

Redefining the Juvenile Bunion

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Introduction/Purpose: The orthopaedic literature is rife with reports of high failure rates following the surgical correction of juvenile bunion deformities. We contend that the reason for these poor outcomes is that although juvenile and adult bunion deformities have similar clinical appearances, the pathophysiology of the two is distinct. As such, successful surgical management of juvenile bunions requires greater understanding of this unique deformity in order to plan appropriate surgical correction. The first step in this process is to redefine the parameters that constitute the juvenile bunion. We propose that the distal metatarsal articular angle (DMAA) is the central defining characteristic of the juvenile bunion and that a higher DMAA may correlate with greater symptomatology in this population.

Methods: An IRB approved retrospective analysis of prospectively enrolled patients between 10 and 18 years of age with bunion deformities was performed at a single pediatric institution over a two-year period. Patients with metabolic bone disease, neurologic disorders, and inflammatory arthritis were excluded. Demographic data was recorded and standardized weight-bearing radiographs were used to determine the hallux valgus angle (HVA), intermetatarsal angle (IMA), distal metatarsal articular angle (DMAA), hallux interphalangeus angle, metatarsal cuneiform angle (MCA), cuneiform obliquity, sesamoid position (SP), and joint congruency. Patient reported outcome measures (PROs) including the Oxford Foot and Ankle Questionnaire (OxAFQ-C), Foot and Ankle Ability Measure (FAAM), Foot and Ankle Outcome Score (FAOS), Pain Numeric Rating Scale Score (PNRS), and Functional Disability Inventory Score (FDI) were administered at initial presentation. Bivariate analysis using Spearman's correlation was used to determine the association between individual deformity parameters and the relationship of those parameters to PRO's.

Results: 32 patients (57 feet) met inclusion criteria (average age of 14 years; range 11-17 years). 48/57 feet (84%) had an elevated DMAA (average $23.1^\circ \pm 7.8^\circ$). The DMAA correlated positively with the HVA ($r=0.734$, $p<0.001$), IMA ($r=0.439$, $p=0.001$), and SP ($r=0.627$, $p<0.001$). No correlations were identified between deformity parameters and age, gender or BMI percentile. While patients with a greater DMAA and more lateralized SP reported greater functional limitations during play and activities of daily living as determined by OxAFQ-C, FAAM and FAOS sub-scores, those with a higher IMA reported more pain as determined by the FAOS pain sub-score ($r=0.354$, $p=0.014$). Multivariate analysis revealed that the IMA remained significantly associated with pain after controlling for other deformity and demographic parameters ($p=0.024$).

Conclusion: In contrast to the average adult bunion, the vast majority of juvenile bunions demonstrate elevation of the DMAA. Furthermore, the DMAA correlates significantly with deformity parameters more familiar to a general or pediatric orthopaedic surgeon such as the HVA, IMA, and sesamoid position. While a higher DMAA and more lateral SP seem to be associated with greater functional disability, elevations in the IMA seem to correlate with complaints of pain. These findings corroborate the need for a more detailed understanding of this unique deformity to perhaps improve upon the historically poorer results following operative management of this condition.

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