

supply in each case corresponded with that of man¹³. In Galago Senegalensis (lesser bush baby), the popliteus arises as a small tendon from the lateral condyle of the femur inferior to the lateral Gastrocnemius attachment. A sesamoid bone lying proximal and medial to head of fibula curves as an accessory attachment¹³. In our study, no proximal attachment to sesamoid bone in relation to head of fibula was found in any of the cadavers.

Clinical significance

Mayfield, Travell and Simons documented that popliteus muscle / tendon injuries occur most frequently with downhill running or walking^{15,16}. Davis et al said this may be due to repetitive use of the popliteus musculotendinous unit in preventing anterior translation of the femur on the tibia as popliteus muscle activity is proportional to increased load on flexed knee¹⁷. David Bryde et al proposed strengthening of Popliteus muscle in preventing injuries to the athletes. Strengthening of Popliteus muscle could also be beneficial for people who have genu recurvatum. They proposed decreasing posterior translation forces of the tibia by increasing the strength and tone of this muscle to reduce pain levels¹⁸.

Open exposure of the posterolateral corner of the knee is challenged by limitation of posterolateral ligamentous tissues and posterior neurovascular structures. The fascicles of popliteus to these proximal sites of attachment might be involved in the reinforcement of the postero-lateral knee joint capsule. The knowledge of discussed attachment sites is important to the surgeon in reconstructive cruciate ligament surgeries. Ruptures of lateral collateral ligaments can be easily recognised and an anatomic graft reconstruction is done to restore varus stability. However, additional injuries to the Popliteus tendon are often unappreciated. The Popliteus bypass reconstruction done typically uses a tendon graft (Achilles tendon allograft or semitendinosus allograft). These operations are normally performed to limit external tibial rotation. Reconstructions place the graft in an alignment favourable for restraining posterior tibial translation¹⁹. Feipel et al found that the popliteus has a role in the protection of knee menisci and tibiofemoral cartilage⁵.

CONCLUSIONS

Popliteus is a compound muscle, developing partly from the superficial layer and partly uniting with the fifth layer. The present study suggests the accessory popliteus attachment on fibula (90%), lateral meniscus (100%) and arcuate popliteal ligament (93.3%) can be considered as constant characteristics. No reference could be found in relation to attachment of Popliteus to lateral meniscus in other species in the available literature. As suggested by other authors, a role of popliteus in the protection of knee meniscus and tibiofemoral cartilage is there. Popliteus muscle/tendon injuries occurring with downhill running or walking can be prevented by strengthening of popliteus muscle exercises. The knowledge of these attachment sites is important to the surgeons in

reconstructive cruciate ligament surgeries. Popliteus muscle bypass reconstruction is done by using tendon grafts (Achilles tendon allografts or semitendinosus allografts). Discussed variations and developmental descriptions should be of particular value to comparative anatomists, anthropologists, kinesiologists and muscular physiologists. Further studies would be required to quantify the proposals presented in our study, as proposed by other authors thereby taking the muscle from its "forgotten" status to one that is recognised and clinically appreciated.

REFERENCES

1. Standing S. 2005. *Knee-Muscles*, In: Gray's Anatomy, 39th Edn, Elsevier Churchill Livingstone, Spain, 1484-1485.
2. Bergman RA, Afifi AK, Miyauchi R. 2004. *Muscles of lower limb: Leg and Foot, In: Illustrated encyclopaedia of human anatomic variations: Opus I: Muscular system: Muscle Groupings*, University of Iowa Health care.
3. Mc Murrich JP. 1905. *The physiology of the crural flexors*. Am J Anat 4: 33-76.
4. Moore KL and Dalley AF. 1999. *Lower Limb*, In: *Clinically oriented Anatomy*, 4th Edn. Lippincott Williams and Wilkins, Philadelphia, 588.
5. Feipel V, Simonnet ML, Rooze M. 2003. *The proximal attachments of the Popliteus muscle; a quantitative study and clinical significance*. Surg Radiol Anat 25(1): 58-63.
6. Kim YC, Chung JH, Yoo WK, Suh JS, Kin SJ and Park CI. 1997. *Anatomy and magnetic resonance imaging of the posterolateral structures of the knee*. Clin Anat 10: 397-404.
7. Tria AJ, Johnson CD, Zawadsky JP. 1989. *The Popliteus tendon*. J Bone Joint Surg 71A (5): 714-716.
8. Last R. 1950. *The Popliteus muscle and the lateral meniscus*. J Bone Joint Surg Br 32: 93-99.
9. Bousquet G, Le Bequec P, Girardin P. 1991. *Les Laxites chroniques du genou*. Medis/McGraw Hill Paris.
10. Shahane S, Ibbotson C, Strachan R, Bickerstaff D. 1999. *The popliteofibular ligament. An anatomical study of the posterolateral corner of the knee*. J Bone Joint Surg Br 81: 636-642.
11. Perretti F de, Berthe A, Lacroix R, Bourgeon A. 1983. *Anatomie fonctionnelle des ligaments et menisques du compartiment lateral de l'articulation femoro-tibiale dans les mouvements de rotation*. Am Kinesi 10: 203-207.
12. Fabbriani C and Oransky M. 1990. *The Popliteus muscle*. In : Jakob P, Staubli HU(eds). *The knee and cruciate ligaments*. Springer, Berlin Heidelberg New York, p 48-61.
13. David Hepburn. 1892. *The comparative anatomy of the muscles and nerves of the superior and inferior extremities of the Anthropoid Apes*. J Anat Physiol 3 (pt2): p338.
14. James I Stevens and V Reggie Edgerton. 1972. *Gross anatomy of hind limb skeletal muscles of the Galago Senegalensis*. Primates , 99.
15. Mayfield GW. 1977. *Popliteus tendon tenosynovitis*. The American Journal of Sports medicine 5: 31-36.
16. Travell JG and Simons DG. 1999. *Myofascial pain and dysfunction. The trigger point manual. The lower extremity*. Volume two: Sydney: Williams and Wilkins.
17. Davis M, Newsam CJ and Perry J. 1995. *Electromyograph analysis of the Popliteus muscle in level and downhill walking*. Clinical Orthopaedics and related research, p211-217.
18. David Bryde, Linda Khong, Palina Karakasidou, Nessa Waters, Michael Wong. 2004. *To investigate the Anatomy and Function of the Popliteus muscle*. School of Physiotherapy, p1.
19. Keith L Markolf, Benjamin R Graves, Susan M Sigward, Steven R Jackson and David R McAllister. 2004. *Popliteus bypass and popliteofibular ligament reconstructions reduce posterior tibial translations and forces in a posterior cruciate ligament graft*. Arthroscopy, p9.

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