Patellar Height after High Tibial Open Wedge Osteotomy

Fernando Oro, Connor Ziegler, Robert LaPrade, Coen Wijdicks, Sean Pietrini
Orthopaedic Surgery, University of Minnesota, Minneapolis, MN
lapra001@umn.edu

Introduction: Proximal high tibial osteotomy (HTO) is an established and standardized procedure for the treatment of medial knee compartment osteoarthritis. Prior studies have shown that HTO delays the need for knee arthroplasty by relieving pain and improving knee function. The controversy surrounding alteration in patellar height, however, represents the primary issue with respect to surgical difficulties and outcomes of total knee arthroplasty following failed HTO. Reduction in patellar height can make surgical exposure of the proximal part of the tibia and eversion of the patella technically demanding in knee arthroplasties performed for failed proximal tibial osteotomies and may therefore necessitate specialized exposure techniques during arthroplasty. Open wedge osteotomies have been reported to be less technically demanding and involve fewer complications than closing wedge osteotomies, thereby proving advantageous in executing the planned coronal plane correction safely and effectively. In radiographically assessing patellar height, a number of different ratios have been utilized. Most popular among these are the Insall-Salvati Index (ISI), the Blackburne-Peel Index (BPI) and the Caton-Deschamps Index (CDI). While the BPI is a direct index of patellar height, the ISI is a direct reference to patellar tendon length and an indirect index of patellar height. Additionally, another ratio employed was developed by Miura and Kawamura and, unlike the other indexes; it uses a femoral reference point in which alteration in patellar height articulates with the femur instead of the tibia. While a decrease in patellar height has been substantiated with regards to closing wedge proximal tibial osteotomies, it has not been widely verified among opening wedge osteotomy procedures.

Materials and Methods: Between May 2000 and May 2007, patients who underwent an opening wedge proximal tibial osteotomy were prospectively followed. All of the HTO procedures were performed by the same surgeon (RFL). All patients who underwent an opening wedge proximal tibial osteotomy were clinically and radiographically evaluated preoperatively and postoperatively in order to assess simultaneous pathology. Patellar height, defined as the distance between the patella and the tibiofemoral joint line, was substantiated using lateral radiographs via a digital radiograph image viewer; Imagecast. Preoperative, immediate postoperative, three month and six month lateral knee AP radiographs were measured for each patient. The ISI, BPI, and CDI were used as radiological measurements for determining patellar height. In addition, a method described by Miura and Kawamura was utilized. The technique for drawing the line perpendicular to the axis of the tibia was modified in our study from the original MKI method to reflect modern computer measurement techniques by utilizing digital measurement techniques. All radiographs were analyzed once by a single reviewer. Statistical analysis used a paired sampled t-test to measure differences.

Results: Eighty-four patients, 67 males and 17 females (85 knees) underwent a proximal tibial opening wedge osteotomy; mean age of 35 years at the time of surgery. Changes in patellar height from preoperative to immediate postoperative assessment were significant using all four methods. There was a highly significant decrease in patellar height utilizing all four methods following opening wedge osteotomy.

Discussion: Patellar descent has been theorized to result from shortening of the patellar tendon caused by arthrofibrosis, interstitial scarring of the patellar tendon, excessive ossification around the patellar tendon during healing causing tendon contracture, prolonged immobilization in extension, adherence of the tendon to adjacent structures, or changes in tibial slope. Additionally, it has been theorized that biological adaptation of the extensor mechanism can lead to shortening of the patellar tendon. To our knowledge there has been only one other report specifically highlighting change in patellar height following opening wedge proximal tibial osteotomy independent of the related closing wedge procedure. While the study by Rogers et al. (2006) utilized the Insall-Salvati, Blackburne-Peel, and Caton-Deschamps indexes, as well as a modified Insall-Salvati ratio in assessing patellar height, there have been no recent studies incorporating four different measuring techniques including a method using a femoral reference point. Accordingly, we sought to substantiate the patellar height after opening wedge osteotomy by utilizing different published methods to measure each patient’s preoperative and postoperative radiographs. Unlike prior studies, we also observed the changes produced after three and six months of follow up. In conclusion, proximal tibial opening wedge osteotomies do decrease patellar height and this effect happens within the first three postoperative months. The shortening of the patellar tendon may affect future surgeries such as total knee arthroplasty, and needs to be evaluated as part of the preoperative assessment in these patients.

Discussion:

Radiographic diagrams showing the four methods used to assess patellar height.