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Title: Risk Factors for Revision or Contralateral ACL Reconstruction: The Value of Physical Therapy

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Objectives: Physical therapy (PT) is routinely prescribed after anterior cruciate ligament (ACL) reconstruction, and is considered a significant contributor to the cost of ACL care. With the upcoming implementation of alternative reimbursement models, data about the true cost and value of ACL rehabilitation are necessary to guide its utilization. The purpose of this study is to evaluate the effects of age, gender, and physical therapy (PT) utilization on second ACL reconstruction rates and to assess the value of post-operative PT.

Methods: Patients who underwent ACL reconstruction (Current Procedural Terminology (CPT) code 29888) between 2007 and 2014 were identified using the PearlDiver database. Demographic data including age and sex were obtained for this cohort. Physical therapy utilization was determined by the percentage of patients with at least one post-operative PT-related code at 2, 4, 6, 12 and 24 weeks after surgery. Patients with a subsequent ACL injury (ipsilateral or contralateral) requiring reconstruction within 24 months of the index procedure were identified. The effects of age, sex and PT utilization on the risk of subsequent ACL surgery were calculated using contingency analysis (chi-square test). Risk ratios (RR) with 95% confidence intervals were calculated for each predictor.

Results: A total of 11,272 patients undergoing ACL reconstruction were identified between 2007 and 2014. PT utilization steadily increased at each time point, and 89.8% of patients had at least one PT visit in the 6 months following ACL reconstruction. A total of 513 patients had subsequent ACL surgery, for a composite subsequent ACL surgery rate of 4.6%. Age under 19 years carried a higher risk of subsequent ACL surgery (8.3% vs. 3.8%, RR = 2.21, 95% CI 1.88 - 2.61, p < 0.0001). Women had a slightly higher rate of subsequent ACL surgery than men (5.1% vs. 4.2%, RR = 1.22, 95% CI 1.03 - 1.44, p = 0.02). Participation in any PT significantly decreased the risk of subsequent ACL surgery (3.9% vs. 10.6%, RR = 0.36, 95% CI = 0.30 - 0.44, p < 0.0001). Subsequent surgery rates were not affected by the number of PT visits if less than 30 visits were utilized. However, patients utilizing greater than 30 visits had a higher risk of subsequent ACL surgery (16.5% vs. 2.3%, RR = 7.15, 95% CI = 5.68 - 9.01, p < 0.0001). The total cost associated with ACL reconstruction within 24 months
was $19,191 per patient. The weighted per-person average reimbursement (PPAR) for PT was $1,879, or 9.8% of the total cost of care.

**Conclusion:** Physical therapy utilization is currently high after ACL reconstruction (89.8%). Participation in PT reduces the incidence of subsequent ACL surgery (ipsilateral or contralateral) nearly three-fold (3.9% vs. 10.6%), at a cost of only $1,879 per patient (< 10% of total cost of care). PT after ACL reconstruction therefore offers significant value, particularly in young (< 19 years) athletes who have a higher risk of subsequent injury. However, excessive PT use after ACLR (> 30 visits) may be an indicator of patients with a sustained risk of re-injury.