

Prepubescent ACL Copers Versus Noncopers: A Biomechanical Comparative Analysis of Pediatric Patients Following an ACL Injury

Henry B. Ellis, M.D., Ashley L. Erdman, M.B.A., Sophia M. Ulman, Ph.D., Alex Loewen, M.S., James J. McGinley, B.S., Benjamin L. Johnson, P.A.-C., Philip L. Wilson, M.D.







Disclosures

- Henry B. Ellis, M.D.
 - Paid Speaker OrthoPediatrics
 - Unpaid Consultant Smith & Nephew
 - Non-Financial Educational Support Smith & Nephew; Arthrex, Inc.
 - Educational Support Plyant Medical
 - Grants Paid to Institution Pediatric Orthopaedic Society of North America (POSNA);
 American Orthopaedic Society of Sports Medicine (AOSSM); United States Department of Defense; Washington University St. Louis
 - Board/Committee Positions Texas Orthopaedic Association (TOA), American Academy of Orthopaedic Surgeons (AAOS), Pediatric Research in Sports Medicine (PRiSM)
- Philip L. Wilson, M.D.
 - Institutional Support Arthrex, Inc.
 - Royalties Elsevier



Introduction

- Pediatric anterior cruciate ligament (ACL) reconstructions are increasing in frequency.¹
 - Surgery is commonly recommended to avoid meniscochondral injury.
 - Some patients may biomechanically adapt to the ACL deficiency.²

Purpose

Identify biomechanical patterns in pre-pubescent patients following an ACL injury who had no residual instability (Copers) compared to those with continued instability that converted to ACL reconstruction (Non-copers).



Methods

- Prospective analysis of pre-pubescent (Tanner stage 1) patients who sustained an isolated ACL injury
- Exclusion criteria
 - Concomitant meniscal tear
 - Current symptoms of instability
- Motion-capture testing
 - Gait, heel touch, and overhead squat tests
 - Electromyography (EMG) analysis
- Data analysis
 - Wilcoxon signed-rank test





Results

- Demographics
 - N = 12
 - 7 Copers
 - 5 Non-copers
 - 9 (75%) Male
 - Mean age 11.8 ± 2.1 years
 - Range 8.7 15.8



Results

- Around 6 months post-injury,* compared to Non-copers, Copers had
 - Decreased
 - Knee valgus during gait, OHS, and HT tests
 - Knee flexion during gait
 - Hip extension during gait
 - Increased
 - Coronal plane knee moment during gait
 - Hip flexion during OHS
 - Ankle dorsiflexion in single leg stance during gait
 - No differences in EMGs between groups



Overhead Squat (OHS)



Heel Touch (HT)



^{*}Average time of testing: 6.6 ± 8.1 months post-injury

Conclusion

- Coronal and sagittal plane biomechanical adaptations are observed in Copers.
 - At six months post-injury Copers demonstrate less knee valgus, less knee flexion and greater ankle dorsiflexion than Non-Copers.
- Future work should focus on identification of pediatric patients that may be more successful with non-operative treatment for isolated ACL injury.



References

- 1. Tepolt FA, Feldman L, Kocher MS. Trends in Pediatric ACL Reconstruction From the PHIS Database. J Pediatr Orthop. 2018 Oct;38(9):e490-e494.
- 2. Ellis, Henry B. Jr MD1,2,a; Zak, Taylor K. MD1; Jamnik, Adam MD1; Lind, Dane R.G. BA3; Dabis, Jessica PT, DPT, OCS1; Losito, Michael PT, MS, OCS1; Wilson, Philip MD1,2; Moatshe, Gilbert MD, PhD4,5. Management of Pediatric Anterior Cruciate Ligament Injuries: A Critical Analysis. JBJS Reviews 11(8):e22.00223, August 2023









UTSouthwesternMedical Center



Henry.Ellis@tsrh.org



scottishriteforchildren.org/sports



@SRChildren_



@ Scottish-Rite-for-Children



@ScottishRiteforChildren



@SRChildren_