CONNECTICUT STATE MEDICAL SOCIETY

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CSMS Committee on the Medical Aspects of Sports

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Skateboarding Knowledge and Injury Prevention

By Amit Lahav, MD

Skateboarding is a sport which involves riding and performing tricks using a skateboard. Teenagers are very familiar with this sport. The key element is a skateboard, which is a board on four equal-sized wheels. Skateboarding was probably born sometime in the late 1940s–1950s, when surfers in California wanted something to do when the waves were flat. No one knows who made the first board, but it seems that several people came up with similar ideas around the same time. The first manufactured skateboards were ordered by a Los Angeles, California surf shop which were meant to be used by surfers in their downtime when they did not surf but could still keep up their skills. Since the 1970s, skateparks have been constructed specifically for the use by skateboarders, BMXers, skaters, and more recently, scooters. By 2001, skateboarding gained sufficient popularity that more children under the age of 18 rode skateboards than played baseball (10.6 million compared to 8.2 million respectively), but traditional organized sports still however dominate youth programs overall.

With the evolution of skateparks, ramps, and more aggressive skating, the skateboard sport began to change. Early skate tricks had consisted mainly of two-dimensional freestyle maneuvers like riding on only two wheels ("wheelie"), spinning only on the back wheels ("pivot"), high jumping over a bar and landing on the board again ("hippie jump"), and long jumping from one board to another. On the down side, skateboarding and similar sports, such as scooters and skating, all involve an inherent risk of falls. This leads to lower limb, upper limb, and spinal or hip injuries, including fractures. The chance of a fractured wrist or hip increases with height, speed, and adventurous challenges that skateboarders enjoy. Most common fractures are of the ankle and wrist. 60% of skateboard injuries involve children under age 15 and most of those injuries occur in boys.

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Spotlight on Diagnostic Imaging: MRI

This new section will provide visual examples of clinically relevant diagnostic imaging findings for clinical conditions or chief complaints that are commonly encountered in the outpatient office setting. It will serve as a review of a differential diagnoses for a specific patient population, anatomical region, and a clinical scenario.

A 41-year-old right-hand dominant woman presented to the office with a six-month history of atraumatic right lateral shoulder pain, greatest with activity, but also positive night pain. She has modified her overhead motions to lessen pain. She denies subjective weakness. Oral NSAIDs are without improvement. She had seen an outside provider, and two prior subacromial corticosteroid injections were without relief.

Her physical examination was notable for full and symmetric active range of motion. Positive pain with rotator cuff strength testing with scapular plane elevation and external rotation in adduction. She had no pain with internal rotation in adduction. She had positive impingement signs of Neer and Hawkins. Glenohumeral stability testing was normal and symmetric. She was non-tender at the AC joint or bicipital groove.

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Editor's Column

Dear *SportsMed* Reader:

We are fortunate to have a diverse group of physicians, athletic trainers and athletic/educational administrators contributing to the discussions at our Committee on the Medical Aspects of Sports meetings. With one of the goals of the Committee being the distribution of sports medicine educational content to the practicing clinician, I begin my role as Editor of our Committee Newsletter hoping to tap into this diverse knowledge base and expand the breadth of topics covered in our Sports Medicine Newsletter.

To this goal, in addition to our review articles, we'll be adding sections of practical application that the reader may able to utilize immediately into their evaluation and treatment of their active patients. We'll begin a section dedicated to diagnostic imaging: radiograph recommendations, MRI, CT and ultrasound. A separate section will be dedicated to the in-office evaluation of athletic injuries and offer both clinical examination and treatment recommendation pearls.

This edition focuses on the in-office evaluation of medial collateral ligament injuries of the knee as well as the differential diagnosis of atraumatic shoulder pain in a middle-aged patient with MRI correlative examples. Dr. Lahav presents an overview of the potential risks associated with skateboarding and provides recommendations that can assist in the counseling of parents in regard to injury prevention.

As always, we welcome your comments both about the content of this newsletter as well as other issues facing athletes in the state that you are seeing and dealing with.

Sincerely,

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Skateboarding

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Head trauma accounts for approximately 3.5–13.1% of all skateboarding injuries. Injury occurs most often to the upper extremities (55–63%), whereas thoracoabdominal and spine injuries account for 1.5–2.9% of all trauma, and lower extremity injuries occur 17–26% of the time.

Other common skateboarding injuries include AC joint sprains, Achilles tendon rupture/ tendinitis including Sever's syndrome, ACL injury, adductor tendinopathy, ankle injuries, lumbar strain/sprain, knee bursitis and patella tendinitis, chondromalacia of the patella, lumbar facet joint pain, hamstring strain, femoroacetabular impingement, periformis syndrome, rotator cuff strain and shoulder impingement, Sinding-Larsen-Johansson syndrome, thigh strain, and iliotibial band strain. Most injuries tend to occur from a loss of balance leading to a fall, and in more recent times due to a failed trick. Skateboard-related injuries are also associated with a high incidence of traumatic brain injury and long bone fractures. Age plays an important role in the anatomic distribution of injuries, injury severity, and outcomes.

In order to decrease injuries for skateboarders, certain guidelines are helpful. General injury prevention considerations include practicing skateboarding safety with the use of protective equipment, learning basic skateboarding skills, use of professionally designed skateboarding areas that are located away from motor vehicles, roads, and pedestrian traffic, sticking to your level of confidence, and avoiding tricks beyond your ability. The use of a quality skateboard is very important. In addition, keep your skateboard in proper working order with good wheel balance and rotation, as well as wheel resistance that is uniform for all four wheels. Do not use headphones while skateboarding, since it is a distraction and it is harder to evaluate your surroundings. Never put more than one person on a skateboard. A skateboard is made for one person to use at a time. As mentioned earlier, wearing proper protective equipment can limit injuries.

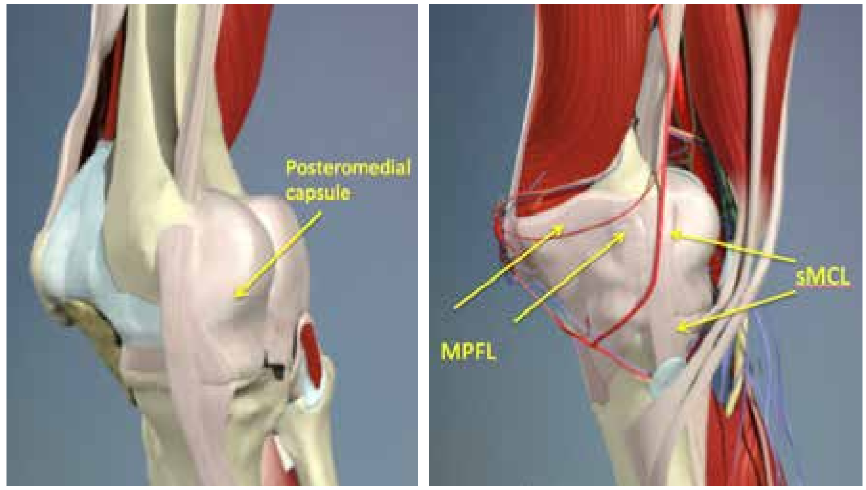
The highest risk for injuries occurs with inexperienced skateboarders. Those who have been skating for a shorter duration suffer approximately one-third of injuries usually caused by falls and lack of protective equipment. Every skateboarder should wear standard safety gear. This includes a helmet, wrist guards, elbow and knee pads, and appropriate shoes, especially when beginning to skateboard. As you get better, a helmet becomes one of the most important pieces of protective equipment to use. Skateboarders who perform tricks should use heavy duty gear. Skateboarders who go near traffic or use homemade skateboard ramps are at risk for injuries and should consider these risks carefully. Experienced skateboarders who encounter unexpected surfaces or try risky stunts, irregular riding surfaces, rocks or other debris can suffer a fall. You can stumble over twigs or fall down slopes. Wet pavements and rough or uneven surfaces can cause a wipeout. In general, avoid risky behavior. Don't skateboard too fast or in dangerous or crowded locations (or holding on to cars). According to the American Academy of Pediatrics, children under age 5 years old should never ride a skateboard. The reflex for falling is not mature enough to prevent an injury and balancing on a board is more difficult for the young ones.

Even in view of injuries that can occur, as with any sport, skateboarding is fun. With the proper knowledge and use of protective equipment, the risks for injuries can be decreased while enjoying the adrenaline rush of skateboarding.

Physical Examination of Medial Collateral Ligament Injuries of the Knee

By Michael J. Medvecky, MD

Figures 1 & 2. Medial Knee Anatomy



Images courtesy of Primal Pictures

Medial collateral ligament (MCL) injuries are one of the most frequently seen knee ligament injuries, and typically occur via a contact or collision mechanism, causing valgus stress with combined tibial external rotation. The treatment algorithm is usually dictated based upon the severity of the medial-sided knee injury as well as injuries to associated structures such as the posteriomedial capsule (PMC), medial meniscus, medial retinaculum, the medial patellofemoral ligament (MPFL), and two cruciate ligaments, anterior (ACL) and posterior (PCL). The goal of this article is to summarize the in-office physical examination of these injuries.

Evaluation and treatment of this injury requires an understanding of the anatomy of the medial aspect of the knee as well as key biomechanical principles.

Clinical Evaluation

A detailed history is obtained from the patient, including mechanism of injury and any subsequent treatment is also delineated. The patient typically will present with medial-sided soft tissue swelling or ecchymosis. A tense effusion is typically not seen with this injury due to the capsular disruption that occurs. The examination is typically limited by pain, swelling, and muscle guarding. The patient will normally maintain the knee in a flexed position due to the swelling and pain inhibition usually related to full extension.

A comprehensive knee examination is performed, including soft tissue assessment, neurovascular status, knee range of motion including assessment of hyperextension, patellofemoral stability, focal areas of tenderness, standing limb alignment and gait, as well as comprehensive assessment of knee motion limits with comparison to contralateral knee.[1] The uninjured knee should be examined first to assess the normal range of motion in the sagittal plane (flexion, extension, and native hyperextension). Native hyperextension can be quantified by the distance in centimeters from the posterior edge of the heel to the bed when the foot is elevated and the thigh is secured to the table. Assessment of the amount of native hyperextension is important as increased hyperextension of the injured knee would only be related to injury to the posterior capsule. This type of knee injury is uncommon but can also be associated with injury to one or both cruciate ligaments and can even portend a complete tibiofemoral knee dislocation, which can be a limb-threatening injury.

Localizing the area of maximal tenderness to palpation can assist in determining the focus of ligamentous injury and possibly associated injuries. Injury to the superficial MCL (sMCL) can be at the femoral attachment site (medial epicondyle), midsubstance (joint line region), or distal aspect along the tibial insertion.

Assessment of patella stability is important, as significant medial-sided injuries can involve damage to the medial femoral condyle attachment sites of the sMCL and the adjacent medial patellofemoral ligament, which is the main ligamentous structure stabilizing the patella from lateral dislocation. Injury to the patella stabilizing ligaments can be assessed by tenderness to palpation along the medial retinaculum, medial aspect of the patella or the medial epicondyle. The stability of the patella to lateral dislocation should be assessed by comparing the amount of lateral translation of the patella is a relaxed position of 0°, as well as at more taut position in 30° of flexion, when the patella is initially engaged within the trochlear groove.

Assessment of ACL and PCL function is also imperative in these injuries, although less commonly injured. The Lachman test is performed by assessing the amount of anterior translation of the tibia at 30° of flexion and the posterior drawer test assesses the amount of posterior translation at 90° of flexion. Combined injuries to the sMCL and a cruciate ligament is uncommon, but more likely seen as a combined sMCL-ACL injury.

Significant medial-sided injuries can also involve damage to the vastus medialis muscle, semimembranous tendon attachment to the posteromedial tibia, and the adductor magnus tendon adjacent to the medial epicondyle.

Classification of Injury

The scientific literature pertaining to medial collateral ligament injuries demonstrates wide variability in the classification schemes used to categorize injury patterns and this leads to considerable difficulty in comparing treatment algorithms or clinical outcome studies.[2–4] Among the earliest classification systems for describing ligament injuries was that proposed by The American Medical Association Standard Nomenclature of Athletic Injuries.[5] Injuries were broken down based upon structural injury and abnormal motion limits resulting from such injury. The first degree (1°) sprain results in injury to a few ligament

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Medial Collateral Ligament Injuries of the Knee

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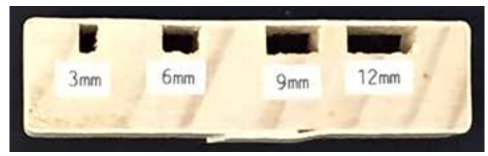
fibers without abnormal motion change. Second degree (2°) injuries result in partial tearing of ligament fibers with increased joint motion but still maintaining structural endpoint. Third-degree (3°) injuries result in complete ligamentous disruption with no functional endpoint achieved.

Modifications of the classification system are seen in various articles pertaining to medial collateral ligament injury with some classification systems using gradations of absolute joint opening (grade 1+, 2+, and 3+). Other classification systems utilize a grading system (grade 1, 2, and 3) with each grade representing an additional 5 mm increase in abnormal joint space opening (grade 1 = Δ(Delta) 0–5mm, grade 2 = Δ(Delta) 6–10mm, grade 3 = Δ(Delta) 11–15mm). The author utilizes the AMA Classification system as outlined by Noyes[4] which is based upon the increase in millimeters in joint space opening compared to the contralateral limb, with gradations based upon biomechanical and kinematic in vitro selective ligament cutting studies by Grood et al, (Figures 1 & 2).[6] Palpation of the medial joint line is used to assess the amount of joint space opening on both the normal and injured knee and the difference between the two is used to categorize the degree of ligament injury (ex., 1st degree, 2nd degree, or 3rd degree sprain).

Figure 3. Joint Space



To aid in patient comfort, and subsequently better accuracy in the physician's ability to examine these injuries, the patient lies on the examination table with the thigh resting on the bed. The leg is supported at the ankle and with one hand palpating the medial joint line to assess for the amount of joint space opening, the supporting hand is used to provide a valgus stress within the comfort level of the patient. Palpation of the joint line is used to try to quantify the amount of joint space opening in millimeters (ex., 0mm, 3mm, 6mm, 9mm, 12mm) as well as qualification of the type of endpoint (firm vs soft). LaPrade et al[7] demonstrated the reproducibility of clinician-applied stress radiography where isolated 3° sMCL injury resulted in an increase of 3.2 mm medial joint gapping at 20° and the increase of 1.7 mm in full extension. A complete medial knee injury (sMCL, dMCL, and POL) resulted in increased medial joint gapping to 6.5 mm and 9.8 mm at 0° and 20°, respectively. Combined complete medial knee injury and ACL injury resulted in increased medial joint gapping of 8 and 14 mm at 0° and 20°, respectively.

There is a fairly uniform consensus in the literature that non-operative management of first- and second-degree MCL injuries is appropriate.[8–12] With regard to acute third-degree medial-sided injuries, some controversy does exist regarding non-operative versus operative intervention.[13–14] However, most studies advocate non-operative treatment of the medial-sided knee injury and it is beyond the scope of this review to discuss the treatment algorithm of the spectrum of these injuries

Our literature on the diagnosis and management of collateral ligament injuries is still lacking in the accurate communication in the type of ligament injuries that are being assessed (isolated sMCL vs. combined sMCL and POL, degree versus grade injury) and this has led to disparity in the classification of types of injuries being evaluated and therefore comparative analysis of studies is limited by this discrepancy. However, recent literature has consolidated our knowledge of the anatomy of the medial aspect of the knee and supported the use of stress radiography for objective assessment of medial ligament injury as well as provided biomechanical support for a medial ligamentous reconstructive option. We hope an emphasis on consistency in our communication of the diagnostic classification of knee injury patterns will lead to improved clinical studies on the optimal treatment of the variations on this type of knee ligament injury.

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Spotlight on Diagnostic Imaging: MRI

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Differential diagnosis

- Rotator cuff tendinopathy (tendonitis) Fig. 2
- Subacromial impingement syndrome
- Calcific tendonitis
- Rotator cuff tear (partial vs complete) Fig. 3 & 4
- Degenerative labral tear
  - SLAP tear Fig. 5 & 6
  - Labral tear and paralabral cyst Fig. 7
- Acromioclavicular joint arthritis
- Adhesive capsulitis Fig. 8
- Glenohumeral arthritis Fig. 9
- Cervical disc disease

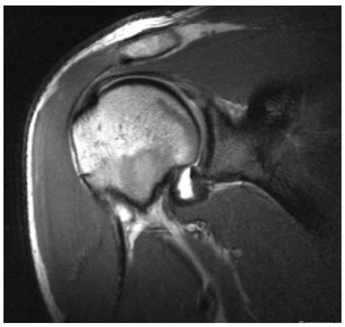

Figure 1. MRI arthrogram proton density weighted coronal image demonstrating NORMAL anatomy. Articular cartilage intact. No rotator cuff tendinopathy. No partial rotator cuff tear with intact tendon attachment onto the greater tuberosity footprint. No labral tear.

Figure 2. MRI arthrogram proton density image demonstrating thickening of the supraspinatus tendon consistent with tendinopathy.

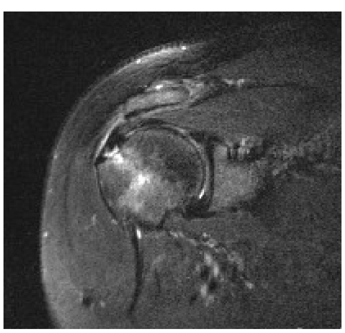

Figure 3. Coronal T2 fat sat non-contrast image showing edema within the substance of the supraspinatus tendon consistent with partial-thickness, intrasubstance rotator cuff tear.

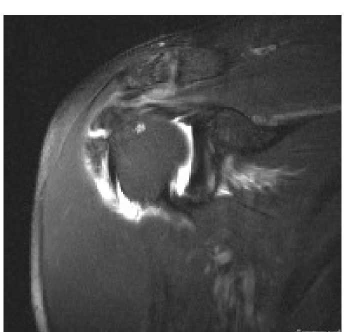

Figure 4. MRI arthrogram Coronal T2 fat sat image showing contrast underneath the supraspinatus attachment onto the greater tuberosity consistent with high-grade, partial-thickness bursal-sided rotator cuff tear vs full-thickness rotator cuff tear.

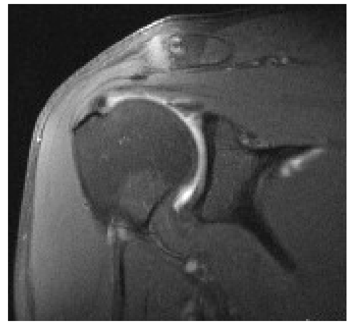

Figure 5. MRI arthrogram with Coronal T2 weighted image showing increased signal undermining the superior labral consistent with superior labral tear (SLAP tear).

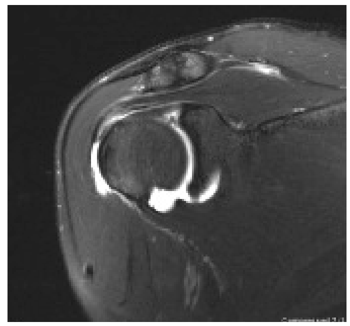

Figure 6. MRI arthrogram Coronal T2 fat saturated image demonstrating contrast undermining the superior labrum consistent with superior labral tear (SLAP tear). However, the contrast is also seen in the subacromial space, indicating extravasation and likely concomitant full-thickness rotator cuff tear.

Figure 7. Coronal T2 fat sat with large paralabral cyst at the spinoglenoid notch, probably causing suprascapular nerve compression with resultant infraspinatus muscle weakness.

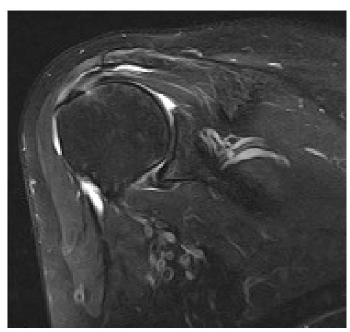

Figure 8. Coronal T2 demonstrating edema and thickening of inferior capsule consistent with adhesive capsulitis.

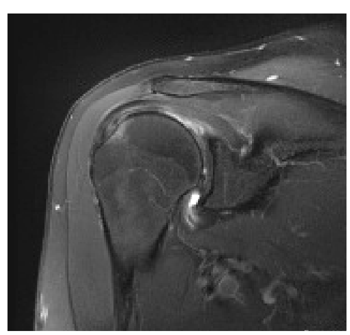

Figure 9. Coronal T2 fat sat demonstrating glenohumeral arthritis with areas of partial and full-thickness articular cartilage loss.