Recent advances in imaging and diagnostics postural: SpinalMeter CervicalMeter

Roma, 18/01/2014
How to get better performance in weightlifting?

• Starting from a balanced posture

...it’s a good choice.
Proper posture helps in all phases of weightlifting
How to perform an exam with SpinalMeter
Other types of exams supported

With the Podometric platform

1. Static exam
Other types of exams supported

With the Podometric platform

1. Static exam
2. Stabilometric exam (soon)
3. Dynamic exam (New)
PosturalMeter
Ambulatory
Thanks
A high-definition system for evaluative and diagnostic purposes, thanks to data and parameters obtained using a platform and anatomical markers in a photographic sequence, processed with dedicated mathematical formula using custom software, which provides a three-dimensional image of the entire rachis and to produces angular measurements of its curves (automatic calculation of Cobb angles) and their deviations and imbalances and postural abnormalities. The only system of its kind to be recognized by a certification from the Ministry of Health as a suitable apparatus for measuring the whole biometric osteo-articular postural apparatus without the use of X-rays.

This system, called SpinalMeter, detects any postural imbalances of the spinal column and in particular structural paramorphisms and dysmorphic features. The examination is absolutely free of radiation emissions and requires no special protection or shielding for either patients or operators. This important feature allows practitioners to perform repeated checks, in order to monitor the status of pathological conditions and the effectiveness of treatment protocols and rehabilitation.

The result of years of mathematics, engineering, computer science and medical research, SpinalMeter is able to take a series of biometric measurements and create a real-time reconstruction of the column in 3D. Its highly reliable data and objective parameters allow specialists to evaluate the spine and accurately diagnose its alterations, and identify diseases, malformations, attitudes, malpositions and imbalances, which often cause painful acute and chronic symptoms in patients, and to screen young and still growing patients, to detect potentially disabling developments.
Biometric laboratory: SpinalMeterEvolution

The current version of SpinalMeter and its fundamental principle (collection of data through a digital photo, without use of radiation) is the starting point of the new version. For the first part of the exam the physician or practitioner applies markers to the pre-defined landmarks on the back of the patient (who stands on a baropodometric platform with 10 sensors per square centimetre). Then the doctor will acquire the photo of the patient’s back and use the mouse to select the landmarks (either highlighted by reflective markers previously applied to the patient, or by clicking directly on the photo, as use of the markers is optional) allowing the system to detect the biometric measurements of the patient, perform all calculations (reconstruction of spine, length discrepancy, Cobb angles, body triangles, etc..) that will appear on the screen along with the 3D reconstruction of the column.

The doctor can then proceed to take other biometric measurements, through acquisition of other data:

• Side photo SX, Side photo DX, Anterior bending position photo (torso bent forward)

Lateral photos allow the calculation of cervical and lumbar fleche among other things, and to also detect rotations of the pelvis. Photos in a bending position allow automatic calculation of kyphosis.

Then, without moving the patient it will be able to assess the plantar support by performing static, dynamic and stabilometric analysis of the plantar support. The doctor may at this point make a series of additional tests in order to obtain a complete clinical postural picture of the patient, specifically:

• Cervical analysis (to check movement of the head). The patient wears CervicalMeter, a helmet-like is asked to move his head forward and backward, turn it to the left and to the right and then tilt it left and right. This interesting examination reveals any difficulties in movement of the head.

• Analysis of the temporomandibular joint - TMJ (the TMJ performs the function of articulating the complex movement of the jaw in three planes of space). The patient wears a temporal headband, which, managed by the system software, allows the addition of two other detection points, in order to evaluate the joint. Improper jaw position or incorrect action of the TMJ causes imbalances in the muscles (such as masseters, external and internal muscles of the neck, trapezius and column) that affect the patient’s balance.

• Thermographic infrared analysis will be performed through integration of infrared cameras into the SpinalMeter Evolution system, using cutting-edge technology to detect radiation in the infrared spectrum, that is, heat. Based on detected temperature differences, thermal imaging cameras can create a crisp image. From the analysis of the image, complex algorithms allow correct detection of the temperature. Body temperature detection in various areas is very useful to the doctor to detect any muscle inflammation.

The software allows the practitioner to record, for each patient, all medical examinations and to read previous radiographic examinations, from a CD provided by the patient, and to acquire and save them in the patient's clinical diary for comparison. The integration of all these tests provides the clinician with the best possible picture in order to make a diagnosis with greater peace of mind. The software is multi-user and multi-medical centre, and the system can be shared among several professionals as well as among different medical centres.
Access the application

- Choose the work group
- Enter user name and password
Opening an exam screen

1. Create or choose a patient
2. Choose the type of exam:
   a) SpinalMeter exam
   b) CervicalMeter
   c) Static pedestal
   d) Stabilometric pedestal

In this case we have opened a SpinalMeter exam, in which the height and weight of the patient can be entered. Using the buttons at the top left, we can capture an image using the stand, or load a file image.
The SpinalMeter system is made up of
1. A computer dedicated to the application

2. An acquisition system made up of
   1. a stand
   2. a “calibration” platform
   3. a stand-platform connector
Posterior photo of the patient, to whom special markers can (optionally) be applied to help the doctor identify anatomical landmarks.

Up to 21 anatomical landmarks are preset, including left, right and specific points of the spinal column.

Of all these anatomical landmarks, only 9 are essential for the precision of the exam.
How to enter the points on the list
Use the mouse to click near the marker on the point to be selected, and the system automatically loads the values in the list of points needed for the postural evaluation.

Markers

SpinalMeter Exam
SpinalMeter Exam

The system identifies the shape of the markers (circular, square, triangular...) and uses their centres as its positions.

If no shape is found (markers haven’t been applied) the system uses the exact point of the mouse click.
SpinalMeter Exam

As the points are selected the system calculates the values
## SpinalMeter Exam

### The values

1. **The planes**
   - Clavicular Plane: -1.42° (Left), 1.499.19 mm (Right)
   - Scapular Plane: 3.50° (Left), 1.016.16 mm (Right)
   - Pelvic Plane: 0.12° (Left), 1.101.11 mm (Right)

2. **Lengths**
   - Clavicle - Heel: 1.510.94 mm (Left), 1.499.19 mm (Right)
   - Clavicle - Popliteus: 1.040.49 mm (Left), 1.016.16 mm (Right)
   - Clavicle - Crest: 425.94 mm (Left), 406.48 mm (Right)
   - Crest - Popliteus: 629.25 mm (Left), 619.12 mm (Right)
   - Crest - Heel: 1.100.49 mm (Left), 1.101.11 mm (Right)
   - Heel - Popliteus: 471.61 mm (Left), 483.09 mm (Right)
   - Valgus / Varus: -176.98° (Left), 174.81° (Right)

3. **Inclination of angles**
   - Clavicular Plane: -1.42° (Left), 1.499.19 mm (Right)
   - Scapular Plane: 3.50° (Left), 1.016.16 mm (Right)
   - Pelvic Plane: 0.12° (Left), 1.101.11 mm (Right)

4. **Body triangles**
   - 11.261.96 mm² (Left), 6.873.39 mm² (Right)
   - 62.10% (Left), 37.90% (Right)
SpinalMeter Exam

The values

1. The planes
2. Lengths
3. Inclination of angles
4. Body triangles
5. Cobb angles
   - With length of the arc
   - Name and inclination of the start and end vertebra

<table>
<thead>
<tr>
<th></th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Angle</td>
</tr>
<tr>
<td>Cobb 1 D1 [-9,74°] D5 [-4,98°]</td>
<td>-4,25°</td>
</tr>
<tr>
<td>Cobb 2 D5 [-4,98°] D11 [7,01°]</td>
<td>12,00°</td>
</tr>
<tr>
<td>Cobb 3 D11 [7,01°] L4 [-1,44°]</td>
<td>-8,46°</td>
</tr>
</tbody>
</table>
SpinalMeter Exam

3D Visualisation

From the model of the vertebral column, you can display a 3D representation with one click.
3D Visualisation

From the model of the vertebral column, you can display a 3D representation with one click.

You can:

1. Rotate the model
3D Visualisation

From the model of the vertebral column, you can display a 3D representation with one click.

You can:
1. Rotate the model
2. Zoom in and out
SpinalMeter Exam

Other views
Right lateral
SpinalMeter Exam

Other views
Right lateral
Left lateral
SpinalMeter Exam
SpinalMeter Exam
CervicalMeter: a helmet-based system that measures the inclination of the head in three axes in real-time

1. Deflection angle (Forward tilt Front-Back)
2. Pitch angle (Lateral Pitch Left-Right)
3. Rotation angle (Rotate Left-Right Side)
CervicalMeter Exam

Acquisition screen

Shows 4 views

1. Deflection angle View (Forward tilt Front-Back)
2. Window Pitch angle View (Lateral Pitch Left-Right)
3. Window Rotation angle View (Rotate Left-Right Side)
4. Gyroscope Heading View
CervicalMeter Exam

Acquisition screen

Before performing acquisition

1. Zero the helmet’s references

2. While the patient repeatedly tilts his head forward and backward, record the deflection angle by clicking Start

3. While the patient repeatedly tilts his head left and right, record the pitch angle by clicking Start

4. While the patient repeatedly turn his head left and right, record the rotation angle by clicking Start
CervicalMeter Exam

Data acquired

1. Deflection angle record (Forward Tilt Front-Back) and Statistical values (angle width, min, max, standard deviation)

2. Pitch angle record (Lateral Pitch Left-Right) and Statistical values (angle width, min, max, standard deviation)

3. Rotation record (Rotate Left-Right Side) and Statistical values (angle width, min, max, standard deviation)
CervicalMeter Exam

Deflection angle (Forward Tilt Front-Back)

Statistical values
1. angle width
2. Mean of Min Front value
3. Mean of Max Back value
4. Standard deviation of two Mean values
CervicalMeter Exam

Pitch angle (Lateral Pitch Left-Right)

Statistical values
1. angle width
2. Mean of Min Left value
3. Mean of Max Right value
4. Standard deviation of two Mean values
Rotation angle (Rotate Left-Right angle)

Statistical values

1. angle width
2. Mean of Min Left value
3. Mean of Max Right value
4. Standard deviation of two Mean values