DOUBLE COLUMN FOOT OSTEOTOMY TO CORRECT VALGUS FOOT DEFORMITY IN CHILDREN WITH SPASTIC CEREBRAL PALSY

THESIS

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BY

Dr. GEORGE MAGDY MORSHED

M.B.B.Ch (Cairo University)

M.Sc. (Orthopaedics) (Cairo University)

SUPERVISORS

Prof. Dr. YEHIA NOOR EL-DEEN TARRAF

Professor of Orthopaedic Surgery

Faculty of Medicine

Cairo University

Prof. Dr. NAGUIB PASHA

Professor of Orthopaedic Surgery

Faculty of Medicine

Cairo University

Prof. Dr. SHERIF NASEEF BISHAY

Assistant Professor of Orthopaedic Surgery

National Institute of Neuromotor System

Faculty of Medicine

Cairo University

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Abstract

Eleven patients (twenty feet) of paralytic flexible hindfoot subtalar valgus secondary to spastic cerebral palsy in children between 6 to 7 years of age were analyzed clinically and radiographically. Subtalar hindfoot valgus is characterized clinically by the most prominent medial bony prominence on standing as being the head of the talus. There is a tetrad of deformity in weightbearing radiography of the foot showing subluxation of the talocalcaneal articulation with plantarflexion of the talus on the calcaneus, lateral subluxation of the talonavicular joint with short lateral column of the foot, medioplantar prominence of the talar head, and depression of the medial longitudinal arch of the foot. Anteroposterior and lateral various radiographic angles are essential to determine the deformity.

Keywords

Double Column Foot Osteotomy To Correct Valgus Foot Deformity

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LIST OF ABBREVIATIONS

AFO	Ankle-foot orthosis
AP	Anteroposterior
ATL	Achilles' tendon lengthening
CP	Cerebral palsy
EDL	Extensor digitorum longus
EHL	Extensor hallucis longus
FDL	Flexor digitorum longus
FHL	Flexor hallucis longus
PL	Peroneus longus
PB	Peroneus brevis
STJ	Subtalar joint
TBI	Total body involvement
TCA_1	Anterior Talocalcaneal angle
TCA_2	Lateral Talocalcaneal angle
$TFMA_1$	Anterior Talo-first metatarsal angle
$TFMA_2$	Lateral Talo-first metatarsal angle
TNA	Talonavicular angle
TNCA	Talonavicular coverage angle
TP	Tibialis posterior
TS	Triceps surae

INTRODUCTION

Rationale & Background:

Deformities of the foot are common in children with spastic cerebral palsy (CP). In addition to spasticity, the weight-bearing and the effect of gravity cause subtalar hindfoot valgus deformity and abducted and/or pronated forefoot; particularly as the child grows up, begins to stand, and gains weight.

Mobile (flexible or correctable) hindfoot valgus deformity in children with spastic cerebral palsy (CP) is initially managed by ankle-foot orthoses (AFO) to provide correction and stability. However, as the foot progresses into more valgus by standing, the talar head becomes more prominent and the medial longitudinal arch collapses making the orthosis difficult and even painful with possible skin problems.

Attempts to correct these deformities previously by fusion of one or multiple joints as in extra-articular subtalar arthrodesis or triple arthrodesis (after skeletal foot maturity), though successful, may be followed by resorption or failure of the graft, non-union (pseudoarthrosis), loss of subtalar joint (STJ) motion, and vulnerability to skin ulceration of the rigid foot.

Lateral foot column lengthening by calcaneal osteotomy and iliac bone graft, or by other calcaneal osteotomies may not be sufficient alone; as shortening osteotomy of the medial column may be necessary for complete correction. In addition, the calcaneal osteotomy may injure the subtalar joint in some cases owing to anatomic variation; and the iliac bone graft may be cumbersome.

AIM OF THE WORK

The aim of the work is to establish a protocol for diagnosis and treatment of paralytic subtalar hindfoot valgus deformity secondary to spastic cerebral palsy (CP) and to evaluate the results of the double column osteotomy of the spastic foot in correction of the foot deformity, foot pain relief, subtalar joint (STJ) mobility, tolerability to orthoses, and overall patient / parent satisfaction.

If the hindfoot deformity is mobile (flexible or correctable), double column foot osteotomies in the form of closing wedge medial cuneiform and opening wedge cuboid osteotomy to shorten the medial column and to lengthen the lateral column of the foot can be performed to correct the foot deformity, to restore peritalar relationship, to develop the foot medial longitudinal arch, and at the same time to preserve the subtalar joint (STJ) mobility. The procedure can be combined with Achilles' tendon lengthening (ATL) if tight, and/or peroneal tendon lengthening if powerful and acting as a deforming agent.

A grading system for evaluation of the results, using point scores, is suggested which can accurately evaluate both the clinical and the radiographic improvement.

FUNCTIONAL ANATOMY AND BIOMECHANICS

THE NORMAL FOOT

From an anatomical perspective, the foot is a complex group of bones, ligaments, fasciae, and muscles. The foot comprises an osseous architecture of the talus, calcaneus, cuboid, navicular, cuneiforms, metatarsals, phalanges, a plethora of hinges, all strung together by gliding tendons, covered by the pearly plantar fascia, then fat-padded to form the sole, humble surface of contact with earth[1]. The foot is a marvelous structure when viewed from the perspective of biomechanical function.

It will be of no much value to depict the anatomical details of all foot structures as the textbooks of anatomy provide these items. However, special concern will be given to the anatomical aspects peculiar to foot mechanics related to this study.

The normal structurally undeformed foot performs diverse functions at specific times during the gait cycle adapting to the ground surface as the body's shock-absorbing mechanism, and functioning as a rigid lever to propel the body across the ground[2].

Functionally, all the bones of the foot move as a unit around the talus which is an intercalated segment without muscular attachment. There is very little intertarsal motion. The foot moves around the two functional entities of the subtalar joint (STJ) which are the talocalcaneal articulation and the transverse tarsal articulation, namely the talonavicular or acetabulum pedis, and the calcaneocuboid articulation, with the interosseous talocalcaneal ligament as the center of rotation[3] (Fig. 1).