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The Effectiveness of Serial Casting in Children with Arthrogryposis

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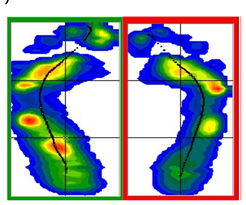
INTRODUCTION

- Arthrogryposis multiplex congenita is a congenital condition that is characterized by joint contractures with resulting gait deviations and foot deformities with an incidence of 1 in every 3,000 live births.[1,2]
- The most common foot deformity is clubfoot, where the foot is adducted and plantarflexed.
- The Ponseti method is used to correct foot position in infants and young children. This method includes gradual stretching of the feet by casting, an Achilles tenotomy, and night bracing.[3]
- Many studies show the effect of Ponseti on children with idiopathic clubfoot, but limited research has been done on children with arthrogryposis.
- **The purpose of this study** was to measure the effectiveness of serial casting on equinovarus in children with arthrogryposis by assessing passive range of motion, parent-reported outcomes, and foot pressure measurements.

METHODS

- Institutional Review Board-approved retrospective study
- Inclusion criteria:
  - Arthrogryposis diagnosis
  - 2 years and older
  - Serial casting for equinovarus foot
  - Pre- and post-assessments (short term [0-6 months] and long term [6-14 months])
- Exclusion criteria:
  - Surgery, except Achilles tenotomy
- The assessments included a physical examination and instrumented gait analysis
- Data were collected from medical records from September 2014 to April 2021
- Outcome measures include:
  - Lower limb passive range of motion (PROM)
  - Pediatric Outcomes Data Collection Instrument (PODCI)[4]
  - Foot pressure[5]
    - Coronal plane pressure index (CPPI)
    - Heel impulse (%)
  - Gross motor function measure (GMFM-D)
  - Brace tolerance
  - Need for post-casting surgery
  - Cast number
- Statistical analysis
  - Paired t-tests were used to analyze pre- and short-term post-casting differences
  - Analysis of variance was used between pre-, short-term, and long-term post-casting outcomes
  - Pearson's correlation coefficients were used to determine the relationship between relevant predictors and variables.



PATIENT SAMPLE

- Evaluated the outcome of 214 serial castings
- Subjects included 50 children with feet casted 2.4 ± 1.9 times
- Average age (years) at casting episode was 6.3 ± 3.5
- Eighteen percent of children had only foot/ankle involvement and 82% had diffuse involvement
- Brace type
  - Pre: none (3%), ankle-foot orthosis (AFO; 68%), knee-ankle-foot orthosis (KAFO; 28%), and supramalleolar orthosis (SMO; 1%)
  - Post: none (3%), AFO (66%), KAFO (29%), and SMO (2%)
- Brace tolerance
  - Pre: good (30%), fair (22%), and poor (48%)
  - Post: good (79%), fair (17%), and poor (4%)

RESULTS

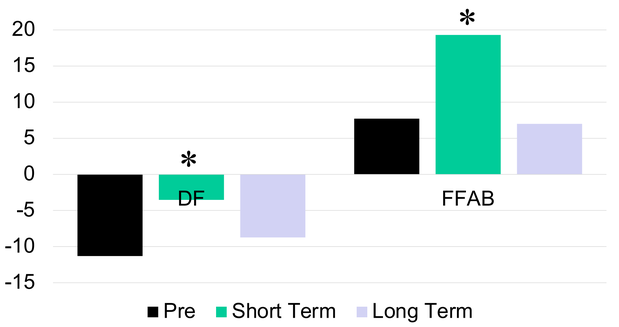


Figure 1: Comparison of PROM measurements

DF- dorsiflexion
FFAB- forefoot abduction

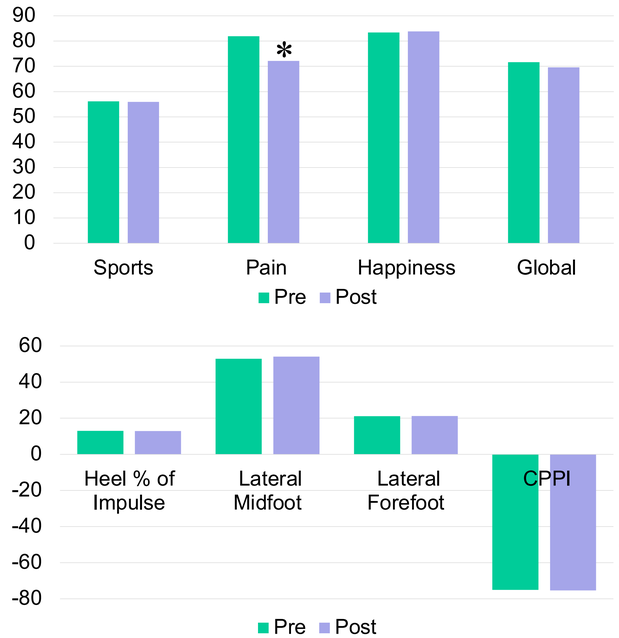


Figure 2: Comparison of PODCI scores

Figure 3: Comparison of foot pressure measurements

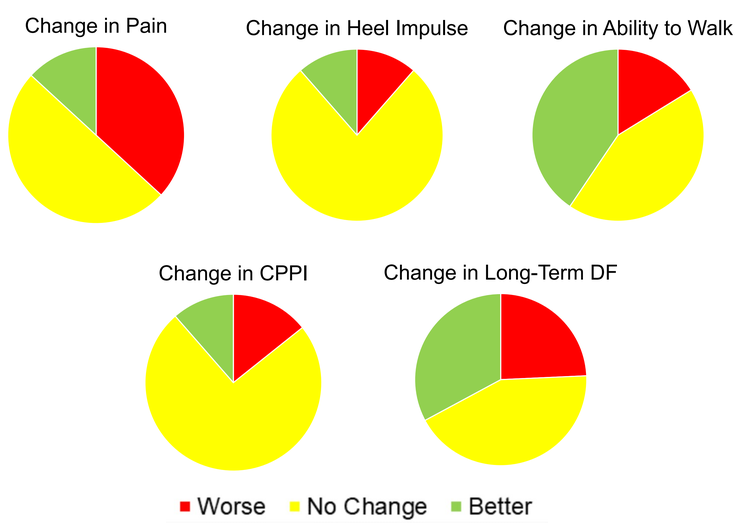


Figure 4: Variation of change in outcomes

RESULTS

Table 1: Correlations Between Predictors and Variables

	R	p	R	p	R	p	R	p	R	p	R	p
Change Pain	-0.0743	0.46	0.0610	0.39	0.0329	0.93	-0.129	0.47	-0.083	0.62	0.055	0.76
Change CPPI	-0.1376	0.38	0.2281	0.49	-0.0885	0.72	-0.069	0.59	-0.27	0.024	0.029	0.823
Change Heel	-0.0276	0.6	0.1089	0.96	-0.2398	0.047	0.167	0.19	0.095	0.43	-0.013	0.9
Change LT DF	0.1440	0.26	0.0021	0.322	-0.0379	0.86	-0.426	0.0012	-0.158	0.25	-0.222	0.1
	Pre Age		**Pre GMFM-D**		**Cast no.**		**Pre DF**		**Pre CPPI**		**Time from Casting**	

LT, long-term

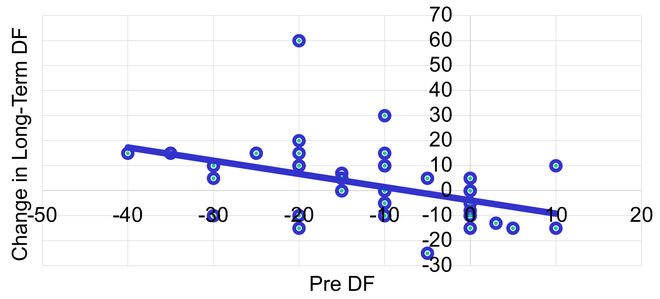


Figure 5: Change in long-term dorsiflexion vs. pre dorsiflexion

R= -0.426
P= 0.0012

Table 2: First Casting Episode to Follow-Up

	1st Cast to Follow-Up (n=50)		1st Cast to Surgery (n=10)	
	1st Cast	Follow-Up	1st Cast	Surgery
Age (years)	5.6 ± 4.5	10.3 ± 5.5	4.6 ± 2.1	9.7 ± 3.0
Total Cast no.	3.3 ± 2.5		5.6 ± 3.2	
Average Time Between (years)	4.6 ± 3.1		4.7 ± 3.2	
Boney Foot Surgery (%)	20		100	

CONCLUSIONS

- The PROM measurements improve following casting but return to baseline by 9 months.
- Starting with more foot deformity correlates with more improvement.
- The less times one is casted or a lower cast number, the more likely heel contact will improve.
- While not significant, there is a weak correlation with GMFM-D. The more functional the child is, the more positive change in CPPI.
- Brace tolerance is greatly improved after casting.
- Casting assists in delaying surgery and creates a braceable foot.

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