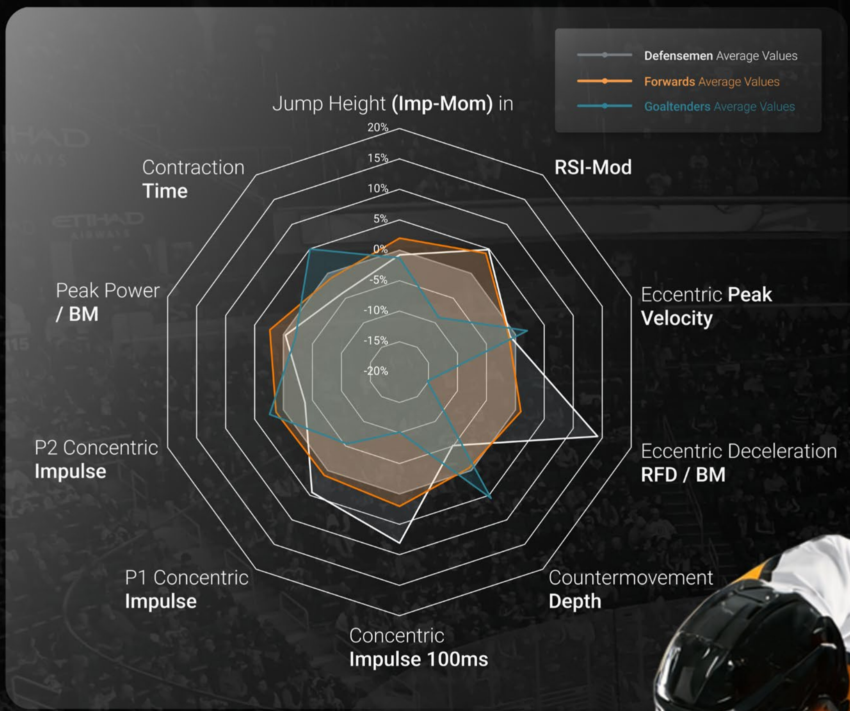
2024/25

NHL Report



VALD

Contents

In this document, we will **cover a wide range of topics and answer some common questions**, including:

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Executive **Summary**

Across the past five seasons, more than 2,300 National Hockey League (NHL) and European league athletes have completed over 43,000 tests using VALD technology, reflecting the growing adoption of objective measurement technology by ice hockey organizations worldwide to support performance, health and decision-making.

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Given the extensive data collected and uploaded to the VALD Data Lakehouse, along with the permissions granted by professional hockey organizations, VALD is uniquely positioned to aggregate athlete information and present a comprehensive summary of testing activity and trends.

Note: This report does not include data from teams that chose not to share their data.

For the 2024/25 season, a growing number of NHL and European league teams used VALD systems, with the number of tested athletes nearly doubling in the NHL and quadrupling in European leagues when compared to the 2020/21 season.

Testing in the NHL occurs throughout the season, with a shift from a single preseason spike to two key checkpoints: one at the end of the season and another upon return to preseason. Similar, though less pronounced, trends are observed in European leagues.

Testing included a range of test types, which have expanded since the 2020/21 season. The tests deployed revealed distinct practices across leagues. On ForceDecks, the following tests were common to both NHL and European organizations:

- Countermovement jump (CMJ)
- Squat jump (SJ)
- Single leg jump (SLJ)
- Isometric mid-thigh pull (IMTP)

European organizations also incorporated the following tests:

- Isometric belt squat
- Abalakov jump
- Drop jump (DJ)

A notable addition was the athletic shoulder (ASH) assessment protocol, which has emerged as the most frequently used upper-limb ForceDecks assessment.

ForceFrame testing across both leagues focused heavily on the hip region, with the hip adduction/abduction (ADD/ABD) 60° test performed most frequently and a special interest in long-lever strength (hip ADD/ABD supine [ankle]) in the NHL. Nordic hamstring testing was widely performed with NordBord, whereas DynaMo was commonly included in hand grip and hip ADD testing. SmartSpeed was used for hockey-specific sprint testing.

Normative values were generated for both the NHL and the major European leagues, allowing direct comparisons between competitions. Positions were mapped consistently across datasets (Goaltender, Defenseman, Forward) to ensure meaningful analysis.

Among jump assessments, the SLJ and SJ distinguished NHL and European league athletes more clearly than the CMJ. Positional trends were largely consistent across leagues and showed only minor differences, suggesting performance patterns are shaped by training and competition environments, though additional context is needed to explain the underlying mechanisms.

Among jump assessments, the **SLJ and SJ distinguished NHL and European league athletes more clearly than the CMJ.**

The high volume of hip ADD testing across both leagues likely reflects the ongoing prevalence of adductor strains in elite ice hockey and the relevance of direct force assessment (Martin et al., 2024; Tyler et al., 2001). At 60° of hip flexion, adductor strength was generally lower than abductor strength in NHL athletes.

How Do I **Use** This Report?

The purpose of this report is to help practitioners make informed decisions that enhance performance, reduce injury risk and improve return-to-play outcomes. By offering population-level insights, organizations can better contextualize their own athlete data within the broader landscape of professional ice hockey.

…[this report enables] organizations [to] **better contextualize their own athlete data within…professional ice hockey.**

Normative values and interpretations are provided across multiple seasons to extend insights far beyond simple performance metrics. Athletes, coaches and support staff alike can find value in understanding key athlete benchmarks while diving deeper to explore how they can be used to drive performance enhancement.

Normative data offer a benchmark for the following:

- **Performance Optimization:** Identifying strengths and weaknesses through needs analysis
- **Preparation for Competition:** Ensuring athletes peak at the right time, particularly during knockout phases of competition
- **Goal Setting:** Informing tailored training programs based on individual profiles
- **Monitoring Fatigue and Recovery:** Detecting signs of overtraining and managing stressors such as travel and training load
- **Long-Term Athlete Development:** Supporting talent identification and tracking progress over time
- **Rehabilitation and Recovery:** Guiding return-to-play decisions, even when comprehensive data is limited

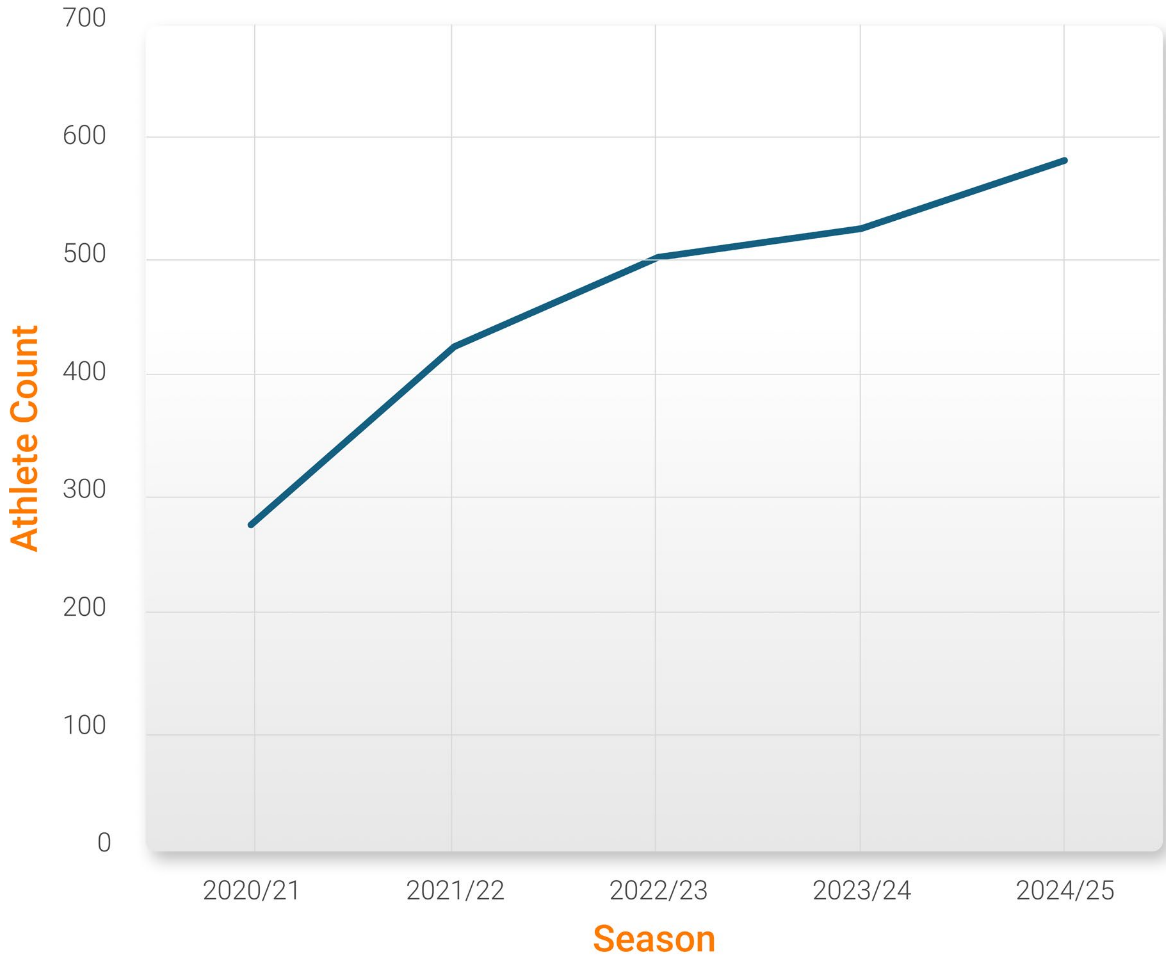
Ultimately, data provides actionable targets and insights that support both athlete development and team strategy. While some tests are universally adopted, others vary between leagues. This report explores those distinctions and the value each brings to the game.

Strength in **Numbers**

VALD systems have become a core part of daily operations across NHL teams, supporting year-round athlete monitoring. From the 2019/20 season final to the end of the 2024/25 season, more than 1,300 NHL athletes have completed over 26,000 tests.

Over this five-year period, the number of **NHL athletes assessed has nearly doubled.**

Over this five-year period, the number of NHL athletes assessed nearly doubled, resulting in a twofold increase in the volume of tests ingested into the VALD Data Lakehouse.



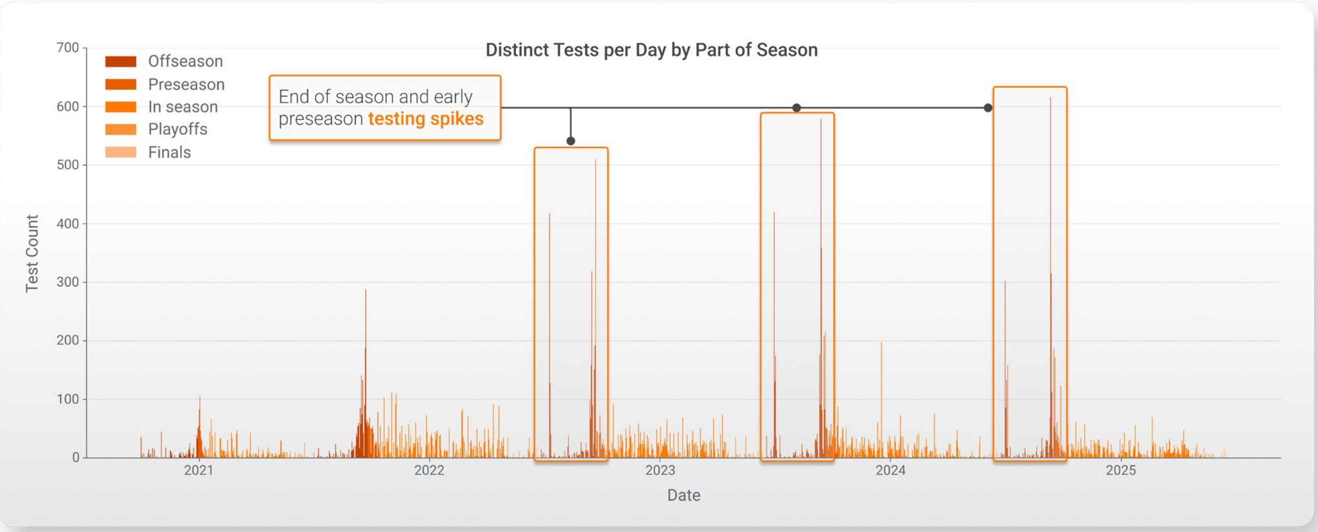
NHL athletes tested per season.

Weekly **Usage**

The portability and simple workflows of modern technologies allow assessments to be conducted wherever athletes train or compete. This enables teams to collect data for multiple purposes, including monitoring, rehabilitation and return-to-play decision-making. This is reflected in day-to-day practice, with testing recorded on 70% of all days during the 2024/25 NHL season.

Traditionally, the highest volumes of testing occurred at the start of preseason when athletes returned from their offseason break. Over the past three seasons, two clear peaks have emerged: one at the end of the season and another at the start of preseason. During these periods, weekly testing volume can increase to two to five times typical levels.

> …two clear peaks have emerged [at the end of season and the start of preseason]. During these periods, **weekly testing volume can increase to two to five times typical levels.**



Twin peaks of modern NHL testing schedules.

The shift in testing timing likely reflects offseason priorities, when athletes focus on recovering from competition while maintaining or improving key physical qualities. Testing before and after the offseason allows teams to evaluate how well athletes preserved or developed their physical capacity during this period.

System-Specific Usage

Testing behavior across the NHL is also evolving. The 2024/25 season recorded 153 distinct test types, representing almost a fourfold increase compared with the 2020/21 season. This expansion indicates that NHL teams are now using modern technologies to capture a much broader spectrum of health and performance data than in earlier seasons, allowing a more detailed understanding of their athletes.

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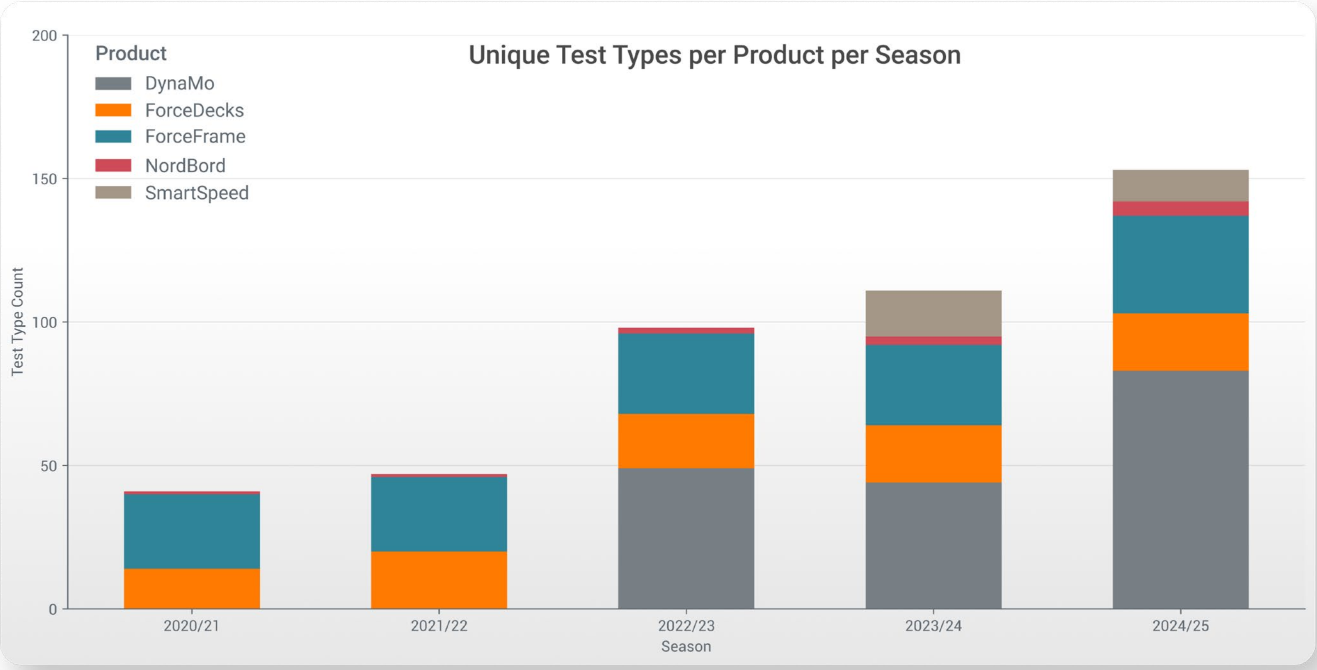

Test type count by system and season.

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Popular **Test Types** in the NHL

Established and emerging test types for the 2024/25 season are outlined below.

Systems	Established Tests	Emerging Tests
ForceFrame	• Hip ADD/ABD Seated • Hip ADD/ABD Supine (Ankle) • Hip ADD/ABD 45° • Hip ADD/ABD 60°	• Hip Flexion Seated
ForceDecks	• CMJ • SLJ • SJ • IMTP	• Isometric Shoulder Y (ISO-Y)
NordBord	• Nordic	• Isometric 60° (ISO 60)
DynaMo	• Hand Grip Strength Neutral • Hand Grip Squeeze 90° Shoulder Flexion	• Hip ADD Supine
SmartSpeed	• On-Ice Hockey-Specific Tests	

ForceDecks

In the 2024/25 season, 84% of all tests conducted by NHL teams were performed using ForceDecks (60%) and ForceFrame (24%).

In the 2024/25 season, **84% of all tests conducted by NHL teams** were performed using ForceDecks and ForceFrame.

The CMJ was the "go-to" test in the NHL, accounting for around 40% of all ForceDecks tests. The CMJ has multiple uses based on its established association with sports performance, rehabilitation, return-to-sport readiness and athlete monitoring. To support profiling, other popular tests include SLJ and SJ.

The IMTP was commonly used across NHL teams as a measure of maximal strength and rapid force production. When interpreted alongside jump assessments, peak force and rate of force development (RFD) values provided additional context for athlete strength profiles.

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The ISO-Y test also appeared as an emerging assessment in the NHL dataset, reflecting the emphasis placed on monitoring shoulder strength and asymmetry in a high-contact sport. This test is particularly valuable because it highlights strength deficits and asymmetries linked to shoulder and scapular injuries, common issues in professional ice hockey (White et al., 2023).

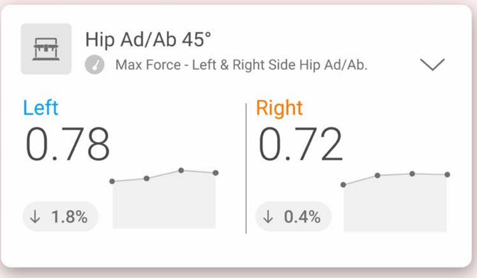
ISO-Y performed on ForceDecks

ForceFrame

Hip-focused assessments are the most common and established ForceFrame tests in the NHL. While the supine ankle position has grown in popularity in recent seasons, the shorter-lever positions (45°, 60° and seated) still account for just under 70% of all hip tests conducted. The hip adduction-to-abduction ratio (ADD:ABD) remains a popular metric and assessment pair in elite ice hockey.

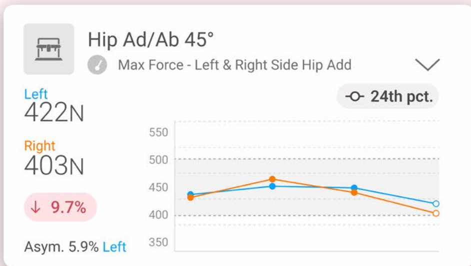
Hip **ADD:ABD <0.8** leads to

17x greater risk of **groin strain injury**



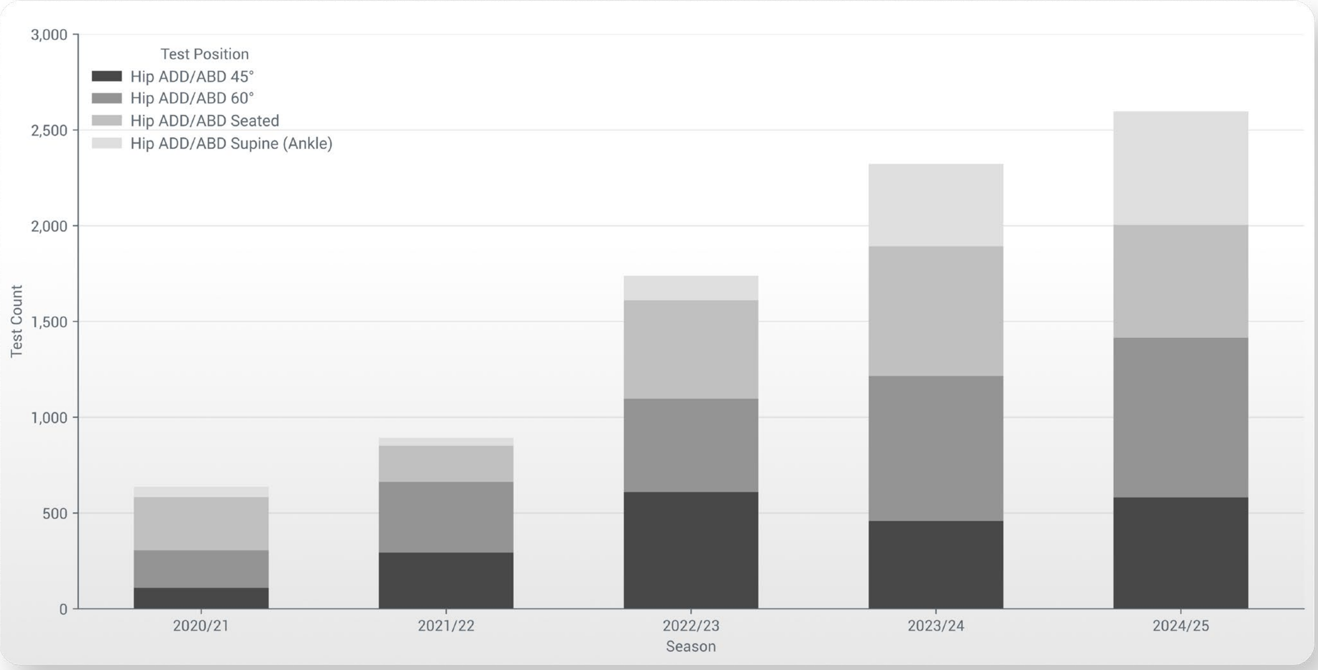
Isometric adductor strength **<465N**

Increased likelihood of **groin injury by 72%**



Data taken from Tyler et al. (2001).

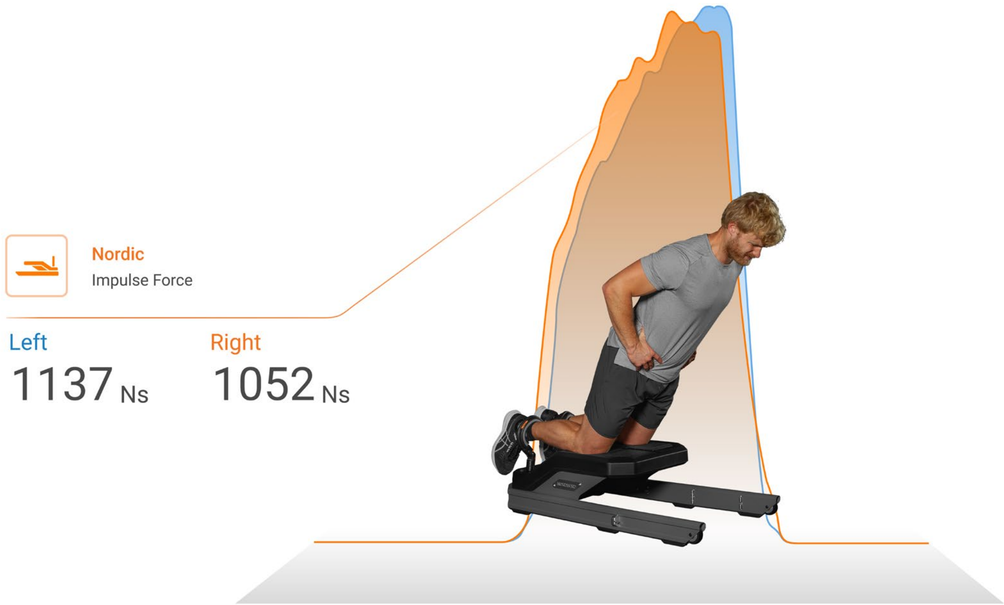
The popularity of hip adductor and abductor testing aligns with the high prevalence of hip and groin injuries in ice hockey (Martin et al., 2024). Athletes are reported to be 17 times more likely to sustain an adductor strain when adductor strength falls below 80% of abductor strength (Tyler et al., 2001).



Hip testing popularity shifts in the NHL.

NordBord

NordBord is widely recognized as the original field-based system and is considered a gold standard for assessing eccentric hamstring strength. Nordics have been used consistently in the NHL over the past five seasons, with increasing volumes of ISO 60 testing in the 2024/25 season. Hip adductors and hamstrings are structurally and functionally linked, and evaluating them together may provide additional insight into injury risk and performance.



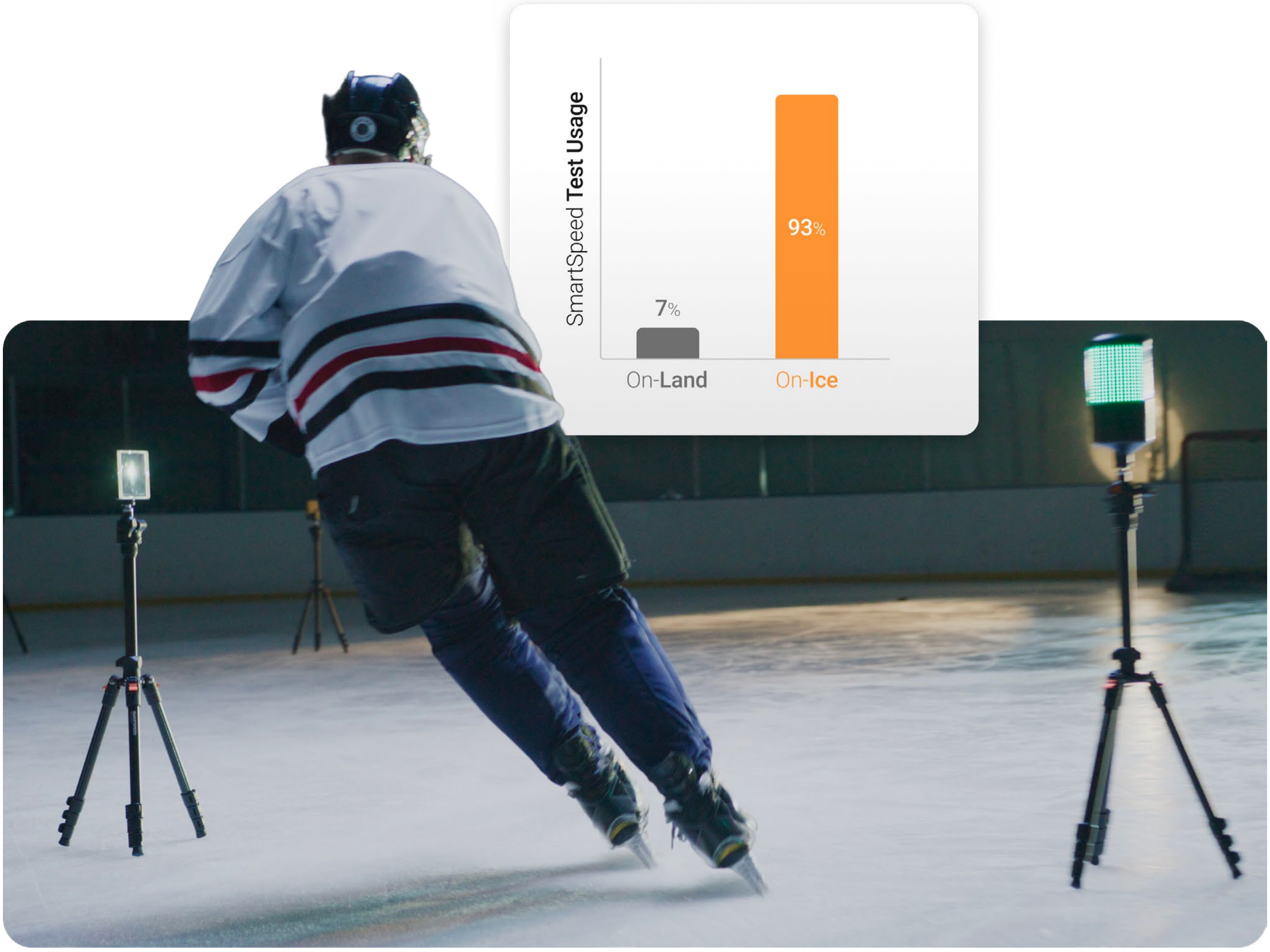
DynaMo

Based on test counts, DynaMo was used primarily for grip strength and hip ADD supine assessments.

Its portability and versatility make it well-suited for monitoring hip adductor strength while traveling, particularly in environments where larger systems are less practical.

SmartSpeed

On-ice position-specific and repeated-effort custom tests accounted for 93% of all SmartSpeed usage in the NHL.



2024/25 Season **Norms**

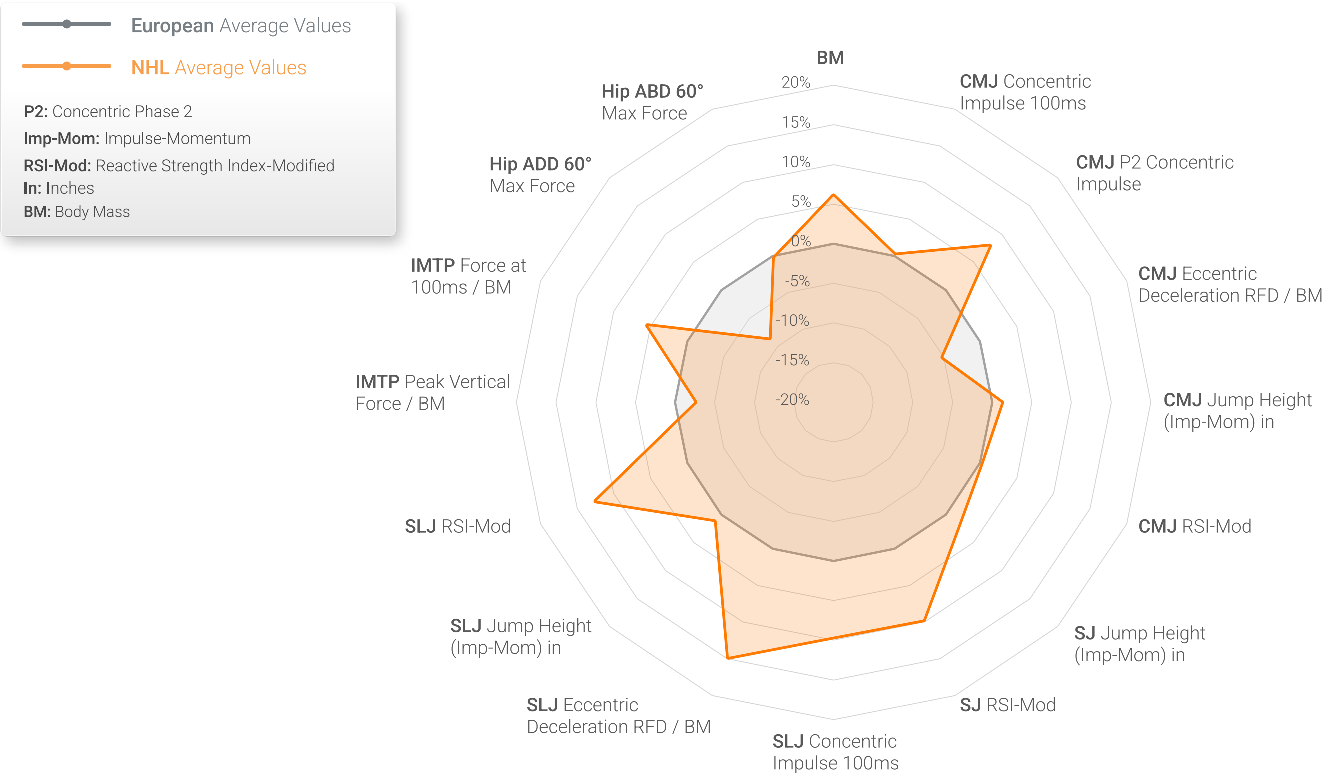
The main focus of this report is to provide insights into key performance metrics and data trends for NHL teams and elite hockey organizations. European league data are included for comparison purposes. Therefore, equivalent benchmarks and normative data descriptions for NHL athletes are not included across all European league datasets.

On average, the NHL population is three years younger and 11 pounds (lb) heavier than European league athletes. These differences should be considered when interpreting the data presented below.

On average, the NHL population is **three years younger and 11lb heavier** than European league athletes.

	Percentiles	Age (years)		Body Mass (lb)	
		European	NHL	European	NHL
Anthropometrics	5th	19	19	167	176
	25th	22	22	177	189
	Median	28	25	188	200
	75th	32	30	201	209
	95th	36	35	217	227

The radar plot below compares multiple performance and anthropometric measures between NHL and European league athletes. The orange line represents the between-league difference, where positive values indicate higher values in the NHL and negative values reflect higher values in the European leagues.



Radar plot comparing NHL and European league test metrics.

No differences between leagues were found in abductor strength, but NHL athletes had weaker adductors than the European league athletes. Around 15% of tests in the NHL were below the 0.80 ADD:ABD threshold for increased adductor strain risk (Tyler et al., 2001), compared with fewer than 5% in the European league. NHL athletes also produced greater relative IMTP force at 100ms, with no difference in relative peak force.

Around 15% of tests in the NHL were below the 0.80 ADD:ABD threshold for increased adductor strain risk, **compared with fewer than 5% in the European league.**

System	Test	Metric	European League							NHL						
			Percentiles							Percentiles						
			1st	5th	25th	Median	75th	95th	99th	1st	5th	25th	Median	75th	95th	99th
ForceFrame	Hip ADD/ ABD 60°	Hip ABD 60° Max Force (N)	319	356	414	455	514	598	641	312	366	413	456	498	578	629
		Hip ABD 60° Max Force Asymmetry (%)	12	10	6	4	1	0	0	12	11	6	4	2	0	0
		Hip ADD 60° Max Force (N)	295	405	485	540	588	661	691	253	326	420	489	556	633	693
		Hip ADD 60° Max Force Asymmetry (%)	12	8	5	3	1	0	0	11	9	6	3	1	0	0
		ADD/ABD 60°	0.78	0.83	1.02	1.13	1.25	1.45	1.56	0.62	0.72	0.91	1.04	1.19	1.38	1.50
ForceDecks	IMTP	Peak Vertical Force (N)	1,994	2,406	2,757	2,976	3,243	3,752	4,192	2,090	2,253	2,685	3,058	3,346	3,908	4,219
		Peak Vertical Force (Net of BW) (N)	1,265	1,589	1,918	2,135	2,371	2,793	3,093	1,278	1,369	1,776	2,129	2,433	2,852	3,023
		Peak Vertical Force / BM (N/kg)	24.6	27.4	32.0	34.7	37.4	42.4	47.1	22.0	24.7	29.5	33.8	37.0	42.1	44.4
		Force at 100ms / BM (N/kg)	9.1	10.5	12.9	15.0	17.7	22.1	24.8	11.4	12.1	13.9	15.9	18.1	21.5	24.3
		Force at 200ms / BM (N/kg)	11.3	12.7	16.0	18.7	22.5	27.6	30.6	12.8	14.0	17.1	19.7	22.7	28.9	30.7
	CMJ	Jump Height (Imp-Mom) cm	30.0	32.8	37.6	40.5	43.4	48.0	51.2	30.8	34.0	38.0	41.0	44.1	49.0	51.7
		Jump Height (Imp-Mom) in	11.8	12.9	14.8	15.9	17.1	18.9	20.1	12.1	13.4	14.9	16.1	17.4	19.3	20.4
		RSI-Mod	0.38	0.45	0.55	0.62	0.71	0.83	0.88	0.42	0.48	0.56	0.63	0.69	0.78	0.82
		Eccentric Peak Velocity (m/s)	-1.10	-1.24	-1.43	-1.56	-1.69	-1.89	-2.01	-1.10	-1.26	-1.46	-1.60	-1.72	-1.91	-2.00
		Eccentric Deceleration RFD / BM (N/s/kg)	33.7	56.6	85.6	110.4	144.8	195.5	212.1	36.5	58.1	83.9	104.8	128.2	167.9	194.6
		Countermovement Depth (cm)	-18.9	-21.4	-29.6	-35.3	-40.4	-46.5	-50.0	-24.4	-28.9	033.6	-37.4	-41.4	-48.1	-52.0
		Phase 1 (P1) Concentric Impulse (Ns)	5	92	114	130	149	176	188	84	99	117	130	144	168	182
		P2 Concentric Impulse (Ns)	113	126	145	158	169	185	196	123	135	154	165	178	196	205
		RSI-Mod	49	57	73	84	94	112	123	57	68	81	91	101	115	125
		Peak Power / BM (W/kg)	43.4	47.3	52.8	56.6	60.4	67.3	70.1	44.5	47.6	52.0	55.7	59.7	65.1	68.5
		Contraction Time (s)	0.959	0.889	0.792	0.716	0.646	0.540	0.492	0.959	0.878	0.791	0.739	0.692	0.634	0.576
	SLJ	Jump Height (Imp-Mom) cm	9.2	14.6	17.4	19.5	21.8	25.4	28.8	8.6	11.6	17.1	19.7	22.1	26.7	30.2
		Jump Height (Imp-Mom) in	3.6	5.8	6.9	7.7	8.6	10.0	11.3	3.4	4.6	6.7	7.7	8.7	10.5	11.9
		RSI-Mod	0.11	0.16	0.21	0.26	0.33	0.44	0.57	0.15	0.19	0.25	0.30	0.35	0.52	0.60
		Eccentric Peak Velocity (m/s)	-0.19	-0.45	-0.69	-0.92	-1.12	-1.33	-1.50	-0.57	-0.75	-0.98	-1.09	-1.21	-1.42	-1.59
		Eccentric Deceleration RFD / BM (N/s/kg)	7	12	24	39	53	85	105	13	20	33	45	58	80	93
		Countermovement Depth (cm)	-5.4	-15.1	-21.6	-25.8	-28.4	-33.9	-42.4	-15.8	-19.3	-24.7	-27.8	-31.1	-35.1	-39.6
		P1 Concentric Impulse (Ns)	15	32	48	60	75	95	106	14	22	51	66	77	92	105
		P2 Concentric Impulse (Ns)	48	63	90	101	113	127	133	51	63	94	108	119	133	140
		RSI-Mod	27	38	52	63	75	95	109	30	38	54	65	76	98	112
		Peak Power / BM (W/kg)	23.3	28.1	31.4	33.9	36.2	41.1	44.5	20.6	24.5	29.9	32.7	35.5	41.4	44.8
		Contraction Time (s)	1.292	1.192	1.015	0.886	0.774	0.647	0.558	1.184	1.030	0.889	0.799	0.713	0.395	0.356
	SJ	Jump Height (Imp-Mom) cm	28.2	32.8	35.3	38.0	41.5	46.8	49.6	27.9	30.5	35.4	38.9	42.8	47.7	50.9
		Jump Height (Imp-Mom) in	11.1	12.5	13.9	15.0	16.3	18.4	19.5	11.0	12.0	13.9	15.3	16.9	18.8	20.1
		RSI-Mod	0.34	0.48	0.68	0.80	0.95	1.17	1.31	0.48	0.58	0.76	0.88	1.03	1.22	1.37
		Peak Power / BM (W/kg)	42.4	46.8	51.9	55.2	58.7	65.2	69.6	44.3	47.8	52.1	56.1	60.6	66.8	70.0
		Contraction Time (s)	0.784	0.711	0.577	0.502	0.431	0.355	0.313	0.768	0.679	0.566	0.485	0.413	0.351	0.303

2024/25 NHL and European league Norms.

European league athletes had higher eccentric deceleration RFD / BM during the CMJ, while NHL athletes had higher P2 concentric impulse, with no other CMJ metrics differentiating European league and NHL athletes. In contrast, the SJ and SLJ provided clearer separation between NHL and European league athletes. This suggests that the more concentric nature of the SJ and the greater demands of the SLJ may reveal specific strength qualities that the CMJ does not capture.

...SJ and SLJ provided clearer separation between NHL and European league athletes.

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Tests More Popular in the NHL

Normative data for tests more popular in the NHL than in European leagues are reported below. They include hand grip strength and hip adductor strength (specifically at 45° of hip flexion and supine at 0° of hip flexion), measured using DynaMo and ForceFrame.

			NHL						
System	Test	Metric	Percentiles						
			1st	5th	25th	Median	75th	95th	99th
NordBord	Nordic	Max Force (N)	293	335	414	463	505	550	583
		Max Force Asymmetry (%)	20.1	16.1	8.0	5.5	2.7	0.6	0.2
		Torque (Nm)	120	146	180	207	231	260	273
DynaMo	Grip Squeeze Neutral	Max Force (N)	431	493	593	663	737	834	877
		Max Force Asymmetry (%)	19	15	8.9	5.2	2.6	0.4	0.1
		Max RFD (N/s)	465	705	1,377	2,136	3,108	4,192	4,698
		Max RFD Asymmetry (%)	58	46	28	16	7	2	0
	Hip ADD Supine	Max Force (N)	56	103	190	244	276	337	370
		Max Force Asymmetry (%)	31.8	25.3	15.4	9.1	5.1	0.4	0
		Max RFD (N/s)	116	203	419	692	1,062	1,733	1,872
		Max RFD Asymmetry (%)	81	73	47	26	15	3	1
ForceFrame	Hip ADD/ABD 45°	Max Force ABD (N)	285	341	411	456	500	578	641
		Max Force Asymmetry (%)	13	11	6	3	2	0	0
		Max Force ADD (N/s)	237	311	424	492	553	647	706
		Max Force Asymmetry (%)	12.6	10.4	6.7	4.1	1.8	0.3	0.1
		Max Force ADD:ABD	0.61	0.70	0.92	1.08	1.21	1.40	1.51
	Hip ADD/ABD Seated	Max Force ABD (N)	291	349	416	462	511	594	639
		Max Force Asymmetry (%)	16	13	8	5	2	0	0
		Max Force ADD (N/s)	250	332	439	499	570	677	727
		Max Force Asymmetry (%)	15.1	12.2	7.6	4.4	1.9	0.4	0.1
		Max Force ADD:ABD	0.65	0.79	0.97	1.09	1.22	1.40	1.50
	Hip ADD/ABD Supine (Ankle)	Max Force ABD (N)	105	131	173	197	225	266	316
		Max Force Asymmetry (%)	17	14	8	4	2	1	0
		Max Force ADD (N/s)	100	126	180	224	263	322	339
		Max Force Asymmetry (%)	21.8	17.9	12.0	5.6	2.7	0.5	0.1
		Max Force ADD:ABD	0.66	0.81	0.99	1.14	1.30	1.56	1.65

2024/25 Norms for tests more popular in the NHL.

Hand grip strength measures have been identified in research involving travel as a marker of circadian rhythms and non-sport-specific physical performance, serving as a surrogate measure of maximal strength (Reilly et al., 2007).

Hand grip testing is a fast, low-fatigue and potentially competitive testing mechanism that has been identified as a biomarker for neuromuscular readiness and a global measure of physical performance.

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Tests More Popular in European Leagues

Normative data for tests more popular in European leagues are reported below. These tests include the isometric belt squat, Abalakov jump and DJ, all performed using ForceDecks.

			European League						
			Percentiles						
System	Test	Metric	1st	5th	25th	Median	75th	95th	99th
ForceDecks	Isometric Belt Squat	Peak Vertical Force (N)	2,287	2,485	3,429	4,063	5,045	6,831	7,481
		Peak Vertical Force (Net of BW) (N)	1,330	1,584	2,539	3,169	4,217	5,978	6,568
		Peak Vertical Force / BM (N/kg)	21.7	27.4	37.4	43.9	54.2	70.6	80.3
		Force at 100ms (N)	11.0	11.5	13.5	15.0	19.2	26.0	27.6
		Force at 200ms (N)	11.8	13.1	15.9	18.3	22.9	29.7	39.7
	Abalakov Jump	Jump Height (Imp-Mom) cm	31.6	35.0	39.2	44.2	48.2	53.6	56.4
		Jump Height (Imp-Mom) in	12.4	13.8	15.4	17.4	19.0	21.1	22.2
		RSI-Mod	0.36	0.40	0.49	0.58	0.64	0.72	0.76
		Eccentric Peak Velocity (m/s)	-0.75	-1.01	-1.28	-1.47	-1.67	-1.89	-2.04
		Eccentric Deceleration RFD / BM (N/s/kg)	19	37	53	72	87	108	133
		Concentric Impulse 100ms	-26.1	-32.6	-39.3	-42.7	-47.9	-54.9	-59.4
		Countermovement Depth (cm)	59	69	86	99	111	121	129
		P1 Concentric Impulse (Ns)	92	104	124	138	151	164	178
		P2 Concentric Impulse (Ns)	86	95	109	115	129	143	151
		Peak Power / BM (W/kg)	47.7	50.7	58.7	62.1	66.0	72.1	74.8
		Contraction Time (s)	1.138	1.088	0.949	0.872	0.828	0.741	0.668
	DJ	Jump Height (Imp-Mom) cm	16.2	20.4	26.8	31.6	37.5	45.4	49.8
		Jump Height (Imp-Mom) in	6.4	8.0	10.5	12.4	14.8	17.9	19.6
		Reactive Strength Index (RSI) (Flight Time / Contact Time)	0.83	0.96	1.12	1.35	2.15	3.01	3.43
		RSI (Jump Height / Contact Time)	0.56	0.64	0.77	0.93	1.32	2.10	2.70
		Coefficient of Restitution	0.69	0.75	0.83	0.92	1.06	1.27	1.52
		Peak Power / BM (W/kg)	89	91	104	116	148	192	216
		Contact Time (s)	0.507	0.500	0.453	0.364	0.229	0.183	0.159

2024/25 Norms for tests more popular in European leagues.

The isometric belt squat may address several limitations of traditional dynamic and isometric strength tests by applying force directly through a hip belt connected beneath the platform, isolating lower-body force production and removing upper-body constraints.

Compared with the IMTP in European league Norms, the isometric belt squat produces substantially higher force outputs, often approaching 50% greater peak values, making it a useful option for assessing lower-body strength across athlete development pathways.

…the **isometric belt squat produces substantially higher force outputs**, often approaching 50% greater peak values…

Position Differences Within the NHL

Positional roles shape the movement demands of NHL athletes. In this section, data are compared across the three primary NHL positions (Goaltender, Forward and Defenseman) based on position labels provided by each organization in athlete profiles.

Defensemen were the heaviest, followed by Forwards, with Goaltenders as the lightest. Age differences across the three positions were within two years.

	Percentiles	Age (years)			Body Mass (lb)		
		Defensemen	Forwards	Goaltenders	Defensemen	Forwards	Goaltenders
Anthropometrics	5th	19	20	18	187	173	176
	25th	22	21	21	194	185	186
	Median	25	24	23	202	199	190
	75th	30	30	29	219	207	200
	95th	37	37	30	229	220	226

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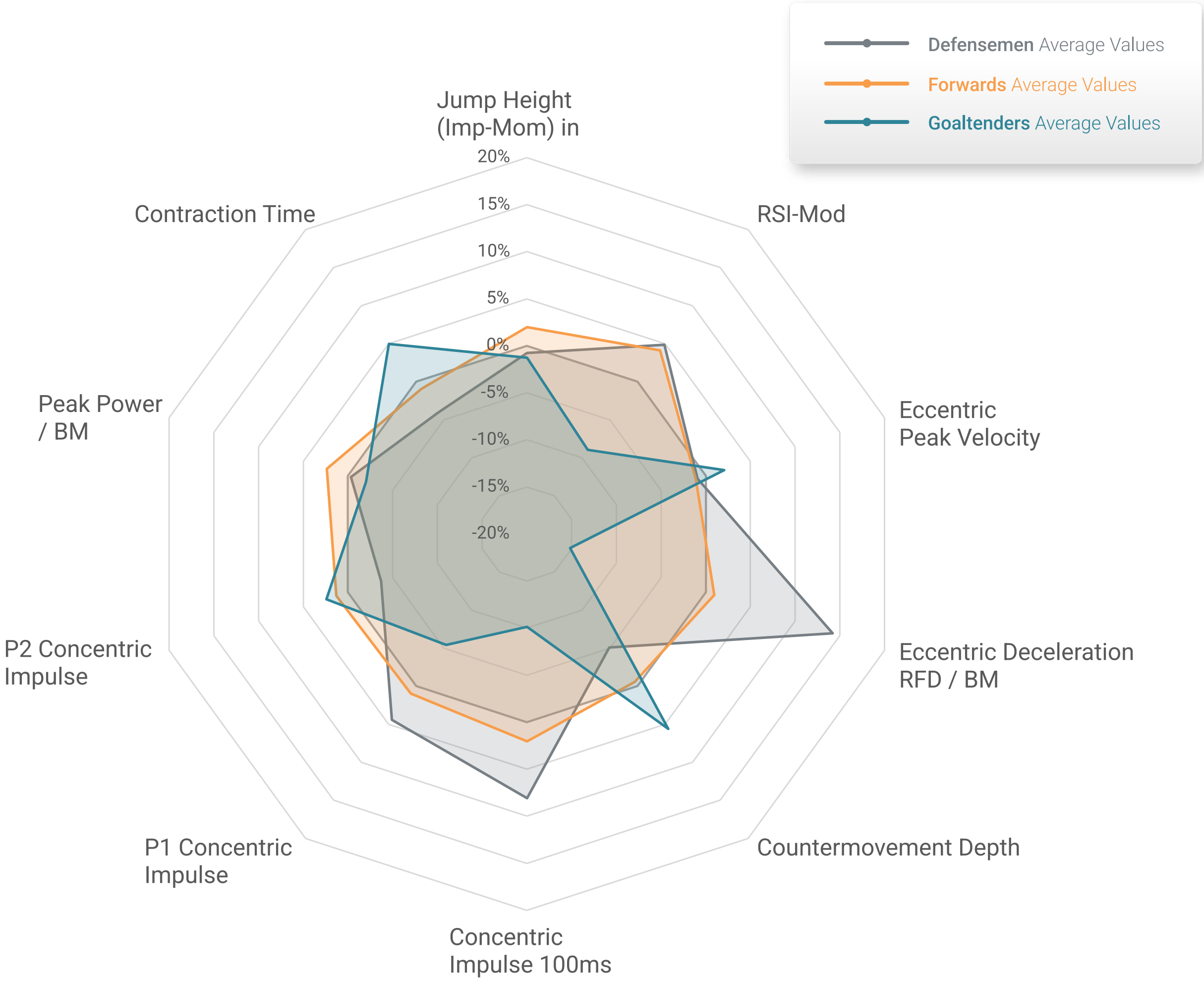
Countermovement Jump

The section outlines position-specific differences in CMJ performance data using various charts and visualizations of NHL athletes.

The following radar plot shows percentage differences from a combined athlete median, compared to individual positions. Positive values indicate the position is above the average, while negative values indicate the position is below the average.



CMJ radar plot comparing NHL athletes across the three positions.

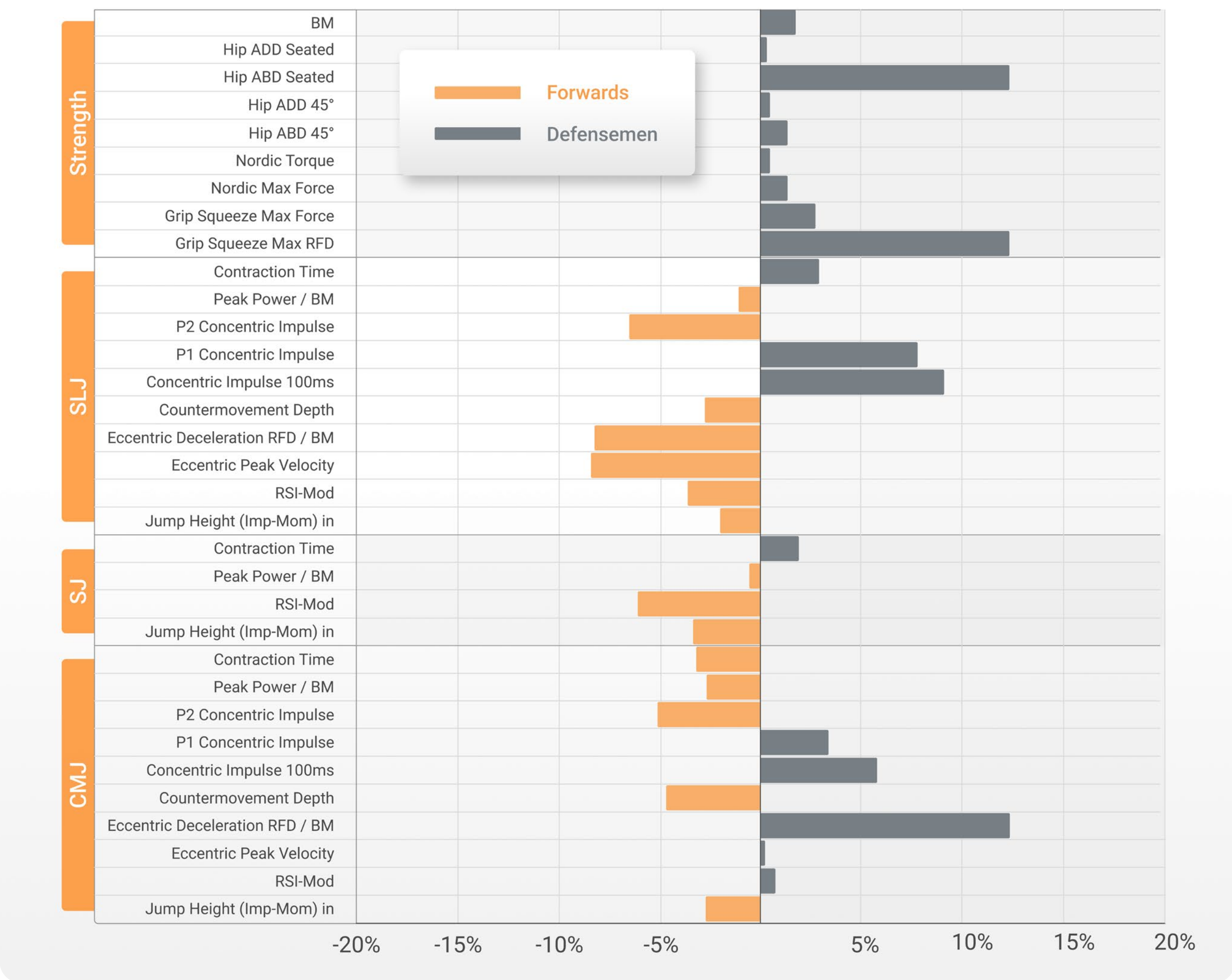
Goaltenders were included in position-specific Norms only for the CMJ due to sample size constraints. While all three positions achieved similar jump heights, Goaltenders had substantially longer contraction time than the skater positions, resulting in a lower RSI-Mod. They also showed greater countermovement depth and lower eccentric deceleration RFD / BM and concentric impulse 100ms.

The most notable position difference was the higher concentric impulse 100ms and eccentric deceleration RFD / BM in NHL Defensemen.

The most notable position difference was the **higher concentric impulse 100ms and eccentric deceleration RFD / BM** in NHL Defensemen.

Strength Tests and Jump Test **Comparisons**

A more comprehensive range of strength and jump tests comparing Forwards and Defensemen is presented below. The percentage differences that are positive values (bars on the right) indicate higher values for the metric in Defensemen. Negative values (bars to the left) indicate higher values in Forwards.



Comparisons between NHL Defensemen and Forwards across the range of tests.

Forwards: Forwards tended to outperform Defensemen in jump assessments, although differences were generally small (<5%). On the most demanding jump assessments, Forwards had greater RSI-Mod for the SJ and higher eccentric peak velocity, eccentric deceleration RFD / BM and P2 concentric impulse for the SLJ.

Defensemen: Defensemen demonstrated significantly higher values in hip ABD (seated) and grip strength RFD. Hip ADD and most other strength measures also favored Defensemen, although these differences were generally small to trivial. For the jump assessments, Defensemen had higher concentric impulse 100ms and eccentric deceleration RFD / BM in the CMJ, as well as greater P1 concentric impulse and concentric impulse 100ms in SLJ.

NHL Position Data

Normative data for strength and jump tests across NHL positions are presented below.

NHL			Defensemen					Forwards				
			Percentiles					Percentiles				
System	Test	Metric	5th	25th	Median	75th	95th	5th	25th	Median	75th	95th
ForceDecks	CMJ	Jump Height (Imp-Mom) cm	33.2	37.0	39.8	42.7	47.6	33.9	38.1	40.9	43.7	48.6
		Jump Height (Imp-Mom) in	13.1	14.6	15.7	16.8	18.7	13.4	15.0	16.1	17.2	19.1
		RSI-Mod	0.47	0.56	0.61	0.67	0.76	0.45	0.54	0.61	0.66	0.76
		Eccentric Peak Velocity (m/s)	-1.29	-1.49	-1.59	-1.69	-1.84	-1.24	-1.45	-1.59	-1.71	-1.91
		Eccentric Deceleration RFD / BM (N/s/kg)	60	83	101	123	163	48	70	89	113	152
		Countermovement Depth (cm)	-29.9	-33.8	-37.3	-41.7	-47.4	-30.4	-35.5	-39.1	-42.8	-50.2
		Concentric Impulse 100ms (Ns)	102	117	129	141	167	87	108	122	137	159
		P1 Concentric Impulse (Ns)	138	154	165	177	197	127	147	160	172	191
		P2 Concentric Impulse (Ns)	70	81	89	98	115	74	85	94	103	116
		Peak Power / BM (W/kg)	47.0	50.7	54.1	57.9	63.4	47.1	52.0	55.6	59.3	64.8
		Contraction Time (s)	0.881	0.798	0.745	0.693	0.641	0.918	0.826	0.769	0.715	0.647
	SJ	Jump Height (Imp-Mom) cm	28.3	35.0	38.5	42.1	46.5	32.4	36.1	39.9	42.8	47.4
		Jump Height (Imp-Mom) in	11.1	13.8	15.2	16.6	18.3	12.7	14.2	15.7	16.9	18.7
		RSI-Mod	0.57	0.75	0.86	1.01	1.25	0.59	0.77	0.91	1.04	1.20
		Peak Power / BM (W/kg)	47.7	51.6	55.8	59.9	66.4	49.5	52.3	56.2	59.9	66.3
		Contraction Time (s)	0.688	0.556	0.481	0.395	0.317	0.747	0.574	0.472	0.408	0.327
	SLJ	Jump Height (Imp-Mom) cm	15.3	19.3	21.4	24.3	27.8	14.3	18.8	21.8	24.9	32.1
		Jump Height (Imp-Mom) in	6.0	7.6	8.4	9.5	11.0	5.6	7.4	8,6	9.8	12.7
		RSI-Mod	0.19	0.23	0.29	0.33	0.41	0.20	0.25	0.30	0.36	0.48
		Eccentric Peak Velocity (m/s)	-0.16	-0.70	-0.92	-1.10	-1.38	-0.15	-0.86	-1.00	-1.13	-1.49
		Eccentric Deceleration RFD / BM (N/s/kg)	15	24	33	45	68	19	28	36	50	77
		Countermovement Depth (cm)	-2.2	-23.3	-27.8	-32.5	-41.0	-1.9	-23.7	-28.5	-32.1	-47.9
		Concentric Impulse 100ms (Ns)	23	49	60	72	93	20	43	55	69	96
		P1 Concentric Impulse (Ns)	74	91	106	117	138	62	84	98	109	134
		P2 Concentric Impulse (Ns)	52	65	76	95	118	47	67	81	106	124
		Peak Power / BM (W/kg)	28.2	32.0	34.8	38.3	43.1	27.4	32.0	35.2	39.6	47.3
		Contraction Time (s)	1.174	1.006	0.906	0.804	0.471	1.123	0.980	0.880	0.737	0.487
ForceFrame	Hip ADD/ABD 45°	ABD Max Force (N)	381	438	467	511	565	351	418	461	503	582
		ADD Max Force (N)	312	424	497	563	661	282	422	495	546	628
		ADD:ABD	0.70	0.90	1.05	1.19	1.36	0.68	0.92	1.07	1.20	1.36
	Hip ADD/ABD Seated	ABD Max Force (N)	342	443	481	533	614	306	377	425	472	543
		ADD Max Force (N)	312	392	463	529	611	289	403	462	535	623
		ADD:ABD	0.67	0.87	0.98	1.09	1.35	0.81	0.95	1.07	1.19	1.34
DynaMo	Grip Squeeze Neutral	Max Force (N)	476	601	674	749	842	480	585	656	717	822
		Max Force Asymmetry (%)	15	10	5	3	0	18	8	5	2	0
		Max RFD (N/s)	536	1,396	2,384	3,196	3,975	799	1,458	2,107	2,948	4,034
		Max RFD Asymmetry (%)	51	29	16	9	2	51	31	17	8	1
NordBord	Nordic	Max Force (N)	339	399	439	471	543	322	392	433	483	530
		Torque (Nm)	146	175	195	217	249	140	174	215	215	250

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NHL			Goaltenders				
System	Test	Metric	Percentiles				
			5th	25th	Median	75th	95th
ForceDecks	CMJ	Jump Height (Imp-Mom) cm	33.4	37.1	39.6	43.3	47.2
		Jump Height (Imp-Mom) in	13.2	14.6	15.6	17.0	18.6
		RSI-Mod	0.42	0.49	0.53	0.59	0.70
		Eccentric Peak Velocity (m/s)	-1.16	-1.49	-1.64	-1.79	-1.94
		Eccentric Deceleration RFD / BM (N/s/kg)	42	60	75	92	135
		Countermovement Depth (cm)	-31.6	-37.3	-41.5	-46.9	-52.8
		Concentric Impulse 100ms (Ns)	86	97	107	120	140
		P1 Concentric Impulse (Ns)	130	142	150	160	176
		P2 Concentric Impulse (Ns)	76	88	95	101	122
		Peak Power / BM (W/kg)	47.1	50.7	53.2	56.8	61.9
		Contraction Time (s)	0.988	0.877	0.815	0.764	0.692

NHL vs. European League Position Differences

Based on the volume of data available, between-league comparisons by positions are confined to the three jump tests most commonly performed. On initial inspection, all three positions feature similar patterns with consistent trends (i.e., the direction of difference is the same for all positions). These findings might reflect differences between the leagues in conditioning practices, competition demands or both.

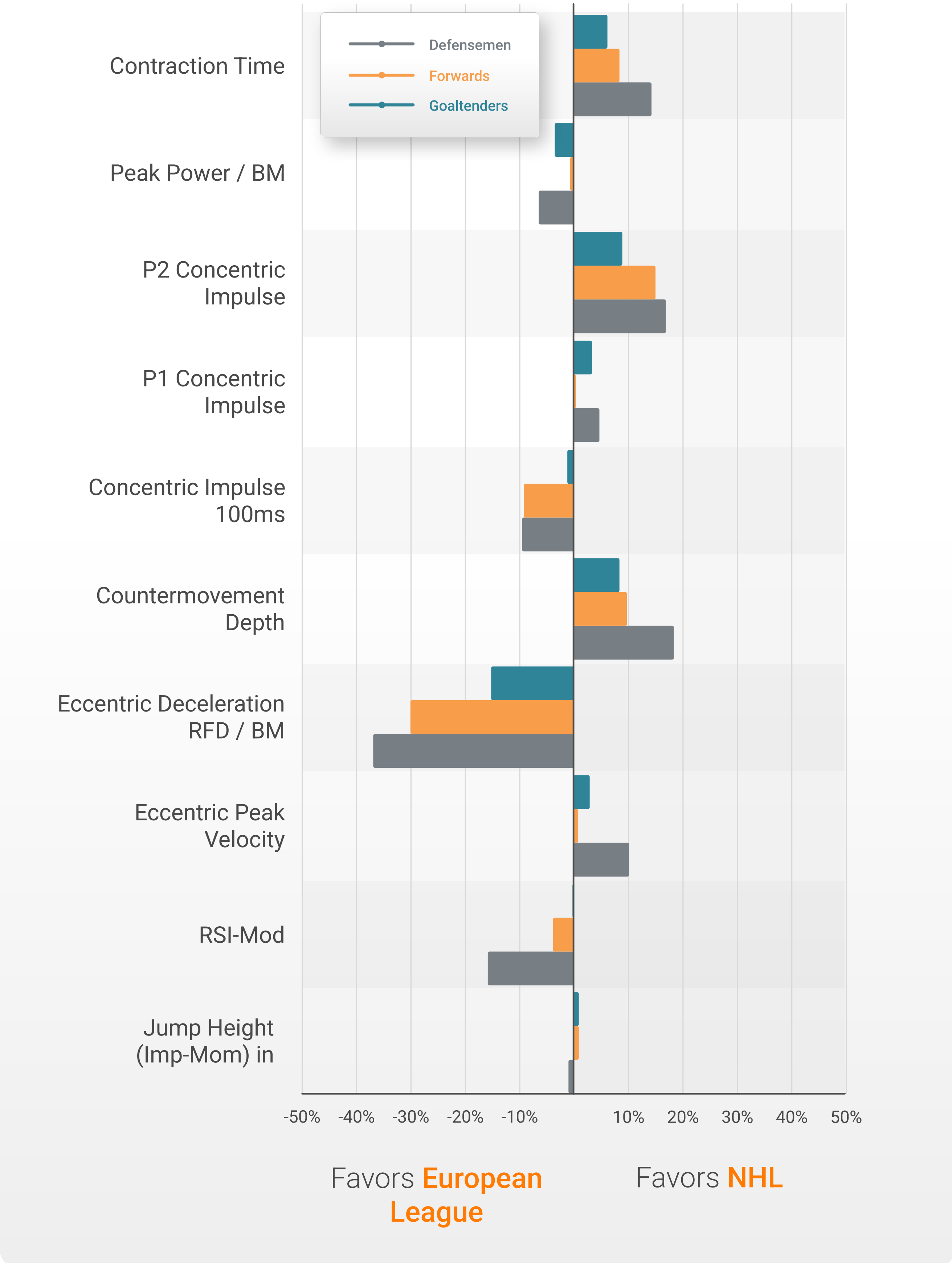
Countermovement Jump

Despite having higher BM, NHL athletes' median CMJ jump height was similar to that of their European league counterparts. However, certain kinetic metrics differentiated NHL athletes.

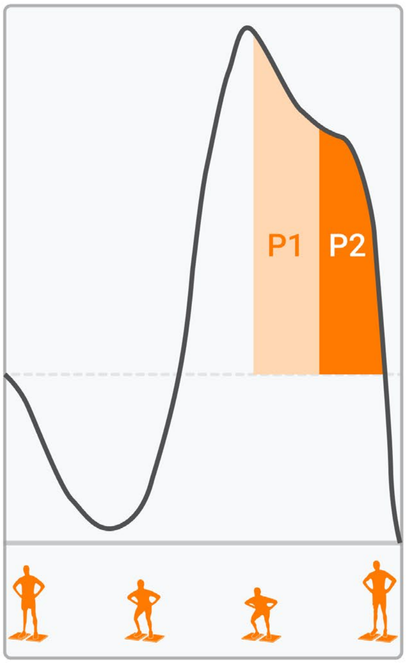
NHL athletes used a greater countermovement depth and longer contraction time, resulting in a lower RSI-Mod. They also had higher P2 concentric impulse across all positions. European league athletes were characterized by higher eccentric deceleration RFD / BM, indicating they "hit the brakes" harder during the downward movement.

NHL athletes used a greater countermovement depth and longer contraction time, **resulting in a lower RSI-Mod.**

Differences between the NHL and European leagues in CMJ metrics by position are shown below. Positive values indicate higher values for the metric in NHL athletes, while negative values indicate higher values in European league athletes.



CMJ metric comparisons between leagues by position.



P1 concentric impulse represents the force produced in the first half of the concentric phase of the CMJ, from the deepest part of the countermovement to halfway up.

P2 concentric impulse represents the force produced in the second half of the concentric phase, producing force at higher velocities during the final push-off phase.

Single Leg Jump

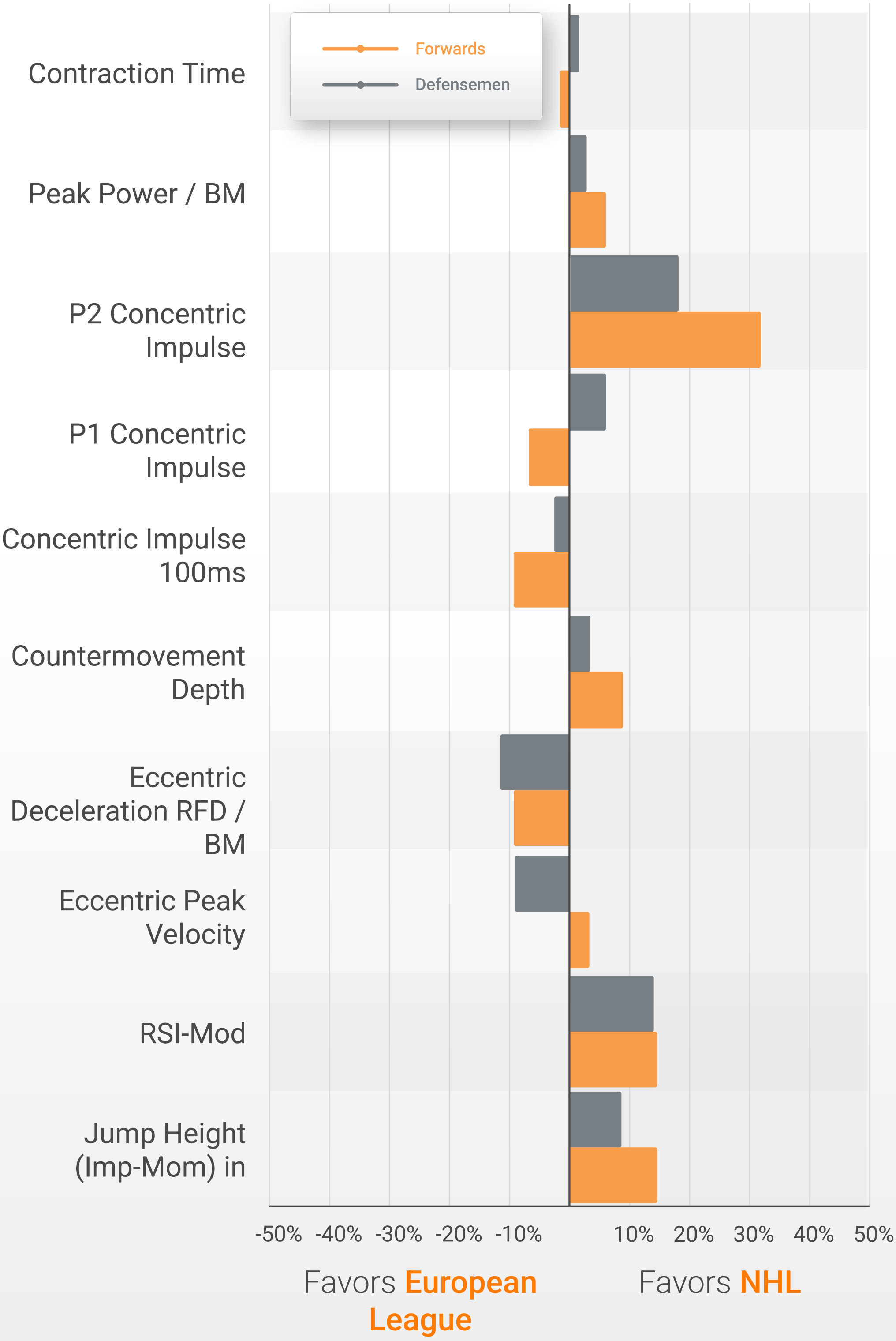
The SLJ is a more demanding movement than the CMJ. Greater control and coordination challenges are involved in maintaining dynamic balance on a smaller base of support during SLJ execution. It is also slower, particularly during the eccentric phase (as measured by eccentric peak velocity), and is performed over a smaller range of motion.

The SLJ better differentiated higher-level ice hockey athletes than the CMJ. The pattern in magnitude and direction of the SLJ metric differences was broadly consistent for both skater positions. NHL athletes jumped higher, and although they had slightly greater countermovement depth, their contraction times were similar to those of European league athletes. As a result, NHL athletes had a higher SLJ RSI-Mod, the reverse of what was observed in the CMJ.

The **SLJ better differentiated higher-level ice hockey athletes** than the CMJ.

As in the CMJ, P2 concentric impulse was substantially higher in NHL athletes than in European league athletes, particularly for Forwards. In combination with the lack of difference between leagues in P1, this again indicates greater impulse specifically during the end-range knee and hip extension and plantar flexion. The higher eccentric deceleration RFD / BM observed in European league athletes during the CMJ was also evident in the SLJ.

Differences between the NHL and European leagues in SLJ metrics by position are shown below. Positive values indicate higher values for the metric in NHL athletes, while negative values indicate higher values in European league athletes.

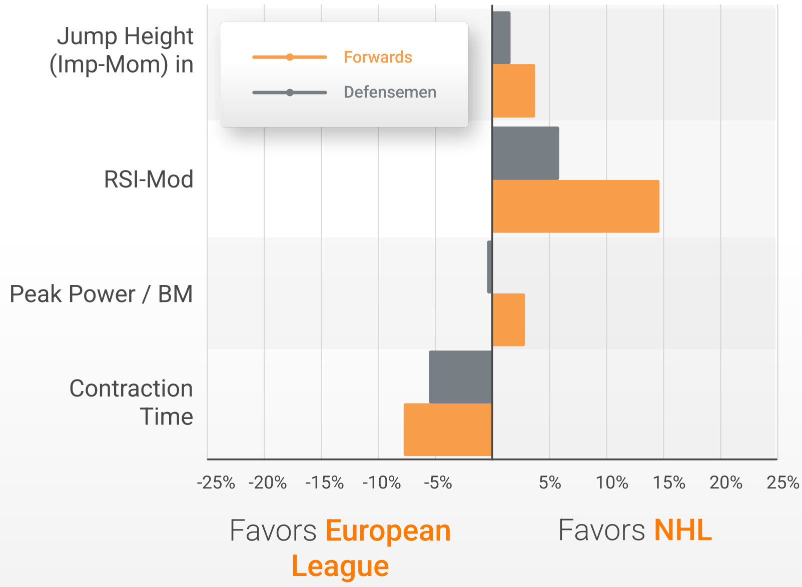


SLJ metric comparisons between leagues by position.

Squat Jump

The SJ is designed so that jump height is produced entirely by force generated during the concentric phase. The brief pause before the upward movement following the descent into the squat position removes the rapid countermovement seen in the CMJ, reducing the contribution of the stretch-shortening cycle (SSC) and shortening the time available to generate force.

Differences between the NHL and European leagues in SJ metrics by position are shown below. Positive values indicate higher values for the metric in NHL athletes, while negative values indicate higher values in European league athletes.



SJ metric comparisons between leagues by position.

Consequently, the SJ is closely associated with starting strength and the ability to accelerate from a stationary position, qualities that translate into explosive first-step actions and early concentric-phase RFD. These are highly valued sporting characteristics and areas where NHL athletes typically excel.

While NHL Forwards jumped slightly higher than their European counterparts, both NHL skater positions had larger differences in contraction times (shorter), which drove superior RSI-Mod.

Although SJ RSI-Mod is not commonly reported, it was included in the study that first proposed RSI-Mod (Ebben & Petushek, 2010). The present dataset demonstrates that RSI-Mod adds value by differentiating leagues and positions more clearly than SJ jump height.

…RSI-Mod adds value by differentiating leagues and positions **more clearly than SJ jump height.**

European League Position Data

Normative data for CMJ, SLJ and SJ across European league positions are presented below.

European League			Goaltenders				
System	Test	Metric	Percentiles				
			5th	25th	Median	75th	95th
ForceDecks	CMJ	Jump Height (Imp-Mom) cm	32.6	37.4	40.0	42.3	46.5
		Jump Height (Imp-Mom) in	12.8	14.7	15.7	16.6	18.3
		RSI-Mod	0.44	0.57	0.62	0.67	0.75
		Eccentric Peak Velocity (m/s)	-1.25	-1.39	-1.48	-1.63	-1.91
		Eccentric Deceleration RFD / BM (N/s/kg)	61	90	109	129	172
		Countermovement Depth (cm)	-24.8	-31.0	-34.5	-38.5	-47.5
		Concentric Impulse 100ms (Ns)	94	108	118	129	163
		P1 Concentric Impulse (Ns)	124	134	143	157	183
		P2 Concentric Impulse (Ns)	66	75	80	87	99
		Peak Power / BM (W/kg)	46.6	54.0	56.9	59.3	63.6
		Contraction Time (s)	0.887	0.763	0.708	0.675	0.607

European League			Defensemen					Forwards				
System	Test	Metric	Percentiles					Percentiles				
			5th	25th	Median	75th	95th	5th	25th	Median	75th	95th
ForceDecks	CMJ	Jump Height (Imp-Mom) cm	32.4	36.6	39.5	42.4	47.0	33.3	37.8	40.6	43.7	48.7
		Jump Height (Imp-Mom) in	12.8	14.4	15.5	16.7	18.5	13.1	14.9	16.0	17.2	19.2
		RSI-Mod	0.46	0.55	0.61	0.68	0.81	0.47	0.55	0.63	0.70	0.80
		Eccentric Peak Velocity (m/s)	-1.31	-1.45	-1.55	-1.66	-1.89	-1.31	-1.46	-1.58	-1.71	-1.87
		Eccentric Deceleration RFD / BM (N/s/kg)	59	86	117	147	193	67	96	121	152	196
		Countermovement Depth (cm)	-21.9	-28.4	-34.4	-40.6	-46.7	-24.3	-30.6	-35.5	-40.4	-46.4
		Concentric Impulse 100ms (Ns)	93	115	131	152	180	99	119	134	147	171
		P1 Concentric Impulse (Ns)	132	148	160	169	192	134	150	159	170	189
		P2 Concentric Impulse (Ns)	60	71	82	90	105	63	72	81	92	106
		Peak Power / BM (W/kg)	46.3	52.3	56.1	60.0	66.1	46.8	51.7	56.0	59.5	64.8
		Contraction Time (s)	0.881	0.788	0.702	0.622	0.519	0.872	0.780	0.708	0.644	0.575
	SLJ	Jump Height (Imp-Mom) cm	13.9	17.4	19.6	21.1	25.0	14.9	17.1	18.8	21.3	25.2
		Jump Height (Imp-Mom) in	5.5	6.9	7.7	8.3	9.9	5.9	6.7	7.4	8.4	9.9
		RSI-Mod	0.18	0.21	0.25	0.30	0.40	0.17	0.21	0.26	0.32	0.44
		Eccentric Peak Velocity (m/s)	-0.51	-0.72	-1.00	-1.16	-1.36	-0.56	-0.80	-0.97	-1.14	-1.39
		Eccentric Deceleration RFD / BM (N/s/kg)	11	18	37	52	72	13	26	39	51	85
		Countermovement Depth (cm)	-16.7	-23.8	-26.8	-29.8	-37.4	-17.6	-22.5	-26.3	-29.0	-34.0
		Concentric Impulse 100ms (Ns)	29	45	61	74	89	36	49	60	73	102
		P1 Concentric Impulse (Ns)	58	90	100	114	126	73	92	103	112	127
		P2 Concentric Impulse (Ns)	45	54	65	84	100	36	49	59	69	83
		Peak Power / BM (W/kg)	28.8	31.9	33.8	35.8	40.7	18.0	30.6	33.2	35.7	40.0
		Contraction Time (s)	1.223	1.063	0.891	0.789	0.670	1.198	1.013	0.890	0.780	0.673
	SJ	Jump Height (Imp-Mom) cm	30.0	34.9	38.0	41.6	46.8	31.6	35.0	38.0	41.6	46.5
		Jump Height (Imp-Mom) in	11.8	13.7	14.9	16.4	18.4	12.4	13.8	15.0	16.4	18.3
		RSI-Mod	0.46	0.69	0.81	0.94	1.14	0.43	0.67	0.79	0.90	1.11
		Peak Power / BM (W/kg)	45.2	52.9	56.0	59.4	65.5	46.7	51.3	55.2	59.1	65.9
		Contraction Time (s)	0.697	0.569	0.510	0.432	0.360	0.715	0.582	0.513	0.451	0.370

Insights

Across the popular hip tests in ice hockey, short-lever tests consistently yield higher forces due to the more favorable testing position. The following data combines both European league and NHL athletes into a single cohort for a broader, more representative comparison pool. The data distribution suggests that athletes with lower ADD max force are less likely to achieve an ADD:ABD ≥ 0.80.

ADD:ABD as the Gatekeeper to Skating Performance and Injury Risk

Higher skating velocity requires greater hip range of motion and increased knee extensor involvement, reflecting faster RFD and power production (Buckeridge et al., 2015). CMJ metrics provide useful proxies of these qualities: they relate to lower-body explosive strength and on-ice sprint performance, particularly during early acceleration, with the strongest associations observed in developing or sub-elite athletes (Asmundson et al., 2024). Concentric CMJ metrics align with the first step and 10-30m acceleration, while eccentric CMJ metrics relate to braking capacity and stopping ability.

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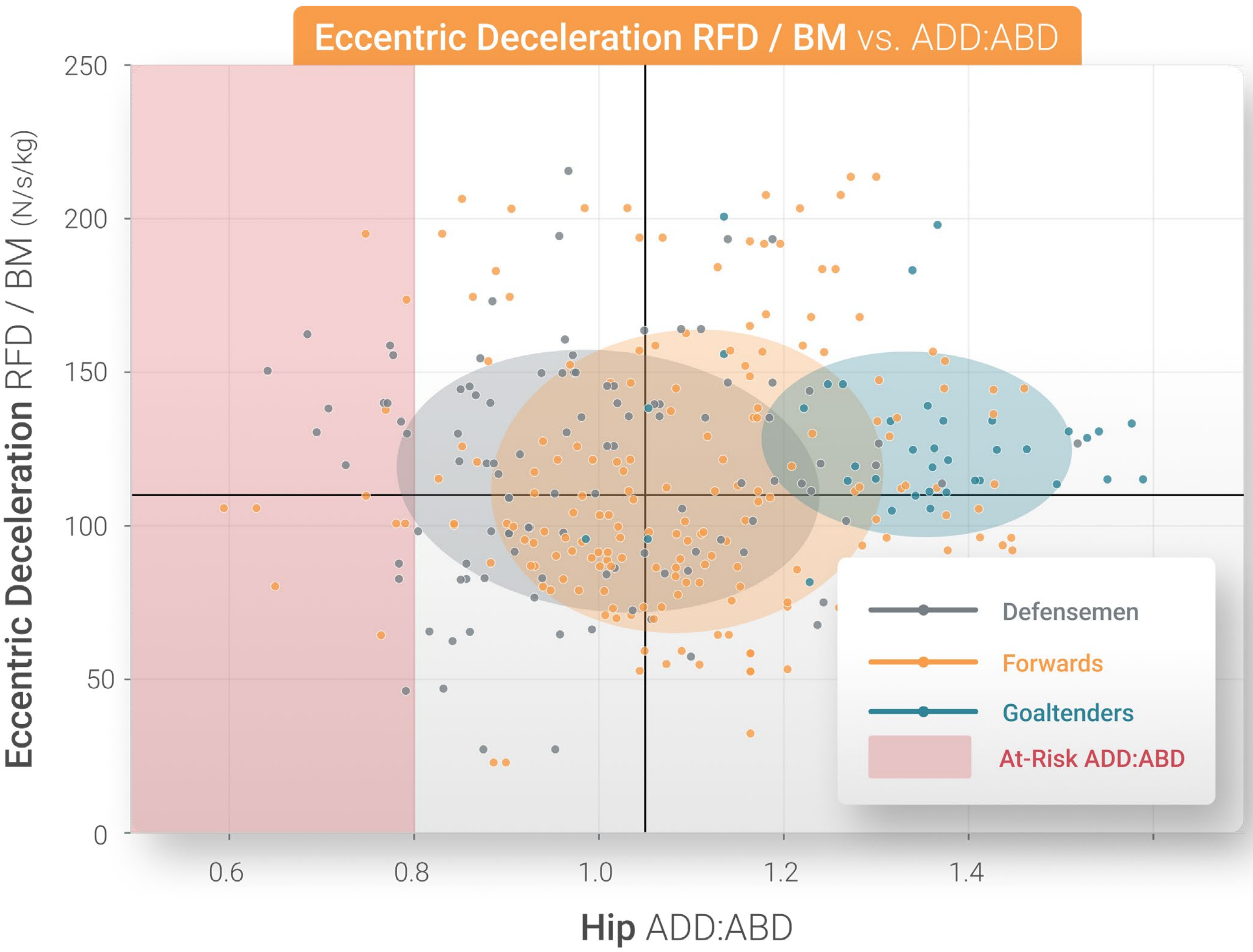
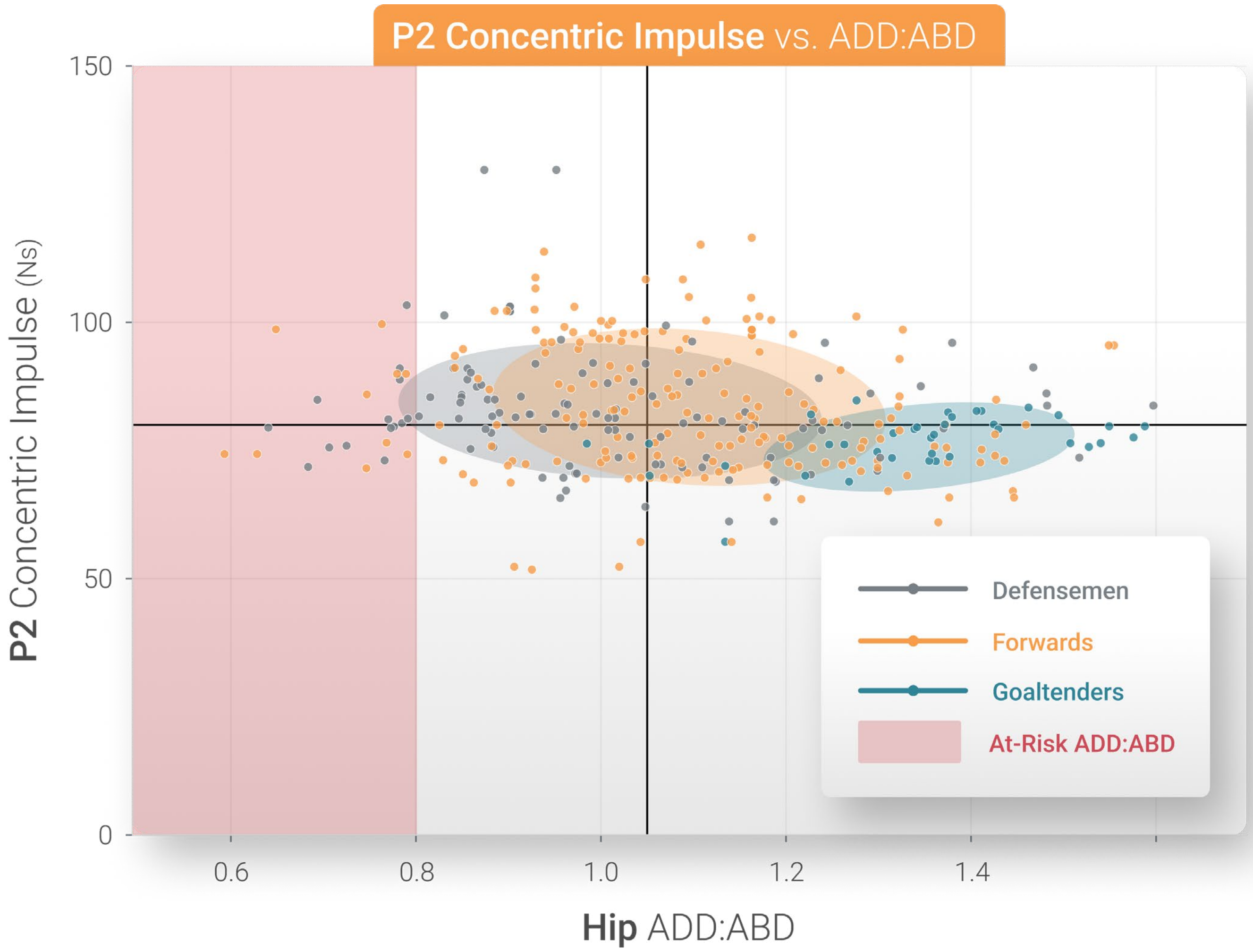
Plotting ADD:ABD (a known risk factor for groin injury) alongside CMJ P2 impulse and CMJ eccentric deceleration RFD / BM shows an integrated profile of hip strength balance and CMJ force qualities, reflecting core mechanical demands of skating and supporting practitioners in identifying risk and tailoring training.

Plotting ADD:ABD alongside CMJ P2 impulse and CMJ eccentric deceleration RFD / BM shows **an integrated profile of hip strength balance and CMJ force qualities…**

This is only an example. Other combinations of systems, tests and metrics can be explored in VALD Hub using the new quadrant report.





Quadrant plots to show strength balance (hip ADD:ABD) and CMJ force qualities (eccentric deceleration RFD /BM and P2 concentric impulse)..

Eccentric Utilization Ratio

The eccentric utilization ratio (EUR) is calculated as:

$$EUR = \frac{\text{CMJ Jump Height}}{\text{SJ Jump Height}}$$

The EUR can provide insight into the athlete's elastic abilities and add context to changes in either jump when considered in isolation, potentially indicating whether an observed change in CMJ jump height is SSC-specific. This is valuable when monitoring both healthy and rehabilitating athletes.

The table below provides Norms based on the ice hockey data ingested into the VALD Data Lakehouse, where both SJ and CMJ tests were conducted on the same day.

	Percentiles	Defensemen		Forwards		Goaltenders		All Positions		Both Leagues
		European	NHL	European	NHL	European	NHL	European	NHL	
EUR	1st	0.87	0.92	0.89	0.93	0.88	0.98	0.87	0.92	0.88
	5th	0.90	0.95	0.95	0.96	0.88	0.98	0.93	0.97	0.94
	25th	0.99	1.00	1.00	1.03	0.99	1.03	0.99	1.01	1.00
	Median	1.03	1.05	1.03	1.06	1.03	1.07	1.03	1.06	1.03
	75th	1.06	1.09	1.06	1.08	1.10	1.08	1.06	1.08	1.07
	95th	1.15	1.22	1.11	1.13	1.14	1.17	1.13	1.17	1.14
	99th	1.19	1.22	1.23	1.14	1.14	1.17	1.21	1.22	1.22

A higher EUR reflects more efficient use of the SSC, while a lower EUR suggests the athlete is less able to utilize elastic energy, even if their underlying strength is good. In some cases, a low EUR is simply driven by an exceptionally strong SJ performance, so it is important to interpret EUR alongside the athlete's SJ and CMJ jump height percentiles.

...it is important to interpret **EUR alongside the athlete's SJ and CMJ jump height percentiles.**

What **Next?**

Ice hockey organizations globally have used and trusted VALD systems for the monitoring, management, development and rehabilitation of their athletes. Over the past decade, the way sporting teams implement objective measurement across the board has – and continues to – evolve at an exponential rate.

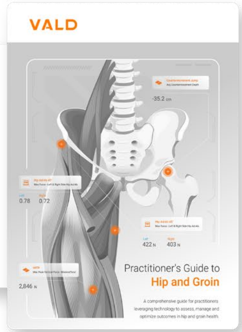
For practitioners wanting to learn more about technology integrated into hockey performance, check out the resources below:

- Practitioner's Guide to Hip and Groin
- Youth Development in Ice Hockey
- Enhancing Ice Hockey Performance with Technology
- Sprint Performance in Elite Ice Hockey

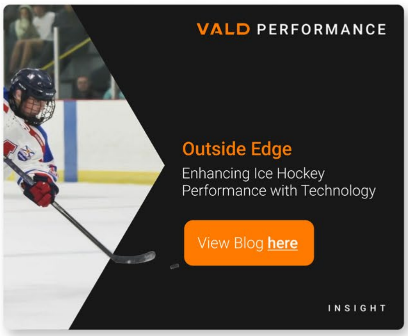
Free eBook

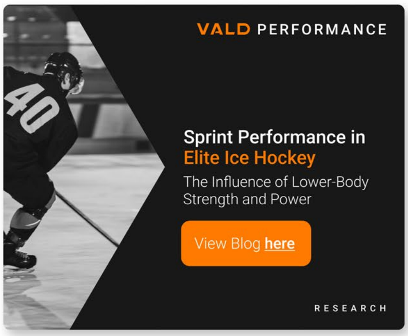
Practitioner's Guide to **Hip and Groin**

Acomprehensive guide for practitioners leveraging technology to assess, manae and optimize outcomes in hip and groin health.



News & Case Studies





This report presents an analysis of a large, international musculoskeletal dataset of elite ice hockey athletes, drawn from VALD's Data Lakehouse to enable cross-league comparisons across teams and regions. Together with recent sport-specific reports in soccer, basketball and rugby league, this work contributes to an expanding body of comparative musculoskeletal profiling in elite sport.

As a VALD user, you can expect to see powerful reports, impactful insights and innovative resources like this to continue emerging. If there is anything you would like to know or important questions you feel practitioners may want answered, please let us know.

We are excited to continue exploring our clients' questions and – within the important bounds of data privacy and security – we will do our best to answer them.

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