



**Balance Assessment  
&  
Balance Training System**

**Version 2.5**

**User Manual**

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# Typographical Conventions

For convenience, the following formatting conventions are used throughout this document.

Formatting Convention	Type of information
	Important messages. They state the <b>fundamental</b> things to keep in mind while using the <i>system</i> , including safety notices. The related text is printed in <b>bold</b> .
	<b>Step-by-step procedures.</b> The procedure is identified by its title written in bold italic below this symbol.
	<b>Informative</b> messages. They state some useful information about the versatility of the system. The related text is printed in <b>bold</b> .
<b><i>Bold Italic</i></b> font type	<b>Reference to other sections</b> of the manual where the mentioned topic is described in detail.



## FallTrak™ User Manual Overview

The FallTrak™ User Manual is structured as follow:

**Introduction:** a brief overview of the components and use of the *FallTrak™* system.

**Hardware & System Setup:** complete details of the hardware components, and how to assemble each component of the *FallTrak™* system.

**Balance Assessment Test Protocol:** step-by-step instructions for testing a patient using the Balance Assessment part of the *FallTrak™* system, including how to start the system, the available tests.

**Balance Training:** step-by-step instructions on how to use Balance Training protocols of the *FallTrak™* system.

**Using FallTrak™ Software:** a reference for the *FallTrak™* software, with details about the functions of each window, and a detailed explanation of the test results.

**Appendix A: Glossary of Terms:** a quick reference guide for the terminology used in this manual, alphabetically sorted.

**Appendix B:** examples of the reports, printed in color.

**Appendix C: Normative Data:** tabulates age specific normative data for Stability Scores of the Balance Assessment test protocols.



# 1 Introduction

## 1.1. Overview

FallTrak™ is a balance analysis system consisting of two parts: The first part, **Balance Assessment**, is designed to quantify a person's ability to maintain balance while standing, by using a user defined protocol, composed of a selectable series of tests. The second component of the system is utilized for **Balance Training** under different support surface and stance conditions by means of visual biofeedback of the Center of Gravity (CoG) on the balance platform.

Sensors inside a square balance platform measure the ground reaction forces exchanged between the patient's feet and the surface of the platform. For **Balance Assessment**, software acquires the force and CoP data and produces reports showing the patient's ability to maintain balance under various test conditions.

The FallTrak™ system is easy and safe to use. Once the minimal assembly is complete, the system is ready for use. The FallTrak™ software allows the clinician to select which tests to be performed and in which order, thus tailoring the specific protocol to the specific patient. Instructions, included for each test and training session, specify when to stand on the platform, how to position the feet, and what to do during the test.

For **Balance Assessment**, the time required to perform all the tests is about 10 minutes. The length of the **Balance Training** session depends on the clinician's choice of time interval for each specific training session.



**The FallTrak™ software requires a basic working knowledge of the Microsoft Windows environment.**



**The FallTrak™ system is designed exclusively for assessing the patient's ability to maintain balance and for balance training. Neither the FallTrak™ manufacturer nor distributor can be responsible for the use of the FallTrak™ system or any of its individual components in any capacity other than their intended use.**



The *FallTrak*™ system is **NOT WATERPROOF** and is for **INDOOR USE ONLY**.

## Software Features

An easy to use software provides the interface for the FallTrak™ system. The FallTrak™ software takes the information from the digital balance platform, analyzes it, stores it, and shows the analysis results.

The software guides the user through the test and training protocols with detailed instructions.

All completed test and training protocols are listed as sessions, and the results for any session can be viewed or printed. For **Balance Assessment**, the results are used to create two types of reports. The **Patient Report** contains basic graphs and descriptions of the patient's ability to maintain balance, and can be given to the patient since it does not include information that could compromise patient-physician confidentiality. The second report type is the **Physician Report**. This report contains all the results and advanced graphs, and is designed for the clinician's records. The **Balance Training** part generates only a single report with graphical and numerical results.

Additional features of the software allow for selecting which assessment test or training protocol to perform, in which order, and repeating any test or training. This allows the clinician to perform only certain tests, investigating specific aspects of the patient's ability to keep balance.

## Balance Assessment Test Protocol

The complete series of **Balance Assessment** tests has been designed to evaluate the patient's ability to maintain balance while standing. Four aspects of stability can be tested: the ability to maintain balance on a hard level surface (**Normal Stability**) with eyes open or closed, and on a soft surface (**Perturbed Stability**) with eyes open or closed.



**When scheduling the patient to be tested with the FallTrak™ system, a gym outfit and easy to remove shoes should be suggested to be worn. Due to possible effects of footwear, the protocol requires the patient to perform all tests either barefoot or wearing socks.**

### ***Normal Stability***

The Normal Stability test requires the patient to stand still on the platform in a comfortable position with the feet symmetrically apart.

The ability to maintain balance is evaluated in two conditions: with the patient's eyes open, and with eyes closed. These results are compared

with age matched standard results obtained for a person of the same height as the patient.

### ***Perturbed Stability***

The Perturbed Stability tests require the patient to stand still on a soft surface. The equilibrium is perturbed by having a compressible cushion (the foam) between the patient's feet and the platform.

The ability to maintain balance is again evaluated in two conditions: with the patient's eyes open, and with eyes closed. These results are compared with age matched standard results obtained for a person of the same height as the patient.

## **Balance Training Protocol**

The **Balance Training** part of the system incorporates three aspects of training: Static Balance Training, Dynamic Balance Training and Limit of Stability Training.



**Even the simplest training protocols featured in this system can be a real challenge to the stability of the patients. The Hand Rail structure provided with the system is NOT designed to prevent the patient from falling. Therefore, the clinician conducting Balance Training should always be on alert and attentive towards the patient as he/she may easily loose balance and fall.**

### ***Static Balance Training***

The Static Balance Training protocol is designed to train the patient to control the **Center of Gravity (CoG)** of the body at different static postures such as standing on one foot or both feet and on different surfaces such as rigid or compliant. The patient tries to keep the CoG in a confined area, for which the position and size can be changed by the clinician. The length of the time period for training is also adjustable.

### ***Dynamic Balance Training***

This protocol can be used to train patients to control the CoG under dynamic conditions while the body is moving. The protocol entails moving the CoG to follow moving targets along a variety of paths. The speed and the size of the path pattern are adjustable for each patient. Moreover, training can be performed on both rigid and compliant surfaces.

### ***Limit of Stability Training***

The Limit of Stability Training intends to improve the patient's ability to shift the CoG voluntarily to preset targets at different locations, maintain the CoG at these positions briefly, and then proceed to the next target location. The locations and size of the target positions are adjustable and training can be performed either in a sequential or random mode.

# 1.2. FallTrak™ Components

FallTrak™ system consists of the following components:

- Balance Platform
- Handrail Structure
- Balance Assessment Foam
- Perturbed Balance Surface for Training
- USB Cable
- FallTrak™ Software
- FallTrak™ User Manual

After you receive the FallTrak™ system, please check the contents of the boxes to make sure that you have all the components listed above. If anything is missing please contact Customer Support (refer to **1.3 Customer Support**).

For minimum computer specifications and installation information, please refer to **2 Hardware & System Setup**.

---

# 1.3. Customer Support

For customer support or sales you can contact:

**MedTrak Technologies, Inc.**  
**475 West Town Place Suite 111**  
**St. Augustine FL 32092**  
**Phone: 1-888-239-6436**  
**Fax: 1-888-239-5507**  
**e-mail: sales@medtrakonline.com**  
**www.medtrakonline.com**

Suggestions or comments about FallTrak™ are always welcomed.



# 2 Hardware & System Setup

## 2.1. Introduction

Few steps are required to properly install the FallTrak™ system. Carefully following the installation steps described in this section will ensure a correct installation of the FallTrak™ system.

### Safety Guidelines & Notes



- ❑ Before proceeding with any testing, be sure to have the *FallTrak™* system properly installed. Failure to do so may result in damage to the *FallTrak™* system, and/or personal injuries.
- ❑ The Handrail structure is ferromagnetic: be careful if the *FallTrak™* system is installed in the same environment as other equipment emitting or sensitive to magnetic fields. Failure to do so can result in system damage, and/or personal injuries.
- ❑ **THE HANDRAIL SYSTEM IS NOT DESIGNED TO PREVENT THE PATIENT FROM FALLING. IT IS ONLY AN ASSISTIVE DEVICE TO IMPROVE PATIENT'S BALANCE DURING BALANCE TRAINING. THEREFORE, THE PHYSICIAN CONDUCTING THE TESTS SHOULD ALWAYS BE ALERT OF THE PATIENT'S MOVEMENTS ON THE BALANCE PLATE. IT IS THE PHYSICIAN'S RESPONSIBILITY TO MAKE SURE THAT THE PATIENT IS ALWAYS SAFE WHILE USING THE FALLTRAK SYSTEM.**
- ❑ The platform cable connecting the *FallTrak™* platform to your computer, as well as all other cables may cause someone to trip. It is recommended that these cables be routed or use masking tape to hold the cables to the floor to prevent tripping.
- ❑ The *FallTrak™* system is **NOT WATERPROOF**. It is **FOR**

**INDOOR USE ONLY.** Using the FallTrak™ system outdoors or exposing it to water can result in system damage.

- ❑ **Do not step on the platform connector. Serious damage can occur to the FallTrak™ platform.**

---

## 2.2. FallTrak™ System Installation

The FallTrak™ system requires the following **minimum** computer specifications.

- **Processor:** minimum Intel Pentium 166 Hz;
- **Memory:** 32 Mb;
- **Hard Disk Space:** 40 Mb;
- **Monitor:** Color, 1024 x 768 resolution;
- **One USB Port;**
- **CD-ROM Drive;**
- **Color Printer;**

### Software and Platform Installation

The FallTrak™ software is provided with your system on a CD-ROM. Before proceeding with software installation, take all the system components out of the boxes (see **1.2 FallTrak™ Components**).

The FallTrak™ Balance Platform contains the force measurement part of the FallTrak™ system. The platform is ready to be used. No assembly is required. It is only necessary to position the platform correctly and connect it to the computer. Follow the subsequent steps for Handrail Structure and Balance Platform installation:



**Handrail Structure  
&  
Balance Platform  
Installation**

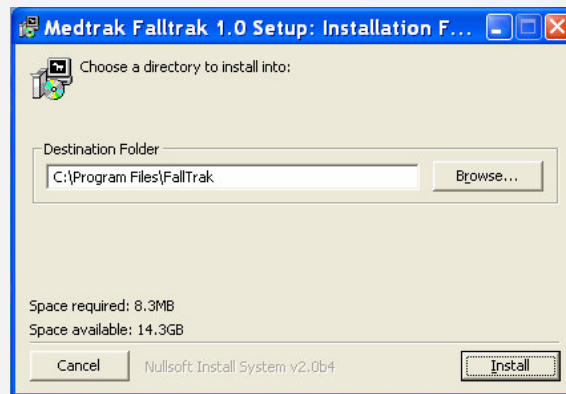
- ❑ **Assemble the Handrail and its accessories by following the instructions supplied with the structure. Note that the height of the Handrail is adjustable to accommodate patients of different heights.**
- ❑ **Position the square Balance Platform approximately in the middle of the U-shaped base of the Handrail Structure with the connector facing forward (towards the closed end of the U-shape). Make sure that the rear feet of the platform sits in the two circular recesses on the crossbar of the Handrail structure.**
- ❑ **Adjust the adjustable foot of the Balance Platform so that it does not rock on the floor.**
- ❑ **Make sure that while the patients are on the platform, they can comfortably hold onto the Handrail.**
- ❑ **Plug in the USB cable into the Balance Platform only. DO NOT PLUG IT INTO THE COMPUTER YET.**

- ❑ **Position the computer onto the PC tray of the Handrail Structure.**

After the handrail and Balance Platform are installed properly, you can proceed to install the FallTrak™ software on your computer as follows:

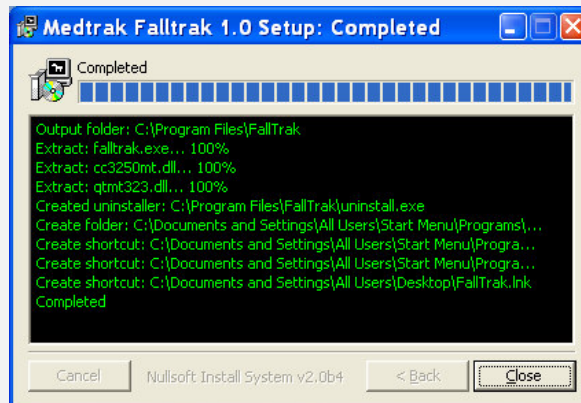


- ❑ **Turn on the computer.**
- ❑ **Insert the CD-ROM labeled FallTrak™ into the CD-ROM drive of the computer.**
- ❑ **The installation software starts automatically and the following window is displayed:**



**Figure 2-1:** Software Installation Window 1

- ❑ **Click "Install" button.**
- ❑ **Depending on the version of the Windows® operating system that the computer uses, the window in Figure 2-4 may appear; click "Continue Anyway".**
- ❑ **FallTrak™ software will install automatically and the following window will display:**



**Figure 2-2:** Software Installation Window 2

- ❑ Click “Close” button to finalize software installation.
- ❑ Plug the USB cable into the USB port of the computer.
- ❑ Since the Balance Platform is a USB device, the hardware driver needs to be installed on the computer. As soon as the USB cable is plugged, the computer will prompt with a message that a new hardware is detected, and the following window will pop up asking to install the driver for the Balance Plate:



Figure 2-3: Balance Platform Driver Installation Window 1

- ❑ Select “Install the software automatically” option and click “Next”.
- ❑ Depending on the version of the Windows® operating system that the computer uses, the following window may appear:



Figure 2-4: Balance Platform Driver Installation Window 2

- ❑ Click “Continue Anyway” to proceed.
- ❑ When the driver installation is complete the window

below will appear to inform that the Balance Platform is successfully installed:

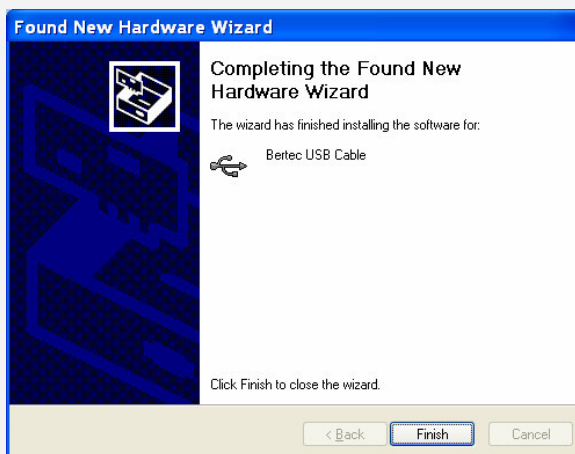


Figure 2-5: Balance Platform Driver Installation Window 3

- ❑ **Click "Finish" to finalize installation.**
- ❑ **Now the FallTrak™ system is ready to be used for testing and training.**

## 2.3. Balance Platform

The Balance Platform is the force measurement part of the FallTrak™ system. It is ready to be used, no assembly is required.



- ❑ **Make sure that all cables are properly routed. Loose cables may cause the patient or other persons to trip and fall. If necessary use masking tape to secure cables to the floor.**
- ❑ **Stepping on the connector of the Balance Platform might cause serious damage to the system.**

### Platform Specifics

The Balance Platform is a USB device, powered from the USB port of the computer. Standard USB cables of up to 5 m (16') can be used as the device cable.

The platform is designed for a maximum load of 500 lb (220 kg). The overall dimensions of the plate are 20" x 20" x 2½".



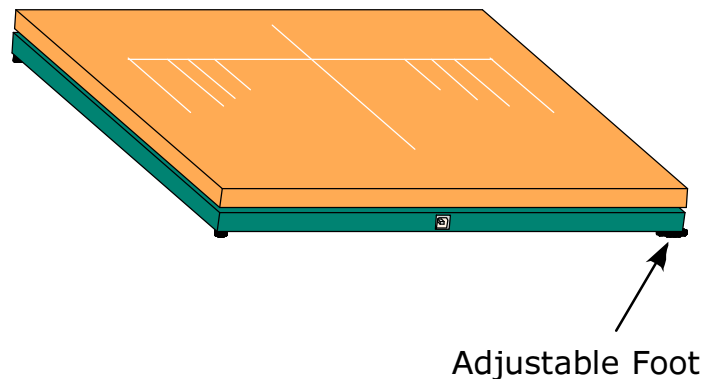
To clean the platform, spray the top surface with a mild detergent or disinfectant, and immediately wipe it clean with a soft cloth. Do not immerse the platform in any liquids, since doing so will damage the system.

### Adjustable Foot

One of the four platform feet is adjustable to accommodate for small irregularities on the floor where the platform is positioned (see Figure 2-6).



The platform needs to be positioned on a flat surface. The adjustable foot can only compensate small height differences of the order  $\pm 1/8$ " (3 mm).



**Figure 2-6:** Adjustable Foot of the Balance Platform

### Balance Assessment Foam

The purple, square foam is used in the Perturbed Stability Tests for the Balance Assessment part of the FallTrak™ system. It consists of a square piece of medium density foam inside a vinyl cover. The over all dimensions of the foam are 20" x 20" x 3", and it has the same markings on it as the Balance Platform.



To clean the foam, spray the top surface with a mild detergent or disinfectant, and immediately wipe it clean with a soft cloth.

# 3 Balance Assessment Test Protocol

## 3.1. Getting Ready for the Test

Before proceeding further make sure that the FallTrak™ software has been properly installed as described in **2.2 FallTrak™ System Installation**, and the Balance Platform is connected to the USB port of the computer.

The **Balance Assessment** and **Balance Training** parts of the software share the same patient database. Therefore, all patient specific information entered will be used for Balance Training as well.



**Only one copy of the FallTrak™ software should be run on the computer at a time. Running more than one copy might make the system unstable.**



**THE CALORICS SESSION OF ELECTRONYSTAGMOGRAPHY (VNG) MIGHT MAKE THE PATIENT DIZZY AND UNSTABLE. THEREFORE, IT IS HIGHLY RECOMMENDED THAT FALLTRAK™ SESSIONS (BOTH ASSESSMENT AND TRAINING) BE PERFORMED BEFORE VNG OR ON A SEPARATE DAY.**

### Starting the FallTrak™ Software



- Turn on your computer.
- Start the FallTrak™ software by clicking on the icon on the desktop of your Windows® operating system.
- The *Patient List* window (see Figure 3-1) will appear with

the list of the patients already in the database of the FallTrak™ system (the list may contain no entries if you are a first time user).

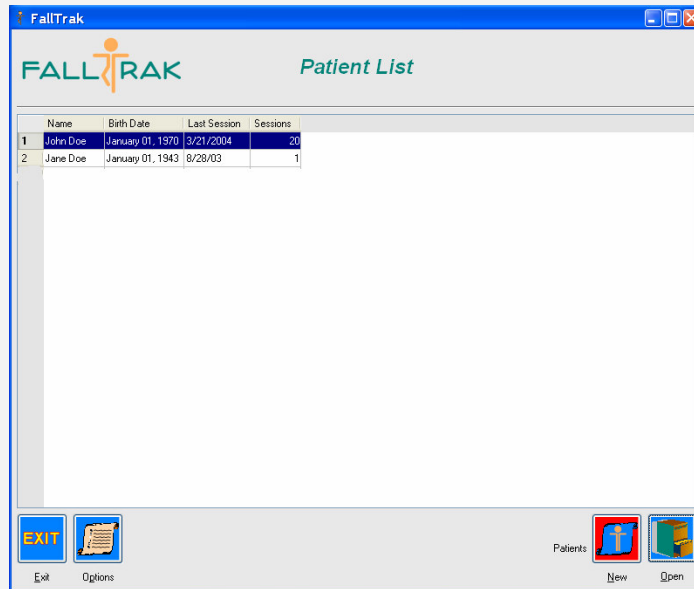


Figure 3-1: Patient List Window

## Entering New Patient Data



### Starting a New Patient Record

- In the *Patient List* window click the "New" button to get the Patient File window shown below.

The screenshot shows the 'FallTrak Patient File' window. It contains the following sections:

- Personal information:** Fields for First Name, Last Name, SSN/ID, Sex (dropdown menu), Date of Birth, Address, Phone, Fax, and E-Mail.
- Patient Notes:** A large text area for entering notes.
- Sessions:** A table with columns for Session date, Operator, and Notes.

At the bottom, there are buttons for 'Back', 'Cancel', 'Sessions', 'New', and 'Open'.

Figure 3-2: Patient File Window



- ❑ Fill in patient specific information to the fields provided on the page.
- ❑ In order to proceed, the field labeled "First Name" should contain an entry. If it is left blank a warning message will display.

## Starting a New Test Session



- ❑ In the *Patient List* window (Figure 3-1), click on the name of the patient. The corresponding row will appear highlighted.
- ❑ Click "Open". The *Patient File* window, shown below, will appear. This window displays patient information along with a list of previous sessions of the patient.

Personal Information

First Name: John | Last Name: Doe

SSN/ID: 123456789 | Sex: M | Date of Birth: January 01, 1970

Address: 123 Main Street

Apt. N

Anytown, ZZ 12345

Phone: (555) 123-4567 | Fax: (555) 234-5678 | E-Mail: doe@anyserver.com

Last session: 3/21/2004 Weight: 27.1 lb Height: 6'0" BMI: 3.7

Patient Notes

Sessions

Session date	Operator	Notes
1 2/7/03	Operator 1	
2 2/7/03	Operator 1	
3 2/13/03	not selected	
4 6/6/03	Operator 1	
5 12/23/03	not selected	
6 12/23/03	not selected	

Back Cancel Sessions New Open

**Figure 3-3:** Patient File Window with Patient Information and List of Previous Sessions.

- ❑ Verify patient information and make corrections if necessary. If desired, add patient notes.
- ❑ Click "New" to start a new test session.

## Test Selection



- ❑ After clicking "New" in the *Patient File* window, the *Session* window shown below will open.

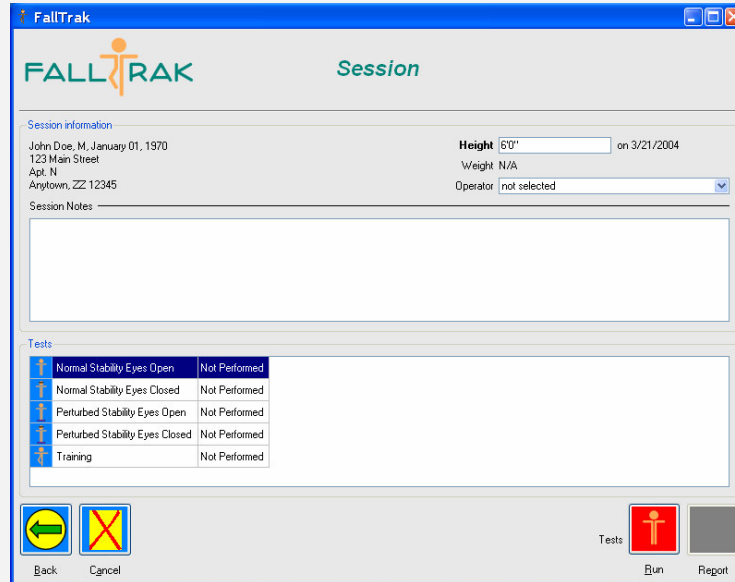


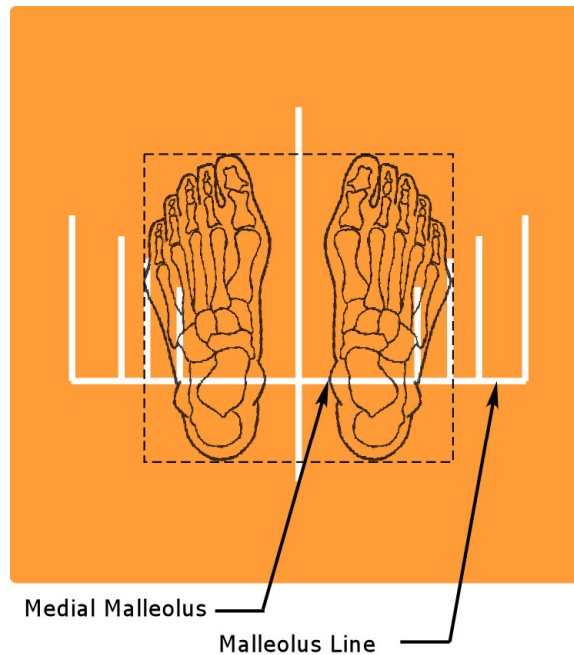
Figure 3-4: Session Window

- ❑ All the patient information entered previously will appear in the *Session* window. If desired, enter operator's name and session notes.
- ❑ If it is the first time you test a patient, enter the height of the patient. Without a proper height the program will display a warning message, and will not proceed to the particular test.
- ❑ Select the particular test you want to perform by clicking on the list of the tests. The tests can be performed in order you want.
- ❑ Click "Run" to perform the test. When finished, the status of the test changes from "NOT PERFORMED" to "PERFORMED".
- ❑ The results of the performed test can immediately be viewed by clicking on the "Report" button.
- ❑ Repeat the above steps for all the tests you wish to be performed.
- ❑ Repeating any particular test will cause loss of the previous results of the same test. If you need multiple test results from the same test, you should start a new session.
- ❑ When done with the test protocol, click the "Back" button to terminate the session and return to the *Patient File* window.

## Positioning the Feet

There are white vinyl markings on the Balance Platform to help with positioning patient's feet. Using these lines as a guide, the feet should be positioned as follows (see Figure 3-5):

- ❑ The medial malleolus of both feet should be aligned with the malleolus line on the platform.
- ❑ The feet should be symmetric around the midline and the outside borders should form an imaginary square.
- ❑ The angular alignment of the feet should be such that the patient does not feel uncomfortable (patient should not be forced to position the feet parallel to each other).



**Figure 3-5:** Position of Feet on the Balance Platform

## 3.2. Performing Assessment Tests



### **Test Protocol Safety Guidelines**

- ❑ The tests contained in the FallTrak™ protocols may not be applicable or appropriate for all patients. Patient safety is the

responsibility of the person administering the tests, and the protocols should be performed according to the specific patient's abilities.

- ❑ Patients performing the FallTrak™ tests may be unsteady or could move outside their normal range of balance. The Handrail structure is to be used for Balance Training protocols only. **THE HANDRAIL SYSTEM IS NOT DESIGNED TO PREVENT THE PATIENT FROM FALLING. IT IS ONLY AN ASSISTIVE DEVICE TO IMPROVE PATIENT'S BALANCE DURING BALANCE TRAINING. THEREFORE, THE PHYSICIAN CONDUCTING THE TESTS SHOULD ALWAYS BE ALERT OF THE PATIENT'S MOVEMENTS ON THE BALANCE PLATE. IT IS THE PHYSICIAN'S RESPONSIBILITY TO MAKE SURE THAT THE PATIENT IS ALWAYS SAFE WHILE USING THE FALLTRAK SYSTEM.**
- ❑ Since the Balance Platform is positioned above the floor level, always assist the patient in stepping onto or off the platform and in assuming the correct position to perform the tests.
- ❑ Follow standard sanitary procedure between patients.
- ❑ The Balance Platform requires a 2-minute warm up period every time the FallTrak™ software is started. This is required for electronics stabilization and optimal performance. Failure to do so can compromise the accuracy of the results obtained with the FallTrak™ system.
- ❑ When scheduling the patient to be tested with the FallTrak™ system, a gym outfit and easy to remove shoes should be suggested to be worn. (Due to possible effects of footwear, the protocol requires the patient to perform all tests either barefoot or wearing socks).
- ❑ The tests can be performed in any order. However, it is suggested to perform the tests in the given order (i.e., Normal Stability, Perturbed Stability). Note that, if something goes wrong during one of the tests, it is possible to redo that test.



### **Test Protocol Tips**

While the patient is performing the tests, note anything that can influence the results of the test and if necessary redo the test. When analyzing the results in the reports, it is possible to add **Session Notes** to the results for easy comparison between different test sessions. Also keep track of how the patient feels in general and especially while performing the test.

To monitor the patient's ability to maintain balance it is good practice to print the *Physicians Report* after every test session. Comparing the results from different test sessions, it is possible to evaluate the patient's ability to maintain balance over time.

The assessment tests are designed to evaluate the standing stability of subjects, and consist of four individual tests: **Normal Stability – Eyes Open, Normal Stability – Eyes Closed, Perturbed Stability – Eyes Open, Perturbed Stability – Eyes Closed.**

## Normal Stability – Eyes Open



- ❑ Enter the Normal Stability – Eyes Open Test page as described in 3.1 Test Selection to open the window shown below.

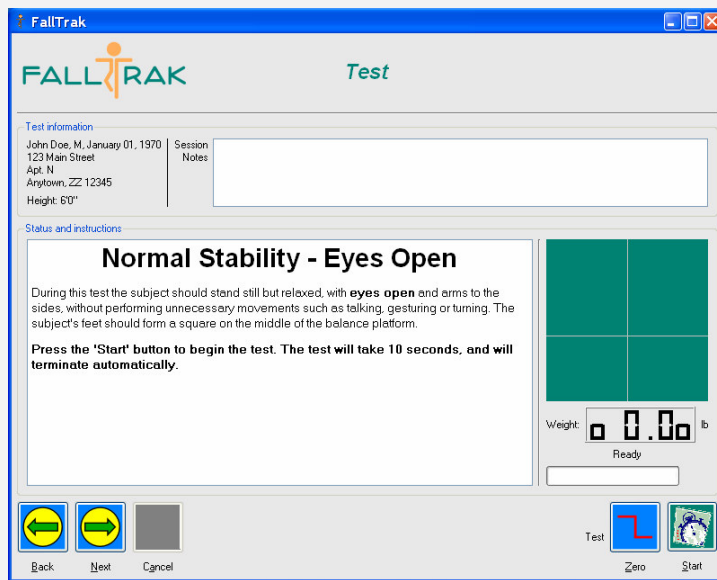


Figure 3-6: Normal Stability – Eyes Open Test Window

- ❑ The digital Balance Platform is a self-calibrating device. Therefore, no calibration is needed before the test. After you enter the Test page the system will calibrate itself and two square calibration marks will appear in the “Weight” window next to the weight display (see Chapter X for details).



- ❑ Instruct the patient to remove the shoes.
- ❑ Avoiding the platform connector, help the patient step onto the FallTrak™ platform and position the feet as described in 3.1 Positioning the Feet.
- ❑ Have the patient stand still in a comfortable position, with weight centered, EYES OPEN and arms to the sides. The patient should avoid any unnecessary movement, such as talking, gesturing, or turning, as reminded by the instructions on the screen.

- ❑ Click "Start" to start the test acquisition, which lasts for 10 seconds.
- ❑ A progress bar appears while the system is collecting data.
- ❑ When the progress bar disappears click "Back" to return to the Session page or "Next" to proceed to the Normal Stability – Eyes Closed test window.

## Normal Stability – Eyes Closed



- ❑ Enter the Normal Stability – Eyes Closed Test page as described in 3.1 Test Selection to open the window shown below.

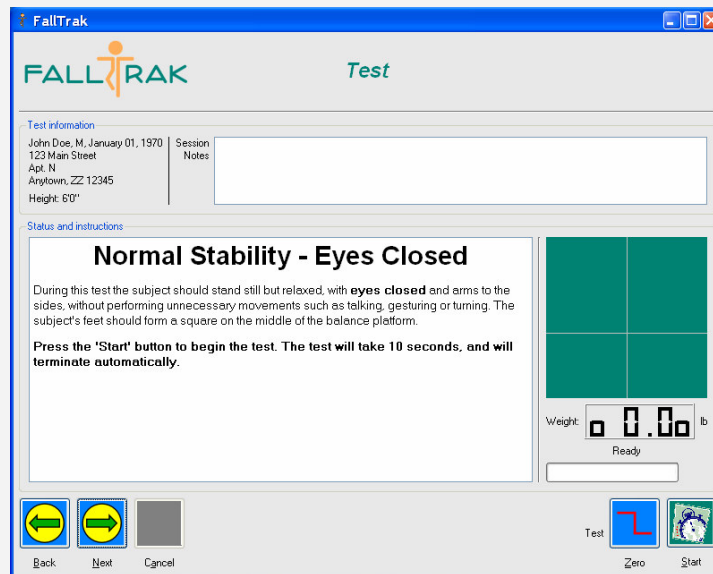


Figure 3-7: Normal Stability – Eyes Closed Test Window

- ❑ Have the patient stand still in a comfortable position, with weight centered, EYES CLOSED and arms to the sides. The patient should avoid any unnecessary movement, such as talking, gesturing, or turning, as reminded by the instructions on the screen.
- ❑ Click "Start" to start the test acquisition, which lasts for 10 seconds.
- ❑ A progress bar appears while the system is collecting data.
- ❑ When the progress bar disappears click "Back" to return to the Session page or "Next" to proceed to the Perturbed Stability – Eyes Open test window.

## Perturbed Stability – Eyes Open



### Perturbed Stability Eyes Open Test Protocol

- Enter the **Perturbed Stability – Eyes Open Test** page as described in **3.1 Test Selection** to open the window shown below.

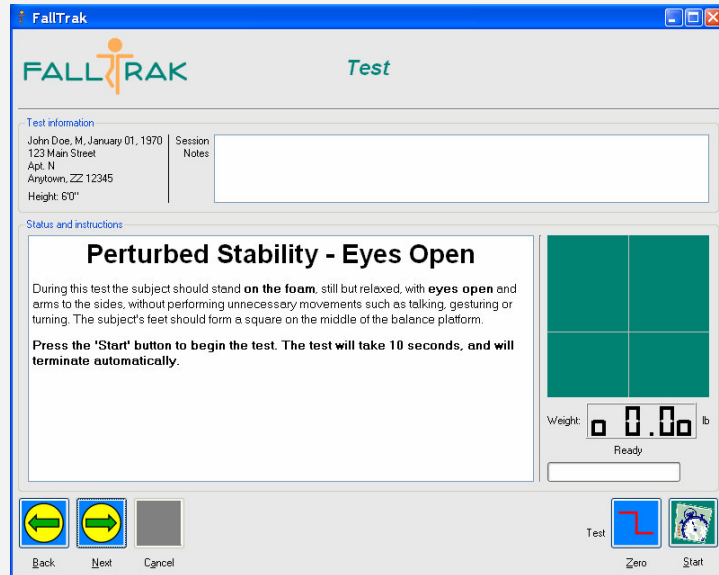


Figure 3-8: Perturbed Stability – Eyes Open Test Window

- Place the **FallTrak™ foam** on the **Balance Platform** with the reference lines facing up as shown below.

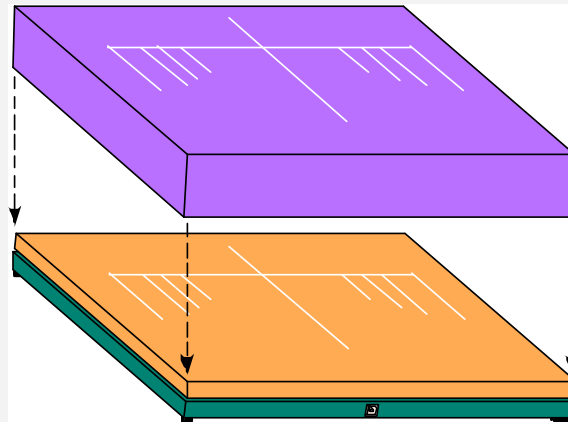


Figure 3-9: Balance Platform & Perturbed Surface Foam

- Wait about **3 seconds** to make sure that the system calibrates itself to compensate for the weight of the foam. Make sure that you see the square self-calibration marks in the weight display.



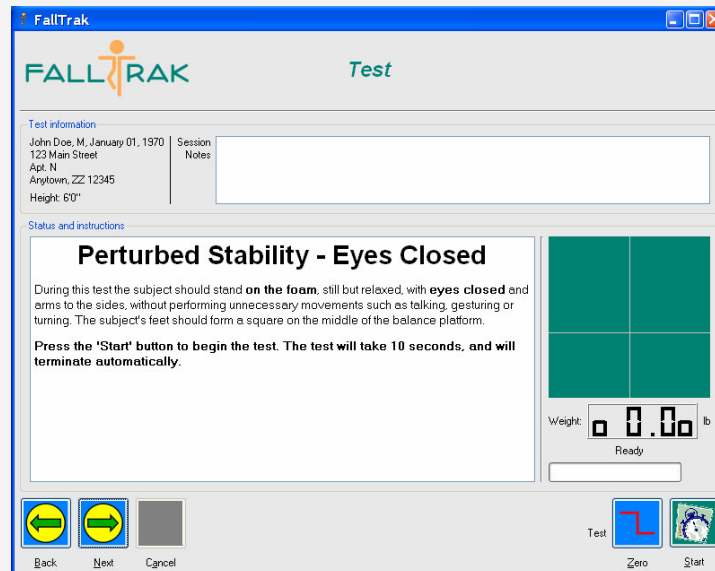
- ❑ **Avoiding the platform connector, help the patient step onto the FallTrak™ platform and position the feet as described in 3.1 Positioning the Feet.**
- ❑ **Have the patient stand still in a comfortable position, with weight centered, EYES OPEN and arms to the sides. The patient should avoid any unnecessary movement, such as talking, gesturing, or turning, as reminded by the instructions on the screen.**
- ❑ **Click "Start" to start the test acquisition, which lasts for 10 seconds.**
- ❑ **A progress bar appears while the system is collecting data.**
- ❑ **When the progress bar disappears click "Back" to return to the Session page or "Next" to proceed to the Perturbed Stability – Eyes Closed test window.**

## Perturbed Stability – Eyes Closed



### Perturbed Stability Eyes Closed Test Protocol

- ❑ **Enter the Perturbed Stability – Eyes Closed Test page as described in 3.1 Test Selection to open the window shown below.**



**Figure 3-10:** Perturbed Stability – Eyes Closed Test Window

- ❑ **Have the patient stand still in a comfortable position,**



with weight centered, **EYES CLOSED** and arms to the sides. The patient should avoid any unnecessary movement, such as talking, gesturing, or turning, as reminded by the instructions on the screen.

- ❑ Click "Start" to start the test acquisition, which lasts for 10 seconds.
- ❑ A progress bar appears while the system is collecting data.
- ❑ When the progress bar disappears click "Back" to return to the Session page or "Next" to proceed to Static Balance Training window.



For Balance Assessment tests the patient does not have to step off the balance platform between the Eyes Open and Eyes Closed tests.

---

### 3.3. Printing the Results

Results of the Balance Assessment tests are presented as comprehensive reports ready to be printed. For detailed information on reports refer to **5.5 Balance Assessment Reports**. To print reports proceed as follows:



Printing Reports

- ❑ From the FallTrak™ Session window, select any test. Then click "Report" button to view the report page. The results for the four tests, evaluating the standing stability, are reported together. Two reports are presented: a Physician's Report and a Patient Report. You can switch between these reports by clicking the corresponding button.
- ❑ While printing the reports, you can add or edit the Session Notes, if desired.
- ❑ To print a report, click "Print" button.
- ❑ Once the tests have been performed, and the results printed, close the reports page by clicking "Back" twice to start a new test session with the same patient.



# 4 Balance Training

## 4.1. Overview

Balance Training module of FallTrak™ consists of three sessions aiming at different aspects of the patient's standing balance. The available training sessions are:

- ❑ **Static Balance Training**
- ❑ **Dynamic Balance Training**
- ❑ **Limits of Stability Training**

The level of difficulty in each session can be changed by varying different session parameters. Some of the session parameters are normalized with respect to the Limit of Stability of the individual patient undergoing training.

The characteristics and intensity of the training should be compatible with the age, symptoms and general physical condition of the patient. Therefore, referral of patients for assessment and training with the FallTrak™ system should be done only by qualified persons.



**THE CALORICS SESSION OR DIFFERENT HEAD MANEUVERS PERFORMED FOR VIDEO ELECTRONYSTAGMOGRAPHY (VNG) ANALYSIS MIGHT MAKE THE PATIENT DIZZY AND UNSTABLE. THEREFORE, IT IS HIGHLY RECOMMENDED THAT FALLTRAK™ SESSIONS (BOTH ASSESSMENT AND TRAINING) BE PERFORMED BEFORE VNG SESSIONS OR ON A SEPARATE DAY.**

The assessment and training modules of the FallTrak™ system share the same patient database. For more information on how to select a patient from the database, enter new patient information or start a new session, see Chapter **3.1 Getting Ready for the Test**. The Balance Training module can be started by selecting "**Training**" and clicking the "Run" button in the **Session** window shown in Figure 3-4.

## 4.2. Static Balance Training

The first session of the Balance Training module is the Static Balance Training session. This session is designed to train the patient to control the body Center of Gravity (CoG) at a given static posture. The patient is required to keep the CoG in a target area for a specified amount of time.

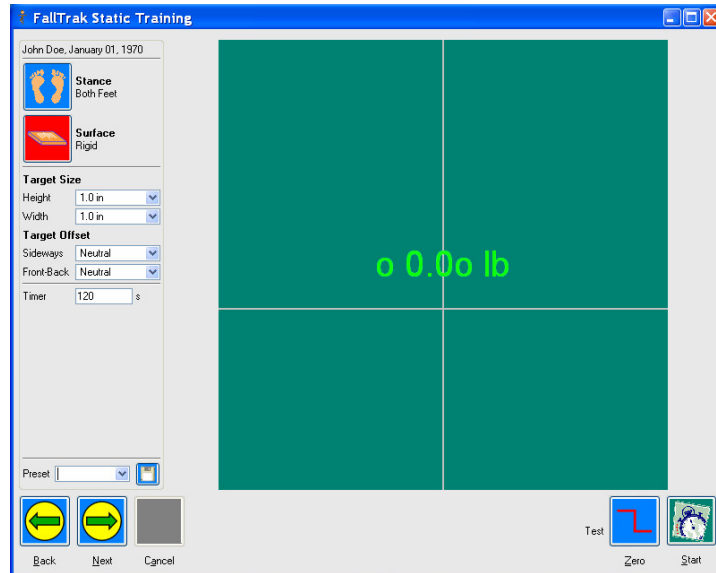


Figure 4-1: Static Balance Training Window

### Selecting Session Parameters

The following parameters can be adjusted to vary the intensity and nature of Static Balance Training (see Figure 4-1):

**Stance:** This parameter is used to select between unilateral and bilateral stance options. Available alternatives are: Left Foot, Both Feet and Right Foot.

**Surface:** Depending on the surface conditions of the Balance Platform two options are available: Rigid Surface and Compliant Surface. Compliant Surface alternative is selected if training is done on the compliant balance board.

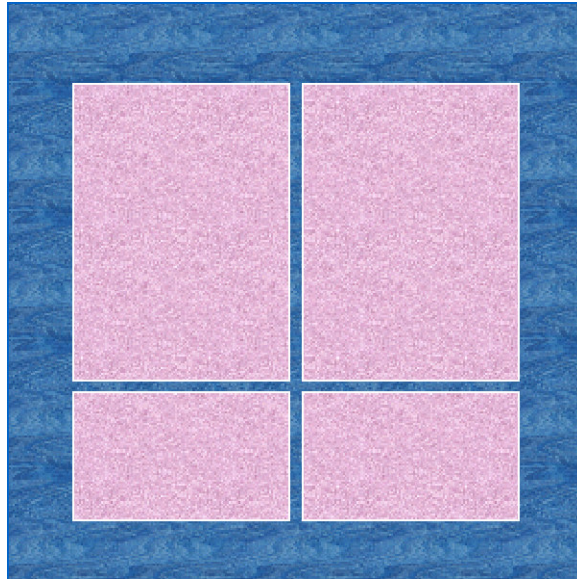
**Target Size:** The target area is a rectangle for which the size is selected by the clinician.

**Target Offset:** The target offset parameter determines how much the center of the target area, whose size is determined by Target Size, will be offset from the neutral standing position of the patient (see 5.6 for detailed explanation).

**Time:** The time parameter entered by the clinician determines the length of the time interval for which the patient is required to keep the Center of Gravity in the target area.

## Positioning the Compliant Balance Board

The *Perturbed Balance Surface* is provided so that the patients can be trained with inaccurate proprioceptive input from the ankle joints. This surface should be positioned such that its edges are aligned with the edges of the Balance Platform.



**Figure 4-2:** Compliant Balance Board on Balance Platform

## Positioning the Feet

Following the guidelines for feet positioning is crucial for a successful training. There are white vinyl markings on the Balance Platform (or a crosshair on the Perturbed Balance Surface) to help with positioning patient's feet. Using these lines as a guide, the feet should be positioned as follows:

### ***If training is to be performed on two feet:***

- ❑ The medial malleolus of both feet should be aligned with the malleolus line on the platform or balance board (see **Figure 3-5**).
- ❑ The feet should be symmetric around the midline and the outside borders should form an imaginary square.
- ❑ The angular alignment of the feet should be such that the patient does not feel uncomfortable (patient should not be forced to position the feet parallel to each other).

### ***If training is to be performed on one foot:***

- ❑ The medial malleolus of the foot in question should be aligned with the malleolus line on the platform.
- ❑ The target foot should be placed such that the centerline mark on the Balance Platform should coincide with the long axis of the foot (approximately passing through the second toe and mid point of the heel).
- ❑ The other foot is next to the stance foot, and it is to be lifted 1-2 inches from the support surface.



**It is strongly suggested that training on one foot should be performed on the firm Balance Platform surface only. Trying to balance the body on one foot on the Balance Board might be dangerous even for a healthy person.**

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- ❑ **Select stance using the "Stance" button.**
- ❑ **Select the surface on which training is to be performed.**
- ❑ **Select the height and width of the rectangular target area.**
- ❑ **Select the sideways and front-back offset of the target center from the neutral standing position.**
- ❑ **Enter duration of the time interval for training to be performed.**
- ❑ **If the Compliant Balance Board is to be used in training, place it on to the Balance Platform as described above. After putting the board make sure that the Balance Platform calibrates itself. If the weight display does not show "0" in 3 seconds, then zero the plate manually by pressing "Zero" button.**
- ❑ **Have the patient step on to the Balance Platform. If the Balance Board is used in training, be careful as the patient is stepping on to it because it is an unstable surface. Note that depending on the general physical condition, the patient might need to get support from the handrail structure during training. Therefore, adjust the height of the handrail so that the patient can comfortably hold on to it.**
- ❑ **It is imperative for accurate results that the guidelines for foot placement is followed as described in 4.2: *Positioning the Feet*.**
- ❑ **Make sure that as the patient is standing erect at a**

neutral posture the Center of Gravity (CoG) cursor (+) is approximately located at the intersection of the two perpendicular lines in the green test area.

- ❑ Click the "Start" button at the lower right hand side of the window to begin training.
- ❑ After clicking "Start" the target rectangle will appear on the screen.
- ❑ The patient is required to hold his/her Center of Gravity, shown as a cross, as close as possible to the center of the target area for the duration specified by the "Time" parameter.
- ❑ After training is finished help the patient get off the Balance Platform.

## 4.3. Dynamic Stability Training

This session intends to train patients to control their Center of Gravity (CoG) under dynamic conditions. The patients are required to follow a target moving along various paths with their CoG, or move their CoG along different paths at a pace, which is comfortable for them. Dynamic Balance Training window is shown below in Figure 4-3.

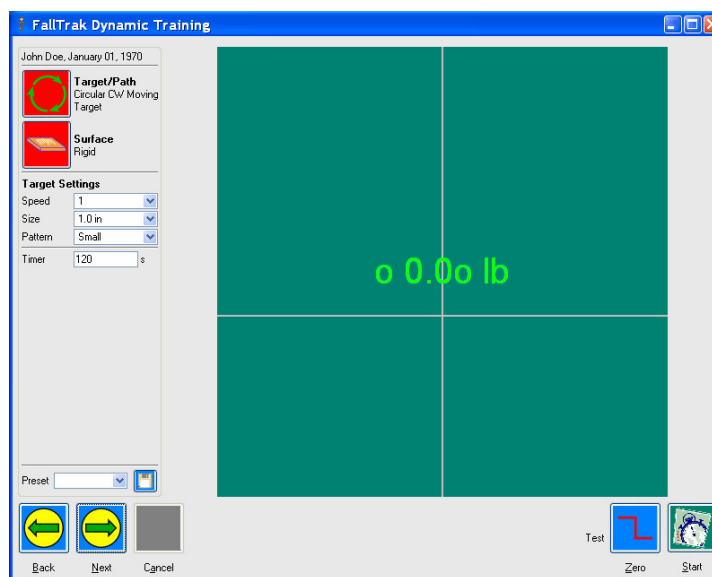


Figure 4-3: Dynamic Balance Training Window

### Selecting Session Parameters

The following parameters can be adjusted to vary the intensity and nature of Limit of Stability Training (for detailed explanation see **5.6: Dynamic Balance Training**).

**Target/Path:** This button is used to select between the “Follow Moving Target” and “Follow Path” options. For both options different path options are available (refer to section 5.6). For “Follow Moving Target” option, the patient is required to follow a moving target along a certain path with his/her Center of Gravity (CoG). For the “Follow Path” option, the patient moves the CoG along the displayed pattern at his/her own pace.

**Surface:** Depending on the surface conditions of the Balance Platform, two options are available: Rigid Surface and Compliant Surface. Compliant Surface alternative is selected if training is done on the compliant balance board.

**Target Speed:** This option sets the target speed for “Follow Moving Target” option.

**Target Size:** The target area is a square where the size is selected by the clinician.

**Pattern Size:** The size of the path, that the patient is required to follow with the Center of Gravity, is selectable.

**Timer:** The value entered for the timer parameter determines the total duration of the Dynamic Stability Training.

### Positioning the Feet

Following the guidelines for feet positioning is crucial for a successful training. There are white vinyl markings on the Balance Platform (or a crosshair on the Perturbed Balance Surface) to help with positioning patient’s feet. Using these lines as a guide, the feet should be positioned as follows:

- The medial malleolus of both feet should be aligned with the malleolus line on the platform or balance board (see **Figure 3-5**).
- The feet should be symmetric around the midline and the outside borders should form an imaginary square.
- The angular alignment of the feet should be such that the patient does not feel uncomfortable (patient should not be forced to position the feet parallel to each other).



- Select training mode using the “Target/Path” button.**
- Select the surface on which training is to be performed.**
- If training mode is “Follow Moving Target”, then set the speed of the target.**
- Select the size of the target.**
- Select pattern size.**



- ❑ Enter duration of the time interval for training to be performed.
- ❑ If the Compliant Balance Board is to be used in training, place it on to the Balance Platform as described in *4.2: Positioning the Compliant Balance Board*. After putting the board make sure that the Balance Platform calibrates itself. If the weight display does not show "0", then zero the plate manually by pressing "Zero" button.
- ❑ Have the patient step on to the Balance Platform. If the Balance Board is used in training, be careful as the patient is stepping on to it because it is an unstable surface. Note that depending on the general physical condition, the patient might need to get support from the handrail structure during training. Therefore, adjust the height of the handrail so that the patient can comfortably hold on to it.
- ❑ It is imperative for accurate results that the guidelines for foot placement is followed as described in *4.3: Positioning the Feet*.
- ❑ Make sure that as the patient is standing erect at a neutral posture the Center of Gravity (CoG) cursor (+) is approximately located at the intersection of the two perpendicular lines in the green test area.
- ❑ Click the "Start" button at the lower right hand side of the window to begin training.
- ❑ If the training mode is "Follow Moving Target", then a target rectangle will appear on the screen. The target will move along the path set by the Target/Path option. The patient is required to keep his/her Center of Gravity, shown as a cross, in the moving target area.
- ❑ If the training mode is "Follow Path", then a path set by the Target/Path option will appear on the screen. The patient is required to move his/her Center of Gravity, depicted as a cross, along the shown path.
- ❑ After training is finished, help the patient get off the Balance Platform.



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## 4.4. Limit of Stability Training

The Limit of Stability Training session is designed to facilitate the patient's ability to voluntarily shift the body center of gravity (CoG) to specific locations and maintain the body at that location for a specified amount of time. This session aims at improving reaction time and sway velocity of the patient while shifting the CoG of the body.

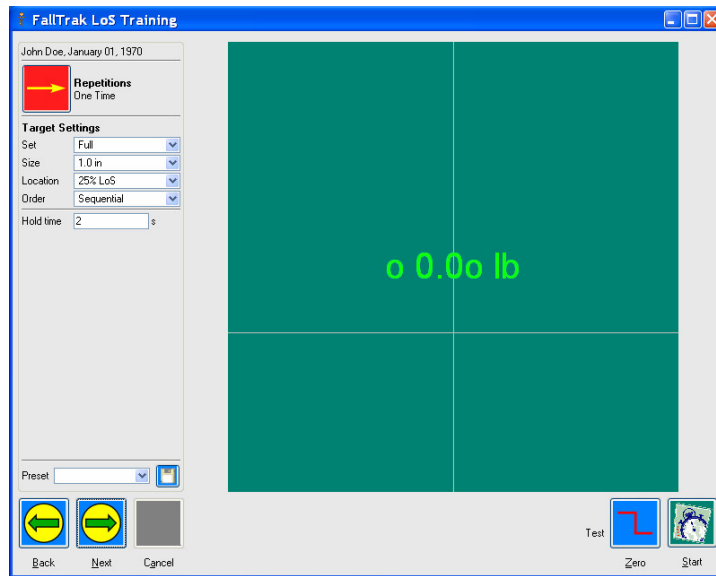


Figure 4-4: Limit of Stability Training Window

### Selecting Session Parameters

The following parameters can be adjusted to vary the intensity and nature of Limit of Stability Training (see Figure 4-4):

**Repetitions:** This parameter is used to determine whether the patient will hit each target in the selected target set once or multiple times. Available options are: *One Time* and *Continuous*.

**Target Set:** Different target sets are available in order to concentrate patient's training into specific directions. The *Full* target set consists of a central target and eight targets uniformly distributed around it. Other target sets are partial subsets of the *Full* target set (see Section **5.6: Limit of Stability Training** for detailed explanation). Available target sets are: *Full*, *Forward*, *Backward*, *Left*, *Right*, *Front/Left*, *Front/Right*, *Backward/Left*, *Backward/Right*.

**Target Size:** The target area is a square for which the side is selected by the clinician.

**Target Location:** The target locations can be changed based on the individual limits of stability of the patient. If the maximum limit of stability (100%) is selected, the targets appear at the theoretical limits of the stability of the patient to be tested.

**Order:** The order of appearance of the targets can be changed to increase the level of training challenge to the patient. If *Sequential* is selected, the targets in the selected set will appear in a counterclockwise manner. On the other hand, selecting *Random* for the target order will make them appear in a random fashion so that the patient will not be able to predict the location of the next target.

**Hold Time:** This parameter specifies the duration for which the patient is required to keep the CoG in the highlighted target before moving to the next target.

## Positioning the Feet

Following the guidelines for feet positioning is crucial for a successful training. There are white vinyl markings on the Balance Platform to help with positioning patient's feet. Using these lines as a guide, the feet should be positioned as follows:

- The medial malleolus of both feet should be aligned with the malleolus line on the platform or balance foam (see **Figure 3-5**).
- The feet should be symmetric around the midline and the outside borders should form an imaginary square.
- The angular alignment of the feet should be such that the patient does not feel uncomfortable (patient should not be forced to position the feet parallel to each other).



**The Limit of Stability Training is to be performed on the rigid Balance Plate surface only. Trying to use the balance foam or perturbed surface might cause the patient to lose balance and result in injury.**

**THE HANDRAIL SYSTEM IS NOT DESIGNED TO PREVENT THE PATIENT FROM FALLING. IT IS ONLY AN ASSISTIVE DEVICE TO IMPROVE PATIENT'S BALANCE DURING BALANCE TRAINING. THEREFORE, THE PHYSICIAN CONDUCTING THE TESTS SHOULD ALWAYS BE ALERT OF THE PATIENT'S MOVEMENTS ON THE BALANCE PLATE. IT IS THE PHYSICIAN'S RESPONSIBILITY TO MAKE SURE THAT THE PATIENT IS ALWAYS SAFE WHILE USING THE FALLTRAK SYSTEM.**



Limit of Stability Training Protocol

- Select the Repetitions mode by clicking the "Repetitions" button.
- Select "Target Set" to match the direction into which the patient is to be trained.
- Select the size of the target.
- Select the locations of the target based on the limit of stability of the patient.
- Select the order of appearance of the targets.
- Enter time duration for the patient to keep the CoG in target areas.
- Have the patient step on to the Balance Platform. Note

that depending on the general physical condition, the patient might need to get support from the handrail structure during training. Therefore, adjust the height of the handrail so that the patient can comfortably hold on to it.

- ❑ Make sure that as the patient is standing erect at a neutral posture the Center of Gravity (CoG) cursor (+) is approximately located at the intersection of the two perpendicular lines in the green test area.
- ❑ Click the "Start" button at the lower right hand side of the window to begin training.
- ❑ After clicking "Start" the selected target set will appear on the screen along with the cross showing the CoG of the patient.
- ❑ The patient is required to shift his/her Center of Gravity, shown as a cross, to the target highlighted in red color as quickly as possible and hold in the target area for the duration specified by the "Hold Time" parameter.
- ❑ If the repetition option is selected as "One Time", training will stop after each target is hit once. If the repetition option is "Continuous", then training should be stopped by the training administrator by clicking the "Stop" button.
- ❑ After training is completed help the patient get off the Balance Platform.

# 5 Using FallTrak™ Software

## 5.1. Starting FallTrak™

If the FallTrak™ software is properly installed (please refer to **2.2 FallTrak™ System Installation**) the FallTrak™ icon will appear on the desktop of the Windows® system (Figure 5-1).



Figure 5-1: FallTrak™ Software Icon

Double clicking on the icon starts the FallTrak software by displaying a flash screen (Figure 5-2), which will stay on your monitor for a few seconds. After the flash screen disappears the **Patient List** window will appear.



Figure 5-2: FallTrak™ Flash Screen

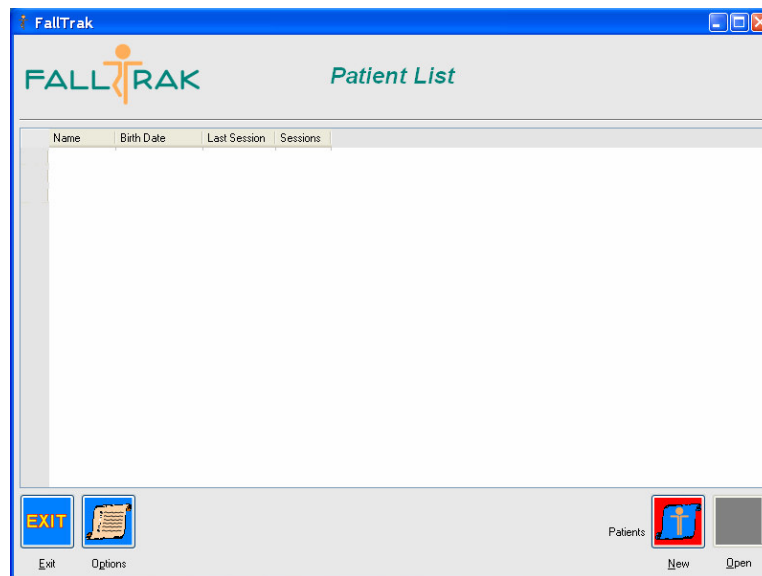


To preserve the integrity of the patient database file, the date and time of the computer should be correct. If they are incorrect, change them following the instructions in your Windows® Help system.

---

## 5.2. Patient List Window

This is the main interface for the FallTrak™ software. It allows the user to keep track of the patients tested using the FallTrak™ system, to add new patients, to view results for existing patients and to customize the FallTrak™. The **Patient List** window includes buttons to navigate through the software.



**Figure 5-3:** Patient List Window

## Buttons



Opens the **Patient File** window to enter new patient information, and is always activated when the FallTrak™ software starts.



Opens the **Patient File** of an existing patient, and gives access to the previous sessions of that patient.



Opens the **Options** window so that the FallTrak™ software can be customized by setting the preferences for the system units, and by changing the header of the report printouts.



Closes the **Patient List** window and exits the FallTrak™ software.

## Customizing FallTrak™

Click the “Options” button in the **Patient List** window to open the **Options** window shown below.

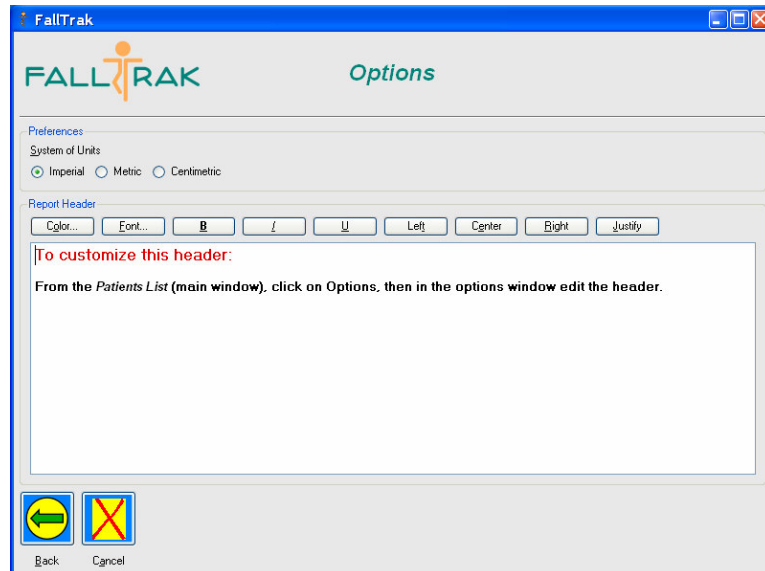


Figure 5-4: Options Window

In the **Preferences** section the desired system of units can be selected by clicking the appropriate button. The system of units preferences will affect the measurement units used by the software in the reports and to display weight. The options are:

- Imperial** (lengths in inches, weight in pounds)
- Metric** (lengths in meters, weight in kilograms)
- Centimetric** (lengths in centimeters, weight in kilograms)

Any change in the preferences will affect the display of the reports immediately, and every time the FallTrak™ software is started the last settings will be remembered.

In the **Options** window the report header can be customized using the text editor.



**Customizing the Report Header**

- In the *Options* window click the text area in the *Report Header* section.**
- Modify the existing report header as desired. You can add a personalized letterhead with name, address, and so on.**
- Format the header text using the buttons on the formatting toolbar.**
- Click the "Back" button to accept the changes and return to the *Patient List* window.**
- Clicking "Cancel" will ignore any changes to the preferences and report header, and return to the Patient List window.**



**Choosing the font size for the report header too large or keeping the text too long might displace the session notes at the bottom of the report pages beyond the printable area of your printer. In this case, you might not be able to print the session notes.**



## Patient List

The **Patient List** displays the names of previously tested patients in the database, their birth date, the date for the last test session, and the total number of previous test sessions for each patient (Figure 5-5). Each new patient is added as the last entry to the list.

	Name	Birth Date	Last Session	Sessions
1	John Doe	January 01, 1970	8/28/03	6
2	Jane Doe	January 01, 1943	8/28/03	1

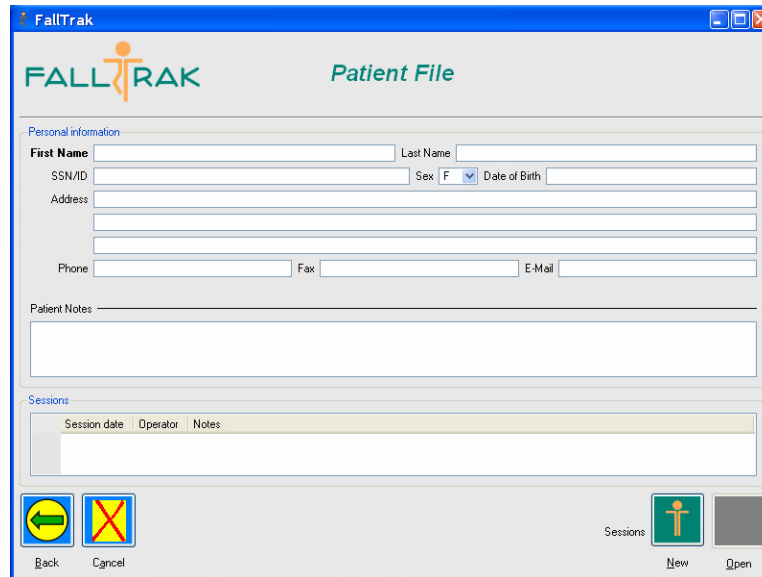
**Figure 5-5:** Patient List



- ❑ **It is possible to adjust the width of the columns by moving the vertical line between columns. However, the next time the software is restarted, the default column sizes are restored.**
- ❑ **To open an existing patient file highlight the patient by clicking once on the name of the patient and then click "Open" button (see 4.3 Patient List window: Buttons). An alternative way is to double click on the patient's name.**
- ❑ **The Patient List can be sorted in an ascending or descending order by repeated clicking of the respective column headers. For example, clicking the "Last Session" column header will sort the list in a chronological order (once for ascending and twice for descending order).**

## 5.3. Patient Information

### Entering New Patient Information



**Figure 5-6:** Patient File Window

Patient information is entered on the Patient File window shown in Figure 5-6. Patient's personal information includes the following:

- First Name**
- Last Name**
- SSN/ID:** Social security number or any other unique ID number
- Sex**
- Date of Birth:** Acceptable formats are: mm/dd/yy, dd-mm-yy, dd.mm.yy, yy-mm-dd, yy.mm.dd
- Address:** All three lines available can be used to enter the address.
- Phone No.**
- Fax No.**
- E-mail Address**



**In the Patient File window the First Name field should have an entry in order the program to proceed to create a session. As a remainder this field label is in bold typeface. The FallTrak™ software will not proceed further until a valid First Name has been entered. The following message will appear if the name is missing.**



Figure 5-7: Warning Message



**The patient information is unique for any patient. Any change will appear in all the previous and new test sessions for the patient.**

The **Notes** field can be used to enter general comments about the patient. After filling in all necessary patient information click, "**New**" to proceed with a new session or click "**Back**" to return to the **Patient List** window. In this case patient information will be saved for future sessions, and patient name will appear on the patient list. Clicking "**Cancel**" will return to the **Patient List** window without saving any information.



**Resting the mouse over any user modifiable field in the Patient Information window for a couple of seconds will activate the TIP associated with this field, with a quick explanation of its functionality.**

## Opening a New Session for Existing Patients

To open a new test session for an existing patient first open the **Patient File** for that patient (please refer to **5.2 Patient List Window**). The **Patient File** window displays the patient information along with a list of previous test sessions (Figure 5-8). The session list includes the session date, operator name and session notes. Update the patient information if necessary, and enter any notes you wish to appear on the reports. Click on the "**New**" button to display the **Session** window.

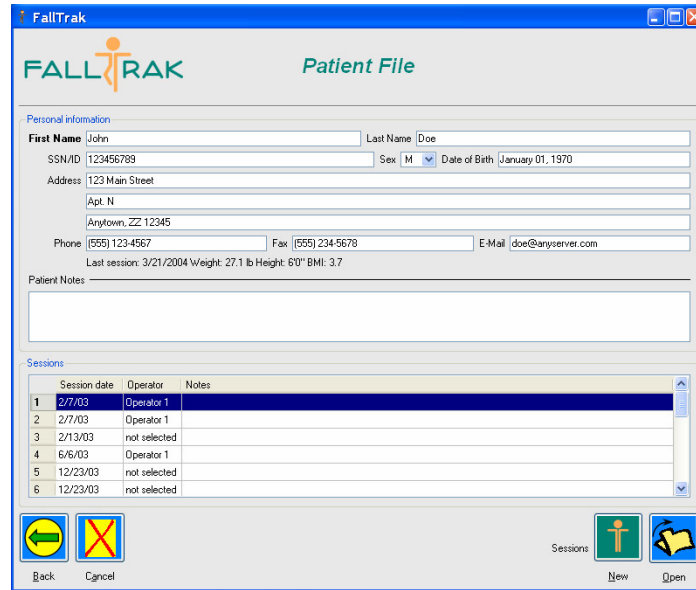


Figure 5-8: Patient File Window with a List of Previous Sessions



It is possible to adjust the width of the columns in the session list by moving the vertical line between columns. However, the next time the software is restarted, the default column sizes are restored.

## 5.4. Balance Assessment Test Sessions

The complete series of tests has been designed to assess the patient's ability to maintain balance while standing. Two aspects can be tested: the ability to maintain balance on a hard level surface (**Normal Stability**), and on a soft surface (**Perturbed Stability**).

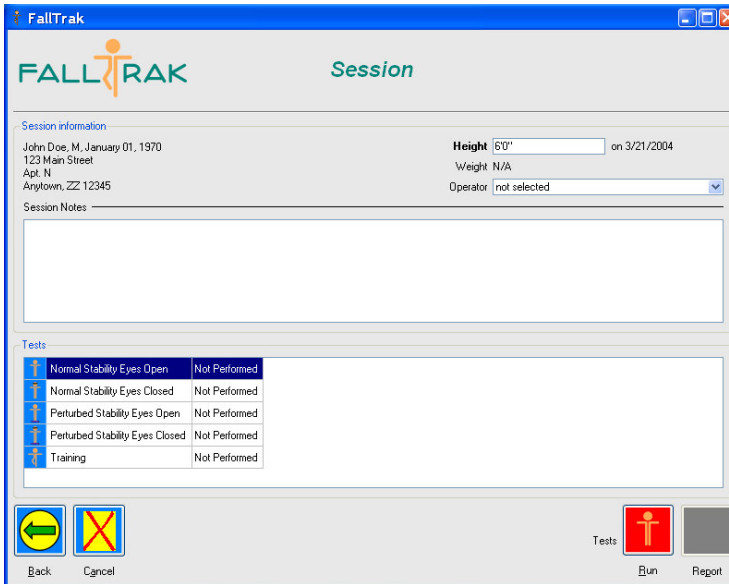
The tests can be performed in any order. However it is suggested that to do them in the order given, i.e., Normal Stability – Eyes Open, Normal Stability – Eyes Closed, Perturbed Stability – Eyes Open, Perturbed Stability – Eyes Closed.



While the patient is performing the test, note anything that can influence the results of the test, and if necessary redo the test. When analyzing the results in the report, it is possible to add all the test notes to the reports for easy comparison between different test sessions. Also keep track of how the patient feels in general especially while performing the test.

## Test Selection

The Session window presents a selection of the tests to perform. Available tests are presented as a list with their status displayed next to them (Figure 5-9).



**Figure 5-9:** Session Window

Since the test results are interpreted based on the height of the patient, modify it if necessary. Enter the name of the operator or select a name from the list. Enter any session notes you want to appear on the reports.

The Balance Assessment module of FallTrak™ incorporates four individual tests:

- ❑ **Normal Stability:**
  - Eyes Open;
  - Eyes Closed;
- ❑ **Perturbed Stability:**
  - Eyes Open;
  - Eyes Closed;

Each test has its status displayed next to it to remind whether it has been performed or not:

- ❑ **Not Performed:** the particular test has yet to be performed.
- ❑ **Performed:** test has been performed and the report is available to be viewed and printed.

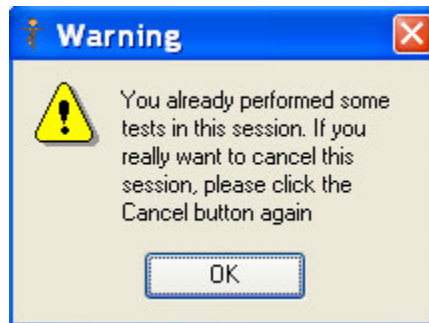
To run a test, click once on the test in the list to highlight it, and then click the **“Run”** button. An alternatively way is to double click on the test in the list.

After the status of a test changes to **Performed**, the report button will be available to view the report for that particular test. After performing all or some of the tests the session can be terminated by clicking the "**Back**" button.



**Once a session is closed, it is not possible to add more tests. A new session must be started.**

If some or all of tests have already been performed, then clicking the "**Cancel**" button will result in the following message:



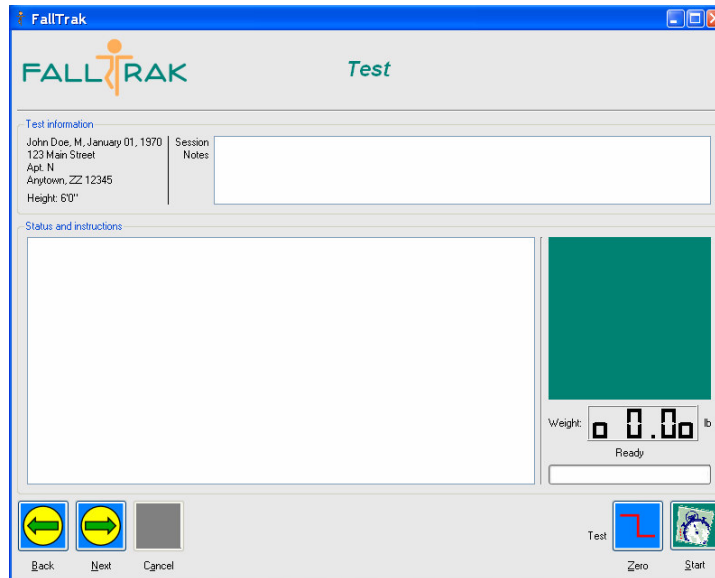
**Figure 5-10:** Warning Message

After clicking "**OK**", clicking "**Cancel**" a second time will result the session to terminate without saving the results.

Details of how to perform individual tests are given in **3.2 Performing Assessment Tests**.

## Test Window

All of the assessment tests are performed using the **Test** window shown below.



**Figure 5-11:** Balance Assessment Test Window

On the upper portion of the page patient information is displayed along with a text editor for **Session Notes**. These notes can be used to edit session notes that have been entered on the **Session** window.

The Status and Instruction section contains information about the particular test that you are performing.

The green square area is used to display the Center of Pressure (CoP) on the balance platform. This display is provided as a visual guide for convenience. The CoP is shown as a white “+” cursor in the area provided (If the FallTrak™ platform is not loaded CoP is not displayed).

The weight display shows the load on the balance platform. The unit of the load depends on the preferences set in the **Options** window (see **5.2: Customizing FallTrak™**). The balance platform is a self-calibrating device. If the load is below approximately 8 lb, the platform will “zero” (calibrate) itself in a few seconds, and two small squares will appear next to the weight display.



For convenience, a “Zero” button is provided for manual calibration.

The status of the system is shown just above the progress bar. If the balance platform is connected properly the message “Ready” is displayed. Other possible messages are “Cable not connected” and “Plate not connected”.



- ❑ If you see “Cable not connected” or “Plate not connected” messages please check the cables and connections to the balance platform.
- ❑ The “Start” button is used to start the tests. After clicking “Start” the tests will terminate automatically in 10 seconds. Clicking the “Start” button multiple times will overwrite the previous tests performed. You can use this feature to repeat unsuccessful tests.
- ❑ The results of tests are not saved unless the Test window is closed. If you click the “Cancel” button the software will discard the test results, and exit to the Session window.
- ❑ Clicking the “Next” button will open the window for the next assessment test.

## Normal Stability

### *Eyes Open*

The **Normal Stability – Eyes Open** test evaluates the patient’s ability to maintain balance on a hard surface with eyes open.

The instructions for this test read as follows:

---

During this test the patient should stand still but relaxed, with EYES OPEN and arms to the sides, without performing unnecessary movements such as talking, gesturing, or turning. The patient's feet should form a square in the middle of the FallTrak platform.

---

### *Eyes Closed*

The **Normal Stability – Eyes Closed** test assesses the patient’s ability to maintain balance on a hard surface with eyes closed.

The instructions for this test read as follows:

---

During this test the patient should stand still but relaxed, with EYES CLOSED and arms to the sides, without performing unnecessary movements such as talking, gesturing, or turning. The patient's feet should form a square in the middle of the FallTrak platform.

---



## Perturbed Stability

### *Eyes Open*

The **Perturbed Stability – Eyes Open** test evaluates the patient’s ability to maintain balance on soft surface with eyes open.

The instructions for this test read as follows:

---

During this test the patient should stand ON THE BALANCE ASSESSMENT FOAM, still but relaxed, with EYES OPEN and arms to the sides, without performing unnecessary movements such as talking, gesturing, or turning. The patient’s feet should form a square in the middle of the foam.

---

### *Eyes Closed*

The **Perturbed Stability – Eyes Closed** test evaluates the patient’s ability to maintain balance on soft surface with eyes open.

The instructions for this test read as follows:

---

During this test the patient should stand ON THE BALANCE ASSESSMENT FOAM, still but relaxed, with EYES CLOSED and arms to the sides, without performing unnecessary movements such as talking, gesturing, or turning. The patient’s feet should form a square in the middle of the foam.

---

---

## 5.5. Balance Assessment Reports

The results of the four tests are summarized a report, which can be accessed from the **Session** window. The results of all the four Balance Assessment tests are integrated into a single report under the heading Standing Stability Report. Therefore, clicking the “**Report**” button while any of the four tests (Normal Stability-Eyes Open, Normal Stability-Eyes Closed, Perturbed Stability-Eyes Open, Perturbed Stability-Eyes Closed) are highlighted will display the same report.

Two versions of the report are available:

- ❑ **Physician Report:** a detailed report intended to be filed with the patient chart. The patient’s information as well as operator name and session notes are included, together with detailed test results.
- ❑ **Patient Report:** a simplified version, with a description of the test results. This report can be given to the patient and does not include information that could compromise patient-physician confidentiality.

The **Print** button is used to print the reports on the printer(s) installed on your Windows® system. The reports are shown on the screen as they will appear when printed on paper. They cannot be edited, except for the Header and Notes sections. To edit the Report Header please refer to **5.2: Customizing FallTrak™**.

## Standing Stability Report

On the report page (see Figure 5-12), clicking **Physician** and **Patient** buttons will switch between the **Physician** and **Patient Reports**. When the report page is opened for the first time, the **Physician Report** is always the default page. The **Physician Report** is a two-page report.

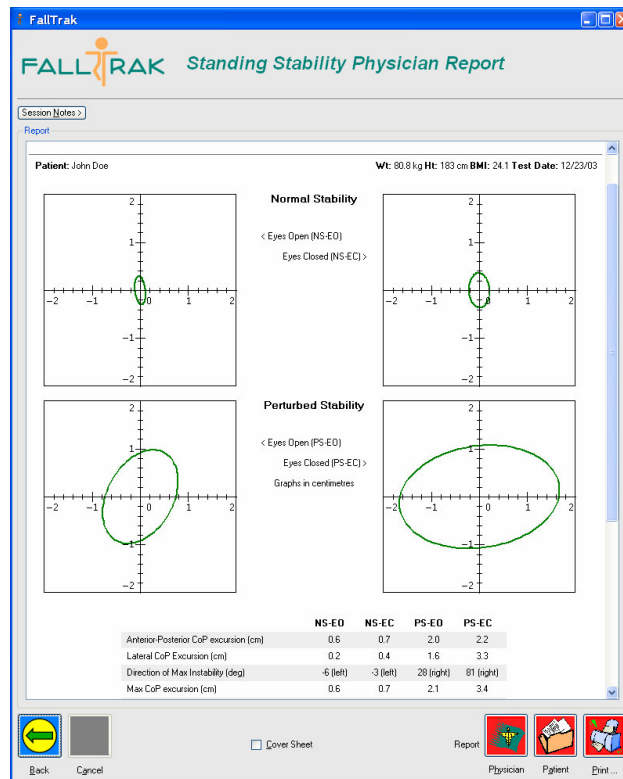


Figure 5-12: Standing Stability Report Page

Clicking the **Session Notes >** button at the top of the page will open a text editor where you can enter and/or edit session notes. By unchecking the check box next to **Cover Sheet** at the bottom of the window, you can hide the cover sheet of the report in the display. In this case the cover sheet of the report will not be printed.

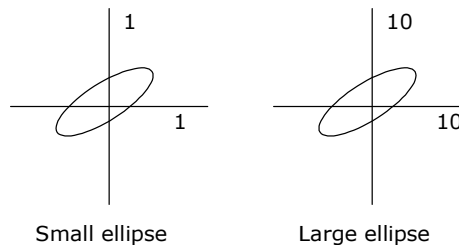
### **Physician Report: Page 1**

This page contains the **Patient Information** as entered in the **Patient File** window. The **Patient Notes** section will display any notes entered in the **Patient File** window. These notes might include patient's medical record, and could be used to keep track of patient's history. Information such as patient conditions, medication, or diagnosis can be recorded here. These notes can be updated every test session, adding new information. They are shown on the reports of all test sessions. This page also displays the *Weight, Height and Body Mass Index (BMI)* of the patient at the top. BMI is calculated based on the latest measured weight of the patient. A sample printout of the **Standing Stability Physician Report** is given in Appendix B.

### **Physician Report: Page 2**

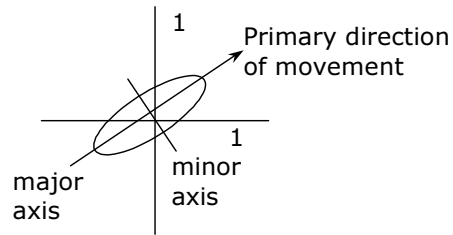
Page 2 of the **Physician Report** shows the results from the Balance assessment tests: **Normal Stability - Eyes Open, Normal Stability - Eyes Closed, Perturbed Stability - Eyes Open, and Perturbed Stability - Eyes Closed**. The *Weight, Height and Body Mass Index (BMI)* of the patient are displayed at the top. BMI is calculated based on the latest measured weight of the patient. The page also displays **Notes** kept during the test session.

Each graph shows a statistical representation of the Center of Pressure: the 95% confidence ellipse, i.e., the ellipse that contains 95% of the Center of Pressure points during the specific test. From each graph it is possible to assess visually how much the patient moved during the test (Figure 5-13): *the smaller the ellipse the better*.



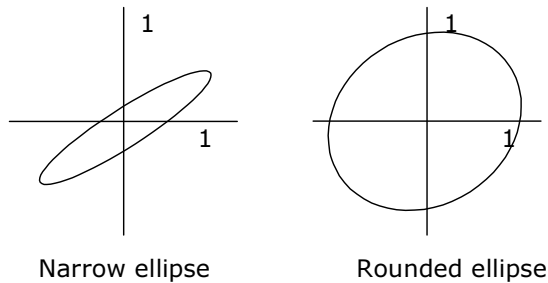
**Figure 5-13:** Ellipse Size

Furthermore, it gives information about which direction the patient moved. The major axis of the ellipse is aligned with the primary direction of movement (Figure 5-14).



**Figure 5-14:** Primary Direction of Movement

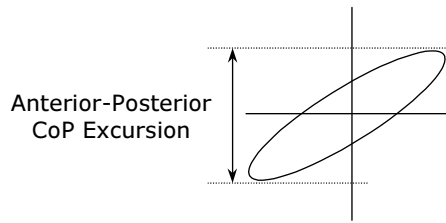
The aspect ratio of the ellipse (ratio between minor and major axes) gives an indication of the directionality of the movement (Figure 5-15). A narrow ellipse indicates that the movement was primarily along one direction, whereas a more rounded ellipse indicates that the movement did not have a well-defined primary direction.



**Figure 5-15:** Ellipse Shape

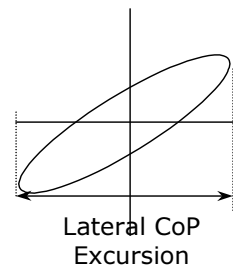
The numerical values for the results are all referred to the statistical analysis conventionally done on the Center of Pressure path: the 95% confidence ellipse. For each test (Normal Stability - Eyes Open (NS-EO), Normal Stability - Eyes Closed (NS-EC), Perturbed Stability - Eyes Open (PS-EO), Perturbed Stability - Eyes Closed (PS-EC)), the parameters considered are the following:

**Anterior-Posterior CoP Excursion**, the length of the projection of the ellipse on the vertical axis (Figure 5-16). It is an indication of the magnitude of the movement in the sagittal plane; the smaller the value the better.



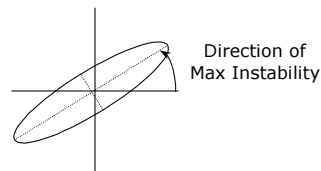
**Figure 5-16:** Anterior-Posterior CoP Excursion

**Lateral CoP Excursion**, the length of the projection of the ellipse on the horizontal axis (Figure 5-17). It is an indication of the magnitude of the movement in the lateral plane; the smaller the value the better.



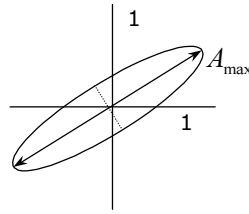
**Figure 5-17:** Lateral CoP Excursion

**Direction of Max Instability**, the amount of counterclockwise rotation necessary to bring the horizontal axis to the major semi-axis of the ellipse, expressed in degrees (Figure 5-18). It is an indication of the primary direction of movement. It can have any value. For example, 0° indicates that the direction of maximum instability is to the forward, whereas +90° indicates that the direction of maximum instability is to the right (by convention **positive** angles are to the **right**).



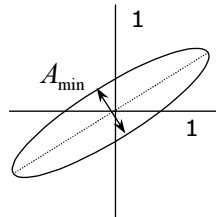
**Figure 5-18:** Direction of Maximum Instability

**Max CoP Excursion**, the major axis of the ellipse  $A_{max}$  (along the axis of maximum standard deviation, Figure 5-19). It is an indication of the magnitude of the movement in the direction of maximum movement; the smaller the value the better.



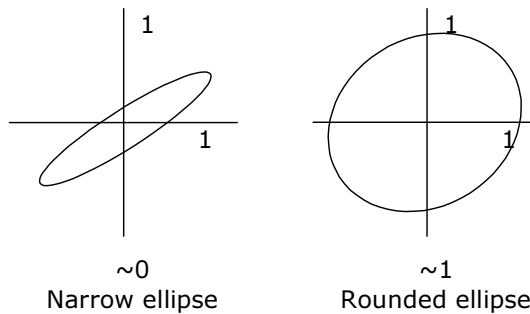
**Figure 5-19:** Ellipse Major Axis

**Min CoP Excursion**, the minor axis of the ellipse  $A_{\min}$  (along the axis of minimum standard deviation, Figure 5-20). It is an indication of the magnitude of the movement in the direction of minimum movement; the smaller the value the better.



**Figure 5-20:** Ellipse Minor Axis

**Min/Max CoP Excursion Ratio**, the aspect ratio of the ellipse (ratio between minor and major semi axes). It gives an indication of the directionality of the movement. It can have any value between 0 and 1. A number closer to 0, corresponding to a narrow ellipse, indicates that the movement was primarily along one direction. A number closer to 1, corresponding to a more rounded ellipse, indicates that the movement did not have a well-defined primary direction (Figure 5-21).



**Figure 5-21:** Min / Max CoP Excursion Ratio

**Max Standard Stability Used**, a score of the patient's ability to maintain balance during the test. It is calculated by the FallTrak software as

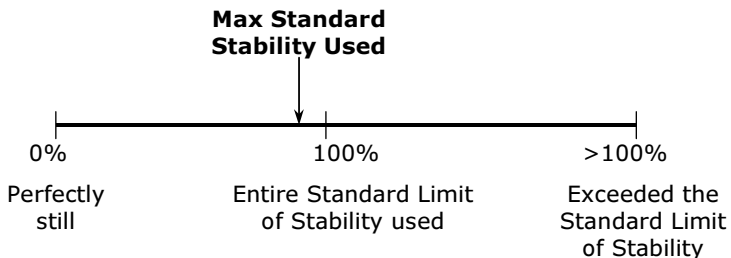
$$\frac{A_{\max}}{S_{\text{standard}}} \%$$

where  $A_{\max}$  is the major semi axis of the 95% confidence ellipse and  $S_{\text{standard}}$  represents the Standard Limit of Stability and it is calculated as

$$S_{\text{standard}} = 0.55H \sin 6.25^\circ$$

where  $H$  is the patient's height (Bioastronautics Data Book, NASA, 1962).

It represents how much of the Standard Limit of Stability was used during the test in the direction of maximum movement. The smaller the value the better. 100% indicates that the patient used the entire Standard Limit of Stability during that particular test. 0% indicates that the patient maintained perfect stillness (although it might be a sign of an incorrectly performed test). A value less than 100% indicates that the patient moved less than the Standard Limit of Stability, and therefore the patient has some stability margin left before losing balance, compared to the standard. A value greater than 100% indicates that the patient exceeded the Standard Limit of Stability, and, theoretically, the patient was unable to maintain any balance during the test (Figure 5-22).



**Figure 5-22:** Max Standard Stability Used

**Min Standard Stability Used**, a score of the patient's ability to maintain balance during the test. It is calculated by the FallTrak™ software as

$$\frac{A_{\min}}{S_{\text{standard}}} \%$$

where  $A_{\min}$  is the minor semi axis of the 95% confidence ellipse and  $S_{\text{standard}}$  represents the Standard Limit of Stability, calculated as

$$S_{\text{standard}} = 0.55H \sin 6.25^\circ$$

where  $H$  is the patient's height (Bioastronautics Data Book, NASA, 1962).

It represents how much of the Standard Limit of Stability was used during the test in the direction of minimum movement. The smaller the value the

better. 100% indicates that the patient used the entire Standard Limit of Stability during that particular test. 0% indicates that the patient maintained perfect stillness (although it might be a sign of an incorrectly performed test). A value less than 100% indicates that the patient moved less than the Standard Limit of Stability, and therefore the patient has some stability margin left before losing balance, compared to the standard. A value greater than 100% indicates that the patient exceeded the Standard Limit of Stability, and, theoretically, the patient was unable to maintain any balance during the test (Figure 5-23).

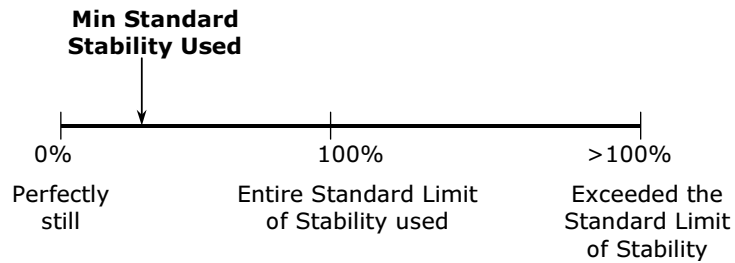


Figure 5-23: Min Standard Stability Used

**Stability Score**, a score of the patient's ability to maintain balance during the test. It is calculated by the FallTrak™ software as

$$\frac{S_{standard} - A_{max}}{S_{standard}} \%$$

where  $A_{max}$  is the major semi axis of the 95% confidence ellipse and  $S_{standard}$  represents the Standard Limit of Stability, calculated as

$$S_{standard} = 0.55H \sin 6.25^\circ$$

where  $H$  is the patient's height (Bioastronautics Data Book, NASA, 1962).

It can have any value between 0% and 100%; the larger the value the better. 100% indicates that the patient was able to maintain perfect stillness. 0% indicates that the patient used all the Standard Limit of Stability during the test, and, theoretically, the patient was unable to maintain any balance during the test.

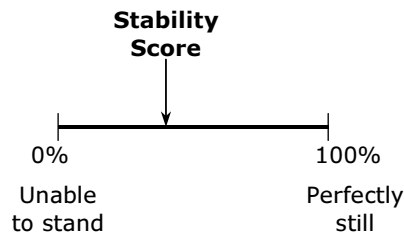


Figure 5-24: Stability Score



On the Physician Report, the line below the Stability Scores displays the **Normative Values for Age Matched Average Score** of healthy persons. The two lines below the normative values display the lower bounds for 2 and 3 Standard Deviations (SD) from the Age Matched Average Score. The Stability Scores of the patient is highlighted with the same color matching normative values indicated by the color bars next to the Average Score and its standard deviations. In other words, **green** for Stability Scores above (Average Score - 2\*SD), **yellow** between (Average Score - 2\*SD) and (Average Score - 3\*SD), **red** for less than (Average Score - 3\*SD).



- ❑ **The Age Matched Average Score information is provided to facilitate the comparison of a patient's Stability Scores with the normative values, but does not constitute a clinical interpretation. Such an interpretation can only be made by a qualified person.**
- ❑ **A full table of Age Matched Average Scores is given in Appendix C.**

### ***Patient Report***

The **Patient Report** consists of four pages and displays only the four graphs shown in the **Standing Stability Physician Report** and the corresponding Stability Scores for each test. Brief descriptions for the meaning of the test results are also given at the bottom of each page. A sample printout of the Standing Stability Patient Report is given in Appendix B.

## **5.6. Balance Training**

The Balance Training sessions can be started in three alternative ways:

- ❑ in the **Session** window shown in Figure 5-25, highlight the Training option in the list and click "**Run**" button.
- ❑ **double click** the Training option in the Session window.
- ❑ in the **Perturbed Stability – Eyes Closed** test page, click the "**Next**" button.



**A valid patient Height should be entered in the Session window in order to start the Balance Training sessions. Entering an invalid height will cause a warning message to pop up.**

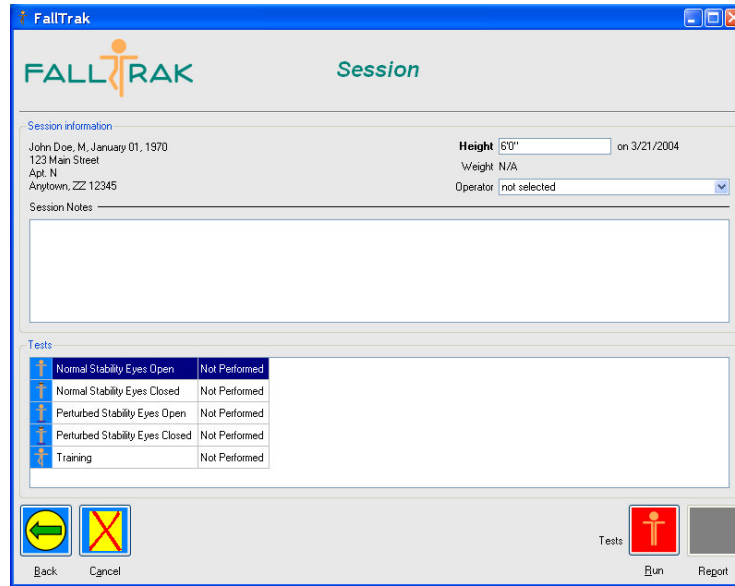


Figure 5-25: Session Page

## Neutral Position

While a person is standing still at a **neutral**, erect posture, the projection of the body Center of Gravity (CoG) is in front of the line connecting the medial malleoli as shown in Figure 5-26.

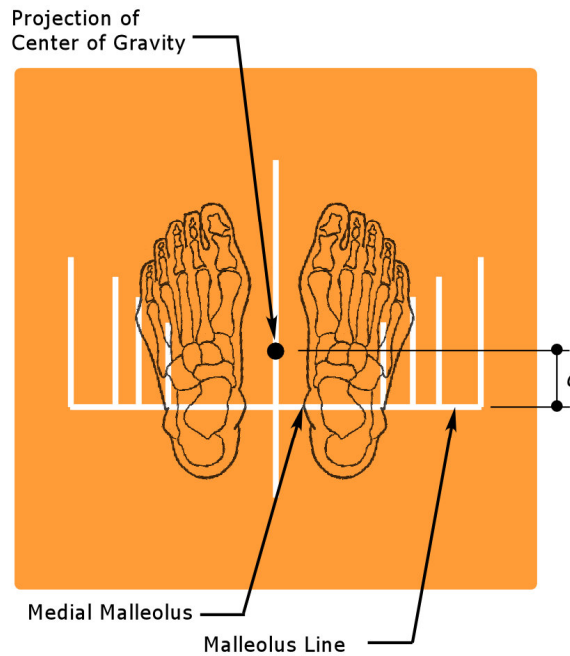


Figure 5-26: Neutral Position of the Projection for the Body Center of Gravity while Standing at an Erect Posture.

The distance “*d*” shown in Figure 5-26 is proportional to the height of the subject. Therefore, following the guidelines for foot positioning is important in balance training sessions. For training the same procedure as in Balance Assessment tests should be followed. The feet should be positioned as shown in Figure 3-5.



**Especially, alignment of the medial malleoli with the malleolus line is very important for establishing the neutral position and offset of the target rectangle for all training sessions.**

## Static Balance Training

The first session of the balance training module is the Static Balance Training, which aims to facilitate the patient’s ability to keep the body Center of Gravity (CoG) confined in a rectangular area at a certain posture. The Static Balance Training window is shown below. The green square area representing the balance platform is divided into four quadrants by two perpendicular lines. The intersection point of these two lines is the **Neutral Position** as described in the previous section.

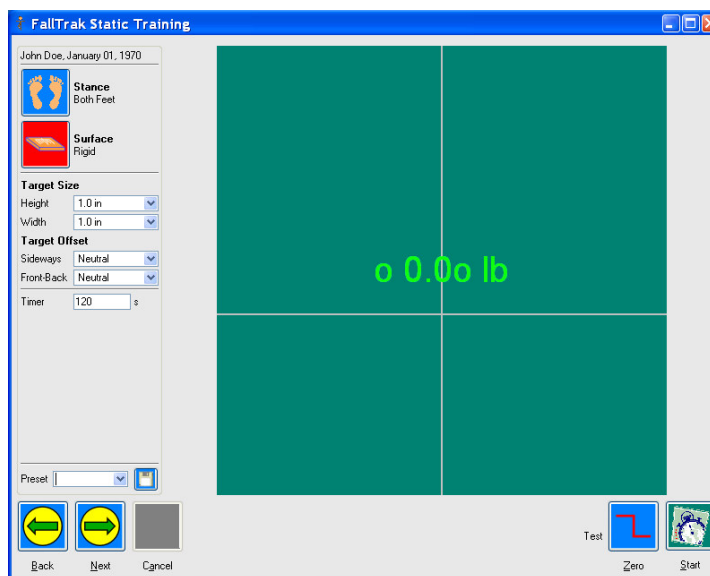
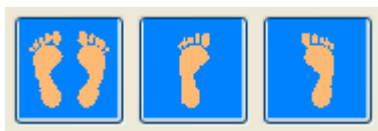


Figure 5-27: Static Balance Training Window

### Training Parameters

The panel on the left lists the options available for training. The body CoG is displayed in the green square area. The following parameters are available for the training:

- **Stance:** This button is used to select between bilateral and unilateral stance options for training. Clicking this button will display “**Both Feet**”, “**Left Foot**” and “**Right Foot**” options as icons shown below. Click the icon corresponding to the stance option you want to choose.



- ❑ **Surface:** Static Balance Training can be performed on the Balance Platform surface (“**Rigid**” option) or on a compliant surface on the Perturbed Balance Surface (“**Compliant**” option). Clicking on the button will display the options below. Click on the icon you want to choose.



- ❑ **Target Size:** The size of the rectangular target area is adjustable so that the challenge of training for the patient can be varied as rehabilitation progresses. The width and height of this area can be altered independently. Select from the dropdown list the height and width of the rectangular target area. Available sizes are: 1.0, 2.0, 2.5, and 3.0 inches.
- ❑ **Target Offset:** The FallTrak™ balance training system assumes that, while a person is standing erect at a neutral posture, the downward projection of his/her center of gravity is a point on the floor in front of the line connecting the two malleoli (see Figure 5-26). The distance between “*d*” the projection point and the malleolus line is proportional to the height of the patient. If the target offset is selected as “**Neutral**” for both directions, the rectangular target area is centered around this neutral projection point, which is the intersection of the two perpendicular lines in the green area on the screen. It is possible to move the target area in the front-back and sideways directions. Selecting the target offset different than neutral will shift the center of the target area by a percentage amount of the patient’s limits of stability, which is also proportional with height. The options for the target offset are: **Neutral, 25%, 50% and 75%**.
- ❑ **Timer:** The time duration specified in seconds determines the period, where the cross-shaped CoG marker should be hold in the rectangular target area. The countdown from the specified time to zero is performed in a cumulative manner, i.e. if the cross exits the target area during training, the countdown pauses until the cross reenters the target area. Therefore, the **total** time the cross cursor is in the target area (continuously or intermittently) adds up to the duration specified by **Timer** parameter.

### ***Training Session***

The weight display in the Static Balance Training window displays the weight on the balance platform. If the platform is unloaded the system will calibrate itself and self-calibration marks (“**o**”) will appear next to the load

value (e.g. 00.00 lb). Before starting training, make sure that the self-calibration marks appear in the load display when the plate is unloaded.



The system is designed to perform self-calibration if the load is under a certain value (approx. 8 lb). Therefore, when the perturbed balance surface is put on the balance platform the system might not calibrate itself automatically. In such a case, click the "Zero" button for manual calibration after positioning the perturbed balance surface on the balance platform.



After the patient steps onto the balance platform, before starting training, make sure that the cursor representing the Center of Gravity ("+") is approximately at the Neutral Position (intersection of the two perpendicular lines on the green test screen) when the patient is standing at an erect, neutral posture.

After clicking the "Start" button to begin training, a rectangular target area appears on the screen. The size of the target area is determined by the parameters set in the "Target Size" option. The center of the target area is offset with respect to the neutral position by an amount specified in the "Target Offset" parameter.

When the Center of Gravity cursor, "+", is outside of the rectangular target area, the rectangle is displayed in "red" color. Shifting the cross cursor into the rectangle changes its color to "yellow". The timer, displayed at the upper left corner counts down only when the rectangle is yellow.

When the timer counts down to zero, training session terminates automatically. After the training is started, the "Start" button transforms into a "Stop" button. It is always possible to click the "Stop" button during training and terminate manually.

The Static Balance Training configuration parameters can be saved using the "Preset" option shown in Figure 5-28. Enter a name for the configuration to be saved, and click on the "Save" button (button with a floppy disk icon on it). Next time you open a Static Balance Training session, you can select from the Preset dropdown menu a previously saved configuration to save time in setting training session parameters. The maximum number of configuration settings that can be saved is 16.

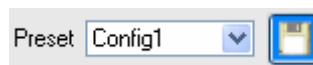


Figure 5-28: Use Preset Option to Save Training Parameters

Clicking the "Back" button opens the "Perturbed Stability – Eyes Closed" test page, and clicking the "Next" button starts the "Dynamic Balance Training".

## Dynamic Balance Training

This training session is designed to facilitate patients' ability to control their Center of Gravity (**CoG**) under dynamic conditions. Patients are either required to follow a moving target with their CoG, or move their CoG along a specific path. The Dynamic Balance Training window is depicted below. The green square area representing the balance platform is divided into four quadrants by two perpendicular lines. The intersection point of these two lines is the **Neutral Position** as described above.

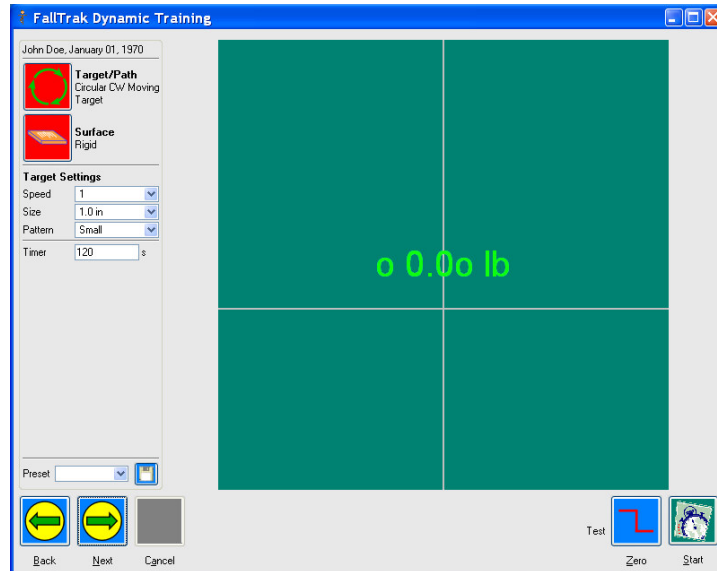
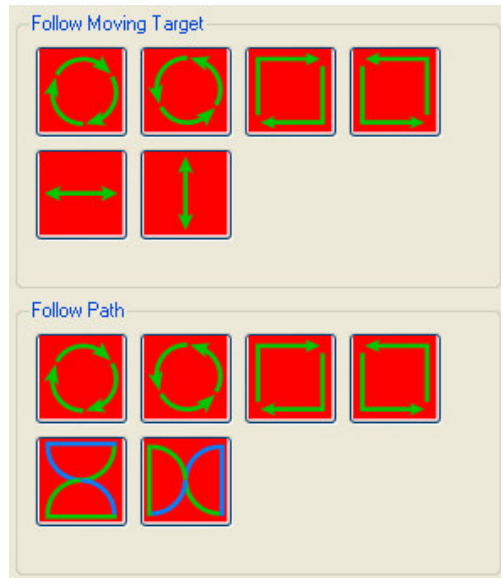


Figure 5-29: Dynamic Balance Training Window

### Training Parameters

The panel on the left lists the options available for training. The body CoG is displayed in the green square area. The following parameters are available for training:

- **Target/Path:** This option is used to select between the "Follow Moving Target" and "Follow Path" alternatives. Clicking the button displays the available options for training as shown in Figure 5-30. For "Follow Moving Target" option, the patient is required to follow a target moving along the selected path with his/her CoG. Available options are: **circular-clockwise**, **circular-counter clockwise**, **rectangular-clockwise**, **rectangular-counter clockwise**, **sideways** and **forward-backward**. For the "Follow Path" option, the patient moves the CoG along the displayed pattern at his/her own pace. Available patterns are: **circular**, **rectangular**, **hourglass** and **butterfly**.



**Figure 5-30:** Patterns Available for Dynamic Balance Training

- ❑ **Surface:** Dynamic Balance Training can be performed on the Balance Platform surface (“**Rigid**” option) or on a compliant surface on the Perturbed Balance Surface (“**Compliant**” option). Clicking on the button will display the options below. Click on the icon you want to choose.



- ❑ **Target Speed:** This option sets the target speed for “Follow Moving Target” option (refer to Target/Path option above). If training is performed with the “Follow Path” option this setting has no effect. Available speeds range from 1 to 10, 1 being the slowest.
- ❑ **Target Size:** The target area is a square where the size is selected by the clinician.
- ❑ **Pattern:** Using this parameter the size of the path, along which the CoG is required to move, can be adjusted. Three options are available: *small*, *medium* and *large*. Depending on the selected pattern size, either the target moves along a larger path (Follow Moving Target training), or a larger path is displayed (Follow Path training).
- ❑ **Timer:** The time duration specified in seconds sets the total training time for the patient. After the “Start” button is pressed, a timer appears at the upper left corner of the screen and counts down to zero.

The weight display in the Dynamic Balance Training window displays the weight on the balance platform. If the platform is unloaded the system will

calibrate itself and self-calibration marks ("o") will appear next to the load value (e.g. **o0.0o lb**). **Before starting training, make sure that the self-calibration marks appear in the load display when the plate is unloaded.**



**The system is designed to perform self-calibration if the load is under a certain value (approx. 8 lb). Therefore, when the perturbed balance surface is put on the balance platform the system might not calibrate itself automatically. In such a case, click the "Zero" button for manual calibration after positioning the perturbed balance surface on the balance platform.**



**After the patient steps onto the balance platform, before starting training, make sure that the cursor representing the Center of Gravity ("+") is approximately at the Neutral Position (intersection of the two perpendicular lines on the green test screen) when the patient is standing at an erect, neutral posture.**

### ***"Follow Moving Target" Training***

After clicking the **"Start"** button to begin training, a square target area appears on the screen. The size of the target area is determined by the size parameter set in the **"Target Size"** option. The shape of the path along which the square target area moves and movement direction is set by the Target/Path option, i.e. circular, rectangular and straight line (forward-backward and sideways). The Target Speed parameter will set the speed of the moving target.

During training, when the Center of Gravity cursor, "+", is outside of the square target area, the square is displayed in **"red"** color. Shifting the cross cursor into the rectangle changes its color to **"yellow"**. Training session terminates automatically after the timer, displayed at the upper left corner, counts down to zero. After training is started, the **"Start"** button transforms into a **"Stop"** button. It is always possible to click the **"Stop"** button during training and terminate manually.

### ***"Follow Path" Training***

After clicking the **"Start"** button to begin training, the pattern selected in the Target/Path option appears on the screen. The patient is required to move the Center of Gravity represented by the "+" cursor on the path. The size of the pattern is determined by the "Pattern" parameter (small, medium or large). Training session terminates automatically after the timer, displayed at the upper left corner, counts down to zero. After training is started, the **"Start"** button transforms into a **"Stop"** button. It is always possible to click the **"Stop"** button during training and terminate manually.

The Dynamic Balance Training configuration parameters can be saved using the **"Preset"** option shown in Figure 5-28. Enter a name for the



configuration to be saved, and click on the “**Save**” button (button with a floppy disk icon on it). Next time you open a Dynamic Balance Training session, you can select from the Preset dropdown menu a previously saved configuration to save time in setting training session parameters. The maximum number of configuration settings that can be saved is 16.

Clicking the “**Back**” button opens the “Static Stability Training” window, and clicking the “**Next**” button starts the “Limit of Stability Training”.

## Limit of Stability Training

The Limit of Stability Training session aims to facilitate the patient’s ability to voluntarily shift the body center of gravity (CoG) to specific locations and maintain the body at that location for a specified amount of time. The objective of the session is to improve reaction time and increase sway velocity of the patient while shifting the CoG of the body. The green square area representing the balance platform is divided into four quadrants by two perpendicular lines. The intersection point of these two lines is the **Neutral Position** as described above.

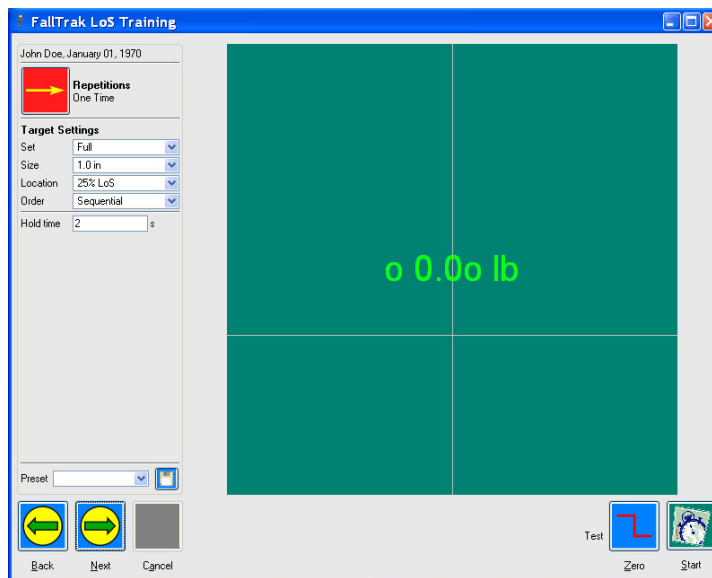


Figure 5-31: Limit of Stability (LoS) Training Window

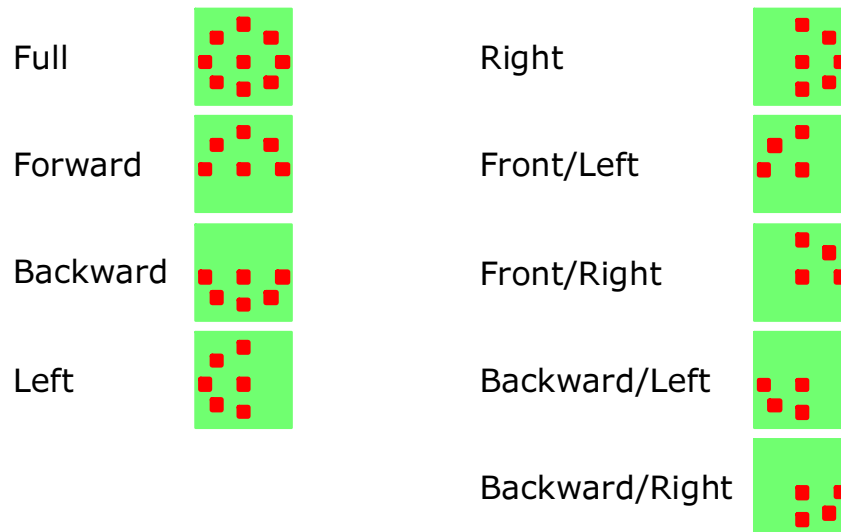
### Training Parameters

The panel on the left lists the options available for training. The body CoG is displayed in the green square area. The following parameters are available for training:

- **Repetitions:** Two options are available; *One Time* and *Continuous*. If **One Time** option is selected, each target in the selected target set appears once and training terminates automatically after each target is hit by the patient once. If **Continuous** option is chosen, then the

targets in the selected target set appear over and over until training is stopped manually by clicking the “**Stop**” button.

- ❑ **Target Set:** Limit of Stability training targets consist of a central target at the neutral position, and several targets dispersed around the neutral position. Nine different target sets are available as shown in Figure 5-32: Full, Forward, Backward, Left, Right, Front/Left, Front/Right, Backward/Left and Backward/Right. Different target sets aim to train the patient into different directions (e.g. right side of a hemiplegic patient).



**Figure 5-32:** Limit of Stability Training Target Sets

- ❑ **Target Size:** The target areas are squares where the size is selected by the clinician.
- ❑ **Target Location:** The distance of the surrounding targets from the neutral position (central target) can be adjusted to vary training challenge to the patient. Targets can be put at 25%, 50%, 75%, 90% and 100% of the Limit of Stability of the patient. For 100% the targets are positioned at the outer limits of the Limit of Stability of the patient (the Limit of Stability of the patient is computed based on his/her height).
- ❑ **Target Order:** During training the targets can be made to appear either **Sequentially** or in a **Random** fashion.
- ❑ **Hold Time:** Duration specified for this parameter determines how long the patient should keep the CoG cursor (“+”) in the highlighted target area before the next target highlights.



**After the patient steps onto the balance platform, before starting training, make sure that the cursor representing the Center of Gravity (“+”) is approximately at the Neutral Position (intersection of the two perpendicular lines on the green test screen) when the patient is standing at an erect, neutral posture.**

## Training Session

After clicking the **Start** button to begin training, the selected target set appears on the screen. The active target is highlighted in **red** color, and the other targets are visible but grayed out. As soon as the CoG cursor ("+") enters the square target area, its color turns to **yellow**. The patient should hold the Center of Gravity (**CoG**) cursor in the target area for the time duration specified by the Hold Time parameter. The next target highlights immediately after the Hold Time expires.

If the **Repetitions** option is set to "One Time", each target will appear once and training will terminate automatically. In case "Continuous" option is chosen for Repetitions, training will go on until **Stop** button is clicked.

The objective of Limit of Stability training is to shift body CoG as quickly as possible to the highlighted target, and hold in the target area as still as possible. Similar to the Static Balance Training session, the time in the target area is computed in a cumulative manner, i.e. the in order the next target to highlight the **total time**, the "+" cursor is in the target area, should add up to Hold Time.

The Limit of Stability Training configuration parameters can be saved using the **Preset** option shown in Figure 5-28. Enter a name for the configuration to be saved, and click on the **Save** button (button with a floppy disk icon on it). Next time you open a Limit of Stability Training session, you can select from the Preset dropdown menu a previously saved configuration to save time in setting training session parameters. The maximum number of configuration settings that can be saved is 16.

Clicking the **Back** button opens the "Dynamic Stability Training" window, and clicking the **Next** button returns to the Session Window.

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## 5.7. Balance Training Session Reports

After any of the three training sessions is performed the results can be viewed as a report. The status of the Training session on the **Session Window** turns to "Performed" after a training is completed as shown in Figure 5-33. Highlight the "Training" option by clicking on it once, and then click the **Report** button to display Training Session reports.

The result of each training is displayed on a single page. The report has the same cover sheet as the assessment reports, which can be hidden by unchecking the "Cover Sheet" option at the bottom of the screen (refer to Figure 5-34). The result for each training is presented in both graphical and tabular form. The graphs depict the target and the trace of patient's Center of Gravity (CoG) during training. Beneath the graph is a table displaying the score and training session parameters. The reports are displayed in the order they are performed. **Appendix B** displays sample reports for the Balance Training sessions of the FallTrak™ system.

As long as the current session is not terminated by clicking the "Back" or "Cancel" button shown in Figure 5-33, the results for any subsequent training performed will be appended to the existing reports.

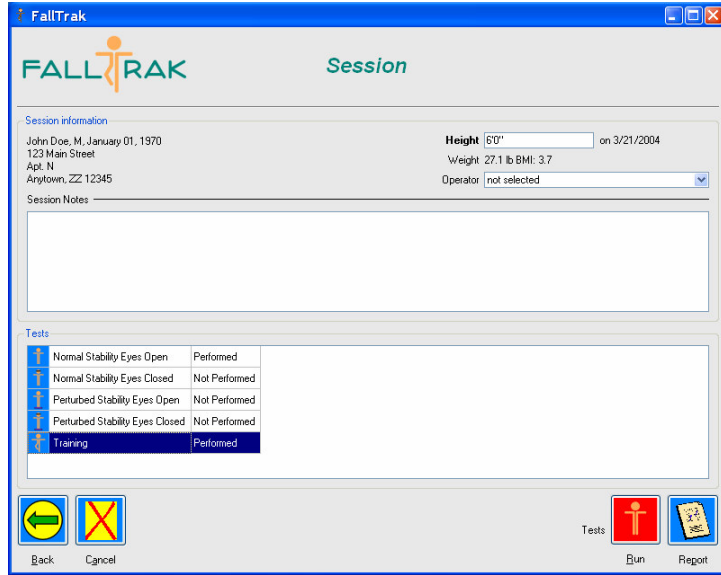


Figure 5-33: Session Window

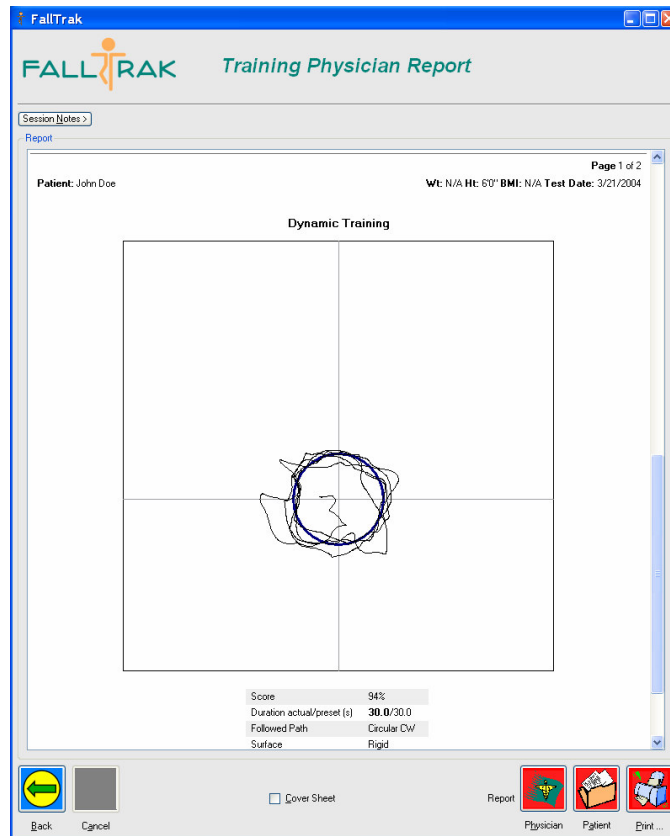


Figure 5-34: Training Sessions Report Page

## Scores

Scores displayed in the reports can be used to evaluate the progress of the patient undergoing rehabilitation training. The score for each training is based on the objective of the training session.

### ***Static Stability Training***

During Static Balance Training, the timer clock does not count down when the patient's Center of Gravity (CoG) is not in the target area. Therefore, the actual time to complete training is usually longer than the parameter set in the **Timer** option. The score is calculated as a percentage of the ratio of preset timer duration to the actual training duration. For example if the Timer is set to 60 seconds and the patient completes the training in 75 seconds then the score will be:

$$\text{Score} = 60/75 \times 100 = \mathbf{80\%}$$

The table in the report also displays the actual and preset timer durations below the score value.

### ***Dynamic Stability Training***

For "**Follow Moving Target**" training, the score is computed based on the average distance of the CoG to the center of the square target. If the CoG (the "+" cursor) is close to the center of the target the score is close to 100%.

For "**Follow Path**" training, the score is calculated as an average distance of the CoG from the displayed path pattern. If the CoG stays close to the path, scores tend to be high (closer to 100%).

### ***Limit of Stability Training***

For the Limit of Stability training, patient performance is evaluated by two different parameters. The first parameter is a percentage score value, which is an averaged indicator of how stable the patient was in each individual target. Similar to the Static Stability training, the time spent for an individual target may be longer than the time specified for the **Hold Time** parameter. The score value is an averaged value of the ratio of the total hold time (number of targets x hold time) to the total training time.

The second parameter displayed as the "**Average Latency**" is a measure of the patient's reaction time to the visual cue for the next target. It is computed as an averaged latency of the patient to react to the next target (time from the instant the next target highlights to the instant the CoG leaves the current target).



**Note that the training scores should NOT be used as an assessment parameter for the overall balance of the patient. Training scores are intended as a tool to evaluate a patient's improvement on the FallTrak™ system as rehabilitation progresses. Visual inspection of the CoG traces is also a valuable tool to evaluate progress qualitatively.**

# Appendix A. Glossary of Terms

## **95% Confidence Ellipse**

The ellipse containing 95% of the Center of Pressure points. It is determined by multiplying the standard deviation of the coordinates of the Center of Pressure points by 1.96.

## **Anterior-Posterior CoP Excursion**

The amount of movement of the Center of Pressure in the sagittal plane. It is calculated as the projection of the 95% confidence ellipse on the sagittal axis.

## **Aspect Ratio**

The characteristic number for an ellipse equal to the minor axis divided by the major axis.

## **Center of Pressure (CoP)**

The point on the surface of the *FallTrak*<sup>™</sup> platform through which the ground reaction force acts. It corresponds to the projection of the subject's Center of Gravity on the platform surface when the subject is motionless.

## **Center of Pressure Path**

The trace of the Center of Pressure points on the platform.

## **Direction of Max Instability**

The direction in which the patient is less stable, and therefore most likely to fall. It corresponds to the angle between the patient's postero-anterior (forward) direction and the major axis of the ellipse. Angles to the left are indicated as negative numbers.

### **Direction of Min Instability**

The direction in which the patient is more stable, and therefore less likely to fall.

### **Lateral CoP Excursion**

The amount of movement of the Center of Pressure in the lateral plane. It is calculated as the projection of the 95% confidence ellipse on the lateral axis.

### **Lateral Plane**

A vertical plane through the longitudinal axis of the trunk dividing the body into front and back halves.

### **Limit of Stability**

How much the patient can move in the specified direction without losing balance.

### **Major Axis**

The larger axis of the ellipse.

### **Max Actual Stability Used**

How much of the patient's Limit of Stability was used by the patient in the Normal Stability - Eyes Open test in the patient's Direction of Maximum Instability.

### **Max CoP Excursion**

The maximum movement of the Center of Pressure in the Direction of Maximum Instability.

### **Max Standard Stability Used**

How much of the Standard Limit of Stability was used in the patient's Direction of Maximum Instability.

### **Min/Max CoP Excursion Ratio**

The ratio between the Minimum CoP Excursion and the Maximum CoP Excursion.



### **Min Actual Stability Used**

How much of the patient's Limit of Stability was used by the patient in the Normal Stability - Eyes Open test in the Direction of Minimum Instability.

### **Min CoP Excursion**

The maximum movement of the Center of Pressure in the direction of minimum instability.

### **Minor Axis**

The smaller axis of the ellipse.

### **Min Standard Stability Used**

How much of the Standard Limit of Stability was used in the Direction of Minimum Instability.

### **Neutral Position of Center of Gravity**

The position of the body's Center of Gravity when the patient is standing at the Neutral Posture.

### **Neutral Posture**

The posture the patient assumes when he/she is standing erect, at a comfortable position with the feet approximately shoulder width apart.

### **Normal Stability**

The patient's ability to stand still on a hard surface in a comfortable position with the feet symmetrically apart.

### **Perturbed Stability**

The patient's ability to stand still on a soft surface in a comfortable position with the feet symmetrically apart.

### **Sagittal Plane**

A vertical plane through the longitudinal axis of the trunk dividing the body into right and left halves.

### **Stability Score**

How much of the Standard Limit of Stability was used by the patient during the Normal or Perturbed Stability tests.

### **Standard Limit of Stability**

The Limit of Stability for a person of a certain height as defined by NASA (Bioastronautic Data Book, 1962).

### **Standard Normal Person**

A person that has the Standard Limit of Stability.

### **Test Protocol**

The series of five tests used to assess the patient's ability to maintain balance.

# Appendix B. Sample Reports



# Appendix C. Normative Data

**Table C-1** – Age Matched Normative Data for FallTrak™ Stability Scores  
(Average ± SD)

<b>AGE (years)</b>	<b>NSEO</b>	<b>NSEC</b>	<b>PSEO</b>	<b>PSEC</b>
0-19	92.4 ± 0.53	90.4 ± 0.63	88.2 ± 0.74	79.0 ± 1.32
20-29	93.6 ± 0.50	92.2 ± 0.60	89.6 ± 0.70	81.6 ± 1.25
30-39	92.5 ± 0.56	91.6 ± 0.68	87.6 ± 0.80	78.2 ± 1.46
40-49	93.4 ± 0.55	91.9 ± 0.66	88.3 ± 0.78	79.5 ± 1.38
50-59	91.9 ± 0.35	91.0 ± 0.58	86.3 ± 0.68	76.5 ± 1.21
60-69	91.7 ± 0.35	90.0 ± 0.43	85.4 ± 0.50	75.2 ± 0.89
70-79	92.0 ± 0.33	90.3 ± 0.40	83.4 ± 0.47	71.3 ± 0.84
80-89	92.3 ± 0.80	91.1 ± 0.96	77.7 ± 1.13	64.8 ± 2.00

**NSEO** : Normal Stability, Eyes Open

**NSEC** : Normal Stability, Eyes Closed

**PSEO** : Perturbed Stability, Eyes Open

**PSEC** : Perturbed Stability, Eyes Closed