Rotatory knee laxity and the pivot shift

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Ejnar Eriksson, in a KSSTA editorial almost 10 years ago, wrote, “I do not think that we yet know enough about how to reconstruct the ACL ideally” [2]. He suggested we should continue with our research efforts. We did. In the following 10 years, the research data in terms of ACL research have more than doubled (Medline search). Rotatory knee laxity is a particularly interesting topic and remains frequently researched. Yet, it is vexing to us that although we have such passion for ACL research, we still don’t fully understand the factors that guarantee adequate restoration of rotatory knee laxity following an ACL injury.

Bull et al. [1] described this phenomenon as “envelope of motion” and used the pivot shift to illustrate that ACL-deficient knees followed the same general path of motion during subluxation and reduction, but that no two knees moved in the same manner. An interesting and still unresolved question is whether we pre-operatively can define and—more difficult—surgically restore knees that display markedly increased rotation?

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This special issue “Rotatory Knee Laxity and the Pivot Shift” features a large number of original and review articles from clinician and scientist experts in the field. Articles also cover experiments from the Panther Global Summit (Pittsburgh, August 2011). Additionally, we asked the contributing authors to strictly adhere to a common terminology, specifically with respect to the terms, “laxity” and “instability”, which are often confused. We hope this will make the articles easier to read and follow, more understandable and enjoyable.

We distinctly remember a session on rotatory knee laxity during the 2006 ACL Study Group meeting in Hawaii. There were several topics on rotatory laxity and rotatory instability. So, what is the difference? During this session, John Feagin defined these terms for the audience “instability is a symptom described by a patient, whereas laxity is an objective finding” [3]. In biomechanical terms, laxity is the passive response of a joint to an externally applied force or torque. Stability, on the other hand, is a functional measure; that is, a knee, regardless of laxity, is only unstable if it “gives way” during functional activities. Therefore, laxity does not imply instability, since a lax joint could be stabilized via neuromuscular control [7].

The pivot-shift test is a particularly complicated, yet highly specific test for ACL deficiency. Only when the ACL is deficient can the lateral tibial plateau sublux anteriorly. It is therefore a test for ligamentous laxity, or isn’t it? Well, during the reduction of the pivot-shift test when the lateral tibial plateau translates posteriorly, the examiner can feel a sudden shift, and the patient will verbalize concern of instability (“giving way”) [4]. We are actually testing *rotational instability*. So, where does this test really fit in? Some researchers view the pivot-shift test as a “bridge” between simple static biomechanic tests (e.g., cadaveric, robotic, simulated) and functional dynamic

kinematic tests (e.g., video motion analysis and dynamic stereo radiography). Some of the answers can be found in this special issue of *KSSTA*.

The pivot-shift testing procedure is also complicated because we all appear to have a different interpretation on how to apply and interpret the test. In a way, it would make sense to “standardize” the pivot shift, so that clinical outcome can be compared in a meaningful manner. During the Panther Global Summit (Pittsburgh, August 2011), we conducted a study with 12 expert surgeons. We found that after watching an instructional video, explaining a standardized pivot-shift technique, their pivot-shift examinations not only looked similar but displayed similar acceleration curves, whereas during the surgeons’ preferred technique, they did not.

We are confident that the instructional video will stimulate discussion and will be helpful in designing research projects. The video is available on the *KSSTA* website.

The goal of an ACL reconstruction should be to reduce the pivot shift! Defining and quantifying the pivot shift pre-operatively is done during the examination under anesthesia (EUA). A high-grade pivot shift may indicate combined injury to the ACL and secondary restraints, small coronal diameter of the lateral tibial plateau [6], or generalized ligamentous laxity [5]. However, to answer the question above, knees that display high-grade pivot shifts, or have excess knee rotational laxity, cannot always be identified pre-operatively. It is the goal of this special issue

of *KSSTA* to answer some of these questions, stimulate further research questions, and more clearly define the role of the pivot shift. The ultimate goal is to standardize the pivot shift.

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