153 LOWER EXTREMITY STRAINS IN THE U.S. NATIONAL FOOTBALL LEAGUE, 2015–2019

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Background Lower extremity (LEX) strains (hamstring, quadriceps, adductor, and calf strains) are among the most common injuries in sports.
Objective Describe the incidence of LEX strains in professional American football.
Design Descriptive epidemiological study.
Setting U.S. National Football League (NFL).
Participants NFL players during the 2015–2019 seasons.
Assessment of Risk Factors Frequency was calculated by setting (game, practice, conditioning), season (offseason, preseason, regular season, postseason), and roster position. Game incidence rates were calculated for season, roster position, and play type.
Main Outcome Measurements LEX strains identified in the standardized league-wide electronic medical record (n=32 teams).
Results Across 5 seasons, 5,780 LEX strains were reported among 2,769 players (1-season risk: 26.7%, 95% CI 26.0%-27.3%), 69% (n=4,015) of which resulted in time-loss. Among time-loss strains, 58.5% were hamstring (n=2,347), 21.3% were adductor (n=855), 11.8% were calf (n=474), 8.0% were quadriceps (n=323), and 0.4% affected multiple muscles (n=16). Most were reported during preseason practices (n=1,076; 27%) and regular season games (n=1,060; 26%). Among game injuries, the highest rate was in preseason (2.9/10,000 player-plays; 95% CI 2.6–3.2). Defensive secondary players sustained the highest proportion of injuries (27%, n=1,082); but, in games, punters and kickers had the highest rate (3.8/10,000 player-plays; 95% CI 2.7–5.3). Among preseason practice strains, 72% (n=775) were reported during training camps. In games, punt plays had nearly twice the rate as kickoff plays (14.9/1,000 plays; 95% CI 13.1–17.0 vs. 7.5/1,000 plays; 95% CI 6.2–8.9, respectively) and over three times the rate as pass (4.3/1,000 plays; 95% CI 4.0–4.7) and run (2.6/1,000 plays; 95% CI 2.3–2.9) plays.
Conclusions LEX strains impact 1 in 4 NFL players each season and occur mostly during preseason practices and regular season games. The 2-week period of training camp practices comprised 19% of all time-loss strains. In games, punt plays had the highest rate.

154 ABSTRACT WITHDRAWN

155 CLINICALLY-ORIENTED ASSESSMENTS OF HAMSTRING MUSCLE STRENGTH ARE RELIABLE

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Background Hamstring muscle strain injuries are a prevalent non-contact injury incurred by field sport athletes. A low level of hamstring muscle strength has been reported to be a risk factor for hamstring muscle strain injury, whereby reliable, clinically-oriented assessments of hamstring muscle strength are required to assist clinicians to implement 'targeted' injury prevention strategies and make objective return-to-participation/sport decisions.
Objective To evaluate the interrater reliability of five different clinically-oriented assessments of hamstring muscle strength.
Design Interrater reliability study.
Setting Sports clubs.
Patients (or Participants) Twenty male field-sport athletes with no reported history of hamstring muscle strain injury within the previous 6 months participated.
Interventions (or Assessment of Risk Factors) Three sports physiotherapists independently assessed participants' hamstring muscle strength using the following clinically-oriented assessments: (1) supine mid-range maximum voluntary isometric contraction (MVIC); (2) prone inner-range MVIC; (3) prone mid-range MVIC; (4) prone mid-range 'eccentric break'; (5) supine outer-range 'eccentric break'.
Main Outcome Measurements Intraclass correlation coefficients (ICCs) and 95% confidence intervals (CI) were calculated to determine interrater reliability. We chose the ICC (2,3) model, which corresponds to a 2-way mixed model, with measurement of the mean of 3 raters and absolute agreement.
Results Excellent interrater reliability was demonstrated for the supine mid-range MVIC (ICC=0.86; 95% CI = 0.70–0.94) and prone mid-range MVIC (ICC=0.79; 95% CI = 0.60–0.91). Good interrater reliability was demonstrated for the prone inner-range MVIC (0.72; 95% CI = 0.44–0.88), prone mid-range 'eccentric break' (ICC=0.67; 95% CI = 0.33–0.85), and supine outer-range 'eccentric break' (ICC=0.67; 95% CI = 0.34–0.85). The highest and lowest force values were registered during the supine outer-range 'eccentric break' (310±57.8N) and prone inner-range MVIC (127±31.4N), respectively.
Conclusions Clinically-oriented assessments of hamstring muscle strength are reliable. These assessments can be used as an integral part of injury prevention, rehabilitation progression and objective return-to- sport decisions.

156 THE NORDIC HAMSTRING EXERCISE – IS IT A PART OF THE WEEKLY TRAINING IN FEMALE ELITE FOOTBALL?

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Background The hamstring muscle strengthening is an integral part of validated injury prevention programs in football. However, it is unknown whether hamstring muscle strengthening exercises are used in female elite football.

Objective To investigate the use of hamstring muscle strengthening in female elite football training.
Design Descriptive, cross-sectional study.
Setting Online questionnaire.
Participants Overall, 338 Danish players were invited to answer the online questionnaire. 123 players from the best national league answered the questionnaire (≤ 18 yrs.: N=70) and (≥ 18 yrs: N=53).
Assessment of Risk Factors The online questionnaire covered e.g. baseline information, years of football experience, previous injuries and amount of hours pr/week doing strength training. The following question was asked: 'Which of the following exercises are a part of your weekly training?' With the following options: Leg Curl, Deadlift, Nordic Hamstring and Kettlebell Swing.
Main Outcome Measurements Four hamstring strength exercises: Leg Curl, Deadlift, Nordic Hamstring and Kettlebell Swing.
Results 54,7% of the adult players reported that they did strength training 3–4 hours/week vs. 39,1% of the youth elite players. All four hamstrings exercises were reported to be a part of the weekly training in both groups: The Nordic Hamstring exercise was performed among 75% of the adult elite players vs 70% of the youth elite players. Deadlift 77% (adult) vs 53% (youth). Kettlebell swing 36% (adult) vs 44% (youth) and finally the Leg curl 40% (adult) vs. 14% (youth)
Conclusions The present results indicate that hamstrings exercises are implemented in the weekly training among the majority of Danish female elite football players. The Nordic Hamstring is overall the most performed hamstring exercise in both groups. However, it remains to be elucidated how the exercise is implemented in terms of frequency and load.

157 PREDICTORS OF TIME TO RETURN TO PLAY AND REINJURY FOLLOWING HAMSTRING STRAIN INJURIES WITH AND WITHOUT TENDON INVOLVEMENT IN PROFESSIONAL FOOTBALL

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Background Hamstring strain injury (HSI) account for ~12% of all injuries in professional football. It is suggested HSIs extending into the intramuscular tendon are more prone to reinjury, resulting in greater time-loss and delayed time to return to play (RTP). Currently, there is a lack of evidence regarding the effects of HSI with and without intramuscular tendon involvement as well as the impact of factors such as removal of a player and grade.
Objectives 1) Describe the number of HSIs using the British Athletics Muscle Injury Classification (BAMIC); 2) Determine if intramuscular tendon HSI results in extended RTP and higher reinjury risk; 3) Determine the predictors of RTP and reinjury.
Methods A retrospective study in one English Premier League football club over four seasons. Players included underwent an MRI within 7 days of injury and were graded by a Radiologist using the BAMIC (0a-4). RTP and reinjury rates were recorded along with information on whether the players was removed from play. Data were analysed using a Kruskal-Wallis test and linear regression.
Results Twenty-nine HSI across 24 players (age = 26 ± 4 years) were recorded over 4 seasons. There was a significant difference in RTP between grades 1a and 2c (P = 0.027). No significant difference was observed in RTP between 2b and 2c and no greater risk of reinjury. Grade of HSI (P = < 0.000) and removal of the player (P = 0.001) were significant predictors of RTP. An increase in grade of HSI resulted in an additional 4 days RTP and removal from the field of play (P = 0.001) resulted in an additional 10 days.
Conclusion HSIs extending into the intramuscular tendon (2b *cf.* 2c) do not influence RTP or reinjury, however RTP is affected by the removal of a player and overall grade.

158 STRENGTH ENDURANCE AND FATIGABILITY: CANDIDATE RISK FACTORS FOR HAMSTRING RE-INJURY IN SPRINT SPORTS?

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Background Hamstring strain injuries (HSI) are characterized by a very high recurrence rate. Despite indications from the field that deficits in strength endurance and fatigability play a role in (re-)injury, screening for these in Return To Sport (RTS) decision making is still not common and requires further investigation.
Objective To justify hamstring strength endurance and fatigability at time of RTS as potential risk factors for re-injury.
Design Observational.
Setting Academic sports rehabilitation centre.
Patients (or Participants) 13 recently injured HSI athletes (M/F;18–35yr) competitive in sprint sports, at time of RTS, and 17 healthy population-matched controls.
Interventions (or Assessment of Risk Factors) All participants underwent a RTS test battery including clinical and functional tests. For this study, single leg hamstring bridge endurance test (SLHB) and maximal isometric hamstring strength test (MIHS) in inner, mid and outer range, using hand-held dynamometry, were investigated. MIHS was retested after a shuttle-run until exhaustion fatigue protocol. Differences between injured (INJ) and uninjured (UNINJ) limb, and differences between injured and healthy athletes (CON) were tested using Students' t-tests and mixed model ANOVA.
Main Outcome Measurements SLHB [number of repetitions]; MIHS [Newton].
Results Concerning SLHB, injured athletes showed a clinically relevant deficit in hamstring strength endurance compared to their healthy peers, both in their injured and un-injured leg (INJ=19.0±5.0; UNINJ=18.9±5.4; CON=24.5±5.3; t=2.6&2.7; p=0.01&0.01respectively). For MIHS, a main group effect was found for outer range (INJ=347.5±67.3; CON=394.8±63.8; F=6.1;p=0.02), revealing that isometric strength was significantly worse in the injured leg compared to healthy controls. An overall fatigue effect was found (F=7.8; p=0.01), adding to the injured athletes' baseline deficit in MIHS performance.