



“ACL surgery: when to do it?”

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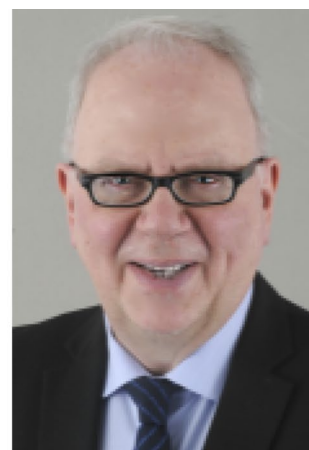
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The athletic seasons are re-opening for all levels of athletes, top level athletes and recreational athletes alike. Increasing speed and power and more people participating in different kinds of sports inevitably leads to a rising number of diagnosed anterior cruciate ligament (ACL) injuries [34]. By and large, restoring knee function and returning to athletic activity requires intact rotatory knee stability. Therefore, early anatomic ACL reconstruction is often recommended.

Following an ACL injury, three different patient responses are observed: (1) a “coper” can return to the pre-injury levels

without surgery and subjective instability; (2) an “adapter” reduces his/her level of activity to avoid subjective instability; and a (3) “non-coper” cannot return to pre-injury activity levels due to subjective instability and episodes of giving way [23]. A screening tool to differentiate potential “copers” from “non-copers” was developed and includes a combination of hop tests, an assessment of quadriceps strength, questionnaires on general knee function, and an account of the frequency of giving-way episodes [5, 22]. However, the reported rate of true “copers” in the literature is low. As an example, one prospective trial of 345 highly active patients with sub-acute ACL tears were screened for the possibility of non-operative treatment. Based on the results of the screening tests (i.e., overall function, various hop tests and the degree of subjective instability), 146 patients were classified as potential “copers”. At final 10-year follow-up, 93% of these previously designated “copers” had undergone ACL reconstruction [12]. Therefore, in young, active patients, wishing to return to jumping, cutting, and/or pivoting sports, ACL reconstruction remains the preferred treatment [20]. This is especially true given the poorer return to sport rates (i.e., 10–30%) of individuals treated non-operatively [5, 26].

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Return to sport is arguably the most important outcome measure for top-level athletes. Overall, only 65% of patients return to their pre-injury sports level after surgical ACL reconstruction, with 55% returning to competitive sports [2]. However, a sub-analysis of return to sports rates after ACL reconstruction in top-level athletes (i.e., football, soccer, basketball) varies between 78 and 90% [9, 14, 32]. In fact, in a recent randomized controlled trial (RCT) of 121 young, active adults (median Tegner 9), 59 patients were allocated to a rehabilitation with optional delayed ACL reconstruction treatment arm [6]. Of the initial non-operatively treated patients, 40% after 2 years and 51% after 5 years opted for a delayed reconstructive procedure—the consequences of which entailed: significantly more meniscal surgeries (5 patients with 6 menisci vs. 19 patients with 29 menisci, $p < 0.001$); a dismal 36% return to pre-injury level of activity at 2 years post-operatively; and a mean Tegner level as low as 5—that is, an ability to perform heavy work and/or participate in recreational level activities.

The ideal timing of ACL reconstruction remains controversial, and is influenced, in part, by the interplay between concomitant injuries such as meniscal tears, incidence of arthrofibrosis, return to full activity, as well as economic factors. Traditional dogma has suggested delaying surgery at least 6 weeks to allow for the knee to “rest”, decrease swelling, and regain range of motion; with early surgery claimed to increase risks of arthrofibrosis [10, 27, 33]. After an ACL injury, the knee experiences a “double-hit” phenomenon—with both an intrinsic inflammatory cascade and an extrinsic quadriceps inhibition (facilitated by the hemarthrosis). It is known that an inflammatory cascade in the joint is initiated and entails an elevation of cytokine levels in the synovial fluid accompanied by effusion and pain [29]. In fact, osteoarthritis is seen after both operative and non-operative treatment, and might be related to the increase of inflammatory, chondrodegenerative cytokines in the synovial fluid in ACL injured knees [16, 25]. This holds true with higher levels of pro-inflammatory cytokines described as an indicator for poor clinical outcomes [15]. To reduce inflammation, the timing of initiating pre-rehabilitation has been popularized with the aim to reduce effusion and restore normal range of motion [4].

Arthrofibrosis following ACL reconstruction is a major complication. Although timing to reconstruction is thought to be an important factor, other co-founders including but not limited to technique (i.e., open versus arthroscopic), graft size, graft type, notch type and bone morphology, and patient compliance have also been implicated [19, 24, 27]. Delving into the literature from the 1990s, most of the early studies associating surgical timing and the incidence of arthrofibrosis utilized an open technique for ACL reconstruction. An open technique in comparison to

an arthroscopic approach may be associated with more postoperative pain and slower postoperative rehabilitation; therefore its influence on arthrofibrosis should not come as a surprise [7]. Nowadays, however, an arthroscopic, anatomic ACL reconstruction is the gold standard [8, 30]; but still, a clear correlation between the timing of ACL reconstruction and the incidence of arthrofibrosis remains elusive [3, 11, 13].

The definition of timing (i.e., what constitutes “early”) varies across the literature [13]. Although timing might not be the only important point for the incidence of postoperative arthrofibrosis, a delay of surgery is not without consequence, with repeat episodes of giving way associated with an increased risk of subsequent injuries to the meniscus and articular cartilage [1, 17, 21]. Therefore, how do we define “early” treatment? In the literature, the definition of early varies between 48 h and 3 weeks [3, 11, 18]. Though it may not always be practical to see patients within 48 h, the majority of patients can usually be assessed within the first week after the injury. Therefore, an analysis of this 1-week period appears to be useful.

In a recent RCT by Eriksson et al. [3], 70 patients with high recreational activity level (Tegner six and higher) were compared for range of motion and patient-reported outcomes (PRO; IKDC, KOOS, Lysholm and Tegner scores) after 3- and 6-months follow-up, with a focus on timing of the ACL reconstruction. “Early” was defined within 8 days after trauma and “delayed” after 6–10 weeks. At the 3-month follow-up, no significant differences in range of motion between groups were evident; yet at 6 months postoperatively, the “early” reconstruction group had less muscular hypotrophy of the thigh muscles. Additionally, at later follow-up, patient-reported outcomes (PROs) were similar. Moreover, with regard to economic burden, a delayed ACL reconstruction resulted in significantly more sick-leave days (89 vs. 57 days) within the first year compared with “early” reconstruction, resulting in higher indirect costs [31]. This is in line with the previous literature, which demonstrated ACL reconstruction as more cost-effective compared with non-operative treatment. In competitive athletes, the incremental cost effectiveness ratio of an ACL reconstruction in comparison to physical therapy was \$22,702 per quality-adjusted life-year [28].

Whether a “weekend warrior” or top-level athlete, the goal for ACL treatment should not deviate: performing an early, anatomic ACL reconstruction to afford restoration of joint stability and knee function, and prevent downstream effects such as arthrofibrosis, subsequent meniscus and articular cartilage injury, and/or the development of osteoarthritis. The study by Eriksson et al. [3] is of great value to the sports medicine surgeon treating ACL injuries in the young and active population. Non-operative treatment of ACL injuries can certainly be discussed in less active patients [20];

however, anything short of offering a young, active athlete early, anatomic ACL reconstruction would be a disservice to our patients.

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