VALD

NORDBORD

HAMSTRING TESTING SYSTEM

Test Guide

Understanding common testing applications on the NordBord.

Contents

1 Introduction

This document aims to provide practitioners with an understanding of common testing applications on the NordBord.

This document assumes the reader has a basic knowledge of how to use the NordBord, including setting up the hardware and software, managing profiles, running tests and accessing results. To get up to speed on these processes, refer to the VALD Support Site.

1.1 What does NordBord Measure?

The NordBord measures eccentric strength, isometric strength and asymmetry of the hamstrings.

What is eccentric and isometric strength?

There are three types of muscle contractions that produce force:

- **Isometric** (**no change in length** whilst producing force)
- **Concentric** (muscle **shortens** whilst producing force)
- **Eccentric** (muscle **lengthens** whilst producing force)

Eccentric muscle contractions produce the highest force output (compared to isometric and concentric contractions). The Nordic hamstring exercise is, in essence, an eccentric contraction of the hamstrings (along with other knee flexors).

By starting in a kneeling position and slowing down the rate you fall, your hamstrings lengthen while also producing increasing force throughout the exercise.

In an isometric muscle contraction, the muscle activates with a force and tension, but the joint is static, there is no shortening or lengthening of the muscle fibres and the limbs don't move.

What is asymmetry?

Asymmetry is sometimes referred to as imbalance, or a difference in performance levels between two sides.

The NordBord collects force output data for both legs and analyses the difference between them.

What are the key metrics?

NordBord measures the following key metrics:

- **Force** – measured in Newtons (N)
- **Torque** – measured in Newton-Metres (Nm)
- **Impulse** – measured in Newton-Seconds (Ns)

Force is measured directly from the NordBord transducers. Load cell sensors interpret how much force is being applied to the hooks.

Torque (or rotational force) can be calculated using the NordBord. Torque is a factor of force and length, where length, in this case, is the distance from the centre of the knee joint to the centre of the NordBord Ankle Hook. This distance is approximated using a calculation derived from the Knee Position setting.

Impulse is calculated by determining the “area under the force curve”. Impulse is a factor of force and time, so the longer and/or more forceful a contraction is held, the larger the impulse results will be.

1.2 Why use the NordBord?

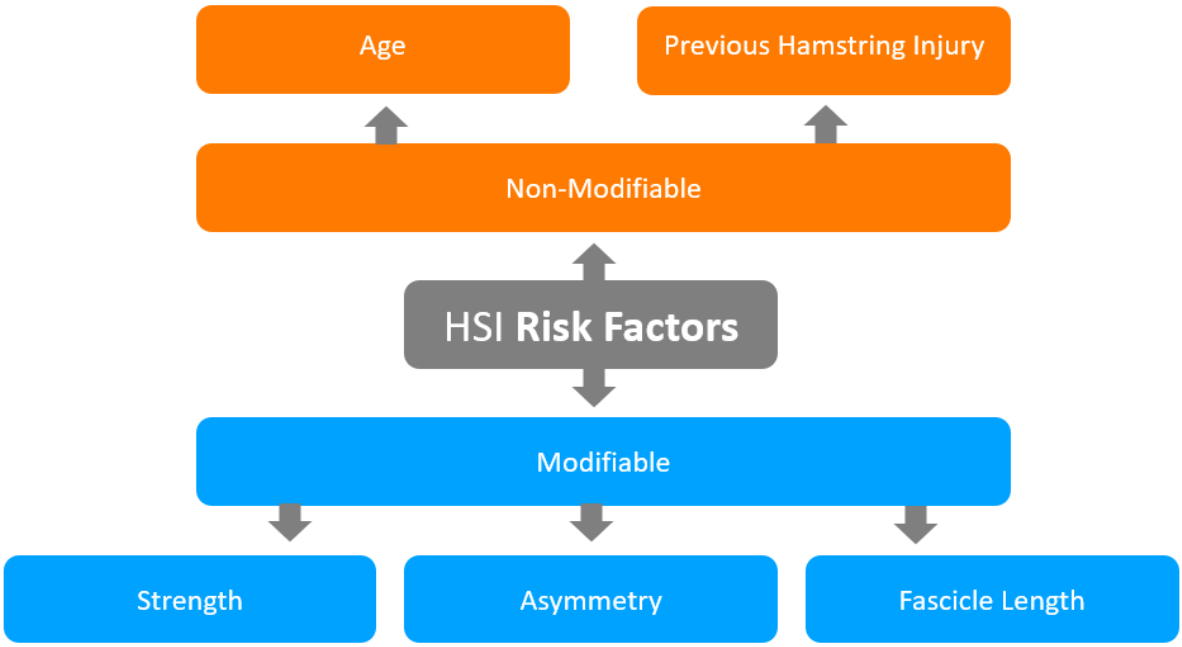
The NordBord can be used for improving hamstring strength, fascicle length and reducing asymmetry all of which are important factors for lowering hamstring injury risk.

What is fascicle length?

Every muscle is made up of several components. The muscle itself is composed of many muscle fibres bundled together. These bundles are called fascicles.

When muscles move, fascicles lengthen and shorten as part of the process to produce force for movement to occur. Muscles with longer fascicles are theoretically better equipped to cope with these movements, as there are a greater number of muscle fibres to absorb force.

What are hamstring strain injury risk factors?



2 Test Types

This section aims to explain each NordBord test type so that users can clearly understand NordBord test results.

Test Types	Description
Nordic	Nordic hamstring curl, an eccentric hamstring contraction.
Razor	Razor hamstring curl, an eccentric hamstring contraction.
ISO Prone (0°)	Isometric hamstring contraction in the prone position.
ISO 30°	Isometric hamstring contraction with knees at 30° of flexion.
ISO 60°	Isometric hamstring contraction with knees at 60° of flexion.

2.1 Nordic

The Nordic is the most common NordBord test, and the test best supported by research.

It is commonly used for:

- Testing maximal knee flexor strength,
- Determining hamstring strength asymmetry; and
- Identifying levels of force or joint positions that may be a limiting factor.

The goal of the Nordic test is to descend from the upright kneeling position in a controlled manner and achieve the highest force output possible before breaking tension.

Advantages

- Highest level of activation.
- Most common standardised method for hamstring testing.
- Highly researched exercise.
- Self-limiting. The individual can choose to stop the repetition at any time.

Considerations

- Physically demanding.

2.1.1 Protocol

Refer to the guide below to perform a **Nordic** test: WATCH HOW TO VIDEO

Starting Position
Ankle hooks placed around the tops of the ankles.
Kneeling on the NordBord.
Head up and chest tall.

Instructions for the Individual
Keep their body straight.
Begin to lean forward, then resist falling.
Catch themself on the ground.
Assume starting position again.
Repeat for the required number of reps.

2.1.2 Results

The NordBord app will automatically detect bilateral reps for the Nordic test. as shown in the sample force trace below:

Common protocol errors for the Nordic test include:

Error	Potential Effect(s)
Hip hinging during movement.	Once actual knee extension begins, the increase in force is much greater per degree of movement, possibly leading to the individual stopping the test before reaching actual peak force.
Not extending until failure.	Underestimating actual peak force. This could be due to hesitation or not understanding the protocol.
Movement well-coordinated but performed too quickly.	Peak force is below individual's true potential.
Toes digging into back of foam pad.	Inaccurate results. Peak force recorded is higher than individual's true peak force.

2.2 Razor

The Razor is a common alternative to the Nordic test, this test features extension of both the hip and knee during the movement.

It is commonly used for:

- Testing maximal knee flexor strength,
- Determining hamstring strength asymmetry; and
- Identifying levels of force or joint positions that may be a limiting factor.

The goal of the Razor test is to descend from the upright kneeling position in a controlled manner and achieve the highest force output possible before breaking tension.

Advantages

- Double joint movement (knee and hip).
- Activate joints associated with both origin and insertion point of hamstrings.

Considerations

- Physically demanding.
- Technically an ISO test (when considering the hamstrings as a complete unit).

2.2.1 Protocol

Refer to the guide below to perform a **Razor** test:

WATCH HOW TO VIDEO

Starting Position
Kneeling on the NordBord.
Ankle hooks placed around the tops of the ankles.
Head up and chest tall.

Instructions for the Individual
Keep their torso straight.
Bend forward at their hips, then extend forwards and resist falling.
Catch themself on the ground.
Assume starting position again.
Repeat for the required number of reps.

2.2.2 Results

The NordBord app will automatically detect bilateral reps for the Razor test, as shown in the sample force trace below:

Common protocol errors for the Razor test include:

Error	Potential Effect(s)
The individual might perform full hip flexion at a fixed knee angle. The knee is extended only slightly from the starting position and any increase in force is from hip extension.	The test becomes a combination of isometric and ISO and ECC strength, making results analysis difficult.
Movement well-coordinated but performed too slow.	Peak force is below individual's true potential. More likely to increase fatigue.

2.3 ISO Prone (0°)

The ISO Prone (0°) is an end-range isometric strength test.

It is commonly used for:

- Early stage testing post hamstring injury, and
- Assessing an individual's ability to maintain maximal contraction.

The goal of the ISO Prone (0°) is to maintain peak force over a designated contraction time.

Advantages

- Less demanding than Nordic test.
- Very easy to setup and standardise.
- Useful in early-stage rehab.

2.3.1 Protocol

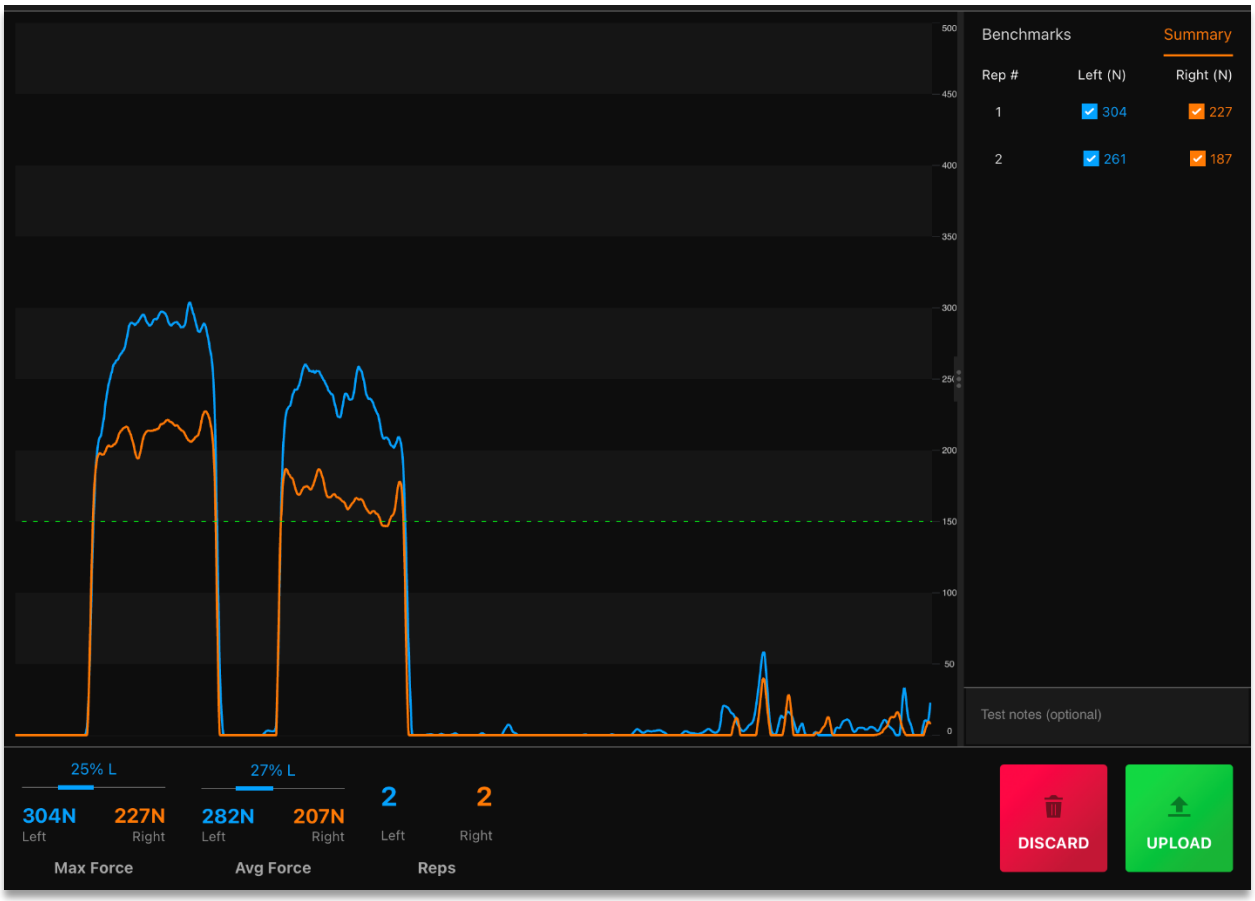
Refer to the guide below to perform an **ISO Prone (0°)** test: WATCH HOW TO VIDEO

Starting Position
Ankle hooks placed around the tops of the ankles.
Kneeling on the NordBord with elbows on the ground.
Legs straight.

Instructions for the Individual
Keep their legs straight.
Pull up on the hooks for the prescribed time.
Relax.
Repeat for the required number of reps.

2.3.2 Results

The NordBord app will automatically detect unilateral reps for the ISO Prone (0°) test, as shown in the sample force trace below:



Common protocol errors for the ISO Prone (0°) test include:

Error	Potential Effect(s)
The body is not inline from ankle to ear. i.e. elbows on the ground create a piked position.	Non-standardised hip flexion angle among individuals.
Getting into the ISO Prone position shifts the body forward and changes the angle of ankle hooks.	Changes the torque calculations since the hooks are no longer in contact with the same part of the ankle/achilles.

2.4 ISO 30°

The ISO 30° is the most common isometric NordBord test. This long-length isometric strength test, is often used to roughly mimic the knee joint angle during the *strike* position in running gait.

It is commonly used for:

- Early stage testing post hamstring injury; and
- Assessing an individual's ability to maintain maximal contraction.

The goal of the ISO 30° is to maintain peak force over a designated contraction time.

Advantages

- Simulates a common sport specific position.
- Less demanding than Nordic test.
- Useful for early-stage rehab.

Considerations

- Challenging to ensure accurate knee/hip angle in test and re-test situations.

2.4.1 Protocol

Refer to the guide below to perform an **ISO (30°)** test: WATCH HOW TO VIDEO

Starting Position
Ankle hooks placed around the tops of the ankles.
Kneeling on the NordBord with hands on the ground.
Knees bent 30°.

Instructions for the Individual
Keep their legs in the same position (knees bent 30°).
Pull up on the hooks for the prescribed time.
Relax.
Repeat for the required number of reps.

2.4.2 Results

The NordBord app will automatically detect unilateral reps for the ISO 30° test, as shown in the sample force trace below:

Common protocol errors for an ISO 30° test include:

Error	Potential Effect(s)
Inconsistent knee/hip angle in re-test setup.	Unreliable results for true comparison.

2.5 ISO 60°

The ISO 60° is a shorter-length isometric strength test.

It is commonly used for:

- Early stage testing post hamstring injury; and
- Assessing an individual's ability to maintain maximal contraction.

The goal of the ISO 60° is to maintain peak force over a designated contraction time.

Advantages

- Less demanding than Nordic test.
- Useful for early-stage rehab.

Considerations

- Challenging to ensure accurate knee/hip angle in test and re-test situations.

2.5.1 Protocol

Refer to the guide below to perform an **ISO (60°)** test: WATCH HOW TO VIDEO

Starting Position
Ankle hooks placed around the tops of the ankles.
Kneeling on the NordBord with hands on the ground.
Knees bent 60°.

Instructions for the Individual
Keep their legs in the same position (knees bent 60°).
Pull up on the hooks for the prescribed time.
Relax.
Repeat for the required number of reps.

2.5.2 Results

The NordBord app will automatically detect unilateral reps for the ISO 60° test, as shown in the sample force trace below:

Common protocol errors for an ISO 60° test include:

Error	Potential Effect(s)
Inconsistent knee/hip angle in re-test setup.	Unreliable results for true comparison.