

# Correlation Between Talar Bone Mineral Density and Talar Component Subsidence After Total Ankle Arthroplasty

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## INTRODUCTION:

Total ankle arthroplasty (TAA) has demonstrated good clinical outcomes in recent years.<sup>1</sup> However, talar component subsidence remains a major postoperative complication that can significantly compromise clinical outcomes and potentially necessitate revision surgery.<sup>2,3</sup> Multiple etiological factors have been reported, including osteolysis, disruption of talar blood supply, malalignment, and anterior component placement. Although poor bone quality has been suggested as a potential contributor to increased subsidence risk, the relationship between preoperative bone mineral density (BMD) and the amount of talar component subsidence has not been sufficiently investigated. Previous studies have demonstrated a proportional correlation between Hounsfield units (HU) obtained from computed tomography (CT) and dual-energy X-ray absorptiometry (DEXA) values.<sup>4</sup> Therefore, this study aimed to evaluate the association between preoperative CT-measured talar BMD and postoperative talar component subsidence in patients undergoing TAA.

## METHODS:

This study included 31 ankles from 31 patients (13 males, 18 females; mean age, 72.8 years) who underwent TAA at our institution between October 2013 and November 2019. All patients underwent preoperative CT scanning and were followed for at least 3 years postoperatively. Preoperative talar BMD was assessed by measuring HU values at four regions of interest (ROI)—anteromedial, anterolateral, posteromedial, and posterolateral—on the axial CT slice 7 mm inferior to the talar dome (Figure 1). Talar component subsidence was evaluated by measuring the change in height from the articular surface on lateral radiographs obtained immediately postoperatively and at 3 years. The correlation between talar BMD and the amount of subsidence was analyzed using Pearson's correlation coefficient.

## RESULTS:

A significant negative correlation was observed between CT-measured talar BMD and the degree of talar component subsidence ( $r = -0.71$ ,  $P < 0.05$ ) (Figure 2). Among regional measurements, medial ROIs demonstrated a stronger negative correlation with subsidence compared to lateral ROIs, with the strongest correlation ( $r = -0.74$ ,  $P < 0.05$ ) found in the posteromedial region (Table 1).

## DISCUSSION:

The main finding of this study was that lower preoperative talar BMD, particularly in the medial aspect, was associated with increased talar component subsidence after TAA. Although DEXA-based assessment of lumbar and proximal femoral BMD is considered standard in orthopedic practice, its correlation with peripheral skeletal sites may be reduced due to joint-specific loading conditions and localized pathology.<sup>5,6</sup> In patients with osteoarthritis undergoing TAA, direct evaluation of local talar bone quality is clinically relevant. Regarding the measurement of talar bone density, previous reports have described evaluations using both dual-energy X-ray absorptiometry (DEXA) and computed tomography (CT). CT-measured HU values are advantageous because preoperative CT is routinely performed in TAA surgical planning, allowing efficient quantification of regional bone density without additional imaging. Previous studies have reported lower medial talar bone density in healthy feet, and finite element analyses have demonstrated increased subsidence associated with medial bone quality deterioration.<sup>9</sup> The present study provides clinical evidence supporting these biomechanical findings, indicating that reduced medial talar BMD may represent a notable risk factor for postoperative subsidence.

## SIGNIFICANCE/CLINICAL RELEVANCE:

The amount of talar component subsidence showed a stronger correlation with the bone mineral density on the medial side of the talus. Medial talar bone density may serve as a useful parameter for preoperative risk assessment in TAA.

## REFERENCES:

- 1: Smith TO, et al. Bone Joint J. 2023. 2: Li SY, et al. Foot Ankle Clin. 2017. 3: Yamamoto T, et al. Foot Ankle Surg. 2021. 4: Alawi M, et al. Cureus. 2021. 5: John K, et al. Plos Genet. 2014. 6: Y.H. Kim, et al. OARSI. 2018. 7: Messina C, et al. J Clin Densitom. 2020. 8: Cody EA, et al. Foot Ankle Int. 2020. 9: Cui Y, et al. Med Sci Monit. 2018.

## IMAGES and TABLE:

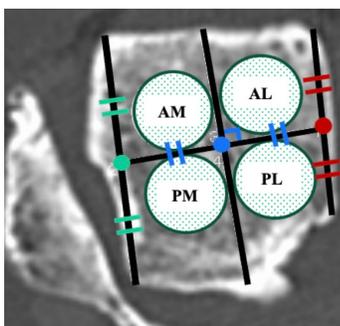


Figure 1: The axial CT image 7mm below the talar dome is used. Using a standard annotation feature, a circular region of interest (ROI) is drawn 4areas: AM: anteromedial, AL: anterolateral, PM: posteromedial, PL: posterolateral

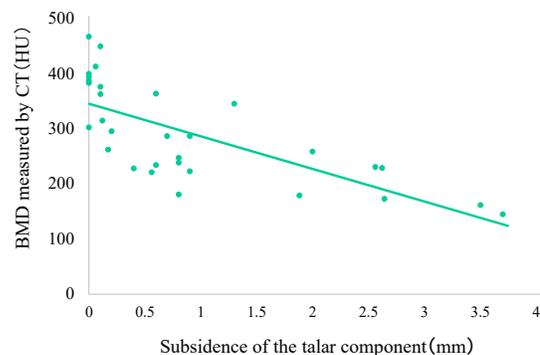


Figure 2: Correlation between CT-measured talar BMD and the amount of talar component subsidence.

Table 1: Correlation between each area BMD and the amount of talar component subsidence.

	Correlation coefficient	P value
AM	-0.70	<0.05
PM	-0.72	<0.05
AL	-0.38	<0.05
PL	-0.53	<0.05
Medial	-0.74	<0.05
Lateral	-0.52	<0.05