

Background

Improvement in emergency medical treatment has resulted in more survivors after severe brain injuries. Patients with these injuries often develop spastic foot and ankle contractures leading to deformities. These deformities impair the patients' ability to stand, walk, sit in a wheelchair with good foot position and to wear shoes. Our aim is to reduce the deformities and to make the patients as active as possible.

Methods

We followed 6 consecutive included patients (4 women and 2 men) with an average age of 33 years (range 29-35) with severe spastic foot and ankle contractures due to brain injury. The serial casting was combined with physical therapy in 6 patients and botulinumtoxin injections combined with physiotherapy in 3 patients. A non-removable well molded below-knee synthetic cast with padding were used and was changed once a week, where we gradually tried to reduce the contractures and the deformity in the foot and ankle. We recorded during the cast period of average 5 weeks (range 3–6) the position of the foot and ankle but also reverse reactions.

Results

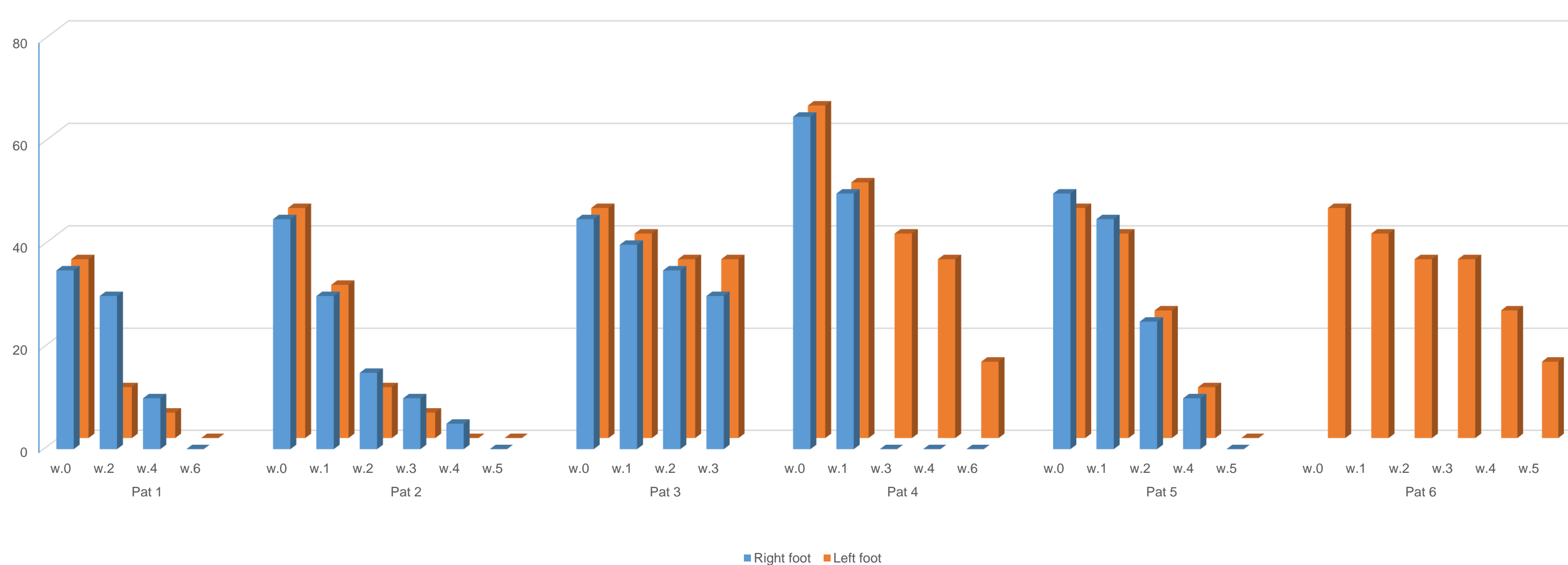
The position of supination and adduction was corrected in the first session. The position of adduction and plantar flexion was corrected at the following sessions.

Summary / Conclusion

Serial casting could be a valuable adjunct in the management of patients with severe spastic contractures in the foot and ankle after brain injuries. Further studies must be done to confirm our results.

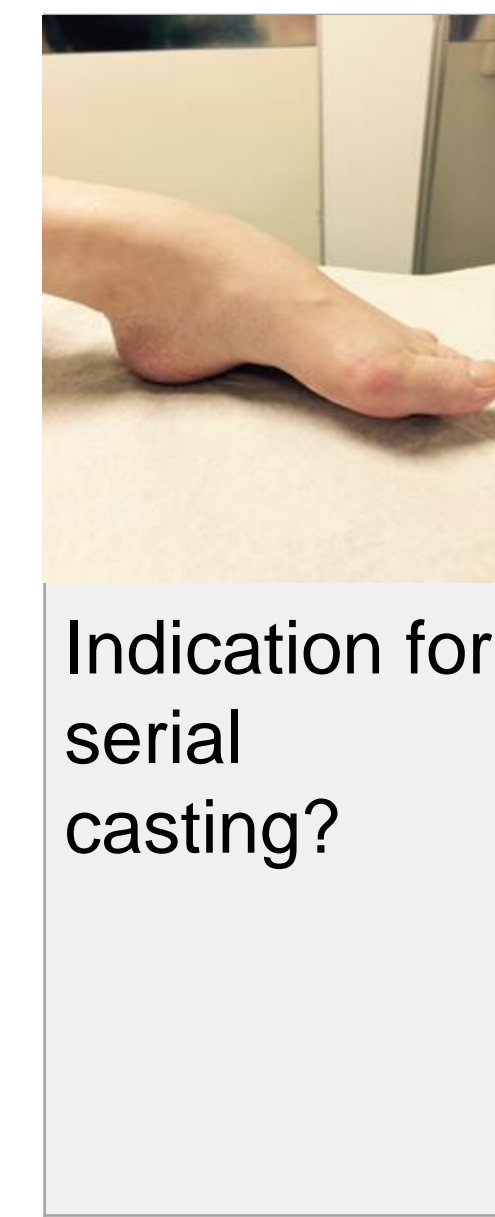
	Age (1st casting)	Gender	Cause Of injury	Date Of Injury	Casting date	Initial foot plantar position (left/right)	End result plantar position (left/right)	Cast period	Clinical status after casting
Patient 1	31	F	Car accident	1997	1999	(-35°/-35°)	(0°/0°)	6 weeks	Transition to orthosis - Walking with a cane
Patient 2	37	M	Cerebral haemorrhage	1996	1999	(-30°/-30°)	(0°/0°)	6 weeks	Transition to orthosis - Standing
Patient 3	29	M	Car accident	2012	2012	(-45°/-45°)	(-35°/-30°)	3 weeks	Non expected result – Operation 3 years after serial casting
Patient 4	35	F	Car accident	2009	2010	(-65°/-65°)	(-15°/-0°)	6 weeks	Assisted standing with orthosis
Patient 5	32	F	In connection to operation	2010	2011	(-45°/-50°)	(0°/0°)	5 weeks	Assisted standing with shoes
Patient 6	34	F	Car accident with traumatic amputation of one leg	2015	2015	(-40°)	(-15°)	5 weeks	Able to stand with CCO and prosthesis. Operation 1 year after serial casting. 2017 assisted walking.

Degrees of plantar flexion deformity with each week of serial casting

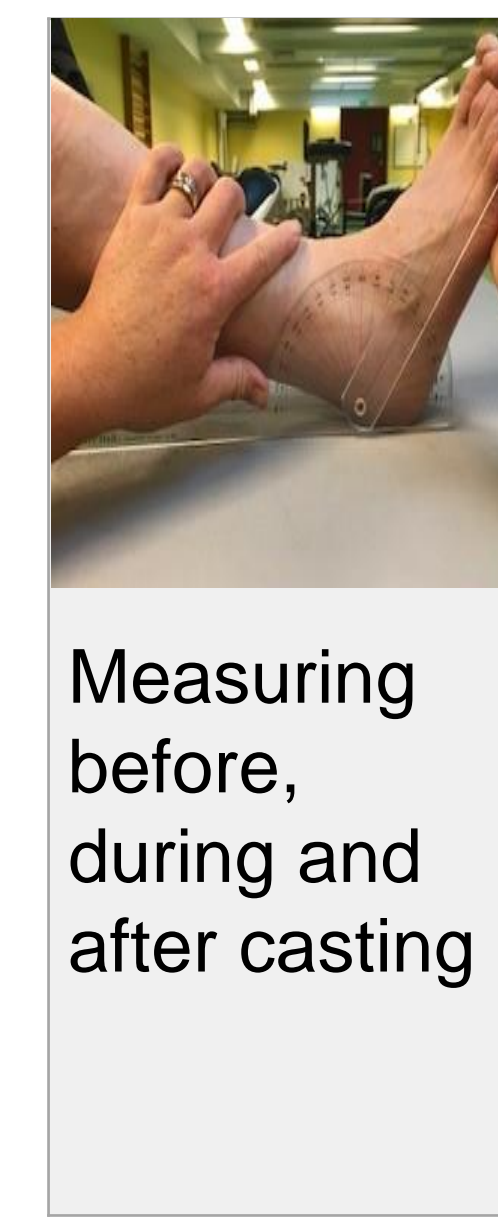


Reverse reaction

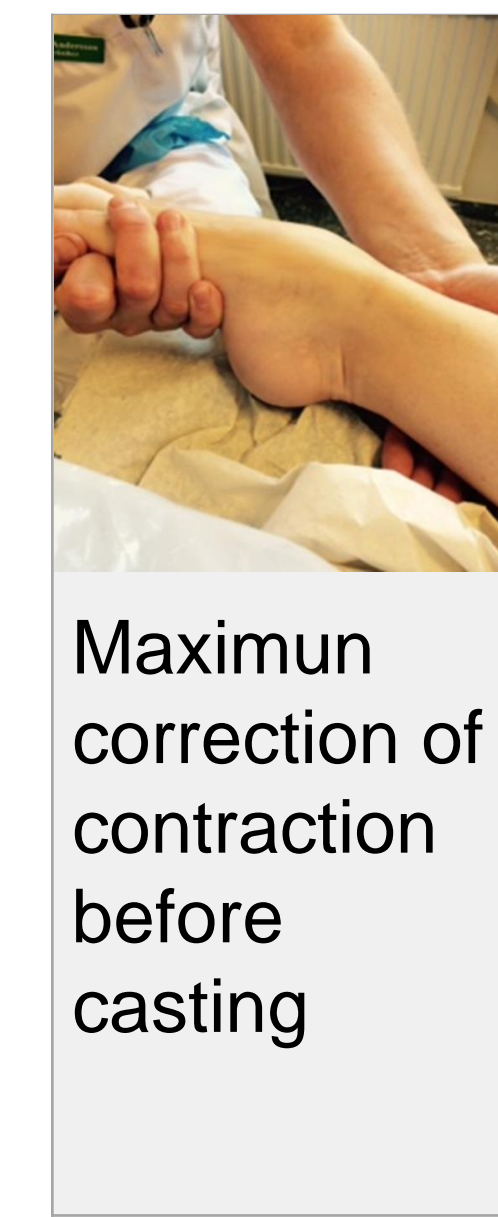
- Pressure ulcer metatarsale 1 – due to inadequate hold technique during casting – with off-loading this complication was solved during the next casting.
- Pressure ulcer lateral malleolus – due to cast technique - with off-loading this complication was solved during the next casting. (See picture)
- Ulcer – due to cutting up the cast and the spasticity of the patient. (See picture)
- Pressure ulcer dig 1 medial side – due to cast technique and the spasticity of the patient - with off-loading this complication was solved during the next casting.



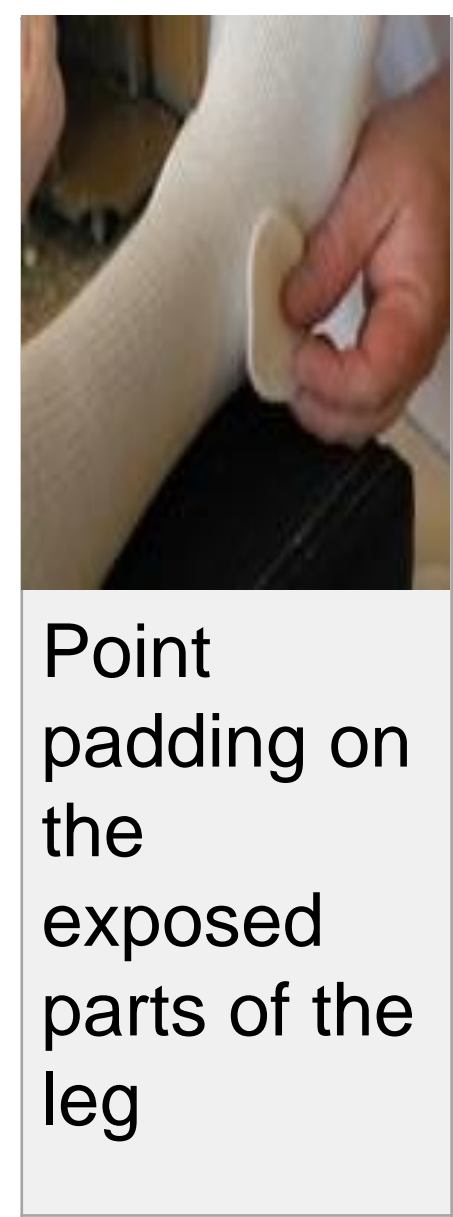
Indication for serial casting?



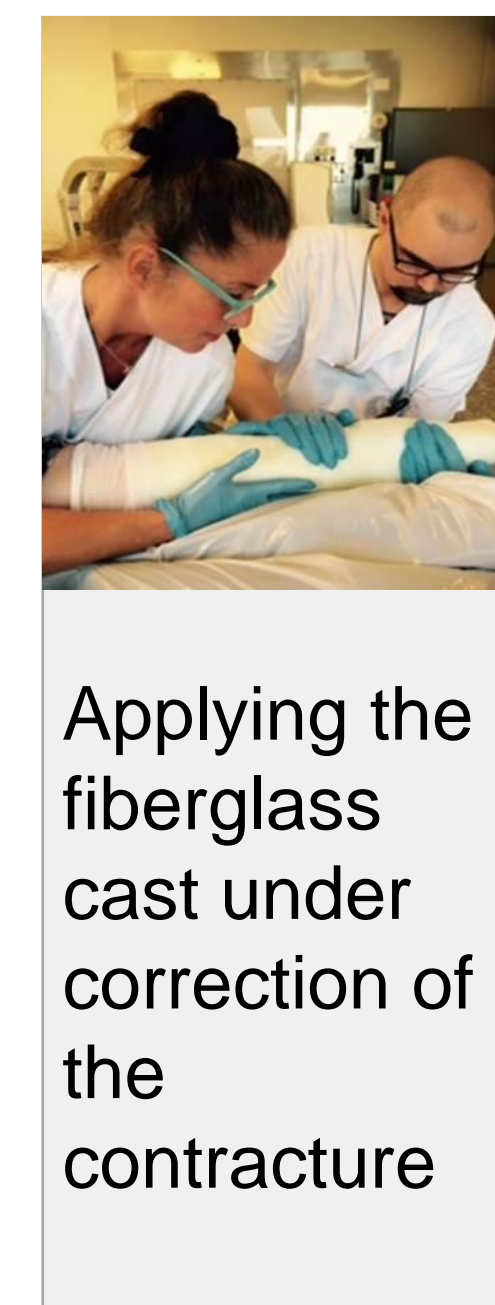
Measuring before, during and after casting



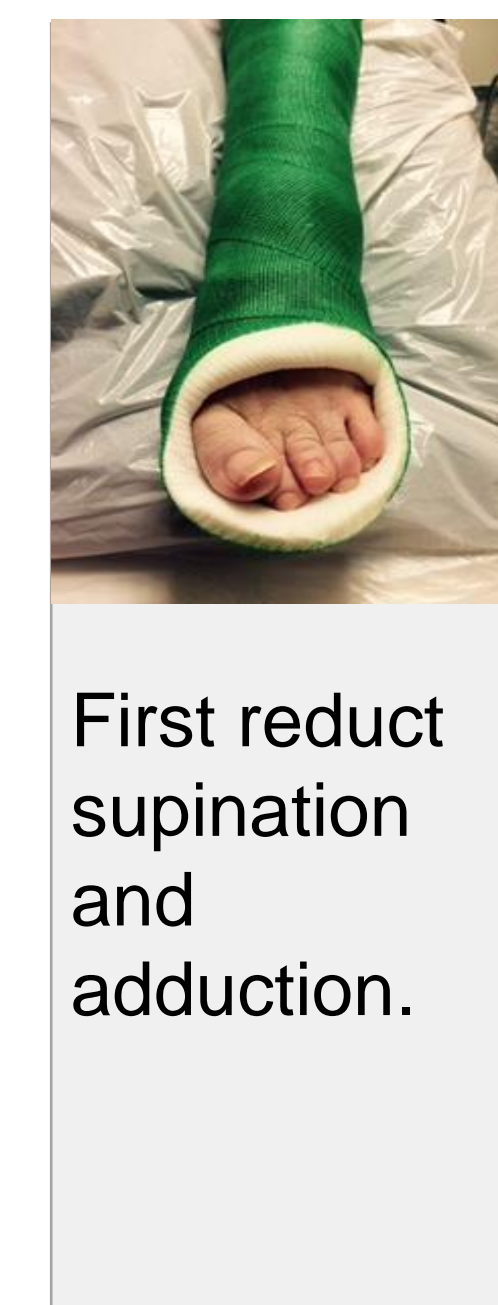
Maximum correction of contraction before casting



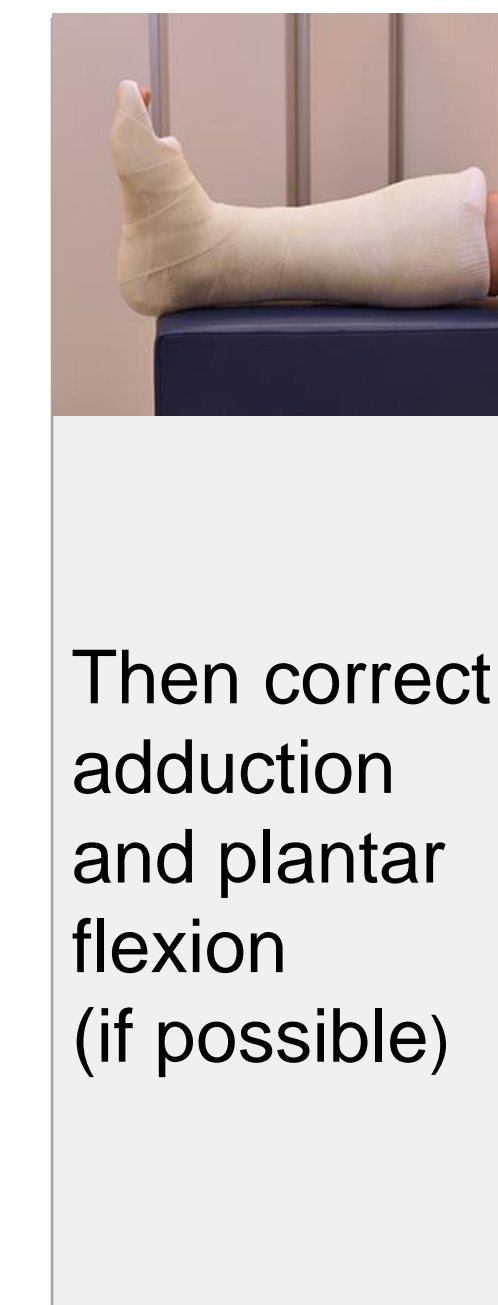
Point padding on the exposed parts of the leg



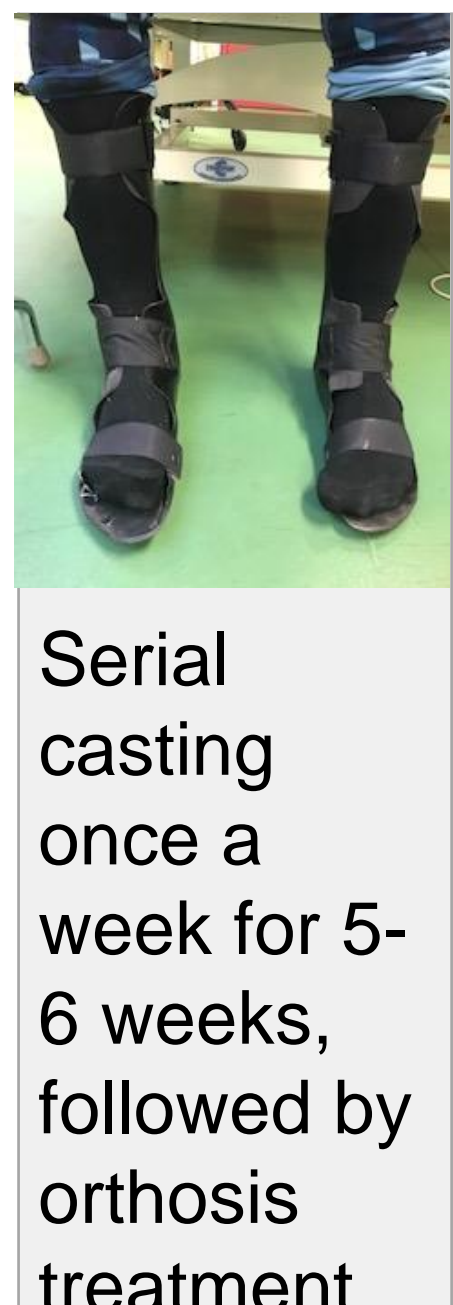
Applying the fiberglass cast under correction of the contracture



First reduce supination and adduction.



Then correct adduction and plantar flexion (if possible)



Serial casting once a week for 5-6 weeks, followed by orthosis treatment



The car crash June 1997



Initial footposition before serial casting. March 1999



Serial casting



4 years after the injury - Walking independent with a cane

Physiotherapeutic aspects when treating patient with serial casting

- Muscles remain intact for later use compared to surgery
- No pain during treatment
- Muscle relaxation – spastic inhibition
- Physical therapy is possible during treatment with serial casting, with even better result as the hypertone and pain is reduced.
- The tactile input of the cast seems to increase body awareness, which reduces anxiety.

Tips and hints

- Quiet room with no disturbances during casting.
- Same staff every time
- Padding material must not be too thick
- Only one joint at a time, but both feet if needed
- Force must never be used to gain an increased range of movement.
- Physiotherapist achieves maximum correction of contracture before casting, but let the cast get hard in submaximal range of dorsiflexion/pronation