THE EFFECT OF ISOMETRIC HIP ADDUCTORS FORCE ON CHANGE OF DIRECTION SPEED OF PROFESSIONAL ICE-HOCKEY PLAYERS

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ABSTRACT

Introduction: Ice-hockey is a sport that requires high acceleration of players for optimal performance. The speed of sports players is influenced by several factors. The aim of research was to determine the effect of the isometric muscle strength of hip adductors on speed with directional changes in ice-hockey players.
Methods: The sample consisted of 15 members of the Slovakian national ice-hockey team, the average age was 27 years, the average height was 186.46 cm (SD ± 5.04), the average body weight was 90.87 kg (SD ± 5.91). Players completed a GroinBar Test of 60° to determine the isometric force of the hip adductors. We used the 5-10-5 test to determine the speed with directional changes. The 5-10-5 shuttle consists of rapid directional changes in a linear plane. It is commonly used as an assessment in different sports. The 5-10-5 Shuttle Drill, also known as the Pro Agility Drill, is a great tool for working on your agility and short-distance explosiveness.
Results: In the research sample consisted of professional hockey players was measured a low degree of correlation (r = 0.006) between isometric muscle strength of the hip adductors and the speed with the directional changes in the 5-10-5 test. The average ice-hockey player's adductors strength was 476.83 N (SD ± 88.50) and the average time achieved in the 5-10-5 test was 4.984 s (SD ± 0.15). We also found low degree of correlation between right adductor force and right side of 5-10-5 test (r = 0.047) as well as left adductor force and left side of 5–10-5 test (r = 0.067).
Conclusion: Research shows a very low degree of correlation in ice-hockey players between the hip adductor strength in the GroinBar Test 60° and the speed with the directional changes in the 5-10-5 test.

Keywords: isometric strength hip adductors; speed with directional changes

Introduction

„A typical game is very dynamic and involves exposure to intermittent high intensity activity, typically in 30 second shifts. Both high-velocity collisions and unpredicted changes of directions are common. This demand for ability requires the athlete to be able not only to accelerate and decelerate repeatedly but also to change direction intermittently while remaining in motion" (Jay, 2019, p. 198). Taft (2015) is adding, that the ability to quickly change direction in field and court separates great athletes from the good ones. This fact we can also apply to the ice ring or ice-hockey players. Terry (2019) states, that when we deconstruct skating, it is series of muscle contractions, which generates the force to move the skater across the ice. The stronger those muscles are, the more force they can generate and the faster the skater will be. “When changing direction or taking off for a loose puck, the more powerful athlete will be able to generate his or her maximum force more quickly, which translates to a more explosive first few strides and the advantage over a less powerful athlete” (Terry, 2019, p. 5). The issue of fitness in hockey is mostly centered around injury prevention and strength and power development (Lutz, 2016). Because of that, we want to be clear what an ice-hockey player needs, which muscle groups he mostly uses and therefore we should develop these abilities according to specific demands. Chang (2009) is also confirming the increasing importance of adductor muscle group with skating speed.

Neeld (2018) states that in forward skating stride (FSS) and forward cross-over stride (FCS) is only stride leg (during FSS) abducting the hip. In all other cases among FSS and FCS (stride leg, stance leg, push under leg, cross-over leg) both legs are hip’s adductors. And because ice-hockey is all about change of direction, accelerations and decelerations, Neeld (2018) states that the 5-10-5 is a transitional speed test that assesses quick starts, rapid decelerations, and explosive direction changes. Terry (2019) is adding that adductors (brevis, magnus, pectineus, and longus) are among primary involved muscles. Vald Performance (2018) published NHL average adduction (413.84 N, SD 117.65) and abduction (408.94 N, SD 98.37) groin strength. They are adding NHL average adduction (5.49%, SD 4.52) and abduction (5.24%, SD 3.89) imbalances between right and left leg.

“The ability to recover in skating stride is primarily achieved by engaging the adductors. Strong adductors enable you to pull the extended leg back under the body quickly and forcefully to then push off and propel into the next stride. The abductors and adductors should be balanced to prevent groin and lower-abdominal strains” (Terry, 2019, p. 89). In this case Vald Performance (2018) states, that players should have the strength ratio between adduction and abduction above 1.01 (SD 0.20) (GroinBar 60° test – According to Vald Performance 2018, the most popular Test Type in the NHL 2017/2018 season). The assessment of isolated adductor and relative adductor/ abductor strength is used for the identification of at-risk players (Thorborg et al. 2011a, 2014; Thorborg et al., 2011) and for early detection of groin problems (Cow et al., 2010; Wollin et al., 2018a). Ryan, DeBurca & Mc Creesh (2014) and Whittaker et al. (2015) identified that athletes with low hip adductors strength (isolated measure and relative to abduction strength) have four times greater chance of hip and groin pain.

Skahan (2016) is in this case indentifying groin area like a probably most common place for soft tissue injuries among ice-hockey players. He suggests to keep their groins healthy and strong especially when they change direction a lot. Hip and groin problems are also common in all kinds of sports and can impact on player’s ability to play, result in pain, or motor deficits (Mosler et al., 2018). Early detection of strength deficits allows appropriate intervention as required (Thorborg et al., 2018). The part of these assessments is also indicating when an athlete is ready for increased resistance in exercise, progression of exercise or higher workloads in general (O’Brien, 2018).

Aim

The aim of research was to determine the effect of the isometric hip adductors´ muscle strength on speed with directional changes of ice-hockey players.

Methods

The sample consisted of 15 members of the Slovakian national ice-hockey team, the average age was 27 years, the average height was 186.46 cm (SD ± 5.04), and the average body weight was

90.87 kg (SD ± 5.91). The research took a part during July 2019, with assistance of FiT Factory facility in Nemce, Banská Bystrica. Players completed several tests as a part of their initial pre-season testing and within that we took a deeper look to the laying GroinBar 60° isometric adductor test as well as change of direction 5-10-5 speed test. GroinBar 60° isometric test was performed on GroinBar device, where players were laying on the floor with feet placed on the platform and 60 ° angle in knee joints. The force pad was positioned perpendicularly to the medial femoral epicondyle and on a signal players performed 2 repetitions of maximal squeezes to force pad in a perpendicular direction. Device software recorded each try and each limb independently. GroinBar is Modular carrier system allows for dozens of positions to be standardised and tested repeatedly. The dimensions of device are length 150 cm, width 103 cm, height 97 cm, weight 27 kg. It communicates via mini-USB or USB cable as well as Bluetooth. It contains chargable lithium ion battery with life approximately 100 hours active use mode and weeks if inactive mode. There are 4 load cell sensors placed on device with capacity of 100kg / 220lb/ 980N and sampling rate moves from default 50 Hz up to 400 Hz (maximum). The GroinBar´s (uniaxial) sensors are precision force transducers, designed for taking accurate measurements at high levels of force. The device is provided with a software, which allows to stream data from GroinBar in real time, it provides real time analytics: maximum and average abduction and adduction force and AB:AD ratio. It also provides immediate, quantitative feedback to athletes with live graphing, targeting absolute or relative strength zones, uploading results to player profiles in DashBord etc. For the second test players performed 5-10-5 m sprint with changes of direction. 5 and 10 meters distances were measured and the lines were market on 0, 5 and 10 meters points. 1 pair of Microgate photocells was used and placed exactly on a 5 meters distance. Player started in the middle right between photocell´s beam, in low stance with 1 hand placed on the ground facing the photocell. On a self-cue player started sprinting 5 meters to a direction of placed hand followed by crossing the line with the other leg as placed hand, cutting and change direction to opposite site, when he ran 10 meters distance, cut to the **same** leg again and ran back to the middle with full speed. Each player performed 2 tries on each side. Microgate Polifemo photocells work as a coaxial optical system. Also, the Polifemo line employs an intelligent link to the timer using the standard 2-wire banana connection. Microsoft Excel 2016 and IBM SPSS v25 software had been used for calculating data´ normality, statistical significance and effect size, causal analysis and synthesis were use for appropriate concusions.

Results

15 members of Slovakian national ice-hockey team participated on measurements of hip adductors isometric strength test as well as test for determining speed with change of direction. Results are presented in *Table 1.*

Table 1 *Test performance summary*

	Left ADD Force (N)	Right ADD Force (N)	Difference L : R (%)	5-10-5 R (sec.)	5-10-5 L (sec.)
Average	467.87	485.80	3.50	4.95	5.02
SD	87	95.10	7.08	0.16	0.13

In *Table 1* you can see team average score as well as score variability presented via standard deviation value. When it comes to adductor isometric force production, most of the players had stronger dominant right leg and achieved faster time to the right side of 5-10-5 test. When it comes to speed with change of direction most of the players are able to cut and change the direction faster on the right side (meant deccelerate and reaccelerate by right leg). For further information see *APPENDIX A*, where detailed test statistics are presented.

Since we wanted to determine, whether hip adductor isometric strength level does have any effect to speed with change of direction we calculated data distribution in IBM SPSS software. Kolmogorov-Smirnov test´s result revealed, that data were normally distributed within a sample in each variable therefore we used Pearson corelation non parametric test for calculate if there exist any corelation between hip adductor isometric force and speed with changes of direction. Results are presented in *Table 2.*

Table 2 *Pearson correlation results*

	Pearson correlation results
Right leg adductor force vs Right side COD test	**0.047**
Left leg adductor force vs Left side COD test	**0.067**
Right and Left leg adductor force vs COD test	**0.006**

From *Table 2* we can declare, that there is no relation between right leg hip adductors force and ability to change direction with right leg (0.047). We can also declare no relation between strength of left leg hip adductors and ability to change direction with left leg (0.067). We cannot consider the adductors isometric strength as prerequisite for change of direction speed ability.

Discussion

The study demonstrates no correlation (0.006) between adductor's strength (GroinBar 60° isometric test) and speed with directional changes (5-10-5 test), while Chang (2009), Neeld (2018) and Terry (2019) states big importance of adductor muscles strength during skating and changing of direction on ice. Our experiment provides a new insight into the relationship between speed with directional changes and adductor strength, because no other research have dealt with the same research problem yet. These data contribute to a clearer understanding of change of direction kinesiology where adductors strength does not play so big role as we expected.

The generalizability of the results is limited by the fact, that we used only one test (GroinBar 60° isometric test) for proclaiming the final correlation. Vald Performance (2018) is offering many other testing positions and options (Unilateral and bilateral supine neutral, supine 60°, supine 90°/90°, seated 90°/90°, seated interval/external hip rotation) which can be used in next researches. The next question for us is, if there possibly is positive correlation between change of direction 5-10-5 test and excentric adductor strength. For this case we plan to use excentric based test type like Copenhagen exercise and try to find, if excentric adductor strength plays bigger role in changing of direction in ice-hockey and sport in general. Our findings are challenge for the existing assumptions and therefore create the space for the next research.

Conclusion

This research aimed to correlate the speed with directional changes with adductor's strength. Based on a quantitative and qualitative analysis of our results, it can be concluded that there is no relationship (0.006) between adductors strength and speed with directional changes. The results indicate that there are other muscle groups and movement qualities which make a difference in final performance. For our research we chose GroinBar 60° test which is according to Vald Performance (2018) the most popular Test Type in the NHL 2017/2018 season. The 5-10-5 test is not only part of the NHL Combine test battery (Marrazza, 2017), but also recommended by Neeld (2018) to assess important speed qualities of hockey players. This research clearly illustrates no correlation between chosen variables, but the question of the most important muscle group involved in changing of direction still remains. Further research is needed to determine the relationship between strength of the adductor muscle group and speed with change of direction.

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