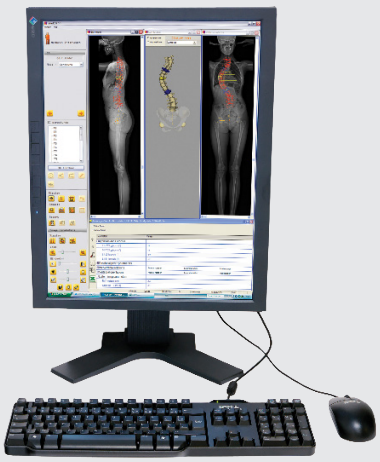
sterEOS - 2D|3D Workstation

The first weight-bearing 3D modeling solution that automatically calculates over 100 clinically relevant parameters.*

Introduction

Designed specifically for orthopaedic applications, the sterEOS workstation offers a state-of-the-art 2D viewer (sterEOS 2D) while also enabling 3D measurements and 3D weight bearing modeling of the bone surface using the EOS simultaneously acquired AP and Lateral biplanar images (sterEOS 3D).



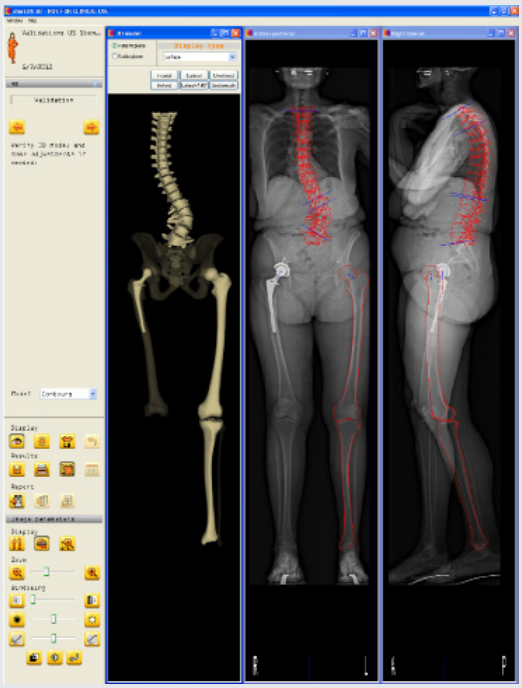
sterEOS workstation

sterEOS 2D

sterEOS 2D provides specialized tools dedicated to the analysis of paired images taken with EOS. sterEOS 2D provides state-of-the-art features for the management of DICOM images acquired from EOS or other modalities**.

sterEOS 3D

Without any additional radiation, sterEOS 3D allows for three-dimensional clinical measurements and modeling of the spine, lower limbs (femur and tibia) and hip prothesis (cup and stem post-operatively). From this 3D modeling, sterEOS automaticaly calculates diverse clinical parameters allowing for global analysis of the patient, as well as Postural Assessment.



sterEOS 3D Final output

Specifications

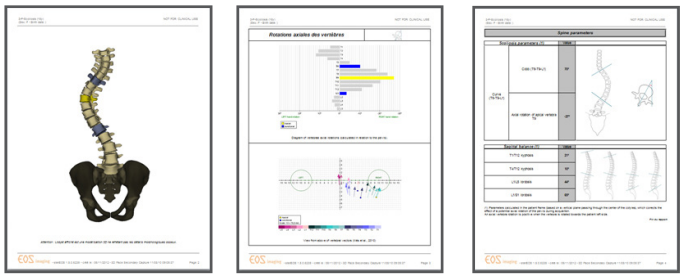
Workstation:

- PC Windows 7
- Dedicated graphics board
- Medical LCD monitor 21 inch colour / 2 million pixels (1600x1200)
- Microsoft Word and Excel
- Reader/Writer CD 16X DVD +/- RW

Communications Interface:

- Transfer of images to the PACS in DICOM format
- Sending images to DICOM printers (Print True Size available)
- Generation of a patient report in DICOM and RTF (Rich Text Format) including selected EOS X-Ray images, 3D images, clinical data and users comments.

Example of a patient report



EC conformity assessment: LNE/G-MED CE0459, Class I (measuring).
For USA - Caution : Federal law restricts this device to sale by or on the order of a physician.
* for the spine, pelvis, femur and tibia.
** except mammography and angiography.

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3 D Modeling

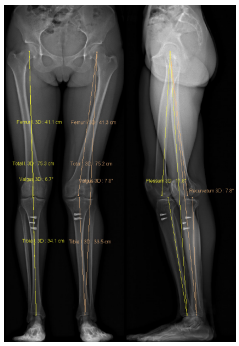
The process of 3D modeling starts by the identification of anatomical landmarks on the frontal and lateral EOS X-rays. These landmarks combined with large statistical databases and contour detection algorithms (spine and lower limb) allow a 3D model that is adjusted to match the bone contours on the EOS X-rays. 3D clinical parameters are then automatically calculated from the model.
Hence full-size 3D modeling can be performed from two low-dose EOS X-rays without any additional radiation. The combination of whole body, low-dose X-ray images and 3D weight-bearing modeling with associated calculations gives various medical specialties, particularly orthopedics, access to new clinical information to aid in the analysis of spine, hip & knee deformities and therapies.

3D Lower Limb Alignment

The fast 3D lower limb alignment process provides reliable leg length and postural angles, independent of the leg orientation or patient position in the EOS system.

Lower limb alignment clinical parameters and display

Lengths	Femoral Axis Length Tibial Axis Length Anatomical length Functional Length
Hip parameters	Femoral Head Diameter
Knee parameters	HKS Varus/Valgus Knee Flexion / Extension

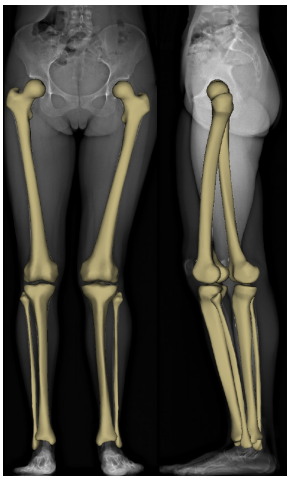


3D Lower Limb Modeling[1]

It is possible to complete the lower limb alignment process to obtain a 3D lower limb model . The visualization of the 3D model can be made from any point of view (top & bottom views, frontal & lateral views). 3D lower limb modeling allows for calculation of further clinical parameters, including femoral and tibial torsions.

Lower limb modeling clinical parameters and display

Lengths	Femoral Axis Length Tibial Axis Length Anatomical Length Functional Length
Hip parameters	Femoral Head Diameter Femoral Offset Neck Shaft Angle Neck Length
Knee Parameters	HKS Varus / Valgus Knee Flexion / Extension Femoral Mechanical Angle Tibial Mechanical Angle
Torsional Parameters	Femoral Torsion Tibial Torsion Femoral-Tibial Rotation



3D orientation of the acetabular cup and femoral stem[2,3]

sterEOS 3D provides the clinician with 3D tools allowing postoperative assessment of acetabular cup orientation and femoral stem position and orientation.

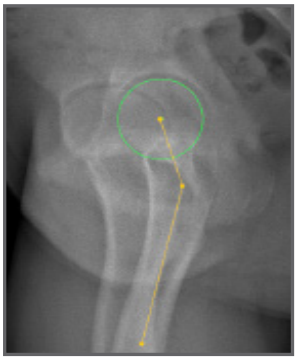
Acetabular cup and femoral stem clinical parameters and display

Acetabular Cup	Anatomical Anteversion and Inclination Functional Anteversion and Inclination
Femoral Stem	Femoral Length Femoral Offset Femoral Antetorsion Neck Shaft Angle

3D Tool Box

Due to the perfect relationship between the two orthogonal images acquired simultaneously with EOS, the 3D toolbox enables the clinician to obtain, in a few clicks, real three-dimensional measurements**, eliminating typical errors linked to X-ray projection and magnification.

3D Tool Box and 3D neck shaft angle measurements



***Provided the reference plan is well positioned*

[1] 3D Lower Limb modeling is unable to highlight bone alterations such as fractures, osteophytes or fibrocartilage calluses and is not adapted for pediatric use. It may not be used in the presence of implants or congenital deformities and when bone structures are not visible in the X-rays. Approved for patients over 15 years old.

[2] 3D measurements of femoral stem may not be used when the femoral head and neck of the stem are not clearly visible in the X-rays.

[3] The 3D envelops of the pelvis and cut femur do not represent precisely the shape of the bone. Their only purpose is to situate the prosthesis in the space.

3D Spine Modeling[1]

The 3D spine modeling process may aid in the analysis of scoliosis and related spinal disorders and deformities. Modeling may be carried out from T1 to L5 and allows for the selection of the apex and junctional vertebrae of the scoliosis and an automatic calculation of clinical parameters. sterEOS allows the user different viewing angles of the global spine (including "birds-eye view" or view from above).

3D spine modeling clinical parameters and display

Fast and full modeling	Scoliosis Parameters	Cobb Angle Axial rotation of the apical vertebrae
	Sagittal Balance Parameters	T1-T12 Kyphosis T4-T12 Kyphosis L1-L5 Lordosis L1-S1 Lordosis
	Pelvic Parameters	Pelvic Version Pelvic Incidence Sacral Slope Pelvic Obliquity Pelvic Rotation
Full modeling	Vertebral & Intervertebral Rotations	Frontal Lateral Axial

Fast 3D modeling: sterEOS 3D provides a fast workflow of spine modeling. It optimizes the processing time by modeling only the vertebrae related to the calculation of the clinical parameters. Fast spine modeling may be carried out from T1 to L5 and allows:

- The identification of the apical and junctional vertebrae of the scoliosis as well as the automatic calculation of the scoliosis parameters: Cobb angles (3 max) and axial rotations of the apical vertebrae.
- The automatic calculation of the sagittal clinical parameters: Kyphosis T1-T12 and T4-T12, Lordosis L1-L5 and L1-S1.

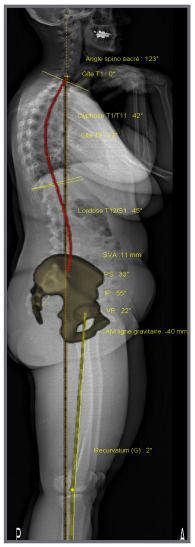
Full 3D modeling: sterEOS 3D spine modeling allows the 3D detailed modeling of all thoracic and lumbar vertebrae. In addition to the clinical parameters computed from the fast 3D modeling of the spine, the system gives access to the calculation of all vertebrae orientations and inter-vertebral rotations (frontal, lateral, axial) of the spine 3D model.

Postural Assessment

sterEOS 3D contains a streamlined application which may aid in the analysis of the degenerative spine and related postural disorders. The software provides access to the clinical parameters of the spine, pelvis and lower limb, allowing for quantification of a patient's sagittal balance.

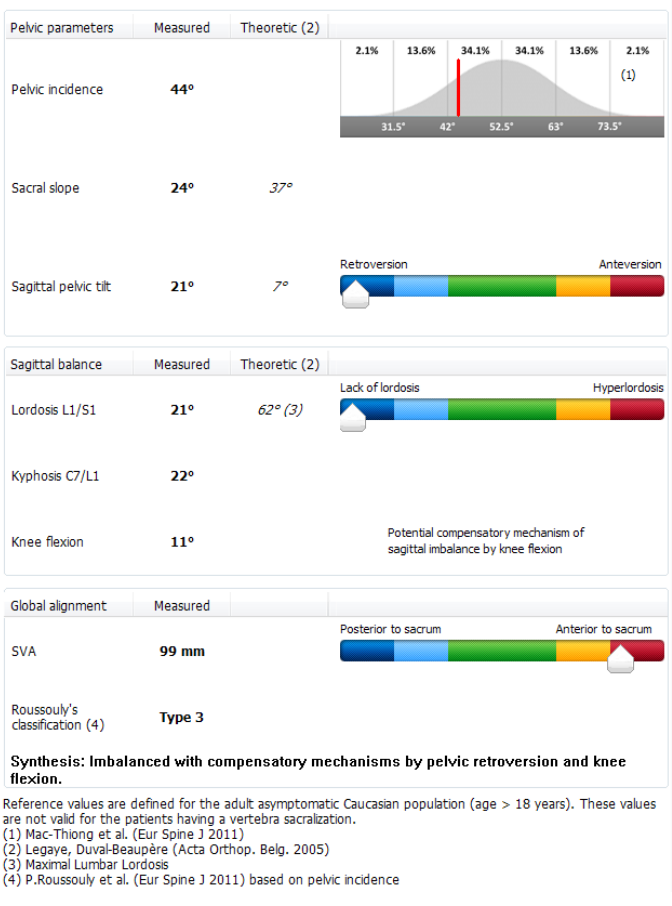
Postural assessment clinical parameters and display

Pelvic Parameters	Pelvic Version Pelvic Incidence Sacral Slope Pelvic Obliquity Pelvic Rotation
Sagittal Balance Parameters	Kyphosis/Lordosis SVA (Sagittal Vertical Axis) CAM plumb line Spino-Sacral Angle T1 tilt T9 tilt Full Body Index Roussouly's classification
Lower limbs	Knee flexion
Scoliosis Parameters	Cobb Angle



The application provides the comparison of the calculated clinical parameters with reference values specific to each patient[2]. In order to aid the user with analysis of the results, a graphical representation of the reference values is provided, highlighting the differences between the measured clinical parameters and reference values. This graphical representation is included to the patient report.

Graphical representation of reference values



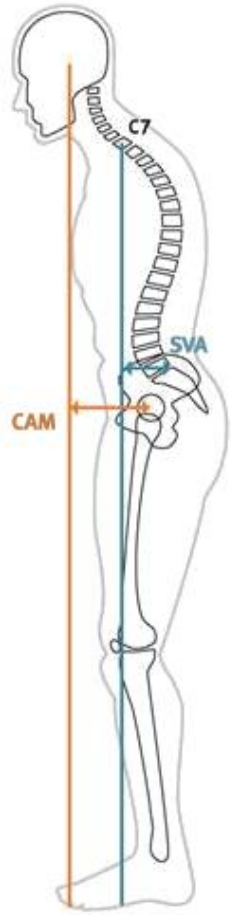
[1] 3D Spine modeling may not be used when the bone structures are not visible in the X-rays, in the presence of implants and in the following pathologies: supernumerary vertebrae, congenital deformities, spondylolisthesis, and other local bone deformities. It is unable to highlight bone alterations such as fractures and local deformation of the bone. Approved for patients over 7 years old.

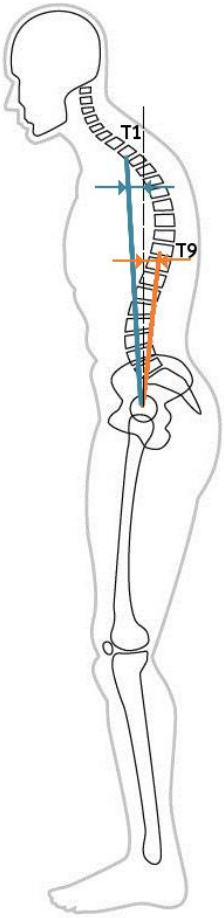
[2] Reference values are defined for the adult asymptomatic Caucasian population (age › 18 years)

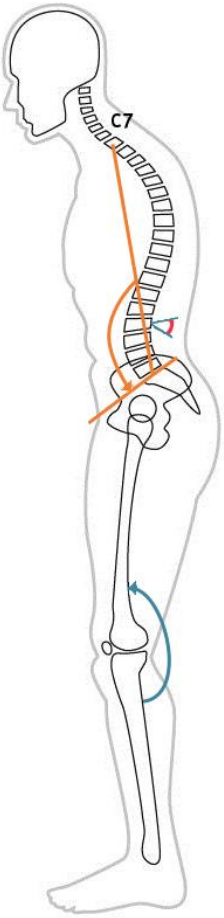
Patient report example

Postural assessment

Sagittal balance

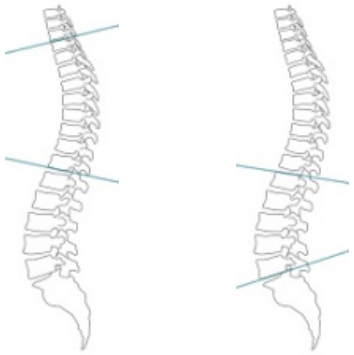






SVA (1)	**104 mm**	T1 Tilt (1)	**-4°**	Spino Sacral Angle (1)	**102°**
CAM plumb line (1)	**140 mm**	T9 Tilt (1)	**6°**	Full Body Index (1)	**15°**
				Knee flexion (Right) (2)	**11°**

Kyphosis/Lordosis (2)

Kyphosis T1/T12	**52°**			Lordosis L1/S1	**46°**

(1) Parameters calculated in the patient frame (based on a vertical plane passing through the center of the acetabula), which corrects the effect of a potential axial rotation of the pelvis during acquisition.
(2) Parameters calculated in the radio frame.

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