



Editorial

Collaborative efforts are needed to gain new knowledge on pediatric and adolescent Anterior Cruciate Ligament (ACL) injuries



Often missed or neglected 2–3 decades ago, pediatric ACL injuries were merely limited to bony avulsions and some catastrophic evolutions of nonoperated ligamentous injuries with signs of early osteoarthritis. Pediatric ACL reconstructions were exceptional and limited to some rare superspecialized centers. Significant knowledge has been gained since, both experimentally and clinically [1,2], but many questions remain.

Considering that a vast majority of pediatric and adolescent ACL injuries do occur during sports activities and that children have the fastest growing incidence of ACL reconstructions among all age groups [3], the International Olympic Committee (IOC) devoted one of its consensus meetings to the subject. A group of 24 international surgeons and physiotherapists with clinical and research experience in the field, as well as an ethics expert, convened in Lausanne, Switzerland in October 2017 to debate for several days on the state of the art on pediatric ACL injuries. Likewise, the French-speaking Arthroscopy Association (SFA) commissioned one of its renowned multicenter symposia to a group of experts under the leadership of Franck Chotel and Nicolas Lefevre. The results of this collective work were presented at the annual meeting of the SFA in December 2017 in Marseille, France. During the same period, the European Society of Sports Traumatology, Knee Surgery and Arthroscopy (ESSKA) has launched their pediatric ACL monitoring initiative, resulting in the creation of the first orthopaedic international multicenter registry on the subject. The project was started at the ESSKA congress in Glasgow in May 2018 and currently includes centers from 7 European countries [4,5].

Pediatric ACL injuries do rarely occur before the age of 8–9 years [1]. During late childhood and adolescence until young adulthood, their incidence increases in a very short period of time from proportions of a rare disease (<50/100,000 people) before adolescence to those of an epidemic in athletes under 18 years [6]. The causes of this sudden increase in incidence are not fully understood yet. More research needs to be done on specific anatomical risk factors like constitutional laxity, the tibial slope, notch width, bony morphology, etc. which may play a role in this evolution. This period of life does not only correspond to a phase of great physiological variation and adaptation in the child or adolescent, but also to many changes around the young athlete. The period when knee growth plates close and when knee joints undergo a physiological stiffening process occurs at around 13–14 years in girls and 15–16 years in boys. Age is expressed as skeletal age which does frequently vary from biological age, a difference which is often not taken into consideration in scientific studies [7]. This great interindividual variability

needs to be accounted for, especially when it comes to sports and athletic training, not only with respect to injury or surgical outcome studies by physicians and scientists, but also to injury prevention. The child grows, alignment of the lower extremity evolves, neurophysiological and muscular changes occur. Likewise, children often change schools during that period, and physical loading increases if they are active in organized sports which, from early adolescence is gradually becoming more performance-oriented. As Ardern et al. mentioned in the IOC consensus [7], the activity level of these young individuals is a confounding factor for ACL injuries: the more children and adolescents participate in pivoting sports, the higher the risk for sustaining an injury. However, this factor is rarely analyzed in the scientific literature, even in professional youth sports. Therefore, it is time to generate more prospective injury surveillance studies by sports schools and academies, teams and federations sharing the responsibility and duty of care over so many young athletes [8].

Injury management is challenging in young patients with open knee growth plates who require either a specific nonoperative treatment or specific surgery. The choice of nonoperative versus surgical management is still very controversial, with 60% of European surgeons choosing surgery as first management of pediatric ACL injuries versus 40% preferring initial nonoperative treatment [5]. In France, the situation is different in the sense that only 11% of surgeons choose surgery as primary option in an 8-years old patient. This number increases to 35% at the age of 13 [9]. These numbers are comparable to an older survey of the Herodicus Society and the ACL Study Group [10].

A large variety of pediatric ACL reconstruction procedures has been described. They show acceptable clinical results and none of them has been shown to be superior to another and they all have their specific complication potential. The safety of correctly performed procedures has been established [2–11] and a limited amount of clinically relevant growth-related complications. Major growth abnormalities are rare (1 to 11%) [10–12], although their real number might be underestimated [5]. Minor, subclinical growth changes seem to be more frequent (12% on comparative radiographs and up to 20% on MRI, including transitory bone bridges) [1–12]. Surgeons need to be aware of this complication potential and referral to highly specialized centers and high volume ACL surgeons may be considered. By initiating significant collaborative work under the impulse of its scientific societies SOFCOT and SFA, the French-speaking orthopaedic community has been very instrumental in gaining new knowledge on pediatric ACL injuries.

New injury types have been described [13] and more recently, the 2017 multicenter trial of the French-speaking arthroscopy association analyzing the MRI signal of ACL grafts suggested that healing may be slower than in adults [14]. Return to sports after pediatric ACL reconstruction should therefore be postponed for a long period of time. In the absence of scientifically supported data including activity level and exposure, the orthopaedic community recommends to wait for 1 year before sending these young athletes back to competitive pivoting sport [7]. A recent study of 100 pediatric patients showed that return to running occurred at 10 ± 5 months and return to pivoting contact sports at 14 ± 4 months [15]. These delays are longer than those which are generally discussed with the patients, their parents and among surgeons.

Nonoperative treatment does not mean no treatment. It should consist of a structured and high-quality rehabilitation program [7] and an individual follow-up of each patient. In the only prospective cohort study on this subject conducted so far in the orthopaedic literature, the development of secondary meniscus tears has been shown to be at 17% at 2 years follow-up [16]. These data have recently been confirmed in a retrospective study by Madelaine et al. [17], but more studies are needed to improve the understanding of ACL deficient knees in pediatric and adolescent populations. Knees which are at risk to develop secondary meniscus tears need to be identified and laxity decompensation and chronic wear-out of these joints needs to be better understood and prevented. A recent study by Ursei et al. [18] indicated that ACL injured children develop compensatory gait adaptations. More studies like this one are needed to get a deeper insight of the natural history of ACL deficient knees in this young population. Surgical literature often highlights the relation between time of ACL injury and associated meniscus or cartilage damage. Although these factors are associated, the causative nature of this association still needs to be proven. Likewise, neither are all patients eligible for surgery, nor are all surgeries successful, nor has surgery been shown to decrease or delay the later development of meniscal injuries or osteoarthritis. Long term data are lacking and the scientific quality of surgical outcome studies is limited, many of them being of cross-sectional or retrospective design [7–19]. Therefore, a systematic surgical approach may not be the solution to be applicable to all patients. Early surgery should be recommended for those children with associated repairable meniscus or cartilage lesions. Structured rehabilitation and eventually a change in sports practice should protect them from repetitive giving way episodes and further intra-articulaire damage [7–17].

After growth plate closure, worrying numbers of recurrent tears and contralateral injuries have recently been reported from all over the world after ACL reconstruction in adolescent athletes, with up to 30% of secondary ACL injuries (either recurrent tears on the operated knee or injuries on the contralateral healthy knee) in this young population [20–24].

The IOC consensus may be considered as the gold standard of the scientific literature in this field in 2018. It summarizes the current state of the art on the subject, but also the areas where future research is needed. The recent efforts of the French speaking orthopaedic community brought significant new knowledge to the understanding of this controversial topic. Likewise, the ESSKA initiative and its pediatric register has the potential to bring additional knowledge to the field. These 3 initiatives illustrate the importance of collaborations in orthopaedic surgery, be it on a national, European or international level. Similar collaborative efforts must be encouraged to gain new knowledge in this particularly complex subject.

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Romain Seil^{a,b,*}
 Franck Chotel^c
 Henri Robert^d

^a Department of Orthopaedic Surgery, Clinique d'Eich,
 Centre Hospitalier de Luxembourg, 78, rue d'Eich,
 L-1460 Luxembourg, Luxembourg

^b Sports Medicine Research Laboratory, Luxembourg
 Institute of Health, 76, rue d'Eich, L-1460
 Luxembourg, Luxembourg

^c Department of Pediatric Orthopaedic Surgery,
 Hôpital Femme Mere Enfant, 59, boulevard Pinel,
 69677 Bron, France

^d Department of Orthopaedic Surgery, Centre
 hospitalier Nord Mayenne, 229, boulevard
 Paul-Lintier, 53100 Mayenne, France

* Corresponding author at: Department of
 Orthopaedic Surgery, Clinique d'Eich, Centre
 Hospitalier de Luxembourg, 78, rue d'Eich, L-1460
 Luxembourg, Luxembourg.
 E-mail address: rseil@yahoo.com (R. Seil)