

Post Surgical Shoulder CPM Following a Surgical Release, MUA or Contracture/Stiffness

Prior to 1989 there were few reports on the use of continuous passive motion (CPM) following the surgical release of a joint contracture. Frykman⁹ reported statistically superior outcomes ($p < .05$) on the use of CPM for stiff MP and PIP joints for posttraumatic ankylosis in 1989. CPM for six weeks in duration was tried after a vigorous hand therapy program had failed or after a previous surgical intervention without CPM had failed. Bradley⁵ reported significant positive results with CPM use for 10 hours per day after arthroscopy and manipulation for primary adhesive capsulitis of the shoulder in 1991. Also in 1991, a retrospective study by Breitfus⁶ found CPM to be superior to physical therapy and a splinting program. The author also looked at start time and found superior results were seen when CPM was started within 48 hours following the surgical procedure. A second retrospective study was done by Schindler²⁵ between 1982-1988 and found CPM the only rehabilitation variable of value. CPM was initiated following an arthrolysis procedure for a contracted joint and resulted in a statistically significant improvement ($p < 0.01$) both in range of motion and function (88% of CPM users improved more than 10° while only 29% of non users had similar success).

Efficacy of Shoulder CPM

A study by Gates¹¹ in 1992 compared physical therapy to a CPM (six weeks) protocol following a release of a joint contracture. The CPM group improved a mean of 47° compared to only 25° in the physical therapy group. Ippolito¹² also reported functional improvements with CPM after six weeks of use compared to a similar series who only utilized physical therapy in 1999. The importance of an intensive early CPM program was emphasized by both Olivier²² and Bennet⁴ following surgical releases in 2000. Olivier²² had ninety-one patients and Bennet¹⁰ had sixty-eight patients who reached statistically significant ($p < 0.05$) gains in range of motion and function after a capsulotomy and post op use of CPM. Aldridge⁴ compared the efficacy of CPM to a traditional splinting program in 2004. Splinting programs following a surgical release of a stiff joint had been the standard of practice with many surgeons. This study of 106 joints joins the growing body of research demonstrating statistical superior results of CPM ($p = 0.27$) over splint only and physical therapy only programs.

Nicholson²⁰ found that CPM following an arthroscopic release in the shoulder was equally effective across five identified etiologic groups as well as providing pain relief in 2003. Recent studies by Bae & Waters³ in 2001, Tsionos²⁷ in 2004, and Wu²⁸ in 2003 confirm that CPM following a joint release to the shoulder, elbow or hand is needed to reach functional range of motion. The average period of use was six weeks following a surgical release or manipulation of the shoulder, elbow or hand in order to reach statistically significant improvements in range of motion and function.

The initial goal of therapy following a surgical release of a contracted joint is to maintain the range-of-motion gained after the release. If passive motion is not started within the first 48 hours following the release the prognosis for improvement is significantly diminished.⁶ O'Driscoll and Giori²¹ have demonstrated that CPM immediately following a surgical release acts to pump blood and edema fluid out of the joint and periarticular tissues. The reduction of these fluids from a synovial joint reduces the risk of post-surgical joint stiffness. A contracted joint typically has an inflammatory component which can be aggravated by the surgical release itself resulting in limited or no improvement in range-of-motion following the surgical procedure. Salter,²⁴ Kim,¹⁴ Kroeder¹⁶ and Moran¹⁹ have all shown that CPM has reparative effects on inflamed joints. However, until recently the mechanism by which CPM acts as an anti-inflammatory agent was unknown. Recent studies by Gassner,¹⁰ Lee,¹⁸ Xu²⁹ and Ferretti⁷ have helped explain the molecular basis for the beneficial effects of CPM on the inflamed joint. A CPM device by applying cyclic tensile stress on the involved joint for an extended time counteracts the effects of the inflammatory agents even better than immobilization.

CPM leads to greater functional outcomes, greater ROM, improved healing by acting as an anti-inflammatory agent and higher patient satisfaction. The duration of CPM use is determined by the severity of the contracture and as long as improvements are seen.

Surgical Release, Manipulation Under Anesthesia, Contracture/Stiffness^{2,3,4,5,6,9,11,12,17,20,} ^{22,23,25,27,28}

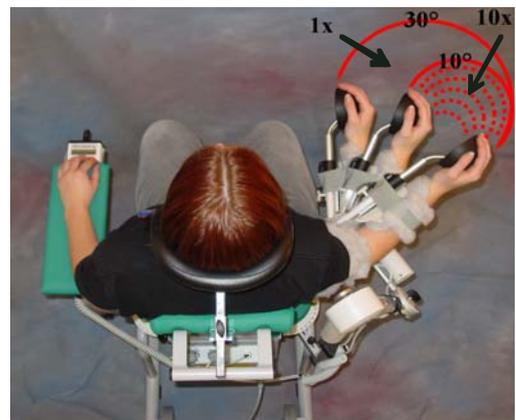
1. SET UP

- The patient is fitted and instructed on use of the Kinex Shoulder CPM Device (preoperatively if possible to improve compliance).^{17,26}
 - **Repeatable Anatomical Position:** Kinex Head Positioner is aligned to the patient to ensure correct positioning each time the CPM device is used.
 - **Anatomical Shoulder Alignment:** Kinex Multi-plane Adjustable Arm helps ensure the CPM device is aligned with the shoulder throughout the arc-of-motion.
 - **Postsurgical Grade Computer Sensor:** Kinex extra-sensitive sensor will reverse direction of movement if too much strain is detected; set between levels 20 (light) & 25 (heavy) depending on extremity size.
- CPM use is initiated 24-48 hours postoperatively, if possible.^{1,6,9,17,20,28}
- The Kinex Shoulder CPM Device is positioned in **scapular elevation**, abduction or flexion.
 - Scapular elevation, abduction or forward flexion is started above 30° and increased to operative range or tolerance level.
 - Rotation is set at operative range or tolerance level.^{13,17,26}
 - External rotation should be at 30° before scapular elevation, abduction or forward flexion, is beyond 90° to avoid impingement.^{13,26}

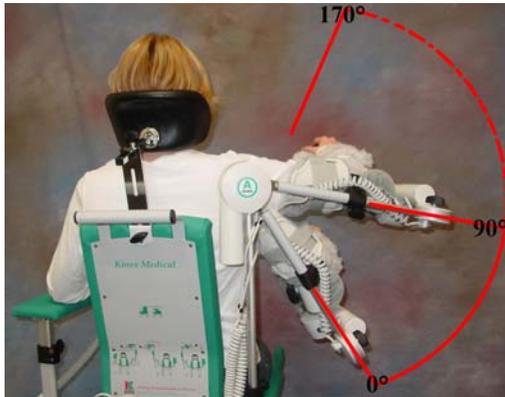
- **Synchronized Kinex CPM: Scapular elevation**, abduction or forward flexion is synchronized with internal/external rotation (internal rotation is avoided if there was a concomitant rotator cuff repair).
- **Isolated Kinex CPM: Scapular elevation**, abduction or forward flexion is not synchronized with rotation. Kinex Shoulder CPM ISO Mode performs **scapular elevation**, abduction or forward flexion separately from rotation (10:10 ratio). **Scapular elevation**, abduction or forward flexion is performed with external rotation at 30° or above. Rotation is performed anywhere in the elevation cycle (usually at the high end).

2. WEARING SCHEDULE GUIDELINE

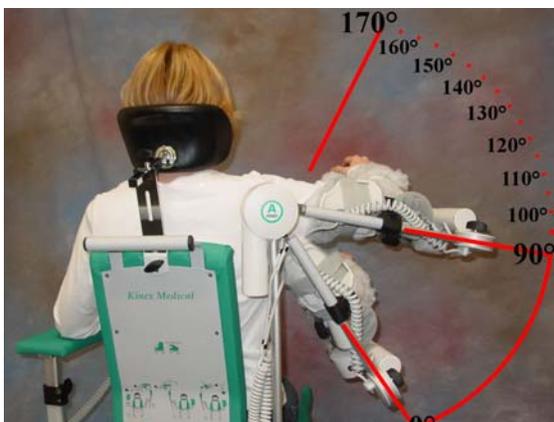
- The Kinex CPM Device is used for 6-8 weeks or as needed.^{3,8,11,17,27}
- Week one, CPM is used 6-20 hours per day or as needed.¹⁵
- Week two and beyond, the CPM is used for 4-8 hours per day in 3-4 sessions or as directed.^{17,26}
- **Kinex End-Range-Repeat Mode:** Three hour daily use schedules or severe contractures are usually performed in the Kinex End-Range-Repeat Mode; Last 10° of the ROM arc is repeated 10X followed by 1 complete ROM arc (10:1 ratio) in order to maximize functional use or need.



- **Kinex Static-Progressive-Stretch Mode:** This mode is used to gain motion in a contracted joint, usually not postoperatively. The Kinex CPM device is placed at end-range with the pause mode set at 5 minutes. After 5 minutes the CPM device is increased to the new end-range. This continues 1-2X a day for 30-60 minutes, week one. Week two the duration is increased to 2-3X a day. Week 3 and beyond the sessions are 60-90 minutes 3X a day.



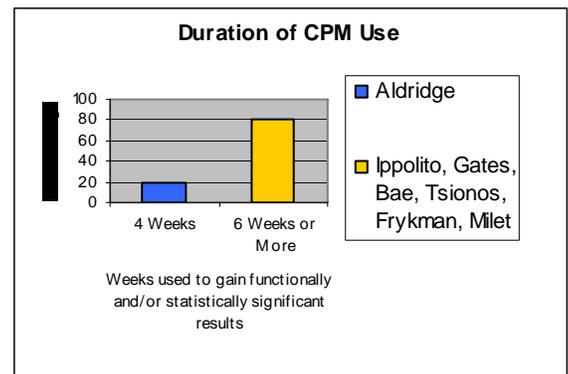
- **Kinex Dynamic-Stretch Mode:** This mode is used to gain motion in a contracted joint, usually not postoperatively. The Kinex CPM device is set at end-range. The force reversal is set between levels 15 (low) and 25 (high) depending on the extremity size or stiffness. The device will move through one full cycle followed by 10 stretch cycles (1:10 ratio). In the stretch cycle the Kinex device will attempt to move the joint 5° beyond end-range. The device will automatically reverse if a force that is stronger than the setting force is met. Duration is 1-2X for 30-60 minutes a day, week one. Week two the device is used 30-60 minutes a day for 2-3X. Week 3 and beyond the device is used 60-90 minutes a day 3X a day.



3. PROM GOALS

- The patient increases ROM as tolerated to meet ROM goals.^{13,17,26}
- CPM use should continue if PROM goals have not been met.¹⁷
- Kinex CPM device can be set at dynamic-progressive-stretch or static-progressive-stretch mode if patient is not progressing as expected.
- Full joint motion may be less during the first 2-3 weeks postoperatively due to swelling.¹⁷
- Scapular elevation, abduction, flexion and rotation end range goal is 85% or better of the operative range.¹⁷

Note: This device must be used under the advice and care of a physician.



Clinical studies that reported duration of use following a surgical release procedure and that reached statistically significant gains in ROM or other outcome measures.

Peer-Reviewed Studies Evaluating Outcome Measures for the Efficacy of CPM Following the Surgical Release of a Joint (Shoulder, Elbow, Hand)

Clinical Study	Purpose of Study	Duration of Use	Results	Primary Finding
Arthroscopic Treatment for Adhesive Capsulitis. Bradley (1991, Operative Techniques in Orthopaedics)	The initial report describes the use of CPM following arthroscopy and manipulation for primary adhesive capsulitis of the shoulder.	Not Reported	CPM is used 10 hours per day with positive results.	This preliminary study demonstrated the safety of shoulder CPM with positive results following manipulation under anesthesia for adhesive capsulitis.
Addressing Glenohumeral Stiffness while Treating the Painful and Stiff Shoulder Arthroscopically: Bennet (2000, J Arthrosc Rel Surg)	Thirty-one patients received either a partial or complete capsular release of the shoulder followed by CPM for passive motion therapy.	Not Reported	Thirty of thirty-one patients had a statistically significant increase in ROM (p>.05).	CPM use was a primary factor in the statistically significant results achieved.
Arthroscopic Capsular Release for Stiff Shoulders Effect of Etiology on Outcomes: Nicholson (2003, J Arthrosc Rel Surg)	Prospective study evaluated outcomes in 68 stiff shoulders following arthroscopic capsular release followed by the use of CPM postoperatively.	Not Reported	The study population showed a significant improvement, p<0.001. Mean improvement in ASES score was 35.5 to 93. Flexion improved from 92° to 165° & Ext. Rot. Improved from 12° to 56°.	Arthroscopic shoulder capsular release with postoperative CPM was equally effective across 5 identified etiologic groups and provided pain relief, restoration of motion and function within an average of 3 months.
Anterior Capsulotomy and Continuous Passive Motion in the Treatment of Posttraumatic Flexion Contracture of the Elbow; A Prospective Study: Gates et al (1992, J Bone Jt Surg)	Thirty-three patients who had a post-traumatic flexion contracture of the elbow underwent an anterior capsulotomy. Fifteen patients did not receive CPM & eighteen patients did receive CPM postoperatively.	CPM was used for a mean of 6 weeks.	The mean postoperative arc of motion improved 25° in the physical therapy group and 47° in the CPM group. The difference was statistically significant.	CPM following the release of a flexion contracture resulted in a statistically significant improvement in function compared to the non-CPM group.
Arthrolysis of Posttraumatic Stiff Elbow; Which Factors Influence the End Result: Breitfus et al (1991, Unfallchirurg)	A retrospective study of 59 patients who received an arthrolysis for posttraumatic stiffness. CPM was compared to splinting and physical therapy. CPM start times were also evaluated.	Not Reported	Patients started on CPM day one lost 15% of intraoperative function while those delayed to day five lost 30%. The combined PT and CPM group lost 17% compared to the splinting group which lost 35%. The CPM gains were statistically significant.	Statistically superior results were obtained with CPM compared to a splinting program. CPM started within 48 hours did better than when CPM was started day 5. Even delayed CPM use was superior to non-CPM protocols.

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