



2017 ANNUAL REPORT

*Internationally distinguished for patient care with
compassion and advanced clinical research*

Cincinnati SportsMedicine Research & Education Foundation
Cincinnati SportsMedicine & Orthopaedic Center — Mercy Health
Noyes Knee Institute

Welcome to our Foundation



The Cincinnati SportsMedicine Research & Education Foundation is a unique foundation in its commitment to excellence in all aspects of patient care, clinically applied research, and the education and teaching of surgeons, physical therapists and allied health professionals throughout the world. The Noyes Knee Institute was founded to advance these goals for all knee disorders. The physicians associated with the Foundation strive through research and clinical practice to develop state-of-the art surgical techniques and treatment options that represent the most advanced procedures available worldwide. Our research personnel and scientists have conducted over 100 clinical research studies involving thousands of patients, published over 350 articles in peer-reviewed medical journals and orthopaedic textbooks, and trained over 150 Sportsmedicine and Arthroscopic Surgeons in our Fellowship program.

A Foundation program, Sportsmetrics, which has received international attention, is a scientifically proven, non-profit neuromuscular training program designed to prevent ACL injuries in female athletes. Our Sportsmetrics staff teaches and certifies allied health professionals on training athletes and implementing the Sportsmetrics program in their communities. Sportsmetrics is the largest program of this type in the world.

In its 32nd year, our annual Advances on the Knee, Shoulder, and Sports Medicine Conference has trained thousands of physicians, physical therapists and athletic trainers world-wide.

We appreciate the many expert guest faculty that support the excellence of this program. The Foundation was founded in 1985 by Frank R. Noyes, MD, President and Medical Director of the Cincinnati SportsMedicine and Orthopaedic Center.

The Foundation was established with the goal of bringing together surgeons, therapists, trainers, researchers and bioengineering professionals in a team approach to develop successful and innovative patient treatment programs to improve the lives of patients. The clinical and bioengineering research studies have received nearly every national and international award possible. These include the highest award from the American Academy of Orthopaedic Surgeons (three Kappa Delta Awards), the Orthopaedic Research and Education Foundation's Clinical Research Award, and the American Orthopaedic Society for Sports Medicine Clinical and Research Awards. The Foundation studies were recently honored and ranked in bibliographic publications in JBJS and Arthroscopy journals as the "most-cited studies" in the world.

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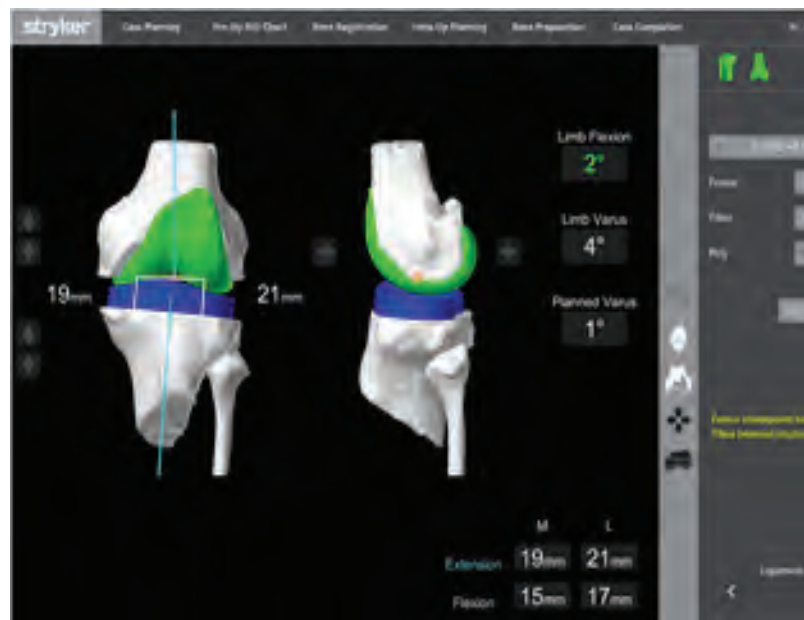
Our Mission

To improve the lives of patients everywhere by offering advanced and state-of-the-art treatments for Orthopaedic and Sports Medicine disorders based on excellence and success in documented clinical outcome studies and application of basic and clinical research.

2017

Accomplishments

Research and education advances are represented by the collaboration of physicians, scientists and research staff at Mercy Health – Cincinnati SportsMedicine and Orthopaedic Center, Cincinnati SportsMedicine Research and Education Foundation, Noyes Knee Institute, and the University of Cincinnati Department of Biomedical Engineering.



Publications

- 2017 represented a very successful year for our Foundation. Several studies were completed, resulting in original manuscripts published in peer-reviewed orthopaedic journals.
- Completion of the 2nd edition of “ACL Injuries in the Female Athlete. Causes, Impacts and Conditioning Programs”. *Springer-Verlag*
- Release of the 2nd edition of two e-books, 1) Operations for Knee Arthritis: What To Do When All Else Has Failed To Stop Your Knee Pain, 2) Knee Arthrofibrosis: Everything You Need to Know to Recognize, Treat, and Prevent Loss of Knee Motion After Injury or Surgery
- Proposal submission and acceptance of a new textbook titled “Return to Sport After ACL Reconstruction and Other Knee Operations: Limiting the Risk of Reinjury and Maximizing Athletic Performance”. *Springer-Verlag*
- Local, national and international presentations by Drs. Noyes, Lindendorf, Hasan, Busam, Bhatia, Galloway and Andrews.
- Series of publications from the Biomechanics and Robotics Division on rotational knee stability and ACL reconstruction.
- Hosted the 1st Annual Frank R. and JoAnne Noyes Eminent Scholarship Program. Visiting scholars included Bertram Zarins, MD and Edward Grood, PhD.



Education

- 35 invited presentations given at international (Paris Shoulder Course; International Musculoskeletal Society - Beirut), national (AAOS, AANA), regional and local meetings.
- 7 abstracts submitted for presentation at international and national meetings.
- 65 teaching conferences attended by fellows, physical therapists, athletic trainers, physical therapy students, and athletic training residents.
- 11 journal clubs attended by staff physicians and fellows.



Fellowship

- Nationally acclaimed sports medicine, knee, and shoulder fellowship program.
- ACGME/RRC accreditation; recognized by the American Orthopaedic Society for Sports Medicine and the Arthroscopy Association of North America.
- 151 fellow graduates (1979-2017) practicing across the United States and Canada.



Sportsmetrics

- Greater than 250 athletes trained in 2017.
- Certification: 172 individuals certified from 50 sites.
- Courses held in Cincinnati, OH; Hilton Head Island, SC; Kansas City, MO; Laramie, WY; Boise, ID.
- Introduced the first Master Level Certification Course for Sportsmetrics-certified individuals. This course provides an advanced level of understanding on ACL injury prevention research and training.

Director Statements

Our Foundation and patient care Center experienced an exceedingly active year with major accomplishments in every division. The enthusiasm and continued excellence of our physician, rehabilitation, administrative and research staffs are a personal delight for me to see in action.



Frank R. Noyes, MD

Medical Director

The new clinical studies, surgical approaches, and research advances are presented in this report.

Select publications are described in greater detail. New research initiatives in the shoulder, knee, hip, injury prevention and performance occurred in 2017.

I hope you will enjoy

this summary of the accomplishments of the Foundation.

The year 2017 represented the fourth year of integration of Cincinnati SportsMedicine & Orthopaedic Center and Mercy Health, which represents one of the fifteen largest healthcare organizations in the United States. We are pleased that Mercy Health and The Jewish Hospital and Foundation has endorsed and supported our clinical research and educational programs through a joint operating agreement.

Our continued growth now numbers a total of 105 dedicated personnel in our Center and Foundation. We offer sports medicine, and specialty clinics at six Centers throughout the Cincinnati and Northern Kentucky region. Last year alone, our physicians saw more than 27,000 new and follow-up patients, while our physical therapy and rehabilitation staff managed more than 60,000 patient visits. Our patients are offered the advantage to enroll in advanced treatment programs in all disciplines. We continue to operate and function at two research Centers within the Foundation and are in the process of increasing our collaboration with a new to be elected Director at the Department of Biomedical Engineering, University of Cincinnati. This relationship has spanned an amazing 40 years of collaboration between scientists and clinicians.

We recently announced the Annual Frank R. and JoAnne Noyes Eminent Scholarship Lecture program to be held yearly at the Department of Orthopaedic Surgery, School of Medicine, University of Cincinnati. Dr. Noyes has been awarded the honor of an Emeritus Professor of Orthopaedic Surgery. We look forward to advancing this important relationship with future research and educational programs. Our sports medicine and arthroscopy fellowship continues to attract an excellent group of orthopedists. The achievements of our fellows in 2016-17 and 2017-18 are provided. Our fellows work closely with our full-time staff and have major commitments to clinical and robotic research studies. The list of publications shows their involvement in national peer reviewed publications and presentations.

Professional Staff

2016-2017 Fellows



Brad Ashman, MD



Chris Karrasch, MD



Jeff Jenks, DO



Mat Phillips, MD

2017-2018 Fellows



Dapo Ajayi, MD



Richie Edeen, MD



Sean Kelly, DO



Mike Palmer, MD

Foundation Staff



Edward Grood, PhD
Emeritus Professor,
University of Cincinnati
Department of Biomedical
Engineering



Sue Barber-Westin, BS
Director, Clinical
Research,
Noyes Knee Institute



Cassie Fleckenstein, MS
Manager,
Clinical Research



Jennifer Riccobene, BA
Research Coordinator



Debbie Hartwig
Administrative Assistant



Tommy Campbell, BA
Director of Marketing,
Noyes Knee Institute
& Sportsmetrics



Stephanie Smith, MS
Manager,
Sportsmetrics Program



Teresa Wood
Fellowship Coordinator/
Administrative Assistant

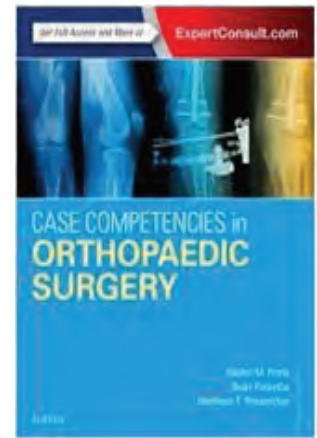
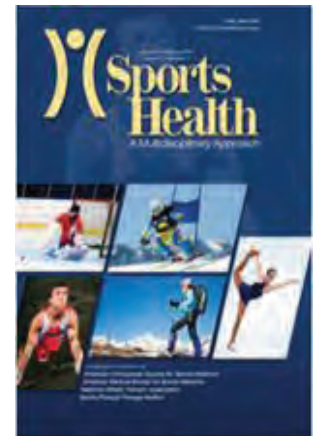
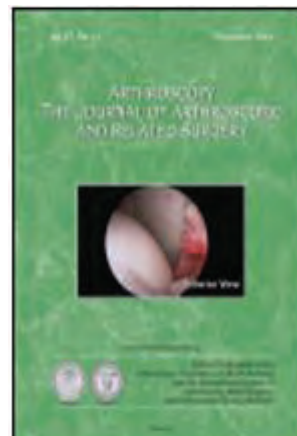


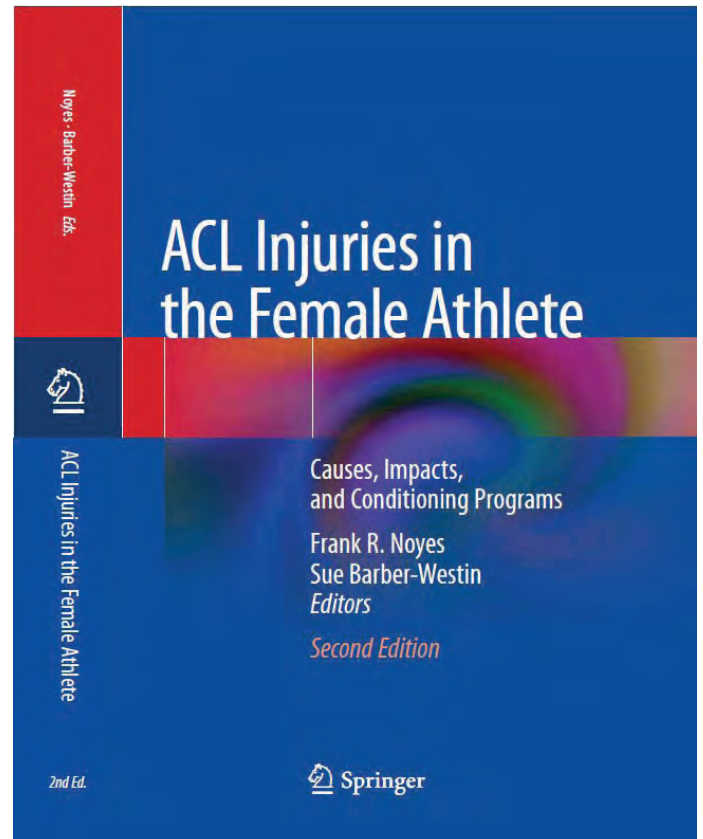
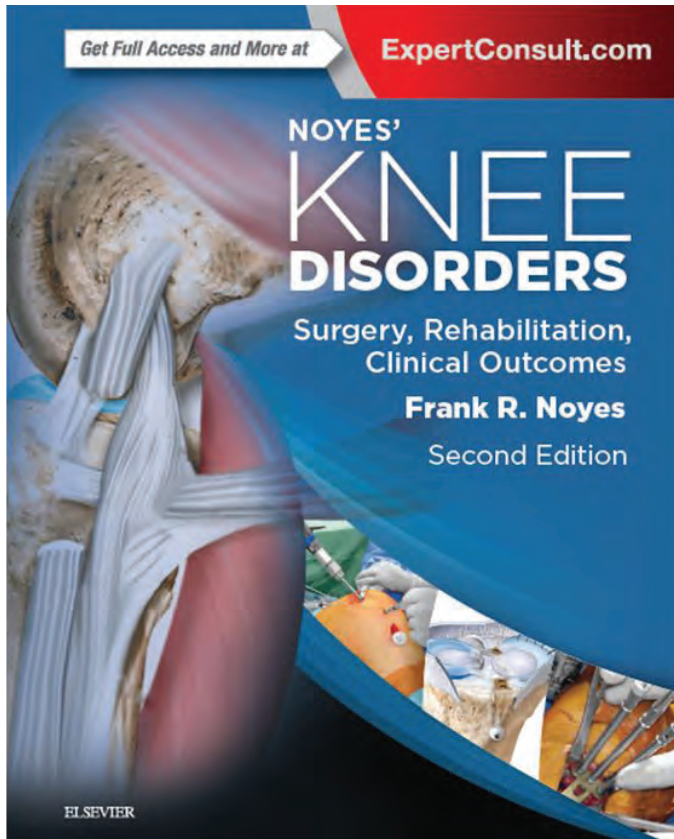
Lauren Huser, MEng,
Research Associate



Corinne Luther, BS
Research Coordinator

2017 Journal Publications and Textbook Chapters





Knee Division: Clinical Outcome Studies & Applied Clinical Research

- Knee Disorders Prospective Registry
- Tibial and Femoral Osteotomy Realignment Studies
- Cartilage and Meniscus Restoration Center
- Robotic Patellofemoral and Tibiofemoral Joint Replacement Center



This division is responsible for every phase of our patient-related studies under the direction of Dr. Frank Noyes. The Knee Registry is over 25 years old and numerous clinical studies have been published on all types of complex knee disorders. The publications have a 90% to 100% follow-up, which is a major credit to our research staff that follow our patients throughout the United States. Patients travel from all over the world to receive specialized care for serious knee disorders and our clinical and research team continue to provide the highest standard of care available with compassion and individualized treatment programs. The breath of clinical outcomes studies are featured in the 2nd edition of the Noyes Knee Disorders book published in 2016.

Personnel: Sue Barber-Westin, Cassie Fleckenstein, Jennifer Riccobene, Cori Luther

Publications

1. Huser LE, Noyes FR, Jurgensmeier D, Levy MS: Anterolateral ligament and iliotibial band control of rotational stability in the anterior cruciate ligament-intact knee: defined by tibiofemoral compartment translations and rotations. *Arthroscopy* 33:595-604, 2017.
2. Noyes FR, Huser LE, Jurgensmeier D, Walsh J, Levy MS: Is an anterolateral ligament reconstruction required in ACL-reconstructed knees with associated injury to the anterolateral structures? A robotic analysis of rotational knee stability. *Am J Sports Med*, ePub Jan 1, 2017.
3. Noyes FR, Huser LE, Levy MS: Rotational knee instability in ACL-deficient knees: Role of the anterolateral ligament and iliotibial band as defined by tibiofemoral compartment translations and rotations. *J Bone Joint Surg Am* 99: 305-314, 2017.
4. Noyes FR, Barber-Westin SD: Decision-making and surgical treatment of posterior cruciate ligament ruptures. In Scott WN (ed.): *Insall & Scott Surgery of the Knee*, 6th Edition. Elsevier, Philadelphia, 2017, pp. 494-538.
5. Noyes FR, Barber-Westin SD: ACL-deficiency in the varus-angulated knee: diagnosis, surgical techniques, clinical outcomes. In Prodromos C (ed): *The Anterior Cruciate Ligament: Reconstruction and Basic Science*, 2nd Edition. Elsevier, Philadelphia, 2017, pp. 413-423.
6. Barber-Westin SD, Noyes FR: Effect of fatigue protocols on lower limb neuromuscular function and implications for anterior cruciate ligament injury prevention training. A systematic review. *Am J Sports Med* 45:3388-3396, 2017.
7. Noyes FR, Barber-Westin SD, Levy MS: Are anticoagulants required after high tibial osteotomy to prevent venous thromboembolism events? A systematic review. *J Orthop Res Physiother* 3: 030, 2017.
8. Barber-Westin SD, Noyes FR: Low-impact sports activities are feasible after meniscus transplantation: A systematic review. *Knee Surg, Sports Traumatol, Arthrosc*, ePub July 27, 2017.
9. Noyes FR, Huser LE, Levy MS: The effect of an ACL reconstruction in controlling rotational knee stability in knees with intact and physiologic laxity of secondary restraints as defined by tibiofemoral compartment translations and graft forces. In press, *J Bone Joint Surg Am* 2017.
10. Operations for Knee Arthritis: What To Do When All Else Has Failed To Stop Your Knee Pain. Noyes FR, Barber-Westin SD (eds.) Available September 12, 2012. Updated 2017.
11. Knee Arthrofibrosis: Everything You Need to Know to Recognize, Treat, and Prevent Loss of Knee Motion After Injury or Surgery. Noyes FR, Barber-Westin SD (eds.) Available September 12, 2012. Updated 2017.
12. Siegel MG. Is fluid type and not the procedure the culprit in fluid extravasation? *Arthroscopy*, 33(8): 1440, 2017.

Textbook chapters

Our textbook [ACL Injuries in the Female Athlete, 2nd Edition](#) was completed in 2017. This second edition was deemed necessary due to the exceptional sales of the 1st Edition that was published in 2012 and to the continuing worldwide research efforts in this area. The first edition has consistently been in the top 20% of the publisher's (Springer-Verlag) online sales, with over 40,000 chapters sold to date. This textbook provides step-by-step details of training programs of proven value in reducing the rate of noncontact ACL injuries in female athletes. Risk factors for ACL injuries in female athletes are described using data from hypothesis-driven investigations. Hundreds of published studies are summarized, providing a clear understanding of the short- and long-term impacts of ACL injuries. The second edition will become available in the summer of 2018.

[ACL Injuries in the Female Athlete. Causes, Impacts, and Conditioning Programs, 2nd Edition](#)

Noyes FR, Barber-Westin SD (eds), Springer-Verlag, Berlin Heidelberg, in press for 2018.

1. Noyes FR, Barber-Westin SD: Chapter 1: The ACL: Anatomy, Biomechanics, Mechanisms of Injury, and the Gender Disparity. In preparation, 2017.
2. Barber-Westin SD, Noyes FR: Chapter 2: Consequences of Complete ACL Ruptures. In preparation, 2017.



3. Noyes FR, Barber-Westin SD: Chapter 4: Risks of Future Joint Arthritis and Reinjury after ACL Reconstruction.
4. Barber-Westin SD, Noyes FR: Chapter 15: Effect of Fatigue and Gender on Lower Limb Neuromuscular Function. In preparation, 2017.
5. Barber-Westin SD, Noyes FR: Chapter 17: Testing for Neuromuscular Problems and Athletic Performance.
6. Noyes FR, Barber-Westin SD: Chapter 18: Sportsmetrics ACL Intervention Training Program: Components, Results.
7. Barber-Westin SD, Noyes FR: Chapter 19: Sports-Specific Programs for Soccer, Basketball, Volleyball, and Tennis.
8. Noyes FR, Barber-Westin SD: Chapter 21: ACL Injury Prevention Warm-up Programs.
9. Barber-Westin SD, Noyes FR: Chapter 22: Effect of Intervention Programs on Reducing the Incidence of ACL Injuries, Improving Neuromuscular Deficiencies, and Enhancing Athletic Performance.
10. Heckmann TP, Noyes FR, Barber-Westin SD: Chapter 24: Rehabilitation After ACL Reconstruction.
11. Noyes FR, Barber-Westin SD: Chapter 27: Functional Assessment of Neuromuscular Function Before Return to Sports After ACL Reconstruction.
12. Barber-Westin SD, Noyes FR: Chapter 29: Promotion of ACL Intervention Training Worldwide.

Manuscripts and Book Chapters Under Review/In Press

1. Barber-Westin SD, Noyes FR: Which anterior cruciate ligament prevention programs are effective in decreasing injury rates and improving neuromuscular indices in female athletes? A systematic review. Under review, *Sports Health*.
2. Barber-Westin SD, Noyes FR: Blood flow-restricted training for lower extremity muscle weakness due to knee pathology. A systematic review. Under review, *Sports Health*.

In 2017, we proposed a new textbook that will be published by Springer in 2019, Return to Sport After ACL Reconstruction and Other Knee Operations: Limiting the Risk of Reinjury and Maximizing Athletic Performance. Nearly a million anterior cruciate ligament (ACL) injuries occur each year worldwide, most of which are sustained by young athletes. The ability to return patients back to sports safely and without subsequent problems is paramount. Return to play has become the subject of increased scrutiny as a result of high reinjury rates that have been reported, as well as disappointing percentages of athletes who returned to sports even though normal or very good knee function was restored.

This unique textbook focuses on return to play after ACL and other knee operations and discusses:

- Common barriers to return to play, including physical, psychological, psychosocial, and neurocognitive problems.
- Return to play decision-based models and the roles of the orthopaedic surgeon and team physician.
- The complete spectrum of optimal treatment for ACL injuries, including preoperative, intraoperative, and postoperative rehabilitation.
- Advanced training concepts such as neuromuscular retraining, work load intensity, external focus, and visual-motor training concepts.
- Objective testing for knee function, neurocognitive function, and cardiovascular fitness.
- Identification and management of psychological issues including fear and depression in the athlete.
- Return to play considerations after meniscus surgery, patellofemoral realignment, articular cartilage procedures, and knee arthroplasty.

The chapters we will write are:

1. Noyes FR, Barber-Westin SD: Advantages and Potential Consequences of Return to Sport: Patient Satisfaction, Reinjury Rates, Knee Osteoarthritis.
2. Barber-Westin SD, Noyes FR: Common Physical and Psychological Barriers to Return to Sport.
3. Barber-Westin SD, Noyes FR: Return to Sport After ACL Reconstruction: Where's the Scientific Evidence?
4. Heckmann TP, Noyes FR, Barber-Westin SD: Preoperative Rehabilitation: Basic Issues.
5. Noyes FR, Barber-Westin SD: Intraoperative Considerations Crucial for a Successful Outcome.
6. Noyes FR, Barber-Westin SD: Early Postoperative Rehabilitation to Avoid Complications and Prepare for Return to Sport Training.
7. Barber-Westin SD, Noyes FR: Sportsmetrics Neuromuscular Training: Basic and Advanced.
8. Noyes FR, Barber-Westin SD: Return to Sport for Soccer and Basketball.
9. Barber-Westin SD, Noyes FR: Return to Sport for Tennis.
10. Noyes FR, Barber-Westin SD: The Physician's Comprehensive Examination.



11. Barber-Westin SD, Noyes FR: Neuromuscular Function, Agility, and Aerobic Testing.
12. Noyes FR, Barber-Westin SD: Muscle Strength and Balance Tests.
13. Barber-Westin SD, Noyes FR: Validated Questionnaires to Measure Return to Sport and Psychological Factors.
14. Barber-Westin SD, Noyes FR: Return to Sport After ACL Revision Reconstruction.
15. Noyes FR, Barber-Westin SD: Return to Sport After Meniscus Operations: Meniscectomy, Repair, and Transplantation.
16. Noyes FR, Barber-Westin SD: Return to Sport After Patellofemoral Realignment.
17. Noyes FR, Barber-Westin SD: Return to Sport After Partial and Total Knee Arthroplasty.
18. Noyes FR, Barber-Westin SD: Current Understandings and Directions for Future Research.

Abstracts

1. Frank R. Noyes, Lauren E. Huser, Darin Jurgensmeier, James Walsh, Martin S. Levy. ACL Reconstruction with Lateral ALL/ITB Injury: Is Anterolateral Reconstruction Needed to Restore Stability? 2017 AAOS Annual Meeting & 2017 AOSSM Specialty Day.
2. Frank R. Noyes, Sue Barber-Westin, Martin Levy. Are Anticoagulants Required after High Tibial Osteotomy to Prevent Venous Thromboembolism Events? 2017 AAOS Annual Meeting.
3. Frank R. Noyes, Sue Barber-Westin, Cassie Fleckenstein, Jenny Riccobene. Patellofemoral Arthroplasty in Younger Patients: Are Recreational Activities Feasible? 2017 AAOS Annual Meeting.

Current Major Studies

1. Long-term Clinical Outcomes Following Meniscus Transplantation.
2. High Tibial Ostotomy with TOMA Fix Locking Plate.
3. MPFL Reconstruction with Proximal Patellar Realignment.
4. ACL Revision with Tibial and/or Femoral Tunnel Bone Grafting.
5. Short and Long-term Clinical Outcomes Following MAKO Patellofemoral and Tibiofemoral Joint Replacements.
6. Cartilage Restoration - OAT, Carticel.
7. Femoral Osteotomy.
8. Return to Recreational Activities and Work Following Total Knee Replacement.
9. Blood Flow Restriction Training for Severe Muscle Atrophy.

Shoulder Division: Clinical Outcome Studies & Applied Clinical Research



The Shoulder Center at Cincinnati SportsMedicine and Orthopaedic Center had a very productive year in 2017. Under the direction of Drs. Samer Hasan, Thomas Lindendorf, and Marc Galloway, the Center is a destination for patients seeking quality nonoperative and operative treatment of their shoulder and elbow conditions and injuries. In addition, the Center continues to lead in various shoulder related research studies. Dr. Hasan is involved with two major, multi-center studies. The first is a five-year, post-market study of the DJO reverse shoulder prosthesis. The second is a two-year randomized, investigational device exemption study of the OrthoSpace InSpace balloon device for the treatment of massive irreparable rotator cuff tears. Dr. Lindendorf continues to evaluate a device to more accurately measure glenohumeral rotation. Full details on our other studies, submitted abstracts, publications and book chapters can be found below.

Personnel: Cassie Fleckenstein, Jennifer Riccobene, Cori Luther

Publications

1. Hasan SS. Revisiting the socket: commentary on an article by Jeremy S. Somerson, MD, et al.: "Clinical and radiographic outcomes of the ream-and-run procedure for primary glenohumeral arthritis. J Bone Joint Surg, 99(15): e85, 2017.

Book Chapters

1. Hasan S., Schwindel, L.E., Fleckenstein, C.M., "Prosthetic Shoulder Arthroplasty in Patients Aged 40 or Less: The Role for Resurfacing Hemiarthroplasty", In: "Shoulder Arthroplasty: Current Concepts 2017, www.Paris-Shoulder-Course.com, Paris, France, 2017, pp. 83-89.
2. Kawtharani, F., Hasan, S.S., Clinical Anatomy of the Clavicle. In: Clavicle Injuries: A Case Based Guide to Diagnosis and Treatment. Groh GI (ed.) Springer, New York, 2018, pp. 1-18.

Manuscripts/Textbook chapters under review, in press

1. Hasan, S.S., Levy, J.C., Leitze, Z.R., Kumar, A.G., Krupp, R.J., Harter, D.G., "A Multi-Center Prospective Study of a Reverse Shoulder Prosthesis with a Lateralized Glenosphere", J Bone Joint Surg. – Am., *submitted*.
2. Hasan, S.S., Rolf, R.H., Simpson, A., Scheuerman, C., Eten, K., Elsass, T.R. "Single Shot versus Continuous Interscalene Block for Postoperative Pain Control following Primary Shoulder Arthroplasty: A prospective randomized clinical trial", J Shoulder Elbow Surg. 2017, *submitted*.
3. Ashman, B., Hasan, S.S., Bhatia S., Intra-operative Neuromonitoring for Brachial Plexus Neurolysis During Delayed Fixation of a Clavicle Fracture Presenting as Thoracic Outlet Syndrome: A case report, J Shoulder Elbow Surg. 2017, *submitted*.

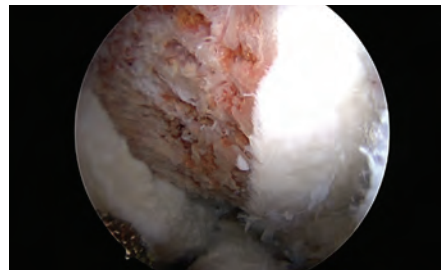
Abstracts

1. Rolf, R.H., Hasan, S.S., Scheuerman, C., Eten, K., Elsass, T.R. "Single shot versus continuous interscalene block for postoperative pain control following primary shoulder arthroplasty: A prospective randomized clinical trial", Annual Meeting of the American Academy of Orthopaedic Surgeons, San Diego, California, March 13-17, 2017.
2. Hasan, S.S., Rolf, R.H., Scheuerman, C., Eten, K., Elsass, T.R. "Single shot versus continuous interscalene block for postoperative pain control following primary shoulder arthroplasty: A prospective randomized clinical trial", Annual Meeting of the American Shoulder and Elbow Surgeon, San Diego, California, March 18, 2017.
3. Hasan, S.S., Schwindel, L., Fleckenstein, C. "Outcomes of prosthetic shoulder arthroplasty in patients forty years old or less", 11th Biennial ISAKOS Congress, Shanghai, China, June 8, 2017.
4. Hasan, S.S., Schwindel, L.E., Fleckenstein, C.M. "Prosthetic shoulder arthroplasty in patients 40 years old or less: Is there a role for resurfacing?" Annual Meeting and Open Meeting of the American Shoulder and Elbow Surgeons, New Orleans, October 11-14, 2017.

Current Studies

1. Distal Biceps Tendon Repairs: Two Incision vs. Single Incision.
2. Results of Prosthetic Shoulder Arthroplasty in Patients Under Age 40.
3. Multicenter Study - Reverse Total Shoulder Replacement.
4. Effect of CPM on Range of Motion Following Rotator Cuff Repair.
5. Glenohumeral Shoulder Rotation and Arch of Motion in Overhead Athletes.
6. Multicenter Study - Shoulder Arthroplasty Failure Experience.
7. Multicenter study - InSpace Device for the Treatment of FullThickness Massive Rotator Cuff Tears.

Hip Division: Clinical Outcome Studies & Applied Clinical Research



The prospective clinical outcomes hip division is responsible for every phase of all patient-related studies under the direction of Dr. Sanjeev Bhatia. The Hip Arthroscopy and Joint Preservation Center aims to provide patients from the Midwest region and beyond with a cutting edge, multidisciplinary approach involving injuries of the hip. Using the latest in newly developed arthroscopic and open surgical techniques, newly developed cartilage technologies, and non-surgical rehab protocols and injections, the Center aims to provide young, active individuals with the best evidence-based non-arthroplasty treatment options for relieving hip and knee pain, delaying the progression of end stage arthritis, and returning individuals to sports and function. Additionally, the Center is actively engaged in research and education efforts to advance the understanding of hip and joint preservation, sports medicine, and orthopaedic wellness.

Personnel: Cassie Fleckenstein, Jennifer Riccobene, Cori Luther

Publications

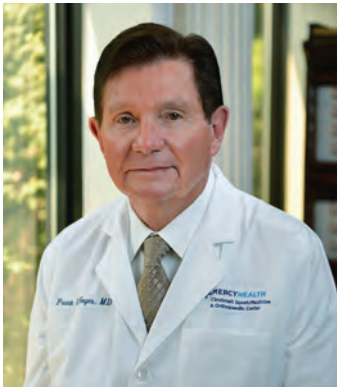
1. Menge TJ, Bhatia S, McNamara SC, Briggs KK, Philippon MJ. Femoroacetabular impingement in professional football players: return to play and predictors of career length after hip arthroscopy. *Am J Sports Med*, 45(8): 1740-1744, 2017.

Manuscripts/Textbook chapters under review, in press

1. Bhatia S, Ellman MB, Nho SJ, Mather RC, Bedi A, Aoki SK, Larson CM, Kelly B, Griffin DR, O'Donnell J, Mei-Dan O. Letter to the Editor: Bilateral Hip Arthroscopy: Direct Comparison of Primary Acetabular Labral Repair and Primary Acetabular Labral Reconstruction. Accepted March 2018. *Arthroscopy*.
2. Bhatia S, Chahla J, Cinque ME, Ellman MB. "Recovery of Hip Muscle Strength After ACL Injury and Reconstruction: Implications for Reducing the Risk of Re-Injury." *ACL Injuries in the Female Athlete-Causes, Impacts, and Conditioning Programs*. Springer-Verlag 2018. In Press.



Local, National, and International Meeting Presentations



Frank R. Noyes, MD

1. Meniscus Repair and Transplantation: What's New in 2017. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 28, 2017.
2. Surgical Correction for Patellofemoral Malalignment. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 28, 2017.
3. Comprehensive Knee Exam: Clinical Rationale and Diagnosis. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 29, 2017.
4. Scientific Basis and Development of the Sportsmetrics™ Neuromuscular Training Programs. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 29, 2017.
5. Surgical Perspective on Avoiding and Treating Knee Arthrofibrosis. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 29, 2017.
6. Surgical Treatment of PCL and Posterolateral Ligament Injuries. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 30, 2017.
7. High Tibial Osteotomy: Techniques and Surgical Results. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 30, 2017.
8. Partial Joint Replacement: Unicompartamental and Patellofemoral. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 30, 2017.
9. Injury Prevention Development, Research and ACL Mechanism of Injury. 2017 Symposium on Sideline Management of the Injured Athlete. UBMD Orthopaedics and Sports Medicine. Skype Presentation. Buffalo, New York. August 11, 2017.
10. Biomechanical Function of the Anterolateral Complex. Anterolateral Complex of the Knee Consensus Group Meeting. Croyley Park, UK. October 24, 2017. This meeting led to a consensus statement to be published in 2018.

Local, National, and International Meeting Presentations



Thomas N. Lindenfeld, MD

1. Shoulder Anatomy Review - What You Need to Know. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 27, 2017.
2. Elbow Anatomy and Basic Arthroscopy. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 28, 2017.



Samer S. Hasan, MD, PhD

1. Invited Speaker, "Altivate Anatomic Shoulder", DjO - National Sales Meeting, Orlando, Florida, January 19-21, 2017.
2. Invited Speaker, Resurfacing Arthroplasty in Patients under 40, Paris Shoulder Arthroplasty Course, Paris, France, February 10, 2017.
3. Invited Speaker, US Experience of the Lateralized Glenoid Reverse, Paris Shoulder Arthroplasty Course, Paris, France, February 11, 2017.
4. Invited Speaker, Current Solutions in Shoulder and Elbow Surgery, Tampa, Florida, February 9-12, 2017.
5. Single Shot vs. Continuous Interscalene Block for Postoperative Pain Control following Primary Shoulder Arthroplasty: A Prospective Randomized Clinical Trial. ASES Specialty Day. San Diego, California. March 18, 2017.
6. Superior Capsular Reconstruction. Mayo Clinic Course on Shoulder Tendon Transfers and Complex Rotator Cuff Repair. Rochester, Minnesota. April 27, 2017.
7. Role of Augmentation Using Achilles Tendon Allograft or a Patch. Mayo Clinic Course on Shoulder Tendon Transfers and Complex Rotator Cuff Repair. Rochester, Minnesota. April 28, 2017.
8. Complications of SLAP and Biceps Surgeries. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 27, 2017.
9. Shoulder Replacement Surgery. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 27, 2017.
10. Operative and Non-Operative Treatment of the Stiff Shoulder. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 27, 2017.
11. Posterior and Multidirectional Instability. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 28, 2017.
12. Outcomes of Prosthetic Shoulder Arthroplasty in Patients Forty Years Old or Less. ISAKOS Congress, Shanghai China. June 4-8, 2017.
13. SLAP Lesions and Biceps Tendinopathy: When to Repair and How. International Musculoskeletal Society, Beirut Lebanon. July 19, 2017.
14. Treatment of Humeral and Glenoid Bone Loss. International Musculoskeletal Society, Beirut Lebanon. July 19, 2017.
15. Anatomic Shoulder Arthroplasty. International Musculoskeletal Society, Beirut Lebanon. July 20, 2017.
16. Distal Biceps Ruptures: Treatment Updates. International Musculoskeletal Society, Beirut Lebanon. July 21, 2017.
17. Shoulder Stiffness: Prevention and Treatment Algorithm. International Musculoskeletal Society, Beirut Lebanon. July 21, 2017.
18. Moderator: Shoulder and Elbow Session. ASES Annual Meeting. New Orleans, LA. October 14, 2017.

Local, National, and International Meeting Presentations



Matthew L. Busam, MD

1. Non-Prosthetic Treatment of Shoulder Arthritis. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 27, 2017.
2. Distal Biceps Injuries. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 28, 2017.
3. Avoiding Complications in ACL Surgery. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 29, 2017.



Sanjeev Bhatia, MD

1. Common Hip Problems and Injuries: Diagnosis and Treatment. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 28, 2017.

2. Hip Arthroscopy: What Works and What Doesn't. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina. May 28, 2017.
3. Bhatia S. "Evaluation of Persistent Pain Following Hip Arthroscopy: Decision-Making and Treatment." Grand Rounds at Steadman-Philippon Research Institute. Vail, CO – November 27, 2017.
4. Bhatia S. "Evaluation of Persistent Pain Following Hip Arthroscopy: Decision-Making and Treatment." Grand Rounds at Steadman-Philippon Research Institute. Vail, CO – January 16, 2017.
5. Bhatia S. "Top 10 Pearls for Starting a Sports Medicine Practice." Grand Rounds at Steadman-Philippon Research Institute. Vail, CO – January 16, 2017.

Fellows

Dr. Bradley Ashman: The Key to the Knee: Lateral and Posterolateral Knee Anatomy. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina, May 27-30, 2017.

Dr. Jeffrey Jenks: Treatment of the ACL Deficient Knee: Presentation of Cases to the Expert Panel. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina, May 27-30, 2017.

Dr. Chris Karrasch: The Key to the Knee: Medial and Anterior Knee Anatomy. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina, May 27-30, 2017.

Dr. Mathew Phillips: Advances in Total Knee Replacement for the Young, Active Patient. 32nd Annual Advances on the Knee, Shoulder and Sports Medicine Conference. Hilton Head Island, South Carolina, May 27-30, 2017.

Biomechanics and Robotics Division

Under the direction of Edward S. Grood, PhD (Professor Emeritus, University of Cincinnati Department of Biomedical Engineering) and Frank R. Noyes, MD, the Biomechanics and Robotics Division conducts in-vitro studies on cadaveric knees using a custom-designed robot based on the Grood-Suntay coordinate system. The robot has the ability to apply precise motions and loads simulating clinical tests, such as the Lachman and pivot-shift, for the purpose of better understanding knee ligament function and replacement. This is achieved through the robot's measurement of tibial translations and rotations in 6 degrees-of-freedom.

Our Foundation in conjunction with the Biomechanics and Robotics Division hosted the 1st Annual Frank R. and JoAnne Noyes Eminent Scholarship Lecture Program in September 2017 at the University of Cincinnati. Endowed Eminent Visiting Scholars Bertram Zarins, MD in Sports Medicine and Edward Grood, PhD in Bioengineering were honored. Dr. Zarins, Emeritus Chief of Sports Medicine at Massachusetts General and Augustus Thorndike Clinical Professor of Orthopaedic Surgery at Harvard Medical, presented a Key Note Address on "Patellar Instability." Dr. Grood, Emeritus Professor and founder of the Department of Biomedical Engineering at the University of Cincinnati, presented a Key Note Address on "Collaborative Research with Robotic Technology." The Key Note Addresses from the visiting scholars were followed by a presentation on the current state of the Biomedical Engineering Department at the University of Cincinnati by Interim Department Chair Jason Shearn, PhD. The first Frank R. and JoAnne Noyes Biomedical Engineering Graduate Student Award was awarded to current PhD student Stacey Gruber. The 2nd Annual Eminent Scholarship Lecture Program will be held in August 2018, featuring Christopher Harner, MD. Dr. Harner is Professor and Vice Chair of Academic Affairs and Sports Medicine Fellowship Program Director of the Department of Orthopaedic Surgery at the University of Texas Health Science Center in Houston.

Personnel: Edward S. Grood, PhD, Lauren Huser, Clinical Fellows

Studies Completed and Published

1. Huser LE, Noyes FR, Jurgensmeier D, Levy MS. Anterolateral Ligament and Iliotibial Band Control of Rotational Stability in the Anterior Cruciate Ligament-Intact Knee: Defined by Tibiofemoral Compartment Translations and Rotations. *Arthroscopy* 2017;33(3):595-604.
2. Noyes FR, Huser LE, Levy MS. Rotational Knee Instability in ACL-Deficient Knees: Role of the Anterolateral Ligament and Iliotibial Band as Defined by Tibiofemoral Compartment Translations and Rotations. *J Bone Joint Surg Am* 2017;99:305-314.
3. Noyes FR, Huser LE, Jurgensmeier D, Walsh J, Levy MS. Is an Anterolateral Ligament Reconstruction Required in ACL Reconstructed Knees with Associated Injury to the Anterolateral Structures? A Robotic Analysis of Rotational Knee Stability. *Am J Sports Med* 2017;45(5):1018-1027.
4. Noyes FR, Huser LE, Levy MS. The Effect of an ACL Reconstruction in Controlling Rotational Knee Stability in Knees with Physiologically Lax Secondary Restraints as Defined by Tibiofemoral Compartment Translations and Graft Forces. *J Bone Joint Surg Am* 2018;100-A(7):586-597.

Manuscripts Under Review/In Press

1. Noyes FR, Huser LE, West J, Jurgensmeier D, Walsh J, Levy MS. Two Different Knee Rotational Instabilities Occur with ACL and Anterolateral Ligament Injuries. A Robotic Study on ACL and Extra-Articular Reconstructions in Restoring Rotational Stability. Submitted to *Arthroscopy* in January 2018. Pending Review.

Accepted Abstracts

1. Huser LE, Noyes FR, West J, Jurgensmeier D, Walsh J, Levy MS. Two Different Knee Rotational Instabilities Occur with Injury to the ACL and Anterolateral Structures. Presented by Lauren Huser, MEng at the 2018 AAOS Annual Meeting in New Orleans, LA.

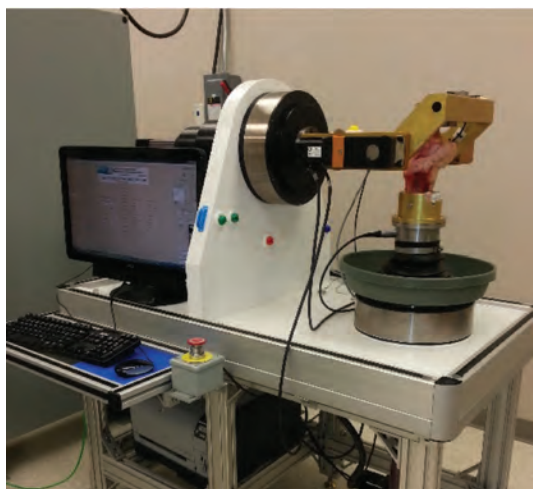
Current Studies

1. How do you properly condition a B-PT-B and STG ACL graft in order to avoid detrimental elongation after implantation?
2. Does a properly conditioned B-PT-B and STG ACL graft restore rotational instability?
3. Does an ACL graft that has been fixed to restore the Lachman test block a pivot-shift?

Upcoming Studies

1. Biomechanics of Posterior cruciate ligament (PCL) sectioning and reconstruction.

Biomechanics and Robotics Division



Our research is performed on a custom 6 degree-of-freedom robotic simulator that was developed and built by Edward S. Grood, PhD. Measurements of translations, rotations, and loads on all 3 axes are displayed and recorded in real-time. This one-of-a-kind system, along with Dr. Grood's expertise in biomechanics, has been instrumental to our success in 2017.

This year has seen the completion of a major project launched in 2014 on the anterolateral complex of the knee. This project and its many facets have benefitted from the work of multiple fellows over the years, including John West, MD (2013-2014), Darin Jurgensmeier, MD (2014-2015), James Walsh, DO (2014-2015), Jared

White, DO (2014-2015), and Matthew Beck, MD (2015-2016). Their efforts resulted in 4 manuscripts: 3 already published and 1 in review.

The series of manuscripts started with a report on the biomechanical role of the anterolateral ligament (ALL) and iliotibial band (ITB) in an ACL-intact knee, published in *Arthroscopy*¹. The major finding of this study was that there was little to no increase in pivot-shift subluxations with ALL and ITB injury. (Figure 1). Another major finding of this study was an increase in internal rotation with anterolateral injury that was not controlled by the ACL. This was a consistent finding throughout our series of studies and has been validated in the literature.

The second manuscript reported on the biomechanical role of the ALL and ITB in an ACL-deficient knee, published in *The Journal of Bone and Joint Surgery*². The same testing was performed on these specimens, but the ACL was sectioned prior to the anterolateral structures. The major finding of this study was that the ALL and ITB are not primary restraints for limiting pivot-shift

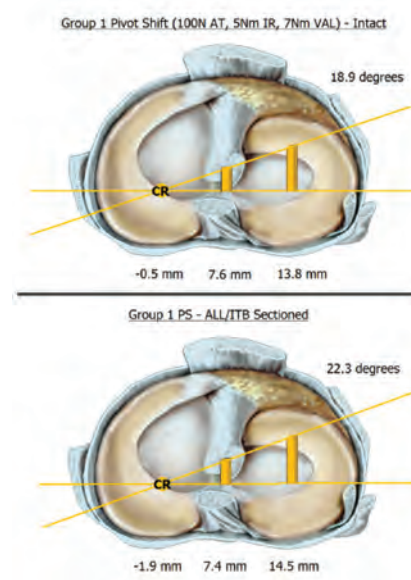


Figure 1

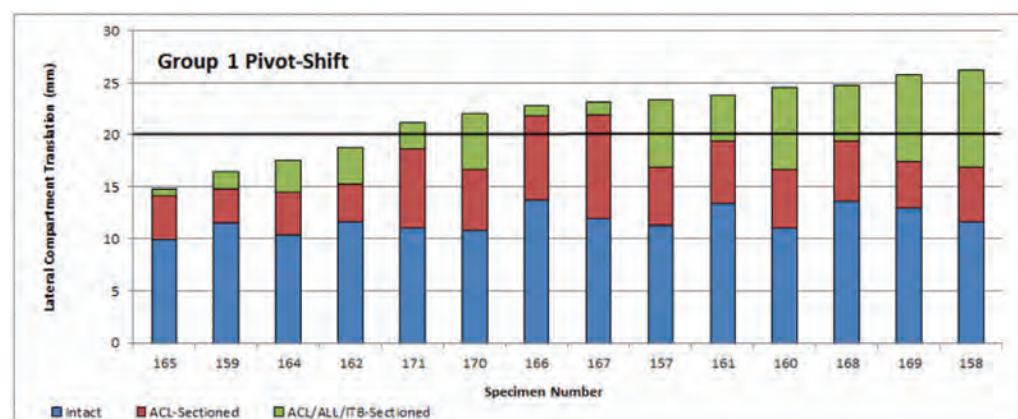


Figure 2

subluxations, but with combined ACL-ALL-ITB injury most knees resulted in a Grade III pivot-shift (Figure 2). Finally, we showed that there was great variability in the restraining action of these structures under internal rotation loading, and this became the basis of a subsequent study.

Biomechanics and Robotics Division

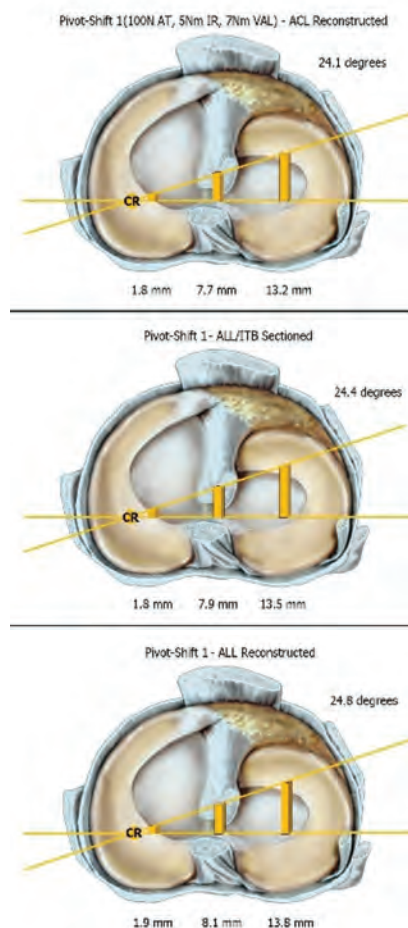


Figure 3

A fourth manuscript, published in the *Journal of Bone and Joint Surgery*⁵, defined knees with and without physiologic laxity of the anterolateral restraints based on pivot-shift subluxations, Lachman translations, and internal rotation limits. The major finding of this study was that, regardless of physiologic laxity, an ACL reconstruction was able to restore knee rotational stability.

Our series on the anterolateral complex continued with a third manuscript that reported on the ability of an ACL reconstruction to restore knee rotational stability with ALL/ITB injury alone, and the effect of further addition of an ALL reconstruction. This was published in the *American Journal of Sports Medicine*³. We concluded that an ACL reconstruction alone will restore the pivot-shift to normal even with anterolateral injury, and thus an added ALL reconstruction had no effect on limiting pivot-shift subluxations (Figure 3). The ALL reconstruction was beneficial in restoring the internal rotation motion limit that was not controlled by the ACL reconstruction alone.

The final manuscript in our series, currently under review⁴, reported on the addition of an ITB tenodesis to knees with anterolateral injury. Two different tenodeses were performed: one that simulated standard clinical practice of fixing under high manual tension and a second that was fixed under a measured low tension. We concluded that a manually-tensioned ITB tenodesis will provide some restraint in the pivot-shift but will majorly over-constrain internal rotation to a degree that is not clinically acceptable.

The low-tension ITB tenodesis will restore the increases in internal rotation due to ALL/ITB injury without major over-constraint but in turn has no effect on the pivot-shift (Figure 4). The findings of this study were presented at the 2018 AAOS Annual Meeting.

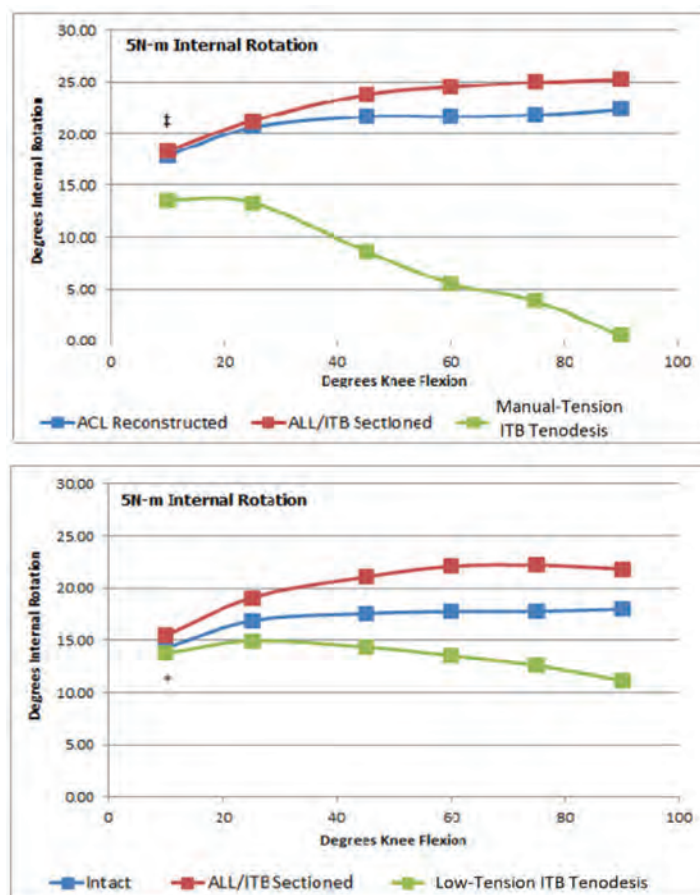


Figure 4

Biomechanics and Robotics Division

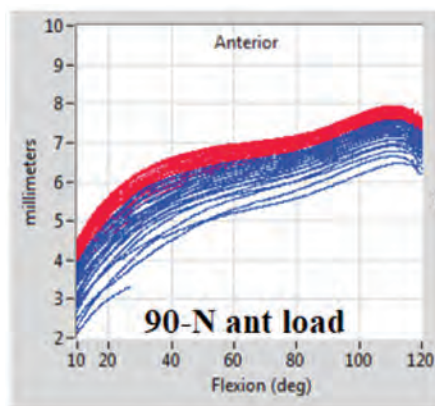


Figure 5

After completion of the series on the anterolateral complex, we started a study on ACL graft conditioning with fellows Brad Ashman, MD (2016-2017) and Michael Palmer, MD (2017-2018) that is currently ongoing. We sought to determine a practical conditioning protocol for two common ACL graft constructs: semitendinosus-gracilis and bone-patellar tendon-bone. A major finding of this study is that graft-board tensioning prior to implantation is not effective in minimizing post-operative graft elongation, as significant increases in anterior translation occur after implantation and cycling (Figure 5). Additionally, we found that cyclic loading of the knee after graft implantation produced a steady-state graft that restored rotational knee stability at time-zero. A manuscript describing this study and its results will be forthcoming.

We have plans for an important study on the posterior cruciate ligament (PCL) to begin in 2018 that explores biomechanics of the PCL and its reconstruction. This will be the first time that the PCL has been studied on our custom 6 degree-of-freedom robotics system.

1. Huser LE, Noyes FR, Jurgensmeier D, Levy MS. Anterolateral Ligament and Iliotibial Band Control of Rotational Stability in the Anterior Cruciate Ligament-Intact Knee: Defined by Tibiofemoral Compartment Translations and Rotations. *Arthroscopy* 2017;33(3):595-604.
2. Noyes FR, Huser LE, Levy MS. Rotational Knee Instability in ACL-Deficient Knees: Role of the Anterolateral Ligament and Iliotibial Band as Defined by Tibiofemoral Compartment Translations and Rotations. *J Bone Joint Surg Am* 2017;99:305-314.
3. Noyes FR, Huser LE, Jurgensmeier D, Walsh J, Levy MS. Is an Anterolateral Ligament Reconstruction Required in ACL Reconstructed Knees with Associated Injury to the Anterolateral Structures? A Robotic Analysis of Rotational Knee Stability. *Am J Sports Med* 2017;45(5):1018-1027.
4. Noyes FR, Huser LE, West J, Jurgensmeier D, Walsh J, Levy MS. Two Different Knee Rotational Instabilities Occur with ACL and Anterolateral Ligament Injuries. A Robotic Study on ACL and Extra-Articular Reconstructions in Restoring Rotational Stability. Submitted to *Arthroscopy* in January 2018. Pending Review.
5. Noyes FR, Huser LE, Levy MS. The Effect of an ACL Reconstruction in Controlling Rotational Knee Stability in Knees with Physiologically Lax Secondary Restraints as Defined by Tibiofemoral Compartment Translations and Graft Forces. *J Bone Joint Surg Am* 2018;100-A(7):586-597.

Advances on the Knee, Shoulder & Sports Medicine Conference

This three and one-half day course provides presentations on the latest controversies and clinical, surgical, and rehabilitation recommendations for knee, shoulder, hip, and sports medicine problems. Cincinnati SportsMedicine has long recognized the collaborative efforts of orthopaedists, physical therapists, athletic trainers and many other health professionals to successfully diagnose and treat musculoskeletal problems.



In 1986, in conjunction with the American Academy of Orthopaedic Surgeons, Cincinnati SportsMedicine Research & Education Foundation co-sponsored a continuing medical education program for orthopaedic medical specialists with the emphasis on the diagnosis and treatment of knee, shoulder, and sports medicine problems. Sponsored by Cincinnati SportsMedicine, this program has evolved into one of the premier continuing education programs in the country, with an internationally recognized guest faculty.

The Annual Advances on the Knee, Shoulder and Sports Medicine Conference is one of the few comprehensive continuing education courses that includes clinical, surgical, and rehabilitation techniques for knee, shoulder, elbow, hip, and

sports medicine pathology. Our internationally recognized, multi-disciplinary faculty share their experiences, research, and clinical outcomes to stimulate medical professionals to rethink their approach to many musculoskeletal challenges.





The 2017 meeting was our 32nd annual Advances on the Knee, Shoulder and Sports Medicine conference. We welcomed over 200 orthopaedic surgeons, physician assistants, physical therapists, physical therapy assistants, and athletic trainers to this conference. In addition to over 200 course participants, we welcomed 11 exhibitors. Course participants enjoyed listening to over 32 hours of presentations, breakouts, and panel discussions on the treatment of disorders of the knee, shoulder, elbow, hip, and sports medicine.

2017 Course Faculty:

Frank R. Noyes, MD
 Sanjeev Bhatia, MD
 Matthew L. Busam, MD
 Samer S. Hasan, MD, PhD
 Thomas N. Lindenfeld, MD
 Stephen J. O'Brien, MD
 Lonnie E. Paulos, MD
 Anthony A. Romeo, MD
 Edward M. Wojtys, MD
 Bradley D. Ashman, MD
 Jeffrey K. Jenks, DO
 Chris Karrasch, MD
 Mathew T. Phillips, MD
 Timothy P. Heckmann, PT, ATC
 George J. Davies, DPT, PT
 Julie Jasontek, PT, MHS
 Russell M. Paine, PT
 Kevin E. Wilk, DPT, PT
 Stephanie L. Smith, MS



Neuromuscular Studies, Sportsmetrics Training Division

The current major goal of the Neuromuscular Studies and Sportsmetrics Training Division is to develop and implement neuromuscular training programs that are effective in both preventing noncontact ACL injuries and improving athletic performance indicators. In addition, we provide WIPP (Warm Up for Injury Prevention and Performance) training to all Mercy Health schools.



We train and educate Mercy Health physical therapists and athletic trainers in order to provide the program in rehab and at the schools. The formal Sportsmetrics program, used as end-stage rehabilitation after ACL reconstruction, is evaluated for its effectiveness in reducing the high incidence of re-injury as athletes return to high-risk sports such as soccer and basketball. The targeted groups for training are high school female athletes involved in a variety of sports such as soccer, basketball, volleyball, and lacrosse.

Personnel: Stephanie Smith, Thomas Campbell, Sue Barber-Westin, Daniel Clifford

Current Studies

1. Effect of Sportsmetrics Training After ACL Reconstruction in Preventing Re-Injuries Upon Return to Sport.
2. Effect of Sportsmetrics Training in Local Female High School Athletes in Preventing Noncontact ACL Injuries.
3. Effect of an Advanced Sportsmetrics Training Program in Local Female High School Athletes in Preventing Noncontact ACL Injuries and Improving Sports Performance.

Number of Athletes Trained

- 3,657 athletes trained in the Cincinnati area since 2001 with overall significant improvements in neuromuscular indices, strength and conditioning levels.
- >250 athletes in 2017

Sportsmetrics Certification Program

Our Sportsmetrics certification program allows physical therapists, athletic trainers, and other healthcare professionals the opportunity to be part of the largest injury prevention program in the country. Our certified instructors use the scientifically-proven Sportsmetrics program as part of their rehabilitation program or in a group training scenario with high school and college athletes. Since 2002, we have certified over 2,100 individuals from 1,250 sites. We have certified trainers in all 50 states and 11 countries.

In 2017, 172 individuals from 50 sites were certified to offer the Sportsmetrics program in their communities. Certifications

were held in

Cincinnati,
OH; Kansas

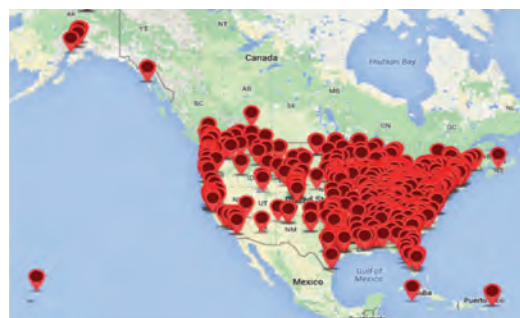
City, MO;

Laramie, WY;

Boise, ID and

Hilton Head

Island, SC.





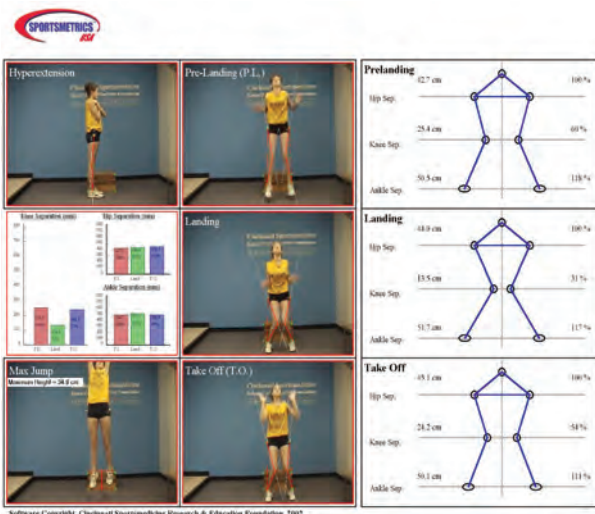
International Sites

Austria, Australia, Brazil, Canada, Finland, Iceland, United Kingdom, Japan, Qatar, The Netherlands, Singapore



On-Site Host Sites since 2002 and number certified

1. Premier Bone & Joint Centers (16): Laramie, WY
2. SERC Physical Therapy (21): Kansas City, MO
3. Dayton Children's Hospital (18): Dayton, OH
4. University of Louisiana- Lafayette (10): Lafayette, LA
5. Emeryville Sports Physical Therapy (10): Emeryville, CA
6. Therapeutic Associates (46): Portland, OR
7. Carolinas Rehabilitation (34): Charlotte, NC
8. Community Rehab (17): Fremont, NE
9. McLeod Sports Medicine (25): Florence, SC
10. Ivy Rehab (23): Hoboken, NJ
11. Victory Sports Medicine (20): Skaneateles, NY
12. North Dakota State University (12): Fargo, ND
13. Apex Physical Therapy (10): San Mateo, CA
14. Georgia Sports Medicine (21): Atlanta, GA
15. The Jackson Clinics (30): Reston, VA
16. Hurley SportsCare (13): Flint, MI
17. SportsCare Memorial Medical Center (32): Springfield, IL
18. Physiotherapy Associates (18): Denver, CO
19. Physiotherapy Associates (15): Dover, DE
20. Northern Michigan Sports Medicine Center (16): Indian River, MI
21. Kitsap Physical Therapy & Sports Clinics (14): Silverdale, WA
22. St. Alphonsus Sports Medicine (20): Boise, ID



Sports Medicine Fellowship Program



The fellowship program at Cincinnati SportsMedicine and Orthopaedic Center - Mercy Health is nationally acclaimed as one of the finest post-residency, sports medicine specialty training experiences. Fellows who train at our Center receive extensive experience in surgery, clinic, academics, and research. The training is accomplished through busy surgical and clinical practices, bio skills laboratories, rehabilitation exposure, on-the-field team coverage, formal weekly teaching conferences, monthly journal clubs, and research projects. The highly structured program includes didactic lectures on sports medicine, indications and complications, rehabilitation, anatomy, and biomechanics. All of the physicians at Cincinnati SportsMedicine & Orthopaedic Center are very dedicated to the educational program and the fellows every year express their gratitude for the surgical and clinical experience. The rehabilitation and athletic trainer faculty, are as well, dedicated to the program and provide a unique educational experience.

Personnel: Frank R. Noyes, Fellowship Director, Cassie Fleckenstein, Teresa Wood

Studies Completed

1. Anterolateral Ligament and Iliotibial Band Control of Rotational Stability in the ACL-Intact Knee: Defined by Tibiofemoral Compartment Translations and Rotations.
2. Rotational Knee Instability in ACL-Deficient Knees: Role of the Anterolateral Ligament and Iliotibial Band as Defined by Tibiofemoral Compartment Translations and Rotations.
3. Is and Anterolateral Ligament Reconstruction Required in ACL-Reconstructed Knees with Associated Injury to the Anterolateral Structures? A Robotic Analysis of Rotational Knee Stability.
4. Results of prosthetic shoulder arthroplasty in patients under age 40.

Manuscripts Under Review/In Press

1. The Effect of an ACL Reconstruction in Controlling Rotational Knee Stability in Knees with Intact and Physiologically Lax Secondary Restraints as Defined by Tibiofemoral Compartment Translations and Graft Forces.

Current Studies

1. Comparison of iliotibial band tenodesis to an anterolateral ligament reconstruction in ACL-intact and ACL-reconstructed knees.
2. Ability of an STG ACL reconstruction using the Arthrex TightRope device to restore rotational knee stability.
3. Determination of the preconditioning protocol required at time-of-surgery to produce a sufficiently pre-tensioned, steady-state graft that will not undergo detrimental elongation following implantation. This will be evaluated in both STG and B-PT-B grafts.
4. Blood flow restriction training for severe muscle atrophy following knee injury and surgery.
5. Massive Rotator Cuff Tear Augmentation
6. Distribution of Shoulder Replacements Among Surgeons and Hospitals

The fellowship program continues to be enriched with Dr. Marc Galloway as the Cincinnati Bengals team physician. Accompanied by the athletic coverage at local high schools, our fellowship provides for a robust sports medicine experience.



University of Cincinnati Department of Biomedical Engineering

Collaboration with the University of Cincinnati Department of Biomedical Engineering continued into its 42nd year. This department was co-founded in 1975 by Drs. Frank R. Noyes and Edward S. Grood as one of the first bioengineering departments in the United States. The collaborative efforts of engineers and orthopaedic surgeons has resulted in the highest honors and awards in orthopaedic research including awards from the Orthopaedic Research and Education Foundation (OREF), American Academy of Orthopaedic Surgeons (AAOS), American Orthopaedic Society for Sports Medicine (AOSSM), and the Orthopaedic Research Society (ORS).



In 2016, the Dean of the College of Engineering announced the formation of a Department of Biomedical Engineering with a new Director and added financial resources for additional programs and faculty. We are pleased to have been asked to participate in this exciting new Department process which

will advance the ability of our Foundation's staff to enter into new and highly innovative ground breaking research. These programs have a translational application to the treatment of Orthopaedic and Sports Medicine disorders.

Presented at the annual meeting of the American Academy of Orthopaedic Surgeons

Patellofemoral Arthroplasty in Younger Patients: Are Recreational Activities Feasible?

Frank Noyes, MD, Sue Barber-Westin, BS, Cassie Fleckenstein, MS, Jennifer Riccobene, BS

Study conducted at the Cincinnati SportsMedicine and Orthopaedic Center-Mercy Health and the Noyes Knee Institute, Cincinnati, Ohio. This study received funding from Stryker, the Jewish Hospital, and the Noyes Knee Institute. Clinical trials gov ID #: NCT0273846.

BACKGROUND

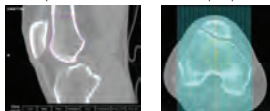
Treatment of isolated severe patellofemoral osteoarthritis in younger active patients is challenging

Patellofemoral arthroplasty (PFA) is a viable option for symptomatic patients in whom severe joint damage and loss of joint space is isolated to the patellofemoral compartment

PFA indications

- Painful patellofemoral arthritis
- Chronic joint dislocation or subluxation
- Trochlear dysplasia
- Trauma

Few studies have determined if patients who undergo PFA can return to recreational sports and work activities without subsequent problems.



STUDY PURPOSE

Prospective investigation on early results of 33 consecutive third-generation PFA procedures. Determine sports and work activity levels in younger active patients.

METHODS

33 Consecutive PFAs in 29 patients (4 bilateral)
Mean age 40 (range, 22-68); 26 patients < 50 yrs

96 Prior Operative Procedures (27 knees)

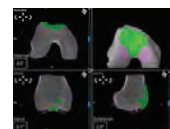
- 16 PF realignment (10 knees)
- 9 articular cartilage restorative procedures (7 knees)

Indications

- DJD: 18 knees
- Osteoarthritis secondary to malalignment: 11 knees
- Osteoarthritis secondary to trauma: 4 knees

PFA Procedure

- Cemented implant (RESTORIS MCK PF Implant System, Stryker)
- 3-D modeling, computer-assisted robotic surgical navigation (RIO, MAKOplasty Partial Knee Resurfacing, Stryker).



Preoperative planning

Allows precise reshaping of abnormal trochlea geometry with minimal bone resection

METHODS (Continued)

Concurrent Procedures
5 PF realignment 11 Z-plasty lateral release

Comorbidities 13 patients

- 6 Obesity, 2 tobacco, 2 diabetes, 1 obesity & tobacco, 1 Ehlers-Danlos syndrome, 1 tobacco & deficiency anemia

Comprehensive clinical evaluation, Cincinnati Knee Rating System, IKDC objective rating

Radiographs (standing AP, lateral, weight-bearing PA, PF axial)
- Trochlear dysplasia (Dejour) - Patellar height (Lindau)
- Kellgren-Lawrence and IKDC (medial & lateral tibiofemoral)

RESULTS

31 knees (mean age 40; 22-68)
followed mean 4 years (range, 2-7 yrs) postop
Cincinnati Knee Rating System
SYMPTOMS, FUNCTION

FACTOR	POINTS	PREOP (no.)	F.U. (no.)	P
Pain*	0-10	1.9 ± 0.9	5.6 ± 1.5	<0.0001
Swelling	0-10	2.7 ± 1.5	5.5 ± 1.9	<0.0001
Patient perception	1-10	3.0 ± 1.2	7.8 ± 2.1	<0.0001
Walking	0-40	26 ± 8	39 ± 3	<0.0001
Stair-climbing	0-40	9 ± 12	34 ± 8	<0.0001
Squatting, kneeling	0-40	4 ± 8	19 ± 15	<0.0001

*2/31 (6%) pain ADL

SPORTS Before and After PFA

TYPE OF SPORT	FREQUENCY	PREOP (no.)	FU (no.)
Low impact (swimming, cycling, aerobics)	1-3 days/mo 1-3 days/wk 4-7 days/wk	0 3 3	5 10 11
High-impact (jumping, pivoting, cutting)	1-3 days/wk	1	1
Not participating in any sports		24	4

Change in sports activity level at follow-up

Increased, no knee problems	20
Same, no knee problems	4
Playing with knee symptoms	3
Did not return because of knee condition	3
Did not return non-knee related reasons	1

*All were participating with symptoms and functional limitations.

No effect outcomes

- Concomitant patellofemoral realignment procedure
- Pre-existing comorbidity

No symptomatic subluxations or dislocations

RESULTS (Continued)

OCCUPATIONS Before and After PFA

WORK LEVEL	PREOP* (no.)	FU (no.)
Very light - light	10	15
Moderate - heavy	5	2
Disabled due to knee condition	8	3
Not working due to reasons not related to knee condition	8	11

*All patients except one who were working had knee-related symptoms and/or functional limitations.

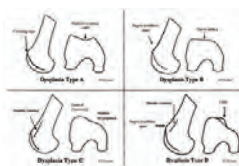
Change in occupational level at follow-up

Increased, no knee problems	5
Same, no knee problems	10
Decreased, no knee problems	1
Working with knee symptoms	1

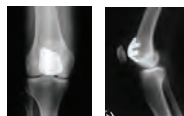
Conclusion: high 85% return to work activities in employed subgroup

RADIOGRAPHIC FINDINGS

Preop Patella Alta - 3 knees, Intra - 2 knees
Dejour: A - 19 knees, B - 7 knees, C - 5 knees
39% severe dysplasia (B, C)



Follow-up Normal position PFA prosthesis all knees
IKDC rated A-B and K-L rated 0-1 in 97% knees
Patella Alta - 2 knees, Intra - 3 knees



SUBSEQUENT OPERATIVE PROCEDURES

- 2 TKA
- 1 MPFL recon
- 1 Lateral unicorondylar replacement
- 3 Arthroscopic scar tissue releases

COMPLICATIONS - FAILURES

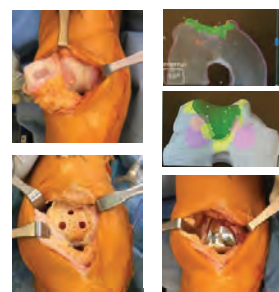
- 1 Infection
- 2/33 (6%) conversion TKA

DISCUSSION

1. High patient perception rating: mean 3.1 pre, 7.6 post (1-10 scale)
2. High participation light sports: pre 22%, post 87%
3. High return work employed subgroup: 85%
4. CRPS preoperative in 6 (18%)
Treat before PFA, recognize return CRPS symptoms postop, knee symptoms improve with PFA
5. Articular cartilage restoration failed, requiring PFA
7 (21%) knees, mean age 32.7 (23-47)
6/7 improved, returned light sports/work; 1 CRPS symptoms f.u.

Operative Procedure Advantages:

- Trochlear dysplasia corrected via PFA implant
- No tibial tubercle correction required for patella alta
- Correct soft tissue (MPFL) deficiency when required
- PF malalignment, z-plasty lateral release commonly required



Potential future problem:

- Knee flexion > 90 deg, patella prosthesis contacts femoral condyles, may produce alterations in cartilage
- Avoid high knee flexion activities postoperatively

CONCLUSIONS

- Robotic PFA is a successful treatment option younger active patients isolated PF arthritis
- Allows return to low-impact recreational activities and occupations in the majority

REFERENCES

Noyes FR, Barber-Westin SD. Unicompartmental patellofemoral replacement. In Noyes' Knee Disorders: Surgery, Rehabilitation, Clinical Outcomes, 2nd Ed, Elsevier, pp. 1036-1057, 2017.

Presented at the annual meeting of the American Academy of Orthopaedic Surgeons

Which Anterior Cruciate Ligament Prevention Programs Are Effective in Decreasing Injury Rates and Improving Neuromuscular Indices in Female Athletes?

Frank R. Noyes, MD, Sue Barber-Westin, BS, Stephanie Smith, MS

Investigation performed at the Noyes Knee Institute and Cincinnati Sportsmedicine & Orthopaedic Center-Mercy Health. Funding received from the Noyes Knee Institute.

BACKGROUND

2/3 ACL tears noncontact (cutting, pivoting, accelerating, decelerating, landing from a jump)

ACL reconstruction does not always restore normal knee kinematics

After reconstruction, 5-30% will tear either ACL graft or contralateral ACL upon return to sports activities

Female athletes 4-10 times increased risk noncontact ACL injuries compared with males in sports and military training

Only a few ACL prevention training programs have significantly decreased noncontact injury rates in female athletes when athlete-exposures were used to calculate injury rates

The ability of prevention programs to change dangerous movement patterns, improve muscle strength, reduce muscular imbalances, decrease landing forces is paramount to reduce noncontact injuries



STUDY PURPOSE AND OBJECTIVE

- (1) Identify ACL prevention training programs that significantly improved neuromuscular factors believed to increase risk ACL injury
- (2) Determine if any of these training programs also significantly decreased noncontact ACL injury rates in female athletes.

METHODS

Systematic Search PubMed, Cochrane, Google Search engine Jan 1995 - May 2017

PRISMA guidelines, studies rated MINORS or PEDro scales

Inclusion Criteria Purpose #1 (1) all levels of evidence, (2) original studies females aged ≥ 12 , (3) English, (4) studies that trained female athletes to improve neuromuscular risk factors, (5) data on ground reaction forces, kinematic/kinetic factors, muscle strength/activation patterns after ACL intervention training.

Inclusion Criteria Purpose #2 (1) same as #1-3 above, (2) ACL noncontact injury rates in female athletes calculated by athlete-exposures.

METHODS (Continued)

Exclusionary Criteria Purpose #1 (1) male subjects, (2) data males & females combined, (3) children <12 years, (4) studies on effects of a single training session, and (5) studies in female athletes who did not undergo training.

Exclusionary Criteria Purpose #2 (1) same as #1-3 above (2) data contact & noncontact ACL injuries combined, (3) athlete-exposures not used in calculations.

RESULTS

Study Purpose #1: Change Neuromuscular Indices

52 studies, 36 different ACL intervention programs

1,060 female athletes trained

6 programs replaced traditional team warm-up; remaining programs used separate training sessions

Direct supervision of training in 40 of 52 investigations



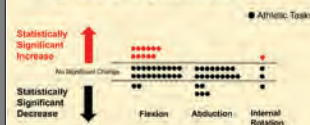
VERTICAL GROUND REACTION FORCES

- No consistent effect of training
- 5 studies significant reductions, 5 studies no change

KNEE JOINT ANGLES

- No consistent findings flexion drop-jump, tuck jump, vertical jump
- No significant increase flexion cutting, single-leg squatting, side-stepping
- Abduction relatively unchanged

Effects of Training on Knee Joint Angles



RESULTS (Continued)

HIP AND KNEE MOMENTS

Knee abduction & flexion - no change most studies
Hip abduction & flexion - relatively unchanged

HAMSTRINGS, QUADRICEPS MUSCLE STRENGTH

15 studies, varying results

Effects of Training on Muscle Strength



Conclusion Purpose #1

3 programs significant impact in improving multiple neuromuscular indices: Sportsmetrics, PEP, and Myer



Study Purpose #2: ACL Injury Reduction

- 16 studies excluded
- 7 no significant reduction noncontact ACL injury rates
- 6 combined contact & noncontact injury rates
- 3 no athlete-exposure data
- 4 studies included (3 programs)

ACL Noncontact Injury Rates Control vs Trained Athletes*

Program	IR Controls	IR Trained	P
Sportsmetrics	0.21	0.03	0.03
PEP	0.49	0.09	< 0.001
KIPP	0.48	0.10	0.04

*per 1000 athlete-exposures; IR injury rate

Conclusion Purpose #2: Only 3 programs effective

DISCUSSION

Over 35 ACL intervention programs published to date

Only 2 (Sportsmetrics, PEP) have significantly impacted both the noncontact ACL injury rate and dangerous neuromuscular movement patterns in female athletes.

Failure other studies may be caused by:

- Short training sessions (10 mins)
- Unsupervised training
- Poor compliance
- No increase in challenge of exercises
- Failure to include plyometrics with body positioning instruction
- Lack of comprehensive strength training



FINAL CONCLUSION

Only 2 programs (Sportsmetrics and PEP) had a significant impact in improving multiple neuromuscular indices and in significantly reducing noncontact ACL injury rates in female athletes.

Successful training concepts:

- Dynamic warm-up
- Supervised plyometrics
- Strength training hamstrings/hip/core/trunk
- Supervised agility training for cutting and pivoting motions
- Minimum 6 weeks of training required

REFERENCES

- Labella CR et al. Effect of Neuromuscular Warm-up on Injuries in Female Soccer and Basketball Athletes in Urban Public High Schools: Cluster Randomized Controlled Trial. *Arch Pediatr Adolesc Med*. 2011;165(11):1033-1040.
- Noyes FR, Barber-Westin SD. Neuromuscular retraining intervention programs: do they reduce noncontact anterior cruciate ligament injury rates in adolescent female athletes? *Arthroscopy*. 2014;30(2):245-255.
- Noyes FR, Barber-Westin SD. ACL injury prevention training in female athletes. A systematic review of injury reduction and results of athletic performance tests. *Sports Health*. 4: 36-46, 2012.
- Mandelbaum BR et al. Effectiveness of a neuromuscular and proprioceptive training program in preventing anterior cruciate ligament injuries in female athletes: 2-year follow-up. *Am J Sports Med*. 2005;33(7):1003-1010.

Event Photos



Event Photos





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