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Comparison of isolated and combined osteotomies on progressive collapsing foot deformity correction: A cadaveric study

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Introduction: Lateral column lengthening (LCL), medial displacement calcaneal osteotomy (MDCO), and cotton osteotomy (CO) are commonly used to treat progressive collapsing foot deformity (PCFD). However, the correction achieved by isolated or combined procedures is poorly defined, and surgical planning remains largely empirical. The biomechanical effects of osteotomy magnitude are also debated, with limited data correlating the size of the correction with alignment. This study aimed to compare the three-dimensional correction produced by isolated and combined LCL, MDCO, and CO in a cadaveric model. We hypothesized that combining procedures would enhance overall alignment correction.

Methods: Twelve cadaveric legs without deformity were mounted under 75 kg axial load with physiological tendon tension. Weight-bearing CT (WBCT) scans were obtained preoperatively. Small, intermediate, and large corrections were performed for each osteotomy. Combinations of two procedures and all three procedures were subsequently executed. Foot and ankle offset (FAO) was measured after each WBCT acquisition.

Results: All osteotomies significantly influenced FAO ($p < 0.05$). As isolated procedures, LCL, MDCO, and CO decreased FAO by 0.36%, 0.8%, and 0.29% per millimeter, respectively. Increasing correction magnitude produced progressive alignment improvement ($p < 0.05$). Two-procedure combinations decreased FAO by 3.9%-7.2% with no significant differences among them ($p = 0.226$). Combining all procedures resulted in FAO reductions of 5.2%-14.2%, with significant differences between groups ($p = 0.002$).

Conclusion: MDCO produced the greatest isolated correction. Increasing osteotomy magnitude resulted in a gradual improvement in alignment. While two-procedure combinations had similar effects, maximal correction was achieved when all procedures were combined with larger displacements. These findings may help guide surgical planning in PCFD.

Keywords: Flatfoot; Osteotomy; Foot deformities.

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