American Yoga NEWSLETTER

Published by the YOGA JOURNAL

Volume 2 Issue 8 4/83

Protecting the Knee in Asana Practice

By Arthur Kilmurray

The human knee is one of nature's engineering masterpieces. This complex structure of bones, ligaments, cartilage and muscles provides both mobility and stability to the body, while absorbing the stresses of weight bearing and locomotion. The intensity of these stresses leaves little room for deviation from precise kinesiology. The alignment of the bones and the action of the muscles must harmoniously interplay to channel the forces safely. Knees are quite unforgiving to those who abuse them. Many asanas, if practiced incorrectly, are potentially damaging to the knees. By being aware of the possible problems and understanding the correct actions of the knee, we can ensure the long-term health of this joint.

Most joints in the body are composed of the same basic parts. Bones are the weight-bearing structures. In a correctly aligned joint, the gravitational force is steered smoothly from one bone into the other. Ligaments are tough elastic bands that securely hold the bones in structurally stable positions, while allowing a full range of movement. They provide stability to the joint. Cartilage provides shock absorption, padding the bones and distributing the stresses equally across the bone interfaces. Muscles move bones through the range of motion determined by the bone and ligament structure, and also provide stability by holding the bones in fixed positions when required.

In the knee joint, the bones involved are the femur (thigh bone) and the tibia (shin bone). They are firmly held together by ligaments on the front (three patellar), sides (medial and lateral collateral), back (two popliteal) and center (anterior and posterior cruciate and three meniscal) of the knee. All the major muscle groups of the legs act on the knee joint. The weight-bearing knee is subject to far more stress and behaves somewhat differently from the non-weight-bearing knee.

On the simplest level, the knee exhibits a hinge-like movement. At one end of the movement, when the two bones form a 180-degree angle, the knee is said to be in extension. The normal range of motion includes all positions between 180 degrees and essentially zero degrees (as in a deep squat). At all angles less than 180 degrees, the knee is said to be in flexion. Movements toward 180 degrees are extensions, and away from 180 degrees are flexions.

A closer examination of the knee reveals a more complex action than a simple hinge-like movement. This joint can also be seen as two adjacent roll and slide joints. The rounded ends of the femoral condylles roll through the two depressions on the top of the tibia and glide back and forth to maintain secure bone contact at all times. However, these two mini-joints are of different size and are not quite parallel. Because of this assymmetry, at the last ten degrees before full extension (and, correspondingly, the first ten degrees of flexion), the inner joint continues moving after the outer joint has stopped, producing a five-degree rotational component to the action. When weight bearing, this comes from a slight medial rotation of the femur on the tibia; when non-weight bearing, the tibia rotates laterally on the femur. This rotational end to the extension action is commonly known as locking the knees.

Although when the knee is weight bearing the tibia cannot rotate on the femur, the non-weight-bearing tibia can exhibit an additional rotation if the angle of the knee is 90 degrees or less. Up to 50 to 55 degrees of movement is possible, mostly in the lateral direction. These actions are normal and necessary for safe use of the knees. Please observe and experience these movements yourself to better understand this discussion.

The two major components of movement at the knee joint are the hinge-like flexion-extension and rotation. It is the excessive movement on one or both of these directions that creates problems. Over rotation can occur in either the weight-bearing or non-weight-bearing positions. When the leg is weight-bearing, the foot is fixed on the floor and cannot move. Therefore, any rotational force (torque) applied to the leg as a whole will be absorbed by the knee. This is a common occurance in standing poses, where a rotational movement of the hip joint is a

(continued on p. 2)

key action. To eliminate this torque, always align the knee cap to be facing in the same direction as the toes. The inner knee should be in line with the ball of the big toe, the outer knee aligned with the ball of the little toe. When these four points lie in one plane, forming a rectangle, there is no torque on the knee. Because of the constant stress of weight bearing, this position must be actively held, responding to changes in other parts of the body. At times, the foot should be rotated to align with the knee if other adjustments are not possible. The angle of the back foot in the standing poses reflects this alignment. For beginners, whose hip joints may be tight, the foot turns in more. As the hip opens, the toes turn outward more to follow the changing angle of the leg. The front knee also follows this rule, both in straight-leg positions like Utthita Trikonasana, and in bent-leg asanas like Virabhadrasana II and Utthita Parsvakonasana.

Non-weight-bearing damage comes from forcing rotational movement on the knee that should be coming from the hip joint. Whereas the knee joint only allows 55 degrees of rotation (when flexed to an angle of 90 degrees or less), the ball and socket hip joint can theoretically allow close to 180 degrees of rotation. However, muscular and ligamentous tension can prevent the hip joint from experiencing its full range of movement. When movement of the hip joint is blocked, the knee must not be forced to compensate. This happens frequently in the practice of Padmasana and its variations. To prevent this, develop hip flexibility while maintaining the integrity of the knee. If strain is felt in the knee when working the hip socket, stop and try something different. Supporting the weight of the knee and leg with blankets or pillows while stretching the hip socket can be an effective way of working.

One of the major sources of knee problems is hyperextension, pushing the angle of the bones beyond 180 degrees. When weight bearing, this is not a static position of the bones, but rather is an active process that overstretches the back of the knee and pushes the inward rotation of the femur beyond the design of the ligaments. The force of gravity is pushed across rather than through the joint. Holding this position slowly overstretches the ligaments and permanently destabilizes the joint. The front leg in Utthita Trikonasana and the standing leg in balance postures, such as Virabhadrasana III and Ardha Chandrasana, are vulnerable to hyperextension.

In asana practice, protecting the knees from hyperextension (and all other knee pathologies) requires starting from a correctly aligned position and maintaining structural integrity as the pose evolves and flows. This necessitates intelligence at the level of the bones as well as the muscles. Each student must learn to align the knee from the center of the joint outward, adjusting the femur and tibia independently to produce the position of maximum stability. This is a dynamic process that involves continual adjusting before, during and after the pose.

The first step in awakening the intelligence of the knee is learning to control the quadricep muscle on the front thigh. This group is the primary extensor of the knee, and awareness here provides muscular stability to all knee positions. More subtle yet more precise control comes from adjusting the thigh bone itself. The position of the femur can be controlled from two major places — the inner knee (medial condyle) and the intertrochanteric line near where the thigh joins the body. By monitoring the position of the medial condyle, the extended knee can be fixed at 180 degrees. Because any hyperextension is a pathological condition and slight flexion is a kinesiologically stable one, work the knee from 175 to 180 degrees, hovering around 179 degrees or so as you zero in on the kinesthetic sensation of a clear 180-degree action.

Pushing the upper end of the femur (along the axis connecting the two trochanters) toward the back of the hip socket (away from the front thigh muscle) will also help protect the knees. If you visualize the femur as a lever with a fulcrum halfway down the bone, you will see that this action relieves the hyperextending pressure that pushes on the knee. This action can be practiced in all standing poses, and is crucial in preventing knee strain in the balancing poses, like Virabhadrasana III and Ardha Chandrasana.

The complement to this working of the femur is adjusting from the tibia region. In the hyperextended position, the top of the tibia is pushed back and the lower tibia pushed forward. The front shin muscles are slack and overstretched, the soleus-achilles tendon is tight, and too much weight falls onto the heels. To correct this situation, the front shin muscles must be activated, the achilles tendon stretched and more weight must be brought onto the balls of the feet. This last action comes from activating the gastrocnemius muscle. Visually, this will raise the heels away from the floor. However, stable weight bearing requires that three points — the heels and base of both the big and little toes — press equally downward. The left of the lateral head of the gastroc connects along with the

(continued on p. 5)

Editor: Linda Cogozzo
Design: Diane McCarney
Subscriptions: Demaris Hammond

AMERICAN YOGA NEWSLETTER subscriptions are $15.00 per year, mailed third-class, monthly. Send calendar listings, letters, news c/o Yoga Journal, 2054 University Ave., Berkeley, CA 94704.

RESOURCES

BODYSENSE℠ Workshops are conducted regularly by Sue Luby, author of Yoga is for You and Hatha Yoga for Total Health. Because Sue considers each person's unique body habits and adapts the exercises to individual needs, BODYSENSE can be challenging for the advanced student and gentle for the beginner. For information on how to bring Sue and this workshop to your students, contact her at 27 Barnard St., Andover, MA 01810, (617) 470-1980, 683-0806.

* * *

Suzie Muchnick announces an expanded class schedule and new location of The Yoga Workshop. All classes are now at The Macrobiotic Foundation of Florida, 3291 Franklin Avenue, Coconut Grove, FL 33133, (305) 448-6625, 661-4645. Classes are taught in the Iyengar-style, with limited class size to ensure individualized attention.

* * *

Sharon Spangler writes from Littleton, Colorado: I use a slinky toy to illustrate the spine to beginning yoga students. It is useful for showing compression when you bend without lengthening, less cumbersome than a string of alternating hockey pucks and jelly donuts, and more accessible and less expensive than a model of the real thing!

* * *

Steven Braff combines yoga teaching along with massage at Innerworks in Philadelphia, Pennsylvania, a holistic fitness center he describes as "on the move." Along with his wife and business partner Wendy Hammarstrom, he brings yoga and dance classes not only to those students who come to his home studio, but also into the neighborhoods of Philadelphia. Wendy teaches the dance classes, while Steven offers Hatha classes that combine the breath and flow of the Kripalu style along with the alignment and strength of the Iyengar approach.

Among Steven's recent endeavors is his work as a contributing writer to The New Frontier, a three-year-old local Philadelphia newspaper. Published monthly, it lists "new age" events and classes. Steven began to contribute articles within the past year, and his column covers such topics as "Organizing Your Practice," "Different Kinds of Yoga," and "The Nature of Discipline." To subscribe to The New Frontier, write 129 N 13th, Philadelphia, PA 19107. If you teach in the Philadelphia, you might consider The New Frontier as an place to advertise your classes and workshops.

To find out more about Steven's work, you can write to him at Innerworks, 604-66th Avenue, Philadelphia, PA 19126, or call (215) 927-6921.•

(continued from p. 2)

fibula with the grounding of the little toe, and the left of the medial gastroc with the big toe. Against the upward lift of the gastrocs, the heel stretches the soleus-achilles tendon down to the floor. This difficult action, the opening of the hinge of the calf muscle, stabilizes the femur onto the tibia and holds the extended knee in a stable position.

The most stable action of the knee is the opening of the extended knee joint. This requires the lifting of the femur up off of the tibia without distorting the correct alignment. This is not a gross movement of the bones, but rather a releasing and stretching of all points of the knee joint. The action must come from the very center of the joint. All sides of the knee squeeze equally toward the center. From this point, the femur is drawn up toward the pelvis and the three points of the foot are grounded into the floor. These two actions flow along the 180-degree aligned bones. All muscles of the legs and thighs are involved. This is a difficult action because of the strong tendency to push back on the bones of the knee when trying to open the joint. This is one of the major habits of beginning and even intermediate students. The action of the bones and muscles must be separated, adjusted and recombined harmoniously. It is important to be able to differentiate between actions of the muscles and movements of the bones. This awareness will allow the safe working of the knee joint.

Yoga is a process of integration. It unites the scientifically analytical left brain with the artistically metaphysical right brain. Just as the flowing patterns of music or dance, by following mathematical and physical laws, can elevate our consciousness to transcendental states, so can our asana practice raise our consciousness. With simplicity, precision and surrender as guidelines, let us move into new territories, exploring the infinite subtleties of the universe.•

Arthur Kilmurray teaches yoga in San Francisco, Calif.

Q.&A.

Q. Is daily asana practice necessary for the yoga teacher? Please respond.•