

Increased Risk of Fixation Failure with 3.5 versus 4.5 Millimeter Screws for Tibial Tubercle Osteotomy

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INTRODUCTION:

Fixation failure is devastating complication following tibial tubercle osteotomy (TTO), often resulting in significant morbidity and reoperation. To date, risk factors for fixation failure following TTO remain poorly defined. The purposes of this study were to assess whether screw size is associated with fixation failure following TTO, as well as identify any other risk factors associated with this complication. We hypothesized that smaller screw size (i.e., two 3.5 mm vs. 4.5 mm) would be associated with an increased risk of fixation failure.

METHODS:

Patients undergoing primary TTO from 2015-2024 by two patellofemoral surgeons fixed with two 3.5 mm or two 4.5 mm screws were compared. The primary outcome was fixation failure (i.e., fracture, nonunion, or delayed union requiring operative intervention) by 6-months. Patient demographic and surgical factors were collected. Univariate and adjusted analyses controlling for known and/or theoretical risk factors for overall complications following TTO were performed. Secondary analysis assessed the association between other factors and fixation failure.

RESULTS:

There were 398 patients with mean follow-up of 2.2 years (mean age 28.3 ± 9.6 years; 74.4% women). The overall rate of fixation failure was 2.0%, occurring at mean 3.3 ± 1.8 months postoperatively. Patients undergoing TTO with 3.5 mm screws were significantly more likely to experience fixation failure than patients undergoing TTO with 4.5 mm screws (7.9% vs. 1.4%, $p=0.03$); results were even more pronounced when limiting analysis to the 296 female patients (7.9% vs. 0.78%, $p=0.02$). Results held in all adjusted analyses, including when controlling for age, sex, smoking, concomitant procedures, and TTO distalization, among other factors (OR 8.2, 95% CI 1.1-60.2, $p=0.04$). No other patient or surgical factor was associated with fixation failure ($p>0.05$ for all).

DISCUSSION AND CONCLUSION: Compared to fixation with two 4.5 mm screws, fixation with two 3.5 mm screws was associated with a significantly increased risk of failure following TTO. These results held when adjusting for patient and surgical factors. Furthermore, no other patient or surgical factors, including TTO distalization, were associated with risk of fixation failure within the numbers available. While fixation failure overall remains rare following TTO, screw size may be a modifiable risk factor to reduce the risk of this devastating complication moving forward.