Serial Casting

Serial casting is a clinical intervention that is used when a person has limited range of motion (ROM) due to increased muscle tone or spasticity. Spasticity is a frequent problem in persons who sustain a traumatic brain injury (TBI) or other neurological insult, such as stroke, spinal cord injury, muscular dystrophy and cerebral palsy.

Spasticity is clinically defined as a muscular hypertonicity characterized by a velocity-dependent increased resistance to stretch, which is known to interfere with voluntary movement. It is usually caused by damage to the motor cortex that controls voluntary movement (Cincinnati Children’s Hospital, 2009).

During an assessment, a manual passive stretch is applied at different rates. A joint is passively moved while the muscles corresponding to that joint are lengthened and shortened. In cases of mild spasticity, the muscles will only resist when stretched at a high rate (velocity-dependent), whereas in cases of moderate spasticity, resistance is noticed at a slower rate and the clasp-knife phenomenon may be exhibited (Dimitrijevic, 1991).

Serial casting is a process in which a series of casts are periodically used to stretch soft tissues for an extended length of time (Cincinnati Children’s Hospital, 2009). As an example, to elongate a rubber band or a balloon, it takes a prolonged stretch and hold for that to occur. Muscles work in a similar fashion.

A prolonged stretch in a lengthened position at low impact will yield better results and functional ROM gains as well as a reduction in spasticity. This was seen in a study that demonstrated at least six hours of stretch was necessary for effectiveness (Cincinnati Children’s Hospital, 2009).

Serial casting can be done on both the upper extremity and the lower extremity to reduce spasticity. It is most effective when it is used within the first six months after injury and with patients who are demonstrating ongoing recovery neurologically (Booth, Boyle & Montgomery, 1983).

When to use serial casting

There are several clinical indications for casting and precautions to take into consideration prior to casting.

The indications include: improve ROM, improve positioning of the extremity to allow better management of activities of daily living, prevent contractures, normalize muscle tone and reduce spasticity, and ultimately maximize the patient’s function.

There are precautions to be aware of prior to casting someone, which include: impaired sensation of the extremity to be casted, poor skin integrity, poor circulation and hard end feel (which could be heterotopic ossification). If the person has heterotopic ossification, serial casting is not indicated as ROM will not be gained due to the fixed end feel caused by the bone growth.

Applying a series of casts to an extremity can be an effective clinical intervention to increase range of motion by slowly stretching the soft tissue.

THE CASTING PROCESS

EDITORS NOTE: The casting process is completed by a professional therapist with training. This is intended to give the reader a basic understanding of the process. It is not intended to be instructional.

Pre-casting process

1. Take measurements of the patient’s extremity in the resting position.
2. Take passive and active range of motion measurements.
3. Assess functional skills with the extremity to be casted.
4. Assess spasticity in the involved extremity.
5. Assess skin integrity.

Casting process

1. Make sure the skin is clean and dry.
2. Apply stockinette to the extremity above and below the joint that will be casted.
3. Apply padding to any bony prominences to reduce the risk of skin breakdown.
4. Wrap the extremity with cast padding.
5. Fold up the ends of the stockinette on the cast padding prior to applying the casting material.
6. Position the extremity in a stretched position that is greater than the resting position and less than the full passive range of motion (PROM) position.
7. Wrap the casting material over the extremity while it is held in the stretched position.
8. Maintain the extremity in this position until the casting material dries.
9. Check for proper circulation on the distal (open end) of the cast.

(Novita Children’s Services, 2012)
Serial Casting continued

These precautions require close monitoring prior to and during casting. The patient’s cognitive status and family/caregiver compliance and understanding of the process are factors in yielding positive outcomes as well.

**Patient/caregiver education**

After a cast is applied, it’s important to provide frequent inspections of the cast and surrounding areas. It is also important for the professional who installed the cast to communicate to the client and their caregivers on what to expect while the cast is in place. They should further explain that mild discomfort is expected as the patient’s extremity is in a stretched position. If discomfort persists, under the direction/orders of the patient’s physician Tylenol® or Motrin® can be given for some relief.

The patient or caregiver should contact the therapist if there are cracks or dents in the cast or an unusual odor in the cast; if something has been dropped inside the cast; if the client complains of itching or dampness or if the client simply refuses to bear weight while the cast is on. If the extremity begins to slip inside the cast, the therapist needs to know that, too. (Cincinnati Children’s Hospital, 2009)

If the client is experiencing severe pain, a skin reaction or poor circulation from the cast, it should be removed.

If the client is being fitted with their first cast, it should be removed within five to seven days to make sure the client’s skin and the extremity is tolerating it. Subsequent casts can be removed between seven and 14 days.

When the cast is removed, the skin should be checked for signs of breakdown, blisters, rash, etc. The therapist should also reassess ROM (active and passive), functional gains and spasticity reduction.

At this point, the therapist should decide whether or not to continue with the casting based on the client’s tolerance and functional gains made from the above assessment.

If it has been determined to proceed with serial casting, the therapist should re-cast the extremity in approximately five more degrees of ROM. Repeat the same steps as previous. The second cast can be kept on for a longer duration if the first cast went well with respect to skin integrity, patient comfort and circulation.

The challenge when using this clinical intervention in the TBI population can be a lack of understanding of the process by patients who may have a cognitive impairment.

A study concluded that casting is more effective than traditional techniques in reducing contractures (increasing ROM) and decreasing spasticity. Interestingly, in this study, the difference between the effects of serial casting and traditional therapy on functional improvement of the extremity did not yield a significant difference. However, it can be concluded that with a reduction in spasticity and improvement in ROM that functional gains will be made overall (Hill, 1994).

Another study, in which a systematic review was completed of the research on serial casting following a brain injury, concluded that only the outcome of improved passive ROM has sufficient evidence to support the use of casts as current best practice.

This study demonstrates the need for continued research in the area of serial casting intervention in persons with a TBI (Mortensen & Eng, 2003). Further research can establish better best practice guidelines for therapists in the areas of reduction in hypertonicity or spasticity as well as change in functional ability.

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**THE ROLE OF BOTOX® IN SERIAL CASTING**

Botulinum toxin, or Botox®, injections into the tight muscle can provide relaxation of the contractile tissue of the muscle and make serial casting more successful.

This medication will block the release of acetylcholine, a neurotransmitter, at the neuromuscular junction, which results in weakness or paralysis in the muscle (Cincinnati Children’s Hospital, 2009) and a reduction in spasticity.

This effect usually takes 10 to 14 days, and it is best to wait until the injection is fully effective before putting on the cast. Serial casting is much more comfortable for a patient when the muscle is weakened and stretched out versus a muscle that is still fully contracting. This will increase the tolerance and the outcome when incorporated with the serial casting.
At Rainbow, we have found success in serial casting with our clients who have sustained a TBI. We have found improvements in our clients’ ROM and can follow up with appropriate resting splints after the serial casting is complete. These splints are more comfortable for the patient and fit better because of the gains made in ROM with serial casting. Most of our patients treated with serial casting are treated with Botox® prior to the casting as it is more comfortable for them and the outcomes are better.

In summary, serial casting is a conservative clinical intervention that can be used to manage the effects of increased spasticity following a TBI. It can improve a patient’s ROM and appears to be more effective when combined with Botox®.

Several clinicians at Rainbow have completed the training in-service on this intervention. They continue to use serial casting in conjunction with traditional therapy techniques and appropriate splinting. While serial casting is not the answer for all patients, it is another “tool” in our toolbox that can make a difference in the quality of life for our clients.

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Written by Julie Ladwig, PT, CBIS, CKTP
Rainbow Rehabilitation Centers

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For information, contact the editor at:

RainbowVisions Magazine
Rainbow Rehabilitation Centers, Inc.
38777 Six Mile Rd., Suite 101, Livonia, MI 48152, USA
E-mail: rainbowvisions@rainbowrehab.com