

The Association Between Squat Depth and Outcomes of Operatively Treated Femoral Shaft Fractures: A Prospective Study in Dar es Salaam, Tanzania

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Background/Purpose: In Sub-Saharan Africa and many other low- and middle-income countries (LMICs), performance of a full squat is required for essential activities of daily living, such as the use of pit latrines. However, traumatic lower extremity injuries, such as femoral shaft fractures, may compromise the ability to squat, even after operative treatment. Thus, objective tests utilizing squatting ability, such as the squat-and-smile test, have been used to assess outcomes in LMICs. However, to date, no study has evaluated the association between squatting and other established outcomes of operatively managed femur fractures in a resource-limited setting. The purpose of this investigation was to compare squat depth with patient-reported outcomes, complications, and reoperation in patients with operatively treated femoral shaft fractures.

Methods: In this IRB-approved prospective observational study, consecutive adult patients with diaphyseal femur fractures (OTA 32) treated by intramedullary nailing were enrolled at a tertiary medical center in Dar es Salaam, Tanzania. Squat depth, need for support, and expression of discomfort were assessed at 6 weeks, 3 months, 6 months, and 1 year postoperatively. Squat depth was graded on a four-point scale—unable to squat (1), hip above knee level (2), hip at knee level (3), and hip below knee level (4). A three-point scale was used to evaluate support (two-hand support [1], one-hand support [2], and no support needed [3]) and facial expression (pain/discomfort [0], neutral [1], smile [2]). EuroQol (EQ)-5D-3L, reoperation, and complications such as nonunion, malunion, and infection were recorded at these time points to assess for correlation.

Results: Out of 332 enrolled patients, 231 patients (70.0%) were followed up and had completed the squat-and-smile test at 1 year. Of included patients (mean age 32, SD 11; 14% female), 16 (6.9%) required reoperation and 21 (9.1%) reported an adverse event over the course of follow-up. Mean EQ-5D VAS (visual analog scale) was 86.7 (SD 16) and EQ-5D-3L health index was 0.91 (SD 0.11). A majority of patients (92.5%) were able to achieve a grade 3 or 4 squat depth at 1 year postoperatively. Average squat depth significantly increased from 2.5 (SD 0.8) at 6 weeks to 3.4 (SD 0.56) at 1 year ($P = 0.01$). Squat depth scores of 3 or above were significantly associated with a higher EQ-5D VAS (90.1, SD 12) than squat depth scores below a 3 (79.7, SD 17; $P = 0.026$). No significant association was found between squat depth and EQ-5D health index, reoperation, or complication rate ($P > 0.05$). Average support needed and expression did not significantly change over time and were not significantly associated with outcome measures ($P > 0.05$).

The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or medical device he or she wishes to use in clinical practice.

Conclusion: For patients operatively treated for femoral shaft fractures, squat depth significantly improves over the course of 1-year postoperative follow-up. Patients who can squat at or below knee level report significantly higher self-rated health than those who cannot. Although squatting ability is not correlated with reoperation or complication rate, its association with patient-reported outcomes may suggest future use of the squat test as an objective functional tool to assess femur fracture recovery in resource-limited settings. Future research to evaluate reliability and responsiveness of the squatting assessment for femur fracture patients is needed.