Surgical Correction of Peritalar Subluxation and Subtalar Joint Articular Coverage Improves Patient-Reported Outcomes In Progressive Collapsing Foot Deformity

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INTRODUCTION:

Optimization of articular joint coverage has been shown to decrease the progression of arthritic degeneration and to improve outcomes in patients with hip and shoulder pathologies. Progressive collapsing foot deformity (PCFD), previously known as adult-acquired flatfoot deformity, has been demonstrated to advance with peritalar subluxation (PTS), progressively decreased articular coverage of the subtalar joint articular facets (anterior, middle, and posterior), as well as the development of sinus tarsi and subfibular impingements. Outcome assessment in PCFD has focused on improving conventional radiographic measurements such as the talus-first metatarsal angle and the hindfoot moment arm. This study aimed to evaluate improvements of PTS, subtalar joint articular coverage, and extra-articular impingement following PCFD joint-sparing surgical treatment, as well as the influence of these improvements in patient-reported outcomes.

METHODS:

IRB-approved prospective comparative study. Adult PCFD patients that failed conservative treatment for three-months and underwent hindfoot joint-sparing surgical procedures by a single-surgeon were enrolled. Realignment soft-tissue and bony procedures performed were recorded. All patients underwent weight-bearing CT (WBCT) preoperatively, and at the 3- and 12-months follow up. Two observers performed traditional WBCT PCFD measurements. The foot bones were segmented, and distance measurements were performed along the entire 3D superior surface of the calcaneus, including the subtalar joint (SJ) articular facets (anterior, middle, and posterior), sinus tarsi, and subfibular area. Color-coded coverage maps (CM) were calculated to grade the amount of articular joint coverage and extra-articular impingement. Patient-reported outcomes (PROs) were recorded at all follow-up timepoints. Pre- and postoperative measurements were compared by paired T Tests/Wilcoxon and a Multivariate regression analysis was utilized to assess the influence of improvements of articular coverage and impingement in PROs.

RESULTS:

Twenty patients were included (15F/5M), mean age, BMI, and follow up of respectively 48.1 (22 to 72) years, 33.88 (23.8 to 46.8) kg/m2, and 13.2 (4 to 27) months. Significant improvements in all traditional PCFD WBCT measurements were noted postoperatively. Articular coverage (CM) of the SJ middle and anterior facets improved postoperatively by respectively 13.5% ($p=0.02$) and 78% ($p=0.001$). Similarly, improvement in sinus tarsi impingement, with a 69% decrease in sinus tarsi coverage was observed ($p<0.001$).

Significant PROs improvements were also noted, with pain catastrophizing score (PCS) improving from 13.4 to 5.2 ($p=0.0032$) and the European Foot and Ankle Score (EFAS) from 6 to 8.5 ($p=0.036$). Improvements in PROs for PCS and EFAS were explained its majority by improvement in SJ articular coverage and sinus tarsi impingement, with R2 values of respectively 84% and 92% for PCS and EFAS.

DISCUSSION AND CONCLUSION:

Peritalar subluxation (PTS) is an important marker of progressive collapsing foot deformity (PCFD). To the author's knowledge, this is the first time that 3D articular coverage maps were utilized to assess deformity correction following surgical treatment in PCFD. We found significant improvements in the subtalar joint (SJ) anterior and middle facet articular coverage as well as significantly decreased sinus tarsi and subfibular impingement. Most importantly, we found that PTS and SJ articular coverage improvements were the most important variables to influence patient-reported outcomes. Three-dimensional evaluation of PTS and joint coverage can hopefully optimize treatment and improve outcomes in PCFD.

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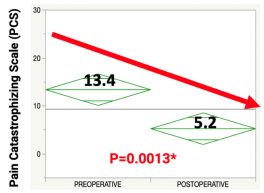
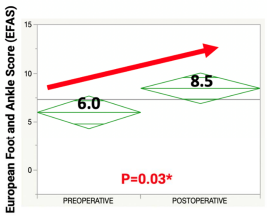
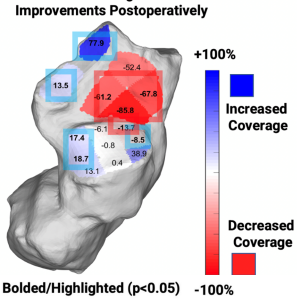




Articular/Extra-Articular Coverage Improvements Postoperatively



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INFLUENCE OF MEASUREMENTS ON EUROPEAN FOOT AND ANKLE SCORE (EFAS)

MEASUREMENTS	P-Value
Sinus Tarsi Coverage	**0.00594**
Middle Facet Incongruence Angle	0.00919
Middle Facet Subluxation	0.00974
Subfibular Distances	**0.01257**
Middle Facet Coverage	**0.01740**
Anterior Facet Coverage	**0.02370**

R^2=0.84

INFLUENCE OF MEASUREMENTS ON EUROPEAN FOOT AND ANKLE SCORE (EFAS)

MEASUREMENTS	P-Value
Middle Facet Coverage	**0.00051**
Sinus Tarsi Coverage	**0.00161**
Middle Facet Incongruence Angle	0.00194
Forefoot Arch Angle	0.00200
Posterior Facet Coverage	**0.00429**
Middle Facet Subluxation	0.00436
Foot And Ankle Offset	0.01676

R^2=0.92