

Balance-Coordination-System

... an all-rounder for evaluation, therapy and training



We invest in health

IMM are a medium-sized company developing and producing electronic boards and devices.

At the same time, IMM are running two health care centres, offering fitness and rehabilitation services, with more than over 1,200 club members. Hence, we have got the possibilities to test all our products by putting them into practice beforehand, as well as the devices of our partners.

The centres also enable us to conduct comprehensive studies gathering information for all different kinds of balance measurements. They will be included in the evaluation software in order to compare the data with the measurement parameters.



... it depends on the balance.

Posture:

The interaction of our muscles and joints determines our posture. A central and symmetrical physical posture is the prerequisite for consistent stresses on all body parts. Our physical posture is subject to many diverse influences, such as movement patterns, professional or sports skill profiles, injuries, anatomical changes (e.g. scoliosis) and, last but not least, aging processes. Hence, it leads to disturbances in posture symmetry, strain and, thus, unilateral wear of the joints.

Balance:

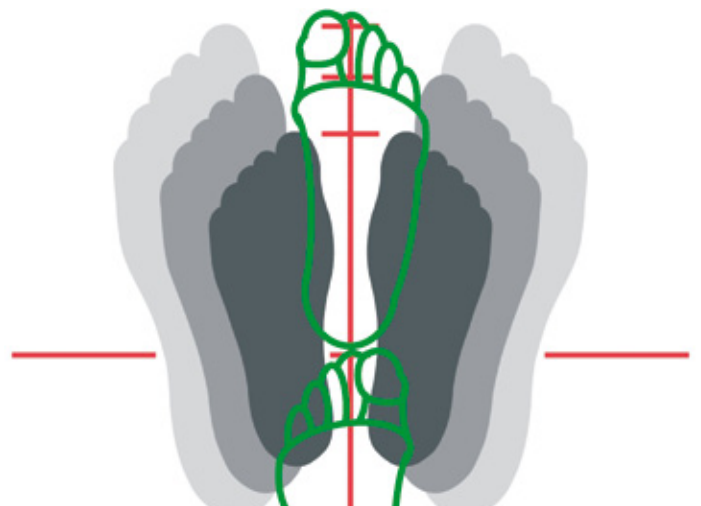
Our regulation of balance is a highly complex interaction of many physical internal sensors, actuators and regulatory mechanisms. Information concerning the position and movement of the joints, muscle tension, our relative position and movement to the earth's gravitational field and many more is obtained from the receptor signals. This information is linked with our intended movement and predetermined as well as learned movement patterns and, hence, commands that control our physical posture are deduced. In this process, several „regulatory circuits“ have mutual effects, which work at different time levels due to their different functions and effects. Visual, vestibular, somatosensory and cerebellar regulatory processes are differentiated. Conclusions of the proportion of these regulatory circuits in balance regulation can be drawn via frequency analysis of balance regulation.

Coordination:

We understand coordination as the capacity to attune the control of our posture and regulation of our balance using movement patterns and intended movement, to react to external influences and to carry out goal-oriented movements. Proprioception (Latin proprius, meaning “one’s own” and perception) is the sense of the relative position of neighbouring parts of the body. Our coordination ability depends on many factors, such as training status, health condition, nutrition, our form of the day, age, etc.

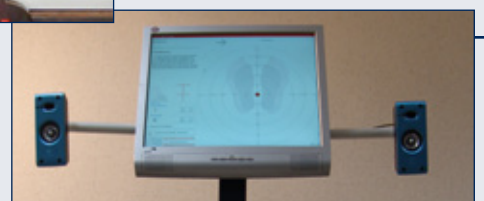
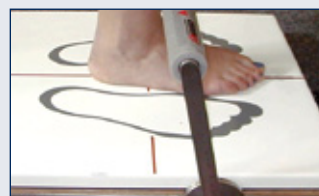
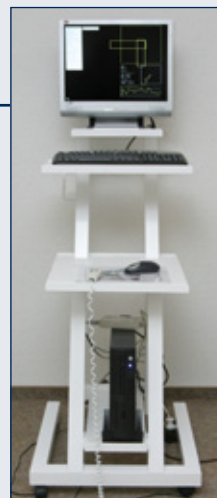
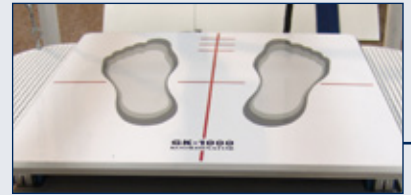
In general, by means of movement and, in particular, by targeted sports activities, we train this complex interaction between our regulatory circuits and, hence, optimise our coordination ability. In particular, the process is effective due to biofeedback training, in which the effects of minimal change in the muscle tone at our body’s centre of gravity are made visible by means of visual feedback.

For this reason, coordination not only indicates our entire physical constitution, but rather represents an excellent instrument to follow up all therapies and trainings affecting the functions of our internal regulatory circuits.



Evaluation, treatment, training

Balance coordination and the effectiveness of balance and proprioception training can be checked using the balance coordination system. The system consists of a balance platform that registers minimum deviations of the body's centre of gravity which will be evaluated by a computer.



The balance coordination system and its components

Balance platform

The balance platform is the technical basis instrument to record displacement of the body's centre of gravity. It is equipped with 4 measuring sensors so that the position of the resulting point where the force is applied can be calculated. Depending on the design of the sensors, the measuring plate is suitable for qualitative measurements and training tasks (Gamma Knife of 100) or for quantitative measurements with reproducible measurement results (Gamma Knife of 1000).

Accessory / options

① **Supporting frame:**

The supporting frame offers an ancillary device for people with limited movement and is an additional safeguard during training as well as represents a prerequisite to mount the swinging structure for dynamic testing and training processes.

② **Swinging structure:**

This accommodating structure for the measuring platform offers the option of carrying out all dynamic tests and training where three-dimensional displacement takes place. The prerequisite is the presence of the supporting frame. ①

③ **PC terminal:**

This visually attractive framework serves to accommodate the computer, keyboard and TFT monitor.

④ **Computer stand:**

The computer stand can be used as an alternative to the computer terminal. ③

⑤ **Provocation device:**

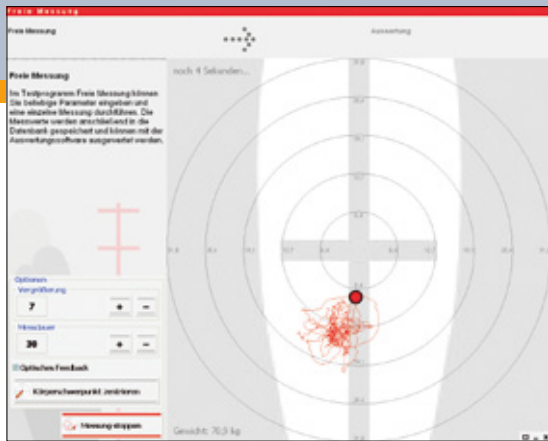
The swinging structure ② attached to the supporting frame ① can show a defined displacement by using this mechanical triggering mechanism so that active dynamic influences are provoked. The triggering process is initiated directly from the software.

⑥ **Positioning bracket:**

The positioning bracket offers position reproducibility on the measuring platform and, therefore, enhanced comparison options in the anterior-posterior plane.

⑦ **Sound module:**

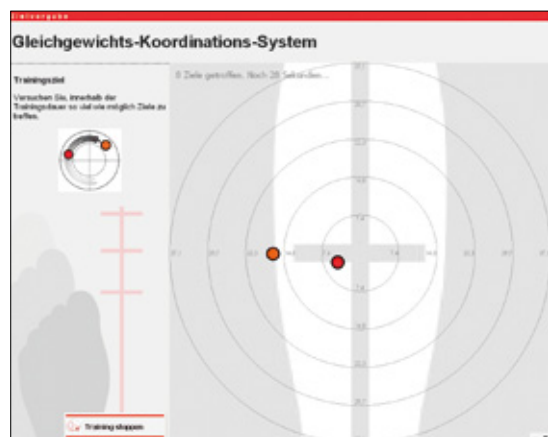
Equipped with a sound module, the system can be used to treat and train people with sight disabilities and those who suffered loss of eye-sight.



①



②



③



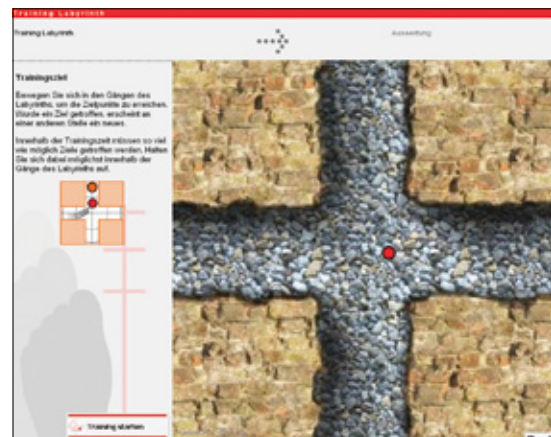
④

Standard module

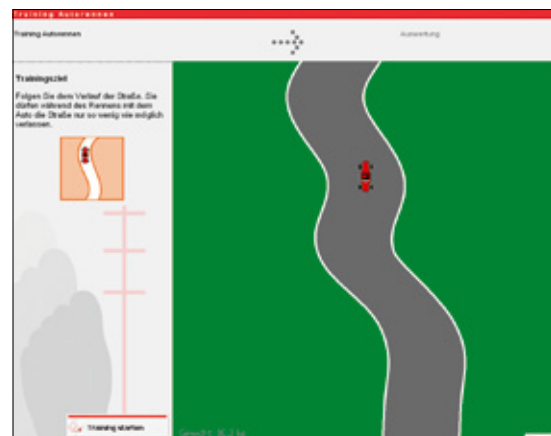
Simple testing and training module to perform a free test and 3 different trainings. Tests and trainings carried out can be stored or printed for documentation as .html files. A detailed evaluation is carried out for free tests. Trainings are evaluated with a specific figure.

Testing and training modules available:

- ① Free testing
- ② Evaluation
- ③ „Target“ training
- ④ „Focus on body's centre of gravity“ training
- ⑤ „Labyrinth“ training
- ⑥ „Motor race“ training (please consider system requirements)



⑤



⑥

Enhanced testing an evaluation module

The enhancement includes measuring and diagnostic modules based on databases to implement comprehensive tests as well as convenient preparation of test databases and administration of test subjects. The database and the test subject can be selected in the start menu **1**.

The automatic tests integrated in the extended test software are based on the classical Romberg test, in which a test is first carried out with open eyes **2**, then with closed eyes. This test is implemented in several practical variations from a viewpoint of neurology or sports medicine.

A detailed evaluation based on the evaluating parameters (please see page 8), which can be retrieved at any time by saving in the corresponding database, are carried out for all measurements and training (for example the variation diagram of different levels or of the radius **3** and the movement of the measurement as a whole including the marked area, respectively **4**).

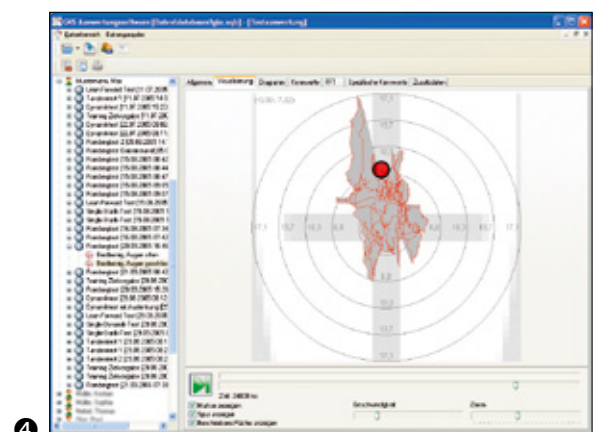
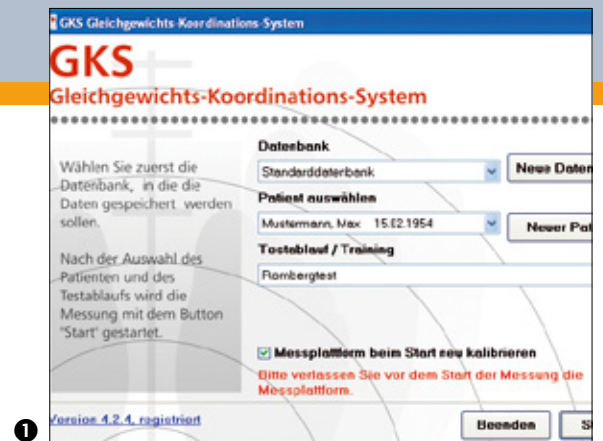
Shuffle and slow motion function, as well as evaluation intervals allow subsequent editing of the measurement and therefore, avoidance of measurement errors, artefacts etc.

Testing and training modules available but in addition with:

- Rombergtest
- Dynamics test / dynamics test with displacement
- Tests with a posture of closed eyes, head forward
- Lean Forward Test
- Tandem test 1 and 2
- Single statics / dynamics test

Sound available as an additional option:

The sound module is an acoustic feedback that will be displayed by masked sounds in different atmospheres (sceneries) once the body's centre is displaced.



Evaluation parameters

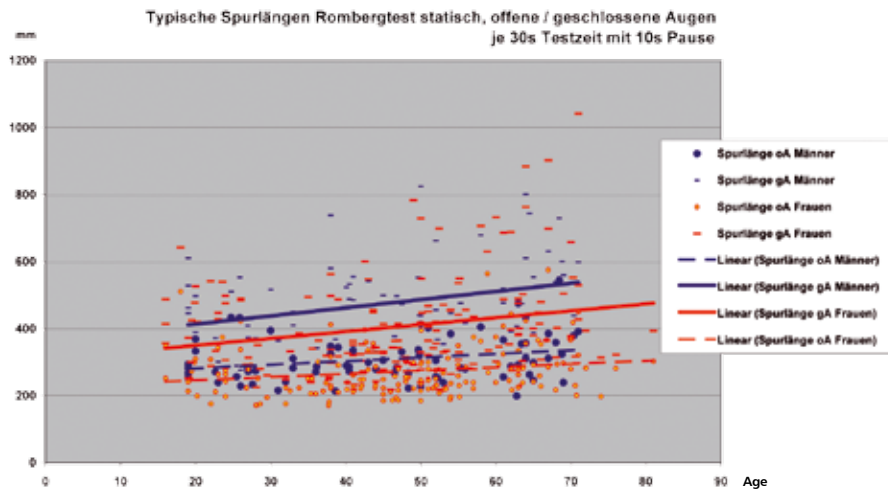


Diagramme of the centre of gravity

Presentation of the displacement process of the centre of gravity. Conclusions on body posture as well as type and manner of balance regulation are drawn from exact positioning. In addition, the displacement in the centre of gravity is divided into lateral and sagittal parts.

Radius

Mean deviation of the body's centre of gravity from its relative centre position [mm]

Surface indicator

Represents the (outlined) surface [mm²] covered by the displacement of the body's centre of gravity

Dynamics indicator

Mean displacement velocity of the body's centre of gravity [mm/s]. It represents the shift length of the centre of gravity when travelled at equal measuring times.

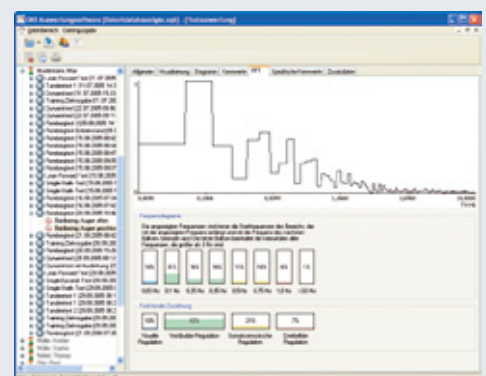
Romberg quotient

Ratio of the surface indicator with open eyes to that with closed eyes

FFT (Fast Fourier Transformation)

Representation of the frequency range obtained during balance testing when the centre of gravity is displaced.

Different frequencies represent different regulatory circuits, in which more profound frequencies are preferentially allocated to visual and vestibular and higher frequencies to the reflex (somatosensory and cerebellar) balance regulation.



The allocation of regulations, which are shown in the evaluating software, to fixed and clearly separated frequencies is mathematically essential; however, in practice, these limits run smoothly and are individually different.



The balance coordination system in practice

The balance coordination system (BCS) is a modular measuring system for computer-supported measurements and therapy for poor posture, stresses or balance disorders as well as biofeedback training of balance and proprioception.

Therefore, the BCS is best suited for testing of posture, balance and coordination.

Posture, balance and proprioception training

Static balance training

Static balance training with or without visual feedback, posture control training following injury of the support and locomotor system, therapy for loss of balance and poor posture. Relief of ataxia, supplementary treatment for locomotion therapy in spinal lesions and brain damage, training to prevent falls.

Applications: Neurology, geriatrics, orthopaedics, physiotherapy, remedial gymnastics

Dynamic passive coordination training

Dynamic balance training and proprioception training with or without visual feedback, alleviation of ataxia, posture training and movement control following injury of the supports and locomotor system, training for the prevention of falls.

Applications: Neurology, orthopaedics, physiotherapy, performance sports

Dynamic active and coordination as well as reaction training with active provocation

Dynamic biofeedback balance training with active balance provocation, proprioception training, training for the prevention of falls, checking and training of muscular reaction speed.

Applications: Neurology, orthopaedics, physiotherapy, performance sports



The balance coordination system in practice

Measuring posture, balance and coordination

All measurements of both posture as well as balance and coordination are determined by means of a force plate of the resulting point of force application (cop - centre of pressure) on the contact surface. In this process, the sheer body's centre of gravity (cog - centre of gravity) and the resulting point of force application (cop), representing overlapping of the body's centre of gravity and the pressure distribution of the base at the measuring plate, must be differentiated.

Control of posture

In this context, we understand control of posture as the static and quasi-dynamic control of the body's centre of gravity: The body structure and posture during loss of balance, anatomic anomalies and poor posture can be controlled by checking the position of the body's centre of gravity.

Applications: Physiotherapy, orthopaedics, neurology, remedial gymnastics: indications and therapy of stresses and relieving postures, exercising in a standing position following spinal lesions or brain damage

Balance analysis

Balance coordination can be checked by measuring the displacement of the centre of gravity („centre of pressure“) under static or dynamic conditions. Sensory motor circuits (head inclination and rotation) can be targeted or masked (for example, when closing eyes -> Romberg test) by means of different configurations of the measuring processes. Balance analysis offers diagnostic support in different indications (vestibular or cerebellar lesions, ataxia, anatomical anomalies) using the implemented standardised tests. Evaluation using Fourier transformation of regulatory portions offers valuable support in diagnosing the causes of ataxia. Reaction tests, which can constitute an excellent application as a control of suitability for exposed requirements (performance sports, occupational medicine), can be carried out by defined balance provocations. Quantification of the measurements and frequency analysis as well as comparison with reference data allows evaluation of the capacity of balance coordination within comparative groups by means of their progress.

Applications: Orthopaedics, neurology, ear-nose-throat, geriatrics, physiotherapy, occupational therapy, remedial gymnastics: Since the coordination capacity has a very strong correlation with the body's entire constitution, balance analysis offers excellent possibilities of controlling the process in many treatments. In the ENT (ear, nose and throat) branch, the analysis of coordinated regulatory circuits forms the basis of ataxia treatment. Targeted balance training often helps to alleviate or heal ataxia.

Your notes:

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hand over:



Interested in this balance test and training system for your professional field of work?

The *MediTECH* GKS consists of:

- Balance platform GKS-100
- Airex cushion for advanced balance test and training
- Complete software solution for test, analysis and training
- Mobile
- Computer interface (USB connection)

Price: 3,280.00 Euro (plus VAT, packing and shipping) product number: 2530-Set

Please contact us for further information:



Langer Acker 7
30900 Wedemark (Region Hannover)
Phone: +49-(0)5130-977780
Fax: +49-(0)5130-9777822
Mail: service@meditech.de
Internet: www.meditech.de