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Original Article

The corrective power of the Cotton osteotomy

Das Korrekturpotenzial der Cotton-Osteotomie

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Summary

The Cotton osteotomy is a plantarflexion osteotomy of the medial cuneiform, which is typically utilized in the reconstruction of adult acquired pes planus, posterior tibialis tendon dysfunction stage II (Johnson and Strom), and forefoot varus. The purpose of this paper is to give an estimate of the angular correction in the sagittal plane for each millimeter of bone graft used in the Cotton osteotomy using 20 cadaveric specimens. We have demonstrated that a surgeon will gain roughly 1.9 degrees of plantar flexion of the medial column for every one millimeter graft inserted into the medial cuneiform. While we have not established the amount of correction that should be done, the effect of increasing the wedge size has been demonstrated and may be helpful to surgeons when performing the Cotton osteotomy.

Zusammenfassung

Die Cotton-Osteotomie stellt eine plantarflektierende Korrekturosteotomie des Os cuneiforme mediale dar. Sie wird typischerweise angewendet bei der Korrektur des Erwachsenen- Plattfußes zur Aufrichtung der medialen Fußwölbung. Zu den Indikationen zählen auch das Tibialis Posterior Insuffizienz- Syndrom Grad II oder der Vorfuß Varus. Mit der vorliegenden Arbeit soll dem Anwender das Ausmaß der Korrektur in Abhängigkeit der Transplantatgröße verdeutlicht werden. An Hand der Auswertung von 20 Kadaver-Präparaten kann mit einer plantarflektierenden Korrektur von 1,9° je eingebrachtem mm eines Knochentransplantates bei der Cotton Osteotomie gerechnet werden. Diese Ergebnisse sollen dem Operateur helfen, das Ausmass der gewünschten Korrektur zu bestimmen.

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Introduction

It is beyond dispute that the open wedge osteotomy of the medial cuneiform results in plantarflexion of the first ray. This osteotomy is typically utilized in the conjunction of other osseous procedures in the reconstruction of adult acquired pes planus, posterior tibialis tendon dysfunction stage II (Johnson and Strom), and forefoot varus [1,5,12]. Cotton initially described this opening wedge medial cuneiform osteotomy to restore the "triangle of support" in 1936 [1]. In doing so, this allows for angulation of the medial column, reducing the forefoot varus, recreating the medial longitudinal arch. This osteotomy typically accompanies multiple other surgical procedures including posterior tibialis debridement / advancement, flexor digitorum longus tendon transfer, calcaneal slide osteotomy, and Evans calcaneal osteotomy for the correction of both pediatric and acquired pes planus. The Cotton osteotomy is indicated in patients who have a fixed forefoot varus, especially following a lateral column lengthening. Advantages of the Cotton osteotomy include preservation of the metatarsal-cuneiform motion and a predictable union rate [11]. However, this osteotomy is relatively contraindicated in patients with osteoarthritis of the first tarsal-metatarsal (TMT) joint [2]. In this case a first TMT arthrodesis may be more beneficial.

The osteotomy is described as a centrally located, dorsal to plantar osteotomy through the medial cuneiform, leaving the plantar cortex intact. The osteotomy is then distracted via a lamina spreader or osteotome to stretch the surrounding soft tissue. The appropriate sized bone graft is then inserted maintaining the anticipated correction. Fixation is determined via surgeon preference and comfort level. Other techniques include the use of interpositional plates for maintenance of the osteotomy.

Currently there are no published guidelines for surgeons to follow in the management of forefoot varus in flatfoot reconstructions. The purpose of this paper is to give an estimate of the angular correction in the sagittal plane for each millimeter of bone graft used in the Cotton osteotomy.

Materials and methods

Twenty fresh-frozen cadaver legs, 9 male and 11 females, of similar ages (average 78.7 years) were used for examination at SCARS (San Diego Cadaver Anatomy Research Symposium). Specimens were allowed to thaw to room temperature prior to the investigation. Transection of the plantar spring ligament and medial column ligaments was performed to simulate a medial column instability in conjunction with posterior tibial tendon dysfunction. Weight bearing simulated lateral radiographs were taken of each specimen prior to incision, identifying lateral talo-first metatarsal angle (Meary's angle) (Figure 1). Mearys angle was determined by bisecting the central aspect of the talus and following that line down the central aspect of the medial column, with a normal value of "0". Then, an anterior medial incision was made over the medial cuneiform extending distally to the base of the first metatarsal. The incision was taken directly down to bone. The soft tissue was then reflected off the osseous structures. The length, width, and depth of the medial cuneiform was measured with a standard ruler. The medial cuneiform osteotomy was made in the central aspect of the cuneiform via visual and fluoroscopic guidance. The sequentially sized trapezoidal Cotton corrective wedges (Wright Medical Technology — Memphis, TN) (4.5, 5.5, and 6.5 mm) were then inserted into the osteotomy until flush with the dorsal cortex (Figure 2). It should be noted that the plantar cortex was maintained ensuring angular correction instead of lengthening of the medial column.

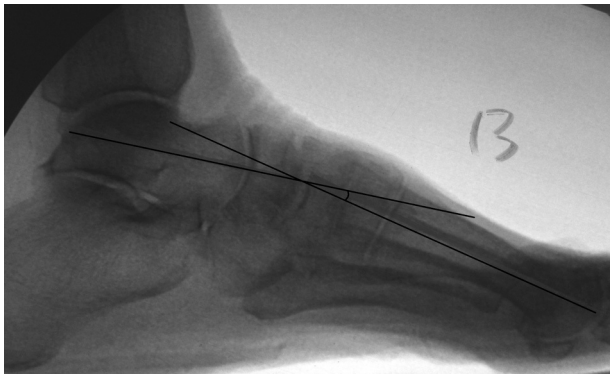

Figure 1. Simulated weight bearing initial radiograph identifying Meary's angle.

Figure 2. Plantarflexion of the first ray with the 6.5 mm corrective wedge.