Knee Surgery, Sports Traumatology, Arthroscopy
https://doi.org/10.1007/s00167-019-05807-6

EDITORIAL

ACL injury, physical activity, and overweight/obesity: a vicious cycle?

Fábio Carlos Lucas de Oliveira[1,2] · Jean-Sébastien Roy[3,4] · Evangelos Pappas[5,6]

Received: 21 October 2019 / Accepted: 12 November 2019

Abbreviations

ACL	Anterior cruciate ligament
ACLR	Anterior cruciate ligament reconstruction
FITT	Frequency, intensity, time, and type
MVPA	Moderate-to-vigorous physical activity
PA	Physical activity

Above-normal weight is a worldwide public health problem and an important risk factor for cardiovascular diseases and premature death [1]. Complications generated by overweight/obesity are estimated at $75–$117 billion per annum in the United States [2]. In this context, regular physical activity is fundamental in managing weight and preventing related problems such as cardiovascular diseases [3, 4] and musculoskeletal disorders. Overweight/obesity is an independent risk factor for musculoskeletal injuries, while increased body mass index may be a predisposing factor for anterior cruciate ligament (ACL) injury [5–7]. While current literature has focused on the association between weight and future ACL injury, there has been little emphasis on physical activity and overweight implications after ACL injury.

Even though people who suffer an ACL injury are commonly physically active prior to the injury, the combination of impairments (e.g., pain, joint instability, reduced mobility, limited range of motion, etc.), possible surgery and its associated post-surgical impairments, and fear of re-injury may result in the adoption of sedentary behaviour following the injury. This lifestyle change may affect participation in moderate-to-vigorous physical activity. It is recommended that adults accumulate 150–300 min of moderate physical activity [8] or 75–150 min of vigorous-intensity physical activity per week to prevent excessive weight gain [3]. However, physical activity level considerably diminishes following ACL injury [9] and is associated with unfavourable weight gain and an increase in obesity markers [10]. A reduction in moderate-to-vigorous physical activity of 14 min/day, on average, has been reported more than 6 months after ACL reconstruction (ACLR), with a step count decrease of 1611 steps/day [9]. Although this reduction may seem small, it can further accelerate and lead to an inactive lifestyle in the long term. At present, little is known about the long-term effects of ACL injuries on overweight/obesity [9]. Therefore, there is an urgent need for researchers, funding agencies and eventually policymakers to focus on ACL injury and its association with physical activity level, overweight/obesity, and other health-related problems to improve prevention and address rising healthcare costs.

Although conservative treatment is an option for ACL injury with similar outcomes as ACLR [11], patients who want to continue participating in cutting and pivoting sports frequently choose to have surgery [12]. Current evidence demonstrates that only 55% of individuals return to competitive sport after ACLR, whereas 65% return to their pre-injury level [13] which contrasts with a popular perception that ACLR will "fix the knee" and guarantee an uncomplicated return to sports [14]. However, a large proportion of patients does not return to sports, and, subsequently, become sedentary due to a combination of factors that may include fear of re-injury, continuing instability, and incomplete recovery of strength and mobility [15–17].

✉ Fábio Carlos Lucas de Oliveira
fabio.carlos.lucas.de.oliveira@umontreal.ca

Jean-Sébastien Roy
jean-sebastien.roy@rea.ulaval.ca

Evangelos Pappas
evangelos.pappas@sydney.edu.au

1 School of Rehabilitation, Université de Montréal, Montreal, QC, Canada

2 Pathokinesiology Laboratory, Centre for Interdisciplinary Research in Rehabilitation of Greater Montreal, CIUSSS Centre-Sud-de-L'Île-de-Montréal, Montreal, QC, Canada

3 Centre for Interdisciplinary Research in Rehabilitation and Social Integration,, CIUSSS-CN, Quebec City, QC, Canada

4 Department of Rehabilitation, Faculty of Medicine, Université Laval, Quebec City, QC, Canada

5 Charles Perkins Centre, The University of Sydney, Camperdown, NSW, Australia

6 Discipline of Physiotherapy, Faculty of Health Sciences, The University of Sydney, Lidcombe, NSW, Australia

Published online: 28 November 2019

This is an understandable decision, nevertheless, it may result in poorer quality of life [18–20] and contribute to overweight/obesity in the mid- or long term. Recently, Burns et al. [21] reported a greater percentage of body mass index in the overweight/obese range among ACLR patients compared to the general population.

Thus, it is reasonable to suggest that ACL injury may lead to decreased physical activity and weight gain, initiating a vicious cycle of injury, sedentary lifestyle, weight gain, and increased risk for musculoskeletal problems and/or cardiovascular disease. A longitudinal study demonstrated that individuals who maintained an active sporting life did not gain weight 5 years after ACL injury [22]. Therefore, educating patients after ACL injury on optimal ways to maintain a moderate physical activity level, by participating in knee-safe sports to reduce the risk of re-injury and keep a healthy weight, may be an important yet underutilised intervention. Besides implementing an effective rehabilitation programme based on restoration of strength and functional performance, health professionals should help patients to understand the risks of re-injury when returning to sport and to avoid creating unrealistic expectations about recovery from ACL injury, [14] independent of treatment choice. Patients should be guided to complete a sport-specific rehabilitation program [23] with safe and gradual training load progression [14]. In addition, they should know that alternative activities, such as cycling or swimming, are feasible options to reduce the risk of recurrence instead of avoiding sports altogether. Not rushing to return to sports is an additional important consideration since it can take longer than 9 months to reach an adequate competitive performance level, while some suggest delaying return to sports until 2 years after surgery [24].

Utilising the current knowledge on the possible impact of ACL injury on physical activity levels and weight gains is important for the development of effective treatment and prevention strategies. To further elucidate the extent of the impact of ACL injuries on weight gain and physical activity level, we need long-term prospective studies. Thereby, we appeal for further studies to investigate the impact of ACL injury on physical activity, overweight/obesity, and general health-related problems using the FITT (frequency, intensity, time, and type) principle to quantify physical activity. There is an urgency for funding bodies and researchers on the investigation of ACL injuries as a potential trigger of overweight/obesity and their devastating consequences.

Author contributions FCLO drafted and wrote the manuscript. JSR contributed substantially to the conception and writing. EP conceived the idea, designed and conceptualised the paper. All authors provided critical revision of the manuscript for important intellectual content and provided detailed suggestions for revisions. All authors approved the final version of this document.

Funding FCLO receives a postdoctoral fellowship from the Fonds de recherche de Québec-Santé (FRQS) (Grant No. 261781). JSR is supported by salary awards from the Canadian Institutes of Health Research (CIHR). No specific grant for this study from any funding agency in the public, commercial or not-for-profit sectors.

Compliance with ethical standards

Conflict of interest The authors have no conflict of interests to declare.

Ethical approval This article does not contain any studies with human participants performed by any of the authors.

References

1. Chenoweth D, Leutzinger J (2006) The economic cost of physical inactivity and excess weight in american adults. J Phys Act Health 3:148–163
2. Colditz GA (1999) Economic costs of obesity and inactivity. Med Sci Sports Exerc 31:S663–S667
3. World Health Organization (2014) Global status report on noncommunicable diseases 2014. WHO, Geneva
4. Warburton DE, Nicol CW, Bredin SS (2006) Health benefits of physical activity: the evidence. CMAJ 174:801–809
5. Bojicic KM, Beaulieu ML, Imaizumi Krieger DY, Ashton-Miller JA, Wojtys EM (2017) Association between lateral posterior tibial slope, body mass index, and ACL injury risk. Orthop J Sports Med 5:2325967116688664
6. Evans KN, Kilcoyne KG, Dickens JF, Rue JP, Giuliani J, Gwinn D, Wilckens JH (2012) Predisposing risk factors for non-contact ACL injuries in military subjects. Knee Surg Sports Traumatol Arthrosc 20:1554–1559
7. Uhorchak JM, Scoville CR, Williams GN, Arciero RA, St Pierre P, Taylor DC (2003) Risk factors associated with noncontact injury of the anterior cruciate ligament: a prospective four-year evaluation of 859 West Point cadets. Am J Sports Med 31:831–842
8. Australia's physical activity and sedentary behaviour guidelines (2014) More than half of all Australian adults are not active enough. Department of Health. Available from: https://www.health.gov.au/internet/main/publishing.nsf/content/F01F92328EDADA5BCA257BF0001E720D/$File/brochure%20PA%20Guidelines_A5_18-64yrs.PDF. Accessed 15 July 2019
9. Bell DR, Pfeiffer KA, Cadmus-Bertram LA, Trigsted SM, Kelly A, Post EG, Hart JM, Cook DB, Dunn WR, Kuenze C (2017) Objectively measured physical activity in patients after anterior cruciate ligament reconstruction. Am J Sports Med 45:1893–1900
10. Myer GD, Faigenbaum AD, Foss KB, Xu Y, Khoury J, Dolan LM, McCambridge TM, Hewett TE (2014) Injury initiates unfavourable weight gain and obesity markers in youth. Br J Sports Med 48:1477–1481
11. Frobell RB, Roos HP, Roos EM, Roemer FW, Ranstam J, Lohmander LS (2013) Treatment for acute anterior cruciate ligament tear: five year outcome of randomised trial. BMJ 346:f232
12. Thorstensson CA, Lohmander LS, Frobell RB, Roos EM, Gooberman-Hill R (2009) Choosing surgery: patients' preferences within a trial of treatments for anterior cruciate ligament injury a qualitative study. BMC Musculoskelet Disord 10:100
13. Ardern CL, Taylor NF, Feller JA, Webster KE (2014) Fifty-five per cent return to competitive sport following anterior cruciate ligament reconstruction surgery: an updated systematic review and meta-analysis including aspects of physical functioning and contextual factors. Br J Sports Med 48:1543–1552

14. Zadro JR, Pappas E (2019) Time for a different approach to anterior cruciate ligament injuries: educate and create realistic expectations. Sports Med 49:357–363
15. Ardern CL, Osterberg A, Sonesson S, Gauffin H, Webster KE, Kvist J (2016) Satisfaction with knee function after primary anterior cruciate ligament reconstruction is associated with self-efficacy, quality of life, and returning to the preinjury physical activity. Arthroscopy 32:1631–1638.e3
16. Duquin TR, Wind WM, Fineberg MS, Smolinski RJ, Buyea CM (2009) Current trends in anterior cruciate ligament reconstruction. J Knee Surg 22:7–12
17. McRae SM, Chahal J, Leiter JR, Marx RG, Macdonald PB (2011) Survey study of members of the Canadian Orthopaedic Association on the natural history and treatment of anterior cruciate ligament injury. Clin J Sport Med 21:249–258
18. Filbay SR, Crossley KM, Ackerman IN (2016) Activity preferences, lifestyle modifications and re-injury fears influence longer-term quality of life in people with knee symptoms following anterior cruciate ligament reconstruction: a qualitative study. J Physiother 62:103–110
19. Filbay SR, Culvenor AG, Ackerman IN, Russell TG, Crossley KM (2015) Quality of life in anterior cruciate ligament-deficient individuals: a systematic review and meta-analysis. Br J Sports Med 49:1033–1041
20. Mamlin LA, Melfi CA, Parchman ML, Gutierrez B, Allen DI, Katz BP, Dittus RS, Heck DA, Freund DA (1998) Management of osteoarthritis of the knee by primary care physicians. Arch Fam Med 7:563–567
21. Burns EA, Collins AD, Jack RA 2nd, McCulloch PC, Lintner DM, Harris JD (2018) Trends in the body mass index of pediatric and adult patients undergoing anterior cruciate ligament reconstruction. Orthop J Sports Med 6:2325967118767398
22. Thoma L, White D, Risberg M, Snyder-Mackler L (2018) Body weight status and status change over 5 years after ACL rupture by age, sex, and region: the Delaware-Oslo cohort. Osteoarthr Cartil 26:S203–S204
23. Kyritsis P, Bahr R, Landreau P, Miladi R, Witvrouw E (2016) Likelihood of ACL graft rupture: not meeting six clinical discharge criteria before return to sport is associated with a four times greater risk of rupture. Br J Sports Med 50:946–951
24. Nagelli CV, Hewett TE (2017) Should return to sport be delayed until 2 years after anterior cruciate ligament reconstruction? biological and functional considerations. Sports Med 47:221–232