Vol. 31, Issue 1 | Spring 2024 | asht.org

ASHTimes
THE NEWSLETTER OF THE AMERICAN SOCIETY OF HAND THERAPISTS

Casting Motion to Mobilize Stiffness: Is This Technique Just for Stiff Hands?

By Kantessa Stewart, OTR/L, CHT

Treating a hand and obtaining no response in range of motion (ROM) gains, despite multiple traditional treatment techniques including the manual therapies and custom orthoses designed to improve ROM, is extremely frustrating. The treatment process can be painful, expensive, depressing and leave your patient with outcomes less than ideal for return to daily life. Casting Motion to Mobilize Stiffness (CMMS), developed by Judy Colditz, OTR/L, CHT, FAOTA, is a technique many therapists read about when studying for the Certified Hand Therapy (CHT) exam.

Bridging the Gap

Bridging the gap from reading about CMMS, to analyzing the concepts within the technique and implementing this in patient care to address the exact patient described above is an intimidating concept. As therapists, we were taught to avoid immobilization, thus applying a cast may not be in the decision hierarchy we have formed for patient care. Explaining the concept to patients and surgeons can be a challenge. The patient may have spent several weeks in an orthosis post op and to then apply a cast could seem like a sign of regression. From the patient standpoint the cast is heavy with restrictions including not being able to remove it or get it wet.

CONTINUED ON PAGE 4 ▸

CONTENTS

Casting Motion to Mobilize Stiffness: Is This Technique Just for Stiff Hands?

◂ CONTINUED FROM PAGE 1

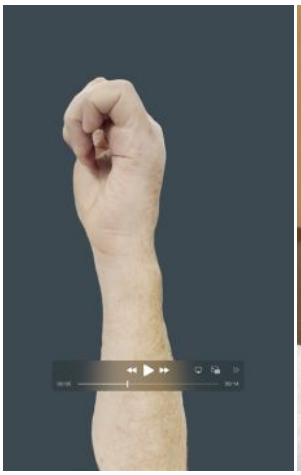
The CMMS process is an involved one, including cast application, choosing joint positions, material selection, removal and access to or purchasing necessary equipment and materials. Gaining understanding on when, how and why a cast is better than custom orthoses designed to improve ROM is important. This knowledge is useful when discussing CMMS as a treatment option with surgeons to aid in education and obtain permission for use on their patient(s). The CMMS technique tends to provoke more questions and hesitation among therapists, physicians and patients than function as a solid solution to the treatment of the hand not responding to traditional therapy.

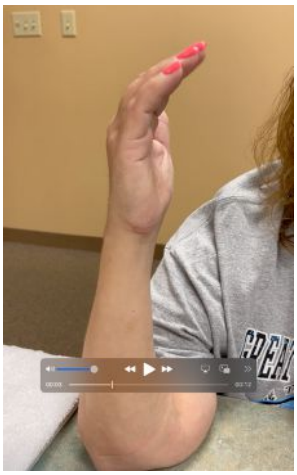
Technique Key Areas

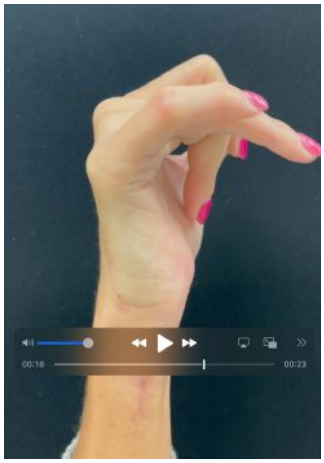
The CMMS technique encompasses several areas of hand therapy simultaneously. Cortical remapping, movement pattern restoration, active redirection, edema and scar management, joint stiffness, muscle balance and proprioceptive feedback are major components.[1] Constraint induced therapy, used in neurological patients, is based on similar principles, where patients are forced to move the impaired arm by constraining the strong and functioning muscles/joints of their intact limb. This addresses the learned non-use of the impaired limb and studies have found increased cortical activation and representation of the contralateral hemisphere.[3]

A More Precise Constraint Induced Therapy

Consider CMMS a more precise version of constraint induced therapy for the hand. The concept requires movement to be analyzed and challenges therapists to look at movement differently. Wrist control and ROM is a strong focus, evaluating whether tenodesis balance is affected and if wrist flexors are recruited during active fisting attempts. As the patient struggles with the stiffness when making a fist they pull hard with the working muscles, attempting to break through the stiffness. The recruitment of the strongest muscles, overpowering the weaker muscles creates the pattern of abnormal motion.[1] When observing the stiff hand moving, a pattern of two movement types is prevalent. Patients lead using their long flexors with little to no MP motion visible (11 30 mvmt pre CMMS video) or lead with interossei showing MCP flexion and minimal IP motion (5-19 movement pattern video).







From reading about CMMS, the technique is described as a treatment for stiff hands. This technique may also be a successful way to help those with no joint stiffness, full passive range of motion (PROM), but lack of full or even functional active motion. Working in hand therapy departments we have all witnessed patients move with odd patterns of motion difficult for us to understand (see 3-18 ulnar view video). It can be seen from the video that full PROM is present but during active attempts the disorganization of movement is extreme. Possible causes include limited tendon excursion, a new learned pattern of motion to avoid pain, neurological in that the patient cannot get the correct muscle(s) to fire or impaired sensation is not providing feedback to the brain. Hand therapists have numerous options including relative motion orthoses to use when PIP flexion is limited, restricting MCP joint flexion and shifting flexion force distally to the PIP joint,[5] buddy taping to the adjacent finger to engage the digit in active use of the hand, and wedges to aide in joint alignment and restoring muscle imbalance.[4]

There are cases however when the hand simply does not respond and AROM impairments remain, affecting return to daily life and work. Evidence shows AROM improves PROM.[1] The scenario of full PROM but limited AROM, combined with a lack of tissue response and measurable gains with traditional therapy is present in hand therapy clinics and begs a viable solution. Here are two cases where CMMS was utilized on non-stiff hands, patients with full PROM, who hit a plateau in their progress with traditional techniques.

Case 1

Patient underwent repair of her right Flexor Carpi Ulnaris (FCU), Flexor Digitorum Profundus (FDP) for middle, ring, and small fingers, Flexor Digitorum Superficialis (FDS) of her ring finger, ulnar nerve repair in zone 5-6. Her treatment post-operatively included use of a forearm-based dorsal blocking orthotic. At six weeks post-op, measures of her index finger through small finger distal palmar crease (DPC) were 5-6 cm (Figure 1), and an ulnar claw deformity was noted (Figure 2). Treatment consisted of an anti-claw, forearm-based night extension orthotic for extrinsic flexor tightness, a hand based P1 block orthotic and multiple techniques to regain AROM flexion with therapeutic exercises and activities. Despite constant changes in therapy to invoke a tissue response, at 10 weeks post-op the patient demonstrated minimal gains in digit AROM. DPC measures at that time were index finger at 2 cm, middle finger at 3 cm, with ring finger and small finger at 5 cm. Wrist AROM measured 53 degrees for extension and 55 degrees for flexion. PIP extension AROM was 40 degrees at MCP, 46 degrees for PIP, and 50 degrees

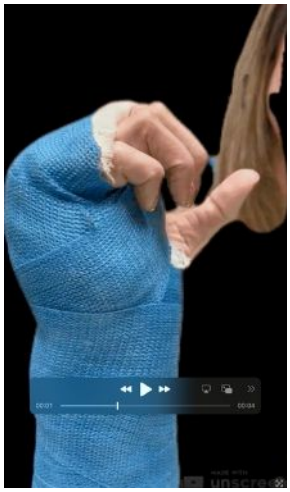
Figure 1. Small finger distal palmer crease

Figure 2. Ulnar claw deformity noted

for DIP. She continued to demonstrate uncoordinated motion. (see 3-18 ulnar view motion video)

CMMS was initiated after 10 weeks of traditional therapy by application of a forearm-based intrinsic minus cast, MCPs blocked in slight flexion to aid in IP extension, PIP joints were left free (Figure 3). A thermoplastic component was used intermittently throughout the day over the digits blocking the PIP to allow focus on DIP motion aiming for FDP activation. Measurable gains were made weekly at both PIP and DIP joints, control of the IP joints improved during hook fisting and claw deformity began to resolve. By stabilizing the wrist and MCP joints, CMMS improved active control of these distal joints.

The first cast was worn continuously for three weeks, then bivalved to allow removal for hygiene and meals, with continuous wear at all other times for another three weeks. Focus was on continued cyclical AROM of the IP joints within the cast aiming to regain a normal movement pattern, assisting the patient in using the correct muscles when making a fist. A total of two casts were used for her care, the second one being applied in an intrinsic plus position (5-9-22 video) 6 weeks from the start of CMMS. Movement improved dramatically, additionally resolving the claw deformity during use of the CMMS technique over a 13 week time frame and 7 therapy sessions.



Video 1: Intrinsic Plus Position in Cast

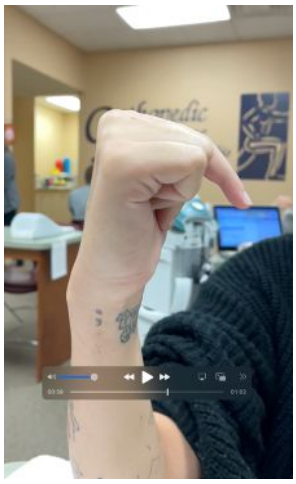
Figure 3 (photos left to right and all are of the same cast). Left: forearm-based intrinsic minus plaster cast to the level of the PIP, with thermoplast cuff blocking PIP motion, DIPs free – photo day of application; Middle: forearm-based cast with IP joints free showing composite DIP and PIP joint flexion – photo six days after application; Right: forearm-based cast with IP joints free showing composite DIP and PIP joint flexion, photo taken after 3 weeks in the cast

The initial outcome from 10 weeks of traditional therapy and 15 total visits was poor. Transitioning to CMMS only required 7 visits before beginning to work toward discharge, permitting return to work and daily life with improved use of the hand. The index and middle fingers regained 100% of their total active motion (TAM) while the ring finger regained 93% and small finger regained 90% of TAM. This was an excellent percent of return based on LaSalle and Strickland Criteria.[2] The outcome supports the CMMS technique is certainly a viable option for the non-stiff hand (Fig 4). CMMS engaged the brain, provided neuro-reeducation and addressed cortical remapping to help this patient with full passive finger joint motion improve her active control.

Figure 4 (from left). Active digit extension at 10 weeks post-op after 15 therapy sessions; active digit extension at discharge after seven visits using CMMS; active digit flexion at 10 weeks post-op after 15 therapy sessions; active digit flexion at discharge after seven visits using CMMS.

Case 2

A delayed presentation of FDP and FDS tendon lacerations to the index finger of the dominant hand. Surgical intervention involved FDS resection and primary Palmaris Longus (PL) graft to the FDP. A total of three months between date of injury and surgical intervention provided the patient ample time to shift dexterity tasks to the middle finger and learn non-use of the index. Post-operatively the patient was treated with a forearm-based dorsal block orthotic and Modified Duran protocol was ordered. At eight weeks post-op the patient showed minimal gliding of the graft, had no improvement in AROM with a relative motion orthotic or buddy taping of the digit. The patient also had full wrist and finger PROM but no pinch strength (see video pre CMMS).



Video 2: Delayed presentation of FDP and FDS

Upon application of the CMMS cast this patient shared moving the finger was a struggle because the motion she did have was now blocked. She felt attempts to move the finger actually straightened the PIP joints rather than flexing them. She described the process as "figuring out how" to make the finger work, needing to "relax the finger first" and then try to bend. With time, use of a dorsal hood to provide proprioception, giving her a target to pull away from, and transitioning to volar targets for her to aim to touch (Figure 5), she was able to achieve 67% return of TAM classifying this as a good outcome per LaSalle and Strickland Criteria.[2]

Her DPC measure on the index finger improved from 6 cm to 2.5 cm, PIP arc of motion improved from 28 to 76 deg and DIP improved from 4 deg to 20 deg. Pinch strength was 3# tip pinch (8# L hand), three-jaw chuck pinch of 8# (13# L hand), power grasp 49# (55# L hand tested on position 2 of the dynamometer) at the time of discharge. This patient went back to work on full duty.

Figure 5. Volar targets for patient to touch

Figure 6. Left: Volar view of digit flexion prior to CMMS on 10/16/23; Discharge visit on January 18, 2024.

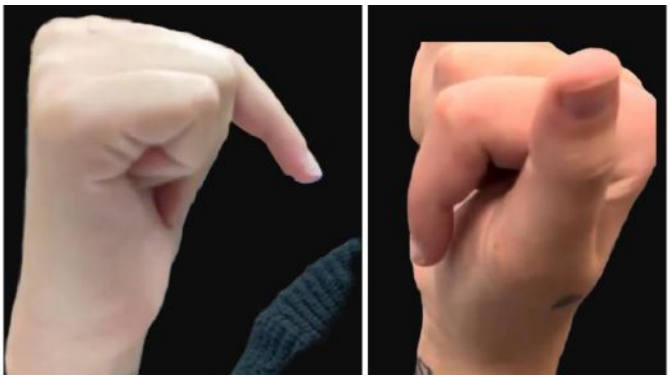


Figure 7. Left: Active digit flexion on 10/16/23 when CMMS was initiated; Right: active digit flexion at therapy discharge on January 18, 2024.

Worthy of Consideration

Clinical outcomes in use of CMMS with hands and fingers not classified as stiff show gains in motion not achieved with prior weeks of therapy using traditional techniques. An argument could be made to support the CMMS concept that actively redirecting motion to the joint(s), not actively moving, creates tendon glide. The technique also works to remap the motor cortex, and helps the patient find the muscle needed to move the joint. CMMS provides proprioceptive feedback enabling patients to be more successful in their exercise cycles, helps with motor planning ultimately restoring a more functional arc of motion, and successfully works to improve AROM when full PROM is present. CMMS is worthy of consideration to treat more than joint stiffness due to the multiple components embedded in the technique and application can provide therapists with a solution to these tough cases.

References

1. Colditz JC. *Chapter 67 Therapist's Management of the Stiff Hand; Rehab of the Hand and Upper Extremity* (6th ed.). (O. F. Skirven, Ed.) Elsevier Mosby; 2011.
2. LaSalle WBSJ. (1983). An evaluation of the two-stage flexor tendon reconstruction technique. *J Hand Surg Am.* 1983;8(3):263–267.
3. Taub E, Uswatte G. Constraint-induced movement therapy: answers and questions after two decades of research. *NeuroRehabil.* 2006;21(2):93-95.
4. Taylor A. The Taylor "Wedges": Pain reduction and alignment in the fingers. *ASHT Times*, 2023;32(1)18-20.
5. Wajon SH. Prescription of exercise relative motion orthoses to improve limited proximal interphalangeal joint movement: A prospective, multi-center, consecutive case series. *J Han Ther* 2023;36:378–388.