Could Isokinetic Evaluation Contribute to the Assessment of Sex Differences in the Incidence of ACL, MCL, and Meniscal Injuries in Collegiate and High School Sports? Response
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What is This?
Dear Editor:


The authors conducted a descriptive epidemiology study to compare the incidence of medial collateral ligament, anterior cruciate ligament (ACL), and meniscal injuries in female and male athletes and to compare injury rates among female and male athletes at the high school and collegiate levels. It is noteworthy that these analyses were conducted for 5 sports: basketball, ice hockey, lacrosse, soccer, and softball/baseball. The authors concluded that rates of knee injuries varied by sex across the 5 sports within the high school and collegiate settings and stated that ACL injury rates appear to have decreased in both the male and female populations but that female athletes may still be at higher risk.

These data indicate the need for continued emphasis on the development and implementation of effective injury prevention programs for at-risk populations. This outstanding study can help physicians, physical therapists, and coaches to develop injury prevention programs. In this context, we would like to highlight the utility of the isokinetic dynamometer in identifying potential risk factors for sports injuries, which in turn may help direct prevention programs.

Isokinetic strength testing of the lower limbs has been recommended as a method for quantifying muscular asymmetries and muscular imbalances. Since lower limb asymmetries are considered an important risk factor for knee injuries, this measure may be helpful in directing strengthening prevention programs.

The isokinetic strength test allows the measurement of the strength balance of the knee flexor and extensor muscles peak torque (H:Q ratio). Also known as the conventional strength ratio (CSR), the H:Q ratio represents the peak torque of the concentric hamstrings strength divided by the peak torque of the concentric quadriceps strength at a specified angular velocity. Previous studies have recommended that the H:Q ratio should lie in the 0.5 to 0.8 range to protect the knee joint. For example, athletes with ACL injury showed a lower risk of anterior subluxation of the lateral tibia when they had an H:Q ratio close to 1.0.

Another proposed method for describing the H:Q ratio is referred to as the dynamic control ratio (DCR), also known as the functional strength ratio. The DCR is calculated by dividing the peak torque of the eccentric hamstrings strength by the peak torque of the concentric quadriceps strength at a specified angular velocity. During knee joint motion, eccentric hamstrings action occurs simultaneously with concentric quadriceps action, and it has therefore been suggested that the DCR is a better indicator of the agonist-antagonist strength relationship for the knee joint. This ratio may dictate dynamic joint stabilization, which potentially protects the knee during sports-related tasks. Low DCR values are thought to indicate poor joint stability, and previous prospective studies have suggested that athletes presenting this imbalance may be at greater risk of injury.

In search of factors influencing this important intrinsic risk factor for knee injuries, several studies have been conducted in different populations, such as professional or recreational athletes, patients with hamstring tendon ACL reconstruction, and patients with rheumatoid arthritis. For instance, Andrade et al conducted a study to determine differences in CSR evaluated at different angular speeds between men and women who practiced judo, handball, or soccer. These authors found that sport modality and angular speed influenced the isokinetic strength profiles of men and women.

In conclusion, we would like to congratulate Stanley et al. on their interesting and relevant paper and to emphasize the importance of muscular isokinetic assessment in profiling athletes susceptible to injury.

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Authors’ Response:

We thank de Lira and colleagues for their comments and interest in our recent paper examining sex differences in the incidence of common knee injuries in collegiate and high school sports. We agree that the findings of this epidemiologic investigation indicate the need for continued emphasis on the dissemination and implementation of both primary and secondary knee injury prevention programming for individuals who participate in high-risk athletic activities.

In their letter, de Lira and colleagues highlight the use of isokinetic strength testing, specifically the dynamic control ratio (DCR), as a tool to identify potential knee injury risk factors (in this case, deficits in lower extremity muscle performance). We have noted that measurement of muscle function is an important component of any comprehensive clinical evaluation, we are cautious to state that a single measure, such as isokinetic strength testing, can be used as a screening tool to identify knee injury risk factors.

In a recent paper, Bahr2 reviewed the key components to developing a screening measure for injury prevention in sports. He outlined 3 essential steps needed to validate a screening tool that can predict and prevent athletic injuries: (1) prospective cohort studies that identify risk factors and define cut-off values; (2) validation studies for the screening tool and cut-off values, performed in multiple, separate cohorts; and (3) randomized controlled trials that test the effectiveness of a combined screening tool and intervention program(s). Through statistical analysis, associations between the result of a screening test and injury risk can be made; however, these associations are not robust enough to conclude that the screening test can predict who is at a higher risk of injury.

To our knowledge, there are no studies to date that have identified strength testing metrics as prospective risk factors.
factors for knee injury during sports-related activities. While numerous studies show associations between muscle performance and various outcomes of physical function, there is not a specific cut-off value that has been established in the literature that predicts an athlete’s risk of a future knee injury.

With that said, we are delighted to know that our work with injury surveillance data is beneficial in driving such discussion of the development and evaluation of knee injury prevention strategies. Almost 20 years ago, van Mechelen emphasized that surveillance was one step of a cyclical process of prevention. Injury surveillance could first answer the “who, when, what, where, and how” related to injury and help drive etiological research to further examine risk factors associated with injury. Injury prevention interventions could subsequently be developed and long-term effects could be evaluated through longitudinal examinations of injury surveillance data. This framework was critical in our examination of knee injury data in collegiate and high school (HS) athletes. For example, regarding anterior cruciate ligament (ACL) injuries, we noted that “as interest in ACL injuries continues, our findings will hopefully serve as a baseline for future research examining time trends in ACL injury rates at both the HS and collegiate levels.” Furthermore, as recommended by de Lira and colleagues, additional prevention strategies are needed. Although our ACL injury rate estimates for college soccer and basketball were lower than those previously reported, we were unable to identify specific ongoing injury prevention efforts that may have been directly associated with these decreases. We are optimistic that longitudinal surveillance efforts, alongside prospective etiological studies, will help to identify future successes in injury prevention.

In conclusion, it is important to use sequential steps to validate evidence-based screening tools that can be efficiently disseminated and implemented with large, diverse groups. Taking this approach permits proper evaluation of the psychometric properties of the screening tool, as noted by Bahr. Furthermore, we promote using a battery of assessment tools to comprehensively evaluate the overall health of athletes, both physical and psychologically, at regular time intervals. Finally, from this updated epidemiological study, we add to the growing knowledge of the landscape of knee injury incidence in young, athletic populations. It is our hope that researchers will use these findings to not only inform their efforts to develop etiological research that further identifies risk factors, but also to validate screening tools with high clinical utility that strive to decrease the burden of musculoskeletal injury.

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