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Postoperative Medial Cuneiform Position Correlation With Patient-Reported Outcomes Following Cotton Osteotomy for Reconstruction of the Stage II Adult-Acquired Flatfoot Deformity

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Abstract

Background: Residual supination of the midfoot during reconstruction of the stage II adult-acquired flatfoot deformity (AAFD) is often addressed with a medial cuneiform (Cotton) osteotomy after adequate correction of the hindfoot valgus deformity. The purpose of this study was to determine if there was a correlation between postoperative alignment of the medial cuneiform and patient-reported outcomes.

Methods: Sixty-three feet in 61 patients with stage II AAFD who underwent a Cotton osteotomy as part of a flatfoot reconstruction were included in the study. Radiographic angles were measured on weightbearing lateral radiographs at a minimum of 40 weeks postoperatively. Pearson's correlation analysis was used to determine if there was an association between postoperative radiographic angles and Foot and Ankle Outcome Score (FAOS) at a minimum of 24 months postoperatively. Patients were also divided into mild plantarflexion (cuneiform articular angle [CAA] $\geq$–2 degrees) and moderate plantarflexion (CAA $<$–2 degrees) groups to evaluate for differences in clinical outcomes.

Results: Postoperative CAA was significantly positively correlated with the postoperative FAOS symptoms ($r = .27$, $P = .03$), daily activities ($r = .29$, $P = .02$), sports activities ($r = .26$, $P = .048$), and quality of life ($r = .28$, $P = .02$) subscales. Patients in the mild plantarflexion group had statistically and clinically better outcomes compared with the moderate plantarflexion group in the FAOS symptoms ($P = .04$), daily activities ($P = .04$), and sports activities ($P = .01$) subscales.

Conclusions: Our study suggests that the surgeon should avoid excessive plantarflexion of the medial cuneiform and use the Cotton osteotomy judiciously as part of a flatfoot reconstruction for stage II AAFD.

Level of Evidence: Level III, comparative series.

Keywords: adult-acquired flatfoot deformity, reconstruction, outcome studies, medial cuneiform

Adult-acquired flatfoot deformity (AAFD) is a complex deformity including multiple components such as hindfoot valgus, forefoot abduction, collapse of the medial longitudinal arch, and medial arch supination.[8] AAFD is typically classified into 4 stages ranging from tenosynovitis of the posterior tibial tendon to rigid, bony deformities.[8] Stage II AAFD is distinguished by passively correctible deformities of the hindfoot, forefoot, and medial longitudinal arch and is the most controversial in terms of operative management.[10] A plantarflexion opening wedge medial cuneiform osteotomy was first described by Cotton (1936) in order to restore a plantigrade foot and has since been widely employed to treat residual supination of the midfoot after correction of the hindfoot valgus deformity in reconstruction of the stage II AAFD.[7-9,15] Supination of the medial longitudinal arch is thought to be a secondary deformity that occurs as a compensatory mechanism in

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order to maintain a plantigrade foot in the setting of persistent hindfoot valgus.[15] Subsequent studies have demonstrated that the Cotton osteotomy has a high rate of union, maintains mobility of the first ray, and allows the surgeon to titrate the amount of necessary correction.[11] Radiographic improvement in the measures of the medial longitudinal arch, including the lateral talar–first metatarsal angle and calcaneal pitch following the Cotton osteotomy, has been demonstrated, but these studies did not control for concomitant procedures that could have affected the arch of the foot.[11,13]

To evaluate the effectiveness of the Cotton opening wedge osteotomy in changing the radiographic alignment of the forefoot, Castaneda et al[2] developed a new radiographic measurement—the cuneiform articular angle (CAA), which they defined as the angle between the proximal and distal articular surfaces of the medial cuneiform on lateral weightbearing radiographs in order to isolate the effect of the Cotton osteotomy. The average change in the CAA preoperatively to postoperatively at an average of 6.5 months was 6.5 degrees.[2] Kunas et al[12] demonstrated that the size of the graft was significantly associated with changes in the CAA. Each millimeter of graft size corresponded to an approximately 2.1 degrees of change in the CAA.[12] However, no studies have examined the relationship between postoperative clinical and radiographic outcomes of the Cotton osteotomy. We hypothesized that patients with increased postoperative plantarflexion of the medial cuneiform would have significantly better outcomes because their residual forefoot supination deformity would be corrected. The primary purpose of this study was to determine if there was a correlation between postoperative alignment of the medial longitudinal arch following a Cotton osteotomy as measured by the CAA and postoperative patient-reported outcomes. We also sought to determine if patients who had more significant postoperative plantarflexion at the medial cuneiform had significantly clinically different outcome scores compared with those patients who had less correction.

Methods

Approval to retrospectively obtain data from an institutional review board–approved foot and ankle registry at the investigators' institution was obtained from the registry's steering committee. The foot and ankle registry contains demographic information, operative notes, imaging studies, and clinical outcome scores. All patients who underwent a flatfoot reconstruction with a Cotton osteotomy for stage II AAFD between November 2006 and May 2016 were identified. Flatfoot reconstructions were performed by 2 fellowship-trained foot and ankle orthopaedic surgeons (S.J.E., J.T.D.).

Inclusion and Exclusion Criteria

Patients were included in this study if they were at least 18 years old at the time of surgery, had preoperative clinical outcome measures, and had preoperative and a minimum of 40-week postoperative lateral weightbearing radiographs of the operative foot. Forty weeks was felt to be sufficient time for radiographic follow-up as the patients were fully weightbearing and the graft was healed completely.[3] Previous data have suggested that radiographic measurements of flatfoot deformity do not change after 3 months postoperatively, and this minimum time point was greater than the average follow-up by Castaneda et al.[2,16] Patients were excluded if they did not have at least 24-month postoperative clinical outcome scores, had midfoot or hindfoot arthritis, or underwent a triple arthrodesis or hindfoot fusion as part of their flatfoot reconstruction. Eighty-two feet in 77 patients met all inclusion criteria. Three feet in 3 patients were excluded due to concomitant fusions. Seven feet in 7 patients were excluded because they were missing preoperative scores. Nine feet in 8 patients were excluded because they were missing postoperative scores. Of these 15 patients who had at least 1 foot excluded due to missing preoperative or postoperative Foot and Ankle Outcome Score (FAOS), 2 patients had a Cotton osteotomy on the contralateral side, had a preoperative score, and had an adequate postoperative score for that side, which was included. Therefore, although 19 feet in 18 patients total were excluded from analysis, 2 of these patients remained in the sample with 1 foot each, leaving 16 patients completely excluded from analysis.

This left 63 feet (34 left and 29 right) in 61 patients who were included in the analysis. Forty women and 21 men with an average age of 53.8 years (range, 19.3-81.6 years) were included in the study. Average time from preoperative FAOS date to surgery was 5.2 months (range, 0.2-40.3 months), and average clinical follow-up was 5.2 years (range, 2.1-10.9 years). Mean radiographic follow-up was 2.9 years (range, 40-479 weeks). All patients in this study underwent a medializing calcaneal osteotomy (MCO) and a Cotton osteotomy. Concomitant procedures included 60 reconstructions that included a flexor digitorum longus (FDL) transfer, 53 patients with a spring ligament repair, 1 patient with a spring ligament reconstruction, and 48 patients who had a lateral column lengthening (LCL).

Clinical Outcome Evaluation

To evaluate clinical outcomes, the FAOS was used because it previously has been validated for AAFD.[14] The FAOS, a clinical outcome measure specific to foot and ankle pathology, is divided into 5 separate subscales: pain, symptoms, quality of life, daily activities, and sports activities. These were each scored separately on a scale from 0 (poor

Table 1. Number of Respondents With Preoperative and Postoperative Clinical Outcome Scores at a Minimum of 2 Years Postoperatively by Foot and Ankle Outcome Score Subscale.

No. of Feet	Pain, No. (%)	Symptoms, No. (%)	Daily Activities, No. (%)	Sports Activities, No. (%)	Quality of Life, No. (%)
63	59 (93.7)	60 (95.2)	60 (95.2)	56 (88.9)	61 (96.8)

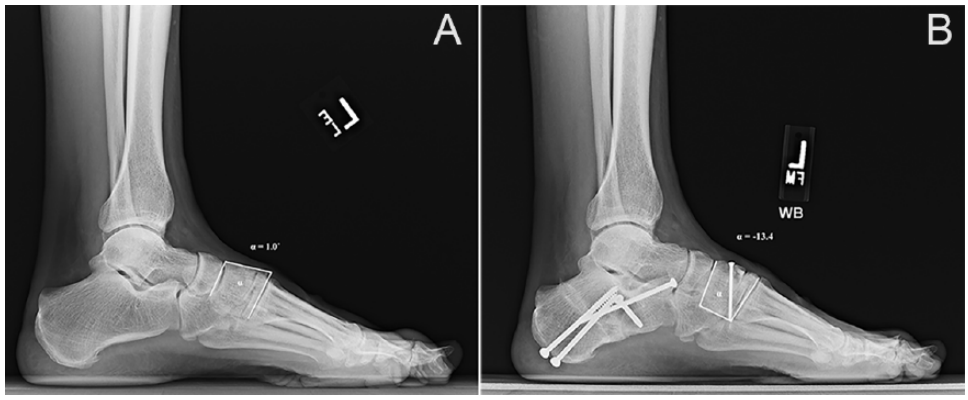

Figure 1. Cuneiform articular angle (CAA). The CAA is the angle between the proximal and distal articular surfaces of the medial cuneiform. The CAA was defined as negative when the distal articular surface was plantarflexed compared with the proximal articular surface. (A) The CAA in a patient prior to a Cotton osteotomy. (B) The CAA in the same patient 1 year after the opening wedge medial cuneiform osteotomy with a 6-mm graft. A medializing heel slide and lateral column lengthening were also performed.

outcome) to 100 (best outcome). The FAOS instrument was self-administered, and depending on applicability to the patient and his or her desire to fill out the score, a patient may not have outcome scores in all FAOS subscales (Table 1). The preoperative FAOS score closest to the date of surgery was chosen. Postoperative FAOS scores were administered and answered at least 24 months after surgery to ensure adequate follow-up time. Consistent with prior work, minimally clinically important differences (MCIDs) for all FAOS subscales were 10 points except for the sports activities subscale, which has previously been estimated to be 15 points.[4]

Radiographic Assessment

Postoperative weightbearing lateral radiographs at a minimum of 40 weeks after surgery were obtained from the registry database. For each patient, the CAA was measured as described by Castaneda et al[2] and was the angle between the proximal and distal articular surfaces of the medial cuneiform (Figure 1A,B). The CAA was arbitrarily defined as negative when the distal articular surface was plantarflexed compared with the proximal articular surface. Postoperative CAA on lateral weightbearing radiographs was used to divide patients into moderate plantarflexion (CAA <-2 degrees) and mild plantarflexion (CAA ≥ -2 degrees). A postoperative CAA of -2 degrees was chosen as it was approximately 2 standard deviations from the average postoperative angle reported by Castaneda et al.[2]

The medial arch sag angle (MASA) as defined by Aiyer et al[1] (Figure 2A,B) and lateral talar–first metatarsal angle (Meary's angle) (Figure 3A,B) were also measured on lateral weightbearing radiographs. An apex dorsal Meary's angle was defined as negative. The MASA is the angle between the proximal articular surface of the navicular and the proximal articular surface of the first metatarsal and has been shown to be a reliable measure in AAFD.[1] Similar to the CAA, MASA was deemed negative when the proximal articular surface of the first metatarsal was plantarflexed compared with the proximal articular surface of the navicular. Radiographs were measured by a single, blinded investigator.

Operative Technique

All flatfoot reconstructions for this cohort were performed by the 2 senior authors, who are fellowship trained in orthopedic foot and ankle surgery. Flatfoot reconstructions consisted of a combination of an FDL transfer, spring ligament repair or reconstruction, MCO, lateral column lengthening, and opening wedge medial cuneiform osteotomy as previously described.[4-6] Cotton osteotomies were indicated if the patient had residual medial arch supination after correction of the hindfoot valgus deformity and the patient did not have preexisting factors such as a substantial hallux

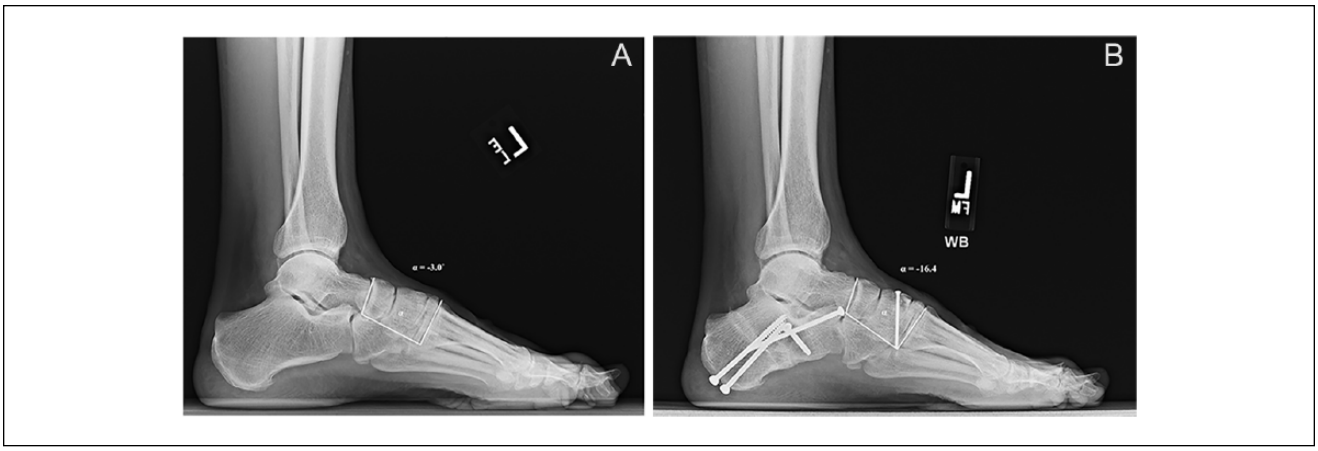

Figure 2. Medial arch sag angle (MASA). The MASA is the angle between the proximal articular surface of the navicular and proximal articular surface of the first metatarsal, and the MASA is negative when the proximal articular surface of the first metatarsal is plantarflexed compared with the proximal articular surface of the navicular. This image demonstrates the preoperative (A) and 1-year postoperative (B) MASA in a patient who underwent a flatfoot reconstruction. A medializing heel slide and lateral column lengthening were also performed.

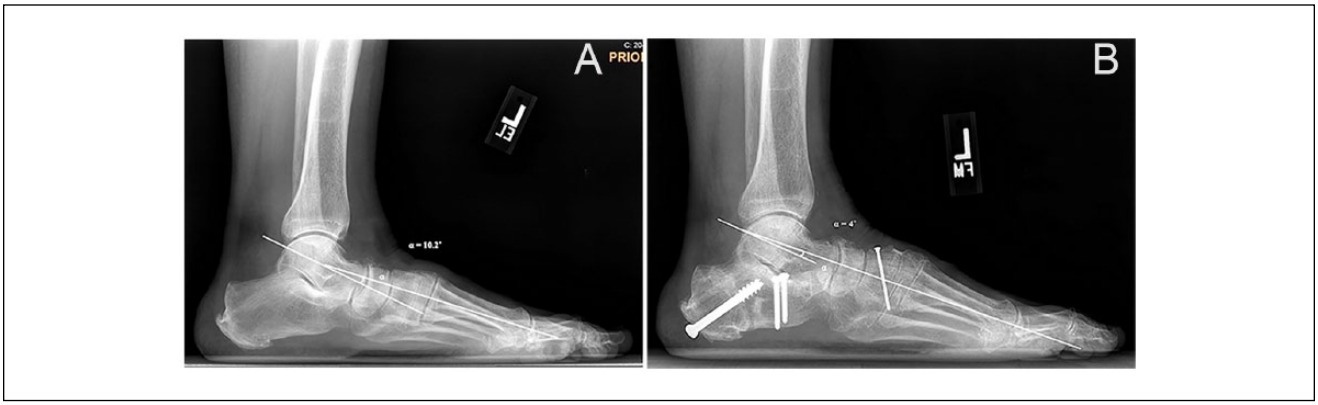

Figure 3. Lateral talar–first metatarsal angle (Meary's angle). Meary's angle is formed by the intersection of the line that bisects the first metatarsal and the midline axis of the talus. An apex dorsal Meary's angle was defined as negative. (A) A preoperative Meary's angle of 10.2 degrees. (B) Restoration of the arch 1 year after a flatfoot reconstruction with an apex plantar angle of 4.0 degrees. A medializing heel slide and lateral column lengthening were also performed.

valgus, plantar gapping, arthritis, or hypermobility of the first tarsometatarsal joint, which in the opinion of the authors are better addressed with a modified Lapidus procedure. The Cotton osteotomy was performed through an incision dorsally over the medial cuneiform between the extensor hallucis longus (EHL) and tibialis anterior tendons. The tendons were protected, and an oscillating saw blade was used to cut the bone down to the plantar cortex, which was left intact. The size of the graft and osteotomy was determined intraoperatively by the senior authors to correct the residual supination deformity and restore a plantigrade foot. Autograft from the iliac crest or allograft was placed in the osteotomy site and assessed on intraoperative fluoroscopic images. The graft was protected using a dorsally placed nonlocking plate, locking compression plate, or single screw. Previous work has demonstrated reliable healing of the Cotton osteotomy site in the absence of internal fixation; therefore, we did not specifically investigate differences in the type of fixation in these patients.[2] Postoperatively, patients were made nonweightbearing for 6 to 8 weeks and slowly progressed to full weightbearing by 10 to 12 weeks.

Statistical Analysis

To evaluate whether postoperative radiographic measurements of medial arch supination were associated with clinical outcomes, Pearson's correlation coefficients were used

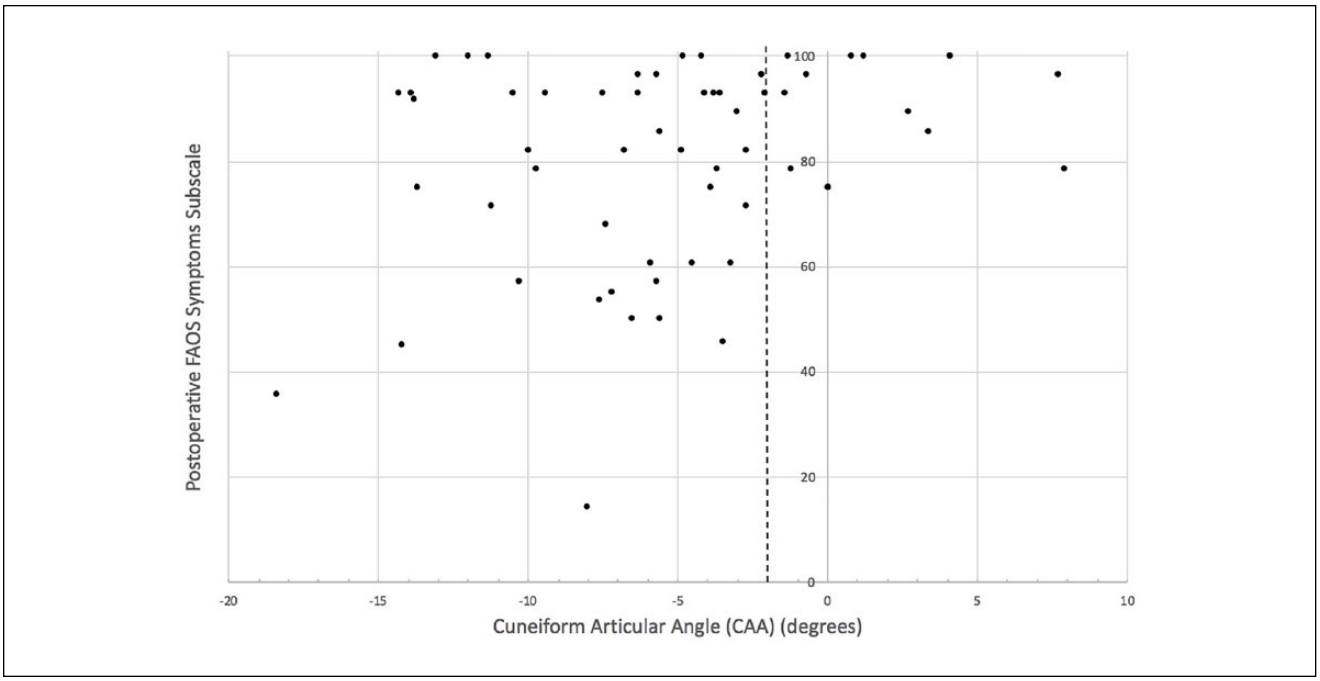

Figure 4. Postoperative Foot and Ankle Outcome Score (FAOS) symptoms subscale by cuneiform articular angle (CAA). This graph demonstrates the statistically significant correlation ($r = .29$, $P = .02$) between the postoperative FAOS symptoms subscale and CAA. The vertical dashed line at −2 degrees shows the cutoff between the moderate (CAA <–2 degrees) and mild (CAA ≥–2 degrees) plantarflexion groups. Patients in the mild plantarflexion group had consistently good results, whereas those in the moderate plantarflexion group had more variability.

to identify relationships between postoperative CAA, MASA, and Meary's angle with postoperative FAOS subscales. Pearson's correlation analysis was also used to determine if there was a relationship between Cotton graft size and postoperative FAOS subscales. Wilcoxon rank-sum tests were used to determine if there were differences in postoperative FAOS subscales between the moderate plantarflexion (CAA <–2 degrees) and mild plantarflexion (CAA ≥–2 degrees) groups. Fisher's exact tests were used to compare differences in categorical variables. P values less than .05 were considered statistically significant. SPSS version 22 (SPSS, Inc, an IBM Company, Chicago, IL) was used to perform all statistical analyses.

Results

The mean (SD) Cotton osteotomy graft size was 5.5 (0.9) mm (range, 4.0-9.0 mm). The mean (SD) postoperative CAA was −5.2 (5.5) degrees (range, –18.4 to 7.9 degrees). The mean (SD) postoperative MASA and Meary's angles were −2.7 (7.8) degrees (range, –17.3 to 20.3 degrees) and 4.8 (6.0) degrees (range, –5.3 to 30.8 degrees), respectively. Postoperative CAA was statistically significantly positively correlated with postoperative FAOS symptoms ($r = .27$, $P = .03$), daily activities ($r = .29$, $P = .02$) (Figure 4), sports activities ($r = .26$, $P = .048$), and quality of life ($r = .28$, $P = .02$) subscales. Postoperative CAA was not significantly correlated with the postoperative FAOS pain subscale ($P = .20$). Positive correlations indicated that higher postoperative FAOS scores were associated with a decreased amount of plantarflexion of the medial cuneiform (ie, a more positive CAA).

When the patients were divided into 2 groups based on postoperative CAA, there were 48 feet in the moderate plantarflexion group (CAA <–2 degrees) and 15 patients in the mild plantarflexion group (CAA ≥–2 degrees). Preoperatively, there were no differences in mean FAOS subscales between the moderate plantarflexion and mild plantarflexion groups (all P values >.10). Although there were no differences in the preoperative Meary's angles between the 2 groups ($P = .49$), patients in the mild plantarflexion group tended to have worse medial arch sag preoperatively than the moderate plantarflexion group. The mean (SD) preoperative CAA in the moderate plantarflexion group was 0.77 (3.4) degrees compared with 4.4 (4.8) degrees in the mild plantarflexion group ($P = .01$). The mean (SD) preoperative MASA in the moderate plantarflexion group was 5.9 (6.0) degrees compared with 12.1 (6.1) degrees in the mild plantarflexion group ($P = .002$). In addition, there were no differences in the frequency of

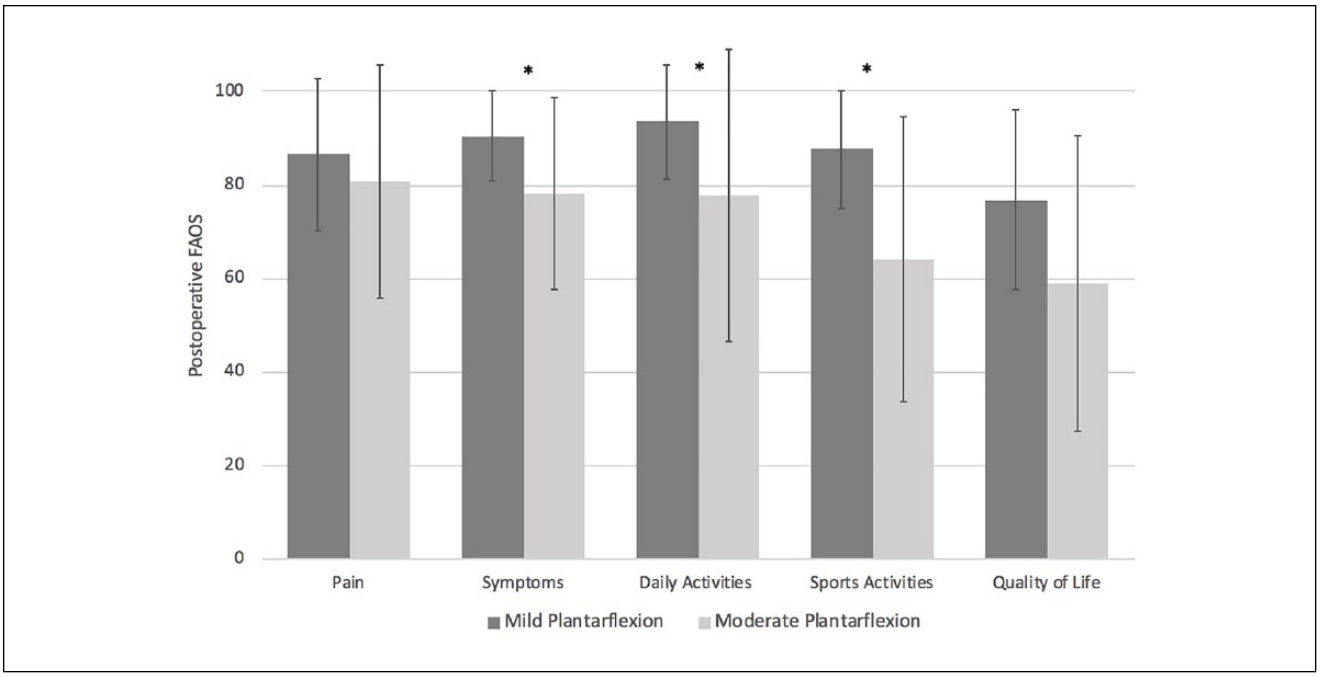

Figure 5. Postoperative Foot and Ankle Outcome Score (FAOS) by medial cuneiform plantarflexion group. Patients in the mild plantarflexion group (cuneiform articular angle [CAA] ≥–2 degrees) had clinically and statistically significantly better postoperative outcomes in the symptoms, daily activities, and sports activities subscales compared with patients in the moderate plantarflexion group (CAA <–2 degrees).
*Statistical significance.

concomitant FDL transfers, spring ligament repairs or reconstructions, or LCLs between the mild and moderate plantarflexion groups (all P values >.10).

For the moderate plantarflexion group, the mean (SD) postoperative pain, symptoms, daily activities, sports activities, and quality of life scores were 80.8 (25.0), 78.2 (20.6), 77.9 (31.2), 64.2 (30.5), and 58.9 (31.6), respectively. For the mild plantarflexion group, the mean (SD) postoperative pain, symptoms, daily activities, sports activities, and quality of life scores were 86.5 (16.4), 90.5 (9.7), 93.5 (12.3), 87.6 (12.7), and 76.8 (19.3), respectively (Figure 5). The mild plantarflexion group had statistically significantly better postoperative outcomes in the FAOS symptoms ($P = .04$), daily activities ($P = .04$), and sports activities ($P = .01$) subscales. Differences postoperatively in the pain ($P = .64$) and quality of life ($P = .08$) subscales did not reach statistical significance.

The Cotton osteotomy graft size was correlated with postoperative Castaneda angle ($r = -.30$, $P = .02$). The graft size was not correlated with postoperative MASA or Meary's angles (all P values >.40). Similarly, the graft size was not correlated with any postoperative FAOS subscale (all P values >.40).

Postoperative MASA was not correlated with any postoperative FAOS subscale (all P values >.30). Postoperative Meary's angle was statistically significantly negatively correlated with the postoperative FAOS pain subscale ($r = -.29$, $P = .02$). A negative correlation in this case suggests that restoration of the medial longitudinal arch was associated with less postoperative pain (ie, a higher postoperative FAOS pain subscale score) because an apex dorsal Meary's angle was defined as negative. Postoperative Meary's angle was not correlated with the symptoms, daily activities, sports activities, or quality of life subscales (all P values >.05).

Discussion

Our study suggests that overcorrecting the residual medial arch supination deformity with excessive plantarflexion of the medial cuneiform with a Cotton osteotomy, as measured on postoperative radiographs, negatively affects patient-reported outcomes. Our hypothesis that patients with increased postoperative plantarflexion of the medial cuneiform would have significantly better outcomes due to correction of the residual medial arch supination deformity was not supported. To the authors' knowledge, this is the first study to investigate the relationship between the Cotton osteotomy as measured by the CAA and clinical outcomes. Radiographic follow-up and the final postoperative CAA, MASA, and Meary's angles in our study were similar to what has previously been reported.[1,2,11] Clinical outcomes were obtained at a minimum of 2 years.

In our study, postoperative CAA was positively correlated with postoperative FAOS symptoms, daily activities, sports activities, and quality of life (all P values $<.05$). Because more negative CAA values reflect increasing plantarflexion of the medial cuneiform, this suggests that excessive plantarflexion of the medial cuneiform on postoperative radiographs resulted in inferior clinical outcomes. We were not able to demonstrate a beneficial clinical effect of the Cotton osteotomy, but based on our results, we cannot recommend against the Cotton osteotomy in select cases. We hypothesize that patients with excess plantarflexion of the medial cuneiform may develop overloading of the medial longitudinal arch, leading to abnormal pressure along the first metatarsal or at the sesamoids. These patients may also develop pain around the tarsometatarsal or naviculocuneiform joints from changes in the distribution of forces across the arch of the foot. The Cotton osteotomy is likely not harmful and may improve outcomes as long as the patient is not overcorrected; however, our study design did not allow us to determine the utility of the Cotton osteotomy in flatfoot reconstructions.

Interestingly, patients who had mild postoperative plantarflexion tended to have less cuneiform plantarflexion and worse sag at the medial longitudinal arch preoperatively as measured by the MASA when compared with the moderate postoperative plantarflexion group. Therefore, patients with less medial longitudinal arch deformity preoperatively are likely at the highest risk of overcorrection, and it may imply that trying to correct residual forefoot supination too aggressively through the Cotton osteotomy could be detrimental to the final outcome.

Cotton osteotomy graft size was not correlated with postoperative outcomes (all P values $>.40$). It is likely that the final postoperative position of the medial cuneiform has a more significant impact on clinical outcomes than the graft size itself. Therefore, graft sizes of Cotton osteotomies should be individualized based on a specific patient's deformity.

In addition, patients in the mild plantarflexion (CAA $\geq$–2 degrees) group had significantly better postoperative FAOS symptoms, daily activities, and sports activities than those with more plantarflexion of the medial cuneiform. These results were also clinically relevant since the differences in mean FAOS scores between the mild plantarflexion and moderate plantarflexion groups were greater than 10 points in the symptoms and daily activities subscales and greater than 15 points in the sports activities subscale, which is consistent with previously reported MCIDs for these subscales.[4]

One study[17] investigated whether residual flexible forefoot varus of less than 20 degrees in patients undergoing an FDL tendon transfer, MCO, and gastrocnemius recession could be corrected with postoperative casting of the forefoot in valgus. The author found that 20 of 28 patients had normal forefoot alignment at 6 months postoperatively, and the remaining 8 patients had less than 10 degrees of residual forefoot varus with no symptoms attributable to this deformity.[17] The abstract demonstrated mild residual forefoot varus after a flatfoot reconstruction can improve with casting and may not need to be treated operatively. Taken with the results of the present study, this suggests that patients with mild residual medial arch supination deformity following a flatfoot reconstruction are at risk of overcorrection with a Cotton osteotomy.

This study is similar to recent work examining postoperative midfoot position with patient-reported outcomes.[4] In that study, the authors divided 55 patients with stage IIB AAFD into 2 groups, abduction and adduction, based on postoperative weightbearing anteroposterior (AP) radiographs at an average of 1.9 years postoperatively and found that patients corrected to a position of adduction had statistically significantly less improvement in the daily activities and quality of life subscales than patients corrected to a position of midfoot abduction.[4] They concluded that overcorrection of the midfoot abduction deformity may result in less patient improvement in stage IIB AAFD reconstruction.[4] Consequently, these 2 studies may indicate to the surgeon that overcorrection of the abduction or residual medial arch supination deformities may not be benign, which has important implications for the amount of correction the surgeon chooses to titrate for an individual patient.

Kunas et al[12] used multivariable regression analysis to identify factors that significantly affected the CAA. They demonstrated that Cotton osteotomy graft size was the most significant predictor of change in the CAA and found that the size of the graft results in a linear change in the CAA.[12] For each millimeter increase in the graft size, there was a corresponding decrease in the CAA by 2.1 degrees.[12] Castaneda et al[2] and Kunas et al[12] reported average preoperative CAA to be 1.0 degrees and 1.3 degrees, respectively. These suggest that smaller Cotton osteotomy graft sizes might be appropriate for most patients.

As a secondary outcome, we found that postoperative Meary's angles were correlated with the FAOS pain subscale ($r = -.29$, $P = .02$). A more negative Meary's angle represented restoration of the medial longitudinal arch as a negative angle was defined as an apex dorsal angle. Interestingly, the medial cuneiform osteotomy has not been shown to significantly affect Meary's angle.[1,12] Therefore, the Cotton osteotomy has a more significant localized effect on the CAA and plantarflexion of the medial cuneiform than the entire medial longitudinal arch. This may partially explain why better clinical outcomes were associated with restoration of the medial longitudinal arch but less plantarflexion of the medial cuneiform and may caution the surgeon from attempting to restore the arch exclusively through large Cotton osteotomy graft sizes.

The most significant limitation of our study was the inability to identify the location of these patients'

symptoms; therefore, the reason for the association of increased plantarflexion following Cotton osteotomy and poorer outcomes is unclear. In the future, we plan to further investigate this relationship and determine if we can localize their symptoms. We were also unable to account for the multiple deformities that comprise a flatfoot reconstruction. While we were not able to account for the effects of hindfoot valgus and forefoot abduction on the medial longitudinal arch of the foot, we attempted to use radiographic measures that have been previously shown to be significantly correlated with the Cotton osteotomy.[1,2,12] In addition, this study is a retrospective study with a limited sample size, especially when patients were broken into 2 groups based on CAA. Additional power may have affected the statistical significance of our outcome variables. Finally, patients who had first tarsometatarsal (TMT) fusions were excluded from this work. Future studies should investigate the results of the TMT fusion on patient-reported outcomes as this was not addressed here.

Conclusion

This is the first study to find a statistically significant correlation between postoperative radiographic measurements of the medial cuneiform following a Cotton osteotomy with patient-reported outcome measures. Patients with a more plantarflexed medial cuneiform after a flatfoot reconstruction for stage II AAFD had inferior postoperative clinical outcome measures in the symptoms, daily activities, and sports activities FAOS subscales. Our work suggests that overcorrection into excessive postoperative plantarflexion of the medial cuneiform with a Cotton osteotomy can negatively affect outcomes of a flatfoot reconstruction.

Declaration of Conflicting Interests

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