Comparison of Serial Casting, Botulinum Toxin A, and Combination Treatment in Children with Cerebral Palsy to Reduce Spasticity in the Ankle

Background
Children with cerebral palsy (CP) commonly present with spasticity in the ankle, exhibiting increased plantar flexion and equinus contractures. This decreases the efficiency of the gastrocnemius, reducing the power of the muscle and producing a crouched gait posture. CP also often limits children’s ambulation and ability to function socially.

Introduction
The combination treatment of serial casting (SC) and botulinum toxin A (BTX-A) has become popular in the past 10 years. BTX-A injected intramuscularly temporarily denervates the intended muscle by preventing the release of acetylcholine into the neuromuscular junction, therefore preventing a contraction. BTX-A effects tend to last 3-6 months. SC involves the successive, prolonged use of single or multiple applications of plaster casts that progressively increase the amount of DF in the ankle. This technique gradually increases the extensibility of muscles and adjacent soft tissue, which can increase the length of and number of sarcomeres in the intended muscle.

Treatment Options for Spasticity

- Serial casting
- Botulinum toxin A
- Rhizotomy*
- Bracing/Orthosis
- Stretching
- Strengthening
- Oral medications
- Surgical tendon release*
- Baclofen pump placement

* Surgical procedures involve the risk of infection, over-lengthening, crouched gait pattern, anesthetic side effects, and recurrence in children less than 6 years old.

Spasticity:
- All interventions create improvement, especially between 3 & 12 months
- All intervention benefits are transient, regardless of the initial contracture intensity
- Combo & SC show larger improvement than BTX-A
- No significant differences exist between SC and BTX-A alone
- BTX-A creates the largest improvements at 12 weeks
- SC is an effective treatment with or without BTX-A

Gait:
- SC increases stride length

PROM:
- No significant changes in PROM with any intervention
- Greatest effect of DF is present between 3 & 7.5 months after SC & combo treatments

Outcome Measures:
- Outcome measures do not produce any significant score change with any intervention
- The Modified Tardieu scale may reveal changes in spasticity more frequently than the Ashworth Scale
- The GMFM showed increased function in one study, but this is not supported by other research
- The GMFM is not reliable to compare pre- and post-intervention scores

Satisfaction
- Parents tend to like BTX-A because it is a one-time treatment, however it can be more expensive and have a higher cost
- SC allows a choice of plaster colors, but it is difficult to carry and bathe a child while casted and requires multiple applications.

Side effects of SC include:
- Skin breakdown & irritation
- Foot/Calc pain
- Cast breakdown
- Tendonitis
- Ankle stiffness/weakness

Accompanying side effects of combo include:
- Falls
- Constipation

http://www.takebellingfoundation.org/take_after_sd_rhizotomy


http://bit.ly/Poster_creation_help

Future Studies
Future studies should examine the long-term effects of treatment options, the amount of BTX-A effective, the peak age of treatment response, responses of varying intensities of spasticity, the functional and social effects of the treatments, effects of treatment on muscle strength, differences between immediate and delayed SC post BTX-A injections, and beneficial and adverse side effects associated with each intervention. BTX-A may be useful in improving tolerance to SC. Further studies should utilize larger sample sizes.

Clinical Significance
- More research is needed to completely understand the benefits and differences between SC, BTX-A, and combo interventions to treat ankle spasticity in children with CP. All interventions can decrease spasticity, however, the research regarding duration of benefits varies.
- SC can produce benefits with or without BTX-A, but in general, combination treatment is thought to produce the greatest benefits.
- No intervention creates a significant change in PROM of ankle DF.
- No outcome measure has been able to adequately assess the effects of interventions to treat spasticity, however, the Modified Tardieu scale may display the greatest sensitivity to change.
- No changes in functional, social, and postural benefits of any intervention were found, but these aspects are difficult to assess.
- It is important to consider family support and satisfaction when implementing and continuing treatment programs to treat spasticity.

References

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