Field Evaluation and Management of Non-Battle Related Knee and Ankle Injuries by the Advanced Tactical Practitioner (ATP) in the Austere Environment — Part Two

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Editor's Note: The following article is being published in three parts due to its size and amount of pictures.
Part One – In Vol. 9 Ed. 1 (Winter 2009) consisted of evaluation of knee injuries;
Part Two – Continues on from Part One and consists of taping procedures for the various knee injuries;
Part Three – Will be in the 2009 Summer Edition and will consist of ankle injury evaluation and taping.

Please keep in mind that this entire article applies only to the austere situation. No one would be able to carry all the braces and sleeves for the various joints in different sizes and for right or left that are available in CONUS on the missions.

Knee Ligament Taping

Knee taping is a good tool for the ATP to have in his rucksack treatment categories. By using standard adhesive tape applied directly to the skin, or by using duct tape, it is possible to tape the knee so that the knee and the damaged ligaments are supported. In addition, the taping will also restrict the motion of the knee joint.

Prior to taping, the type and area of damage must be identified as to whether it is a patellar dislocation, torn cartilage, torn medial collateral ligament, torn lateral collateral ligament, or torn anterior cruciate ligament. Once the area of the injury is identified, the skin is cleaned to remove any underlying dirt or debris. With the skin dry, the tape may be applied directly to the skin.

The initial step is to elevate the heel about two inches. This could be on a roll of tape as shown in Figure 22 or on any other object. By elevating the heel, the knee is flexed, giving the optimal position for taping (Figure 23).

Figure 22: *Elevate heel about 2 inches.*

Figure 23: *Heel elevation forces knee flexion for optimal taping position.*

Figure 24: *Proximal anchoring strips of tape applied. Approximately 50% of the thigh is taped with anchoring strips.*

Initially, three or four anchoring strips are applied at the distal thigh and three or four anchoring strips are applied in a circumferential fashion at the proximal foreleg (Figure 24). These anchoring strips are NOT applied in a spiral fashion, but as independent, overlapping circumferential strips. If possible, the leg should be shaved. As an alternative, tape prewrap may be used to protect the skin. In an austere situation, if supplies are limited and prewrap is not available, the tape should be applied directly to the skin. The tape is applied with approximately a 30 – 50% overlap (Figure 25).

Figure 25: *Distal anchoring strips of tape applied covering approximately 50% of the lower leg.*

Figure 26: *Initial crossing stability tape strip.*

Once the anchoring strips have been applied, an X pattern of overlapping tape is applied on each side of the joint (Figure 26 and Figure 27). The crossing of the tape occurs at the mid-portion of the side of the joint, which is where the ligaments lie.

Figure 27: *First set of crossing stability tape strips are applied.*

This is then reinforced with a second set of crossing tape strips (Figures 28 and 29).

Figure 28: *Application of 2nd set of crossing tape strips.*

Figure 29: *Final crossing strip applied.*

Once a double layer of crossing tape strips has been applied, a final single vertical strip is applied (Figure 30).

Figure 30: *Vertical reinforcing strip which further anchors the central X of tape.*

Once the strips are applied on one side of the joint, similar taping is done on the opposite side of the joint (Figure 31).

Figure 31: *Same crossing tape applied to opposite of the knee, centered at the mid-joint line.*

Figure 32: *Proximal circumferential anchoring strips applied proximal to the joint.*

Once both sides have the X-crossed tapes applied along with the vertical reinforcing strip, more circumferential anchoring strips are applied to anchor the medial and lateral X-crossed strips (Figures 32 and 33).

Figure 33: *Distal circumferential anchoring strips applied.*

During the process of taping, it is important to recognize that the popliteal fossa (posterior aspect of the joint) must be left open to prevent the development of tape blisters (Figure 34).

Figure 34: *Popliteal fossa left open to allow for flexion and extension, minimizing the probability of development of skin blisters beneath the tape as the knee moves.*

In addition, the kneecap must be left open to allow normal superior and inferior glide motion (Figure 33). This taping technique will provide rotational stability as well as stability against varus and valgus forces. In addition, flexion and extension will also be somewhat limited.

MENSICUS

When checking for a torn meniscus, it is necessary to palpate the medial and lateral joint lines for tenderness. A McMurray's test is then performed. The medial McMurray's test (Figure 35) is performed by forcibly flexing the knee and palpating the posteromedial joint line (to check the medial meniscus) with one hand. With the other hand, grasp the foot and externally rotate the leg at the hip and apply a varus force at the knee (compressing the medial side of the femur and tibia against the medial meniscus) and extend the knee. If there is a torn meniscus, a click may be felt or heard, and the test is usually painful if there is a damaged medial meniscus.

Figure 35: *Apply a varus force to compress the medial tibia and femur, compressing the medial meniscus.*

Figure 36: *Apply a valgus force to compress the lateral tibia and femur, compressing the lateral meniscus.*

In a similar fashion, the lateral McMurray's test (Figure 36) compresses the lateral side of the femur and tibia together and will pinch the lateral meniscus. The lateral McMurray's test is performed by placing one hand on the posterolateral joint line, grasping the foot with the other hand, forcibly flexing the knee, internally rotating the hip thus producing a valgus force at the knee joint (which compresses the lateral meniscus between the femur and the tibia) and extending the knee. If the meniscus is damaged, this will cause pain; but if the meniscus is normal, this will not cause pain.

When a person has a torn meniscus, this means that the C-shaped piece of fibro-cartilage known as the meniscal cartilage is torn and that this piece of tissue may displace inside the joint. Often it is a semi-attached free fragment much like the balloon on a string. As this fragment moves around, the fragment may go from being in an intra-articular position (Figure 37), but not trapped between the bones (which is a relatively painless situation), to moving to where the meniscal fragment becomes trapped between the bones (Figure 38). When the torn meniscal fragment becomes trapped between the bones, there will be the loss of extension, and increased pain. In addition, the knee may develop an effusion.

Figure 37: *Fragment of the medial meniscus trapped in the medial gutter of the knee, adjacent to the medial femoral condyle. Black circle surrounds the meniscal fragment.*

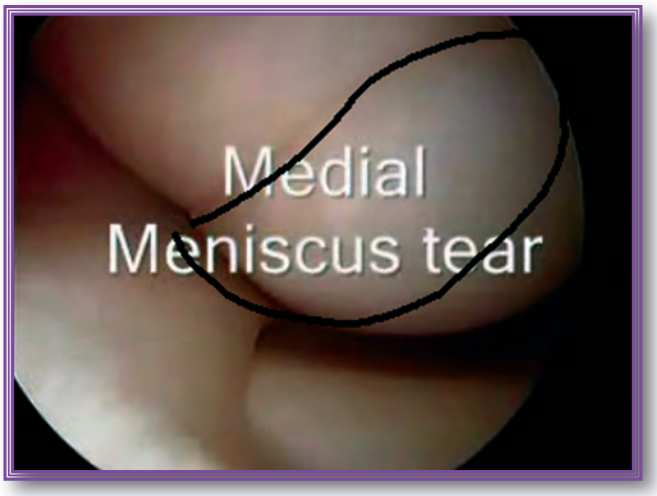

Figure 38: *Medial meniscal fragment trapped in an intra-articular position, between the femur and the tibia. Black circle surrounds meniscal fragment.*

Figure 39: *Joint positioned with the medial side of the joint (where the suspected meniscal tear is located) facing the floor.*

Although difficult, if any injured Soldier presents with a complaint of a locked knee due to a torn meniscal cartilage, he will have pain with terminal extension, loss of terminal extension and difficulty weight bearing. When on a mission in an austere situation, this interferes with the patient's ability to ambulate successfully. Therefore, the only realistic option to continue the mission is to try to reduce the meniscus tear. To successfully unlock a knee and reduce a meniscal tear, it is necessary to define whether the medial meniscus is torn or the lateral meniscus. This is done by palpating the joint lines, performing the McMurray test as described above, and isolating the PRIMARY pain source to the medial or lateral joint line.

To reduce the meniscus, it is necessary to understand the principles that are involved. The reduction of a torn medial meniscus will be described in detail. With a torn medial meniscus, the meniscal fragment has slipped inside the joint into a position between the femur and the tibia, much as a wedge slips between the door and the floor. This wedge or meniscal cartilage prevents the knee from coming into terminal extension. By placing the knee in a position that opens the medial side of the joint, and then by allowing gravity to pull the fragment out of the way (Figure 39 and 40), it is often possible to unlock a knee. This is not a long term curative measure and the knee may become locked again. If this happens, the procedure may need to be repeated. Definitive treatment of a meniscal tear requires arthroscopic surgery.

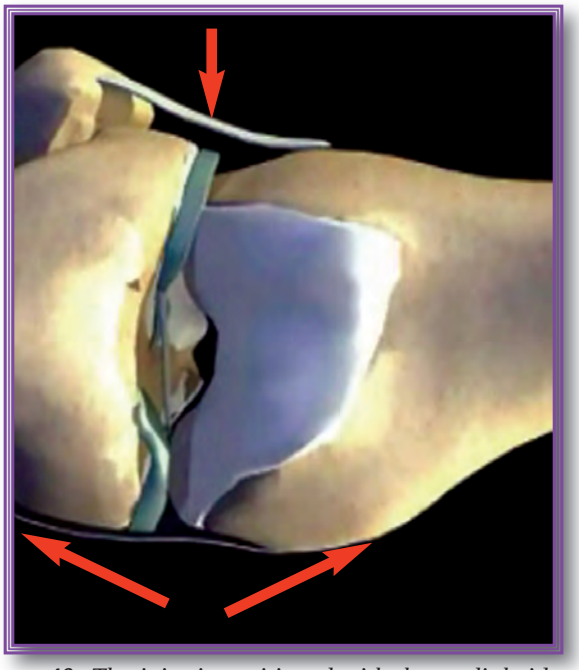

Figure 40: *The joint is positioned with the medial side of the joint (where the suspected meniscal tear is located) facing the floor. With a force directed at the lateral joint line (producing a valgus force), the medial side of the joint opens, increasing the likelihood that the entrapped medial meniscal fragment will drop out of the joint with the effects of gravity and manipulation.*

The procedure itself is rarely successful on the first try and often it is necessary to do this two or three times before the knee will become unlocked. Basically, the knee is placed such that the joint line is perpendicular to the ground (Figures 39 and 41) with the medial aspect of the joint is facing the ground. A downward pressure is applied to the

lateral aspect of the joint (Figures 40 and 42). As this is done, the knee is taken from a position of maximum flexion to extension. Usually by doing this two or three times, it is possible to force the fragment out of the joint and unlock the knee.

Figure 41: *Medial side of joint facing the ground with a downward (valgus producing force) applied to the lateral joint line.*

Figure 42: *Continue force application and gradually straighten the leg.*

In a similar fashion, the lateral meniscal tear may also be reduced by opening the lateral side of the knee, applying pressure to the medial side of the knee and extending the knee (Figures 43 and 44).

Figure 43: *Lateral side of joint facing the ground with a downward (varus producing force) applied to the medial joint line.*

Figure 44: *Continue force application and gradually straighten the leg.*

Once reduced and the motion is returned, it is then necessary to tape the knee to restrict full flexion and twisting. These are the two motions that will often allow the fragment to slip into the joint again.

The ligament taping that has been described previously (Figures 22 through 34) will prevent twisting and restrict full flexion, activities that increase the likelihood of additional locking episodes. The patient is then placed on an anti-inflammatory medication, his rucksack load should be redistributed, and walking sticks provided. Upon return to base, further medical evaluation is required. With respect to evacuation, the

healthcare provider should discuss the mission requirements with the teamleader. If the Soldier can be made functional and is able to continue walking and weight bearing, then the probability of mission completion is certainly greater. However, if the ATP is unable to unlock the knee, then it is unlikely that the patient will be able to remain functional.

Keep in mind that a previously locked knee, which has been successfully unlocked, may again become locked if significant physical demands continue to be placed upon the knee. There may be no advance warning of subsequent locking episodes, consider this when allowing an Operator to return or continue the mission.

Patella Dislocation

Patellar dislocations typically occur with a twisting injury or a blow to the medial aspect of the patella. Occasionally, a blow to the lateral aspect of a partially bent knee, while a patient is pivoting, will allow the kneecap to dislocate. On exam, the knee is typically flexed and there is an obvious deformity of the front of the joint (Figure 45).

Figure 45: *Right knee patellar dislocation with obvious patellar deformity. The patella is dislocated laterally and tilted, distorting the normal anatomy.*

To correlate this to what you would see on an X-ray, the kneecap, which normally sits in the center of the groove, sits on the lateral aspect of the knee (Figure 46).

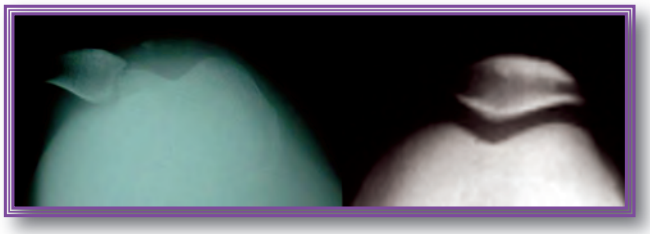

Figure 46: *X-ray appearance of the dislocated patella on the left and the normal appearing alignment on the right.*

When the kneecap comes out of place, this is usually easily reduced by simply bringing the knee into a position of full extension. A mistake that most people make is that they try to reduce the kneecap while the knee is flexed. Not only is this an incredibly painful procedure, but reducing the patella while the knee is flexed causes additional damage to the articular surface of the patella and distal femur (chondral or osteochondral fractures). However, if the knee is brought into a position of full extension, this relaxes the tissue around the kneecap and the kneecap will often auto-reduce. An additional trick is to passively extend the knee into full extension, and then passively flex the hip to approximately 45 degrees. In this position, the quadriceps muscle is relaxed, making reduction of the patella easier. If the patella still is not reducible, then with the knee fully extended (passively), a slight medially directed pressure at the lateral border of the patella will often allow the kneecap to reduce. Once reduced, the knee should be taped and anti-inflammatory medications given. With the knee taped, it is obviously necessary to avoid carrying heavy loads. Once the patient returns to base, further medical evaluation is required. Most Soldiers who have dislocated kneecaps will be able to continue the mission, but again this will need to be discussed with the teamleader.

When taping the kneecap, start with the application of three or four anchoring strips above the knee and three or four anchoring strips below the knee (Figure 47), as previously described.

Figure 47: *With the heel elevated and the knee flexed, the anchoring strops are applied as with the previously described ligament taping.*

The criss-cross tape strips are then applied initially at the lateral aspect of the knee. However, when applying these strips, they should be applied in a criss-cross fashion with the X-centered at the lateral border of the patella (Figures 48 and 49), rather than at the mid-portion of the joint line as done for ligament injuries (Figures 26 and 27).

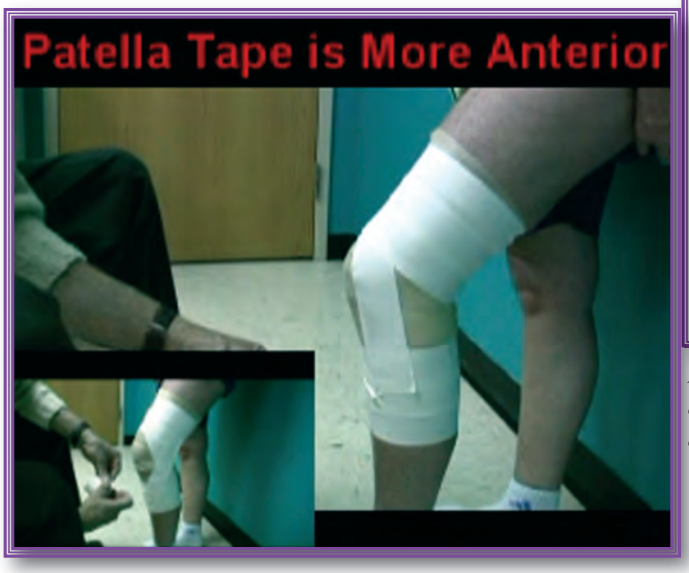

Figure 48: *Crossing tape stripe is initially applied at the lateral border of the patella, rather then at the mid joint line as shown in the insert and Figures 26 and 27.*

Figure 49: *Second X-tape strip applied centered at the lateral patella border.*

After applying two criss-cross strips at the lateral border of the patella, a patella stabilizing strip is applied (Figure 50).

Figure 50: *Patella stabilizing tape strip initially applied at the lateral aspect of the knee, starting posterolaterally and advancing to the lateral border of the patella.*

Once the strip has been applied laterally, the remaining tail is split, forming a Y-shaped piece of tape (Figure 51).

Figure 51: *Split the tape in half lengthwise, forming a Y-shaped piece of tape with two tails.*

After starting laterally with the base, and then passing half the tape at the superior border of the patella and continuing on to the medial aspect of the knee, the second tail is applied to the inferior border of the patella and then onto the medial knee (Figure 52).

Figure 52: *The second half of the split tape is applied just below the inferior border of the patella and then pulled to the medial aspect of the knee.*

Figure 53: *The first additional lateral patellar anchoring strip.*

Figure 54: *The second and final lateral patellar anchoring strip.*

After application of the horizontal Y-shaped patella stabilizing strip, additional reinforcing X-tape strips are applied to the lateral border of the patella (Figures 53 and 54)

Next, the medial tape tails of the Y-shaped horizontal patellar stabilizing tape strip are anchored in place by placing the X-anchoring strips medially. As with ligament taping, the medial X-anchoring strip are centered at the medial joint line with a final vertical anchoring strip (Figure 55). (The medial X-tape strips and vertical strip are NOT placed adjacent to the patella.)

During the process of applying anchoring strips, remember that it is necessary to keep the posterior aspect of the knee open so that tape blisters don't develop. Once the criss-cross X-strips have been applied, the circumferential anchoring strips are applied above and below the knee (Figure 56), as with the ligament taping.

Figure 55: *Medial X-tape strips applied, along with the vertical anchoring strip. This is the same pattern that was shown in figures 26-30.*

Figure 56*: Proximal and distal circumferential anchoring strips.*

This taping method works to stabilize the patella because you now have a medially directed force applied to the border of the patella (Figure 57) as well as the buttressing effect of the tape strips at the lateral border of the patella. In addition, the taping decreases the amount of rotation at the knee joint and the amount of flexion and extension so that the kneecap tends to remain seated in the patellar groove.

All of the treatment methods discussed in this article are only meant as temporary treatments. When the mission is completed, further evaluation and treatment should be sought for the Soldier.

In the next issue, Part 3 will discuss the evaluation and treatment of ankle sprains.

Figure 57: *Mechanical effects of the Y-shaped patellar stabilizing strip.*

This completes Part Two of this article. Part Three will appear in the Summer 2009 edition and will consist of ankle injuries.

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Dr Hammesfahr has served as president of the largest regional orthopaedic association, the Southern Orthopaedic Association. Currently, he is the Director of the Center for Orthopaedics and Sports Medicine and serves as the Chairman of the USSOCOM Curriculum and Examination Board.