**Title.**

**Hip and groin injury management in English youth football: A survey of 64 professional academies**

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**Abstract**

**Objective**: The purpose of this study was to determine the strategies used in English football academies to manage hip/groin injury.

**Methods:** Eighty-six academies were invited to complete an online survey based on three themes: Hip/groin injury (1) prevention; (2) screening; (3) return-to-play (RTP).

**Results:** Sixty-four (74%) academies responded, of which fifty-two (81%) regularly conducted hip/groin injury prevention exercises; most commonly core/abdominal related, while only half of academies used high load eccentric exercises. Fifty-three (83%) utilised screening measures for hip/groin injury, with adductor-strength testing commonly used in 40 (77%) academies, whilst patient-reported outcome measures were used infrequently (6%). Fifty (78%) academies followed a specific RTP protocol, often linked to player baseline scores; with adductor-strength deficits and pain on RTP tests commonly noted indicators of readiness to RTP.

**Conclusion:** Most, but not all responding academies, address prevention, screening and RTP in their management of hip/groin injury. Many preventative exercises are utilised, with core/abdominal related exercises most common. Screening for baseline scores, in particular assessing adductor-strength is often used for gauging RTP post-injury. Most management methods described by academies link to current evidence based literature; yet many elements of practice could be improved / standardised in the academy youth football level in the future.

**Introduction**

Approximately 15,000 male players aged between eight and eighteen years are presently registered within the English association football 'academy' system. Academies are independently audited and given a category status of 1 to 4, with category 1 being the highest achievable (The Premier League, 2011).

Talented young academy players train and compete at a high level throughout their biological maturation; a developmental phase linked to overuse injuries and morphological changes in the hip/groin/pelvis region (Schinkel and Bol 1995; Sailly et al. 2015; Tak et al. 2015).Injuries to this region are reported to represent between 7.1% and 12% of total injuries in youth football players (Price et al. 2004; Le Gall et al. 2006) and whilst we know very little about their impact in football, data from youth Australian football league players has previously shown such injury to be associated with related pathology in senior years (Gabbe et al. 2010). Consequently, youth hip/groin injuries may be a contributing factor to missed game time at the senior level. It is apparent therefore that attention to detecting and preventing youth hip/groin injury would be of substantial importance to club medical departments. However, very little is known about injury management strategies adopted by professional football clubs (McCall et al. 2014),where established prevention programmes are often modified (O’Brien and Finch, 2016) and based upon anecdotal experience (Finch, 2006).

Our general understanding of athlete hip/groin injury has developed rapidly in recent years, likely due to increased research interest and the associated rise in the number of published peer-reviewed articles (Whittaker et al. 2015). However, a direct association between intervention and reduced hip/groin injury has yet to be established, warranting further investigation (Esteve et al. 2015), especially in adolescent athletes (Weir et al. 2015) where research is scarce. Despite this, the identification of modifiable risk factors for hip/groin injury, such as low adductor strength (Tyler et al. 2001; Engebretson et al. 2010; Thorborg et al. 2014)and its correction / improvement gained through exercise (Tyler et al. 2002; Jensen et al. 2014; Ishoi et al. 2016)demonstrate how scientific findings can inform prevention strategies. Indeed, risk factors for hip/groin injuries have been a dominant focus of research attention to date (Drew, 2015) and fundamental to identifying these risks are tests that facilitate the discrimination between those with and without hip/groin pain. Indeed, Mosler et al (2015) highlighted how patient reported outcome measure (PROM) scores and adductor squeeze test values were amongst the best outcome measures capable of doing so. Effective risk identification requires reliable, valid and responsive examination methods; and clinicians are arguably now well-armed with methodologies to facilitate this process, with methods for measuring hip/groin strength (Thorborg et al. 2010; Delahunt et al. 2011; Light and Thorborg, 2016), range of motion (Roach et al. 2013; Krause et al. 2015)and self-reported pain/function (Thorborg et al. 2011; Mohtadi et al. 2012)now well established.

Reducing the gap between clinical science and football club practice is desired (McCall et al. 2014). The methods used to identify and manage hip/groin injury in English football academies is currently un-reported, yet reviewing literature to date; it is arguable that medical provision should be optimised during this important phase of player development. Thus, the primary objective of this study was to determine the strategies most commonly used in English football academies to manage hip/groin injury, and consider our findings in light of the most contemporaneous peer-reviewed published literature in the field. This may facilitate clinicians in highlighting areas of medical management that may be insufficient and benefit researchers by directing future studies in areas yet to be explored; such as validating measures for quick and accurate assessments of youth footballer groin pain or dysfunction.

**Methods**

***Participants***

Ninety-one English professional youth academies were in operation at the time of the project. We invited 86 of these 91 clubs to partake in this national cross sectional, survey study. The youth academies of those invited were classified as category 3 or above academies. These academies develop male players aged U-9 through to U-21. Category 4 academies (n=5) were not invited to participate (figure 1) as they focus resources towards U-17 to U-21 age groups only and thus do not fully represent a ‘complete’ provision of youth footballer development (FIGURE ONE NEAR HERE). Academies are independently audited and given a Category status of 1 to 4, with 1 considered as the ‘elite’. Up to 10 different factors influence this grading, including productivity rates; training facilities; coaching, education and welfare provisions (The Premier League, 2017).

The Head of Medical or Academy Medical services at each club was contacted via email or telephone. It was requested that they, or a senior medical staff member (whomever deemed most suitable) completed the survey. A statement requesting participants to give “detailed and true responses” with insurance that no professional judgment would be indicated in the findings was issued. All participating academies consented to partake and agreed to the following statement; "the results of the survey may be published in conference proceedings, courses and scientific journal articles" after which, they were provided access to the online questionnaire. No incentives to complete the survey was offered and ethical approval was obtained from the Research Ethics Committee of\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*.

***Survey***

An online password-protected questionnaire (https://chichester.onlinesurveys.ac.uk/hip-groin-prevention-management-in-youth-academy-footb) was developed using a web-based survey tool (Bristol Online Survey https://www.onlinesurveys.ac.uk) with the aim of establishing the methods of management of hip and groin injuries in football academies. The survey was developed by the authors and comprised of a maximum of 58 questions (dependent on responses) across three thematic areas related to hip/groin injury management: (1) prevention; (2) screening; (3) return-to-play (RTP). A variety of question types composed the survey, from ‘yes or no’ style questions to those allowing a multiple choice of answers from a selection of pre-defined answers. These questions further offered the chance for particpants to input ‘free text’, for any supporting notes or when the selectable options were deemed not suitable or accurate for their answer. The development of the questionnaire content and terminology used, was guided by the clinical experience of the authors and their knowledge of the peer-reviewed published literature in the field. The questionnaire was piloted amongst senior medical staff from two professional academies who completed the survey a minimum of twice, until consensus on readability, technical functionality, understanding and efficiency was agreed. Survey data was collected from 01/04/2016 until the scheduled survey closure (30/09/2016). A maximum of three reminders were sent to encourage survey completion, with the online template only allowing full submission after the completion of all questions. The reporting of the study adheres to the STROBE (Strengthening the Reporting of Observational studies in Epidemiology) statement, considered as a minimum reporting standard for cross-sectional studies in the area of athletic groin pain (Delahunt et al. 2015).

***Survey analysis***

Questionnaire responses were exported to IBM SPSS Statistics for Macintosh, Version 22.0. Absolute and mean percentage values were calculated for each individual question response within the three survey sections (prevention; screening and RTP), providing descriptive statistics for the methods used, how often they were implemented, the ages of players subjected to these methods and the reasons for (or against) their utilization. Commonly noted responses outside of the pre-composed answers for selection were analysed for common themes and subsequently presented.

**Results**

***Participants***

We received a total of 64 completed surveys representing a 74% response rate with participation from all four English professional leagues. Figure 2 shows the participating academy categories and the league of which their ‘senior’ team were playing at the time of completion.

(FIGURE TWO NEAR HERE)

***Hip / groin injury management***

***Prevention***

Of the participating academies, 52/64 (81%) stated that they conducted hip/groin injury prevention exercises, mainly due to a belief that they reduce injury risk (43/52 (83%)) and familiarity with peer-reviewed research supporting their use (34/52 (65%)). Eleven (21%) academies stated all academy age players performed these exercises, whilst 43 (83%) under-18 squads performed them. Figure 3 shows the wide range of exercises that were reported to be used, with core/abdominal training being the most common (90%). (FIGURE THREE NEAR HERE) Most of these academies performed such exercises on a weekly (40%) or daily (35%) basis throughout the playing season. Twelve (19%) of the 64 academies stated they did not have a hip/groin focused prevention strategy, with 6 (50%) alluding that this was due to a lack of time, whilst 2 (17%) academies used a holistic “non-specific” injury prevention protocol. One (8%) academy reported that the focus of their prevention exercises related primarily to the prevention of ankle and knee joint injuries.

***Screening***

Fifty-three (83%) of the 64 participating academies, utilised screening measures for hip/groin injury including all but one of the participating category 1 academies. Forty-eight (91%) of these academies completed this assessment to establish baseline scores for players, whilst 33 (64%) and 9 (17%) academies stated department ‘ethos’ and league policy requirement as reasons respectively. Two (4%) academies stated their screening directed prevention interventions and a further 2 (4%) undertook screening for research purposes. Eight (16%) academies performed screening measures on all academy age players, whilst 45 (86%) screened their under-18 squad. Table 1 shows the differing screening components used by the 53 (83%) academies who performed screening, with adductor strength testing being the most popular, used by 41 (77%) academies (of which the adductors squeeze test was the most common form of assessment). The least used screening theme was PROMs, used in just 3 (6%) academies. Eleven (17%) academies stated they did not screen for hip/groin injury. Nine (82%) of these stated a lack of time for their reason; whilst 2 (27%) stated a lack of equipment and 1 (9%) due to a belief that the data generated from screening was not useful.

TABLE ONE NEAR HERE

***Return-to-play***

Fifty (78%) of the 64 participating academies stated they followed a specific RTP protocol for players post hip/groin injury. In 36 (72%) of these academies, these were integrally linked to player baseline scores on the same assessments used as part of their screening process. Forty-one (82%) academies further stated their protocols increased confidence in the RTP decision, whilst their use to support ongoing research was also noted by 10 (20%) academies. Two (4%) academies stated they felt that RTP protocols “reduced the chance of re-injury”, whilst one academy utilized RTP protocols for “auditing and quality assurance” purposes. Twelve (24%) academies stated the RTP protocol was used on all academy age players, whilst 34 (68%) used the protocol for their under-18’s. Fourteen (22%) of the 64 participating academies, stated they did not utilize a specific hip/groin pain RTP protocols, typically adopting generic performance based criterion (36%), whilst 14% felt that such measures did not aid the RTP decision and 7% noted a lack of research related to RTP protocols in the area. Akin to screening; the most commonly noted measure of the RTP process was that of adductor strength. Most often this was measured via manual resistance used by 21 (42%) academies, whilst 23 (46%) used a sphygmomanometer, 9 (18%) used a HHD and 2 (4%) used an Isokinetic machine. The most common reasons that indicated a player was not ready for full RTP during adductor strength testing, were reports of pain during the test, noted by 35 (70%) of academies. This was followed by a strength deficit of >15% compared to baseline measures (of the same leg) obtained during routine screening and bi-lateral strength symmetry of less than 85%. Four (8%) of clubs used the adductor to abductor strength ratio as a measure featuring in their RTP protocol. With regards to PROMs; whilst only 3 clubs utilised an official validated measure within their RTP protocol (all using HAGOS), 15 (30%) of the academies used player self-reported pain during functional activity as an indication of a players readiness for RTP, with 2 (4%) academies specifying that RTP was unacceptable if the player reported pain above 3/10 on a NRS (Numerical Rating Scale).

**Discussion**

The primary objective of this study was to determine the strategies most commonly used in English football academies to manage hip/groin injury. The results show that academies of all category classifications utilise methods of prevention, screening and RTP protocols in their management of hip / groin injury in their players. However, there is a lack of standardisation evident by large variations in practice. Interestingly, our findings suggest that age has an exponential relationship with the amount of medical management received. Academies focussed most of their practice towards older players (figure 4), which may be problematic as growth and maturation are potential risk factors for young soccer players (Van der Sluis et al. 2014), particularly in the hip/groin region (Le Gall et al. 2007). FIGURE FOUR NEAR HERE. This may of course simply reflect how younger players are likely to partake in less formal training than their older counterparts and thus are subjected to less training loads that render them vulnerable to injury. Furthermore, it may be unreasonable to expect certain components of senior player medical management (e.g. PROMs or adductor strength tests) to be performed on adolescent players which may be deemed over-invasive or lack research support in youth athlete populations. It is difficult therefore to say if these measures are relevant to youth players, or indeed in the case of PROMs, if they are even able to understand them. Consequently, this is potentially an irrelevant finding, yet it does expose a possible gap in the research to explore.

***Prevention:***

The choice and use of preventative exercises varied greatly amongst the academies surveyed. Exercises that are representative of high-loading such as eccentric muscle contractions were utilised by only 28 (54%) of academies that performed prevention training. This is surprising considering that improving eccentric hip adductor strength appears to decrease the risk of sustaining groin injuries in football (Holmich et al. 2010) and was previously shown to be the case in ice-hockey (Tyler et al. 2002). An effective cost and time-efficient method of delivering high-load eccentric adduction is by adopting the Copenhagen adduction exercise. However, only 6 (13%) academies stated they used the exercise whilst 37 (73%) used adductor bridge exercises and 28 (54%) used cable / band resistance. These latter exercises require additional equipment; whilst the Copenhagen adduction does not. The Copenhagen adduction exercise is partner-assisted, dynamic and performed with a great range of eccentric adduction. This may reflect the muscle actions and total range of motion achieved during kicking (Charnock et al. 2009) and mitigate the risk of adductor injury during the kicking swing phase (Anderson 2014). In contrast 90% (47) of academies utilise core or abdominal exercises despite limited evidence associating deficits in abdominal strength with the risk of incurring hip/groin injury. Most academies reported that they believed that preventative exercise reduces the risk of hip/groin injury. Whilst high-quality adequately powered intervention studies for the prevention of hip/groin injuries are scarce; a previous prevention program study did find a (nonsignificant) correlation to reducing injury (Holmich et al. 2010). We acknowledge that any prevention plan would be influenced by many variables and individualised to club needs / perceptions of staff; yet interventions aimed at reducing hip/groin injury are still worthwhile implementing (Esteve et al. 2015). Interestingly, no responses indicated the use of stretching as a preventative measure. This may relate to the fact we chose not to include stretching methods as a pre-defined answer due to the lack of supporting research for its preventative use in football (Arnason et al. 2008) and other sports (Lauersen et al. 2014). However, participants were asked to record any ‘other’ exercises that they used and stretching of any kind was not mentioned by any participant.

As the impact of preventative intervention is unknown in the male youth footballer population (and thus we cannot assume any method is better than another); it was still surprising some academies did not implement any prevention exercises, mainly due to a lack of time availability to perform them. If a lack of time is a significant obstacle to providing preventative measures, academies could look to implement a more consistent generic warm-up program such as the FIFA 11+ which has been shown reduce hip/groin injuries, albeit in a young adult (18-25 years) footballer population (Silvers-Granelli et al. 2015). Granted, the FIFA 11+ does not offer potentially useful prevention approaches such as adductor specific or high-load eccentric exercises; but it may offer a useful compromise when medical staff believe exercise intervention *is* worth implementing, but time made available by coaches is the main obstacle in doing so. Regardless of the chosen approach, medical staff should make effort to simplify and improve the time efficiency of prevention exercises, which may result in coaching staff becoming more responsive to such demands. A warm-up based solution such as the FIFA11+, that does not impact coaching time, may render an excuse of lacking time to perform prevention exercises unacceptable.

***Screening:***

It is evident from our findings that hip/groin injury screening is highly valued amongst the surveyed academies and in most instances, practice aligns to peer-reviewed literature on outcome measures used to discriminate between sports persons with and without hip/groin pain. Whilst the use of screening tests to predict injury has been challenged (Bahr 2016), it is evident that academies place a high level of importance on referring to them when gauging a player’s baseline scores for later use in the RTP management post-injury; as indicated by the forty-eight (91%) of academies that performed such measures. The adductor squeeze test was the most commonly used clinical assessment; a useful measure for differentiating those with and without groin pain (Mosler et al. 2015) and potentially detecting adductor strength deficits preceding groin injury (Crow et al. 2010; Light and Thorborg 2016; Delahunt et al. 2017). The clinical assessment of hip joint range of motion was also commonly used, particularly the modified Thomas test (Harvey 1998). The assessment of hip joint internal rotation was infrequently used, as was the bent knee fall out, despite evidence supporting their ability to discriminate between sports persons with and without hip/groin pain (Mosler et al. 2015). The Copenhagen hip and groin outcome score (HAGOS) questionnaire was the only PROM utilised, but in just 3 (6%) of the 53 academies that practiced screening (one of each academy category). Future research should seek to establish why PROMs are not adopted amongst academies, despite their capability in identifying present disability related to hip/groin pain (Mosler et al. 2015) and athletes at risk of developing hip/groin pain (Thorborg et al. 2014). Perhaps PROMs are perceived by medical staff as time consuming or lack sport-specificity; yet using the ‘sport, function and recreation’ subscale of the HAGOS (just eight questions) has shown promising predictive value for hip / groin injury in Gaelic footballers (Delahunt et al. 2017) and certainly warrants consideration for its use.

Not all screening methods aligned to peer-reviewed literature recommendations with large variations in methods observed. This is likely due to a vast range of variables, including staff numbers, financial input for equipment and time to complete screening tests. However, it should be noted that evidence-based outcome measures can be cost and time efficient; for example, reliable assessment of adductor strength with a HHD or pressure sphygmomanometer (Light and Thorborg 2016).Indeed, the under utilised PROMs are free and could be completed at any time during the week, even during classroom based sessions. In short, irrespective barriers that academies may face; it is possible to utilize valid and reliable methods of screening, which are low cost and time efficient.

***Return to play:***

Specific RTP protocols are utilised by most academies (50/64 = 78%) and are commonly linked to player baseline scores on the same assessments used during the screening process. Forty-three (86%) of these academies stated their protocols increased confidence in the RTP decision. This further emphasises the importance of utilizing valid and reliable clinical tools during the screening process. Forty-five (90%) of these academies measure adductor strength as part of their RTP criteria, yet interestingly nearly half (21 (46%)) stated they use manual resistance to gauge adductor strength, which may be problematic in detecting deficits reliably (Cuthbert & Goodheart, 2007). Twenty-three (51%) of these 45 academies used the more objective pressure sphygmomanometer method, yet only 11 (24%) used a HHD which has been found to be precise and adaptable to test positions that yield high torque values (Light & Thorborg, 2016). Perhaps however, this is unsurprising given the financial expense of a HHD in relation to a pressuresphygmomanometer. Adductor strength testing helps establish whether a player is deemed ready for RTP in the academies surveyed. Academies often refer to baseline screening measures to establish if a player has a <15% deficit on the injured leg and/or aim for a >85% bi-lateral strength symmetry to determine player readiness to RTP. Previous research has shown that both of these markers offer a reasonable target for objectifying player readiness (Orchard, 2005; Tyler 2010) although leg dominance may be considered when establishing targets for rehabilitating adductor strength (Thorborg et al. 2011a 2011b). Our findings highlight that reports of pain play a key role in determining player readiness for RTP, both during adductor strength testing and functional activity. Whilst only eight clubs utilised a validated PROM (HAGOS) for assessing pain / symptoms during the RTP process; many academies clearly pay close attention to self-reported pain during the RTP process. When asked to describe findings that would indicate a player is not ready to RTP, pain was noted in 16/18 (89%) responses, whilst two clubs explicitly specified that this was the case when a players self-reporting of pain on a NRS score was above 3/10. This is often a number quoted that is an acceptable level of discomfort during the rehabilitation process; yet its correlation to RTP has not been established and warrants further investigation. Indeed, Thorborg et al (2017) showed how adductor strength squeeze testing in conjunction with NRS offers a valid indicator of groin pain in footballers. Perhaps therefore, by combining subjective symptom reporting with objective measures, it may increase confidence in the RTP decision and subsequently reduce the risk of re-injury. Such an approach was noted by just two participating academies as part of their RTP protocol and this could be a focus for future research.

***Limitations***

We acknowledge that the responses to our survey represent the perception and experiences of those answering the questions and may vary based on their employment role. Furthermore, a response rate of 74% is not a full representation of all the clubs invited. Indeed, the spread of non-responding academy categories was skewed heavily by a high number of category 3 clubs (figure 2) and thus should be considered as a limitation. As we did not receive any rejections to complete the survey from invitees, we can only speculate that non-participation was based upon not receiving the invitation to partake, lack of time or perceived speciality knowledge to respond. With reference to survey questions; they offered pre-defined answers and although participants had the option to input text outside these pre-defined answers, we cannot rule out the possibility that participants may have felt obliged to select an answer offered, resulting in response bias. Secondly, ‘prevention’ theme questions were presented using commonly used terminology that makes it difficult to differentiate specific and actual exercise characteristics (e.g. load level or contraction type), therefore multiple answers may have been selected when the particpants is actually trying to describe just one exercise. Finally, it is acknowledged that much of the discussion of our findings is based upon evidence from studies using predominantly adult, healthy participants and may therefore lack direct application to youth players.

**Conclusion**

Most academies, but not all, address prevention, screening and RTP in hip/groin injury management, with a focus being directed towards older youth players. Whilst few academies do no hip/groin prevention exercise training, most academies address prevention using a variety of preventative exercises, with core/abdominal related exercises most commonly used. Screening for baseline scores to be used for RTP is also common, in particular assessing adductor strength. Specific RTP protocols (for post hip/groin injury) exist in most academies, appearing to increase confidence in the RTP decision. Our findings suggest that most methods of academy hip/groin injury management, demonstrates a link to current evidence based literature, yet there are many elements of practice that could be improved / standardised across the field. Future research should aim to explore ways to improve the standardisation of management across academies from clubs of all category classifications.

***Practical Implications***

By describing the previously un-reported management of hip/groin injury in youth academy football our work gives academy medical staff a unique chance to review their current practice comparing their methods to other academies and gauge their provision in relation to the available evidence base. Secondly, we hope that it will encourage discussion for inclusion of patient reported outcome measures in youth players and adopting high-loading adductor specific exercises. Finally, the study highlights areas of youth footballer injury management that warrants future research attention, such as validating assessment and monitoring tools in this talented pool of young players.

**References**

Anderson L. 2014. Risk factors for groin injury during football kicking: A biomechanical perspective. Aspetar Sports Medicine Journal. 3:252-256.

Arnason, A., Andersen, T. E., Holme, I., Engebretsen, L. Bahr, R. 2008. Prevention of hamstring strains in elite soccer: an intervention study. Scand J Med Sci Sports. 18: 40–48.

Bahr R. 2016. Why screening tests to predict injury do not work – and probably never will…:a critical review. Br J Sports Med  Published Online First: 19 April 2016. doi: 10.1136/bjsports-2016-096256

Barengo NC, Meneses-Echavez JF, Ramirez-Velez R, et al. 2014. The impact of the FIFA 11+ training program on injury prevention in football players: a systematic review. Int J Environ Res Public Health. 11:11986–2000.

Charnock BL, Lewis CL, Garrett WE Jr, Queen RM. 2009 Adductor longus mechanics during the maximal effort soccer kick. Sports Biomech. 8:223–234

Crow JF, Pearce AJ, Veale JP et al. 2010. Hip adductor muscle strength is reduced preceding and during the onset of groin pain in elite junior Australian football players. J Sci Med Sport. 13(2):202–204.

Cuthbert SC, Goodheart GJ. (2007). On the reliability and validity of manual muscle testing: a literature review. Chiropr Osteopath, 15, 4. http://doi.org/10.1186/1746-1340-15-4

Delahunt E, Fitzpatrick H, Blake C. 2017. Pre-season adductor squeeze test and HAGOS function sport and recreation subscale scores predict groin injury in Gaelic football players. Phys Ther Sports. 23:1-6

Delahunt E, McEntee BL, Kennelly C et al. 2011. Intrarater reliability of the adductor squeeze test in gaelic games athletes. J Athlet Train. 46(3):241–245

Delahunt E, Thorborg K, Khan K, et al. 2015. Minimum reporting standards for clinical research on groin pain in athletes. Br J Sports Med. 49:775-781.

Drew M. Some athletes are immature…skeletally. 2015. Br J Sports Med. 49:766

Engebretsen AH, Myklebust G, Holme I et al. 2010. Intrinsic risk factors for groin injuries among male soccer players: a prospective cohort study. Am J Sports Med. 38(10):2051–2057.

Esteve E, Rathleff MS, Bagur-Calafat C, et al. 2015. Prevention of groin injuries in sports: a systematic review with meta-analysis of randomised controlled trials. Br J Sports Med. 49:785–791

Finch C. 2006. A new framework for research leading to sports injury prevention. J Sci and Med Sport. 9(1), 3-9.

Gabbe BJ, Bailey M, Cook J, et al. 2010. The association between hip and groin injuries in elite junior football years and injuries sustained during elite senior competition. Br J Sports Med. 44 (11): 799-802.

Harvey D. 1998. Assessment of the flexibility of elite athletes using the Modified Thomas Test. British Journal of Sports Medicine, 32, 68–70.

Holmich P, Larsen K, Krogsgaard K, et al. 2010. Exercise program for prevention of groin pain in football players: a cluster-randomized trial. Scand J Med Sci Sports. 20:814–821.

Ishoi L, Sorensen C, Kaae, N et al. 2016. Large eccentric strength increase using the Copenhagen adduction exercise in football: A randomised controlled trial. Scand J Med Sci Sports. 26:1334-1342.

Jensen J, Holmich P, Bandholm T, et al. 2014. Eccentric strengthening effect of hip-adductor training with elastic bands in soccer players: a randomised controlled trial. Br J Sports Med. 48:332–338.

Krause D, Hollman J, Krych, A et al. 2015. Reliability of hip internal rotation range of motion using a digital inclinometer. Knee Surg Sports Traumatol Arthrosc. 9: 2565-2567.

Lauersen JB, Bertelsen DM, Andersen LB. 2014. The effectiveness of exercise interventions to prevent sports injuries: a systematic review and meta-analysis of randomised controlled trials. Br J Sports Med. 48:871-877.

Le Gall F, Carling C, Reilly T, et al. 2006. Incidence of injuries in elite French youth soccer players: a ten-season study. Am J Sports Med. 34:928–938.

Le Gall F, Carling C, Reilly T. 2007. Biological maturity and injury in elite youth football. Scand J Med Sci Sports. 17:564-572.

Light N, Thorborg K. 2016. The precision and torque production of common hip adductor squeeze tests in elite football. J Sci Med Sport. 19(11):888-892.

McCall A, Carling C, Nedelec M, et al. 2014. Risk factors, testing and preventative strategies for non-contact injuries in professional football: current perceptions and practices of 44 teams from various premier leagues. Br J Sports Med. 8:1352-1357.

Mohtadi NG, Griffin DR, Pedersen ME, et al. 2012. The development and validation of a self-administered quality-of-life outcome measure for young, active patients with symptomatic hip disease: the International Hip Outcome Tool (iHOT-33). Arthroscopy. 28(5):595- 610.

Mosler AB, Agricola R, Weir A, et al. 2015. Which factors differentiate athletes with hip/groin pain from those without? A systematic review with meta-analysis. Br J Sports Med. 49:810.

O’Brien J, Finch C. 2016. Injury prevention exercise programmes in professional youth soccer: understanding the perceptions of programme deliverers. BMJ Open Sport Exerc Med;2:e000075. doi:10.1136/bmjsem-2015- 000075

Orchard J, Best TM, Verrall GM. 2005. Return to play following muscle strains. Clin J

Sport Med.15:436–41.

Price RJ, Hawkins RD, Hulse MA, et al. 2004. The Football Association research program: an audit of injuries in academy youth football. Br J Sports Med. 38:466–471.

Roach S, San Juan J, Suprak D, et al. 2013. Concurrent validity of digital inclinometer and universal goniometer in assessing passive hip mobility in healthy subjects. Int J Sports Phys Thera. 8(5):680-688.

Sailly M, Whiteley R, Read JW, et al. 2015. Pubic apophysitis: a previously undescribed clinical entity of groin pain in athletes. Br J Sports Med. 49:828–34.

Schinkel SL, Bol E. Actions in youth soccer games causing injuries. 1995. Med Sci Sports Exerc. 27:43–47.

Serner A, Jakobsen MD, Andersen LL, et al. 2014. EMG evaluation of hip adduction exercises for soccer players: implications for exercise selection in prevention and treatment of groin injuries. Br J Sports Med. 48:1108–1114.

Silvers-Granelli H, Mandelbaum B, Adeniji O, et al. 2015. Efficacy of the FIFA 11+ injury prevention program in the collegiate male soccer player. Am J Sports Med. 43:2628–37.

Tak I, Weir A, Langhout R, et al. 2015. The relationship between the frequency of football practice during skeletal growth and the presence of a cam deformity in adult elite football players. Br J Sports Med. 0:1–5.

The Premier League. 2011. Elite Player Performance Plan. [accessed 2016 Nov 01]

https://www.goalreports.com/EPLPlan.pdf.

The Premier League. 2017. Elite Player Performance Plan. [accessed 2017 Aug 05] https://www.premierleague.com/youth/EPPP.

Thorborg K, Branci S, Nielsen MP et al. 2014. Eccentric and isometric hip adduction strength in male soccer players with and without adductor-related groin pain. Orthop J Sports Med. 2(2):1–7.

Thorborg K, Branci S, Nielsen MP, et al. 2017. Copenhagen five-second squeeze: a valid indicator of sports-related hip and groin function. Br J Sports Med. 51:594-599.

Thorborg K, Branci S, Stensbirk F, et al. 2014. Copenhagen hip and groin outcome score (HAGOS) in male soccer: reference values for hip and groin injury-free players. Br J Sports Med. 48:557–9.

Thorborg K, Couppé C, Petersen J*,* et al. 2011. Eccentric hip adduction and abduction strength in elite soccer players and matched controls: a cross-sectional study

Br J Sports Med;45:10-13.

Thorborg K, Hölmich P, Christensen R, et al. 2011. The Copenhagen Hip and Groin Outcome Score (HAGOS): development and validation according to the COSMIN checklist. Br J Sports Med. 45:478–9.

Thorborg K, Petersen J, Magnusson SP, et al. 2010. Clinical assessment of hip strength using a hand-held dynamometer is reliable. Scand J Med Sci Sports. 20:493–501.

Thorborg K, Serner A, Petersen J, et al. 2011. Hip adduction and abduction strength profiles in elite soccer players: implications for clinical evaluation of hip adductor muscle recovery after injury. Am J Sports Med.39:121-126.

Tyler TF, Nicholas SJ, Campbell RJ, et al. 2001. The association of hip strength and flexibility with the incidence of adductor muscle strains in professional ice hockey players. Am J Sports Med. 29:124–8.

Tyler TF, Nicholas SJ, Campbell RJ, et al. 2002. The effectiveness of a preseason exercise program to prevent adductor muscle strains in professional ice hockey players. Am J Sports Med. 30:680–683.

Van der Sluis A, Elferink-Gemser M, Coelho-e-Silva M, et al. 2014. Sport injuries aligned to peak height velocity in talented pubertal soccer players. Int J Sports Med. 35:351–355.

von Elm E, Altman DG, Egger M, et al. 2007. Strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. BMJ. 335:806–8.

Weir A, Brukner P, Delahunt E, et al. 2015. Doha agreement meeting on terminology and definitions in groin pain in athletes. Br J Sports Med. 49:786-774.

Whittaker JL, Small C, Maffey L, et al. 2015. Risk factors for groin injury in sport: an updated systematic review. Br J Sports Med. 49:803-809.

**8**

**Table 1. Screening themes and tests used by 53 (83%) of participating academies that practice specific hip/groin associated screening**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **Screening theme** | **Number of academies using theme (%)** | **Specific tests used** | **Number of academies using test (%) in rank order** |
| **Adductor Strength** | 41 (77%) | Bi-lateral Adduction (Squeeze test) | 24 (59%) |
|  |  | Uni-lateral Isometric Adduction | 8 (20%) |
|  |  | Concentric Adduction | 4 (10%) |
|  |  | Eccentric Adduction | 3 (7%) |
|  |  | Adductor bridge (timed hold) | 1 (2%) |
|  |  |  |  |
| **Hip Mobility** | 38 (72%) | Modified Thomas Test | 33 (87%) |
|  |  | Internal ROM with Hips 90° Flexion | 10 (26%) |
|  |  | FABERS test | 9 (24%) |
|  |  | External ROM with Hips 90° Flexion | 8 (21%) |
|  |  | FADDIR test | 7 (18%) |
|  |  | Bent Knee Fall Out test | 7 (18%) |
|  |  | Hip Abduction ROM | 6 (16%) |
|  |  | Internal ROM with Hips 0° Flexion | 6 (16%) |
|  |  | External ROM with Hips 0° Flexion | 4 (11%) |
|  |  | Thomas Test | 2 (5%) |
|  |  | Functional Mobility Scale | 1 (3%) |
|  |  |  |  |
| **Trunk Muscle Function** | 18 (34%) | Back Muscle Strength Test | 7 (39%) |
|  |  | Abdominal Muscle Strength Test | 7 (39%) |
|  |  | Core endurance tests (e.g. timed plank) | 3 (17%) |
|  |  | Functional Movement Screen  Lumbo-pelvic dissociation | 3 (17%)  2 (11%) |
|  |  | Abdominal Thickness Ultrasound Scan | 1 (5%) |
|  |  | Rotary Stabilisation | 1 (5%) |
|  |  |  |  |
| **Hip / Groin Specific Patient Reported Outcome Measure** | 3 (6%) | HAGOS questionnaire | 3 (100%) |