

The CMMS Treatment Technique for Stiffness of the Hand

Casting Motion to Mobilize Stiffness (CMMS) is a treatment technique developed by the author to treat stiffness in the hand.¹ The technique reduces hand stiffness using a series of plaster of Paris casts which immobilize selected joints to direct active muscle force to the stiffer joints, to reduce edema, and to repattern the motor cortex. See Figure 1.

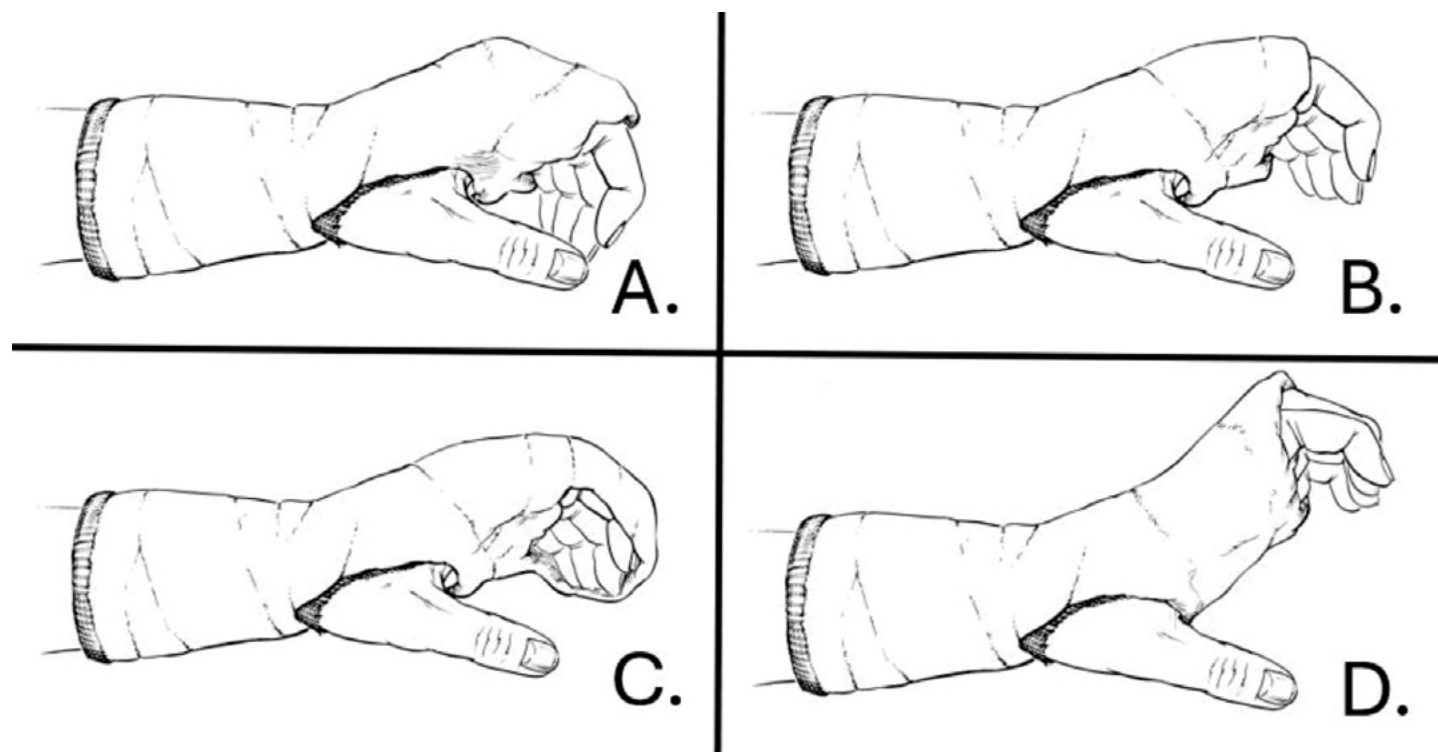


Figure 1: Common CMMS cast designs: A. Cast to block MP joint flexion and stabilize wrist in slight extension: Note MP joints are not fully extended because of severe interosseous tightness. B. Cast to block MP joint flexion with MP joints in full extension: this could be the first cast if edema is minimal and interosseous tightness mild. C. The first CMMS cast may require a hood to help the patient isolate the extrinsic finger flexors. D. When range of motion gains are made, a cast taking the MP joints into hyperextension will maximize interosseous and lumbrical muscle length, if needed.

Immobilizing any part of a stiff hand is counterintuitive, especially because we are taught one should never immobilize the finger metacarpophalangeal (MP) joint in extension! See Figure 2. Why then does the CMMS treatment method advocate both contradictory approaches? And why are therapists the world over using this technique with impressive results?



Fig.2: A CMMS cast positioning the wrist in slight extension and the finger MP joints blocked in extension to allow active motion to elongate the interosseous muscles. Note the varying levels of the block to allow full PIP joint motion. Photo courtesy of Kevin Parks.

For this article to be meaningful, the common example of a patient who falls on the outstretched hand and sustains a distal radius fracture will be used. After immobilization for fracture healing, the patient's hand is stiff, swollen, and nonfunctional—and often painful. A detailed examination would reveal:

- Limited active and passive motion in all finger joints
- Inability to initiate the normal pattern of finger flexion² (flexion occurs first at the MP joints: Figure 3)
- Inability to support wrist in extension during active finger flexion
- Edematous hand, often with a hyper-sympathetic tissue response which may include heightened pain response
- Inability to use the hand functionally.

Since the hand per se was not injured, it is assumed the patient should be able to resolve the stiffness with hand therapy. But the improved finger motion obtained after stretching in therapy is not maintained between sessions because the patient reverts to their maladapted active movement pattern created by the stiffness.



Fig.3: Typical maladapted pattern of active finger flexion: dominant MP joint flexion and inability to stabilize wrist in extension.

In our example, the maladapted pattern is finger flexion initiated with MP joints rather than the interphalangeal (IP) joints, and wrist flexion instead of stable wrist extension (Figure 3). Following mobilization in therapy, the patient has no ability to actively use the passive joint motion gained. To regain productive active finger motion, the patient's brain must redefine the normal finger flexion pattern by prolonged, repetitive, active motion in the cast which demands finger flexion to start with the IP joints.²

The patient is caught in a vicious circle. In our example:

- Joints are stiff, making the normal pattern of active motion impossible
- Because there is limited motion, hand edema persists
- Because the patient initiates flexion at the MP joints, the IP joint stiffness and the interosseous muscle tightness (which causes the MP joint to flex first) cannot be resolved.³⁻⁵

Progress can be initiated only by simultaneously addressing the problems listed above to: 1) decrease edema and tissue reactivity (and thus reduce pain), 2) increase joint mobility, and 3) 2 improve the pattern of active motion. Applying a non-removable plaster of Paris cast with the wrist in slight extension and the MP joints blocked in extension accomplishes the following:

- The evenly distributed pressure and warmth of the plaster cast decreases the hand edema and calms the tissues. Sometimes the only purpose of the first cast is edema reduction.
- Regardless of whether the joint stiffness is caused by capsular tightness or lack of tendon glide, immobilizing the more mobile proximal joints directs the force of active motion to the stiffest joints. Yes, active motion can improve passive motion! One of the hallmarks of this treatment technique is the elimination of all passive motion.
- The fact that the cast is non-removable means the new pattern of motion (our example: initiating active IP joint flexion) is repeated continuously over a prolonged period, requiring the patient's brain to relearn how finger flexion should occur.

CMMS treatment consists of a series of non-removable plaster casts which may be of the same design or differing designs; each cast has a specific goal. The greatest challenge for the clinician

is to trust the CMMS process, letting go of long held beliefs and habits about common treatment techniques.

The two most difficult challenges are 1) knowing that the temporary stiffness created by the casting is necessary to allow a change in the pattern of motion and 2) leaving the cast on long enough. Improved joint motion and edema reduction occur quickly but changing the pattern of motion embedded in the motor cortex takes many repetitions over a longer time. When therapists start using the CMMS technique, they invariably remove the cast too soon because they are nervous about leaving it on longer.

What are the frequently asked questions about CMMS?

Q: Is there a written CMMS Protocol?

A: Protocols are written for specific diagnoses which follow a specific course of healing. The CMMS technique is used for multiple types of stiffness in the hand, seen at many different stages of healing, with differing injury complexities. Therefore, there is no simple structured description of the technique. Advanced knowledge of anatomy, biomechanics, tissue maturity and critical clinical thinking are required to appropriately use the CMMS technique.

Q: What is the design of the cast?

A: The cast design is determined by an evaluation of the hand and observation of active motion. See Figure 1. In our example above of the stiff hand following a distal radius fracture, finger flexion began with MP joint flexion: a cardinal sign of interosseous muscle tightness.³⁻⁵ Positioning the wrist in some extension while blocking the MP joints in extension positively addresses the many reasons for IP joint limitations, because this "hook" position within the cast:

1. Maximizes both flexor digitorum profundus (FDP) and flexor digitorum superficialis (FDS) glide within zone 2, driving IP joint flexion.
2. Maximizes differential glide between the FDP and FDS within zone 2, maximizing IP joint flexion.
3. Maximally elongates both the interosseous and the lumbrical muscles, allowing full IP joint flexion.
4. Compresses the fingers and palm to mobilize edema.
5. Patterns the motor cortex to initiate finger flexion with the IP joints, while the wrist is in some extension: the normal pattern essential for active grasp.

Q: When do I change the design of the cast and what is the design of the next cast?

A: Each cast design has one specific purpose: To direct active motion to the one area where motion is most needed to regain function (See Figure 1). This goal is developed from a detailed examination of the hand and observation of its movement. When that goal is met, the hand is again evaluated to determine the next most needed motion, which informs the next cast design.

In our example above, perhaps the first cast goal is edema reduction while beginning some active IP joint flexion (blocking the MP joints from initiating finger flexion). If it is determined the interosseous muscle tightness is severe, the next cast should not extend the MP joints fully into a hook position, thus allowing the active motion to regain the IP joint flexion without the maximum resistance of the tight interosseous muscles. When IP joint flexion is regained in this position, the next cast positions the MP joints in full extension (perhaps hyperextension) to maximally elongate the interosseous muscles. Maximum interosseous muscle elongation, which occurs in the hook position, is required before full finger flexion can be regained.³⁻⁵

Q: What diagnoses can be treated with the CMMS technique?

A: CMMS is typically used after the acute healing of many kinds of trauma or surgery to alter residual hand stiffness. Since the focus of CMMS is to reestablish a productive active motion pattern, it can be especially useful in helping regain motion in an adhered flexor tendon after tendon healing is assured or following tenolysis. The non-removable cast assures that all exercise is directed to the specific tendon glide/motion needed. Some examples that include, but are not limited to, the use of CMMS for stiffness/limited tendon glide are:

1. After fractures of the hand/wrist
2. After tendon repair or tenolysis
3. Following Dupuytren's surgery⁶
4. After soft tissue/crush injury to the hand
5. Following joint dislocation/s of the hand

Q: How long do I leave the cast on?

A: This is an unanswerable question as it varies with each patient and with each cast, but two guidelines are helpful:

1. Keep each cast in place until the goal for that cast is achieved.
2. Consider how long the hand has been in the maladapted pattern with accompanying tissue stiffness: the longer the stiffness, the longer the total time in the casts will be required.

Retraining of the motor cortex requires many repetitions over time for the active motion to be retained when the cast is removed. Until one becomes comfortable with this technique, the cast is likely to be removed too soon, and the maladapted pattern will return. The main obstacle to regaining functional motion in a stiff hand is permanently changing the maladapted motion pattern, which means changing the brain.

Q: Why can I not make a removable orthosis to accomplish the same purpose?

A: In some patient circumstances, a removable orthosis accomplishes the same purpose, but a chronically stiff hand will revert to the maladapted pattern and erase the gains made when the orthosis is removed. If it can be removed, it will be removed, taking longer to achieve progress, or perhaps, not gaining functional motion at all.



Fig.4: Left hand shows good range of IP flexion while stabilizing wrist in extension. (MP joint flexion is temporarily limited from being in the cast.) This patient is ready to start slowly weaning out of his left hand CMMS cast.

Q: How do I discontinue the CMMS treatment?

A: When the patient can demonstrate the normal active pattern of motion out of the cast for short periods of time, they may be ready to begin weaning out of the cast. See Figure 4. The cast is bi-valved (cut down each side) so that one side allows an opening for the hand to be removed/reapplied and the other side serves as a hinge because the stockinette and padding remain intact (only the paster is cut.) To reapply, the cast is fastened with circumferential hook and loop straps. See Figure 5.



Fig.5: CMMS cast is bivalved. A: Cut side edges are finished with wide adhesive tape and B. Hook and loop circumferential straps hold the cast closed.

Weaning must be a slow process. The patient begins with short periods of time out of the cast. When the active pattern of motion begins to deteriorate and reverts to the maladapted pattern, the cast must be immediately reapplied. Instead of increasing the length of time out of the cast, keep the periods out of the cast short and increase the number of times out of the cast.

The goal is that the patient never experiences the maladaptive movement pattern when out of the cast but continues to reinforce the productive pattern. It is recommended that the patient continue to sleep in the cast until full weaning has occurred.

Q: Why is plaster of Paris casting recommended over the newer and more convenient casting materials?

A: Most chronically stiff hands retain significant edema limiting motion and the limited motion prevents the edema reduction. The cast redirects motion to the stiffest joint while also providing warmth and a “pseudo-massage” to stimulate the initial lymphatics⁷ as the hand moves slightly inside the cast. This direct positive pressure and warmth is vital to create edema reduction. Intimate contouring of the cast material against the hand cannot be achieved with the newer synthetic casting materials, thus robbing the patient of the maximum benefit of casting.

Occasionally, there may be limited motion in one finger, for example, and the hand is not edematous or reactive, making the use the synthetic materials more appropriate for this purpose.

Q: What are the barriers to using the CMMS treatment technique?

A: This is not a technique to be used by beginners. It requires advanced understanding of hand anatomy and movement, tissue response to stress, and biomechanics. CMMS also demands a well-developed skill in applying comfortable and precise casts, which is not a common skill among therapists.

Most of all, this approach creates anxiety for many therapists. For this technique to be successful, one must abandon all passive range of motion and other hands-on treatment techniques and allow active motion within the cast to create the improvement.

The immobilization of some joints within the cast will usually create temporary stiffness in the immobilized joints, so range of motion measurements may initially show a decline in total active motion. But these joints will readily regain their motion—now as part of a normal pattern of movement.

The only concern would be if there has been direct trauma to the dorsum of the hand, causing adherence of the extensor tendons, or skin shortening.

Interestingly, in our example, although one assumes the wrist muscles are prevented from contracting through range when casted, one can often observe the spontaneous contraction of the wrist extensor muscles during active finger flexion upon the removal of the cast --when in fact this was impossible prior to casting!

Q: What are the advantages of the CMMS technique?

A: Surgery is rarely helpful in resolving chronic hand stiffness because there is no focal point of stiffness. CMMS is a non-invasive, non-painful way to reestablish functional motion which requires a minimal number of visits. The best candidate for this technique is the patient whose hand seems impossible to help. The only requirement is the patient have normal muscle innervation.

Q: How can I learn more about this technique?

A: The author has taught several CMMS courses in years past and many therapists who attended those courses now use the technique and teach their co-workers. Although there are avenues to learn this technique online, CMMS is best mastered via hands-on, in-person learning. Some additional resources are:

ONLINE RESOURCES (Free of charge)

- Live CMMS Online Discussion Group held every other month in the USA at 8PM EST. [Register to receive notifications. https://survey.zohopublic.com/zs/iyCCry](https://survey.zohopublic.com/zs/iyCCry)

- BraceLab LinkedIn Page about CMMS <https://lnkd.in/gmHudxDh>

- Colditz JC. Therapist’s Management of the Stiff Hand. In: Skirven TM, Osterman AL, Fedorczyk J, Amadio P, eds. Rehabilitation of the hand and upper

extremity. 6th ed. Philadelphia: Elsevier Mosby; 2011.

Free online copy. <https://bracelab.com/clinicians-classroom/therapists-management-of-the-stiff-hand>)

- **Clinical Pearls** <https://bracelab.com/clinicians-classroom/category/clinical-pearls>

- **No. 84** - May 2024: The CMMS Discussion Group: What We Have Learned <https://bracelab.com/clinicians-classroom/the-cmms-discussion-group-what-we-have-learned>
- **No. 77** - February 2023: CMMS: How is the Cast Position Determined? <https://bracelab.com/clinicians-classroom/cmms-how-is-the-cast-position-determined>
- **No. 65** - Nov. 2020: Which Hook Exercise Most Effectively Decreases Finger Stiffness? <https://bracelab.com/clinicians-classroom/which-hook-exercise-most-effectively-decreases-finger-stiffness>
- **No. 66** - Feb. 2021: Regaining Synergistic Wrist Extension after Ending CMMS Too Early <https://bracelab.com/clinicians-classroom/regaining-synergistic-wrist-extension-after-ending-cmms-too-early>
- **No. 40** - May 2016: Regaining Flexor Tendon Glide within Zone 2 <https://bracelab.com/clinicians-classroom/regaining-flexor-tendon-glide-within-zone-2>
- **No. 32** - October 2014: Immobilizing the MP Joint in Extension? <https://bracelab.com/clinicians-classroom/immobilizing-mp-joint-extension>
- **No. 22** - November 2012: Lumbrical Muscle Tightness & Testing <https://bracelab.com/clinicians-classroom/lumbrical-muscle-tightness>
- **No. 21** - September 2012: Nuances of Interosseous Muscle Tightness Testing <https://bracelab.com/clinicians-classroom/nuances-of-interosseous-muscle-tightness-testing>
- **No. 20** - July 2012: Quantifying Interosseous Muscle Tightness Testing <https://bracelab.com/clinicians-classroom/quantifying-interosseous-muscle-tightness-testing>

- **No. 19** - May 2012: Interosseous Muscle Tightness <https://bracelab.com/clinicians-classroom/interosseous-muscle-tightness-testing>

- **No. 1** - July 2008: Touch the Dots <https://bracelab.com/clinicians-classroom/touch-the-dots>

- Colditz JC. Plaster of Paris: the forgotten splinting material. *J Hand Ther.* 2002; (15):144-157. **Free online copy.** <https://bracelab.com/clinicians-classroom/plaster-of-paris-the-forgotten-hand-splinting-material>

- Colditz JC. Active Redirection Instead of Passive Motion for Joint Stiffness. *ASHT Times.* 2014 & *IFSSH Ezine.* 2014. **Free online copy.** <https://bracelab.com/clinicians-classroom/active-redirection-instead-passive-motion-joint-stiffness>

HANDS-ON COURSES

ASHT Traveling Course <https://asht.org/education/courses/traveling-course> (2025); CMMS: Changing the Way We Treat the Stiff Hand (yet to be scheduled at time of publication.)

Session at the **IFSSH Triennial Congress** <https://www.ifssh-ifsht2025.org/s/> in Washington, DC on March 26, 2025: Introduction to Casting Motion to Mobilize Stiffness for Treatment of the Stiff Hand

ONLINE COURSE (FEE)

CMMS Introductory Course <https://www.robymidgley.com/cmms-intro-course>

CONCLUSION

This brief article does not allow an in-depth explanation of this technique. Seek an experienced therapist who uses the CMMS technique who is willing to be your mentor. Consider the resources listed above to gain further insight and information from your therapy peers. Most of all, imagine the day you are excited to receive a treatment referral for an impossibly stiff hand because you now have the tools to change it!

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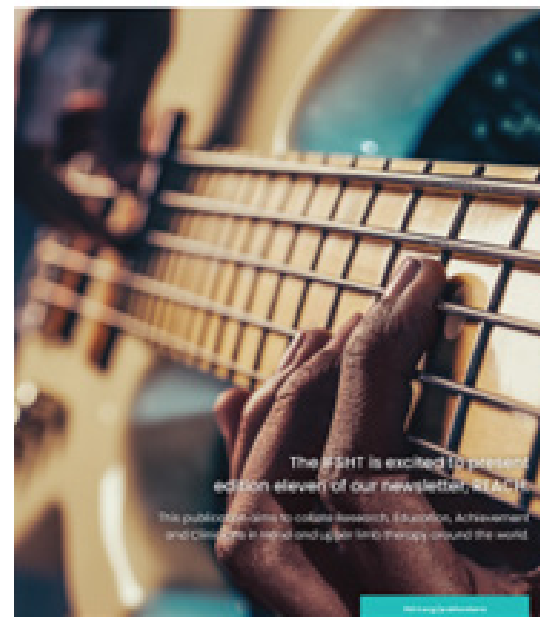
IFSH NEWSLETTER - REACH

Issue 2 of volume 4 of the IFSHT newsletter is available on the IFSHT website.

This issue is a special feature on the musician and hand therapy: <https://ifsh.org/publications/>

The publication aims to collate Research, Education, Achievement and Clinicians in Hand and upper limb therapy around the world.

We call on hand and upper limb therapy clinicians and researchers to submit any contributions for consideration to: informationofficer@ifsh.org



UPCOMING EVENTS

The 60th Congress of the French Society of Hand Surgery will be held from the 19th to the 21st December 2024 at the Palais des Congrès Porte Maillot in Paris:
Website: <https://gemcongres.com/>

Explore the hundreds of different programs and sessions at the 2025 IFSSH and IFSHT Triennial Congress, including where the programs and sessions will held, when they will occur, and who will be presenting!

Finally, the next IFSSH and IFSHT Triennial Congress is only months away! Hosted by the American Society for Surgery of the Hand, American Society of Hand Therapists, and American Association for Hand Surgery. The event will be held in Washington, USA in 2025 from March 24-28.

Check back often as new details on these programs and sessions are added frequently.

<https://www.ifssh2025.org/s/>



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