Serial Casting For The Lower Extremity: An Introduction Using An Evidence-Based Care Guideline

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Objectives

• To review an evidence-based care guideline for lower extremity serial casting treatment

• To examine the current body of evidence related to lower extremity serial casting
Objectives

- To observe and discuss serial casting techniques for the ankle-foot complex
- To facilitate open-ended conversations across disciplines to determine best plan of care during serial casting of the lower extremities (i.e. casting with botulinum toxin injections, knee extension splinting, etc.)
Development of an Evidence-Based Care Guideline - Background

- Stretching has always been a core therapeutic intervention for physical therapists
- Despite stretching, ROM limitations often persist and progress into contractures
- Also joint stiffness can result from immobilization, especially in an abnormal or non-functional position
Development of an Evidence-Based Care Guideline - Background

• Animal models show that muscle tissue can be effectively stretched by:
  – Low load: i.e. not too aggressively
  – Long duration: at least 6 hours in a muscle with abnormal muscle tone (Tardieu, 1987).

• Prolonged immobilization in plaster casts started in earnest in the 1970s.
Development of an Evidence-Based Care Guideline - Background

• Theories about casting include:
  – Increase in number of sarcomeres in series
  – Reduce abnormal muscle tone by interfering with muscle spindle excitation**
  – Neutral warmth of casts aid relaxation**

• **Studies to support these theories have had inconclusive results.
Development of an Evidence-Based Care Guideline - Background

• Variation was noted regarding the methods of delivery of serial casting treatment

• An evidence based practice group assembled in 2006 to search the literature and make recommendations regarding serial casting process including frequency, duration, and materials
Development of an Evidence-Based Care Guideline – EBP Process

• Basic steps which lead to an evidence-based decision are:
  – development of a specific clinical question
  – conduction of a precise literature search
  – critical appraisal of each article
  – synthesis of the evidence
  – development of care recommendations
Development of an Evidence-Based Care Guideline – EBP Process

• We used LEGEND (Let Evidence Guide Every New Decision) evidence evaluation system
• It includes tools and resources for gathering and critically appraising published works, grading the body of evidence found, and judging the strength of the concluding recommendation statements
Development of an Evidence-Based Care Guideline – Literature Search

- **Keywords:** serial casting, casting, cast, physical therapy, spasticity, cerebral palsy, idiopathic toe walking, toe walking, brain injury, Duchenne Muscular Dystrophy

- **Databases:** CINAHL, Medline, Pubmed, PEDro, Cochrane Library, Scopus, ACP Journal Club, Hooked on Evidence, PsychInfo
Development of an Evidence-Based Care Guideline – Critical Appraisal

• In 2009: 18 research articles and 3 books were deemed appropriate to include in the Clinical Practice Guideline, including 4 RCTs and several lower level studies (including case reports, cohort studies and general reviews).

• In 2013: All original research studies were reviewed as well as several new articles. 30 research articles and 2 books have been used in revising the Clinical Practice Guideline. 5 systematic reviews, 2 RCTs, as well as a few lower level studies were added. More research articles studying ITW were included.
Evidence Summary – Cerebral Palsy

- Strong support that casting improves ankle DF PROM
- Moderate support for short term gait improvements
- Insufficient evidence or lack of consensus to support muscle tone and long term gait improvements
Evidence Summary – Cerebral Palsy


• Contracture management utilizing Serial Casting: “green-light” intervention in the lower extremity, strong “yellow-light” intervention in the upper extremity.

• 1b
Evidence Summary – Cerebral Palsy

  - Compared casting vs botox in terms of spasticity reduction – neither superior.
  - Compared casting with botox to casting alone – neither superior.
  - Casting improved gait more so than botox alone.
  - 1a
Evidence Summary – Cerebral Palsy

  – Significant improvements in tone, dynamic spasticity, and PROM in both treatment groups, but the results were more significant in botox with casting group.
  – Standing dimension D of GMFM-66 significantly improved in botox with casting group.
  – 3a
Evidence Summary – Brain Injury

- Strong support that casting improves ankle DF PROM
- Lack of consensus or insufficient evidence to support changes in muscle tone or gait after casting.
Evidence Summary – Brain Injury

  - Serial casting was shown to be an effective treatment strategy for improving passive ROM, but not clear as to reducing muscle tone.
  - Takeaway: serial casting needs to be an adjunct therapy with this population - it is not a stand alone treatment.
  - 1a level
Evidence Summary – Brain Injury

  - Strong evidence that serial casting does reduce ankle plantarflexion contractures
  - Moderate evidence to show that using botox A with casting is no more effective than casting alone
  - 1b level
Evidence Summary – Brain Injury

  – Levels of evidence were low due to study designs
  – Consistent evidence though that PROM improved when joints were casted
  – 1b level
Evidence Summary – Idiopathic Toe Walking

- Moderate support for improvements in ankle DF PROM
- Moderate support for short term gait improvements
- Insufficient evidence to support long term gait improvements.
Evidence Summary – Idiopathic Toe Walking

  - There was no significant difference between the study groups with respect to 3D gait analysis, parent rating of time on toes, PROM hip/knee/ankle, and ankle DF strength.
  - They had similar improvement and longevity of results.
  - 2a
Evidence Summary – Idiopathic Toe Walking

  - Supported serial casting as a conservative treatment option to prolong/avoid surgery in ITW population
  - Author supported use of serial casting in children under 2 y.o.
  - 5a
Evidence Summary – Duchenne Muscular Dystrophy

- Overall low level of evidence
- Moderate support for improved ankle DF PROM with casting.
- There was a lack of evidence to support gait changes.
Evidence Summary – Duchenne Muscular Dystrophy

  - Ankle DF improved w/ knee flexed and knee extended (B)
  - No change in timed tests pre- and post-casting
  - Negative correlation b/t age and # of casts (i.e. younger need less casts)
  - 4a
Serial Casting of the Lower Extremities
Indications for Serial Casting

• Decreased ROM in children who are diagnosed with CP, TBI, DMD, juvenile idiopathic arthritis, etc.
• More than 5 degrees difference is noted between R1 and R2 (Tardieu and Tardieu, 1987)
• Persistent hypertonicity/spasticity
Indications for Serial Casting

• Poor joint alignment
• Shortened soft tissue, nerves, vessels, and ligaments
• Risk of further deformity
• Extremity cannot be controlled with splinting alone
Precautions

- Allergies or prior skin reactions to casting materials
- Decreased sensation
- Poor communication
- Excessive sweating
Precautions

• Confirmed fracture healing if recent fracture
• Longstanding/fixed contracture at extremity to be casted
• Sensory issues (i.e. tactile defensiveness, poor tolerance to handling etc.) may cause decreased compliance
Contraindications

- Poor skin integrity
- HTN or increased ICP
- Uncontrolled autonomic storming
- History of or recent non-union fracture at the site to be casted
- Marked edema in extremity to be casted
- Inadequate bone density (osteoporosis) at the extremity to be casted
Contraindications

• Need for limb access for monitoring vital signs or medication administration
• Impaired circulation or recent DVT in limb
• Heterotopic ossification at the extremity to be casted
• Bony joint limitations in area to be casted
Casting Evaluation

- Patient/Client History
  - Medical/Surgical History
  - Botulinum toxin injections sites and dates
  - Allergies/skin sensitivities
  - Current conditions
- Patient/client goals
- Past casting/PT treatment
- Orthotic, Protective, and Supportive Devices
- Gait, Locomotion, and Balance
  - Observational Gait Scale (if appropriate)
Casting Evaluation

- Motor Function
  - Gross Motor Function Classification System (if appropriate)
- Muscle Performance
  - Strength (functional assessment only)
- Pain
- Posture
- Range of Motion
  - Active and Passive
- Reflex Integrity/Muscle Tone
  - Muscle tone-Modified Tardieu scale (R1/R2)
Casting Procedures

• Perform casting after being trained and demonstrating competency
• Solid soft cast or bi-valved fiberglass cast
• Once per week for 4-6 weeks
• Bi-valved cast or custom nighttime splint after completion of casting
• Recommendations for AFOs and burst of PT following casting
Discussion Questions

- Botox
- Knee extension splinting
- Duration of casting
- Other
References

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References

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