

physio sensing

PhysioSensing Podo Software Manual

20.0.0.0



Welcome

Thank you for your confidence and preference on PhysioSensing!

The PhysioSensing platform has an advanced system of balance evaluation and it can also be used to evaluate the plantar pressure map. Therefore, you can use PhysioSensing as a stabilometric or barapodometric platform. It is important that you read this manual before using it so that you can maximize the potential of PhysioSensing in the right conditions.

We hope that this manual will be your first support in case of need, however, whenever you need contact us to info@sensingfuture.pt

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a greater step

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1. PC requirements & Quick installation

To install and use PhysioSensing Podo software, you should have a computer with the following characteristics:

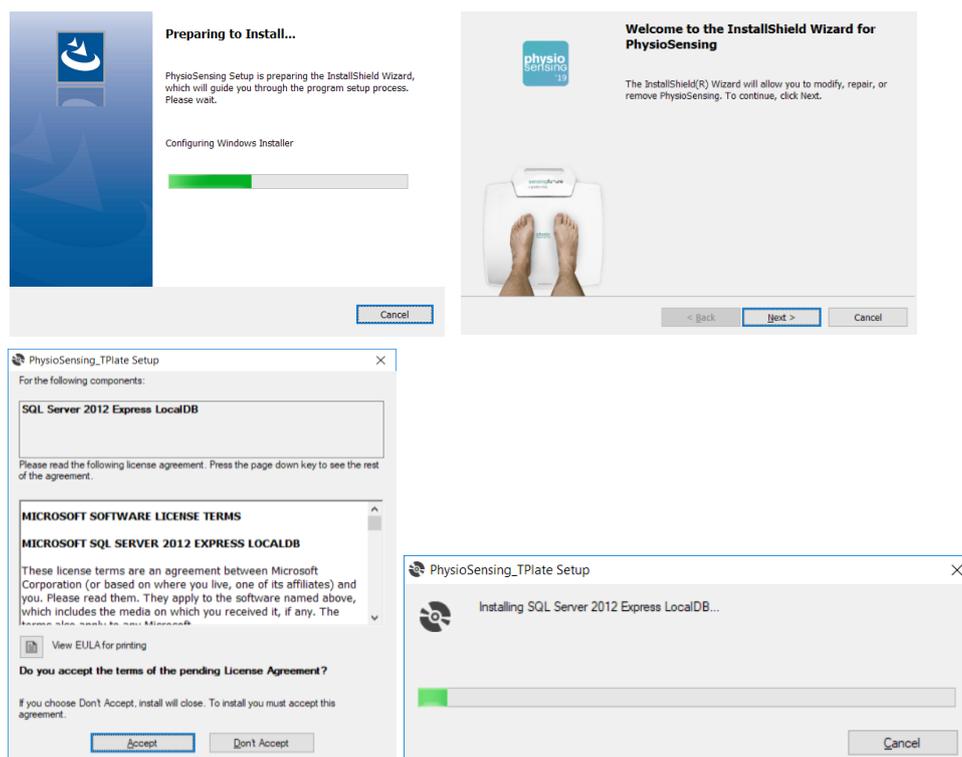
- Processor (CPU): Intel Core i3, Quad-Core, 2GHz (minimum)
Avoid 'U' versions processors - Ultra low power
- RAM: 4 GB (minimum)
- Operating System: Windows 7, 8 or 10 (32 or 64 bits)
- Minimum 2 USB 2.0 or 3.0 ports on the PC
- Recommended Resolution: 1080x720

The software is not compatible with Macintosh (Apple), Tablets, and All-in-One PC. When using a laptop, it is recommended to be plugged in while using the software (due to battery power saving options).

Before and during installation do not connect the platform to the computer. If you need help during the installation process we provide online, telephone or remote support.

Verify that you have WinRAR installed, after verifying that you have WinRAR installed, the steps to install the PhysioSensing Podo software are:

1. If you already installed another version of the PhysioSensing Podo software, uninstall it from the Control Panel. If you never installed a previous version go to the next step.
2. Click on setup.exe inside the folder PhysioSensing Podo and click Yes, Next and Install (see Figure 1). Several windows will appear and just click Accept, Next or Ok until it finishes the installation process.



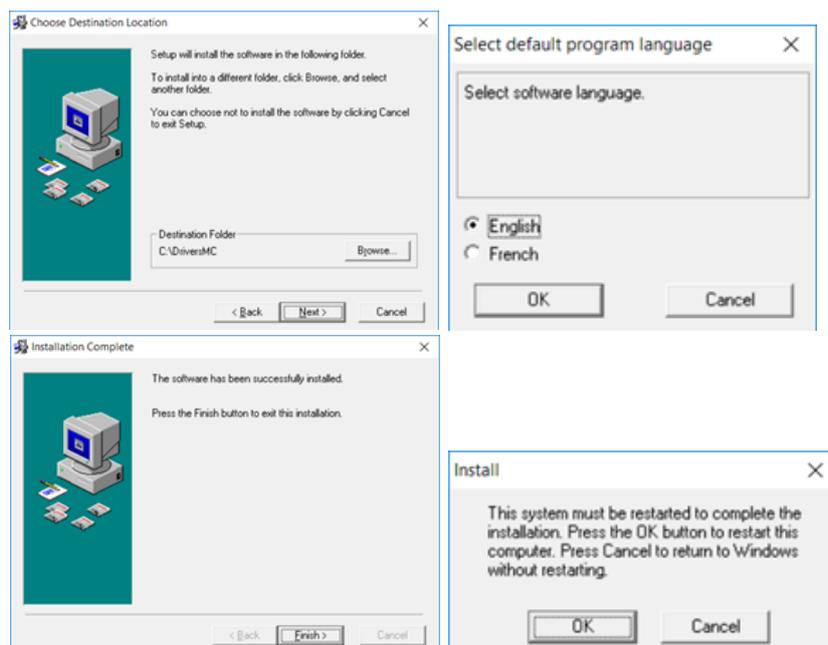


Figure 1 – PhysioSensing Podo installation windows.

3. To verify that the driver is installed, connect the USB cable to the computer in a USB 2.0 or 3.0 port and go to Device Manager and check if the “USB Serial Converter” exists on the Universal Serial Bus Controllers.
4. The installation is complete, the PhysioSensing Podo software is ready to be used.

2. PhysioSensing Podo software activation

To have full access to PhysioSensing Podo, first it must be activated. The activation key should be near to the PhysioSensing equipment. When running the PhysioSensing Podo, the first interface, in case the software is not activated yet, is the following interface (Figure 2). To activate the software, internet connection is required.

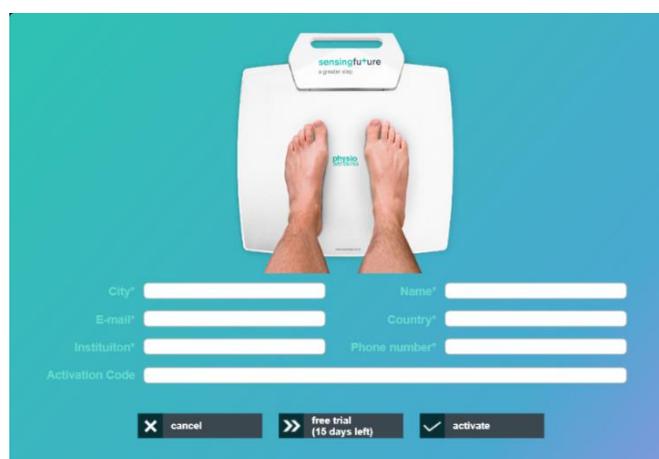


Figure 2 - Software activation interface.

For the activation process all input fields in the interface should be filled, as well as, the activation code supplied in the acquisition of PhysioSensing. After getting everything filled, click on Activate button. If the user does not yet have an activation key to activate PhysioSensing Podo, it is also possible to use PhysioSensing Podo during 15 days after installation by clicking on Free Trial button.

3. Start menu

PhysioSensing Podo was designed to be available for use in a short time period. In order to begin operation, it is necessary to ensure that the entire installation procedure has been carried out successfully. After starting the computer where the application is installed, it is necessary to click on the icon named PhysioSensing Podo to start the program. The first interface of the software (Figure 3) allows the health professional to quickly choose between the four exams available, that allow the identification of balance and gait disorders, and muscle strength problems in the lower limbs.

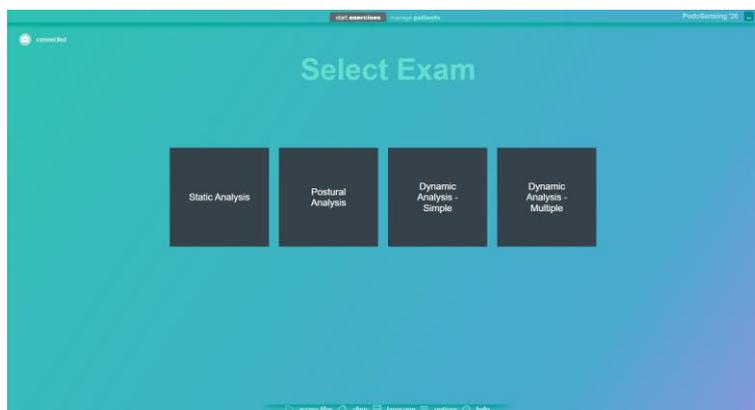


Figure 3 - Initial interface of PhysioSensing Podo.

3.1. Exams

The PhysioSensing Podo exams allow the evaluation of several characteristics of static balance and also gait. At the end of each exam an interface with the plantar pressure distribution and several results appears. In this interface the health professional can click Save and Export to save the results and generate a clinical report in PDF format.

In case the patient has previous sessions with the selected exam it also appears the option to view the progress between sessions through graphs and tables. These data can be exported in PDF format as a progress report.

In addition, two more tabs – parameters and clinical practice – appear in the results interface. In the first one is a table with the description of each parameter calculated in the exam, and in the latter some articles found in the scientific community about the clinical application and scientific evidence of the exam is listed.

1. Static Analysis

The Static Analysis protocol allows the plantar pressure distribution analysis on the sagittal and anteroposterior planes of a single (static) pressure image, dividing the pressure image on four quadrants. After recording the pressure image with the Start button several parameters appear regarding the pressure distribution on the four quadrants and the left panel options become available: Selection of view, Add measures and other lines Options (see Figure 4). In the pressure image, the left, global and right center of pressure also appear as 3 circles with a gray line connecting them, and the rotation degree between the left and right COP is displayed as well over the global COP (middle circle).

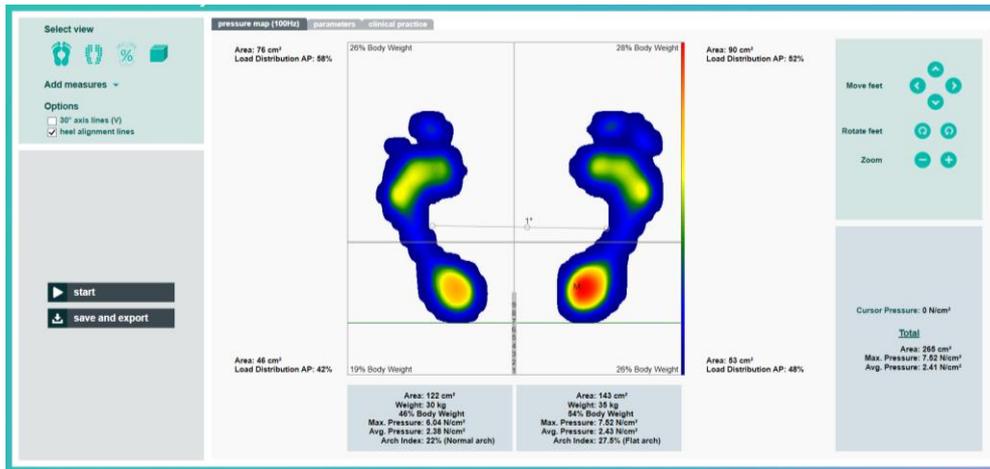


Figure 4- Static analysis interface on Standard view.

For each quadrant is calculated the surface area, load distribution on the anteroposterior plane and body weight percentage. A sagittal analysis is also available with each foot area, weight (in kilograms and expressed as body weight percentage), maximum and average pressure values, and the Arch Index with indication of the arch height (high, normal or flat). Moreover, the total feet area, maximum and average pressures are displayed on the right panel. In this panel is also possible to obtain the pressure in a specific point by placing the cursor over the desired point and some visualization tools – move feet (left, up, right or down), rotate feet (left or right) and zoom in and out.

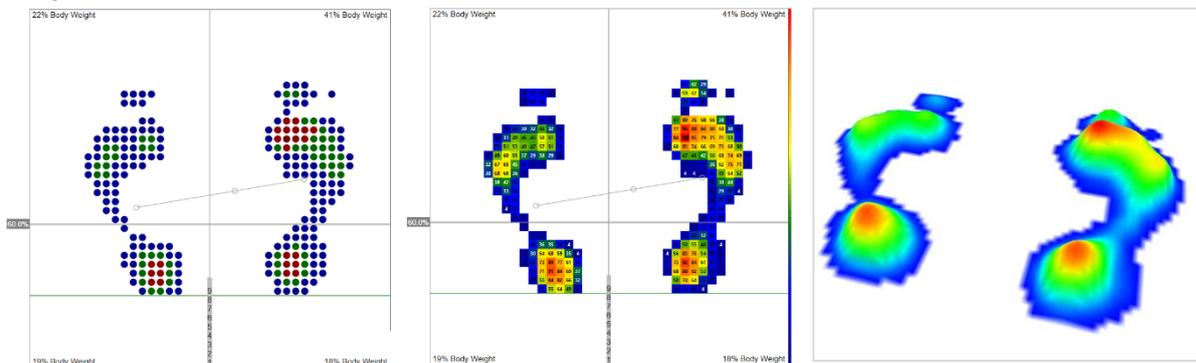


Figure 5 – Isopressure, Percents and 3D view.

On the left panel there are available four different views (Figure 4 and Figure 5) – Standard, Isopressure, Percents and 3D:

- The Standard view shows the pressure distribution with a color palette from blue to red, in which blue represents lower values of pressure and red represents higher values.
- The Isopressure view displays the pressure distribution with only three colors (red, green and blue), each one representing high, medium and low values of pressure, relative to the peak pressure.



Figure 6 – Threshold selection for Isopressure.

The threshold of each pressure level can be adjusted on the left panel. For example, using the default values displayed in Figure 6 the red dots correspond to the pressure values above 75% of the maximum pressure, the green dots correspond to pressures between 50% and 75% of the maximum pressure and the blue dots correspond to pressure values below 50% of the maximum pressure.

- The Percents view illustrates the pressure values expressed in percentage relative to the peak pressure.
- The 3D view shows the pressure distribution in 3 dimensions, so as to easily locate the maximum pressure zones.

When one of the first three views is selected the feet center of pressure is represented as well as the left and right foot center of pressure. A letter M also appears depicting the maximum pressure point. In addition, the anteroposterior line in gray can be adjusted by dragging the gray rectangle with a percentage value on the left side of the line. This value expresses the position of the line relative to the length of the platform active surface.

On those views, the Add Measures option on the left panel become available, in which several measures can be selected:

- Length: draws a line and calculates distance between the two points of the line (cm).
- Area: draws an ellipse and calculates the surface area within the ellipse (cm²).
- Angle: draws two lines and calculates the angle between the two lines (°).
- Pressure: obtains pressure on a specific point (kPa, g/cm² or N/cm²)¹.
- Zone: draws a rectangle and calculates the maximum pressure and surface area in the selected zone.
- Comment: writes the comment on a specific point.

To add a measure just click on the measure button and click (once) on the desired point over the pressure distribution. Depending on the measure, a line, ellipse or rectangle will appear after the first click. Then click on a second point to display the measure result. The Angle measure is the only exception, in which three clicks are necessary so as to draw the two lines. The measures added will not be saved on the PhysioSensing database but will appear on the clinical report.

After clicking on any measure button, the action can be cancelled by clicking on the Cancel button. Additionally, to clear a particular measure, select the measure on the Clear list box, or remove all added measures by clicking on Clear All button.

Regarding the lines Options on the left panel (Figure 7), the heel alignment lines appear by default on the first three views, but can be removed by deselecting the checkbox. The lines turn green when the left and right heel are aligned, otherwise appear in red. Furthermore, the 30° axis lines can be selected to show several lines with an angle of 30° on those views.

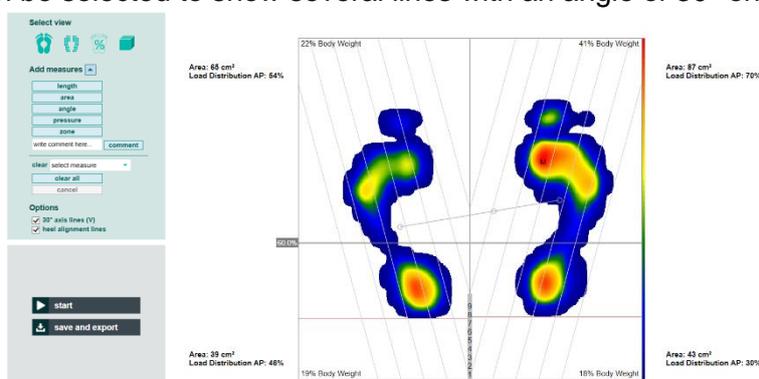


Figure 7 – Example of Standard view with 30° axis lines and heel alignment lines selected.

When the analysis is complete, the following results can be saved and generate a clinical report (Figure 8):

¹ According to the selected unit on the Software options (section 5).

Data	Description
Total Area	Total support surface (cm ²)
Left and right foot area	Support surface for left and right foot (cm ²)
Area per quadrant	Support surface for each quadrant (cm ²)
Load distribution anteroposterior per foot	Percentage of support in the front and back of each foot (%)
Left and right weight	Weight applied on the left and right foot (kg or lbs)
Body weight % per quadrant	Percentage of weight on each quadrant (%)
Left and right body weight %	Percentage of weight on each foot (%)
Maximum pressure	Maximum pressure point measured over both feet (kPa, N/cm ² or g/cm ²)
Left and right max. pressure	Maximum pressure point measured over the left and right foot (kPa, N/cm ² or g/cm ²)
Average pressure	Average pressure calculated over both feet (kPa, N/cm ² or g/cm ²)
Left and right avg. pressure	Average pressure calculated over the left and right foot (kPa, N/cm ² or g/cm ²)
COP Rotation Degree	Angle between left and right foot center of pressure (°)
Left and right Arch Index ²	Ratio of the midfoot area to the foot area (except toes), to evaluate the arch height

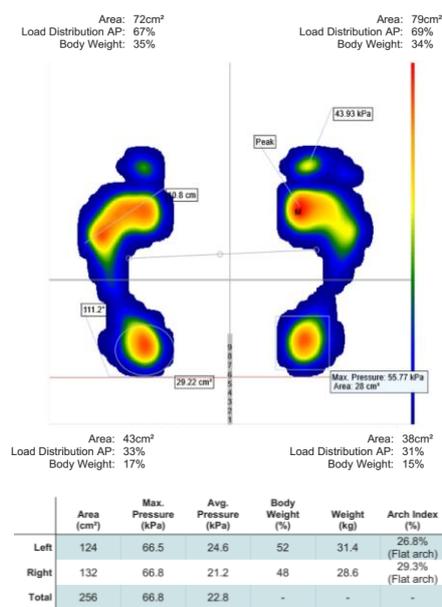


Figure 8 – Example of clinical report for the Static Analysis.

² The Arch Index output is based on the article: Cavanagh PR, Rodgers MM. (1987) The arch index: a useful measure from footprints. Journal of Biomechanics, 20(5), 547-51. doi: 10.1016/0021-9290(87)90255-7.

2. Postural Analysis

Use Postural Analysis to analyze the plantar pressure distribution and several characteristics of postural control during a pre-defined time. This exam allows selection of the frequency acquisition and duration of the exam. The maximum number of images allowed is 2400 to avoid performance issues. For longer test duration, lower values of frequency acquisition must be selected.

At the end of the exam, an interface with the plantar pressure map, and several parameters similar to Static Analysis exam are presented (Figure 9). In this exam, the feet image shown is the average data from all pressure distribution saved during the test. Moreover, two other tabs named Graphs and Table appear.

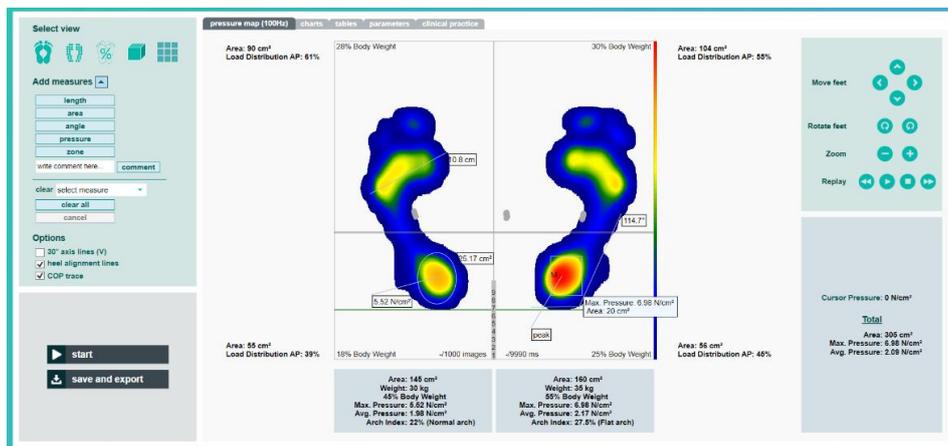


Figure 9 – Postural analysis interface on Standard view with several measures added.

As mentioned, the first tab shows all information just like in Static Analysis, from view selection and measures addition to several parameters for left and right foot and body weight distribution in the four quadrants. In this exam a new button appears in the Select View panel – the Mosaic view, which displays all the pressure distribution saved during the test in one view (Figure 10). In this view the zoom option is enabled to zoom in or zoom out all the feet images.

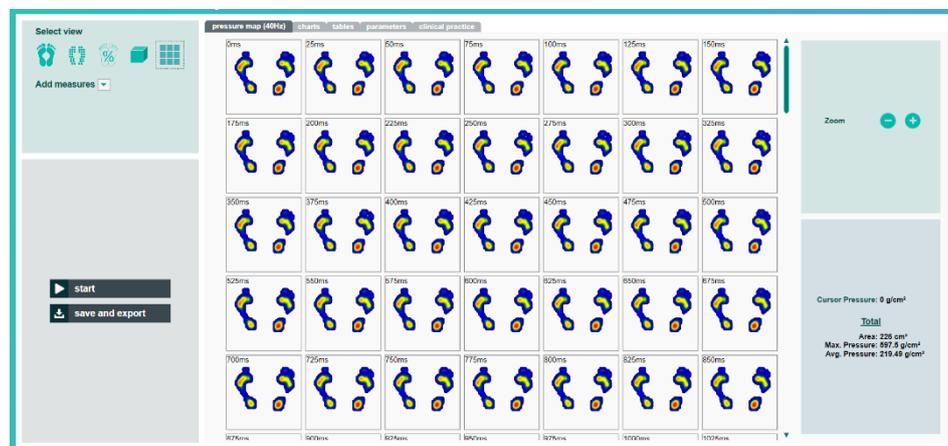


Figure 10 – Mosaic view.

Additionally, when one of the first three views is selected it is possible to use the Replay tool (in the upper right panel). This tool allows to view each pressure image saved, along with all the feet information (area, peak pressure, ...) and the center of pressure data during the test by clicking on play button, to pause in a specific timestamp (pause button), to see the next image (forward button) or the previous image (backward button). Also, the stop button allows

going back to view the average image. Moreover, in the left panel option the center of pressure trace appears by default on, but can be removed by deselecting the checkbox.

In Graphs tab, three statokinesigram (for global, left and right center of pressure), two stabilograms and two spectral analysis graphs (for the mediolateral and anteroposterior directions) and the center of pressure velocity graph can be analyzed (Figure 11).

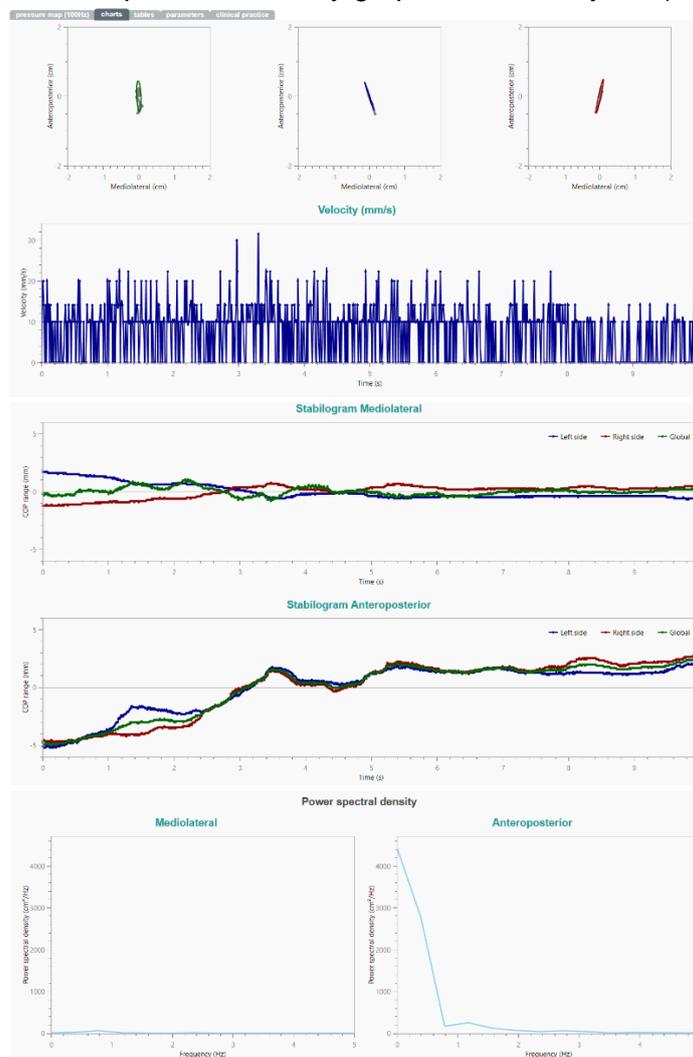


Figure 11 – Example of the Graphs tab.

At last, in Table tab the following parameters, obtained through the pressure center, are presented:

Data	Description
Ellipse area (95%)	Area of the prediction ellipse with 95% of the COP values, calculated with the principal component analysis method (mm ²)
Left ellipse area (95%)	Area of the prediction ellipse with 95% of the COP values on the left side of the platform, calculated with the principal component analysis method (mm ²)
Right ellipse area (95%)	Area of the prediction ellipse with 95% of the COP values on the right side of the platform, calculated with the principal component analysis method (mm ²)

COP displacement	Total length of the center of pressure path (mm)
COP displacement anteroposterior	Total length of the COP path in the anteroposterior direction (mm)
COP displacement mediolateral	Total length of the COP path in the mediolateral direction (mm)
COP displacement range anteroposterior	Distance between maximum and minimum COP values in the anteroposterior direction (mm)
COP displacement range mediolateral	Distance between maximum and minimum COP values in the mediolateral direction (mm)
Mean COP distance	Mean of the center of pressure trajectory (mm)
Standard deviation of COP	Dispersion of the distance travelled of the COP from the mean position during the test time (mm)
Mean COP anteroposterior distance	Mean of the COP trajectory in the anteroposterior direction (mm)
Mean COP mediolateral distance	Mean of the COP trajectory in the mediolateral direction (mm)
Standard deviation of COP anteroposterior	Dispersion of the distance travelled of the COP in the anteroposterior direction from the mean position during the test time (mm)
Standard deviation of COP mediolateral	Dispersion of the distance travelled of the COP in the mediolateral direction from the mean position during the test time (mm)
Anteroposterior root mean square	Square root of the mean square value of COP in the anteroposterior direction (mm)
Mediolateral root mean square	Square root of the mean square value of COP in the mediolateral direction (mm)
COP anteroposterior range	Distance between maximum and minimum displacement of COP values in the anteroposterior direction (mm)
COP mediolateral range	Distance between maximum and minimum displacement of COP values in the mediolateral direction (mm)
Mean velocity	Distance travelled by center of pressure divided by test time (mm/s)
Standard deviation of velocity	Dispersion of the COP velocity from the mean velocity during the test time (mm/s)
Mean anteroposterior velocity	COP distance travelled in the anteroposterior direction divided by test time (mm/s)
Mean mediolateral velocity	COP distance travelled in the mediolateral direction divided by test time (mm/s)
Displacement/Ellipse area	COP displacement divided by ellipse area (1/mm)
Trial time	Elapsed time: preset value in seconds. In the case of loss of balance, appears the time until the fall has occurred

In addition, through the Fourier transform it is possible to perform a frequency domain analysis for each COP direction (anteroposterior and mediolateral):

Data	Description
Peak frequency	Frequency with the highest amplitude among all frequencies that compose the spectrum
Mean frequency	Weighted average of the amplitude spectrum
Median frequency	Frequency that contains up to 50% of the total power spectrum
Frequency at 70.7%	Frequency that contains up to 70.7% of the total power spectrum
Frequency at 80%	Frequency that contains up to 80% of the total power spectrum
Frequency at 85%	Frequency that contains up to 85% of the total power spectrum
Frequency at 90%	Frequency that contains up to 90% of the total power spectrum
Frequency at 95%	Frequency that contains up to 95% of the total power spectrum
Frequency at 99%	Frequency that contains up to 99% of the total power spectrum

These results as well as the pressure, area and load distribution information (similar to the data table from Static Analysis) can be saved on the software database and exported for excel, as shown in Figure 12. A sheet with all the COP data will also be created. Moreover, a clinical report in PDF with all the results mentioned in the previous tables including the graphs from Graphs Tab can be generated (see Figure 13).

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Patient's details: Name: John Stuart Gender: Male Height: 1.68 m Weight: 72 kg Age: 59 ID: T04_10				Date: 28.05.2020						
parameter	Left	Right	Total	Time (ms)	Velocity (mm/s)	COP_ML (mm)	COP_AP (mm)	Frequency (Hz)	PSD ML (cm ² /Hz)	PSD AP (cm ² /Hz)
Area (cm ²)	145	160	305	0	0	-0,23	-4,81	0	12,94	4421,64
Max. Pressure (N/cm ²)	5,5	7	7	10	14,14	-0,13	-4,91	0,39	24,29	2764,31
Avg. Pressure (N/cm ²)	2	2,2	2,1	20	20	-0,33	-4,91	0,78	59,17	167,14
Body Weight (%)	45,4	54,6	-	30	20	-0,13	-4,91	1,17	13,74	251
Weight (kg)	29,5	35,5	-	40	10	-0,23	-4,91	1,56	5,16	119,97
Arch Index (%)	22%(Normal)	ari 27.5%(Flat)	-	50	0	-0,23	-4,91	1,96	0,43	64,77
parameter	Results			60	14,14	-0,13	-4,81	2,35	13,85	40,77
Ellipse area left (mm ²)	1,29			70	0	-0,13	-4,81	2,74	1,83	56,99
Ellipse area right (mm ²)	5			80	20	-0,33	-4,81	3,13	2,49	40,41
Ellipse area (mm ²)	8,35			90	14,14	-0,23	-4,91	3,52	1,07	9,46
COP displacement (mm)	75			100	10	-0,23	-4,81	3,91	2,3	21,26
COP displacement ML (mm)	52,2			110	14,14	-0,33	-4,91	4,3	0,54	16,6
COP displacement AP (mm)	32,6			120	0	-0,33	-4,91	4,69	0,08	13,74
Displacement range ML (mm)	1,9			130	14,14	-0,43	-4,81	5,08	0,06	13,45
Displacement range AP (mm)	7,3			140	14,14	-0,33	-4,91	5,47	0,04	11,23
Mean COP distance (mm)	109,41			150	0	-0,33	-4,91	5,87	0,15	7,5
Global analysis	Data	PSD		160	10	-0,43	-4,91	6,26	0,01	6,42
				170	10	-0,33	-4,91	6,65	0,12	5,88
				180	0	-0,33	-4,91	7,04	0,11	3,04
				190	0	-0,33	-4,91	7,43	0,07	5,1
				200	10	-0,43	-4,91	7,82	0,11	4,68
				210	10	-0,33	-4,91	8,21	0,17	3,38
				220	0	-0,33	-4,91	8,6	0,01	3,25
				230	0	-0,33	-4,91	8,99	0,03	2,89
				240	14,14	-0,23	-4,81	9,38	0,05	2,46
				250	10	-0,33	-4,81	9,78	0,08	2,28
				260	0	-0,33	-4,81	10,17	0,17	3,03
				270	0	-0,33	-4,81	10,56	0,03	1,26
				280	0	-0,33	-4,81	10,95	0,07	2,34
				290	10	-0,43	-4,81	11,34	0	2,31
				300	10	-0,33	-4,81	11,73	0,02	1,56
				310	0	-0,33	-4,81	12,12	0,08	1,77
				320	0	-0,33	-4,81	12,51	0,02	1,79

Figure 12 - Example of excel file for Postural Analysis exam.

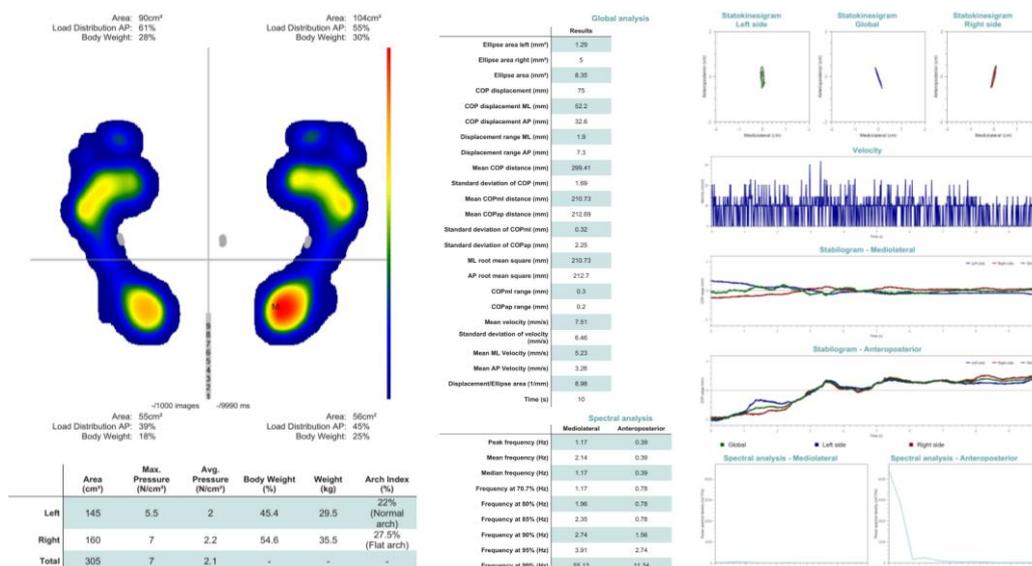


Figure 13 - Example of the clinical report for Postural Analysis exam.

All the COP parameters were based on the following articles:

- Schubert, P., Kirchner, M., Schmidtbleicher, D. and Haas, C. (2012) About the structure of posturography: Sampling duration, parametrization, focus of attention (part I). *Journal of Biomedical Science and Engineering*, **5**, 496-507. doi: 10.4236/jbise.2012.59062.
- Duarte, M., and Freitas, S. (2010) Revision of posturography based on force plate for balance evaluation. *Revista Brasileira de Fisioterapia*, **14**, 183-192. doi:10.1590/S1413-35552010000300003.

3. Dynamic Analysis – Simple or Multiple

Analyze the plantar pressure distribution on the platform during one gait cycle (Dynamic Analysis – Simple exam) or during the most significant cycle of four gait cycles (Dynamic Analysis – Multiple exam). In any of the exams the patient must walk from left to right or from right to left with one foot over the platform, preferably in the middle (see Figure 14).

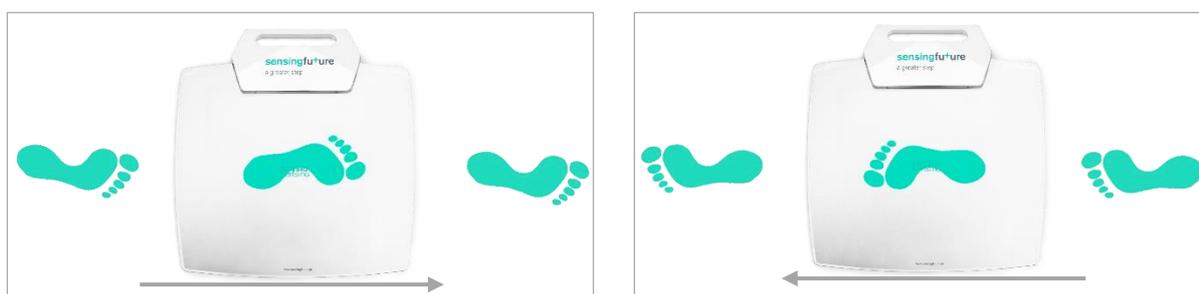


Figure 14 – Indication of how the steps should be performed, from right to left or vice-versa.

In the Simple exam the patient will need to walk over the platform with the left foot. Then, the foot will appear in replay on the interface so that the health professional can verify if the step was done correctly so as to proceed to the right foot or repeat the left foot. After completing both steps an interface similar to the Postural Analysis results will appear.

On the other hand, the Multiple exam requires eight steps over the platform, four with each foot. In this case, the health professional has the force graphs as support to verify the step force over time (which should have the shape of the letter M). When finishing a step over the platform the software also displays the pressure image for the left (top images) or right foot

(bottom images) accordingly to the foot used (Figure 15). Nevertheless, the software algorithm can sometimes put the foot in the wrong section and the health professional must click on the three dots of the wrong image and click on Is Left Foot or Is Right Foot to switch it to the proper position. In the three dots the Delete action is also available to remove any incorrect step (in case part of the foot is out of sensor area or step not done naturally, for example).



Figure 15 –Dynamic Analysis - Multiple interface during acquisition.

After completing all the eight acquisitions, the left and right force average will appear in the corresponding force graph and also the left and right foot closest to the average are indicated with a black border (Figure 16). At last, after checking all the acquisitions the health professional must click on Continue for the software to show the results for the most significant feet.



Figure 16 – Dynamic Analysis - Multiple interface with all the acquisitions completed.

Both exams, Simple and Multiple, will show the same results interface (see Figure 17) after finishing the acquisitions. This interface is similar to the Postural Analysis exam, in which is possible to select between five different views (Figure 18 and Figure 20), add measures (Figure 19), and move feet or replay the acquisitions. However, when clicking on Move, Rotate or Zoom the transformation will occur on the selected foot on Options.

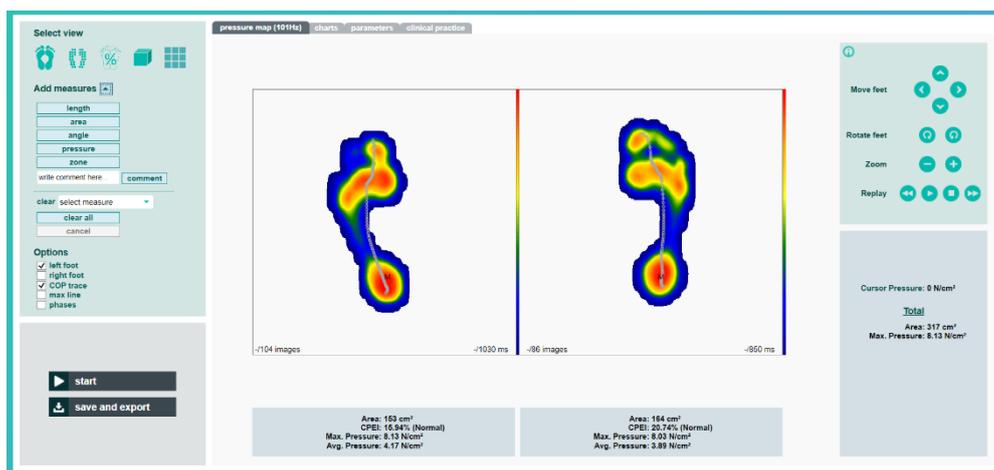


Figure 17 – Dynamic Analysis results interface (same for Simple and Multiple exam).

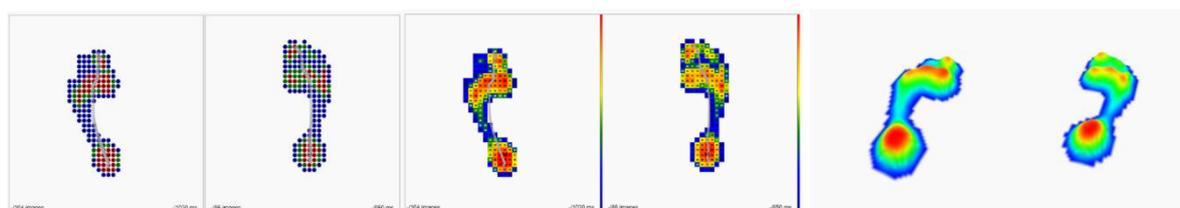


Figure 18 – Isopressure, Percents and 3D view for the Dynamic Analysis.

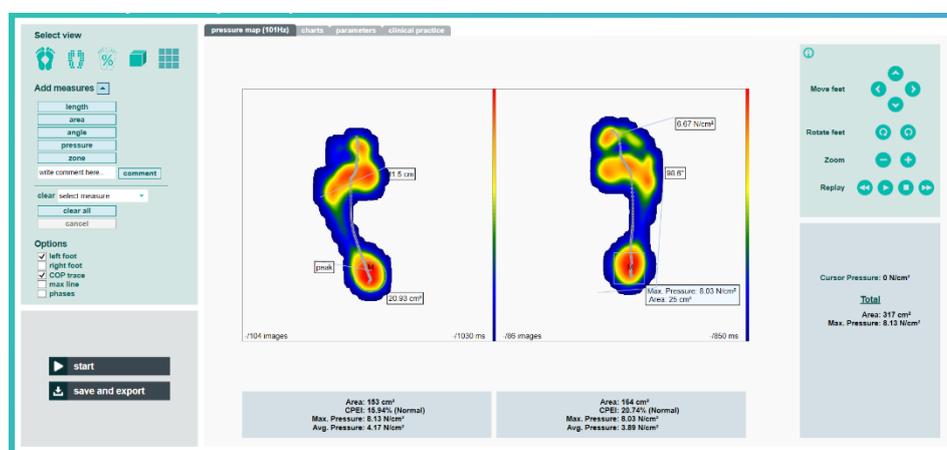


Figure 19 – Example of several measures added in the Standard View.

In this case, the feet images shown are the average of all the pressure data saved during each step with the center of pressure progression trace in gray (COP trajectory during the step). Similar to the other exams, the contact area, maximum and average pressure are displayed for each foot, and the cursor pressure, total area and total maximum average, too. This exam also indicates the foot function (normal, supinated or pronated foot) based on the center of pressure excursion index (CPEI) value.

Regarding the Mosaic View (Figure 20), it will show all the pressure images saved for the selected foot on Options. In this view it also appears the gait phases' information, in which four images appear with a gray border indicating T0, T1, T2 and T3. This corresponds to some of the phases from the gait cycle (see Figure 21).



Figure 20 – Mosaic view for the left foot.

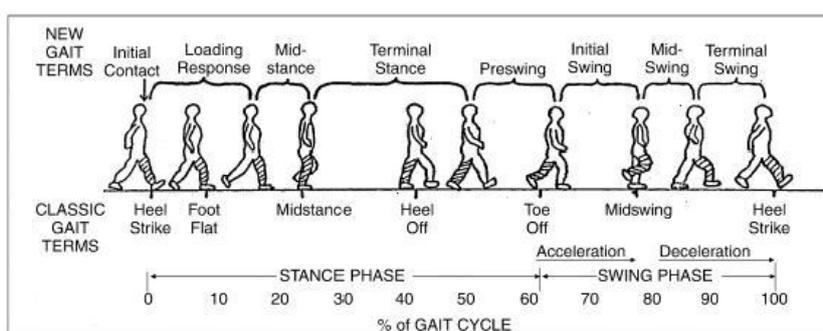


Figure 21 – Gait cycle terms (adapted from: Cuccurullo, S. (2004) Physical Medicine and Rehabilitation Board Review. Demos Medical Publishing).

With this exam it is possible to analyze the Stance Phase in detail, in which the software calculates the percentage time (shown in the right bottom panel) for three phases – Heel Strike to Foot Flat (Phase 1), Foot Flat to Heel Off (Phase 2), and Heel Off to Toe Off (Phase 3). In other words, Phase 1 starts with the initial contact from the heel to the moment the forefoot touches the ground, Phase 2 is from that instant to the moment the heel leaves the floor, and at last Phase 3 is from that point until the toe is raised (end of contact). Normal percentage time values for these three phases are, respectively, 20%, 60%, and 20% of the step duration (Stance Phase). So, Phase 1 corresponds to images from T0 to T1, Phase 2 from T1 to T2 and Phase 3 from T2 to T3. The pre-selected images (T0, T1, T2, and T3) correspond to the normal time values, however the patient can have different time distribution and the health professional should select the correct images for each phase, by clicking in the image that should be changed and then in the right image that correspond to the phase moments described above.

Regarding the Options available, left foot is selected by default, which means when using the transformations tool in the right upper panel the transformation will occur in the selected foot and also in the Mosaic View will appear the foot images for that foot. To switch to the right foot the checkbox with the same name must be selected. Moreover, COP trace can be removed by deselecting the checkbox, and maximum trace (max line) can be selected to display the maximum load positions (in red line) during the step. Furthermore, the phases checkbox can be selected to show the phases time representation (T0, T1, T2 and T3 timestamp relative to COP trace position) when any of the first three views is selected, and also to represent the phases images timestamp with dashed lines in the graphs from Graphs tab (see Figure 22 - Figure 24).

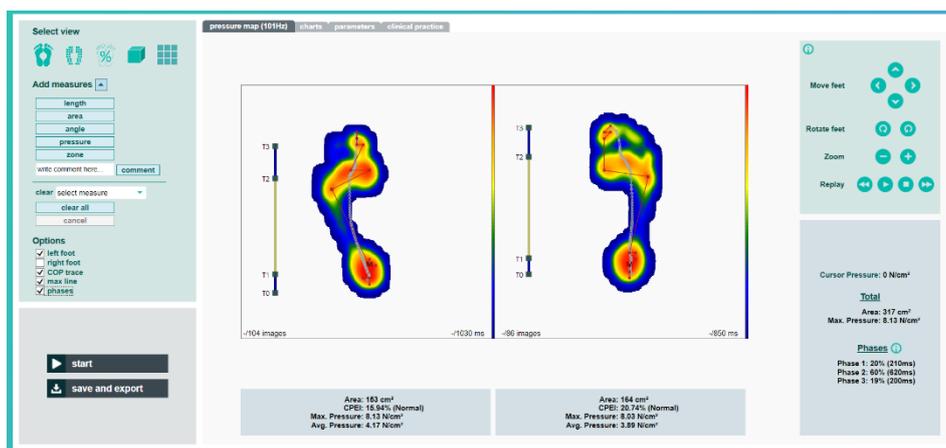


Figure 22 – Standard View with max line and phases option selected.

The Graph tab for this exam (Figure 23 and Figure 24), will show the force data (in percentage relative to the maximum force value obtained during both steps), the contact area, the COP velocity, the maximum pressure and the average pressure over time for each foot. In addition, the last graph, Peak Risk, allows a comparison of the maximum pressure peaks in the forefoot and rearfoot with normative data³. Higher values than normative data will appear in red, and are indicative of higher risk of ulcer formation.

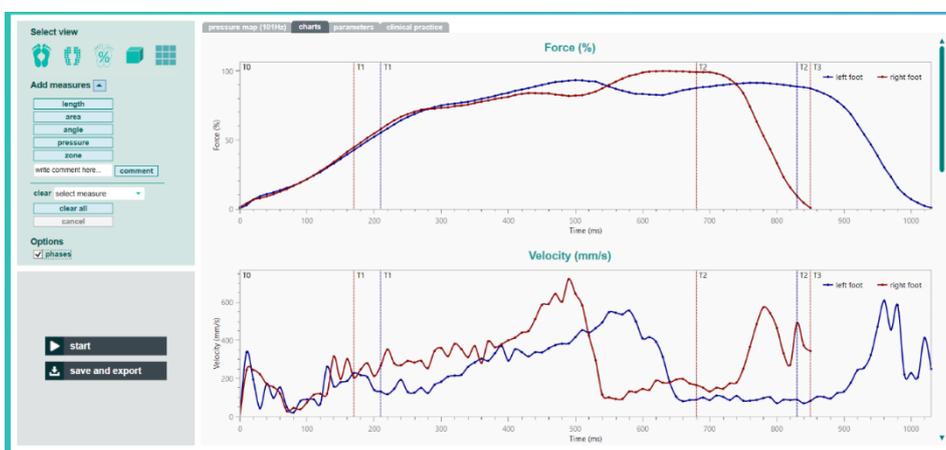


Figure 23 – Graphs tab interface for the Dynamic Analysis with phase option selected. Force and velocity graph example with T0, T1, T2 and T3 images timestamp from phases represented.

³ The Peak Risk output is based on the article: Giacomozzi C, Martelli F. (2006) Peak pressure curve: an effective parameter for early detection of foot functional impairments in diabetic patients. *Gait Posture*, Jun;23(4):464-70. doi: 10.1016/j.gaitpost.2005.06.006.

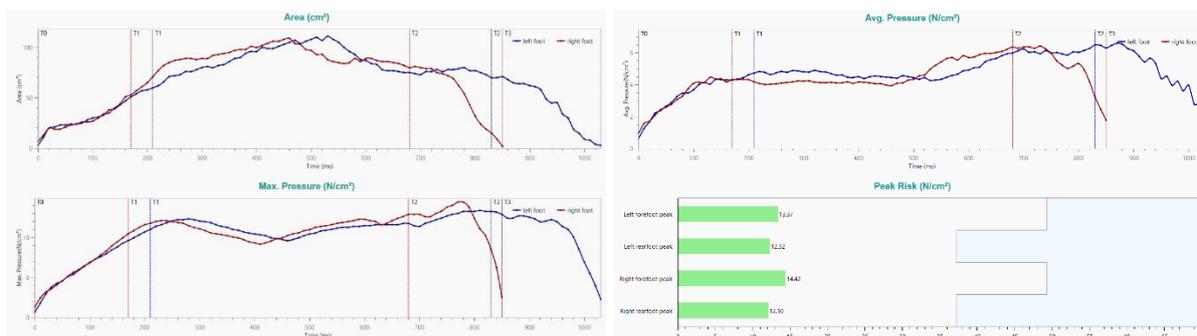


Figure 24 – Area, maximum pressure, average pressure and peak risk graphs example.

When the analysis is complete, the following results can be saved, generate a excel file with all the data from the graphs (Figure 25) or export all the information shown to a clinical report in PDF format (Figure 26):

Data	Description
Total Area	Total support surface (cm ²)
Maximum pressure	Maximum pressure point measured over both feet (kPa, N/cm ² or g/cm ²)
Left and right foot area	Support surface for left and right foot (cm ²)
Left and right foot average pressure	Average pressure calculated over the left and right foot (kPa, N/cm ² or g/cm ²)
Left and right foot maximum pressure	Maximum pressure point measured over the left and right foot (kPa, N/cm ² or g/cm ²)
Left and right foot CPEI	Ratio of the distance from the COP to the construction line (center of pressure excursion (CPE)) and the foot width at the anterior third of foot length, for left and right foot ⁴
Left and right rearfoot peak	Maximum pressure point measured over the back portion of the left and right foot (kPa, N/cm ² or g/cm ²)
Left and right forefoot peak	Maximum pressure point measured over the front portion of the left and right foot (kPa, N/cm ² or g/cm ²)
Contact time	Total time of foot contact with the platform, for left and right foot (s)

⁴ The CPEI output is based on the article: Menz, Hylton B et al. (2013) Planus Foot Posture and Pronated Foot Function are Associated with Foot Pain: The Framingham Foot Study. *Arthritis Care Res (Hoboken)*, 65(12): 1991–1999. doi:10.1002/acr.22079.

Sensing Future Technologies									
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Patient's details: Name: John Stuart Gender: Male Height: 1.68 m Weight: 72 kg Age: 59 ID: T04_10 Date: 28.05.2020									
parameter	Left	Right							
Area (cm ²)	153	164							
Max. Pressure (N/cm ²)	8.1	8							
Avg. Pressure (N/cm ²)	4.2	3.9							
CPEI (%)	15.94% (Normal)	20.74% (Normal)							

Time (ms)	COP_ML (mm)	COP_AP (mm)	Force (N)	Velocity (mm/s)	Area (cm ²)	Max. Pressure (N/cm ²)	Avg. Pressure (N/cm ²)	Time (ms)	COP_ML (mm)	COP_AP (mm)	Force (N)	Velocity (mm/s)	Area (cm ²)
0	19,68571429	30,31428571	0,957288	0	3	0,045252445	0,61562181	0	21,37991304	29,4	0,294	1,266102	0
10	19,85114504	30,0106837	2,675559	338,3953369	11	1,782440702	1,248661668	10	21,14432618	29,22281213	3,952439	244,6358996	13
20	19,93457944	29,84267913	6,55369	195,1408913	20	2,935784686	1,682833722	20	21,14545455	29,07603006	6,660795	245,8174475	20
30	19,9717833	29,81828462	9,0445	44,4885204	21	3,774580311	2,11824177	30	21,10428871	28,85724246	7,708705	232,7268688	19
40	19,96148582	29,64463602	10,6574	173,96174	23	4,246460265	2,379626718	40	21,06219522	28,69146341	9,037854	170,9421952	19
50	19,93316195	29,54027164	10,1302	99,53881593	23	4,5609951209	2,659985038	50	21,11030177	28,54318418	10,5802	155,8877159	21
60	19,88595166	29,4026798	13,51571	154,112867	24	5,137623201	2,892097414	60	21,06448763	28,41095451	12,46284	121,0900688	23
70	19,87006028	29,33432019	15,3409	50,79751997	24	5,609445374	3,261254884	70	21,09111792	28,41889314	14,37851	29,31693951	24
80	19,85722208	29,33633814	16,87422	22,07416815	25	5,976418826	3,466322910	80	21,05836669	28,31279393	16,65746	46,3075956	26
90	19,80085653	29,27730193	19,08899	81,64265257	28	6,448241364	3,497478185	90	21,09698026	28,33391405	18,95849	38,87212149	26
100	19,75806452	29,19686907	21,51897	91,10783428	30	6,815214445	3,683710785	100	21,09314227	28,25895999	21,51272	75,062571	27
110	19,71723557	29,11504425	24,241515	91,44563778	31	7,287036899	4,013028261	110	21,11413048	28,14583333	26,30915	115,051196	30
120	19,70221113	29,0485474	26,70475	68,1717263	33	7,601585348	4,155851049	120	21,15998396	28,03498183	27,45789	120,7930128	34
130	19,6588643	28,80395499	29,90767	262,886499	38	7,968588434	4,04636113	130	21,17870036	27,91440403	30,49653	121,0964879	35
140	19,55472868	28,65333333	32,91517	159,0031961	39	8,440380973	4,335121618	140	21,23377462	27,80284146	34,09966	316,4286063	40
150	19,48646362	28,4856176	36,18842	181,0764664	43	8,807350559	4,3221117	150	21,27440633	27,60838664	37,55307	598,6564659	44
160	19,42217148	28,3081891	39,3561	188,6496083	47	9,279176598	4,31789711	160	21,27268687	27,30541089	41,46207	302,971161	53
170	19,33652008	28,09560229	42,71127	229,267571	51	9,593724957	4,300883448	170	21,25687805	26,90051711	44,7099	205,5535814	53
180	19,26505221	27,88935792	45,94729	218,279667	54	9,960689043	4,36969804	180	21,23413517	26,65337915	48,05681	248,1557154	57
190	19,19581454	27,69270617	49,28496	208,4845124	57	10,32767113	4,438626847	190	21,21750287	26,37319151	51,57987	280,5535082	61
200	19,14501221	27,56119461	52,9881	140,975862	58	10,69464421	4,630549553	200	21,17830589	26,13634141	54,70599	213,3482351	65
210	19,10201696	27,43681192	55,51845	131,6099285	60	11,00919257	4,734826552	210	21,14139111	25,89699734	57,9324	269,104243	71
220	19,06073867	27,3292333	58,31967	118,3406042	62	11,37616566	4,830684883	220	21,09398176	25,54739591	61,2683	352,9694043	77
230	19,01114994	27,18771843	61,34131	146,8320089	66	11,54886457	4,77833057	230	21,08656154	25,36705519	64,22968	380,701389	82
240	18,94009217	27,00748682	64,20445	193,7503554	71	11,8479882	4,646602875	240	21,09390802	24,9973346	66,82814	270,9992382	85
250	18,88802083	26,88817402	66,63939	130,1638367	72	12,0576871	4,753175206	250	21,07443573	24,74668284	68,77884	292,9702579	87
260	18,83543552	26,7726335	68,79333	126,644043	73	12,21496128	4,839929221	260	21,08984375	24,4203125	70,4613	284,762892	88

Figure 25 – Example of the excel file for the Dynamic Analysis exam.

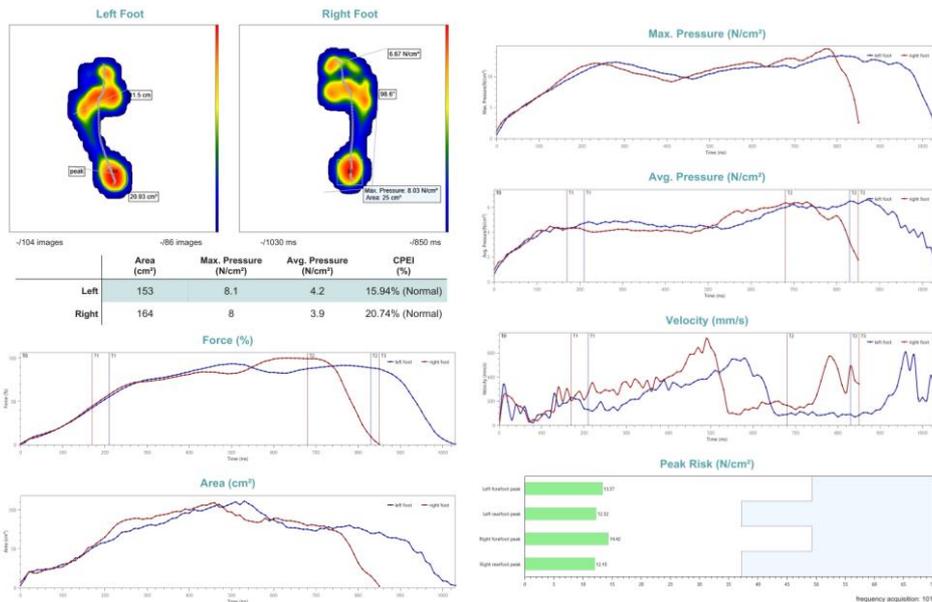


Figure 26 – Example of the clinical report for the Dynamic Analysis exam.

4. Progress view & report

As mentioned, in case the patient has previous sessions with the selected exam, it also appears the option to view the progress (view progress button) between sessions in the save and export window. When clicking on it a new window appears with all the patient's previous sessions (Figure 27). After selecting one of the sessions available, the progress view opens. In this view can be observed the overall parameters for the two sessions (selected session and last session) on a table and the plantar pressure distribution with several information for left and right foot as well. These parameters change according to the exam selected. In addition, the view selection is available and other options (such as heel alignment heels, COP trace, replay) depending on the exam. Figure 28 shows an example of the progress view for the Static Analysis protocol. Moreover, the health professional can select another session for comparison or export the progress view in PDF format.

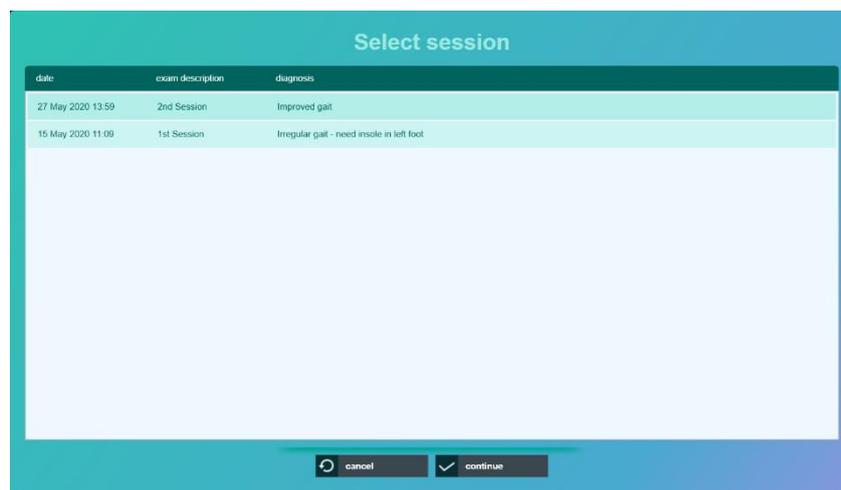


Figure 27 – Example of the Select Session window.

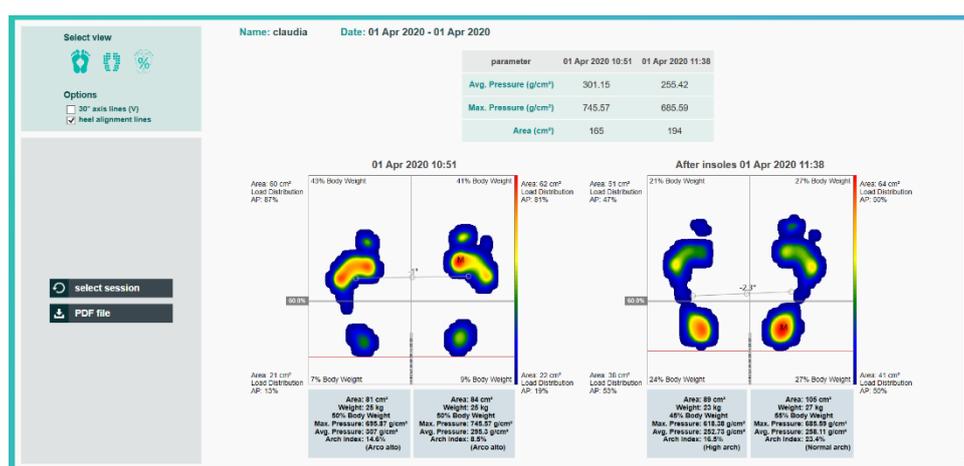


Figure 28 - Example of the progress view for the Static Analysis protocol.

4. Manage patients and results

4.1. Manage patients

The health professional can add a new patient to the software database through two methods:

- At the end of an exam by clicking Save and Export.
- From the Manage Patients tab in the start menu.

The interface for adding a patient changes according to the method used (see Figure 29). By clicking Save or Export, you can use a previously registered patient or add a new patient to the database.

The screenshot shows the PodoSensing 2.0 interface with four main sections:

- 1. Patient identification:** Includes fields for name, birth date (with a calendar icon), gender (set to 'male'), ID, weight (65 kg), and height (1 m, 70 cm).
- 2. Clinical information:** Includes fields for exam description, diagnosis, clinic, and health professional.
- 3. Clinical report:** Contains buttons for 'create PDF' and 'view progress'.
- 4. Save data:** Contains a 'save and exit' button.

Below these sections is a 'user assistance' box with the following instructions:

1. Start by choosing a patient in the "Name" field or add a new patient.
2. Enter the data regarding the clinic and the diagnosis.
3. Allow results to be exported as Excel or PDF and view the progress graphs.
4. Save the results to the database and exit the exercise/protocol.

Note: In 3, the Excel or PDF file can be generated even without patient and clinic data.

The bottom part of the image shows the 'add patient' form with fields for name, weight (kg), ID, gender (male), height (1 m, 70 cm), and birth date (select a date). It includes 'cancel' and 'add' buttons.

Figure 29 – Interfaces that allow the insertion of a new patient in the aforementioned order.

From the Manage Patients tab (Figure 30) it is possible to access the list of all patients recorded in the database as well as add new patient profiles. Here, the personal information of a patient that has been previously registered can also be edited.

The screenshot shows the 'manage patients' interface with a table of patient records:

name	ID	birth date	gender	height	weight
Physisense Balance	402-1001	11/01/1985	F	1.50m	50.0kg
Physisense Balance	402-1002	11/01/1986	F	1.52m	50.0kg
Physisense Balance	402-1003	11/01/1987	M	1.55m	50.0kg
Physisense Balance	1001	11/01/1988	M	1.55m	50.0kg

At the bottom right, there is an 'add patient' button.

Figure 30 – Interface of Manage Patients tab.

Note: In case you have also purchased PhysioSensing Balance, the patient database is shared between applications, which means this interface will show patients from both applications. If you want a quotation for PhysioSensing Balance contact us.

4.2. Results recording

For results recording the health professional must click on Save and Export button after finishing an exam. As mentioned before, this interface allows the insertion/edit of patient information and clinical information (see Figure 31). Before saving, the health professional can generate a clinical report with all the exam results and after that must click on Save and Exit button to store the information on the database. However, the software allows the creation of

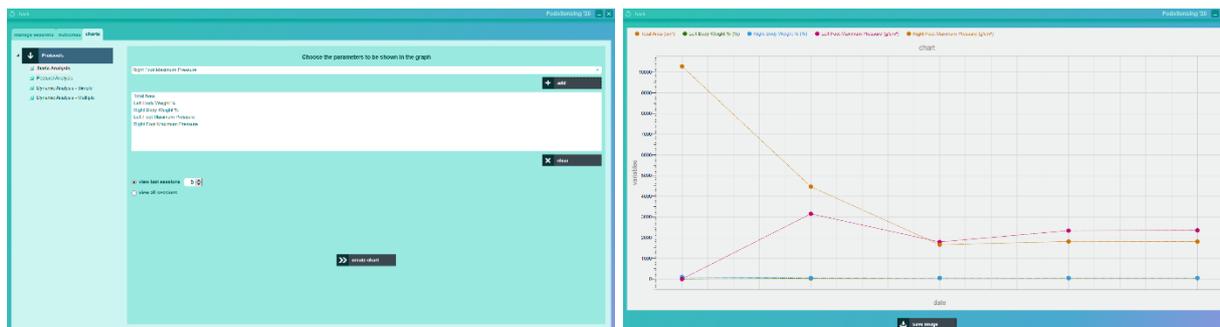


Figure 34 – Interface to generate graphs and an example.

5. Definitions and connectivity

In the start menu the health professional has access to the following definitions:

- Change the language in use, with the option of choosing Portuguese, Spanish, English, French, Turkish and Simplified Chinese. However, some languages are not fully translated and will appear in English.
- Change the units of measure (weight, height and pressure) that the system will use.
- Access to the working directory with all the files generated by the software.
- Use the help option, for clarification on the application and the manufacturer, or the PhysioSensing support option.
- Insertion of data about the clinic (see Figure 35).

Figure 35 – Interface of add clinic information option.

On this last point, the health professional can add the following information:

- Clinic name, that will be saved on the software database and added automatically to all clinical reports;
- Insert/Edit logo that will appear in the upper right corner of the start menu interface, and also on all clinical reports.
- Working directory, where all the generated files by the software will be saved.

Throughout the application a connectivity symbol appears in the upper right corner to provide information about the connection state of the PhysioSensing platform. If the symbol has a cross in a red circle and the word Disconnected means that the platform is not properly connected to the computer, otherwise it is working properly and sending data.

6. Closing application

At any moment it is possible to close the application in the computer with the button in the superior right corner. This procedure can be executed at any location of the application.

Attention:

- After saving the data of one of the patients, the application can be closed at any location, being guaranteed that the data will always be saved.
- Never turn off the computer by removing the power source as it will result in loss of data of the current exercise (the previous ones are assured) and may cause damage to the computer in use.