

Can Intraoperative Tactile Feedback be used for Assessment of Bone Density in Total Knee Arthroplasty?

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INTRODUCTION:

The success of cementless total knee arthroplasty (TKA) is thought to depend heavily on bone mineral density, and intraoperative decision-making regarding the need for cement fixation remains subjective. While dual-energy X-ray absorptiometry (DEXA) is the current standard for assessing bone mineral density (BMD), it is underutilized and rarely assesses the tibia. Portable quantitative ultrasound (QUS) devices offer a validated, accessible alternative for site-specific BMD assessment. This study aimed to evaluate the relationship between intraoperative surgeon assessment and QUS-derived BMD.

METHODS: A prospective observational study was conducted among patients undergoing primary TKA. Preoperative BMD was measured at the proximal tibia using a portable QUS device. Based on QUS-derived T-scores, patients were categorized as having normal BMD (T-score > -1.0), osteopenia (T-score between -2.5 and -1.0), or osteoporosis (T-score < -2.5). The primary outcome was the association between BMD category and the surgeon's intraoperative decision to use cement fixation based upon visual and tactile assessment of bone quality. Surgeons were blinded to QUS results. Chi-square testing was used to assess associations between BMD category and fixation method.

RESULTS: In total, 110 patients were included in this study. Of these, 27.3% had normal BMD, 25.5% were osteopenic, and 47.3% were osteoporotic. Cement fixation was chosen in 34.5% of patients. By BMD category, cement fixation was chosen in 5 patients with normal BMD (16.7%), 8 patients with osteopenia (28.6%), and 25 patients with osteoporosis (48.1%). There was a statistically significant association between BMD category and the chosen fixation type (Chi-square = 8.89, $p = 0.012$).

DISCUSSION AND CONCLUSION:

Surgeon assessment of tibial bone quality and the decision to perform cemented or cementless TKA correlated with objective QUS-derived BMD measurements. However, a substantial proportion of patients with low BMD did not receive cemented fixation, indicating that surgeon judgment alone may not consistently identify compromised bone. Portable QUS may serve as a valuable adjunct to improve consistency and standardization in preoperative bone quality evaluation, ultimately supporting more informed decision-making in cementless TKA.