Knees – the Great Negotiators

By Paul Fox

There's a joke among some in the Ashtanga Yoga community about how you tell what kind of practitioner or teacher a person is. Look at their knees. Closely. Is there that tell tale scar to show recent keyhole surgery? Perhaps a torn meniscus has been repaired, or a more serious injury has required the surgeon's knife.

If you have a strong hatha yoga practice, like Ashtanga, and do postures without awareness or sensitivity towards the knees then injury is not just possible, it is very likely. Aggressive attempts to achieve the lotus or other postures requiring very open hips will – if the required opening does not exist – lead to the knees kopping it – big time.

This article is an attempt to explore the anatomy of the knee in relation to yoga practice and to suggest an approach to this most fascinating joint which will enable asana to be practiced safely. That doesn't mean jettisoning all the "strong" postures or adopting an overly cautious approach to the knees.

The knee is the "great negotiator" in movements of the leg. Like all great negotiators, the knee is always looking for a workable compromise to the demands placed on it by the body and the wilful mind. Sometimes, when the awareness and sensitivity are not there – and ahimsa is absent – the compromise becomes unworkable and the knee itself is compromised in terms of torn ligaments, meniscus damage or systematic weakening.

Although it is a hinge joint, the knee is much less stable than the elbow which is a more straightforward hinge. Structurally and functionally, the knee allows for a much greater range of movement. This is partly the product of our evolution from quadruped to biped. And as humans have come up to standing, the knee has suddenly become a joint that is expected to bear much more weight from above, as well as absorb shocks and impact coming up the leg from the ground.

The knee also sits between two highly stable joints – the hip and the ankle. The hip is a tough old bird by any standards, with a snug ball and socket and all held in place by a complex network of muscles, ligaments and fascia (connective tissue). The hip is highly stable and strong for weight bearing. It is rare for anyone in a yoga class to pull something or damage their hip joint (although there are a range of degenerative conditions and/or hip replacement which can change this picture dramatically).

At the other end of the leg, the foot is also a highly sophisticated negotiator, but this time of foundation. The matrix of metatarsals and phalanges move and adjust to plant the foot securely on even the most unpromising terrain. (It is no surprise that even with the advances in computing and robotics, there is still no

machine that can come even close to matching the agility of a human scampering over rock pools at a beach with a bandy net looking for crabs!) But just above the bones of the foot there is the very stable hinge joint of the ankle. The tibia and fibula bones of the lower leg clamp either side of the talus at the top of the ankle, providing for a strong joint held securely in place by ligaments, muscles and fascia. The ankle is therefore mainly involved in hinge joint movements of dorsi flexion (lifting the toes and foot) and plantar flexion (pointing the toes and foot).

In comparison to the bone-to-bone anchoring of the hip and the ankle, the knee looks absurdly weak and vulnerable. Here, a cursory examination of the anatomy of the joint shows a couple of shaped and grooved bones sitting on top of each other and held together by ligaments, tendons and fascia.

The accompanying diagram shows the main skeletal and muscular connections at the knee. It shows how the distal end of the femur (ie where the femur joins the knee) has two curved heads, or condyles, which fit snugly into the concave curves of the tibia (lower leg), with the discs of the meniscus helping to create this concave shape and providing a gliding surface between the two bones. So that the femur does not roll off the lower leg when the knee is flexed (bent), and to more evenly distribute force, the head of the femur moves in a rolling and then gliding action over the menisci. The femur also articulates with the patella, or kneecap, which protects the front of the joint and adds stability. It is bound to the knee joint by ligaments connecting to the femur and meniscus and is enclosed in the main capsule of the knee, which creates a single synovial cavity enclosing the patella and heads of the femur and tibia.

It is tempting to dwell further on the complex anatomy of the knee, but the main point is that the joint is structurally less stable than other joints and held together by strong ligaments, mainly the anterior and posterior cruciates, the collateral ligaments to the side and the patellar ligament. This structure gives the knee its incredible range of movement and its ability to negotiate the demands for movement placed on it.

Let us consider three postures involving the knee.

The first is the squat, whether on the toes or with heels grounded (or with some support under the heels to enable a firmer foundation). This posture is a good hip opener and popular in yoga classes and yoga for pregnancy classes. The knee should track the toes to avoid sending an imbalance of force up the inside or (less commonly) the outside of the joint. A wall can be used to avoid going too deeply into the squat,.

The interesting thing about this posture is what happens to the knee cap. In a squat the patella is forced strongly back against the groove in the head of the femur with a force of up to 400 kg! So practicing a squat is imposing an

immense force on the knee joint, albeit one that the joint is well capable of bearing.

In the warrior posture, Virabhadrasana, the knees are vulnerable to being twisted and compromised if the foot position is too ambitious. A classical sideways warrior with the back foot open and the front foot turned out 90 degrees assumes that the practitioner has fully open hips. Because this posture is practiced with the knee bent (and knee not going beyond the ankle to avoid overloading the joint), the knee is more vulnerable than when "locked" straight. A stiff hipped student attempting warrior with this foot position may twist the knee of the back leg and find that the front bent knee is tracking inwards, imposing a potentially dangerous load on the inside of the knee. The solution, as has been explored before in Spectrum, is to turn the back foot inwards and allow the hips to turn a little so that the knees are better able to track the foot and avoid twisting. This adjustment is probably advisable in a class situation, but for more physically advanced students with open hips, there is a loss of the hip opening quality of this posture if this modification is insisted upon

The lotus, or padmasana, presents an extreme demand on the knee joint but, again, the knee is up to the task if the practitioner is prepared to do the necessary preparatory work and not be greedy to achieve the posture. The lotus reveals another amazing quality of the knee – the way it allows the lower leg to rotate laterally or medially when bent. When the knee is locked straight, such rotation happens only at the hip (the ankle can also rotate medially and laterally somewhat). With the knee bent, the ligaments that stabilise the joint are relaxed, allowing the hamstrings to play their part in rotating the lower leg. The extent of this rotation is limited by the structure of the bones and by the acl and pcl (anterior and posterior cruciate ligaments) which form a cross shape from the front to the back of the joint, partly to hold the knee joint together. During lateral rotation of the lower leg the cruciates slacken somewhat, whereas during medial rotation they tighten.

Some yoga teachers shy away from accessing this rotation, believing that is can damage the knee, while I have heard others swear blind that such rotation does not exist! Everyday activities like running up the stairs, running around corners or getting in or out of a car all access this rotation.

Perhaps the most interesting point of debate about this rotation below the knee is whether postures like Virasana with the knees turned out is dangerous for the long term health of the joint because the ligaments surrounding the knee are being stretched could become lax. Here, individual teachers will just have to make up their own minds. My own view is that I am not going to tell someone who naturally sits with that kind of rotation (as most infants do) that they are doing something wrong. Every body is different, and some adults have maintained their fundamental openings better than others.

In the lotus posture two movements of the leg are required – lateral rotation of the femur and lateral rotation of the tibia/fibula in the lower leg (ie accessing that rotation in the knee joint). With a full range of movement in the hips and adequate lateral rotation in the bent knee, lotus is a comfortable and easy posture, with or without a block/blanket under the hips or possibly some knee support.

The accompanying photo shows a recommended manner of entering padmasana. The leg is bent and the knee relaxed to the side, with the other leg also relaxed and beginning to move laterally. The foot is then received by the hands, like a sacred offering on a plate, showing respect for the body – especially the knee. Slowly the foot is elevated a little, with the leg and knee still relaxed, and the foot carefully drawn in so that the heel heads towards the midline of the body (in this case the navel) and gently released onto the top of the inner thigh so that the wedge shape of the foot is sitting snugly against the downward angle of the laterally rotating inner thigh. The knee should be grounded and free of strain or pain (pain in the knee in any posture is a red light – STOP). The rotation in the lower leg at the knee should allow the sole of the foot to present to the heavens, so that the ankle is not under strain by being excessively inverted.

This approach to padmasana shows loving kindness towards the body, respect for the knee and an appreciation of the anatomical openings required for asanas involving the knee. It is totally different from reaching forward over the top of the foot and using arm strength to pull the foot into position. This all too common approach shows a lack of awareness for the knee and is asking for trouble.

So the next time you look at your knees – even if they are wrinkly or knobbly – send them some love. With proper care and attention, they will negotiate happily for you for years to come.