

# Anterolateral Complex Reconstruction: Another Fad or Method to Improve ACL Outcomes?

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**Summary:** Anterolateral rotational laxity of the knee is a persistent problem following anterior cruciate ligament reconstruction (ACLR) that can lead to increased rates of graft failure. Renewed interest in the anterolateral complex of the knee has led to a resurgence in the use of adjunctive techniques such as lateral extra-articular tenodesis and anterolateral ligament reconstruction. Use of these techniques can restore normal knee kinematics and potentially thereby reduce the rate of graft failure. Historically, experience with modified ACLR techniques such as the double-bundle ACLR have shown that improved biomechanics is not always reflected in clinical outcome trials. Additional procedures also come with additional costs and further economic analysis needs to be performed to clarify whether these additional costs are offset by improved clinical and societal outcomes in the longer-term.

**Key Words:** anterolateral ligament—lateral extra-articular tenodesis—cost-effectiveness.

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The recent interest in the anterolateral complex (ALC) of the knee has resulted in an upsurge in the development of new reconstruction techniques of the anterolateral ligament (ALL) and a renewed interest in lateral extra-articular tenodesis (LET). These surgical reconstructions are being recommended as adjuvant procedures to existing anterior cruciate ligament reconstruction (ACLR) strategies, with proposed benefits of improving rotational laxity and ultimately reducing failure. But why is this necessary? Will it potentially come at a cost, both to the patient and our respective health care systems? Is the additional cost justified by improvement in patient outcomes? This paper will summarize the reasons for the recent interest in ALC reconstruction. Furthermore, drawing on comparisons of past surgical procedures, the advent of ALC reconstruction will be compared with the evolution of double-bundle ACLR (DB-ACLR) focusing particularly on the associated health care costs.

## THE PROBLEM WITH ACLR

Acute knee injuries have been shown to result in post-traumatic osteoarthritis (PTOA) in a high proportion of young patients<sup>1</sup> the development of which has been clearly linked to a

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significant socioeconomic burden.<sup>2</sup> One of the most common injuries to affect young people, and therefore the working population, is anterior cruciate ligament (ACL) injury. ACL rupture is a common clinical entity that results in increased anterior tibial translation and anterolateral rotational laxity of the knee. Patients report persistent instability and lack of trust in the knee. This can have significant detrimental effects on their ability to perform pivoting sports, but more importantly, has been shown to result in a reduction in work performance and have a negative impact on activities of daily living.<sup>2</sup> The goals of ACLR are to restore knee kinematics to allow both a return to normal functional activities and to protect the knee from damage to further structures. ACL deficiency has been shown to result in a high incidence of meniscal pathology,<sup>3</sup> the result of which leads to an increased risk of the development of osteoarthritis.<sup>4</sup> Factors associated with clinically significant symptoms of PTOA after ACLR include subsequent surgery, meniscal damage, and chondral injury.<sup>5</sup> Successful ACLR can therefore be judged, in both the short and long-term, on patient-reported outcome measures, return to sport and a reduction in risk of subsequent meniscal injury and further surgery, and potentially, the development of PTOA.<sup>6–8</sup> Although ACLR has been shown to produce good to excellent results in most cases, some issues in the more recent literature have been highlighted. Poor rates of return to sport and function have been reported, as well as alarmingly high rates of failure in young patients.<sup>9</sup> Furthermore, many studies have shown that many patients continue to exhibit persistent anterolateral rotatory laxity following ACLR, as measured by the pivot-shift test,<sup>10</sup> with the latter being shown to correlate with poor patient outcome.<sup>11</sup>

ACLR techniques therefore continue to evolve with these issues in mind, but persistent abnormalities in knee kinematics following surgery clearly have a detrimental effect. Ongoing rotational laxity leads to inferior clinical outcomes and may not always be fully controlled by a well-performed contemporary ACLR.<sup>10,11</sup> This has led to a renewed focus on the anatomic determinants of this detrimental pathology. Most recently, the anterolateral structures of the knee have become an extremely popular topic, with surgical methods for reconstructing these structures as an adjuvant to ACLR becoming more prevalent.<sup>12</sup> Although this concept is not new, a greater understanding of the patients who will benefit most from these combined procedures is developing.<sup>13</sup> Potential benefits would therefore include greater rotational stability leading to a decrease in the higher failure rates seen particularly in young patients and progressive osteoarthritic changes seen after isolated ACLR.<sup>14,15</sup>

## HISTORICAL PERSPECTIVES

Since the first reconstruction of the ACL was performed over a century ago by Hey Groves of Bristol, much thought, development and debate has gone into the optimal technique for restoring function to an ACL-deficient knee.<sup>16</sup> Reconstruction

procedures can be classified as being extra-articular and/or intra-articular, nonanatomic, and anatomic. Grafts and fixation methods have varied equally, and the number of bundles have doubled and halved, but most modern methods focus on an attempt to create a reconstruction that is as anatomic as possible in terms of the ACL attachments, dimensions, and alignment of collagen fibers.<sup>17</sup>

Initial ACLRs in the early part of the twentieth century recognized the need for an obliquely orientated, intra-articular graft. However, these techniques were superseded in the mid-part of the century by extra-articular reconstructions, initially by Strickler in 1937 and, in the second half of the century, by Lemaire and Macintosh. For these authors, an isolated LET was used to control anterolateral rotatory laxity. This came at a cost of early failures due to residual instability with the consequence of early degenerative change within the knee.<sup>18</sup> Interestingly, Lemaire's early descriptions of his technique was that it was "designed to palliate rupture of the anterior cruciate ligament."<sup>19</sup> Combined procedures then followed, but this practice was not widespread and much of the developments in the late twentieth century were toward an arthroscopically assisted operation primarily involving passage of an intra-articular graft. This technique led to a consistency in practice with many published case series showing satisfactory results. Thompson et al<sup>20</sup> recently published the results of a long-term follow-up of patients 20 years post-ACLR with this technique, with a high proportion continuing to show good subjective and objective results. In this case series, nonideal tunnel position was highlighted as a major risk factor for further injury, along with male sex and younger age (below 18 y) at time of injury. Recognition that graft placement also played a role in controlling rotation, with the trans-tibial reconstruction technique leading to placement of a graft that was more vertically orientated than the native ACL,<sup>21</sup> and thus a scenario that can lead to rotational laxity.<sup>22</sup> Therefore, improvements in the position of the femoral tunnel and overall graft position have dominated the past 20 years in terms of ACLR technique evolution.

### DB-ACLR—THE ANSWER TO PERSISTENT ROTATIONAL LAXITY?

The search to improve normal kinematics of the knee following ACLR led to a renaissance in the application of anatomic understanding to the clinical problem. This can be attributed to the work carried out in the early part of the twenty first century and the development of DB-ACLR. In 2004 and 2006 Yasuda and Buoncrisiani, respectively, published work into an anatomically based reconstruction technique involving anteromedial and posterolateral grafts, to try to mimic the configuration of the native ACL more accurately.<sup>23,24</sup> In doing so, the femoral anatomy was more clearly defined with the ACL footprint being subjected to a more careful analysis to allow more accurate placement of 2 femoral tunnels. Ferretti et al<sup>25</sup> described the soft tissue relationship to the bony landmarks on the lateral femoral condyle, the latter consisting of the lateral intercondylar ridge and lateral bifurcate ridge. Although many surgeons may have moved away from double-bundle techniques, these reference points still guide the graft placement for many single-bundle techniques.

The current gold standard of ACLR is probably seen to be anatomic single-bundle ACLR (SB-ACLR). Born out of the crucible of research into double-bundle reconstruction that gave us an increased understanding of the femoral anatomy, it is a technique for maximizing the bulk of collagen placed into an aperture on the lateral femoral condyle that most closely represents the native ACL footprint. The arguments for a SB-ACLR hinge on there being no

compelling evidence that a DB-ACLR leads to improved clinical outcomes. A recent meta-analysis by Chahla et al<sup>26</sup> showed improved control of anteroposterior tibial translation with DB-ACLR but no improvement in any of the clinical outcomes measures assessed. A similar analysis by Desai et al<sup>27</sup> echoed this conclusion, showing that improved kinematics was limited to anteroposterior laxity and that this did not translate to clinical benefit. A systematic review of meta-analyses by Mascarenhas et al<sup>28</sup> concluded similarly that DB-ACLR provided significantly better knee stability (by KT arthrometry and pivot-shift testing) than SB-ACLR but no advantages in clinical outcomes or risk of graft failure. Furthermore, existing economic analyses of DB-ACLR shows greater initial costs when compared with SB-ACLR and suggest that early, single-bundle, outpatient hamstring, or bone-patella tendon autograft ACLR is the most cost-effective method for managing the ACL-deficient patient.<sup>29</sup> Longer-term clinical results, however, are necessary to truly evaluate the cost-effectiveness of this approach.<sup>30</sup>

### KINEMATIC RESTORATION VERSUS CLINICAL OUTCOME: WHAT IS MORE IMPORTANT?

The ongoing dilemma is that despite the best efforts of the research community and practicing surgeons worldwide, our best attempts at restoration of anatomy do not accurately recreate the normal kinematics of the knee. The initial problem that prompted a move to an anatomic reconstruction was of failure to restore kinematics. This has been improved but does not seem to have translated to clear-cut, longer-term clinical benefit. The focus on the ALC and additional restraints to anterolateral translation will need to be carefully followed and the clinical outcomes compared with existing techniques. Given the increased focus on value-based care within most health care systems, any improvements in kinematics or outcomes with adjunctive surgical techniques will also need to be examined from an economic standpoint. There are a number of parallels that can be drawn between DB-ACLR and the recent focus on the ALC of the knee.

Figure 1 represents a synopsis of the key events in the development of both DB-ACLR and ALL reconstruction/adjunctive LET techniques which probably mirrors the development of many new surgical techniques. A landmark anatomic paper has initiated both movements.<sup>12,31</sup> Further biomechanical cadaveric studies then follow which show improvements in the kinematics. During this time period one can assume that operations are being performed which involve the technique in question and patients are being recruited as part of both randomized comparative trials and cohort studies to evaluate the clinical effects of the new intervention or technique. In the case of DB-ACLR, meta-analyses follow which fail to show the clinical improvements to correlate with the biomechanical advantages and, along with economic analyses, the technique wanes in popularity. The above process may be reflected in the literature through the volume of publications. A simple literature search of the PubMed database was performed looking at the number of publications per year of DB-ACLR versus anterolateral ligament and LET. The trend in publications on DB-ACLR can be seen to have peaked in the middle part of this decade and may now be on the way down. Surgical practice still grossly favors SB-ACLR in most parts of the world with 92.3% of American Orthopaedic Society for Sports Medicine members recently surveyed using SB-ACLR as their technique of choice.<sup>32</sup> This finding is echoed by other recent surveys performed around the world with  $\leq 10\%$  of surgeons favoring the use of a double-bundle reconstruction.<sup>33,34</sup>

There are considerations to be made when comparing the current interest in the ALC of the knee to DB-ACLR. Lateral extra-articular procedures have been used for decades both in

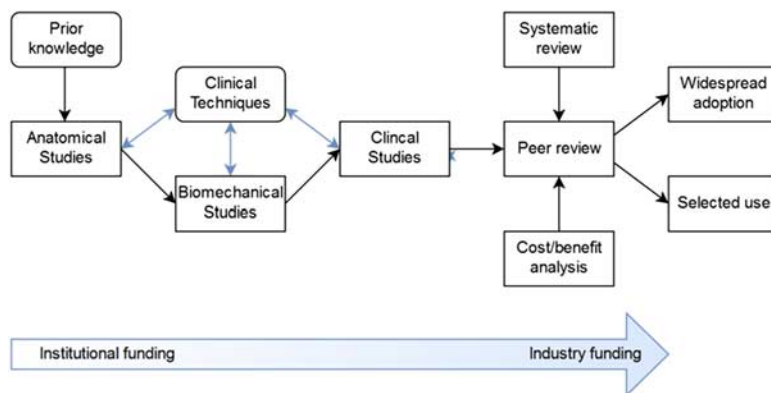


FIGURE 1. Development of orthopedic techniques. [full color online](#)

isolation and in combination with intra-articular procedures. There is already a wealth of understanding and clinical data that support their use, which is currently being built upon once more with a view toward improving clinical outcomes. In 2003, Marcacci et al<sup>35</sup> published 5-year follow-up data on high-level athletes who had undergone a combined procedure showing good clinical stability. Noyes and Barber<sup>36</sup> showed a significant reduction in rerupture rates with the use of an adjunctive extra-articular Lemaire type procedure in chronic ACL-deficient patients treated with allograft.

Publications relating to both the anterolateral ligament and LET have been rapidly on the rise since the anatomic paper published by Claes and colleagues in 2013. This rate of initial rise looks very similar to that seen almost a decade previously relating to DB-ACLR (Fig. 2). In a similar manner to DB-ACLR, the biomechanical studies seem to favor anterolateral adjuncts in terms of control of internal rotation. The key papers are summarized in Table 1.<sup>38,40-43</sup> Inderhaug et al<sup>37</sup> showed in a cadaveric study that the addition of an appropriately tensioned lateral adjunctive procedure restored native kinematics to the knee in the context of ACL+ALL injury. Spencer et al<sup>39</sup> showed that LET had a composite effect in restoring both anterior and rotational constraint in 12 ACL-sectioned cadaveric knees. A meta-analysis by Hewison et al<sup>44</sup> concluded that in a similar manner to DB-ACLR, the addition of an LET to

ACLR procedures significantly reduced the incidence of a pivot-shift in favor of combined procedures, but no conclusive data to suggest an improvement in the clinical outcomes.

Two papers in this issue have both separately focused on the results of ALL reconstruction (Sonnerly-Cottet) and LET (Lording). Both procedures show potential benefit in reducing rotational laxity; however, adequately controlled, appropriately powered prospective randomized clinical trial data are still lacking. The ongoing study by Getgood et al<sup>45</sup> (STAbiLiTY Study: ClinicalTrials.gov #NCT02018354) will aim to provide important information as to the efficacy of adjuvant LET procedures to contemporary ACLR, as well as to provide important information as to who may benefit most from these procedures, both from a clinical and cost point of view.

### ALC RECONSTRUCTION—TECHNIQUES AND OUTCOMES

Procedures which address reconstruction of the ALC of the knee fall largely into 2 camps: LET and reconstruction of the anterolateral ligament reconstruction (ALLR).

Multiple techniques exist for performing the LET, all of which share some commonality in redirecting a strip of the iliotibial band (ITB) underneath the fibular collateral ligament (FCL) more proximally. In 1975, Lemaire<sup>19</sup> published the first description of

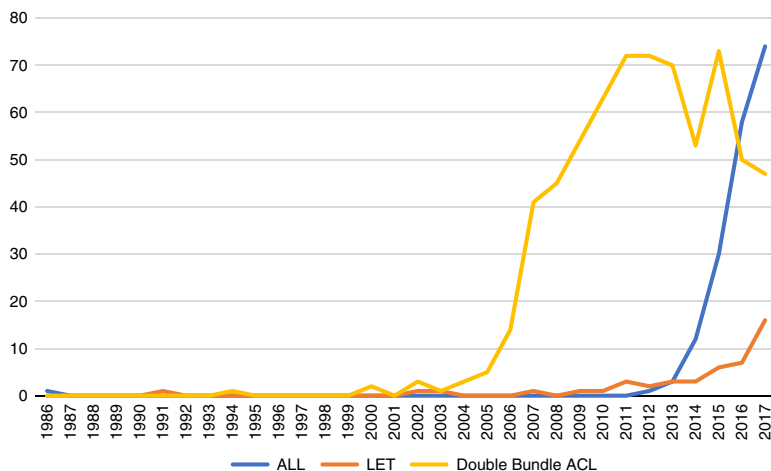


FIGURE 2. Publishing trends. ACL indicates anterior cruciate ligament; ALL, anterolateral ligament; LET, lateral extra-articular tenodesis. [full color online](#)

TABLE 1. Biomechanical Studies of ALLR and LET

References	Type of Study	Technique Examined	Methods	Outcomes
Inderhaug et al <sup>37</sup>	Biomechanical. In vitro 12 cadaveric specimens	ALLR LET	Comparison of ACLR alone vs. ACLR with ALLR, Lemaire and MacIntosh LET ACL-sectioned vs. ACL+ALL-sectioned specimens	ACLR+ALL did not restore native kinematics ACLR+LET (Lemaire or MacIntosh tensioned at 20N) restored anterior translation and rotational kinematics to intact state
Geeslin et al <sup>38</sup>	Biomechanical In vitro 10 paired cadaveric specimens	ALLR LET	Comparison of ACLR+ALLR in 1 knee vs. ACLR +modified-Lemaire LET in paired specimen Sectioning of ACL, ALL, and Kaplan fibers	ACLR alone did not control internal rotation. Addition of LET and ALLR to ACLR significantly improved internal tibial rotation and pivot-shift cf. ACLR alone. Significantly greater reduction in laxity with internal rotation and pivot-shift testing was found with the LET procedure than ALLR
Spencer et al <sup>39</sup>	Biomechanical In vitro 12 cadaveric specimens	ALLR LET	Comparison of ACLR vs. ACLR with ALLR and modified-Lemaire LET ACL-sectioned vs. ACLR+ALL-sectioned specimens	The ALL showed a role in controlling anterolateral laxity. LET had a composite effect in governing both anterior and rotational laxity. Anatomic ALLR did not reduce anterolateral rotational laxity
Branch et al <sup>40</sup>	Biomechanical In vivo 18 patients	LET	9 y postoperative. Robotic testing of axial knee rotation. Comparison of ACLR alone vs. ACLR+LET	The addition of LET to standard ACLR reduces internal rotation of the tibia with respect to the femur when compared with ACLR alone
Monaco et al <sup>41</sup>	Biomechanical In vivo 20 patients	LET	Dynamic evaluation with computer navigation Comparison of SB-ACLR followed by LET with LET followed by SB-ACLR	LET had little effect in reducing the anterior translation of the tibia at 30-degree flexion. LET more effective than SB-ACLR in controlling tibial internal rotation. Anatomic SB-ACLR and LET were synergistic in controlling the pivot-shift phenomenon
Monaco et al <sup>42</sup>	Biomechanical In vivo 20 patients	LET	Dynamic evaluation with computer navigation. Comparison of SB-ACLR+LET with DB-ACLR Patients alternately assigned to DB-ACLR vs. SB-ACLR+LET (modified MacIntosh)	Anatomic SB-ACLR+LET more effective in reducing internal rotation of tibia at 30-degree flexion, as compared with DB-ACLR
Engebretsen et al <sup>43</sup>	Biomechanical In vitro 7 cadaveric specimens	LET	Comparison of load placed on ACLR graft with and without LET	LET+SB-ACLR significantly decreased the force in the ACL composite graft by an average of 43%. Load sharing appeared to occur between the tenodesis and intra-articular graft

ACL indicates anterior cruciate ligament; ACLR, anterior cruciate ligament reconstruction; ALL, anterolateral ligament; ALLR, anterolateral ligament reconstruction; DB, double-bundle; LET, lateral extra-articular tenodesis; SB, single-bundle.

his own extra-articular technique. A 15 cm by 12 mm strip of the posterior ITB was harvested, and left attached distally to Gerdy's tubercle. An osseous tunnel was drilled distal and deep to the FCL attachment, exiting on the posterior femoral condyle. The ITB was passed through this tunnel, and then back under the proximal FCL and sutured onto itself. The graft was then secured with the knee held in full external rotation.

One year later, MacIntosh<sup>46</sup> described his procedure utilizing a 20 cm strip of the ITB, again left attached distally, and routed under the FCL, through a subperiosteal tunnel at the insertion of the lateral intermuscular septum and sutured back onto itself. A combined intra-articular and extra-articular procedure was subsequently described involving the intra-articular limb of the ACLR being passed "over the top" and through the knee.

At a similar time, Ellison<sup>47</sup> described a technique that involved taking a strip of ITB that was detached from Gerdy's tubercle with a bony fragment and then routed under the FCL and resecured just anteriorly to the tubercle. He also included a plication of the middle third capsular ligament beneath the FCL.

Modern techniques are modifications of the Lemaire and MacIntosh procedures which use a shorter strip of ITB which is left attached distally and passed under the FCL more proximally. This can then be secured to the femur either with an interference screw within a bone tunnel or simply with a bone staple (authors' preferred technique). ALL reconstruction techniques must be differentiated from the above procedures.

They attempt to recreate the anatomy of the ALL, rather than using the ITB which has a more medial attachment point on the proximal tibia. ALLR therefore involves the use of graft material—allograft or often ipsilateral or contralateral hamstring tendons, to recreate a ligament from femoral to tibial bony attachment points. Chahla et al<sup>48</sup> describe their technique of an ipsilateral hamstring tendon graft passed under the ITB and secured to a femoral attachment point 4.7 mm proximal and posterior to the femoral origin of the FCL. The tibial anchor point is midway between Gerdy's tubercle and the fibular head. In this and many described technique, the graft ends are secured by means of interference screws within bony tunnels.

The clinical results of these techniques are discussed in additional articles in this edition by Lording and Sonnery-Cottet.<sup>49</sup> Above and beyond these, a significant cost-difference exists with a modified-Lemaire type LET only requiring the addition of a bony staple compared with the use of  $\geq 2$  additional interference screws with most described anatomic ALLR. The anatomic technique described by Sonnery-Cottet et al<sup>50</sup> utilizes a double-bundle technique to recreate the triangular nature of the ALL but this requires 3 interference screws.

## SOCIOECONOMIC IMPLICATIONS

ACL tears are among the most common musculoskeletal injury and therefore represent a significant economic burden to

the health care system.<sup>2</sup> Given the high volume of ACLR procedures performed each year, it is crucial to not only optimize efficiency at the time of surgery, but also improve long-term outcomes by minimizing the risk of failure and further costly reoperations, and delaying the progression of knee osteoarthritis. Therefore, investigation of interventions that may improve outcomes following ACLR are warranted, particularly given constrained health care budgets and thus an increased focus on value-based care.

Although advanced surgical techniques have the potential to improve patient outcomes, they typically also come with increased costs. Importantly, in addition to evaluating clinical outcomes with adjunctive surgical procedures, the associated health care resources consumed also need to be evaluated to determine whether the increased cost is justified relative to the improvement in clinical outcome.

To ensure efficient allocation of scarce health care dollars, policy makers rely on high-quality data from economic evaluations. An economic evaluation is a systematic method to determine the value for money of health care interventions by simultaneously evaluating costs and clinical effectiveness. By determining the incremental cost of the new intervention compared with current standard of care to achieve an additional unit of effectiveness, an economic evaluation can assist decision makers, clinicians, and patients in deciding the treatment alternative that offers the best value relative to health care resources spent.

Further, when evaluating the cost-effectiveness of a new intervention, in addition to the direct costs to the health care system, it is also important to consider indirect costs to patients and society. Collection of both direct and indirect health care resource use allows for an economic evaluation from multiple perspectives. For example, the health care perspective includes direct medical costs to the health care system including hospital, procedure-related, clinician and provider time, and any tests, procedures or surgeries. In addition to the health care system costs, the societal perspective also includes any out-of-pocket costs to the patient and caregivers as well as indirect costs such as reduced productivity, and time off employment, homemaking, or activities as a result of the intervention.

## ECONOMIC EVIDENCE FOR ALL AND LET PROCEDURES

We are not aware of any high-quality evidence evaluating the cost-effectiveness of ALC techniques in ACLR. Conversely, there have been 4 studies that report costs when comparing ACLR using single-bundle and double-bundle techniques. Two studies are cost description studies and 2 are full economic evaluations.

Similar to DB-ACLR, reconstruction with an adjunctive ALC technique results in an increase in cost from slightly longer operating room time and also increases the cost of the procedure through the use of additional fixation materials such as sutures, staples or anchors, and, depending on the technique, supplemental grafts. Nunez et al<sup>51</sup> compared DB-ACLR to SB-ACLR and showed that while both techniques led to similar clinical outcomes 2 years after ACLR, the single-bundle technique had significantly lower total cost. However, they did not calculate the incremental cost of DB-ACLR compared with SB-ACLR, therefore conclusions about the cost-effectiveness cannot be made.

Brophy and colleagues investigated the economic impact if all SB-ACLRs were instead performed as DB-ACLR. The authors reported additional total costs of up to \$3962 per

surgery with the double-bundle technique,<sup>52</sup> estimating that a reduction in revision rate from 4.0% to 1.5% after a DB-ACLR would be required to offset this additional cost. LET and ALL procedures may result in a reduced degree of rotational laxity and a reduced risk of failure<sup>53</sup> which could contribute to lower overall costs in the longer-term. An LET such as the modified-Lemaire procedure performed by our group<sup>13</sup> involves no additional grafts, a single bone staple, and 2 additional sutures. This further reduction in procedural costs might therefore require a lesser reduction in revision rate to offset these modest costs. Further, the potential improvement in patient outcomes and reduced risk of failure may also allow earlier return to work and a reduction in lost productivity which will also lower indirect costs, and thus offset the higher upfront procedural-related resource use.

Of the full economic evaluations, Paxton et al<sup>30</sup> used an economic model to compare the 2 techniques, and report the incremental cost of DB-ACLR per quality-adjusted life year (QALY). A QALY is a preference-based measure of quality of life that incorporates both length of life and quality of life into a single metric and is calculated by multiplying the length of time an individual spends in a health state by the quality of that health state. The quality of the health state is measured by a utility score ranging from 0 to 1. In this study, utility scores were estimated based on International Knee Documentation Committee grades following ACLR obtained from the literature. The authors found that DB-ACLR may be cost-effective compared with SB-ACLR; however, their model was highly sensitive to utility scores following surgery. Therefore, future studies using more precise estimates of utility are required to confirm their results.

More recently, Sernert and Hansson<sup>54</sup> conducted a full economic evaluation alongside a randomized trial comparing the single to DB-ACLR over 2 years of follow-up and found that although the DB technique had higher procedure-related costs, when they also accounted for productivity losses there were no significant difference in cost between the 2 groups. Therefore, they suggest that although DB-ACLR is likely not cost-effective from the health care perspective, it may be cost-effective compared with SB-ACLR from a societal perspective.

Therefore, there is potential for these procedures that confer additional rotational stability to improve value from both the health care payer and societal perspectives. In addition to future evidence regarding the clinical efficacy of ALL and LET, high-quality evidence with longer-term follow-up that simultaneously evaluates both the clinical outcomes as well as both direct and indirect health care resource use is required to determine whether these procedures represent good value.

## CONCLUSIONS

Persistent anterolateral rotatory laxity following contemporary ACLR procedures remains an unwelcome complication that can lead to poor outcomes. A greater understanding of the ALC of the knee has led to a renewed interest in adjunctive extra-articular procedures and ALL reconstruction in a bid to control rotational laxity and minimize graft failure. History has shown that modification of techniques in ACLR can lead to more favorable kinematics, but this has not always translated into an improvement in clinical outcomes. Similarly, adjunctive techniques are associated with increased procedural costs and operating time, which need to be balanced against potentially modest clinical gains. The clinical case for selective use of additional procedures in ACLR is building. In addition to randomized trials involving both LET and ALL reconstruction,

economic analyses with accurate costs and longer-term outcome data will help to determine whether there is a place for these procedures in health care systems looking to provide value-based care.

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