"The Knee Crisis Handbook" by Dr. Brian Halpern

Lessons for the Martial Artist, by Darwin Farrar, BS, MS, MPP, JD[1]

It was the last 30 seconds of round one in the first tournament I'd fought in more than a decade. I was comfortably ahead on points and I decided to save my waxing energy for the next round. When my opponent attacked I hesitated before attempting a jumping back kick and my opponent ran into me mid-kick. I landed awkwardly and my knee made a loud pop and buckled. I knew right then that I'd torn my ACL. This was my third knee injury. My first knee injury happened five years prior when someone tackled me during a basketball game and bent my knee sideways. Less than two years later I tore my left ACL, also during a basketball game. All of these injuries occurred after going injury free over more than a decade of competitive Taekwondo. After three significant knee injuries, I've become keenly interested in, if not obsessed with, understanding the functioning and strengthening of the knee. In addition to understanding how the knee is supposed to work and the details of the injuries I've suffered, I've tried to learn how to prevent further damage and injury. One of the more useful and informative books I've read is "The Knee Crisis Handbook" by Dr. Brian Halpern.[2] In addition to helping me better understand how my knees are supposed to work, and how to prevent future injury, this book has helped me better understand why I didn't injure my knee sooner.

As shown in the graph below, the major bones in the knee are the femur (thigh bone), the tibia (shin bone) and the patella (the knee cap). It is essentially a hinge joint that is held in place by the medial collateral (MCL), lateral collateral (LCL), anterior cruciate (ACL) and posterior cruciate ligaments (PCL). The knee is the largest joint in the body. The patella (kneecap) slides along a groove on the femur, and covers the front of the joint. The meniscus and cartilage cushion the spaces between these bones, and act as shock absorbers during movement. The quadriceps muscle groups on the front of the upper leg help straighten the leg from a bent position, while the hamstring muscle group, on the back of the upper leg, help to bend the knee. Tendons, tough cords of tissue that connect muscle to bone, link the quadriceps muscle to the patella and helps provide power to extend the leg. The patellar tendon connects the patella to the tibia. Finally, several large fibrous bands of tissue, called ligaments, support the knee on both sides to provide strength and stability to the joint. The function of the four ligaments that connect the femur and tibia are as follows:

- The medial collateral ligament (MCL) provides stability to the inside of the knee.
- The lateral collateral ligament (LCL) provides stability to the outside of the knee.
- The anterior cruciate ligament (ACL), in the center of the knee,

[1] In partial satisfaction of the 3rd Dan requirements.

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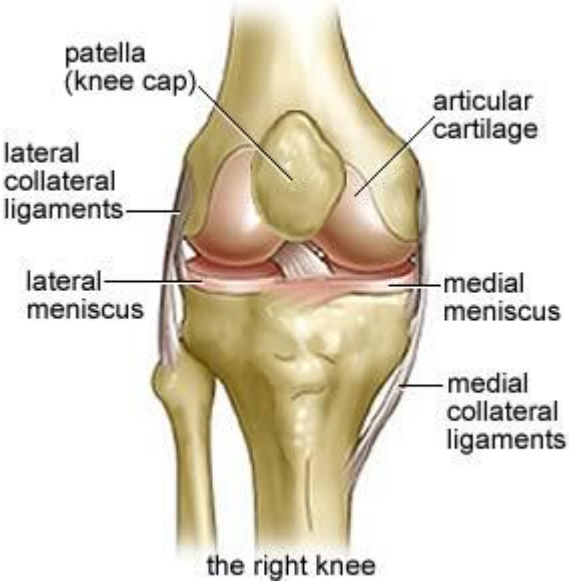
limits rotation and the forward movement of the tibia.

- The posterior cruciate ligament (PCL), also in the center of the knee, limits backward movement of the tibia.

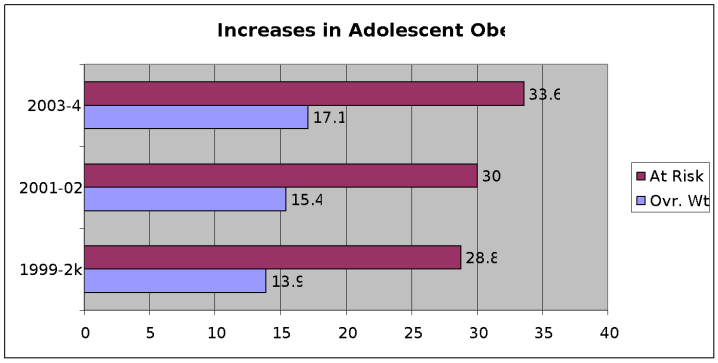


Dr. Halpern's reference to a "knee crisis" in the title of the book is not just sale seeking hyperbole. Ligament injuries to the knee are increasingly common. This is especially true with regard to sports that require stopping and starting or quickly changing directions. Dr. Halpern identifies several factors that contribute to the increasing frequency of knee injuries. First, knee traumas in women have gone up dramatically. Dr. Halpern notes that "recent statistical analysis shows that women are four to six times more likely to have specific traumatic knee injuries (like ligament tears) than men are." (P.1.) Indeed, one study found that a female basketball player is five times more likely to suffer a non-contact ACL tear than a male basketball player of the same level.[3] Further evidence comes from a survey completed by athletes who competed in the 1988 US Olympic trials. Thirteen out of 64 females suffered an ACl tear compared to only three out of 80 males. In addition, there was a greater need for surgery with the female ACL tears. Researchers suspect one of the most likely causes for the different injury rates between the genders is the way women are built.[4] Women tend to have wider hips and are slightly knock-kneed (their thighbones tend to curve inward from the hip to the knee) and this alignment can create added stress on the joints. Another cause could be traced to a female's muscles. More often, women tend to use their leg muscles differently than men.

[3] See 'ACL injuries in the female athlete', Journal of Sports Rehabilitation, 6, pp 97-110, 1997.

[4] *Id.*

A second factor identified by Dr. Halpern is chronic obesity. As noted in a report in the Journal of the American Medical Association, the rate and risk of obesity in children and adolescents significantly increased over the years 1999-2000, 2001-2002, and 2003-2004.[5] These results are shown graphically below.



Carrying more weight adds pressure to the knee joint exponentially and obesity is a well established predictor of knee trauma.[6]

Finally, Dr. Haplern notes that sports that involve jumping, running, turning, and kicking put extreme amounts of pressure on the knees. By way of example, Dr. Halpern reports that kicking a soccer ball puts as much as seven times your normal body weight on the knees. (p.89) Dr. Halpern's statement that basketball, soccer (16-25%), and skiing (20%) account for the majority of sports related knee injuries is consistent with my experience. While at my orthopedic surgeon's office for a check-up I spoke with two other knee reconstruction patients in the waiting room. Where I injured my knee playing basketball, a man about my age tore his ACL skiing, and a woman patient about the same age tore her ACL playing soccer.

While there don't appear to be any statistics describing the frequency of knee injury in Taekwondo, the jumping, kicking, and turning motions that are common to the sport suggest the need for concern. [7] As one researcher notes, non-contact ACL tears always involves a rapid deceleration of the knee joint. This can happen during a landing from a jump, or during a leg plant in a cutting movement (side-step).[8] Taekwondo practioners must be capable of performing a controlled and stable rapid deceleration of the knee in all directions, forwards, diagonal and sideways. If the knee is not stable during a rapid deceleration, owing to forces from the hip and ankle placing the knee in a weak position, a non-contact ACL tear can occur. Indeed, one common position that can lead to an ACL

[5] *JAMA*. 2006;295:1549-1555.

[6] See American Journal of Epidemiology Vol. 130, No. 2: 278-288

[7] While a comprehensive review of the literature addressing specific sources of knee injury is beyond the scope of this book report, a google search of the terms Taekwondo and knee injury returned a paltry (by current standards) 62,800 hits.

[8] 'ACL injuries in the female athlete', Journal of Sports Rehabilitation, 6, pp 97-110, 1997.

tear is when the knee is fixed around 20 degrees of flexion, almost straight, the torso is leaning forward, the thigh is internally rotated, shin externally rotated and the foot is pronated, as often occurs when a front kick is executed.[9] Here the quadriceps and hamstrings are attempting to control the deceleration of the knee, but the position places overload on the ACL.

Indeed, given the nature or biomechanics of Taekwondo and the increasing populatrity of the sport aspects of Taekwondo, one might expect to find significant research linking Taekwondo to knee injury. That this is not the case likely results from one of two causes; either the research hasn't caught on to any such trend, or alternately, no such trend exists.

In his book, Dr. Halpern indirectly yet quite persuasively argues that the practice of Taekwondo is not likely to result in a disproportionate number of knee injuries and may even have a preventative effect. First, in addition to monitoring weight[10] and working gradually to get into shape, Dr. Halpern emphasizes "five protective conditioning factors ... strength, flexibility, balance, agility, and timing." These factors, which can be found in most martial arts workouts, are particularly relevant to Taekwondo. Consider for example, a typical intermediate Taekwondo work out where a warm-up, that may include running and calisthenics, may be followed by stretching, then standing and jumping kicks (for both speed, power, and agility), and end with practicing forms (that emphasize balance and timing).

Dr. Halpern goes on to identify specific workouts that focus on improving general knee health, ACL health, and stretching. Many of the techniques, stretches, and exercises identified by Dr. Halpern are a routine part of most modern Taekwondo workouts. For example, Dr. Halpren identifies the following six stretches as supporting knee health: 1) Quadricep Stretch; 2) Hamstring Stretch; 3) Hip Flexor Stretch; 4) Piriformis Stretch; 5) Illiotibial Band Stretch; and; 6) Calf Stretch. Again, these stretches are common to Taekwondo workouts. Indeed, almost every workout I can recall over the last 30 years has featured these stretches or some variant on them.

Finally, Dr. Halpern provides sport specific advice on how to build eccentric strength, balance the strength ratio between opposing muscles,[11] and jump so as to prevent knee injury. While the strength building exercises Dr. Halpren recommends are less demanding and not likely to add to most Taekwondo workouts, his description of proper jumping is instructive. Jumping, or more correctly, landing, is especially important for knee health. According to Dr. Halpren, with sports that involve jumping, twisting and turning you must:

> Keep your knees and underneath you at all times, instead of allowing them to splay out. As you land, use your hamstrings, not just your

[9]'ACL injuries in the female athlete', Journal of Sports Rehabilitation, 6, pp 97-110, 1997.

[10]According to one study, every pound in excess of your normal weight puts three or four additional pounds of pressure on your knee every time you take a step.

[11]The hamstrings, in the back of the thigh, and the quadriceps, the muscles in the front of the thigh, are crucial shock and impact absorbers.

> quads, and shift your weight from your toes to your mid-foot – like a rocking chair, and keep your knees bent. Keep moving after landing, so your body doesn't have to decelerate quite as much.

Jumping is especially important when performing plyometrics.

Plyometric exercises are specialized, high intensity training techniques used to develop athletic power (strength and speed). Plyometric training involves high-intensity, explosive muscular contractions that invoke the stretch reflex (stretching the muscle before it contracts so that it contracts with greater force). Because these drills and exercises typically increase speed and strength and build power, when done correctly they can make a marked contribution to knee health. The most common plyometric exercises include hops, jumps and bounding movements. These and more advanced plyometric exercises are comparable to many Taekwondo practice drills. In both cases, practicing with a focus on proper landing technique can have a protective (by virtue of strengthening the supporting muscles) and preventative (by building proper landing technique into muscle memory) effect.

Herein rests the strength of Dr. Halpren's book. Rather than be seen as introducing a whole new program of knee beneficial exercises, Dr. Halpren's book can help focus any exercise program so that it builds rather than detracts from knee health. As applied to Taekwondo, Dr. Halpren's knee health book has the potential to substantially reduce the likelihood of knee injury by ensuring that the numerous jumping, flying, turning kicks that Taekwondo is famous for are always followed by a safe, biomechanically sound landing.

ABSTRACT:

"The Knee Crisis Handbook" by Dr. Brian Halpern

Lessons for the Martial Artist,

In his book, "The Knee Crisis" Dr. Halpern identifies various factors that contribute to as well as offset the likelihood of knee injury. Dr. Halpren indirectly yet quite persuasively argues that the practice of Taekwondo is not likely to result in a disproportionate number of knee injuries and may even have a preventative effect. As applied to Taekwondo, Dr. Halpren's knee health book has the potential to substantially reduce the likelihood of knee injury by ensuring that the numerous jumping, flying, turning kicks that Taekwondo is famous for are always followed by a safe, biomechanically sound landing.