



Letter to the Editor

The modern-day ACL surgeon's armamentarium should include multiple surgical approaches including primary repair, augmentation, and reconstruction: A letter to the Editor



ARTICLE INFO

Keywords

ACL
 ACL reconstruction
 ACL repair
 ACL augmentation
 ACL treatment options

We would like to thank the authors for their highly valuable publication [1] and commend them for conducting the largest ACL survey performed to date, including over 2000 ISAKOS sport surgeons. The study illuminates current trends in ACL reconstruction (ACLR) surgery and highlights the variation in techniques used depending on a surgeon's location and expertise [1].

Hereby, we would like to provide our critique on both the chosen title and methods used. We strongly believe that the “benchmark” in today's ACL surgery is not solely represented by ACLR, but rather by a patient-individualized decision process that considers the complete, modern-day ACL surgery toolkit (e.g. primary repair, augmentation, and reconstruction).

The authors of this letter are aware of the ongoing reluctance toward ACL primary repair (ACLPR) within today's orthopedic sports medicine and trauma community. ACLPR had been abandoned after historical open ACL repair techniques were reported to have high failure and complication rates at mid-term follow-up [2,3,4]. Over the past decade, there has been a resurgence of interest in modern-day ACL primary repair as new arthroscopic techniques, rehabilitation protocols [5,6], and an appropriate patient selection algorithm based on tear type and tissue quality have been adopted [7,8]. With this in mind, historic outcomes using obsolete techniques and rehabilitation protocols [2,3,4] should not be confused with results using state-of-the-art techniques on an evidence-based selected patient cohort, as these techniques show acceptable and comparable failure rates at early and mid-term follow-up as compared to ACLR [9,10,7,11,12,13–18].

Even if recent randomized-controlled trials reported good short- and mid-term results of ACL primary repair compared to ACLR, it has to be highlighted that until now, high-quality long-term evidence for ACL primary repair is still limited given its recent resurgence [19,5,11,12,20]. However, non-negatable functional outcome parameters considering the success of a surgical procedure must be considered: rehabilitation following primary ACL primary repair has been shown to be faster and less painful [13], given the repair's minimally invasive nature and no graft harvesting. Furthermore, it provides greater and earlier return of full range of motion (ROM) [21,13], and at short and mid-term

follow-up, excellent patient-reported outcomes (PROMs) have been reported [19,11,12,20,13,14,16,17,18].

The authors presented several clinical scenarios with varied age and sports participation. We suggest that tear location and timing of injury are also critically important. With these factors considered, a preservation-first approach [8] might be indicated. The survey, as presented, queried surgeons about graft choices as if ACLR would be the only valid treatment option. Again, we strongly believe that this is an antiquated approach.

Considering the positive functional outcomes [9,19,22,11,12,20,21,13–18] and failure rates [9,19,10,7,11,12,20,13–18], it must be emphasized that selective arthroscopic ACL primary repair is a reasonable treatment approach for ACL tears in appropriately selected patients [8]. Lastly, considering ACL re-rupture, few bridges are burned performing primary ACL primary repair; thus, revision surgery is less complicated than after failed reconstruction [23].

We want to thank the authors again for their valuable contribution and want to emphasize that this letter should not be perceived as an argument regarding “ACL primary repair vs. reconstruction”. Based on the current literature and the authors' collective professional experience, we opine that the modern-day ACL surgeon's toolbox is not limited to ACLR alone, but equipped with a multifaceted armamentarium of procedures. We strongly recommend that future benchmark surveys include a more complete representation of the surgical (primary repair, augmentation, and reconstruction) and non-surgical options to treat the ACL-injured patient.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

Gregory S. DiFelice reports a relationship with Arthrex Inc that includes royalties and consulting.

Adnan Saithna reports a relationship with Arthrex Inc that includes consulting or advisory; and is a ISAKOS Committee member.

Clemens Koesters reports a relationship with Mathys AG Bettlach that includes consulting or advisory.

<https://doi.org/10.1016/j.jisako.2023.03.434>

Received 18 November 2022; Accepted 28 March 2023

Available online 5 April 2023

2059-7754/© 2023 The Authors. Published by Elsevier Inc. on behalf of International Society of Arthroscopy, Knee Surgery and Orthopedic Sports Medicine. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Edoardo Monaco reports a relationship with Arthrex Inc and Amplitude that includes consulting.

Etienne Cavaignac reports a relationship with Arthrex Inc that includes consulting or advisory.

Rachel M. Frank reports a relationship with Arthrex Inc that includes consulting; and with Elsevier: Publishing royalties, financial or material support.

Bertrand Sonnery-Cottet reports a relationship with Arthrex Inc that includes royalties and consulting.

Georg Brandl reports a relationship with Arthrex Inc that includes consulting or advisory.

Patrick A. Smith reports a relationship with Arthrex Inc that includes consulting, research grants, royalties, and intellectual property.

Gordon Mackay reports a relationship with Arthrex Inc that includes consulting and royalties (InternalBrace™).

Clemens Kösters reports a relationship with Mathys Medical that includes medical advisor.

Adnan Saithna reports a relationship with Arthrex Inc that includes consulting; and further: AANA Committee, OJSM Editorial Board, ISA-KOS Committee.

Wolf Petersen, reports a relationship with Karl Storz that includes consultancy fees; OPED: Consultancy fees; Arthrex: Lecture fees; Plasmoconcept: Lecture fees.

Stefan Eggli, reports a relationship with Mathys Orthopedic LTD that includes consulting.

References

- Tuca M, Valderrama I, Eriksson K, Tapasvi S. Current trends in ACL surgery. A worldwide benchmark study. *J ISAKOS* 2022. <https://doi.org/10.1016/j.jisako.2022.08.009>.
- Engelbretsen L, Benum P, Fasting O, Molster A, Strand T. A prospective, randomized study of three surgical techniques for treatment of acute ruptures of the anterior cruciate ligament. *Am J Sports Med* 1990;18:585–90. <https://doi.org/10.1177/036354659001800605>.
- Feagin Jr JA, Curl WW. Isolated tear of the anterior cruciate ligament: 5-year follow-up study. *Am J Sports Med* 1976;4:95–100. <https://doi.org/10.1177/036354657600400301>.
- Odensten M, Lysholm J, Gillquist J. Suture of fresh ruptures of the anterior cruciate ligament. A 5-year follow-up. *Acta Orthop Scand* 1984;55:270–2. <https://doi.org/10.3109/17453678408992354>.
- Hoogslag RAG, Brouwer RW, de Vries AJ, Boer BC, Huis In 't Veld R. Efficacy of nonaugmented, static augmented, and dynamic augmented suture repair of the ruptured anterior cruciate ligament: a systematic review of the literature. *Am J Sports Med* 2020;48:3626–37. <https://doi.org/10.1177/0363546520904690>.
- Li J, Rothrauff B, Chen S, Zhao S, Wu Z, Chen Q, et al. Trends in anterior cruciate ligament repair: a bibliometric and visualized analysis. *Orthopaedic Journal of Sports Medicine* 2022. <https://doi.org/10.1177/23259671221132564>.
- Hopper GP, Aithie JMS, Jenkins JM, Wilson WT, Mackay GM. Combined anterior cruciate ligament repair and anterolateral ligament internal brace augmentation: minimum 2-year patient-reported outcome measures. *Orthop J Sports Med* 2020;8:2325967120968557. <https://doi.org/10.1177/2325967120968557>.
- van der List JP, DiFelice GS. Preservation of the anterior cruciate ligament: a treatment algorithm based on tear location and tissue quality. *Am J Orthop (Belle Mead NJ)* 2016;45:E393–405. PMID: 28005092.
- Ferreira A, Saithna A, Carrozzo A, Guy S, Vieira TD, Barth J, et al. The minimal clinically important difference, patient acceptable symptom state, and clinical outcomes of anterior cruciate ligament repair versus reconstruction: a matched-pair analysis from the SANTI study group. *Am J Sports Med* 2022. <https://doi.org/10.1177/03635465221126171>.
- Heusdens CHW, Hopper GP, Dossche L, Roelant E, Mackay GM. Anterior cruciate ligament repair with Independent Suture Tape Reinforcement: a case series with 2-year follow-up. *Knee Surg Sports Traumatol Arthrosc* 2019;27:60–7. <https://doi.org/10.1007/s00167-018-5239-1>.
- Hoogslag RAG, Huis In 't Veld R, Brouwer RW, de Graaff F, Verdonschot N. Acute anterior cruciate ligament rupture: repair or reconstruction? Five-year results of a randomized controlled clinical trial. *Am J Sports Med* 2022;50:1779–87. <https://doi.org/10.1177/03635465221090527>.
- Jonkergouw A, van der List JP, DiFelice GS. Arthroscopic primary repair of proximal anterior cruciate ligament tears: outcomes of the first 56 consecutive patients and the role of additional internal bracing. *Knee Surg. Sports Traumatol Arthrosc* 2019;27:21–8. <https://doi.org/10.1007/s00167-018-5338-z>.
- Vermeijden HD, Monaco E, Marzilli F, Yang XA, van der List JP, Ferretti A, et al. Primary repair versus reconstruction in patients with bilateral anterior cruciate ligament injuries: what do patients prefer? *Adv Orthop* 2022;2022:3558311. <https://doi.org/10.1155/2022/3558311>.
- Vermeijden HD, van der List JP, Benner JL, Rademakers MV, Kerkhoffs G, DiFelice GS. Primary repair with suture augmentation for proximal anterior cruciate ligament tears: a systematic review with meta-analysis. *Knee* 2022;38:19–29. <https://doi.org/10.1016/j.knee.2022.07.001>.
- Vermeijden HD, van der List JP, DiFelice GS. Acute and delayed anterior cruciate ligament repair results in similar short to mid-term outcomes. *Knee* 2021;29:142–9. <https://doi.org/10.1016/j.knee.2021.01.028>.
- Vermeijden HD, Yang XA, van der List JP, DiFelice GS. Role of age on success of arthroscopic primary repair of proximal anterior cruciate ligament tears. *Arthroscopy* 2021;37:1194–201. <https://doi.org/10.1016/j.arthro.2020.11.024>.
- Wilson WT, Hopper GP, Banger MS, Blyth MJG, Riches PE, MacKay GM. Anterior cruciate ligament repair with internal brace augmentation: a systematic review. *Knee* 2022;35:192–200. <https://doi.org/10.1016/j.knee.2022.03.009>.
- Schneider KN, Ahlbaumer G, Gosheger G, Theil C, Weller J, Goth A. Promising functional outcomes following anterior cruciate ligament repair with suture augmentation. *Knee Surg Sports Traumatol Arthrosc* 2022 Nov 29. <https://doi.org/10.1007/s00167-022-07236-4>. epub ahead of print.
- Glasbrenner J, Raschke MJ, Kittl C, Herbst E, Peez C, Briesse T, et al. Comparable instrumented knee joint laxity and patient-reported outcomes after ACL repair with dynamic intraligamentary stabilization or ACL reconstruction: 5-year results of a randomized controlled trial. *Am J Sports Med* 2022;50:3256–64. <https://doi.org/10.1177/03635465221117777>.
- Kosters C, Glasbrenner J, Spickermann L, Kittl C, Domnick C, Herbort M, et al. Repair with dynamic intraligamentary stabilization versus primary reconstruction of acute anterior cruciate ligament tears: 2-year results from a prospective randomized study. *Am J Sports Med* 2020;48:1108–16. <https://doi.org/10.1177/0363546520905863>.
- van der List JP, DiFelice GS. Range of motion and complications following primary repair versus reconstruction of the anterior cruciate ligament. *Knee* 2017;24:798–807. <https://doi.org/10.1016/j.knee.2017.04.007>.
- Ferretti A, Monaco E, Annibaldi A, Carrozzo A, Bruschi M, Argento G, et al. The healing potential of an acutely repaired ACL: a sequential MRI study. *J Orthop Traumatol* 2020;21:14. <https://doi.org/10.1186/s10195-020-00553-9>.
- van der List JP, Vermeijden HD, O'Brien R, DiFelice GS. Anterior cruciate ligament reconstruction following failed primary repair: surgical technique and a report of three cases. *Minerva Ortop Traumatol* 2019;70(2):70–7. <https://doi.org/10.23736/S0394-3410.19.03924-9>.

Sebastian Rilke*

Department of Orthopaedic Surgery, Hospital for Special Surgery, New York-Presbyterian, Weill Medical College of Cornell University, New York, NY, 10021, USA
Medical University of Vienna, Vienna, 1090, Austria

Adnan Saithna

AZBSC Orthopedics, Scottsdale, Arizona, 85255, USA
School of Science & Technology, Nottingham Trent University, Clifton Campus, Nottingham, UK

Andrea Achtnich

Department of Orthopedic Sports Medicine, Klinikum Rechts der Isar, TU Technische Universität Munich, Munich, 81675, Germany

Andrea Ferretti

Institute of Sports Medicine and Science, Italian National Olympic Committee, Rome, 00197, Italy

Bertrand Sonnery-Cottet

Centre Orthopédique Santy, FIFA Medical Centre of Excellence, Groupe Ramsay-Generale de Sante, Hôpital Privé Jean Mermoz, Lyon, 69008, France

Clemens Kösters

Department of Orthopaedic, Hand- and Trauma Surgery, Maria-Josef-Hospital Greven, Greven, 48268, Germany

Craig R. Bottoni

Department of Orthopaedics, Tripler Army Medical Center, Honolulu, Hawaii, 96859, USA

Edoardo Monaco

Orthopaedic Unit and Kirk Kilgour Sports Injury Center, Sant'Andrea University Hospital, "Sapienza" University of Rome, Rome, 00185, Italy

Etienne Cavaignac

Department of Orthopedic Surgery and Trauma, Pierre-Paul Riquet Hospital, Toulouse, 31300, France

- Georg Ahlbaeumer
Center for Bone and Joint Surgery, Klinik Gut St Moritz, St Moritz, 7500,
Switzerland
- Georg Brandl
Department of Orthopedic Surgery, St. Vincent Shoulder & Sports Clinic,
Vienna, 1030, Austria
- Gordon M. Mackay
Faculty of Health Sciences and Sport, University of Stirling, Stirling, Scotland,
UK
- Harmen D. Vermeijden
Department of Orthopaedic Surgery, Hospital for Special Surgery, NewYork-
Presbyterian, Weill Medical College of Cornell University, New York, NY,
10021, USA
Amsterdam UMC, University of Amsterdam, Department of Orthopaedic
Surgery, Amsterdam, 1081, the Netherlands
- Ignacio Dallo
SportMe Medical Center, Seville, 41013, Spain
- J. Lee Pace
Children's Health Andrews Institute Plano, TX, 75024, USA
- Jelle P. van der List
Department of Orthopaedic Surgery, Hospital for Special Surgery, NewYork-
Presbyterian, Weill Medical College of Cornell University, New York, NY,
10021, USA
Amsterdam UMC, University of Amsterdam, Department of Orthopaedic
Surgery, Amsterdam, 1081, the Netherlands
- Jesús Rey Moggia
Servicio de Ortopedia y Traumatología, Hospital "General San Martín", La
Plata, Argentina
Unidad de Artroscopía y Traumatología Deportiva, Clínica CROMA y
Sanatorio IPENSA, La Plata, Argentina
- Jorge Chahla
Midwest Orthopaedics at Rush, Chicago, IL, 60612, USA
- Jorge Pablo Batista
Boca Juniors Athletic Club Director, Football Medical Department, Brandsen,
CABA, Buenos Aires, Argentina
- Karl H. Frosch
Department of Trauma and Orthopaedic Surgery, University Medical Center
Hamburg-Eppendorf, Hamburg, 20251, Germany
- Kristian N. Schneider
Center for Bone and Joint Surgery, Klinik Gut St Moritz, St Moritz, 7500,
Switzerland
Department of Orthopaedics and Tumor Orthopaedics, University Hospital of
Münster, Münster, 48149, Germany
- Patrick A. Smith
Columbia Orthopaedic Group, Columbia, MO, 65201, USA
Department of Orthopaedic Surgery, University of Missouri, Columbia, MO,
65201, USA
- Rachel M. Frank
Department of Orthopaedic Surgery, University of Colorado School of
Medicine, Aurora, Colorado, 80045, USA
- Roy A.G. Hoogslag
Centre for Orthopaedic Surgery and Sports Medicine OCON, Hengelo, 7555,
the Netherlands
- Stefan Eggli
Department of Orthopaedic Surgery, Sonnenhof Hospital, Bern, 3006,
Switzerland
- Wiemi A. Douguih
Department of Orthopaedic Surgery, MedStar Washington Hospital Center,
Washington, DC, 20010, USA
- Wolf Petersen
Department of Orthopaedic and Trauma Surgery, Martin-Luther-Hospital,
Berlin, 14193, Germany
- Gregory S. DiFelice
Department of Orthopaedic Surgery, Hospital for Special Surgery, NewYork-
Presbyterian, Weill Medical College of Cornell University, New York, NY,
10021, USA

* Corresponding author. Department of Orthopaedic Surgery, Hospital for Special Surgery, NewYork-Presbyterian, Weill Medical College of Cornell University, New York, NY, 10021, USA.
E-mail address: rilks@hss.edu (S. Rilk).