

European Spine Phantom

QRM-ESP

The standard for quality control in bone mineral densitometry by DXA and QCT.

The European Spine Phantom **QRM-ESP** is now the standard for quality control - accuracy and reproducibility - in spinal BMD quantification for more than a decade [3]. Its design is closely anthropomorphic by its outer measures and internal lumbar vertebrae inserts such that standard patient protocols can be utilized, both in DXA and QCT.

The phantom's main body consists of water-equivalent resin, the three inserts contain varying amounts of calcium hydroxyapatite (CaHA) to cover the full physiological range of spongy and cortical bone densities for all age groups.

QRM-ESP allows to check reproducibility and accuracy with the following quantities:

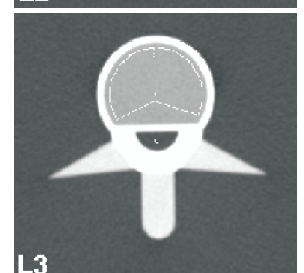
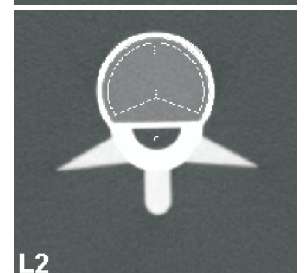
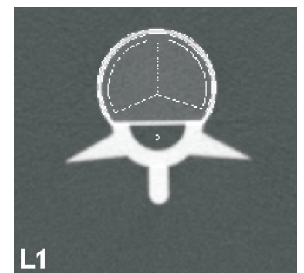
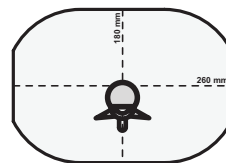
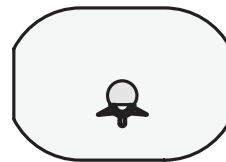
- ✓ bone mineral content (BMC) in g for DXA
- ✓ bone mineral area density (BMD) in g/cm^2 for DXA
- ✓ trabecular and cortical bone mineral density in g/cm^3 for QCT
- ✓ cortical thickness in mm for QCT
- ✓ positioning accuracy in QCT

Cross-sectional view of the three vertebrae

- | | |
|-----------|---|
| L1 | Spongyous: 50 HA (mg/cm^3) |
| | Cortical: 800 HA (mg/cm^3) |
| L2 | Spongyous: 100 HA (mg/cm^3) |
| | Cortical: 800 HA (mg/cm^3) |
| L3 | Spongyous: 200 HA (mg/cm^3) |
| | Cortical: 800 HA (mg/cm^3) |



Resin based water-equivalent phantom body approximately oval shape but with flattened sides for ease of positioning.

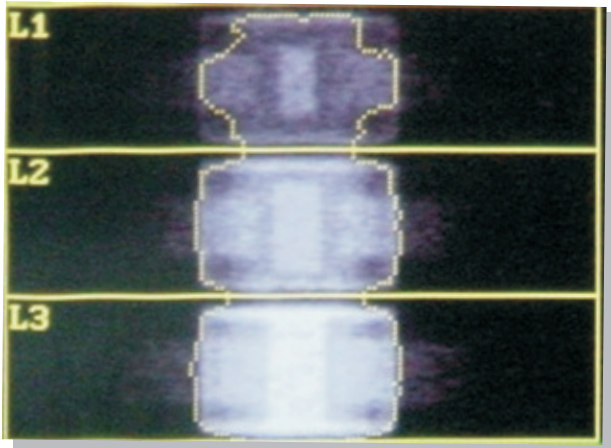


QCT images of the QRM-ESP. Scans of the midvertebral selections with automatically determined ROI for spongyous and cortical bone superimposed.

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DXA scan of QRM-ESP



DXA image of QRM-ESP

Specification

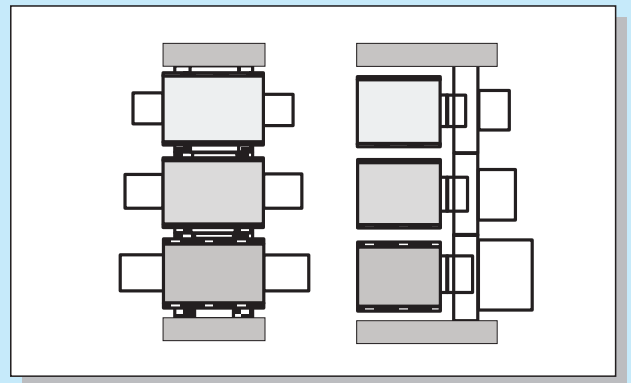
Dimensions of phantom 260 x 180 mm
H = 110 mm

Base material water-equivalent plastic
Spongy bone densities 50, 100, 200 HA
(mg/cm³) for Q-CT

HA in cortical structures and spinal process:
400, 800 HA (mg/cm³)

Area density of vertebrae (AP): for DXA
0.5, 1.0, 1.5 (g/cm²)

Accuracy ±3% of specified values
±1% of certified values



Drawing of the spine insert

References

- [1] Kalender, W.A.: A Phantom for Standardization and Quality Control in Spinal Bone Mineral Measurements by QCT and DXA. Design Considerations and Specifications. Med. Phys. 19 (1991) 583-588
- [2] Genant, H.K. et al.: Universal Standardization for Dual X-Ray Absorptiometry: Patient and Phantom Cross-Calibration Results. J.Bone Miner. Res. 9 (1994) 1503-1514
- [3] Kalender, W.A., Felsenberg, D., Genant, H., Fischer, M., Dequeker, J., Reeve, J.: The European Spine Phantom - a tool for standardization and quality control in spinal bone measurements by DXA and QCT. European J. Radiology 20 (1995) 83-92