



Surgical correction of flexible planovalgus feet in children and adolescents with neuromuscular disorders

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَمَا تَوْفِيقِي إِلَّا بِاللَّهِ ۖ عَلَيْهِ تَوَكَّلْتُ وَإِلَيْهِ أُنِيبُ

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Dedication

I dedicate this work to

My parents and brothers for their continuous encouragement and
persistence that I complete this work

My wife and my 3 little children for all what they endured during
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Abstract

Introduction:

Planovalgus is the most common foot deformity in cerebral palsy patients, in particular in patients with diplegia and quadriplegia. Surgery is recommended if the foot is painful or there is progressive mechanical collapse compromising walking ability. Numerous surgical procedures were described and no one proved superior. This study was conducted to evaluate the effect of Triple C operation in patients with neuromuscular disorders.

Material and methods:

Our population was 30 feet (18 patients) with cerebral palsy, diplegia and quadriplegia. The inclusion criteria were ambulatory children and adolescents (skeletally immature) older than 4 years with flexible deformity. We identified patient age, sex, functional status, associated soft tissue foot and ankle procedures, and type of graft used. Assessment was done using clinical, radiological and functional outcomes. The **Primary outcome** was radiological angles measured from different plain x-ray views (Antero-Posterior, lateral and hindfoot views).

Results:

Radiological results were described as mean, range and standard deviation (SD). The mean preoperative **calcaneal pitch angle** was -2.3° (range -64° to 19° , SD= 17.98°) compared to a mean of 10.1° (range -7° to 33° , SD= 9.89°) at final follow-up. The mean preoperative **lat talocalcaneal angle** was 49.4° (range 25° to 68° , SD= 11.4°) compared to a mean of 43.17° (range 22° to 67° , SD= 11.96°) at final follow-up. The mean preoperative **lat talo-first metatarsal angle** was 40.17° (range 18° to 74° , SD= 14.9°) compared to a mean of 18.63° (range 0° to 40° , SD= 11.15°) at final follow-up. The mean preoperative **AP talonavicular coverage angle** was 46.43°

(range 19° - 78° , SD= 13.5°) compared to a mean of 33.17° (range 0° to 62° , SD= 17.12°) at final follow-up. The mean preoperative ***AP talo-first metatarsal angle*** was 38.83 (range 17 to 55, SD= 8.99) compared to a mean of 20.8 (range -18 to 47, SD= 13.20) at final follow-up. The postoperative change was significant for all angles.

Abduction deformity (AP-TN and AP-T1st) showed greater correction in both the groups with strut graft (13 feet) and strut graft with peroneus brevis lengthening (9 feet) as compared to the group with standard graft (8 feet).

Discussion:

The triple C osteotomies in our study as in others proved to be a reliable option in correction of flexible planovalgus feet in cerebral palsy patients with very few complications. Feet with deformity more than mean+3SD showed the highest degree of undercorrection. Associated soft tissue problems should be addressed during the index surgery.

Keywords

Cerebral palsy, triple-C, foot osteotomy, planus, flatfoot, Valgus, paediatric, children

List of abbreviations

AFO	Ankle-foot-orthosis
AOFAS	American orthopaedic foot and ankle society
AP	Antero-posterior
ATL	Achilles tendon lengthening
COP	Center of pressure
CP	Cerebral palsy
CPPI	Coronal plane pressure index
FMS	Functional mobility scale
GC	Gastrocnemius
GMFCS	Gross motor functional classification system
GRF	Ground reaction force
GRFc	Ground reaction force on calcaneus
GRFff	Ground reaction force on forefoot
GRFO	Ground reaction foot orthosis
Lat	Lateral
LCL	Lateral calcaneal lengthening
LFF	Lateral forefoot
LMF	Lateral midfoot
LMNL	Lower motor neuron lesions
MDCO	Medial displacement calcaneal osteotomy
MFF	Medial forefoot
MMF	Medial midfoot
PF/KE	Plantar flexion / knee extension
PXR	Plain X-rays

ROM	Range of motion
SEMLS	Single event multilevel surgery
SMDO	Supramalleolar derotation osteotomy
STJ	Subtalar joint
UMNL	Upper motor neuron lesions

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