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Adductor Muscle Strains in Sport

Stephen J. Nicholas and *Timothy F. Tyler*

The Nicholas Institute of Sports Medicine and Athletic Trauma, Lenox Hill Hospital, New York, USA

Contents

Abstract

An in-season adductor muscle strain may be debilitating for the athlete. Furthermore, an adductor strain that is treated improperly could become chronic and career threatening. Any one of the six muscles of the adductor group could be involved. The degree of injury can range from a minor strain (Grade I), where minimal playing time is lost, to a severe strain (Grade III) in which there is complete loss of muscle function.

Ice hockey and soccer players seem particularly susceptible to adductor muscle strains. In professional ice hockey players throughout the world, ~10% of all injuries are groin strains. These injuries, which have been linked to hip muscle weakness, previous injuries to that area, preseason practice sessions and level of experience, may be preventable if such risk factors can be addressed before each season. Hip-strengthening exercises were shown to be an effective method of reducing the incidence of adductor strains in one closely followed National Hockey League ice hockey team.

Despite the identification of risk factors and strengthening intervention for ice hockey players, adductor strains continue to occur throughout sport. Clinicians feel an active training programme, along with completely restoring the strength of the adductor muscle group, is the key to successful rehabilitation. Surgical intervention is available if nonoperative treatment fails for 6 months or longer. Adductor release and tenotomy was reported to have limited success in athletes.

The aim of this article is to provide a comprehensive literature review on adductor muscle injuries. Included are details of the anatomy, diagnosis, epidemiology, prevention, rehabilitation and surgical options in the adductor muscle region. Adductor muscle strains, which can result in missed playing time for athletes in many sports, are encountered more frequently in ice hockey and soccer.[1-3]

These sports require strong eccentric contraction of the adductor musculature during competition.[4,5] Recently, adductor muscle strength has been linked to the incidence of adductor muscle strains. Specifically, the strength ratio of the adduction to abduction muscle groups has been identified as a risk factor in professional ice hockey players.[6] Intervention programmes can lower the incidence of adductor muscle strains but not avoid them altogether. Therefore, proper injury treatment and rehabilitation must be implemented to limit the amount of missed playing time and avoid surgical intervention.[7]

1. Adductor Musculature

The group of muscles along the inner thigh is referred to as the adductor muscle group. This group of six muscles includes the pectineus, adductor longus, adductor brevis, adductor magnus, gracilis and obturator externus. All of the adductor muscles are innervated by the obturator nerve, except for the pectineus, which gets its motor intervention from the femoral nerve. These muscles originate in the inguinal region at various points on the pubis. They travel below the pubis to insert along the medial femur. The main action of this muscle group is to adduct the thigh in the open kinetic chain and stabilise the lower extremity to perturbation in the closed kinetic chain. Each individual muscle can also provide assistance in femoral flexion and rotation.[8,9] The adductor longus is thought to be the most frequently injured adductor muscle.[10] Its lack of mechanical advantage may make it more susceptible to strain.

1.1 Adductor Muscle Injury Evaluation

A groin strain is defined as pain on palpation of the adductor tendons or the insertion on the pubic bone, or both, and groin pain during adduction against resistance.[1,7,11] Groin strains are graded as first-degree if there is pain, but minimal loss of strength and minimal restriction of motion; second-degree if there is tissue damage that compromises the strength of the muscle, but not including complete loss of strength and function; and third-degree if there is complete disruption of the muscle tendon unit, including complete loss of function of the muscle.[12] A thorough history and a physical examination are needed to differentiate groin strains from athletic pubalgia, osteitis pubis, hernia, hip-joint osteoarthrosis, rectal or testicular referred pain, piriformis syndrome or the presence of a coexisting fracture of the pelvis or lower extremities.[1,10,11,13] Imaging studies can sometimes be useful to rule out other possible causes of inguinal pain.[14]

2. Adductor Muscle Strain Incidence

The exact incidence of adductor muscle strains in sport is unknown. This is due, in part, to athletes playing through minor groin pain and the injury going unreported. In addition, overlapping diagnosis can also skew the exact incidence. Groin strains are among the most common injuries seen in ice hockey players.[6,15,16] It has been documented that groin strains accounted for 10% of all injuries in elite Swedish ice hockey players.[17] Furthermore, Molsa et al.[18] reported that groin strains accounted for 43% of all muscles strains in elite Finish ice hockey players. Tyler et al.[6] published that the incidence of groin strains in a single National Hockey League (NHL) team was 3.2 strains per 1000 player-game exposures. In a larger study of 26 NHL teams, Emery et al.[2] reported the incidence of adductor strains in the NHL has increased over the last 6 years. The rate of injury was greatest during the preseason compared with regular and post-season play.[2] Prospective soccer studies in Scandinavia reported a groin strain incidence of between 10 and 18 injuries per 100 soccer players.[15,16] Ekstrand and Gillquist[3] documented 32 groin strains in 180 male soccer players, representing 13% of all injuries during a year. Adductor muscle strains, certainly, are not isolated to these two sports.

3. Risk Factors

Previous studies have shown an association between strength and/or flexibility and musculoskeletal strains in various athletic populations.[3,19,20] Ekstrand and Gillquist[3] found that preseason hip

abduction range of motion was decreased in soccer players who subsequently sustained groin strains compared with uninjured players. This is in contrast to the data published on professional ice hockey players that showed no relationship between passive or active abduction range of motion (adductor flexibility) and adductor muscle strains.[6,21] It is to be noted that the adductor injuries in the soccer population included hip flexor strains.

Adductor muscle strength has been associated with subsequent muscle strain. Tyler et al.[6] found preseason hip adduction strength was 18% lower in NHL players who subsequently sustained groin strains compared with uninjured players. The hip adduction to abduction strength ratio was also significantly different between the two groups. Adduction strength was 95% of abduction strength in the uninjured players, but only 78% of abduction strength in the injured players. Additionally, in the players who sustained a groin strain, preseason adduction to abduction strength ratio was lower on the side that subsequently sustained a groin strain compared with the uninjured side. Adduction strength was 86% of abduction strength on the uninjured side, but only 70% of abduction strength on the injured side. Conversely, another study on adductor strains in ice hockey players found no relationship between peak isometric adductor torque and the incidence of adductor strains.[21] Unlike the previous study, this study had multiple testers using a modified Nicholas manual hand-held dynamometer, which would increase the variability and decrease the likelihood of finding strength differences. However, the results demonstrated that players who practised during the off-season were less likely to sustain a groin injury than rookies in the NHL.[21] The final risk factor was the presence of a previous adductor strain. Tyler et al.[6] also linked pre-existing injury as a risk factor. In their study, four of the nine groin strains (44%) were recurrent injuries. This is consistent with results from Seward et al.,[22] who reported a 32% recurrence rate for groin strains in Australian Rules Football.

4. Prevention

Now that researchers can identify players at risk for a future adductor strain, the next step is to design an intervention programme to address all risk factors. Tyler et al.[23] demonstrated that a therapeutic intervention of strengthening the adductor muscle group could be an effective method for preventing adductor strains in professional ice hockey players identified as being at risk. Before the 2000 and 2001 seasons, professional ice hockey players were strength tested. Thirty-three of 58 players were classified as 'at risk' (i.e. had an adduction to abduction strength ratio of less than 80%) and placed on an intervention programme consisting of strengthening and functional exercises aimed at increasing adductor strength (table I). Injuries were tracked over the two seasons. A total of 3 adductor strains occurred, all in game situations. This gives an incidence of 0.71 adductor strains per 1000 player-game exposures. Adductor strains accounted for ~2% of all injuries. In contrast, there were 11 adductor strains and an incidence of 3.2 adductor strains per 1000 player-game exposures during the two seasons before the intervention. In those seasons, adductor strains accounted for ~8% of all injuries. This was significantly lower than the incidence reported by Lorentzon et al.,[17] who found adductor strains to be 10% of all injuries. In the Tyler et al.[23] study, of the three players who sustained adductor strains, none had sustained a previous adductor strain on the same side. One player had bilateral adductor strains at different times during the first season. These data demonstrate that a therapeutic intervention of strengthening the adductor muscle group can be an effective method for preventing adductor strains in professional ice hockey players.

5. Rehabilitation

Despite the identification of risk factors and strengthening intervention for ice hockey players, adductor strains continue to occur in all sports.[14] The high incidence of recurrent strains could be caused by incomplete rehabilitation or inadequate time for complete tissue repair. Hölmich et al.[7]

Table I. Adductor strain injury prevention programme. Clinical goal: adduction strength at least 80% of abduction strength

Programme	Exercise
Warm-up	Bike
	Adductor stretching
	Sumo squats
	Side lunges
	Kneeling pelvic tilts
Strengthening programme	Ball squeezes (legs bent to legs straight) — different ball sizes
	Concentric adduction (with weight against gravity)
	Adduction in standing on cable column or elastic resistance (with leg straight)
	Seated adduction machine
	Standing with involved foot on sliding board moving in sagittal plane
	Bilateral adduction on sliding board moving in frontal plane (i.e. bilateral adduction simultaneously)
	Unilateral lunges with reciprocal arm movements
Sports-specific training	On ice: kneeling adductor pull togethers
	Standing: resisted stride lengths on cable column to simulate skating
	Slide skating
	Cable column crossover pulls

demonstrated that a passive physical therapy programme of massage, stretching and modalities was ineffective in treating chronic groin strains. By contrast, an 8- to 12-week active strengthening programme, consisting of progressive resistive adduction and abduction exercises, balance training, abdominal strengthening and skating movements on a slide board, proved effective in treating chronic groin strains. An increased emphasis on strengthening exercises may reduce the recurrence rate of groin strains. An adductor muscle strain injury programme, progressing the athlete through the phases of healing, has been developed by Tyler et al.[23] and anecdotally seems to be effective (table II). This type of treatment and rehabilitation programme, which combines modalities and passive treatment immediately, followed by an active training programme emphasising eccentric resistive exercise, has been supported throughout the literature.[11,14]

6. Surgical Treatment

Nonoperative therapy should be tried for several months and is successful in most instances. However, if symptoms persist for more than 6 months after an appropriately administered physical therapy regimen and a period of protected weight bearing with crutches until the patient is pain-free, then surgical intervention should be considered. Before adductor surgery, other causes of groin pain should be ruled out. These include osteitis pubis, athletic pubalgia (colloquially referred to as 'sports hernia'), labral tears, referred pain from testicular or gynaecological pathology, femoral neck stress fractures, and synovitis or arthritis of the hip.[1,11,14] If the diagnosis is correct, adductor tenotomy has been suggested as a technique to improve symptoms. However, this is an end-stage option to be tried only after all conservative methods have failed. Akermark and Johansson[24] performed adductor tenotomy on 16 athletes. All patients improved, but only ten athletes (63%) were able to return to their previous sports activities. Five athletes were able to return to sports but at a lower level. Post-operatively, as one might expect, the patients had decreased isokinetic strength compared with the normal side.

7. Conclusion

An effective strategy for injury prevention[1] is to identify the incidence of a specific injury,[2] identify risk factors for the injury,[3] design interven-

tions to address the risk factors,[4] and test the effectiveness of the intervention at reducing the incidence of the injury. This has been accomplished in male professional ice hockey players but needs to be explored in female players and in other sports. Adductor strains or groin pain in the athlete remain a difficult injury to diagnose, classify and treat. A multidisciplinary approach is often required to rule out the various causes of groin pain. To properly manage the athlete, the practitioner should have up-to-date knowledge about orthopaedic and general surgery. The crossover between specialities must be carefully considered so that the physician managing an athlete is aware of the myriad diagnoses

Table II. Groin strain post-injury programme

Phase	Treatment	Clinical milestone
Phase I (acute)	RICE for first ~48 hours after injury	Concentric adduction (against gravity without pain)
	NSAIDs	
	Massage	
	TENS	
	Ultrasound	
	Submaximal (25-50%) isometric adduction with knees bent then with knees straight progressing to maximal isometric adduction, pain free	
	Hip PROM in pain-free range	
	Nonweight-bearing hip PREs, without weight, in anti-gravity position (all except abduction)	
	Pain-free, low-load, high-repetition exercise	
	Upper body and trunk strengthening	
	Contralateral lower extremity strengthening	
	Flexibility programme for noninvolved muscles	
	Bilateral balance board	
Phase II (subacute)	Bicycling/swimming	Involved lower extremity PROM equal to that of the uninvolved side, and involved adductor strength at least 75% that of the ipsilateral abductors
	Sumo squats	
	Single-limb stance	
	Concentric adduction (with weight against gravity)	
	Standing with involved foot on sliding board moving in frontal plane	
	Standing adduction weighted pulley system or Theraband™ [a]	
	Seated adduction machine	
	Bilateral adduction on sliding board moving in frontal plane (i.e. bilateral adduction simultaneously)	
	Unilateral lunges (sagittal) with reciprocal arm movements	
	Multiplane trunk tilting	
	Balance-board squats with throwbacks	
	General flexibility programme	
Phase III (sports-specific training)	Phase II exercises with increase in load, intensity, speed and volume	Adduction strength at least 90-100% of the abduction strength, and involved muscle strength equal to that of the contralateral side
	Standing: resisted stride lengths on cable column to simulate skating	
	Slide board	
	On ice: kneeling adductor pull togethers	
	Lunges (in all planes)	
	Correct or modify ice-skating technique	

a Use of tradenames is for product identification only and does not imply endorsement.

NSAIDs = non-steroidal anti-inflammatory drugs; **PREs** = progressive resistance exercises; **PROM** = passive range of motion; **RICE** = rest, ice, compression and elevation; **TENS** = transcutaneous electrical nerve stimulation.

that might account for groin pain and is knowledgeable regarding the various treatment regimens. Once the diagnosis of adductor muscle strain is arrived at, a comprehensive active training programme, along with completely strengthening the adductor muscle group to its uninjured state, is the key to successful rehabilitation.

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Correspondence and offprints: *Timothy F. Tyler*, The Nicholas Institute of Sports Medicine and Athletic Trauma, Lenox Hill Hospital, 130 East 77th Street, New York, NY 10021, USA .
E-mail: Tyler@NISMAT.org