Bone Bruising with Knee Injuries

It's not surprising that a high-energy, traumatic injury to the knee can cause considerable damage. Ligaments like the anterior cruciate ligament (ACL) tend to go first. With greater intensity of force the damage can extend to the meniscus and medial collateral ligament (MCL). And now we know from this new study that before the meniscus or medial collateral ligament (MCL) give way, bone contusion (bruising) occurs first.

In fact, the more extensive the bone contusion, the more likely it is there will be associated injuries to other parts of the knee. A bone contusion (bruise) shows up on MRIs as increased fluid called edema inside the bone marrow (center of the bone). With anterior cruciate ruptures, the bone is usually bruised along the lateral border. Lateral tells us the area involved is along the side of the knee away from the other knee.

When the injury occurs, the foot is often planted firmly on the ground while the athlete is moving in a different direction. The intensity and speed of the event shifts the weight over the knee. The femur (thigh bone) rotates and the resulting shear force ruptures the ACL.

The exact mechanism by which the bone gets bruised isn't quite clear yet. One theory is that bone bruising occurs as a result of a mechanism referred to as contrecoup. The contrecoup mechanism describes the motion in the knee as the knee shifts back to compensate for the first pivot-shift during the initial injury.

The discovery that bone contusion occurs during ACL ruptures was made by looking at MRIs of 81 patients who had an ACL injury that required surgery. Most of the people in the study were athletes engaged in their sport (soccer, basketball, baseball, volleyball) at the time of the injury. But there were a few who were involved in a fall or car accident. Everyone in the study had MRIs taken within six weeks of the injury. The MRIs were essential in determining that there had been bone bruising.

By taking a closer look at the MRIs in relation to the patients' injuries, they were able to see how often bone contusions occurred. And, in fact, they found an 84 per cent rate of bone contusions in this group. By breaking the data down further, they recorded 73 per cent of the bone contusions were located along the lateral side of the tibial plateau. The tibial plateau is the flat shelf of bone at the top of the tibia (shin bone). The tibial plateau forms the bottom half of the knee joint.

There were almost as many (68 per cent) of corresponding bone bruises along the lateral femoral condyle. The femoral condyle is the round end of the bottom of the femur. There is a lateral and a medial femoral condyle (one on each side of the femur). The femur forms the upper part of the knee joint.

In a smaller number of cases, there was bruising along the medial femoral condyle (24 per cent) and on the medial tibial plateau (26 per cent). Bruises along both the femoral and tibial sides of the joint on the same side (medial or lateral) are called kissing bone contusions.

The surgeons were also able to identify how many patients had meniscal injuries (and what type) at the time of the arthroscopic surgery. About half of the group had some type of meniscal injury. They compared how many patients with bone contusions also had a torn or damaged medial or lateral meniscus. The greater the bone contusions, the more the meniscal injuries.

This makes sense if we remember the contrecoup mechanism. The initial injury damages one side of the joint. The knee shifts (rupturing the ACL) then shifts back (bruising the bone and tearing the medial collateral ligament). With enough force on the either side, the meniscus can be torn as well.
In summary, we've known all along that a lateral force on the knee intense enough to rupture the ACL is often enough to damage other aspects of the knee as well. This study shows how bone contusions (bruising) occur much more often than ever realized. With minimal force, there may be no bone contusion. With moderate force, the lateral side of the joint is affected first. And with severe force, there is enough energy behind the event to bruise the bone on both sides (medial and lateral).