

Middlesex University Research Repository

An open access repository of

Middlesex University research

<http://eprints.mdx.ac.uk>

Oakley, Aiden J., Jennings, Jacob and Bishop, Chris ORCID logo ORCID:
<https://orcid.org/0000-0002-1505-1287> (2018) Holistic hamstring health: not just the Nordic hamstring exercise. *British Journal of Sports Medicine*, 52 (13) . pp. 816-817. ISSN 0306-3674
[Article] (doi:10.1136/bjsports-2016-097137)

Final accepted version (with author's formatting)

This version is available at: <https://eprints.mdx.ac.uk/21988/>

Copyright:

Middlesex University Research Repository makes the University's research available electronically.

Copyright and moral rights to this work are retained by the author and/or other copyright owners unless otherwise stated. The work is supplied on the understanding that any use for commercial gain is strictly forbidden. A copy may be downloaded for personal, non-commercial, research or study without prior permission and without charge.

Works, including theses and research projects, may not be reproduced in any format or medium, or extensive quotations taken from them, or their content changed in any way, without first obtaining permission in writing from the copyright holder(s). They may not be sold or exploited commercially in any format or medium without the prior written permission of the copyright holder(s).

Full bibliographic details must be given when referring to, or quoting from full items including the author's name, the title of the work, publication details where relevant (place, publisher, date), pagination, and for theses or dissertations the awarding institution, the degree type awarded, and the date of the award.

If you believe that any material held in the repository infringes copyright law, please contact the Repository Team at Middlesex University via the following email address:

eprints@mdx.ac.uk

The item will be removed from the repository while any claim is being investigated.

See also repository copyright: re-use policy: <http://eprints.mdx.ac.uk/policies.html#copy>

1 HOLISTIC HAMSTRING HEALTH: NOT JUST THE NORDIC
2 HAMSTRING EXERCISE

3
4 Aiden J. Oakley¹, Jacob Jennings¹, Chris J. Bishop²

5
6 **AFFILIATIONS:**

7 ¹*ASPIRE Academy, Department of Sport Sciences, Doha, Qatar*

8 ²*London Sports Institute, Middlesex University, Allianz Park, Greenlands Lane, NW4*

9 *1RL.*

10
11
12 **CORRESPONDING AUTHOR:**

13 **Name:** Aiden J. Oakley

14 **Email:** aiden.oakley@aspire.qa

15 **Address:** *ASPIRE Academy*

16 Department of Sport Sciences

17 Doha

18 Qatar

19 PO Box: 22287

1 **Introduction**

2 Hamstring strain injuries (HSI) are the most prevalent in team sports, accounting for 12
3 – 26% of injuries in Australian rules football, American football, football, rugby and track
4 and field (1). The biceps femoris is the most commonly injured muscle with 53 – 68% of
5 injuries occurring during sprinting (1). In European football, the incidence and
6 recurrence of HSI has continued to rise while in Australian rules football a notable
7 reduction in HSI recurrences has been reported (1). It is possible that evidenced based
8 hamstring injury prevention is not adopted or adhered to in some elite level football
9 teams (2) which may explain the rise in HSI.

10 Although not an exhaustive list, HSI risk factors include: age, previous injury, strength
11 imbalance, flexibility, fatigue (1), and low eccentric strength (3). There is a growing body
12 of evidence on the Nordic Hamstring Exercise (NHE) and its impact on HSI reduction
13 (4). However, there may be misconceptions (fueled by social media) that this is the only
14 exercise used to prevent HSI. The NHE is not the “silver bullet” that critics imply
15 practitioners claim it to be, and it is unlikely that experienced practitioners solely rely on
16 the NHE when dealing with HSI.

17

18 **The Nordic hamstring exercise (NHE)**

19 The popularity of the NHE may lie in its ease of use, requiring no equipment and being
20 effective at reducing the risk of HSI (4). It is possible the intervention was adopted out of
21 necessity to address HSI in sports like football (4) that may have only recently
22 embraced more traditional strength training. While seen by some to be non-functional,

1 the NHE combined with sports specific training in professional and amateur football
2 players has been shown to reduce both the incidence and recurrence rate of HSI by
3 60% and 85% respectively following a 10-week intervention programme (4). Greater
4 eccentric hamstring strength may also offset the likelihood of injury in older or previously
5 injured athletes (3). This appears to be an effective intervention, requiring minimal effort
6 when compliance is adequate.

7 The invention of devices like the “NordBord®” allow for quick, easy, and reliable
8 measurements of eccentric knee flexor strength, which may explain the recent
9 popularity of the NHE. These devices may provide a link between testing and training
10 where daily feedback is received and actionable data are generated. However, the NHE
11 may be limited in its effectiveness by only training eccentric knee flexor strength in a
12 knee dominant action. A low adoption rate and poor adherence to the exercise in elite
13 level football (2), may be due to the initial soreness experienced by some with this
14 exercise (4).

15

16 **Hamstring health – two missing parts of the puzzle**

17 While the NHE is an effective prevention tool, we continue to observe a high incidence
18 of HSI. A greater appreciation for the multifactorial nature of HSI while also addressing
19 the primary injury mechanism – sprinting (1) is required. We propose a more holistic
20 approach to hamstring health (Figure 1).

21 **Exercise Selection**

1 During the late swing phase of running, the biceps femoris and other hamstring muscles
2 function eccentrically to resist hip flexion and decelerate knee extension (5), where they
3 undergo large ranges of motion and different activation patterns. It would therefore be
4 advisable to train the hamstrings with both hip and knee dominant exercises.

5 Holistic hamstring health (Figure 1), suggests alternative options including the use of
6 other hip and knee dominant exercises reported in elite level football (2). A growing
7 body of evidence exists for the 'hip extension exercise'. It has been shown to target the
8 biceps femoris long head and semitendinosus while the NHE preferentially recruits
9 semitendinosus, but also elicits the greatest absolute activation of biceps femoris
10 compared to other hamstring exercises (6). Overloading the eccentric contractions may
11 elongate muscle fascicles which could mediate the protective mechanism of improving
12 muscle strength at longer lengths (6).

13 High Speed Running (Sprinting)

14 Exposing athletes to increased weekly sprint distances (90-120m above 95% maximum
15 velocity) and exposures (6-10 efforts) in team based running sports has also been
16 shown to have a protective effect on lower limb injuries (7). Importantly, the acute high
17 speed running load should be progressed gradually, avoiding large sudden increases
18 which may increase the odds of HSI (8).

19

20 Conclusion

21 The NHE is only one method of strengthening, which is important for hamstring health.

22 We would advocate that both hip and knee dominant exercises be included in an injury

1 prevention programme. While the exercises discussed develop eccentric hamstring
2 strength, the contractions occur at a much slower rate than during sprinting and it would
3 be logical to regularly and progressively expose the athlete to high speed running. Only
4 when all these factors are addressed in a multifaceted approach can we hope to
5 achieve holistic hamstring health.

6

7

*** Figure 1 about here ***

1 REFERENCES

- 2 1. Opar DA, Williams MD, Shield AJ. Hamstring strain injuries: factors that lead to injury and re-
3 injury. *Sports Med.* 2012;42(3):209-26.
- 4 2. Bahr R, Thorborg K, Ekstrand J. Evidence-based hamstring injury prevention is not adopted by
5 the majority of Champions League or Norwegian Premier League football teams: the Nordic Hamstring
6 survey. *British Journal of Sports Medicine.* 2015;49(22):1466.
- 7 3. Opar DA, Williams MD, Timmins RG, Hickey J, Duhig SJ, Shield AJ. Eccentric hamstring strength
8 and hamstring injury risk in Australian footballers. *Med Sci Sports Exerc.* 2014;47(4):857-65.
- 9 4. Petersen J, Thorborg K, Nielsen MB, Budtz-Jorgensen E, Holmich P. Preventive effect of eccentric
10 training on acute hamstring injuries in men's soccer: a cluster-randomized controlled trial. *Am J Sports*
11 *Med.* 2011;39(11):2296-303.
- 12 5. Higashihara A, Nagano Y, Ono T, Fukubayashi T. Differences in activation properties of the
13 hamstring muscles during overground sprinting. *Gait Posture.* 2015;42(3):360-4.
- 14 6. Bourne MN, Williams MD, Opar DA, Al Najjar A, Kerr GK, Shield AJ. Impact of exercise selection
15 on hamstring muscle activation. *Br J Sports Med.* 2016.
- 16 7. Malone S, Roe M, Doran DA, Gabbett TJ, Collins K. High chronic training loads and exposure to
17 bouts of maximal velocity running reduce injury risk in elite Gaelic football. *J Sci Med Sport.* 2016.
- 18 8. Duhig S, Shield AJ, Opar D, Gabbett TJ, Ferguson C, Williams M. Effect of high-speed running on
19 hamstring strain injury risk. *Br J Sports Med.* 2016.

20

21

22

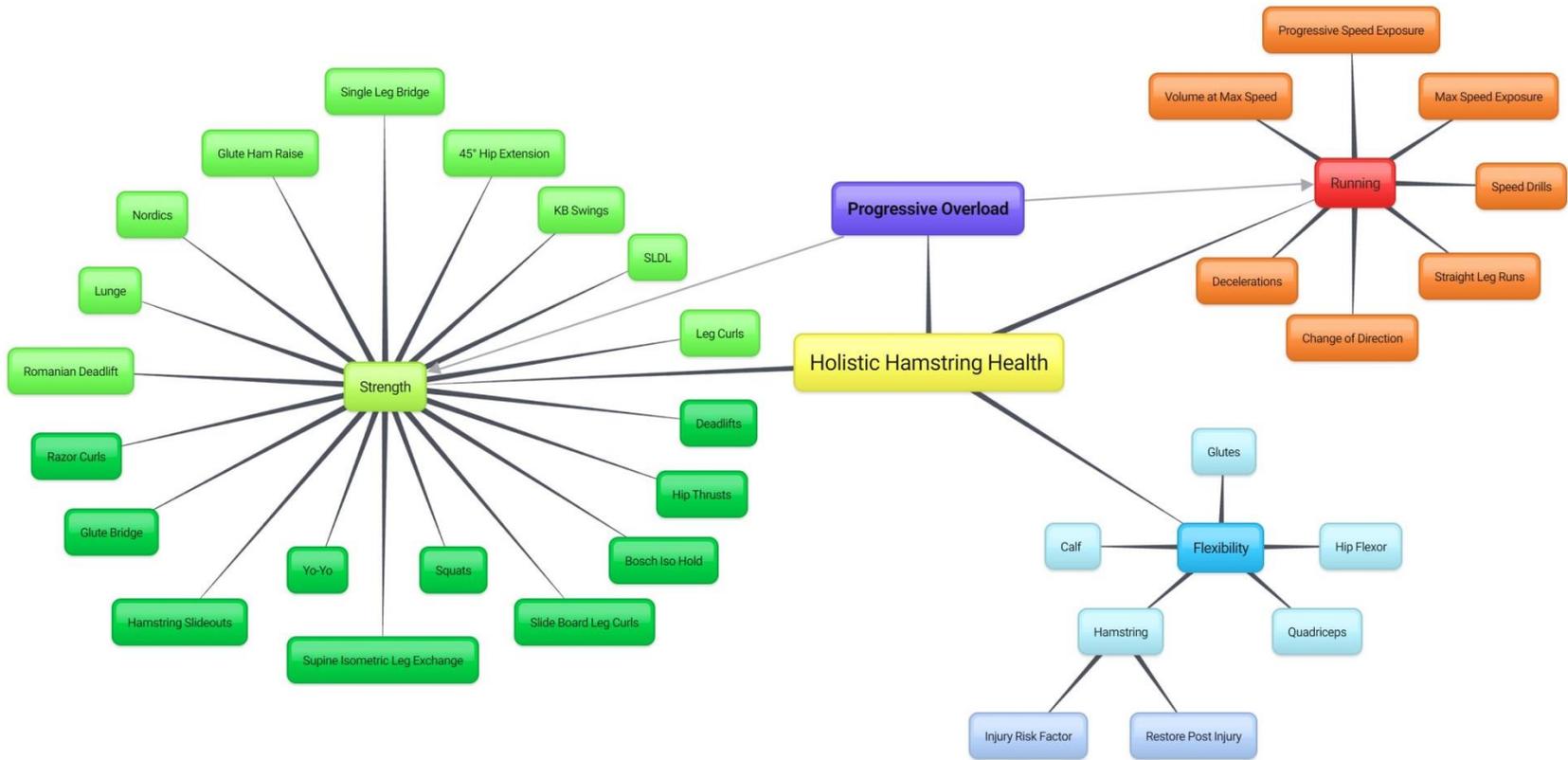
23

1

2 **FIGURE LEGEND**

3 **Figure 1:** Holistic hamstring health: A holistic approach to hamstring strain injury prevention and hamstring strengthening.

4



5

created with www.bubbl.us