

## Supplement 2 – Extended version of characteristics of included studies

First author, year of publication	Number of injuries, gender, age, type of sport, time to RTP	Timing of MRI examination	Re-injury period	Re-injury definition	Number of re-injuries (%)	MRI findings of the lesion	Association with re-injury	
							Significant	Non-significant
Baseline MRI								
Gibbs et al. [10], 2004	<ul style="list-style-type: none"> <li>- N=31</li> <li>- All male</li> <li>- Age: NR</li> <li>- Australian Rules Football, professional</li> <li>- Time to RTP: mean 13,8 days (range 2-33)</li> </ul>	1-3 days after index injury	Same playing season*	Injury in the same limb and in the same season following the initial injury.	N=6 (19,4%)	Length of hyperintensity		Re-injury 8 cm (IQR 5-17) vs no re-injury 11 cm (IQR 9-15). P=0.73.
						CSA of hyperintensity		Re-injury 31% (IQR 19-86) vs no re-injury 41% (IQR 36-49). P=0.78.
Ekstrand et al. [13], 2016 AND Hallén & Ekstrand [11], 2014 AND Ekstrand et al. [12], 2011	<ul style="list-style-type: none"> <li>- N=255</li> <li>- All male</li> <li>- Age: NR</li> <li>- Football, professional</li> <li>- Time to RTP: mean 20 days (±15), (95% CI 18 to 22)</li> </ul>	1-2 days after index injury	<2 months	Injury of the same type and at the same site as an index injury occurring no more than two months after a player's return to full participation from the index injury.	N=41 (16.1%)	Involved muscle	Re-injury vs no re-injury BF: 39/212 =18% SM + ST: 1/41 =2% P = 0.009.	
						Grading (according to Peetrans)		Re-injury vs no re-injury of grade 1 and 2 injuries: P=0.95.
Koulouris et al. [14], 2007	<ul style="list-style-type: none"> <li>- N=41</li> <li>- All male</li> <li>- Age: single strain group (n=31): 24 years (±3.8), repeat strain group (n=10): 25,5 years (±3.8)</li> <li>- Australian Rules Football, professional</li> <li>- Time to RTP: NR</li> </ul>	≤3 days after index injury	Same playing season	Re-injury of the hamstring muscle during the same competition period.	N=10 (=24,4%)	Length of hyperintensity		Re-injury: median 95 mm (range 60-150) and mean 98.7 (±27) mm vs no re-injury: median 75 mm (range 18-240) and mean 83.8 (±44) mm. P=0.35.
						CSA of hyperintensity		Re-injury: mean 18.5 (±11.7)% and median 12.5% (range 5-40%) vs no re-injury: mean 19.7 (±15.3)% and median 15% (range 5-60%). P=0.82.
						Involved muscle		Re-injury vs no re-injury BF: 8 vs 26 SM: 0 vs 3 ST: 0 vs 2 Mixed: 2 vs 0. P=0.20.
						Injury location		Re-injury vs no re-injury: Musculotendinous junction: 5 vs 16 Myofascial: 4 vs 11 Mixed: 0 vs 2 Tendon-bone: 0 vs 2 Proximal tendon: 1 vs 0 P=0.89.

Pollock et al. [15], 2015	<ul style="list-style-type: none"> <li>- N=65</li> <li>- 63,3% (n=28) male, 36,4% (n=16) female</li> <li>- Age: 23,8 years (<math>\pm 4.3</math>), range 19-39 years</li> <li>- Track and field athletes: 31 sprinters, 8 vertical/horizontal jumpers, 3 middle distance athletes, 1 thrower and 1 endurance runner</li> <li>- Time to RTP: 26,4 days (<math>\pm 28.1</math>), range 4-150 days</li> </ul>	$\leq 7$ days after index injury	<3 months	Injury recurrence to the same hamstring muscle during rehabilitation or within 3 months of return to full training. A recurrence was recorded if the athlete sustained an acute, sudden exacerbation of hamstring pain during exercise, followed by worsening of functional and clinical tests, and requiring cessation of current activity and subsequent modification of rehabilitation or training for greater than 48 h.	N=6 (9,2%)**	Grading (according to the British Athletics Muscle Injury Classification)	Re-injury vs no re-injury Grade 0: 1 vs 20 Grade 1a: 0 vs 5 Grade 1b: 2 vs 2 Grade 2a: 0 vs 2 Grade 2b: 1 vs 16 Grade 2c: 5 vs 3 Grade 3a: 0 vs 0 Grade 3b: 0 vs 1 Grade 3c: 4 vs 3 Grade 4: 0 vs 0 Fisher's exact test, two-tailed P=0.025, n=44.	
						Grading (according to the number (1-3) within the British Athletics Muscle Injury Classification)		Fisher exact test, two-tailed P=1.000, n=44.
						Injury location		Proximal vs central vs distal injuries: Fisher's exact test, two-tailed, P=0.269, n=44.
						Intratendinous injuries (according to the letter (a-c) within the British Athletics Muscle Injury Classification)	Fisher exact test, two-tailed P=0.030, n=44.	
						Involved muscle		BF long head vs SM vs ST vs BF short head: Fisher's exact test, two-tailed P=0.077, n=40.
Silder et al. [18], 2013	<ul style="list-style-type: none"> <li>- N=25</li> <li>- 80% (n=20) male, 20% (n=5) female</li> <li>- Age: mean 24 years (<math>\pm 9</math>)</li> <li>- Sports requiring high-speed running</li> <li>- Time to RTP: mean 26,9 days.</li> <li>PRES group (n=12): mean 28.8 days (<math>\pm 11.4</math>), median 28 days (IQR 20-33).</li> <li>PATS group (n=13) 25.2 days (<math>\pm 6.3</math>), median 23 days (IQR 21-28).</li> </ul>	PRES group: median 7 (IQR 6-7) days after index injury. PATS group: median 5 (IQR 3-6) days	1 year	A specific mechanism that caused a return of posterior thigh pain, pain with resisted knee flexion, tenderness to palpation along the muscle/tendon unit, and decreased ability to do sporting activities (perceived strength and power).	N=4 (16%)	CSA of hyperintensity	Re-injury: 87% [95% CI: 68%, 100%] vs no-reinjury: 54% [95% CI: 43%, 65%]. P = 0.015.	
						Length of hyperintensity		P=NR, but >0.05.
Verrall et al. [19], 2006	<ul style="list-style-type: none"> <li>- N= 30</li> <li>- All male</li> </ul>	2 to 6 days (median 3)	The same and	A recurrent injury was recorded when a player	N=12 (40%)	Transverse size of hyperintensity		Re-injury: mean 46.8% $\pm$ 23.3% vs no re-injury: mean 46.0% $\pm$ 29.1%. P>0,05.

	<ul style="list-style-type: none"> <li>- Age: mean 23,6 years (<math>\pm</math> 3.2)</li> <li>- Australian Rules Football, professional</li> <li>- Time to RTP: mean 28 days.</li> </ul> <p>Single injury group (n=18): 28.8 days (<math>\pm</math> 9.9). Re-injury group (n=12): 26,8 days (<math>\pm</math> 9.4)</p>	after index injury	subsequent playing season	developed pain localized to the same posterior thigh as the original injury during the course of playing and/or training and if this reinjury caused that athlete to miss subsequent match playing time. Injuries involving direct trauma (collision contact) to the posterior thigh were again excluded.	in the same season ***	Volume size of hyperintensity		Re-injury: mean $31.6 \text{ cm}^3 \pm 47.5 \text{ cm}^3$ vs no re-injury: $36.2 \text{ cm}^3 \pm 44.6 \text{ cm}^3$ . $P>0.05$ .
						Muscle involved		Biceps femoris principal injured muscle: n=26. Re-injury 9 vs. no re-injury 17. $P>0.05$ .
						Number of muscles involved		Only one muscle injured: n=17. Re-injury 7 vs no re-injury 10. $P>0,05$ .
De Vos et al. [20], 2014	<ul style="list-style-type: none"> <li>- N= 64</li> <li>- 95% (n=61) male, 5% (n=3) female</li> <li>- Age: median 28 years (IQR 23–33)</li> <li>- Football: 45. Indoor football: 1. Hockey: 11. Athletics: 4. Tennis: 1. American football: 1. Fitness: 1. - Time to RTP: median 40 days (IQR 31–55)</li> </ul>	$\leq$ 5 days from index injury	$\leq$ 1 year	Acute posterior thigh pain in the index leg, which caused time loss from training or match play.	N=17 (27%)	Muscle involved		BF: n=56 ST/SM: n=8 HR 0,5 (95% CI 0,1 - 3,4). $P=0,440$ .
						Grading (according to Peetrons)		Grade 1: n=18 Grade 2: n=46 HR 1,3 (0,4 - 4,1). $P=0,624$ .
						Volume of hyperintensity		HR 1,00 (1,00 - 1,00). $P=0,112$ .
						CSA of hyperintensity		HR 0,95 (0,18 - 5,11). $P=0,947$ .
						Length of hyperintensity		HR 1,00 (0,99 - 1,01). $P=0,525$ .
						Distance to tuber		HR 1,00 (0,98 - 1,00). $P= 0,978$ .
MRI al RTP								
Reurink et al. [16], 2013	<ul style="list-style-type: none"> <li>- N=53</li> <li>- All male</li> <li>- Age: median 27 years (range 18-46)</li> <li>- 40 Football, 6 indoor football, 5 field hockey, 1 athletics, 1 squash.</li> <li>- Time to RTP: median 28 days (range 12-76)</li> </ul>	Median 2 days after RTP (range 3 days before - 3 days after RTP)	< 2 months	Acute hamstring injuries that occurred within 2 months after RTP at the same site.	N=5 (9%)	Hyperintensity present		Re-injury 80% (4 out of 5 subjects) vs no re-injury 90% (43 out of 48 subjects). $P=NR$ .
						Length of hyperintensity		Re-injury: median 65 mm (range 0-94 mm) vs no re-injury: median 73 mm (range 0-220 mm). $P=NR$ .
						CSA of hyperintensity		Re-injury: median 14% (range 0-31%) vs no re-injury: median 8% (range 0-90%). $P=NR$ .
Reurink et al. [17], 2015	<ul style="list-style-type: none"> <li>- N=108</li> <li>- 97% (n=105) male, 3% (n=3) female</li> <li>Age: mean 28 years (<math>\pm</math>7)</li> <li>- 76 football (=70%), 12 field hockey (=11%), 9 indoor football (=8%), 5</li> </ul>	$\leq$ 1 week after RTP	< 1 year	Dutch cohort: Acute onset of posterior thigh pain that occurred at the same side as the initial injury and caused absence from play.  Qatar cohort: Acute	N=26 (24,1%)	Fibrosis present		Re-injury: 16 (out of 26 = 62%) vs no re-injury: 51 (out of 82 = 62%). HR 0.95 (95% CI, 0.43-2.1; $P = 0.898$ ).
						Involved muscle with fibrosis		Re-injury: 10 of 10 in BF, 0 in SM en ST vs no re-injury: 26 in BF, 5 in SM en 0 in ST. $P=NR$ .

	track and field (=5%), 6 other (=5%) - Time to RTP: median 30 days (IQR 22-42)			hamstring injuries in the same leg.		Longitudinal length of fibrosis		Re-injury 3.3 cm (IQR 2.5-7.8) vs no re-injury 6.5 cm (IQR 4.0-14.5). P=NR.
						Length of fibrosis on axial view		Re-injury 0.7 cm (IQR 0.5-1.5) vs no re-injury 1.0 cm (IQR 0.7-1.4). P=NR.
						Width of fibrosis on axial view		Re-injury 0.4 cm (IQR 0.2-0.6) vs no re-injury 0.5 cm (IQR 0.3-0.7). P=NR.
						Volume of fibrosis		Re-injury 0.4 cm (IQR 0.2-4.2) vs no re-injury 2.0 cm (IQR 0.7-3.9). P=NR.
Silder et al. [18], 2013	- N=25 - 80% (n=20) male, 20% (n=5) female - Age: mean 24 years ( $\pm$ 9) - Sports requiring high-speed running - Time to RTP: mean 26,9 days. PRES group (n=12): mean 28.8 days ( $\pm$ 11.4), median 28 days (IQR 20-33) PATS group (n=13) 25.2 days ( $\pm$ 6.3), median 23 days (IQR 21-28)	$\leq$ 7 days after RTP	1 year	A specific mechanism that caused a return of posterior thigh pain, pain with resisted knee flexion, tenderness to palpation along the muscle/tendon unit, and decreased ability to do sporting activities (perceived strength and power).	N=4 (16%)	Normalized T2 hyperintensity		P=NR, but $>$ 0.05.

BF: biceps femoris. CSA: cross sectional area. IQR: interquartile range. NR: not reported. PATS: progressive agility and trunk stabilization program. PRES: progressive running and eccentric strengthening program. RTP: return to play. SM: semimembranosus. ST: semitendinosus.

\*= Hamstring injuries that occurred just prior to a Christmas or end of season break period which could not be monitored during rehabilitation were excluded.

\*\*= We excluded the exacerbations of symptoms before returning to play during rehabilitation and asked Pollock et al. for new data of only the re-injuries after RTP (N=6), because this possibly would influence the results. The data of the determinants with a non-significant association with re-injury are not recalculated.

\*\*\*= From the study of Verrall et al. we only used the data from the same season as the hamstring injury, not the data from the subsequent season, because in the data synthesis we only can use one dataset per article and the follow-up of one season gave the best comparison with the length of follow-up of the other studies (follow-up varying from 2 months to a maximum of 1 year).