RehaGait®

Your mobile gait analysis solution

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Clinical gait analysis

Clinical gait analysis is the process by which quantitative information is collected to aid in understanding the etiology of gait abnormalities and in treatment decision-making. This process is facilitated through the use of different technologies. Essential to the process is the interpretation of these data by experts with substantial knowledge in normal and pathologic gait.

The goal of clinical gait analysis is to assist in treatment decision-making. It is a process whereby gait characteristics are measured, abnormalities are identified, causes are postulated, and treatments are proposed. It is important to appreciate that while gait analysis does use technology, it does not replace the human observer. Rather, clinical gait analysis serves as an adjunct to aid in understanding - more precisely and at times more accurately - visual impressions of a patient's gait impairment.

Through the thoughtful use of technology, gait analysis provides an opportunity to enhance the details of complex movement patterns. That may involve a number of lower (and upper) extremity joints and segments simultaneously and include movements that occur in several planes of motion concurrently, as well as to understand and correlate the associated muscle activity. Structured subjective observation is the key element. Being able to examine gait from top to bottom and acknowledge any problems has long been seen as the quickest and most effective way.

Support your subjective observation

The usage of **RehaGait** enables clinicians to quantify the observation. This mobile gait analysis system is used to track interventions over time with a measureable reporting that is increasingly required to receive objective data. The flexibility of **RehaGait** allows the user to get **fast, accurate measurements in everyday situations.** The system includes easy to use and intuitive software that allows you to review the data quickly and to make adjustments to your observations.

In everyday clinical practice, RehaGait can be used as a tool for the analysis of gait disorders and clinical quality management in neurological, orthopaedic and geriatric rehabilitation.

RehaGait at a glance

RehaGait is designed to strengthen subjective diagnosis by quantifying and refining what can be seen and helping to detect and track changes over time. The system comes with up to 7 straps and MotionSensors which can be fitted to the feet, lower legs, thighs and hip. The ideal walking distance is about 20 meters, but also short distances can be measured. During walking, the foot movement is measured, especially the patterns of acceleration and angular velocity.

Objective results, combined with integrated video capture function allows you to monitor the patient's condition, determine problem areas, assess the gait quality and identify asymmetries in the lower limbs.

Give patients complete freedom of movement

Objective data: results and progression are shown graphically

Mobile use, no need for a gait lab, you can use it outside or on a treadmill

Intuitive handling

Wide range of indications

Using RehaGait is indicated in neurological patients. Neurological disorders include:
· Stroke
· Traumatic brain injury (TBI)
· Parkinson's disease
· Multiple sclerosis (MS)

User friendly

A big tablet screen makes it easy to interact with the RehaGait software. The operation happens via the tablet based RehaGait software together with wireless MotionSensors.

Objective data

A reference database (n= 1800 healthy volunteers) of normal gait pattern is implemented in the RehaGait software. That enables a simple, fast and accurate assessment of patient´s gait pattern.

Mobile use

RehaGait is a completely portable system that takes minutes to set up. In just moments, you can record, measure, analyse and report on one's gait patterns which makes it ideal for clinical analysis.

Data management

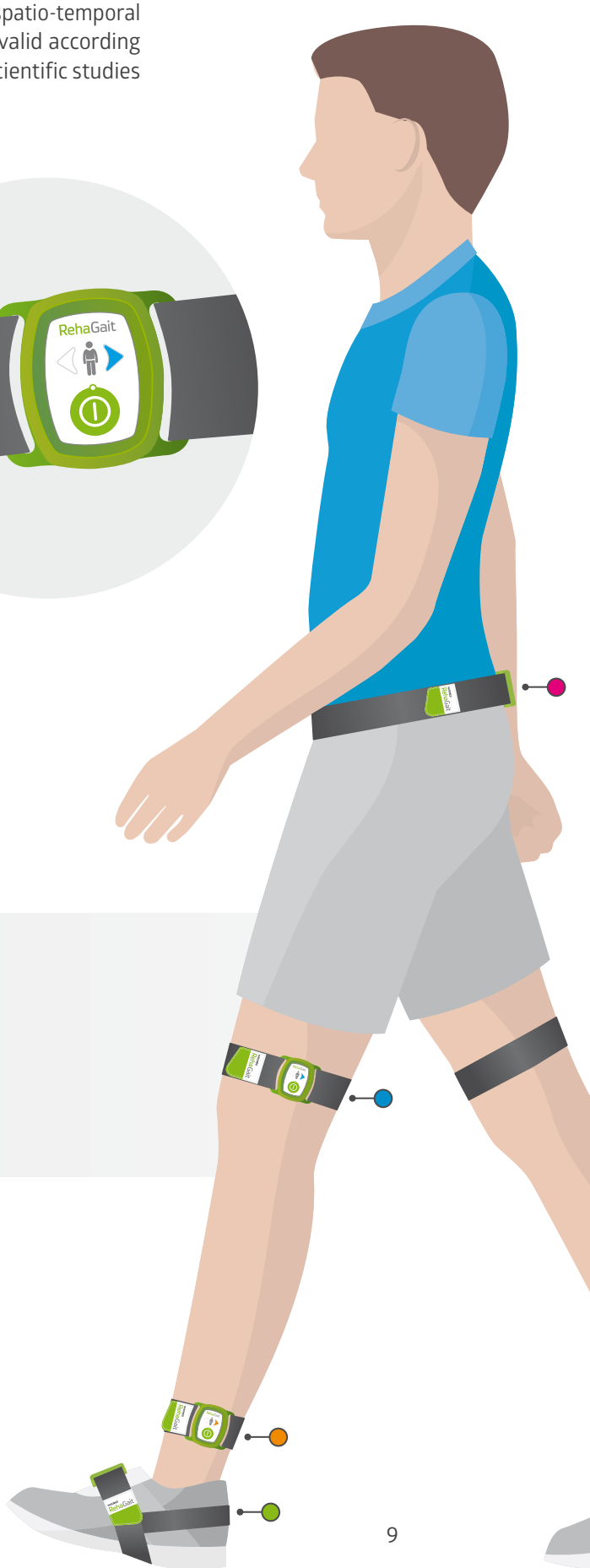
RehaGait analysis software uses a database for patient management and storage of measurements and analysis results. In this way, the user has at any time access to older measurements in order to compare them to each other or to present and evaluate the therapy progress.

Wireless MotionSensors for data recording

RehaGait is equipped with up to 7 MotionSensors, which record spatio-temporal specific parameters during walking. The accuracy is clinically valid according to the gold standard and has been published several times in scientific studies (Schwesig et al., 2010, Donath et al., 2016).

These MotionSensors utilize the inertia of the mass to detect movement changes. One MotionSensor consists of a three-axis accelerometer for recording the linear acceleration, a three-axis gyroscope for recording the angular velocity and a three-axis magnetometer for recording the earth's magnetic. They connect via Bluetooth to the tablet software and can be read from up to 20m away.

The MotionSensors are attached at 7 points; around the hip, above the knees, above the ankles and on the proximal, lateral aspect of the foot or shoe.

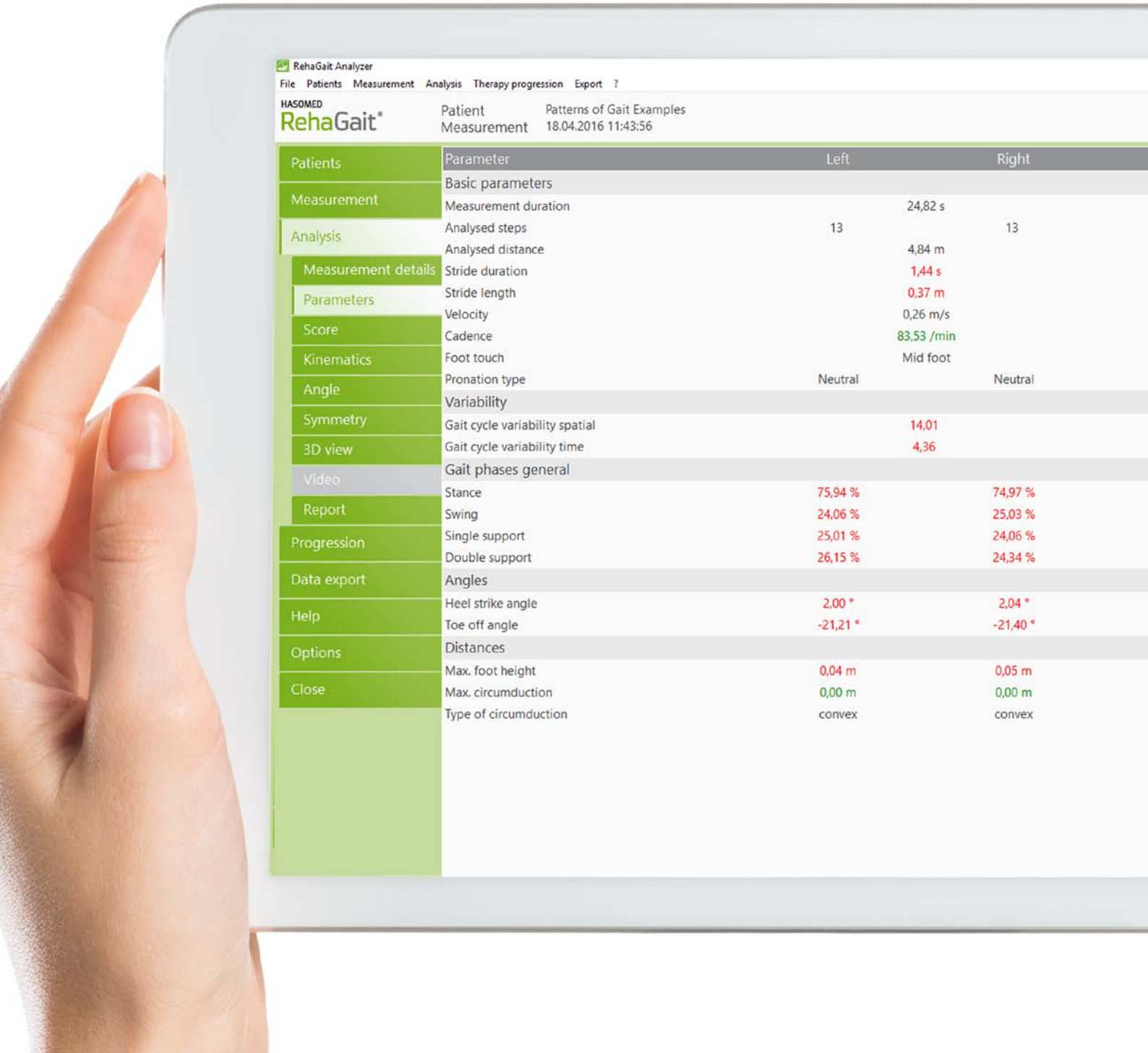


- Position: Hip (Dorsal)
- Position: Thigh (Lateral)
- Position: Shank (Lateral)
- Position: Foot (Dorsum of foot)

RehaGait software

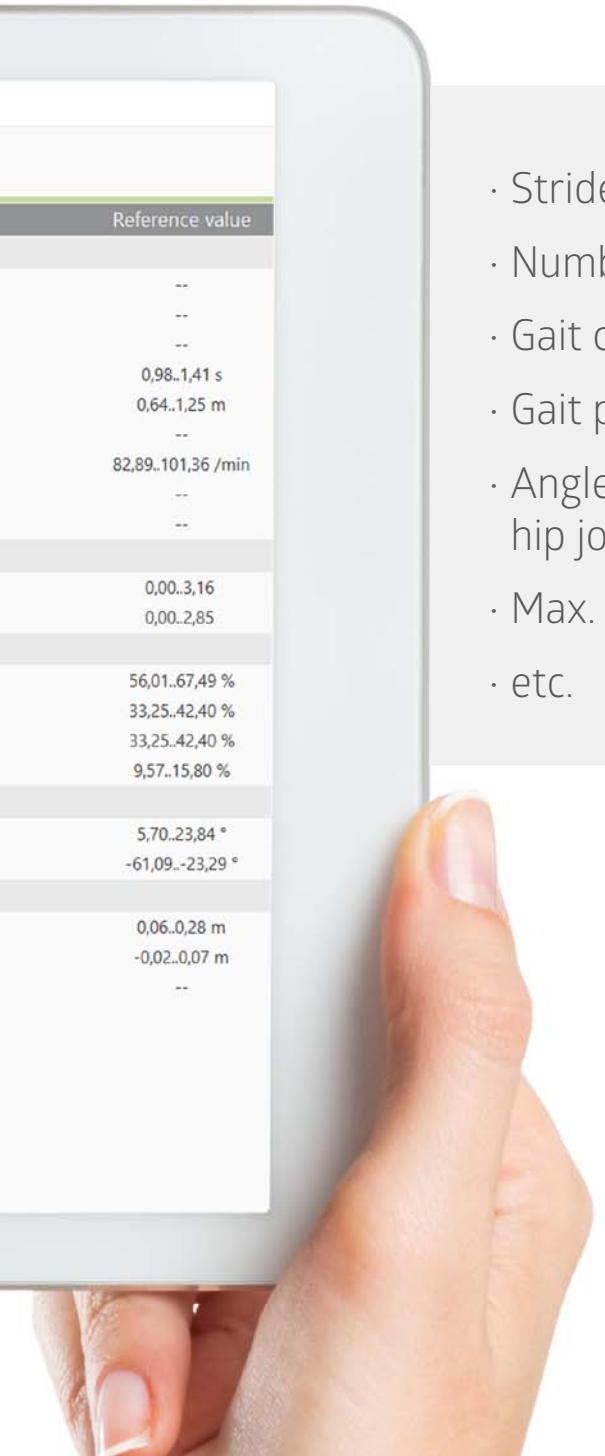
RehaGait software

Software comes pre-programmed on the included Windows tablet on purchase, this intuitive system allows you to perform the recordings quickly and easily and view the gait patterns on the tablet. All the most common functions are presented in an easy to navigate left-hand menu rather than buried in multiple complex menus. A custom report can be generated within 10 minutes of your subject.



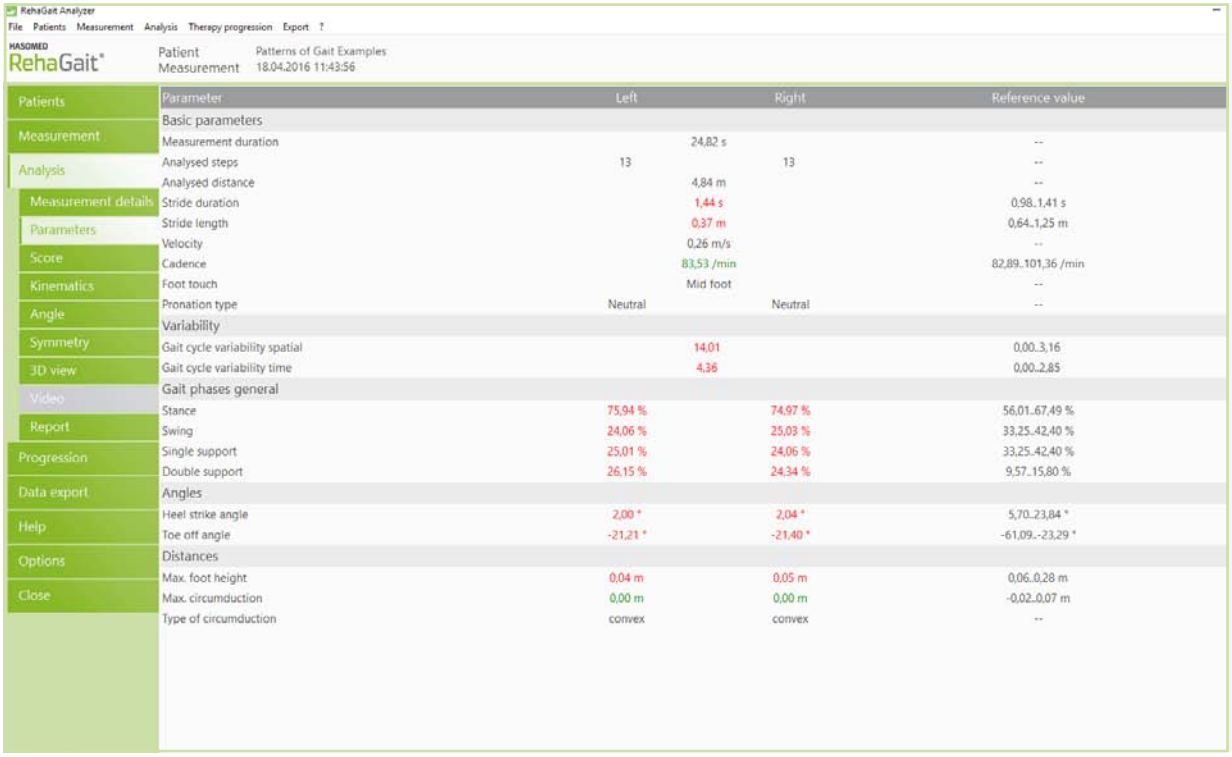
What data will you receive after a 10 step cycle?

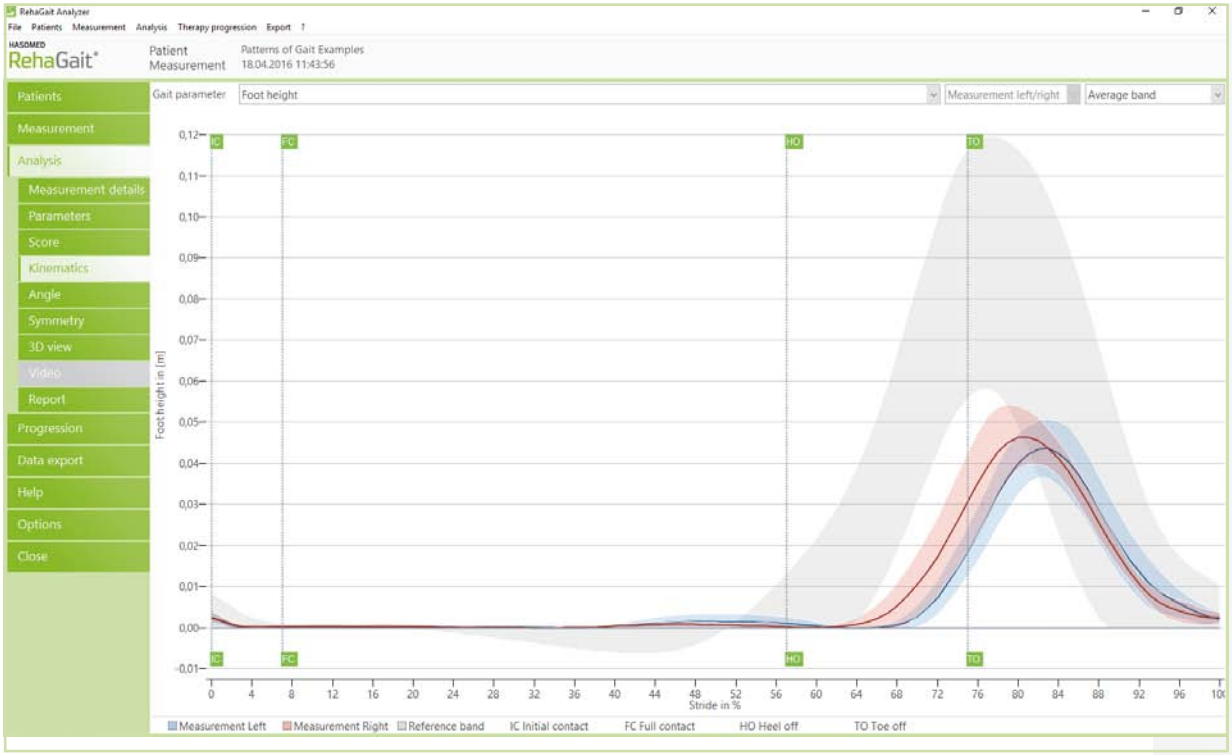
After you have done the calibration and your measurement, the analysis just takes some seconds. You will be directly forwarded to the parameter screen, which gives you an comprehensive overview for all measured and analyzed gait parameters.



- Stride lengths & stride duration
- Number of steps, cadence & velocity
- Gait cycle variability
- Gait phases
- Angles (foot, ankle joint, knee joint, hip joint)
- Max. foot height
- etc.

How the system works





Parameter overview

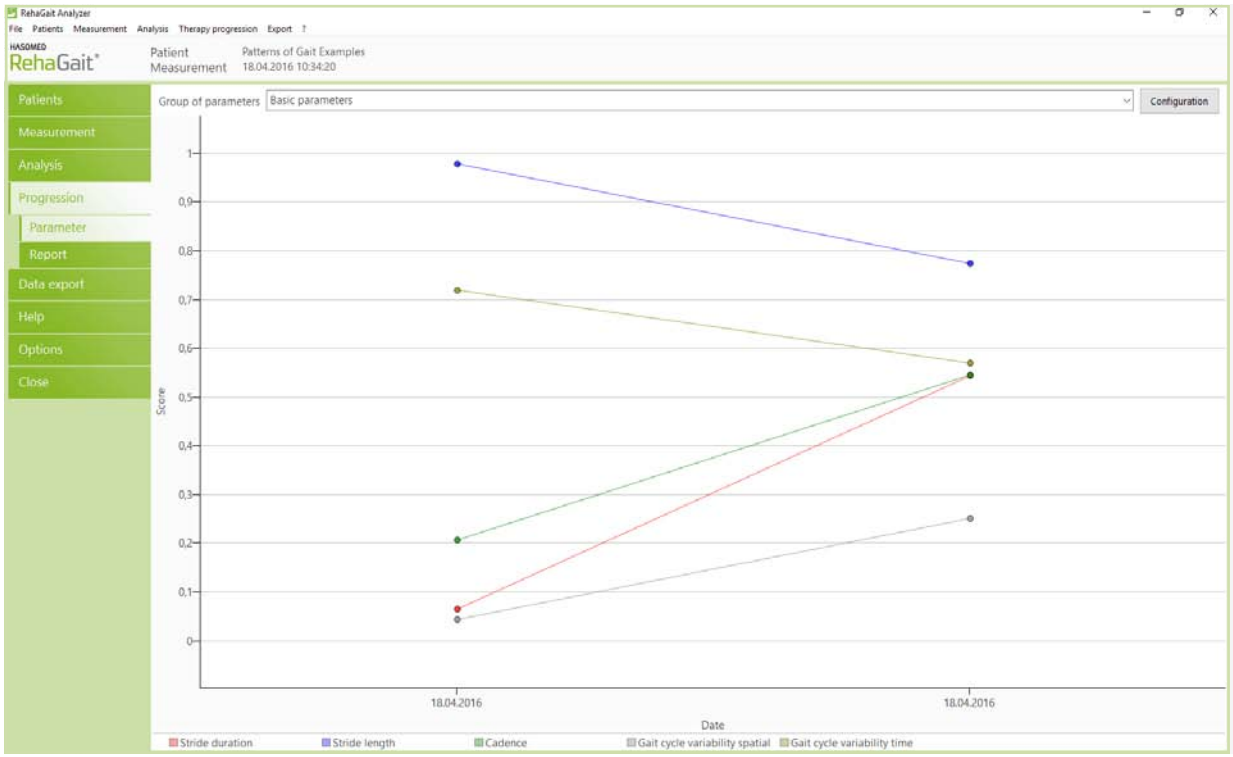
The results of all gait parameters are listed in the parameter overview. These are compared with reference values (n=1800) and they will show you in a clear and easy way whether the patient is within (green) or outside (red) of the reference database. The parameter overview provides information about basic parameter like analyzed distances, stride duration, stride length, cadence, velocity, etc. Furthermore you can find additional gait parameters for:

- Spatial & time gait variability
- Gait phases (e.g. stance, swing, single support & double support)
- Angles (e.g. heel strike angle, Toe off angle, knee angles, hip angle)
- Distances (e.g. foot height & circumduction)

Kinematics and angles

The kinematics of individual steps are displayed for such parameters as foot height, ground clearance, circumduction, velocity and acceleration. Averaged gait curves, normalized to the gait cycle are presented as a light band around the red (right foot/leg) and blue (left foot/leg) curves. Grey reference bands are related to the reference database and will give a guidance for your analysis.

The angles of the individual steps are shown for ground-foot angle, ankle, knee and hip joint angles. With the selection box, you can also display the individual steps next to each other. The grey reference band in the background is similar to the kinematics description and will support your analysis visually.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Measurement
Patterns of Gait Examples
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Patients
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Parameter
Report
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Help
Options
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Group of parameters
Basic parameters
Configuration
Score
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0,4
0,3
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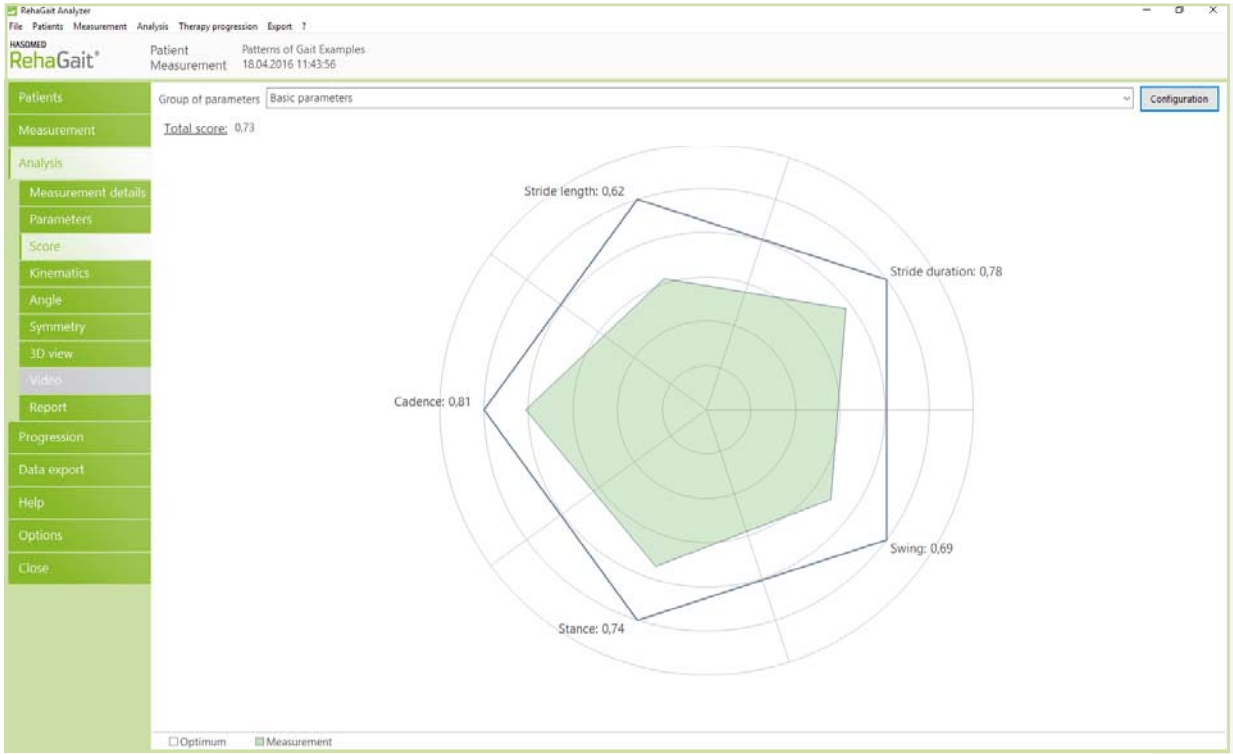
Date
Stride duration
Stride length
Cadence
Gait cycle variability spatial
Gait cycle variability time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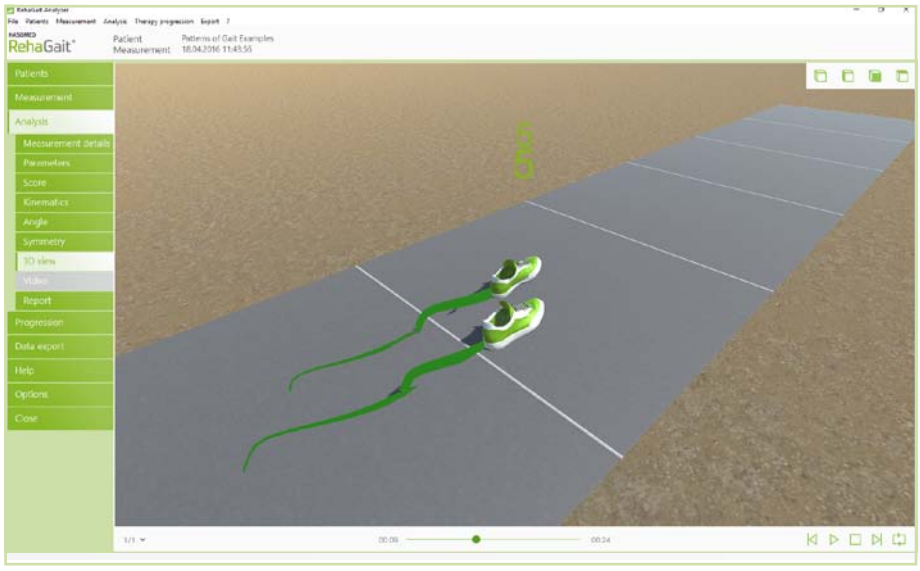
Patients
Measurement
Analysis
Measurement details
Parameters
Score
Kinematics
Angle
Symmetry
3D view
Video
Report
Progression
Data export
Help
Options
Close
Group of parameters
Basic parameters
Configuration
Total score: 0,73
Stride length: 0,62
Stride duration: 0,78
Cadence: 0,81
Swing: 0,69
Stance: 0,74
Optimum
Measurement

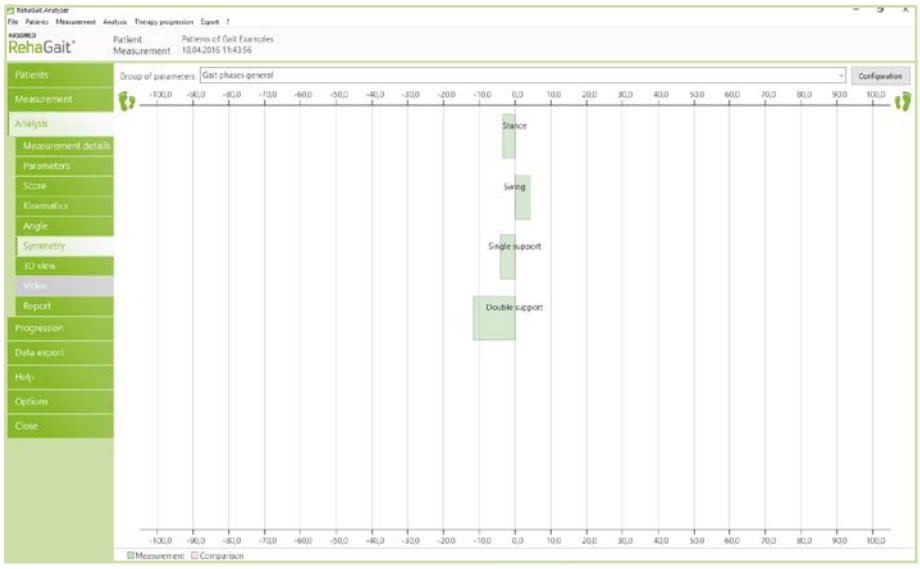
Progression

After a successful analysis, you will find the flow charts sorted by parameter group. The course of parameters is shown as score model. The recorded value is compared with a maximum of 1.0 to the reference value median of the corresponding parameter. The individual measurement sessions are indicated on the horizontal scale and the corresponding score points are linked to a regression line. Thus, increasing straight lines between the measurement session points show an improvement of the parameter. The selection box allows you to use predefined groups to select gait parameters.

Score graphs

The configurable score graphic gives a quick overview of strengths and weaknesses of the patient. The closer the inner green n-corner comes to the outer blue n-corner, the better is the gait pattern with respect to the related parameter. The selection box allows you to use predefined groups to select gait parameters or to create a customized parameter group for this score graphic.


RehaGait
Patients
Measurement
Analysis
Measurement details
Parameters
Score
Kinematics
Angle
Symmetry
3D view
Video
Report
Progression
Data export
Help
Options
Close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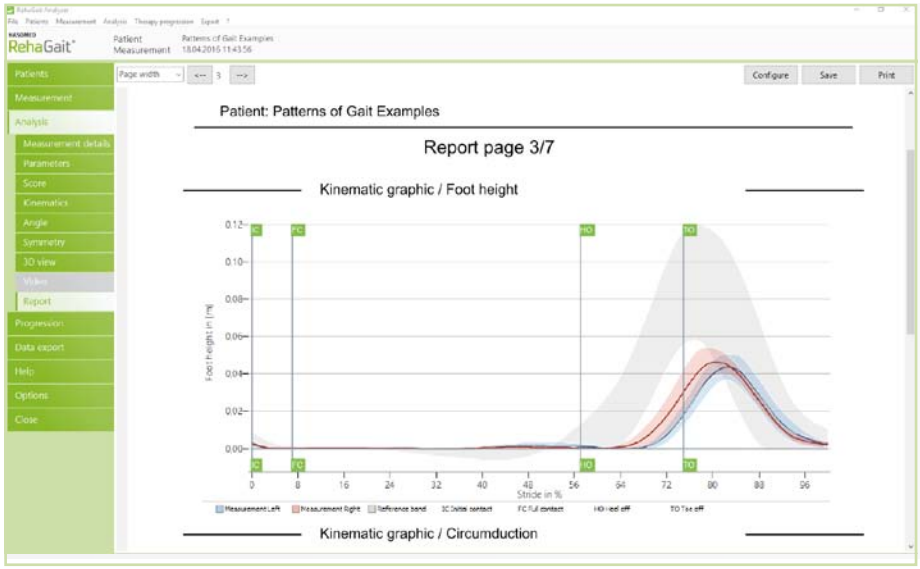
Group of parameters: Gait phases general
Configuration
Stance
Swing
Single support
Double support
Measurement
Comparison


RehaGait
Configure
Save
Print
Patient: Patterns of Gait Examples
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Kinematic graphic / Foot height
Kinematic graphic / Circumduction

3D Animation

Here you have the possibility to view the recorded gait of the patient as an animation more precisely from different perspectives and playback-speeds. The 3D view shows the movement of the feet, according to the measurement results, across the analyzed measurement path. The positional trajectories of the feet are preserved in the form of a green band for the last seconds of the measurement. Use the different perspectives to change the view or to visualize the gait pattern for your patient.

Symmetry

Symmetry indices are calculated for all bipedal parameters. The farther a bar is away from value 0, the bigger is the difference in symmetry of this parameter. If the symmetrical pattern is displayed in the negative range, a preference is given to the left foot of this parameter, while a shift of the symmetry to the right side of the body is indicated in the positive scale. These objective results, combined with integrated video capture function allows you to monitor the patient's condition, determine problem areas, assess the gait quality and identify asymmetries in the lower limbs.

Create reports and export your results

Quality assurance is an important topic in hospital´s daily practice. RehaGait offers the possibility to print out individual analysis or therapeutic procedures of the patient in form of a report or to store them digitally as PDF-file.
For further investigations or scientific purposes, RehaGait offers a variety of export possibilities. Several measurements of different patients can be compared and statistically processed as: Raw values, CSV files, Normalized curves, Analyzed curves, CSV export with single steps, etc..


Donath et al. Journal of NeuroEngineering and Rehabilitation (2016) 13:6
DOI 10.1186/s12984-016-0113-6
RESEARCH
Journal of NeuroEngineering and Rehabilitation
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Validity and reliability of a portable gait analysis system for measuring spatiotemporal gait characteristics: comparison to an instrumented treadmill
Lars Donath, Oliver Faude, Eric Lichtenstein, Corina Nüesch and Annegret Mündermann
Abstract
Background:

Studies and evidences

Validity and reliability of a portable gait analysis system for measuring spatiotemporal gait characteristics: comparison to an instrumented treadmill
Donath L, Faude O, Lichtenstein E, Nüesch C, Mündermann A
J Neuroeng Rehabil. 2016 Jan 20;13:6. doi: 10.1186/s12984-016-0115-z.

Spatiotemporal gait parameters during dual task walking in need of care elderly and young adults. A cross-sectional study.
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Z Gerontol Geriatr. 2015 Dec;48(8):740-6. doi: 10.1007/s00391-015-0884-1. Epub 2015 Apr 16

Amplitude-oriented exercise in Parkinson's disease: a randomized study comparing LSVT-BIG and a short training protocol.
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Neural Transm (Vienna). 2015 Feb;122(2):253-6. doi: 10.1007/s00702-014-1245-8. Epub 2014 May 29.

Feasibility of visual instrumented movement feedback therapy in individuals with motor incomplete spinal cord injury walking on a treadmill.
Schliessmann D, Schuld C, Schneiders M, Derlien S, Glöckner M, Gladow T, Weidner N, Rupp R
Front Hum Neurosci. 2014 Jun 12;8:416. doi: 10.3389/fnhum.2014.00416. eCollection 2014.

Can falls be predicted with gait analytical and posturographic measurement systems?
A prospective follow-up study in a nursing home population.
Schwesig R, Fischer D, Lauenroth A, Becker S, Leuchte S.

Inertial sensor based reference gait data for healthy subjects.
Renè Schwesig, Siegfried Leuchte, David Fischer, Regina Ullmann, Alexander Kluttig
Gait & Posture 33 (2011), Issue 4, 673–678, Elsevier 2011

Gait Analysis System on the Basis of Inertial Sensors.
Kauert R., Wolfgang Liedecke, Peter Weber
Conference-Paper, TAR (2007), Berlin

Frequently asked questions (FAQ)

General

What is the difference between RehaGait Analyzer and RehaGait Analyzer Pro?
RehaGait Analyzer uses 2 foot sensors. RehaGait Analyzer Pro uses 5 sensors additionally to the 2 foot sensors (7 sensors at all). This allows the analysis of ankle joint angle, knee joint angle and hip angle.

How long does the battery of the MotionSensors and Tablet are working?
MotionSensors: up to 11 h operating time, 4 h charging time.
Tablet: between 6-8 h operating time, 5h charging time.

For which distance the Bluetooth connection works?
20 meters at ideal conditions; Recommendation: stay within 10m.

Is the software running on each tablet or is it possible to use my own device?
No, please use the included RehaGait Analyzer (Pro) tablet.

In which plane (frontal, sagittal and transversal) are the angles measured in the RehaGait Analyzer (Pro) system?
Measurement data is recorded in all three planes. However, the analysis in the sagittal plane is the final output for the RehaGait Analyzer (Pro) software.

Which factors influences the reference data?
The knowledge of reference data enables a simple, fast and accurate assessment of the gait of a patient. The RehaGait Analyzer (Pro) reference data is based on measurements on 1860 healthy volunteers over the entire life span. The reference values are related to age, body height and gait velocity.
Age: 05-95 years, Body height: 118 cm-206 cm

Application spectrum

Are outdoor measurement possible?
Yes, outdoor measurements are possible, as long as all parts stay dry and clean.

How does the RehaGait Analyzer (Pro) works on treadmills?
Treadmill measurements are possible. Before starting the treadmill measurement, a normal calibration without the treadmill is required. The gait analysis on the treadmill should be started when the patient walks with intended speed on the treadmill. The measurement should be stopped before the treadmill speed is reduced.

Does a treadmill have any effect on RehaGait Analyzer (Pro)?
The electrical environment and noises of treadmills have no effect on RehaGait Analyzer (Pro).

How fast can you run with the RehaGait Analyzer (Pro)?
A comfortable gait velocity is recommended. The run velocity can be increased up to a moderate level. However, a high-speed measurement over a longer duration is not intended.

Measurement

How long is the maximum measuring distance (meters)?
Any length is possible. Recommendation is 10-30 meters. Please note the longer the distance, the longer the analysis duration.

How long a measurement can be performed?
The measurement can be performed as long as desired. The recommended distance is 10-30 meters or 40-60 seconds of walking time.

Why is the specified measurement distance not the same as the real walked distance?
The indicated term „analyzed distance“ does not correspond to the “real distance“, since RehaGait Analyzer (Pro) will only analyze complete strides. Additionally, strides may not be considered because of acceleration, deceleration or curves.

Is there a minimum and a maximum for the stride length?
No, the MotionSensors measures all possible stride lengths.

Analysis

What is shown in the report?
All results and graphs can be displayed in the report (patient information, measurements, parameters, graphics, etc.). The report is configurable to individual needs.

How the score is calculated in the RehaGait Analyzer (Pro)?
The score allows a fast and clear reference value-dependent evaluation of the gait parameters. The vertices on the outer blue n-corner mark the reference value median (center of the reference value range) of the respective parameters. The vertices of the inner green n-corner indicate the measured values of the patient. The measured value is related to a maximum of 1.0 to the reference value median. This relative value is behind the respective parameter.
The total score is calculated as the average of the relative values of the selected parameters. If you have selected a comparison measurement, this n-vertex is displayed in pink and the relative values of the comparison parameters are given in brackets. The closer the inner green n-corner comes to the outer blue n-corner, the better the gait with respect to the respective parameter is. The score range is between 0 (remarkable) and 1 (unremarkable).

For further information please visit **www.rehagait.com**
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Notes

Imprint

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MOBILE GAIT ANALYSIS

For further information please visit www.rehagait.com
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