

Physiotherapy Assessment of Hamstring Strains

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Objective: To establish a standardized assessment procedure for hamstring injuries.

Methods: A questionnaire with a case scenario of a Grade II hamstring strain and a choice of tests to be included in an objective examination at 2 days and at 2 weeks post injury was completed by physiotherapists with an interest in sports injuries.

Results. Fifty-seven fully completed, anonymous questionnaires revealed that the most popular tests for a suspected Grade II hamstring strain 2 days post-injury are passive straight leg raise and passive knee extension with 90° hip flexion, followed by manual muscle tests at 90° and 15° knee flexion. An assessment at 2 weeks would include the functional pain provocation tests of single leg bridging at 45° hip flexion and 90° knee flexion and prone hamstring flicks and an assessment of neural tension (passive slump test). This would then be followed by assessment and/or treatment of lumbar spine or gluteal trigger points followed by reassessment of hamstring strength or length.

Conclusion: There are a large number of variations for objective testing of a hamstring strain with mild agreement amongst sports physiotherapists regarding optimal tests and testing positions.

Hamstring muscle strains are common in sport (Ekstrand and Gillquist 1983; Askling, Karlsson et al. 2003, Stanton and Purdam 1989; Orchard and Seward 2002). The results of a clinical examination of a suspected hamstring strain should enable a physiotherapist or medical practitioner to make a diagnosis and prognosis. There is no universally accepted clinical assessment for a suspected hamstring strain.

Methods

Members of Sports Physiotherapy Australia (a special interest subgroup of the Australian Physiotherapy Association) and elite sports team physiotherapists (n=650) were invited to complete an anonymous multi-choice questionnaire in June 2002.

A case scenario was presented; a 22- year old footballer with no history of previous hamstring strain or low back pain describes a sudden onset of pain in the posterior thigh while accelerating to chase an opponent. He is unable to play on and limps off the field. Your subjective examination at Day 2 makes you suspect that he may have a Grade II hamstring strain. Which tests would you include in your objective examination at (i) 2 days post injury and at (ii) 2 weeks post injury? Please indicate your answer depending on how often you would use the tests when assessing such a patient a rating of 0-3 (0-Never, 1-Occasionally, 2-Often, 3-Always).

The questionnaire consisted of 51 hamstring assessment techniques given over 5 sections comprising length tests, static strength tests, dynamic strength tests, tests of proximal structures and palpation positions. The pre-survey trial revealed that elite AFL and sports physiotherapists typically conduct a clinical assessment consisting of one or two flexibility tests, one or two static strength or pain provocation tests, palpation of the site of injury and further tests assessing dynamic strength, neural mobility, the lumbar spine and gluteal trigger points according to earlier assessment results.

This survey was a collaborative effort between Price Warren, the Centre for Health, Exercise and Sports Medicine (Melbourne University) and Sports Physiotherapy Australia (SPA), and has been approved by the University of Melbourne Human Research Ethics Committee.

Results

Sixty-one anonymous responses were received, with 57 fully completed. Of these, 88% were SPA members, 51% had post-graduate qualifications and 53% were high level team physiotherapists.

A : Length tests

- The most commonly used tests were passive; **Passive SLR** (PSLR) with 77% of respondents always using this test at two days, & **Passive Knee Extension** (PKE) (knee extension in supine with 90° hip flexion), 72% of respondents always using this test at two days. 91% of respondents said they would often or always use **PSLR** at 2 days and 97% at 2 weeks post injury.
- Only 9 out of 57 (16%) said never to the **PKE** (at both 2 days and 2 weeks).
- Other tests included: **Active SLR**, **PSLR with internal rotation/external rotation** (IR/ER) bias or **abduction/adduction** (Add/Abd) bias, **Active Knee Extension** (AKE), **PKE with full hip flexion**.

- The least popular length tests were active; **AKE** and **Active SLR** (ASLR) with 90% and 89%, respectively, never or rarely using these tests at 2 days. The usage of length tests were in similar proportions at 2 weeks as they were at 2 days.

B : Hamstring static strength tests

- The most commonly used static strength tests were prone isometric tests- **isometric Manual Muscle Test (MMT) in prone with 90° knee flexion**, followed by the same test carried out at **15°** and **30°** knee flexion.
- 47% of respondents said they would always use an isometric MMT in prone 90° knee flexion at 2 weeks post injury while 14% said they would never this test. The least commonly used tests were those with the hip in flexion and those involving tibial internal or external rotation.
- **Sitting with 90 hip flexion resisting active knee flexion**- 72% would NEVER use it at 2 days and 60% would NEVER at 2 weeks.
- **Standing leaning forward over table** (hip 20° -60° F) resisting 90° knee flexion -67% would NEVER use it at 2 days and 47% would NEVER use it at 2 weeks.
- Other tests included combinations of isometric resisted hip extension, and the above tests with hip IR/ER bias and supine resisted knee flexion at varying degrees of hip flexion.
- The use of static strength tests were in similar proportions at 2 weeks as they were at 2 days.

C; Dynamic strength tests

- There was less consensus with dynamic hamstring tests
- They were used significantly more often at the 2 week assessment than at 2 days.
- Most commonly used test was **single leg bridge** at 45° hip F/ 90° knee F -31% would use it often or always at 2 days and 56% often or always at 2 weeks Also **prone hamstring flicks** (rapid knee extensions) - 61% would always or often use the test at 2 weeks with 28% using it occasionally.
- **Hamstring Drag Test** (HDT) 14% often or always used it at 2 days and 20% at 2 weeks.
- **Hamstring lowers**, like the Nordic eccentric strengthening exercise; 18% often or always used this at 2 weeks.
- Other functional tests in this group included the ‘Sprint start’ functional loading, sprint drill (hip-knee flexion/extension reps in standing), moving the trunk back and forth with weight on hands and heels, standing hamstring flicks and bridging at 20° knee flexion.

D: Proximal Structures

- Neural tension is the most commonly assessed proximal structure using the **passive slump test**- 84% would often or always assess neural tension at 2 weeks and only 5 respondents (9%) never at 2 weeks; 23% never assess neural tension at 2 days.
- **Assessment/Treatment of lumbar spine**- 61% would often or always assess/treat the lumbar spine at 2 days while 19% would never. 74% would often or always assess/treat the lumbar spine at 2 weeks post-injury and then reassess hamstring strength or length. Only 3 respondents (5%) would never assess/treat the lumbar spine at 2 weeks.
- **Assessment/Treatment of gluteal trigger points**- 51% would often or always assess/treat gluteal trigger points at 2 days while 28% would never. 68% would often or always assess/treat gluteal trigger points at 2 weeks then reassess hamstring strength or

length. Only 8 out of 57 respondents (14%) would never assess/treat gluteal trigger points at 2 weeks.

Discussion

Measurements of muscle length are considered a routine part of the clinical assessment of a suspected muscle strain (Brukner and Kahn 2001). The SLR, measuring hamstring tightness by the angle of hip flexion with the knee extended, was first described in 1881 (Urban 1981) and is claimed to be the most common method of measuring hamstring flexibility in clinical practice {Sullivan, 1992}, a claim verified by this survey.

The AKE has the greatest frequency of use in measuring hamstring range of motion in the literature (Sullivan, DeJulia et al. 1992, Hennessy, 1993, Brown, 1993, Malliaropoulos, 2004, Gadjosik, 1983, Spernoga, 2001, Gabbe, 2005, Turl, 1998, Coole, 1887), however was rarely utilized by respondents to this survey. Recent work submitted for publication by Warren (Warren, Bennell et al. 2008) suggests that the AKE test might be more accurate as a length test for an injured hamstring, particularly compared to the prognostic value of the PSLR.

The most commonly used static strength tests were prone isometric tests with the knee between 0° and 90° of knee flexion. The least commonly used tests were those with the hip in end range flexion and those involving tibial internal or external rotation. Manual muscle testing (MMT) carried out in outer range with a medial (Internal Rotation/Flexion) or lateral (External Rotation/Flexion) resistance emphasis should assist in determining local hamstring involvement and aid in defining the hamstring region of injury, in particular, assisting in the determination of whether the medial or lateral hamstring is injured. This is important in light of the fact that numerous studies have shown that athletes with lateral (biceps femoris) strains take longer to return to play and have a greater risk of recurrence than those with medial hamstring strains (Garrett, Rich et al. 1989; Brandser, El-Khoury et al. 1995; De Smet and Best 2000; Verrall, Slavotinek et al. 2003; Connell, Schneider-Kolsky et al. 2004; Woods, Hawkins et al. 2004). Recent analysis of muscle kinematics during sprinting by Thelen (Thelen, Chumanov et al. 2005) demonstrates that biceps femoris is stretched the most during the late swing phase of sprinting which may relate to the magnitude of force developed in muscle. tests performed in the outer range of hamstring length approximating the knee angle in the late swing phase of running (Simonsen, Thomsen et al. 1985) which is thought to be more functionally provocative than inner range.

The “taking off the shoe” test (TOST) has been claimed to be a simple and reliable dynamic strength test used by Zeren (Zeren, Haluk et al. 2006) particularly at two weeks. He claims that other tests (PSLR, AKE, MMT’s and active slump tests) have a tendency to become negative after three days. The TOST is similar to the Hamstring Drag Test (HDT) used by % of respondents, where the injured leg is placed forward of the uninjured leg, pressed into the floor and dragged back.

Proximal structures are commonly assessed, particularly at 2 weeks post-injury. Pain-sensitive neuromeningeal structures have been suggested as a potential source of pain in the posterior thigh in hamstring injuries (Massey 1982; Maitland 1986; Kornberg and Lew 1989; Turl and George 1998) and referred pain from the lumbar spine (Maitland 1986), sciatic nerve or gluteal and piriformis muscles can mimic grade 1 hamstring strains (Kornberg and Lew 1989, Verrall, 2001).

Palpation should assist in determining local hamstring involvement and aid in defining the hamstring region of injury, in particular, assisting in the determination of whether the medial or lateral hamstring is injured. Most physiotherapists palpate an injured hamstring in pronelying with the foot resting on the plinth.

Conclusion

A large array of assessment techniques for hamstring strains exist with mild agreement amongst sports physiotherapists regarding optimal tests and testing positions. The most popular tests for a suspected Grade II hamstring strain 2 days post-injury are passive straight leg raise and passive knee extension in 90° hip flexion, followed by manual muscle tests in prone at 90° and 15° knee flexion. An assessment at 2 weeks would include the functional pain provocation tests of single leg bridging at 45° hip flexion and 90° knee flexion and/or prone hamstring flicks and an assessment of neural tension (passive slump test). This would then be followed by assessment and/or treatment of lumbar spine or gluteal trigger points followed by reassessment of hamstring strength or length.

Further study may be worthwhile given the prevalence of hamstring injuries in sport, refining optimal assessment tests and their predictive value in diagnosis and prognosis.

References

- Askling, C., J. Karlsson, et al. (2003). "Hamstring injury occurrence in elite soccer players after preseason strength training with eccentric overload." Scandinavian Journal of Medicine & Science in Sports. 13: 244-250.
- Brandser, E. A., G. Y. El-Khoury, et al. (1995). "Hamstring Injuries: Radiographic, Conventional Tomographic, Ct and MR imaging characteristics." Radiology 179: 257-262.
- Brukner, P. and K. Kahn (2001). Clinical Sports Medicine 2nd Edition, McGraw Hill.
- Connell, D. A., M. E. Schneider-Kolsky, et al. (2004). "A longitudinal study comparing sonographic and MR imaging assessment of acute and healing hamstring injuries." American Journal of Sports Medicine 34(6): 1008-1015.
- De Smet, A. A. and T. M. Best (2000). "MR Imaging of the Distribution and Location of Acute Hamstring Injuries in Athletes." American Journal of Roentgenology 174: 393-399.
- Ekstrand, J. J. and Gillquist (1983). "Soccer injuries and their mechanisms; A prospective study." Medicine and Science in Sports and Exercise 15: 267-270.
- Garrett, W. E. J., F. R. Rich, et al. (1989). "Computed tomography of hamstring muscle strain." Medicine and Science in Sports and Exercise 21(5): 506-514.
- Kornberg, C. and P. Lew (1989). "The effect of stretching neural structures on grade one hamstring injuries." The Journal of Orthopaedic and Sports Physical Therapy. 10: 481-487.
- Maitland, G. (1986). Vertebral Manipulation, 5th edition, Butterworth & Co.
- Massey, A. (1982). The Slump Test : an investigation of the movement of pain sensitive structures in the vertebral canal in subjects with low back pain. Postgraduate Diploma Dissertation. Adelaide.
- Orchard, J. and H. Seward (2002). "Epidemiology of injuries in the Australian Football League, seasons 1997-2000." British Journal of Sports Medicine 36(1): 39-45.
- Simonsen, E. B., L. Thomsen, et al. (1985). "Activity of mono- and biarticular leg muscles during sprint running." European Journal of Applied Physiology and Occupational Physiology 54(5): 524-532.

- Stanton, P. and C. Purdam (1989). "Hamstring injuries in sprinting-the role of eccentric exercise." Journal of Sports and Physical Therapy 10: 342-349.
- Sullivan, M. K., J. J. DeJulia, et al. (1992). "Effect of pelvic position and stretching technique on hamstring muscle length." Medicine and Science in Sports and Exercise 24: 1383-1389.
- Thelen, D. G., E. S. Chumanov, et al. (2005). "Hamstring muscle kinematics during treadmill sprinting." Medical Science in Sports and Exercise 37: 108-114.
- Turl, S. E. and K. P. George (1998). "Adverse neural tension: a factor in repetitive hamstring strain?" Journal of Orthopaedic & Sports Physical Therapy. 27(1): 16-21.
- Urban, L. M. (1981). "The straight-leg-raising test: a review." Journal of Sports and Physical Therapy 2(3).
- Verrall, G. M., J. P. Slavotinek, et al. (2003). "Diagnostic and prognostic value of clinical findings in 83 athletes with posterior thigh injury: comparison of clinical findings with magnetic resonance imaging documentation of hamstring muscle strain." The American Journal of Sports Medicine 31(6): 969-73.
- Warren, P., K. Bennell, et al. (2008). "Hamstring muscle strains - early clinical predictors of time to return to competition." Awaiting publication.
- Woods, C., R. Hawkins, et al. (2004). "The Football Association Medical Research Programme: an audit of injuries in professional football-analysis of hamstring injuries." British Journal of Sports Medicine 38(6): 36-41.
- Zeren, B., H. Haluk, et al. (2006). "A New Self-diagnostic Test for Biceps Femoris Muscle Strains." Clinical Journal of Sports Medicine 16: 166-169.