**KNEE ASSESSMENT: PROCEDURES FOR CLINICAL KNEE EXAMINATION, QUADRICEPS POWER TEST AND HOP TESTS**

*Knee examination*

A standard knee examination was performed by a trained physical therapist. During the examination, knee joint effusion was assessed with the modified stroke test.1 The test was performed with the athlete in a supine position with the knee fully extended. The physical therapist attempted to move the fluid within the joint capsule to the suprapatellar pouch by stroking upward from the medial tibiofemoral joint line to the suprapatellar pouch. The physical therapist then stroked downward on the distal lateral thigh from the suprapatellar pouch to the lateral tibiofemoral joint line and watched for a wave of fluid on the medial side of the knee. The modified stroke test was graded on a 5-point scale (table 1)

*Table 1: Grading of the modified stroke test for knee effusion*

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| --- | --- |
| **Grade** | **Result** |
| 0 | No wave produced on downstroke |
| Trace | Small wave on medial side with downstroke |
| 1+ | Larger bulge on medial side with downstroke |
| 2+ | Effusion spontaneously returns to medial side after upstroke (no downstroke necessary) |
| 3+ | So much fluid in the knee that it is not possible to move the effusion out of the medial aspect |

The Lachman test2 was performed with the athlete in the supine position and the knee in 20-30 degrees of flexion. The physical therapist stabilized the femur with one hand and pulled the proximal tibia anteriorly with the other hand. A positive test was defined as an increased amount of tibial displacement with a soft endpoint.

*General warm-up*

Prior to quadriceps power and hop tests, the athlete performed 10 minutes of general warm-up on an ergometer bicycle. Then, the quadriceps power test was performed and, lastly, the hop tests.

*Quadriceps power test*

Quadriceps muscle power was tested with a linear encoder connected to the weight stack of a leg extension machine (Technogym, Italy).3 The load, displacement, and acceleration of the weight lifted were measured. Peak power was calculated by Musclelab, a computerized muscle testing system (Ergotest Technology, Norway). The commercially available software established the parabolic power-velocity relationship from the athlete’s maximal repetitions at different loads. Peak quadriceps power was defined as the peak of this parabolic curve. A standardized, specific warm-up was performed on the seated leg extension machine. The athlete completed 10 bilateral repetitions at a low load through the full range of motion, followed by 5 unilateral repetitions with the same load. An appropriate starting weight for testing was selected based on the athlete’s performance during a pre-test, which consisted of a single submaximal repetition. The athlete was asked, on a given signal, to kick as quickly and forcefully as possible from 100 degrees of flexion to full extension. Each leg was tested, in an alternating order, with one maximal repetition at each load. The load was increased by 5 kg per repetition until failure.

*Single-leg hop tests*

Hop tests were not performed if the athlete had a +2 effusion or if the athlete was unwilling to hop.

For the triple hop test,4 the athlete hopped forward as far as possible. To begin, the athlete stood on one leg, then performed three hops in succession and landed on the same leg. A trial was valid if the athlete held the landing position >2 seconds and did not touch the floor or wall with his or her hands or other leg. One practice trial was performed prior to the test for familiarization. The uninvolved leg was tested before the involved leg, and two valid trials were required for each leg. If the athlete increased the distance by more than 10% from the first to the second valid trial, a third trial was performed. The distance hopped was measured with measuring tape from the toe in the starting position to the toe in the landing position. The arms were not restricted during the test.

For the side hop test,5 the athlete performed as many single-leg sideways hops as possible over a distance of minimum 40 cm in 30 seconds. Touching the tape outlining the 40 cm distance was recorded as an error, and the test was only valid if >75% of the hops were correct. If more than 25% of the hops were errors, a new test was performed after a 3-minute rest period. The athlete performed 5-10 test hops on each leg for familiarization prior to the test. The uninvolved leg was tested before the involved leg, and one trial was allowed for each leg. The arms were not restricted during the test.

References

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