## Serial casting in the treatment of idiopathic toe-walkers and review of the literature

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| **This prospective study and review of the literature concludes that serial casting is effective in improving ankle dorsiflexion and decreasing the observation of toe walking in children referred to physical therapy with a diagnosis of idiopathic toe-walking.**  |

**Citation/s:** Fox, A. Deaken, S. Pettigrew, G. Paton, R. Serial casting for the treatment of idiopathic toe-walkers and review of the literature. *Acta Orthopedica Beligica*. 2006;**72**:722-730.

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**Clinical Question:** Is serial casting effective for improving dorsiflexion range of motion and decreasing the observation of toe-walking in children who are seen by a physical therapist with a diagnosis of idiopathic toe-walking?

**Search Terms:** We searched EBSCOhost, including CINAHL and MEDLINE, using the search terms “idiopathic toe walk\*” and “casting,” which resulted in “3” hits including the selected article. No systematic reviews or randomized controlled trials were identified through a literature search that addressed the clinical question. “Idiopathic toe walk\*” and “physical therapy” were entered into EBSCOhost and returned “3” hits. When “idiopathic toe walk” was entered independently, 8 results were returned, with the majority being case studies.

**Methods:** A total of 44 typically developing children were included in this study, ranging in age from 2 years to 14 years 4 months. All participants had no delay in age of independent walking. Sixty eight percent of the participants were male. All children over the age of 2 years old who were being seen for a primary diagnosis of idiopathic toe walking at the Paediatric Orthopedic Clinic of the senior author were asked to participate in the study. Data was collected between December 1999 and September 2003. Inclusion criteria included the following: over the age of 2 years, main complaint of toe-walking (parental observation), independent walking achieved, no known diagnosis of neuromuscular disorder, neurological condition, or developmental delay, and no known orthopedic complications. Cases with known neuromuscular disorders and autism were not included in the study. All cases were treated with below the knee walking casts set in plantigrade. Serial casts were changed every two weeks. All parents were also instructed in performing passive Achilles tendon stretching. All children were clinically reviewed for ankle dorsiflexion range of motion and presence of toe walking at a 3-month follow-up and then at 6 month intervals thereafter.

**Statistical Analysis:** Demographic variables included gestational age, time spent in hospital, age of development of independent walking, age of appearance of toe-walking, and age at presentation to PT clinic. Additionally, parents were asked to report on family history of toe-walking, method of birth delivery, reasons for any hospital stays, percentage of time spent walking on toes, and any complaints of lower-extremity pain or problems.

A Mann-Whitney U-test was used to compare the continuous demographic variables of successfully treated toe-walkers and continued toe-walkers. When sample sizes were small a Fisher’s exact test for categorical data was used. The parametric data such as dorsiflexion range of motion were analyzed using the Wilcoxon matched pairs signed rank sum test. Finally, pre- and post-treatment ankle range of motion was analyzed for correlation to investigate the link between fixed ankle equinus and age. For all statistical analyses, a p-value of <0.05 was considered to be significant.

**Results:** Following serial casting for between 3 and 10 weeks (mean 5.7 +/- 1.1 median 6), 66% of patients exhibited a successful outcome, classified as such by either the absence of toe-walking or parent report of satisfaction. Younger children appeared more likely to improve.

There were no significant differences in dorsiflexion range of motion prior to casting between those who continued to toe-walk and those who did not. Following casting, there were no significant differences in dorsiflexion with the knee extended between the groups. However, those children who no longer toe-walked showed significantly more dorsiflexion range with the knee flexed (11.3± 1.72 for non-toe walkers vs. 6.8± 3.0 for continued toe-walkers with a 95% CI).

Finally, all demographic variables were compared to the outcome of serial casting to identify risk factors for unsuccessful treatment. There was no significance found between any of the demographical information collected and outcome of casting. The median length of time in a cast approached significance at p=.09.

**Comments:** Significance was found between groups with regard to dorsiflexion range of motion with the knee flexed, but not when the knee was extended, leading researchers to conclude that stretching of the soleus and tendo Achilles and not just the gastrocnemius is important for a successful outcome.

The time spent in casts was individualized and did not follow a specific protocol. Casting was stopped when there was a decreased resistance to passive dorsiflexion stretch. However, outcomes approached significance with longer periods of casting, supporting the use of casts for at least six weeks.

**Clinical Application:** Serial casting in idiopathic toe-walking children has been shown to be effective in the short term to improve normal gait mechanics and ankle dorsiflexion. This study casted subjects until there was ‘reduced resistance to passive ankle dorsiflexion’ for a mean length of 6 weeks. Younger children who received this conservative treatment had better outcomes at follow-up when compared to the older children in this study. This is consistent with other literature indicating the longer a child is ambulating on their toes, the more likely they are to have an Achilles tendon contracture, requiring more invasive and aggressive treatment. Though serial casting for toe walking has been controversial in the literature, this study reported successful long-term outcomes following 6 weeks of casting and a stretching program. The specific stretching protocol would have been beneficial to identify what prescription of stretching exercises and duration were necessary to see the positive results of this study. Our patient’s age of 13 years was captured by this study, but is at the upper range of the article’s sample. Therefore, it is possible that the casting of our patient will not yield the successful long-term results that would be expected in a younger child. It can be hypothesized that casting an older child for a longer duration of time may be more beneficial in long term outcomes according to the Fox article. Clear communication emphasizing the possible outcomes and importance of compliance with stretching is crucial to convey to the patient and family in order to achieve optimal outcomes in idiopathic toe walkers. Further research is necessary to assess the optimal duration of serial casting in the treatment of children with idiopathic toe walking.

**Data Sources**: CINAHL, MEDLINE, EBSCOhost

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