0 for water). Although not hot to the touch, the temperature is sufficient to cause burns over time.

- Although paraffin can be recycled back to the tank, it is the practice in UWS clinics to discard it after each use.
- Paraffin may be sterilized by heating it to 176ºF (80ºC) or more for a few hours. It then has to be cooled to operating temperature of 124°F-129°F (51°C-54°C) which may take several more hours (possibly overnight).

Technique #1: Dip Immersion with Wrapping
- Set aside two terry-cloth towels and either waxed paper, table paper, or plastic wrap.
- Instruct the patient to dip the part, remove it from the bath and allow the paraffin on the part to harden until it looks dull (the paraffin transitions from clear to translucent to opaque). Repeat this process up to 10-12 times forming a glove of solid paraffin.
- After the glove is formed, instruct the patient not to crack the paraffin or to touch the bottom of the tank.
- Quickly wrap the part with the paraffin in waxed paper, plastic wrap, or table paper and then in several layers of terry cloth toweling to retain the heat. Secure with rubber bands or tape if needed. Do not allow heat to escape.
- Let the patient sit comfortably.
- Treatment time is 20-30 minutes.
- Unwrap the part, remove the paraffin by peeling it off, and discard it.
- Follow up with planned treatment while the part is still warm.

Technique #2: Continuous Immersion

- Dip the part, remove it and allow the paraffin on the part to harden until it looks dull (the paraffin transitions from clear to translucent to opaque). Repeat this process 6-8 times so that a glove of solid paraffin is formed.
- Instruct the patient not to crack the paraffin or to touch the bottom of the tank.
- Instruct the patient to keep their hand immersed in the paraffin bath.
- Common treatment time is 20-30 minutes.
- Remove the paraffin by peeling it off and discard it.
- Follow up with planned treatment while part is still warm.

Contraindications: See contraindications for thermotherapy, p. 5.

Precautions: Feet should either be wrapped in plastic bags and then immersed in the bath or placed in a plastic bag filled with wax.

Ultrasound

Effect: To aid in tissue healing; reduce pain; increase circulation; create a deep heating effect; for phonophoresis.

Technique

- Intensity: Range 0.5-2.5 W/cm^2

  Acute: 0.5-1.0 W/cm^2
  Chronic: 1.0-1.5 W/cm^2

  Thermal effects: 0.5-2.5 W/cm^2
  Non-thermal effects: <0.5 W/cm^2

- Frequency is dependent upon the thickness of the tissue.
  - 1 MHz: 1-2 inches (3-5 cm)
  - 3 MHz: 0.4-0.8 inch (1-2 cm)

  Note: Some Dynatronic machines may have a frequency of 2 MHz. Frequency should be estimated to fall between the recommendations for 1 and 3 MHz.

- **Mode:** Pulsed (20% duty cycle) is used in the acute phase of injury, near boney areas, when thermal effects are not desired, and for tissue healing.

  Note: Pulsed mode is especially helpful for the acute and subacute inflammatory stages to aid in soft tissue repair, stimulate blood flow, reduce pain, and bone fracture and tendon repair.

- **Mode:** Continuous (100%) is used when strong thermal effects are desired, such as when treating muscle spasm, joint stiffness, pain, joint contracture and scar tissue.

Contraindications:
See contraindications for electrotherapy, p. 4.

- Along the cervical sympathetic ganglion (or over the anteriorlateral neck)
- Directly over the spinal column after laminectomy
- In patients with severe arterial disease or deep vein thrombosis
- In patients with bleeding disorders or TB

Precautions:

- Over a bony prominence (use 3 MHz, pulsed at 0.5 W/cm^2 and avoid lingering over the boney area)
- Over epiphyseal plates in children (use 3 MHz, pulsed at 0.5 W/cm^2 and avoid lingering over the boney area)
- Any surgically implanted artificial product (e.g., Gortex or mesh) may build up heat in an area.

Specific Protocols

- **Soft Tissue Healing:** Accelerate the transition of inflammatory stage to proliferative stage to remodeling stage of healing.
  - Pulsed (20%)
  - 1 MHz
  - 0.5 W/cm^2
  - 5 minutes per field
  - 3x/week

- **Bursitis and Tendonitis:** Increase fibroblast activation and collagen secretion.
  - Pulsed (20%)
  - Frequency based on tissue depth (1 MHz or 3 MHz)
  - 0.5-1.0 W/cm^2
  - 5 minutes per field
  - Daily, for up to two weeks

- **Joint Contracture/Scar Tissue:** Elevation of tissue to 104°F (40°C)
  - Continuous (100%)
  - Frequency based on tissue depth (1 MHz or 3 MHz)
  - 1.0-2.5 W/cm^2
  - 5 minutes per field
  - 3x/week for 3-4 weeks (follow with stretching of heated tissue)

- **Pain and Muscle Spasm:** Increased pain threshold due to decreased nerve transmission
  - Continuous (100%)
  - Frequency based on tissue depth (1 MHz or 3 MHz)
  - 0.5-1.0 W/cm^2
  - 5 minutes per field
  - Daily, for up to two weeks

- **Calcium Deposits:** Facilitate re-absorption of deposits in soft tissue.
  - Pulsed (20%)
  - Frequency 1 MHz
  - 2.5 W/cm^2
  - 15 minutes per field
  - 5x/week for 3 weeks, then 3x/week for 3 weeks (24 total)

➢ SPECIAL MEDIUM

Application can be *direct* (gel) or *indirect* (water bath).

Indirect technique (water bath) is indicated when the treatment surface area is highly irregular and either good soundhead contact is not achievable or the soundhead irritates a boney area. Typically water baths work well for an ankle, wrist, hand or elbow.

When using the indirect technique (water bath) the soundhead is kept 0.5-1.0 inch from the skin surface.

Doses are increased by 0.5 W/cm^2 when using a water bath.

Time: Acute: 5 minutes
Chronic: 10 minutes

➢ PHONOPHORESIS

Phonophoresis can be used to drive whole molecules of medicinal substances across the skin. Penetration 1-2 mm into skin and superficial circulation.

Technique:
Frequency: 3 MHz if available for more superficial absorption
Duty cycle: 20% duty cycle if addressing an inflammatory condition
Intensity: 0.5-0.75 W/cm^2
Time: 5-10 minutes

The following substances may be applied.

- *Hydrocortisone ointment* 1%: Anti-inflammatory, analgesic
- *Lidocaine ointment* 5% (LMX 4%): Analgesic
- *Salicylate ointment* 10% (Myoflex): Anti-inflammatory

Other non-prescriptive substances can be considered.[§]

➢ ULTRASOUND/EMS COMBINATION THERAPY

The electrode pad is placed near the treatment area. The ultrasound head is placed over the target tissue. See parameters for US and EMS therapy.

Contraindications: See contraindications for electrotherapy, p. 4.

[§] *See* Jaskoviak P, Shafer R. Applied Physiotherapy: Practical Clinical Applications with Emphasis on the Management of Pain and Related Symptoms (2nd ed). Arlington, VA: American Chiropractic Association; 1993: 230.

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PT CHART (5/1/14)

Modified from Bazin, S.et al.(2006) and cross referenced with Robertson (2001 and Houghton 2010).

	Cold Therapy	Hot Pack	Pulsed Shortwave	Inter-ferential	Laser	Other Low Frequency	Shortwave (Cont/ Pulsed)	Tens	Ultra Violet Radiation	Ultrasound (Non-Thermal)	Ultrasound (Thermal)	Wax
Active Epiphysis		CAUTION	**LOCAL** STOP	**LOCAL** STOP	**LOCAL** STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP		LOCAL STOP	LOCAL STOP	
DVT	**LOCAL** STOP	**LOCAL** STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP
Implant, Acitve (Pacemaker)			LOCAL STOP	LOCAL STOP		LOCAL STOP	STOP	LOCAL STOP		LOCAL STOP	LOCAL STOP	
Implant, Metal		CAUTION	CAUTION				LOCAL STOP					
Local circulatory insufficiency	LOCAL STOP	LOCAL STOP	CAUTION	CAUTION	CAUTION	CAUTION	LOCAL STOP	CAUTION		CAUTION	LOCAL STOP	CAUTION
Malignancy	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP
Pregnancy (around fetus)	CAUTION	CAUTION	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	LOCAL STOP	CAUTION	LOCAL STOP	LOCAL STOP	
Pregnancy (anywhere)			STOP				STOP		CAUTION			

CAUTION = **Precaution** STOP = **Contraindicated** **LOCAL** STOP = **Local contraindication**

Note: All modalities are contraindicated over the eyes except for hot and cold and over the testis except hot, cold and ultraviolet light.

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