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The use of polyvinyl alcohol hydrogel implants in the lesser metatarsal heads. Is it safe? A cadaveric study

Alexandre Leme Godoy-Santos¹, Cesar de Cesar Netto², Lauren Roberts², Taylor Cabe², Jonathan Deland², Mark Drakos²

1. Instituto de Ortopedia e Traumatologia, Hospital das Clínicas, Faculdade de Medicina, Universidade de São Paulo, São Paulo, SP, Brazil.

2. Hospital for Special Surgery, New York City, USA.

ABSTRACT

Introduction: Treatment of lesser toe metatarsophalangeal joint (MTPJ) arthritis is challenging, and surgical options are scarce. The use of synthetic polyvinyl alcohol hydrogel implants in the treatment of lesser MTPJ arthritis may provide symptomatic relief. An essential technical limitation is that only 8mm and 10mm implants are currently available, potentially limiting their use in the lesser metatarsals.

Objective: to evaluate the average dimensions of the lesser metatarsal heads using CT scans and anatomical dissections and to perform drilling of the heads, aiming to assess the largest implant that could be safely used.

Methods: The height and width of all lesser metatarsals were measured on CT and during anatomic dissection. Sequential reaming of the second to fourth metatarsals was performed. The maximum reaming size, largest implant inserted, and failure of the metatarsal head were recorded. Metatarsal head sizes were compared, and a multiple regression analysis evaluated measurements that influenced maximum drilling and implant size.

Results: CT and anatomical measurements demonstrated a significant correlation (ICC range, 0.63 to 0.85). Mean values for the height and width of the metatarsal heads respectively were as follows: second (14.9mm and 9.9mm), third (14.8mm and 8.8mm), fourth (14.0mm and 8.7mm) and fifth (12.3mm and 9.3mm). All the second, third and fourth metatarsal heads could be safely drilled up to 7.5mm, preserving an intact bone rim. During 80% of the time, the heads could be safely drilled up to 8.0mm. The height of the metatarsal heads was the only factor to significantly influence the size of maximum reaming and the introduced implant. In 20%, 40% and 50% of the second, third, and fourth metatarsal heads, respectively, neither 8mm nor 10mm PVAH implants could be used.

Conclusion: Our cadaveric study found that even though the majority of the lesser metatarsal heads could be safely drilled up to 8mm, the smallest PVAH implant size currently available in most countries (8mm) could be inserted in most of the second but only in about half of the third and fourth metatarsal heads. The remaining bone rim around the inserted implants was considerably thin, usually measuring less than 1mm. To optimize the use PVAH in lesser metatarsal heads, smaller implant options are needed.

Keywords: Lesser metatarsal; Arthritis; Cadaveric study.

