This is a sample guideline. Each patient should be carefully evaluated by his / her physician and therapist for specific patient considerations to optimize a successful outcome. ORI CPM Benefits & Protocols, Rev 03/02
ACL RECONSTRUCTION:
Anterior cruciate ligament is a main stabilizer for the knee joint and reconstructions are usually due to sports related injuries. This type of injury can result when the knee is forced in a lateral direction while weight bearing, flexed and externally rotated or forced into hyperextension. Patients usually notice a strong tearing or popping sensation at the time of injury and the joint is painful, instable and shows signs of swelling.

BENEFITS OF CPM
- Minimizes scar tissue formation
- Prevents cartilage degeneration associated with immobilization
- Passive motion increases overall range of motion (ROM) in the surrounding tissues
- Improved biological healing via longer doses of motion will guarantee an exact balance of connective tissue constituents, resulting in an organized collagen matrix
- Constant movement activates the gate control mechanism, where proprioceptive feedback overrides pain transmission

SUGGESTED CPM PROTOCOL
- Start ROM at 0-90 degrees for straight ACL reconstructions
- For additional safety with MCL or meniscal repairs along with an ACL reconstruction, start the patient at 20-90 degrees
- 8-10 hours per day
- 3-6 weeks
TOTAL JOINT REPLACEMENT - KNEE

A total knee replacement is the same as a total knee arthroplasty. The joint is completely removed and replaced with an artificial implant. This is a common method of treatment for advanced osteoarthritis and other degenerative joint diseases.

BENEFITS OF CPM

- Joint surfaces are lubricated through joint motion. This helps to deliver nutrition to the tissue.
- Collagen cross links are prevented, the collagen lays down properly and heals in a more uniform, strengthened manner
- ROM is maintained and increased
- Swelling is decreased
- Pain is decreased through activation of the gate control mechanism

SUGGESTED CPM PROTOCOL

- Initial settings:
  - 0-40 degrees on day 0 post-op
  - 20 hours a day
- Progressive settings:
  - Increase 10 degrees per day starting on day 2 post-op use
  - Up to 20 hours per day
  - 1-3 weeks post-operatively
TOTAL JOINT REPLACEMENT - SHOULDER AND ANKLE

BENEFITS OF CPM

- Joint surfaces are lubricated through joint motion. This helps to deliver nutrition to the tissue
- Collagen cross links are prevented, the collagen lays down properly and heals in a more uniform, strengthened manner
- ROM is maintained and increased
- Swelling is decreased
- Pain is decreased through activation of the gate control mechanism

SHOULDER:

A total shoulder replacement is also known as a total shoulder arthroplasty. The destruction of the glenohumeral joint is caused by chronic degenerative arthritis, traumatically induced arthritis, osteonecrosis, or rheumatoid arthritis. Prosthetic joint replacement for treatment of advanced joint degeneration may be either partial or complete.

SUGGESTED CPM PROTOCOL

- Initial settings: External rotation at 40-50 degrees and elevation at 40-50 degrees
- Increase 5-10 degrees daily
- Maximum settings: Rotation at 65 degrees, elevation at 110 degrees
- 4-6 hrs per day / at least 1 hr at a time

ANKLE:

The ankle is a complex joint with many movements and bony structures. The fact that the ankle is a weight-bearing joint makes it difficult for rehabilitation.

SUGGESTED CPM PROTOCOL

- Initial ROM based on stability of joint and available range
- Initial Setting: To patient tolerance, 2-12 hrs per day
- 1-12 weeks with an average of 6 weeks
ROTATOR CUFF REPAIR:

Activities that involve repetitive use of the arm above the horizontal level may produce an overuse syndrome. This overuse eventually can lead to tendon degeneration and rupture of the rotator cuff. The rotator cuff functions as a dynamic stabilizer for the glenohumeral (GH) joint in the shoulder.

BENEFITS OF CPM

- Early passive range of motion (PROM) tolerated - typically large amount of pain with this injury
- Maintain and increase ROM
- Collagen lays down properly and heals in a more uniform, strengthened manner
- Constant movement activates the gate control mechanism, where proprioceptive feedback over-rides pain transmission. Therefore, the patient is likely to be compliant in active extension exercises if pain free.
- Improves circulation and helps decrease edema
- Maintains passive glenohumeral joint motion in a non-impingement and protective range.

SUGGESTED CPM PROTOCOL

- Initial settings:
  - External rotation at 40-50 degrees
  - Elevation at 40-50 degrees
  - Increase 5-10 degrees daily
- Maximum settings:
  - Rotation at 65 degrees
  - Elevation at 110 degrees
- 4-6 hrs per day for at least 1 hr at a time
ADHESIVE CAPSULITIS FOR SHOULDER OR ELBOW:

Adhesive capsulitis is where the joint capsule has become “frozen”. This syndrome results in a decrease in both active and passive motion due to the scar tissue or adhesion formation on the articular, capsular, and periarticular structures.

BENEFITS OF CPM

- Maintains ROM gained in therapy or surgery
- If there is pain, constant movement activates the gate control mechanism, where proprioceptive feedback over-rides pain transmission. Therefore, the patient is likely to be compliant in active extension exercises if pain free.
- Allows collagen to realign properly in parallel versus a random arrangement for a better matrix (less likely to develop degenerative joint disease)
- Improves circulation and helps decrease edema

SUGGESTED SHOULDER CPM PROTOCOL

- After manipulation
- Initial settings:
  - Rotation at 65 degrees
  - Elevation at 90-110 degrees
- Do not exceed initial settings with CPM
- Treat aggressively
- 4-6 hrs per day at least 1 hr at a time

SUGGESTED ELBOW CPM PROTOCOL

- After surgical procedure
- Initial settings of 0-90 degrees
- Progressive settings of 1 to 120 degrees by week 6
- 6-8 hours per day
- 6-8 weeks
SUBACROMIAL DECOMPRESSSION:

This surgical procedure is used to treat shoulder impingement syndrome. Impingement refers to the encroachment of the acromion, coracoacromial ligament, coracoid process, and/or the acromioclavicular joint on the rotator cuff mechanism that passes beneath them as the glenohumeral joint is moved.

BENEFITS OF CPM

- Reduce inflammation while maintaining passive range of motion (PROM) in a non-impingement and protective range.
- Motion produces an increased balance of CT components which leads to a more organized collagen matrix (decreased adhesions).
- Constant movement activates the gate control mechanism, where proprioceptive feedback over-rides pain transmission. Therefore, the patient is likely to be compliant in active extension exercises if pain free.

SUGGESTED CPM PROTOCOL #1

- Initial settings:
  - Rotation at 40 degrees, increase 5-10 degrees daily
  - Elevation at 40-50 degrees
- Maximum settings
  - Rotation to 65 degrees
  - Elevation to 90 degrees by one week
  - Maximum at 110 degrees with CPM

SUGGESTED CPM PROTOCOL #2

- Post-op day 1 in plane of scapula as tolerated
- Elevation: progress to 90 degrees
- Rotation: progress to 60 degrees
- Progress to full ROM
- This may take 2-4 weeks
- 6-8 hours per day
- Remove for active exercise as prescribed by physician
THERMALLY ASSISTED CAPSULAR SHIFT (TACS):

Shoulder joint instability can occur when the GH joint capsule has become unstable - dislocation is common. Capsular shift can occur in one or multiple directions and the type of pathology dictates the type of operative procedure. Thermally assisted capsular shift (TACS) is performed arthroscopically with a device that heats the shoulder joint capsule and causes it to shrink.

BENEFITS OF CPM

- Provides immediate ROM in a safe pre-set range so as not to jeopardize stability
  - No stretch on the capsule
  - Eliminates joint loading
- Prevents adhesions
- Balances CT components and collagen lies down properly
- Constant movement activates the gate control mechanism, where proprioceptive feedback over-rides pain transmission. Therefore, the patient is likely to be compliant in active extension exercises if pain free.

SUGGESTED CPM PROTOCOL

- Post-op day 1 in plane of scapula as tolerated
  - Abduction to 90 degrees as tolerated
  - External rotation to 60 degrees as tolerated
- 6 hrs per day for 4-6 weeks
- CPM can be weaned at 6 weeks post-op
- Some physicians may choose not to use CPM because of the nature of the original problem (instability)
CARTILAGE REPAIR – FOR KNEE OR SHOULDERT:
Healthy cartilage is a key factor in the health of the joint. Cartilage defects can lead to degenerative joint disease, such as osteoarthritis (OA), and can inhibit proper rotation and gliding of joint surfaces.

BENEFITS OF CPM
- Produces convection (pumping of synovial fluid into cartilage)
- Nutrients get to cartilage to aid healing
- Proper remodeling of cartilage can occur
- Maintains passive range of motion (PROM) without compressive loading of the joint
- Constant movement activates the gate control mechanism, where proprioceptive feedback over-rides pain transmission. Therefore, the patient is likely to be compliant in active extension exercises if pain free.

KNEE CARTILAGE REPAIR: SUGGESTED CPM PROTOCOL
- For Microfracture Technique and other repair procedures
- Initial Settings: widest available ROM within patient tolerance
- 6-8 hrs per day
- 6-8 weeks

SHOULDER CARTILAGE REPAIR: SUGGESTED CPM PROTOCOL
- Physician ROM limits will vary
- Device should be placed post-operative on day one, or as tolerated
- Initial Settings:
  - Abduction and rotation to 1/2 the range of the opposite side in the first 4-6 weeks
- Progress abduction to 90 degrees
- Progress external rotation to 60 degrees
- Both abduction and external rotation should be in the plane of the scapula
- 6-8 hours per day for 2-4 or 4-6 weeks
INTRA-ARTICULAR FRACTURES:

An intra-articular fracture is a fracture of the bone within the joint, such as the wrist. Open reduction internal fixation (ORIF) or external fixation is often required.

BENEFITS OF CPM

- Helps to reduce swelling
- Provides passive range of motion (PROM) to prevent stiffness
- Constant movement activates the gate control mechanism, where proprioceptive feedback over-rides pain transmission. Therefore, the patient is likely to be more compliant in active exercises if pain free.
- Promotes articular cartilage hyaline-like remodeling
- Can significantly lessen likelihood of developing degenerative osteoarthritis (OA) at the fracture site
- Allows for improved biological healing (due to longer doses of motion). This results in an improved collagen matrix and the prevention of adhesions forming on surrounding structures.

SUGGESTED CPM PROTOCOL #1

- Apply within the first week, preferably within 24 hours post-operatively
- ROM dependent on initial measurements
- Time on unit
  - Max: 24 hours/day
  - Min: 8-10 hours/day
  - Resting hours preferable
- Remove for exercise as prescribed by physician or therapist
- Educate the patient on the difference between active and passive exercise. CPM is not a substitute for active exercise.

SUGGESTED CPM PROTOCOL #2

- Elevate extremity if applicable
- When PROM is maintained at available PROM range, CPM may be weaned. This usually occurs at 3-6 weeks post-op
- Splinting is often used in conjunction with CPM
- Educate the patient on the difference between active and passive exercise. CPM is not a substitute for active exercise.
FLEXOR TENDON TENOLYSIS:

Tenolysis is the surgical excision of adhesions from tendon(s) and this procedure is usually secondary to a poor rehab outcome from a previous primary injury.

- Successful digital flexor tendon gliding is dependent on the flexor digitorum profundus (FDP) differentially gliding separately from the flexor digitorum sublimis (FDS).
- The patient may have been non-compliant in initial rehab. Another point to consider would be the amount of scar tissue as well as the location of the scar from the primary injury.
- Initial post-operative period can be painful (0-14 days).

BENEFITS OF CPM

- Increased passive movement inhibits adhesion formation.
- Increased convection (increased pumping of synovial fluid) increases joint nutrition.
- Motion produces an increased balance of CT components which leads to a more organized collagen matrix.
- Pain is controlled through activation of gate control mechanism.

SUGGESTED GUIDELINES - PRE-OP

- Document active and passive range of motion statistics.
- Isolate and measure FDS vs. FDP excursion.
- Fabricate splint if custom design preferred; otherwise make adjustments to the prefabricated splint.
- Educate the patient on the difference between active and passive exercise. Emphasize that CPM is not a substitute for active exercise.

SUGGESTED POST-OP CARE AND CPM PROTOCOL

- Patient should remove the CPM device hourly for active differential tendon gliding. It is important to start active motions ASAP to maximize tendon pull through.
- Record intra-operative active and passive range of motion (PROM). Record current active and passive ROM and the % difference. Inform the patient of the intra-operative ROM.
- Splinting is often used in conjunction with CPM. Be sure to modify any splints to accommodate swelling and post-operative dressings.
- CPM use will vary if the tendon is frayed or in poor condition.
- Apply CPM within week one, as soon as possible post-operatively.
- Optimal wear is for 24 hours. Minimum is 8-10 hours a day, resting hours are preferred. Keep hand elevated.
- As active ROM maintains PROM, CPM can be weaned, usually at 3-6 weeks.
FLEXOR TENDON LACERATION REPAIR:

This is the repair to lacerations of the fibrous connective tissue that serves as the attachment of the muscles to bone.

- Digital lacerations will involve one or both of the extrinsic flexors of the hand. Most common digital lacerations occur in either Zone I or Zone II. Severe injuries can involve Zone III.
- Conventional practice includes immobilization or early movement programs following philosophies of Kleinert and/or Duran.
- Research findings demonstrate immobilization can render a tendon mechanically inferior in strength and structure.
- Treatment strategies are often chosen based on associated injuries such as laceration of a digital nerve and/or artery, or fractures. Additional considerations include patient profile and anticipated compliance.
- Connective tissue (CT) changes are natural by-products of surgery. Connective tissue adhesions have a much greater deleterious effect on functional outcomes in the digit than in larger joints.

BENEFITS OF CPM

- Tendons under the influence of early motion demonstrate a greater mean breaking strength.
- Synovial fluid diffusion is enhanced with the application of CPM. Diffusion of fluids can enhance intrinsic tendon healing.
- Improved biological healing via longer doses of motion will guarantee an exact balance of connective tissue constituents; resulting in an organized collagen matrix, preventing tendinous adhesions and adhesions to surrounding capsular structures.
- Tendon excursion is improved as a secondary by-product of altered adhesion formation.
- Constant movement activates the gate control mechanism, where proprioceptive feedback over-rides pain transmission. Therefore, the patient is likely to be compliant in active extension exercises if pain free (applicable to the Kleinert protocol).

SUGGESTED POST-OP GUIDELINES AND CPM PROTOCOL

- Document passive range of motion statistics if cleared by physician.
- Fabricate splint if custom design preferred; otherwise make adjustments to the prefabricated splint. Proper wrist and MP joint positioning should adhere to physician protocol (most common positioning includes the wrist at 25 - 30 degrees of flexion and MP joints at 50-70 degrees of flexion).
- Instruct patient on device usage and adjustments. Attach the CPM to provide flexion of both IP joints within the confines of a dorsal block splint.
FLEXOR TENDON LACERATION REPAIR – CONTINUED

SUGGESTED POST-OP GUIDELINES AND CPM PROTOCOL

- Set the arc of motion in a comfortable range. The process of diffusion of synovial fluid, which leads to intrinsic healing, occurs irrelevant of the arc of motion. Maximize available passive range over several days to maintain normal joint range as well as stimulating improved healing.
- Apply within the first week, preferably within 24 hours post-op.
- Optimal time on unit: 24 hours/day, minimum time: 8-10 hours/day.
- Elevate the hand whenever possible.
- If prescribed by physician, remove at 4 weeks post-operatively for active exercise.
- When passive range of motion (PROM) is maintained at available range, CPM may be weaned, this is usually 3-6 weeks post-operative.
- Educate the patient on difference between active and passive exercise, CPM is not a substitute for active exercise.
DUPUYTREN’S CONTRACTURE RELEASE
This is an operative procedure for releasing the contracture of the palmar fascia – often involving the ring and little fingers.

- Range of motion results in palmar vs. digital fasciectomy (or both) for Dupuytren's disease may vary.
- Motion regained at the PIP joint will vary based on the length of time the joint was contracted and whether or not the patient had a fixed joint contracture pre-operatively.
- Improvement in joint motion with CPM added to the post-op protocol is largely influenced by the above considerations.
- In long-standing contractures, CPM can provide extensor tendon re-balancing as well as optimizing active and passive flexion. Caution should be noted for associated neurovascular structures under tension with recent release.

BENEFITS IN USING CONTINUOUS PASSIVE MOTION
- Motion is improved in both directions, flexion and extension, active and passive.
- Constant movement activates the gate control mechanism, where proprioceptive feedback over-rides pain transmission, therefore patient is likely to be compliant in active exercises if pain free. This may prevent a common flare response so often associated with Dupuytren's.
- Connective tissue healing responds favorably to continuous movement, orienting a collagen matrix in parallel lines.
- Maintains motion that the patient often is non-compliant in performing in the first two weeks. This is particularly evident in the patient with open wounds post-operative.

SUGGESTED PRE-OP GUIDELINES
- Document active and passive range of motion statistics. Record the % difference.
- Determine the length of time the joint has been contracted or length of time that an extensor lag has been present.
- Fabricate splint if a custom design is preferred; otherwise make adjustments to a pre-fabricated splint.
- Provide patient instructions on the use of the device. Have the patient put the splint and device on and take them off; as well as perform ROM adjustments and ON/OFF functions.
DUPUYTREN'S CONTRACTURE RELEASE
SUGGESTED POST-OP GUIDELINES AND CPM PROTOCOL

- Wound care as indicated. Drainage is likely to increase with the use of CPM.
- Record active and passive range of motion and the difference.
- Modify the splint to accommodate swelling and post-operative dressings.
- Review the patient’s instructions.
- Patient may use a resting splint at night for static extension.
- Apply within first week, preferably within 24 hours post-op.
- Optimal time on unit is 24 hours; or at least 8-10 hours/day.
- Set arc of motion within a comfortable range, MP and PIP must achieve neutral, then increase daily to achieve maximum flexion.
- Remove for exercise as prescribed by physician or therapist.
- As patient's active motion maintains the passive range available, CPM can be weaned between weeks 4 to 6 post-op.
- Extension splinting is used in conjunction with CPM and often continues after CPM is discontinued.
- Educate the patient on the difference between active and passive exercise. CPM is not a substitute for active exercise.

CARPAL TUNNEL SYNDROME (CTS):
This is also called repetitive stress syndrome. The impingement of the median nerve within the carpal tunnel of the wrist can result in numbness, tingling and pain. The surgical solution is to release the carpal tunnel and relieve the pressure on the nerve.

BENEFITS OF CPM
- Prevents adhesion formation
- Provide optimal wound healing to the carpal ligament
- Maintain and increase passive range of motion (PROM)

SUGGESTED CPM PROTOCOL
- 8 - 10 hrs per day with 2 hrs on / 2 hrs off for 1-2 weeks
- 5 - 8 hours per day at 3 or more weeks of treatment
- Wean usage and discharge by the 3rd to 4th week
PIP JOINT CAPSULECTOMY:
Capsulectomy is the surgical removal of the joint capsule; usually performed after permanent connective tissue changes secondary to trauma and immobilization. This surgical procedure is usually indicated secondary to a poor rehab outcome from a previous primary injury. History would indicate that the patient’s non-compliance may be a factor in current prognosis.

- Initial post-operative period can be painful (0-14 days).
- Connective tissue changes are natural by-products of surgery.
- The average arc of PIP joint motion is 0 to 110 degrees.

BENEFITS OF CPM
- Improved biological healing via longer doses of motion will guarantee an exact balance of connective tissue constituents, resulting in an organized collagen matrix.
- Constant movement activates the gate control mechanism, where proprioceptive feedback overrides pain transmission.
- Instead of only addressing the end range of either flexion or extension via splinting, a CPM device will maintain the full range achieved in surgery, for both directions.

SUGGESTED PRE-OP GUIDELINES
- Document active and passive range of motion statistics.
- Determine the length of time the joint has been stiff.
- Fabricate splint if custom design preferred; otherwise make adjustments to the prefabricated splint.
- Provide patient instructions on the use, wearing and adjusting of the device.

SUGGESTED POST-OP GUIDELINES AND CPM PROTOCOL
- Document active and passive range of motion statistics. Inform the patient of the intra-operative ROM.
- Modify the splint to accommodate swelling and post-operative dressings.
- Apply CPM within first week, preferably within 24 hours post-op.
- Optimal wearing is 24 hours; or, at least 8-10 hours/day. Keep hand elevated.
- Remove for exercise as prescribed by physician or therapist.
- When passive range of motion (PROM) is maintained at available range, CPM may be weaned at 3-6 weeks post-op.
- Splinting is often used in conjunction with CPM.
- Educate the patient on the difference between active and passive exercise. CPM is not a substitute for active exercise.
REFLEX SYMPATHETIC DYSTROPHY:
An intense pain syndrome usually accompanied by trophic changes. RSD is most commonly seen in the hand.
- Pain response will vary on case-by-case basis.
- Trophic changes include discoloration, skin changes, sweaty or dry, cold and clammy or red and warm to touch.
- Conventional practice could include a series of blocks to break the pain cycle.
- Persistent stiffness can accompany the patient’s pain response.
- Connective tissue changes can occur to self-imposed immobilization secondary to pain. Connective tissue adhesions have a much greater deleterious effect on functional outcomes in the hand than in larger joints.

BENEFITS OF CPM
- Long-term stiffness may be prevented if the patient can tolerate gentle cycles of passive motion.
- Constant movement activates the gate control mechanism, where feedback overrides pain transmission; therefore, patient is likely to be compliant in active exercises if pain free.
- The motion via a CPM device is predictable, therefore a patient may accept this treatment more readily, especially if he/she can control the settings.
- Movement via the CPM device will counteract the adverse effects that the patient will experience from self-imposed immobilization until the patient resumes normal movement.

POST-OPERATIVE GUIDELINES AND CPM PROTOCOL
- Active motion takes precedence. Resume wearing CPM between sessions when patient is not performing active motion. CPM is not a substitute for active exercise.
- Document active and passive range of motion statistics. Record the % difference.
- Provide patient instructions on the use of the device. Familiarize the patient with the process and functions.
- Let the patient set the arc of motion in a comfortable range.
- Involve the patient in balancing the CPM wearing schedule with their active exercises. Patient should remove the CPM device as prescribed for active differential tendon gliding.
- Apply early when patient starts to demonstrate initial signs of RSD, or if you anticipate that patient's response to pain will result in self imposed immobilization.
- Optimal wearing is whenever patient is not actively exercising or using their hand within a 24 hour time period; or, at least 8-10 hours/night.
- Elevate hand as needed.
- As patient's active motion maintains the passive range available, CPM can be weaned.
DIGITAL INTRA-ARTICULAR FRACTURES:
This type of fracture is a break(s) within the finger joint; open reduction internal fixation (ORIF) is often required.

- Articular cartilage defects lead to degenerative joint disease.
- A stable fracture is required before early motion programs can begin.
- Conventional practice includes additional cast support to decrease edema and additional protection from a potential fall.
- Active musculo-tendinous contraction may exert greater force across the fracture site than passive motion.
- Connective tissue changes are natural by-products of surgery. Connective tissue adhesions have a much greater deleterious effect on functional outcomes in the digit than in larger joints.

BENEFITS OF CPM
- With rigid internal fixation and continuous passive motion, articular cartilage defects heal more appropriately with hyaline-like articular cartilage.
- CPM significantly lessens the likelihood of developing degenerative joint disease at the fracture site.
- Improved biological healing via longer doses of motion will guarantee an exact balance of connective tissue constituents; resulting in an organized collagen matrix, preventing adhesions of surrounding tendinous and capsular structures.
- Constant movement activates the gate control mechanism, where proprioceptive feedback over-rides pain transmission. Therefore, the patient is likely to be compliant in active exercise if it is pain free. Initiation of active range of motion (AROM) should be approved by the physician/PT.

SUGGESTED POST-OP GUIDELINES
- Wound care as indicated.
- Document active and passive range of motion statistics. Record the % difference.
- Fabricate splint if custom design preferred; otherwise make adjustments to the prefabricated splint.
- Provide patient instructions on the use of the device. Have patient put on the splint and device and then remove them; as well as perform ROM adjustments and ON/OFF functions.
- Set the arc of motion in a comfortable range. The process of diffusion of synovial fluid, which leads to regeneration of articular cartilage, occurs irrelevant of the arc of motion.
DIGITAL INTRA-ARTICULAR FRACTURES: CONTINUED

SUGGESTED CPM PROTOCOL (GENERAL PARAMETERS)
- Will depend on fixation used to stabilize
- Casting
- ORIF (Open Reduction Internal Fixation)
- External fixation
- Physician should not recommend CPM until fracture is considered stable

SUGGESTED CPM PROTOCOL (ADJACENT OR DISTAL)
- CPM initiated 0-5 days post-op to adjacent digits or to joint distal to the fracture site
- Motion must not interfere with fracture site
- ROM to tolerance and increased slowly
- 8-10 hrs daily, resting hours preferable.
- Discharge when AROM maintains passive range of motion (PROM)

SUGGESTED CPM PROTOCOL (AT FRACTURE SITE)
- CPM initiated 5 days post-operatively or when fracture site is stable
- ORIF may be sooner than 5 days post-operatively
- Closed reduction may be 3-6 weeks post-operatively
- Set ROM to patience tolerance
- Optimum use 8-12 hrs per day
- Discharge when AROM maintains PROM
- Educate the patient on the difference between active and passive exercise. CPM is not a substitute for active exercise.
- Splinting is often used in conjunction with CPM.
DIGITAL BURNS:
Burns to the hands and fingers can be caused by excessive exposure to thermal, chemical, electrical or radioactive agents.

- With more severe burns, determine the degree of tendon involvement. CPM can enhance the nutrition to a healing tendon, although CPM should be applied in a protective position if tendon involvement suspected.
- Connective tissue (CT) and healing skin will respond favorably to continuous movement, orienting a collagen matrix in parallel lines.
- CPM can be used post-grafting. Timing will vary regarding how many days post-grafting a physician will approve initiating CPM (one to seven days).
- CPM will maintain joint mobility. This is particularly important in the comatose patient, or in a patient too critically ill to perform active range of motion (AROM).
- Connective tissue changes can occur to self-imposed immobilization secondary to pain combined with trauma. Connective tissue adhesions have a much greater deleterious effect on functional outcomes in the hand than in larger joints.

BENEFITS OF CPM
- Patient’s long-term stiffness may be prevented if tolerant of gentle CPM cycles.
- Constant movement activates the gate control mechanism and helps to reduce pain. Patient is likely to be less apprehensive and more compliant in active exercises if pain free.
- CPM motion is predictable; a patient may accept this treatment more readily. Particularly if he/she can control the settings.
- Movement via the CPM device will counteract the adverse effects the patient will experience from self-imposed immobilization.

SUGGESTED POST-INJURY GUIDELINES AND CPM PROTOCOL
- Active motion takes precedence. Resume wearing CPM in between sessions of active motion. CPM is not a substitute for active exercise.
- Document active and passive ROM (PROM) statistics. Record the % difference.
- Modifications on finger attachments may be necessary, depending on wound care needs.
- Provide patient instructions on the wearing, adjusting and use of the device.
- Let the patient set the arc of motion in a comfortable range. Involve the patient in balancing the CPM wearing schedule with their active exercises. Remove for exercise as prescribed by physician or therapist.
- Apply early if active motion alone does not achieve full motion.
- Optimal wearing is whenever patient is not actively exercising or using their hand within a 24 hour time period. Minimum: 8-10 hours/night. Elevate hand as needed.
- As patient’s AROM maintains the PROM available, CPM can be weaned.
DIGITAL JOINT ARTHROPLASTY: PIP AND MP

Joint arthroplasty uses an artificial joint to reconstruct or replace a diseased or traumatized joint.

- Scar encapsulation provides stability in digital small joint replacements. Connective tissue constituents responsible for scar encapsulation respond favorably to continuous movement, orienting a collagen matrix in parallel lines.
- CPM can be initiated immediately post-op up to day three in conjunction with physician / therapist preferred protocol.
- Mobility within CPM can be progressively increased while maintaining lateral stability and proper alignment.
- Setting parameters for CPM will be influenced by any extensor or intrinsic reconstruction that may have been done at the same time by the physician.
- Regaining maximum flexion is important, particularly in PIP joint replacements secondary to traumatic injuries.
- In MP arthroplasties Unsell, Frykman and Yahiku reported no incidence of wound dehiscence or infection when CPM was added post-operatively.

BENEFITS OF CPM – PIP JOINTS

- Motion is improved in both directions, flexion and extension, active and passive.
- Constant movement activates the gate control mechanism, where proprioceptive feedback over-rides pain transmission; therefore, patient is likely to be compliant in active exercises if pain free.
- CPM device can achieve maximum available flexion (often > 90 degrees) without compromising stability.
- Movement via the CPM device could facilitate extensor tendon gliding. This is particularly effective in patients that have experienced traumatic contusion to the extensor mechanism. Tendon gliding or tracking of the intrinsic extensors were inactive pre-operatively secondary to scarring.
SUGGESTED POST-OP GUIDELINES AND CPM PROTOCOL – PIP JOINTS

- Document active and passive range of motion statistics.
- Determine the length of time the joint has been subluxed or that an extensor lag has been present.
- Fabricate custom CPM splint if preferred; otherwise adjust a pre-fabricated splint.
- Provide patient instructions on the use, wearing and functions of the device.
- Record active and passive range of motion. Document the % difference.
- Splinting can be used in conjunction with CPM.
- Patient may use resting splint at night.
- Apply within first week, preferably within 24 hours post-operatively.
- Optimal wearing is 24 hours; or, at least 8-10 hours/day (resting hours preferable).
- Set arc of flexion in a comfortable range, increase daily to achieve maximum flexion.
- Remove for exercise as prescribed by physician or therapist. Educate the patient on active vs. passive motion. CPM is not a substitute for active exercise.
- As patient’s AROM maintains PROM available, CPM can be weaned between 6 to 8 weeks post-op.
DIGITAL JOINT ARTHROPLASTY: PIP AND MP - CONTINUED

BENEFITS OF CPM – MP JOINTS
- Motion is improved in both directions, flexion and extension, active and passive.
- Constant movement activates the gate control mechanism to help control pain. This is likely to improve compliance with active exercise.
- CPM improves post-operative range of motion.
- Movement via the CPM device could facilitate extensor tendon re-education. This is particularly effective in patients with long-term subluxation who have lost proprioceptive awareness of extensor function.

SUGGESTED PRE-OP GUIDELINES – MP JOINTS
- Document active and passive range of motion statistics and determine the length of time the joint has been subluxed or that an extensor lag has been present.
- Fabricate custom CPM splint if preferred; otherwise adjust a pre-fabricated splint.
- Provide patient instructions on the use, wearing and adjustment of the device. Advise patient to select a large shirt to accommodate removal over bulky post-op dressings.

SUGGESTED POST-OP GUIDELINES & CPM PROTOCOL – MP JOINTS
- Record active and passive range of motion. Record the % difference.
- Modify the CPM splint to accommodate swelling and post-operative dressings.
- Patient may use resting splint at night. Splinting can be used in conjunction with CPM and often continues at night even after CPM is discontinued.
- Apply within first week, preferably within 24 hours post-op.
- Optimal wearing is 24 hours; minimum is at least 8-10 hours/day.
- Set arc of flexion within a comfortable range, always returning to neutral MP extension. Progress flexion to tolerance.
- Remove for exercise usually in second week or as prescribed by physician or therapist.
- Patient may be monitored daily within the first week then three times weekly thereafter. Therapy can be discontinued at eight weeks except for periodic check ups.
- As patient’s active motion maintains the passive range available, CPM can be weaned between weeks 6 to 8 post-operatively.
- Educate the patient on the difference between active and passive exercise. CPM is not a substitute for active exercise.
CRUSH INJURY / SOFT TISSUE INJURIES OF THE HAND:

A crush or soft tissue injury can be one in which the skin may not be broken and a fracture may or may not be present, but underlying connective tissue will demonstrate a severe inflammatory response.

- Multiple systems frequently involved, i.e. vascular, musculotendinous, skeletal, nerve, etc.
- Pain, swelling and discoloration are common symptoms.
- Healing begins without surgical intervention unless an associated fracture warrants ORIF.
- Research findings demonstrate immobilization and injury result in greater adhesion formation.
- Connective tissue changes are natural by-products of injury. Connective tissue adhesions have a much greater deleterious effect on functional outcomes in the hand than in larger joints.

BENEFITS OF CPM

- Early motion will mitigate the adverse effects of immobilization on tendons.
- Synovial fluid diffusion is enhanced with the application of CPM.
- Improved biological healing via longer doses of motion will guarantee an exact balance of connective tissue constituents. This results in an organized collagen matrix, preventing tendinous adhesions and adhesions to surrounding capsular structures.
- Constant movement activates the gate control mechanism, to help control pain. Therefore, the patient is likely to be compliant in active exercises.

SUGGESTED POST-INJURY GUIDELINES AND CPM PROTOCOL

- Document active and passive range of motion statistics and record the % difference.
- Fabricate custom splint for CPM. Fabricate resting splint to be used when patient is not in CPM. Splinting is often used in conjunction with CPM.
- Provide patient instructions on the use, wearing and adjustment of the device.
- Set the arc of motion in a comfortable range. Isolate and measure FDS vs. FDP excursion.
- Review patient instructions. Patient should remove CPM device hourly for active differential tendon gliding. Educate the patient on active vs. passive exercise. CPM is not a substitute for active exercise.
- Apply CPM within first week, preferably within 24 hours post-injury. Fracture(s), if present, must be stable.
- Optimal wearing is 24 hours; minimum is at least 8-10 hours/day. Elevate hand.
- Remove for exercise as prescribed by physician or therapist.
- As patient’s active motion maintains the passive range available, CPM can be weaned between weeks 3 to 6 post-injury.
25

This is a sample guideline. Each patient should be carefully evaluated by his / her physician and therapist for specific patient considerations to optimize a successful outcome.  ORI CPM Benefits & Protocols, Rev 03/02
HAND SPECIFIC REFERENCES

Tenolysis References

Flexor Tendon Laceration Repair References

Dupuytren’s Contracture Release References
Capsulectomy References

RSD References

Digital Fractures References

Digital Burns References
28

This is a sample guideline. Each patient should be carefully evaluated by his / her physician and therapist for specific patient considerations to optimize a successful outcome. ORI CPM Benefits & Protocols, Rev 03/02