ACCURACY OF THE ECHOGRAPHIC-MEASURED "OSTEOPOROSIS SCORE" IN ESTIMATING SPINE MINERAL DENSITY IN PATIENTS AGED OVER 65 YEARS

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Abstract

Osteoporotic fractures are one of the major worldwide problems in terms of mortality, disability and healthcare costs. The key to reduce the occurrence of fragility fractures would be an earlier osteoporosis diagnosis through population mass screenings. The currently accepted "gold standard" method for osteoporosis diagnosis is represented by the evaluation of bone mineral density (BMD) of spine and femur through dual-energy X-ray absorptiometry (DXA). However, because of high costs and issues related to X-ray employment, DXA cannot be used for screening purposes. We investigated the possible clinical feasibility and accuracy of an innovative ultrasound (US) method for diagnosis of osteoporosis of the spine. A total of 303 recruited female patients (aged 65–80 y, body mass index (BMI) < 25 kg/m^2) underwent two different diagnostic investigations: a conventional spinal DXA and abdominal echographic scanning of the lumbar spine, performed with the ECHOS echographic device (Echolight s.r.l., Lecce, Italy), configured for the acquisition of both echographic images and unfiltered radiofrequency signals. US images and radiofrequency signals were analyzed via a new fully automatic algorithm that performed a series of spectral and statistical analyses, providing a novel diagnostic parameter called "Osteoporosis Score" (O.S.). If dual X-ray absorptiometry is assumed to be the gold standard reference, the accuracy of O.S.-based diagnoses was 83,8%, with Cohen's k = 0.752 (p < 0.0001). Significant correlations were also found between US-O.S. and DXA-BMD values in single age intervals: r = 0.76 in 65-70 y, r = 0.72 in 70-75 y, r = 0.75 in 75-80 y (p<0.001 for all). The results obtained suggest that the proposed method has the potential for future routine application in US-based diagnosis of osteoporosis.

Objective

To test the diagnostic accuracy of a recently introduced **ultrasound (US) parameter**, called **"Osteoporosis Score" (O.S.),** in the estimation of spinal bone mineral density (BMD) in elderly people.
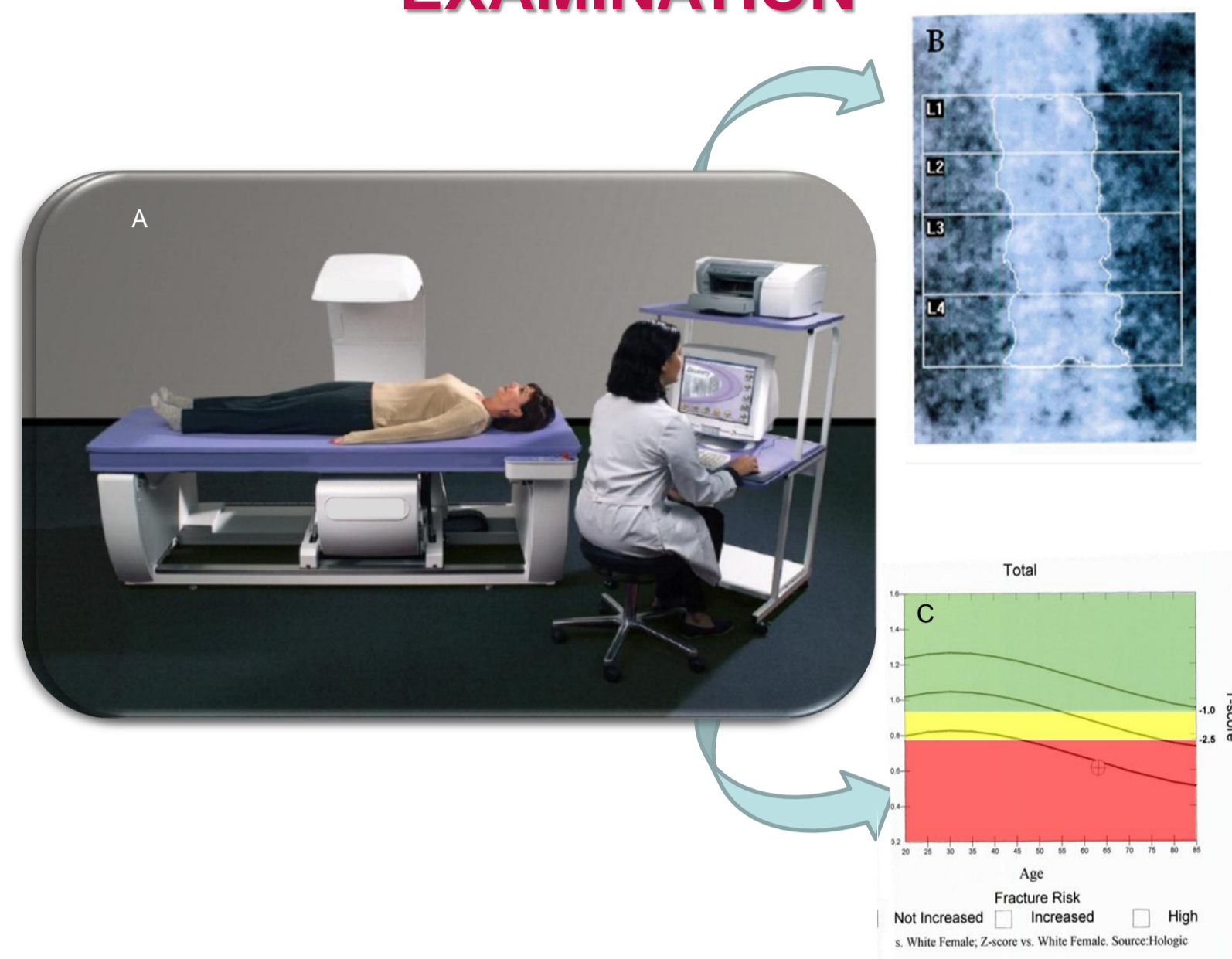
Methods

A cohort of 303 female patients was recruited according to the following criteria:

- ✓ 65-80 years of age;
- ✓ BMI < 25 kg/m^2;
- ✓ no severe deambulation impairments
- ✓ medical prescription for a spinal DXA

Each patient underwent two exams:
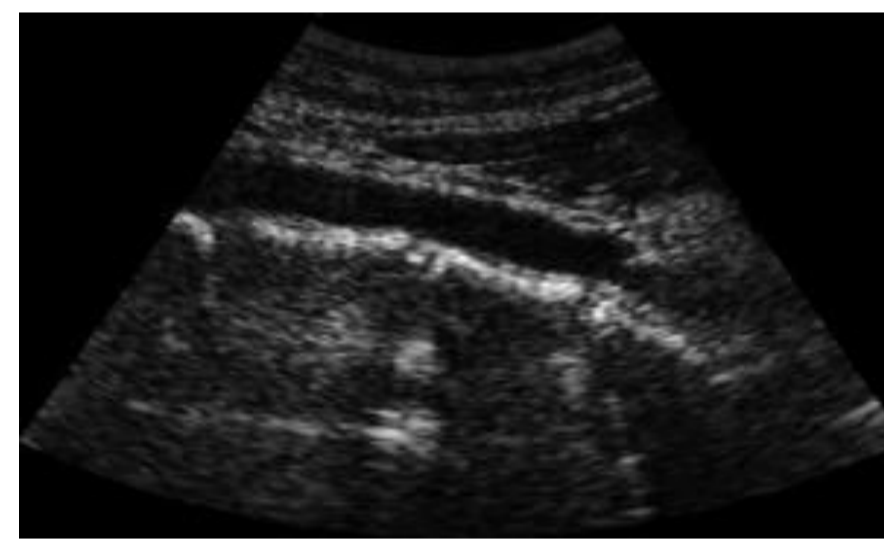
1. CONVENTIONAL SPINAL DXA EXAMINATION

2. US SCAN OF LUMBAR SPINE

- **Acquisition of both US images and "raw" RF signals**

- **Target interface visualization**

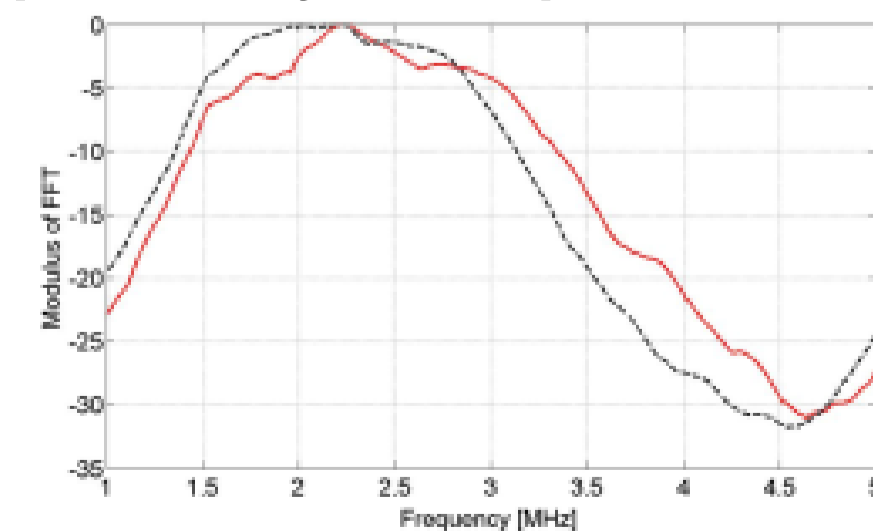- **Automatic segmentation of bone interface**

- **Automatic detection of ROI**

ROI

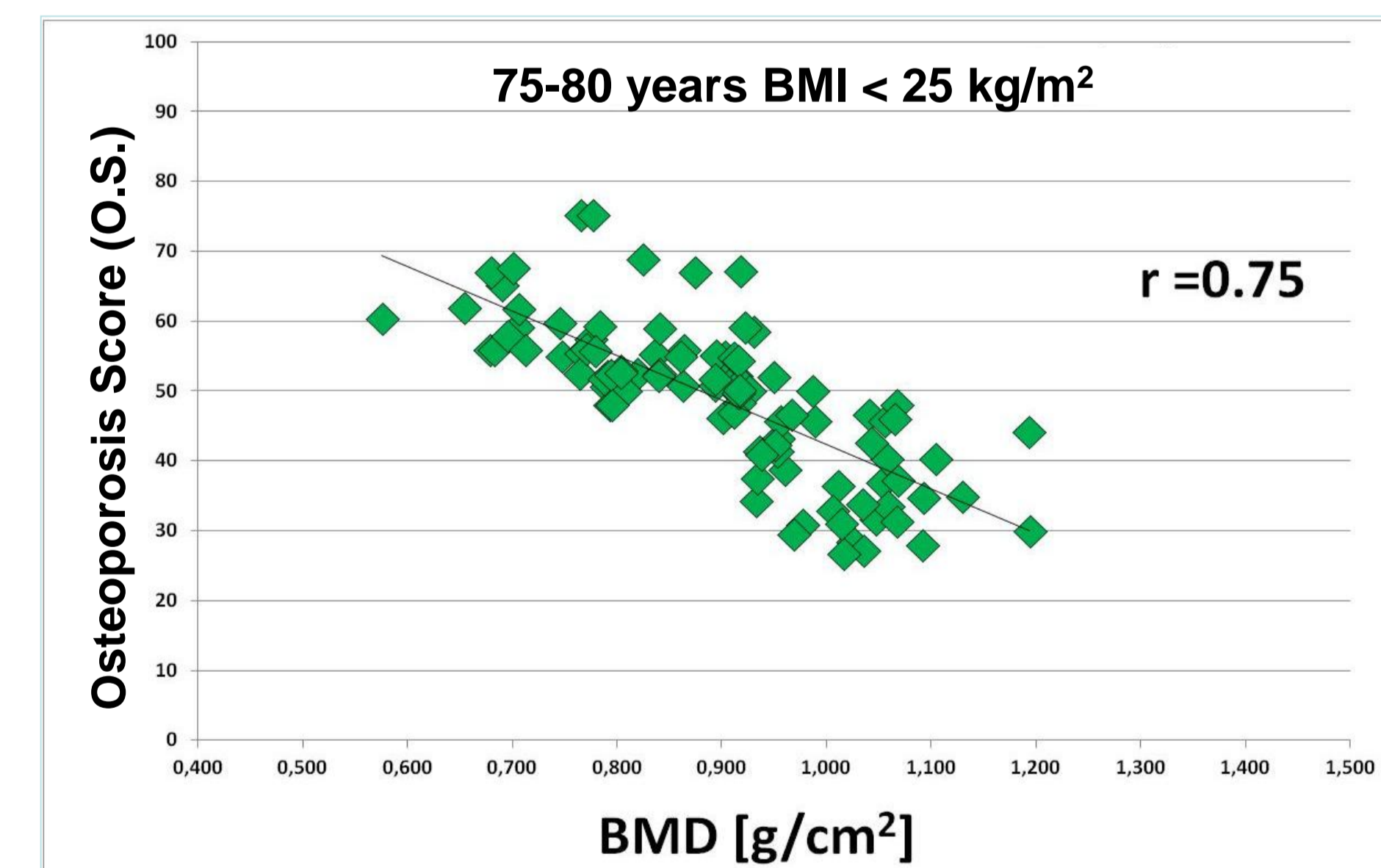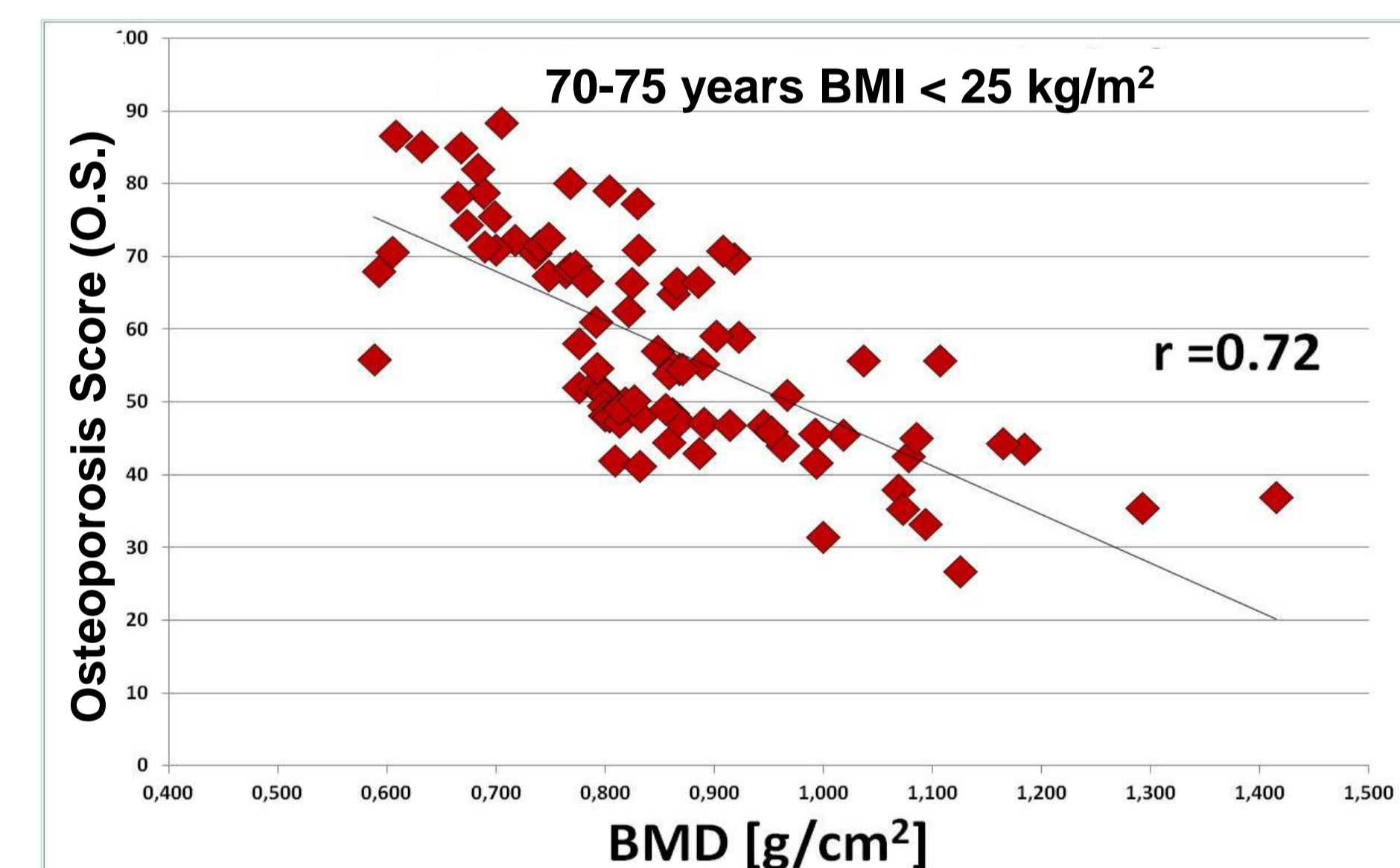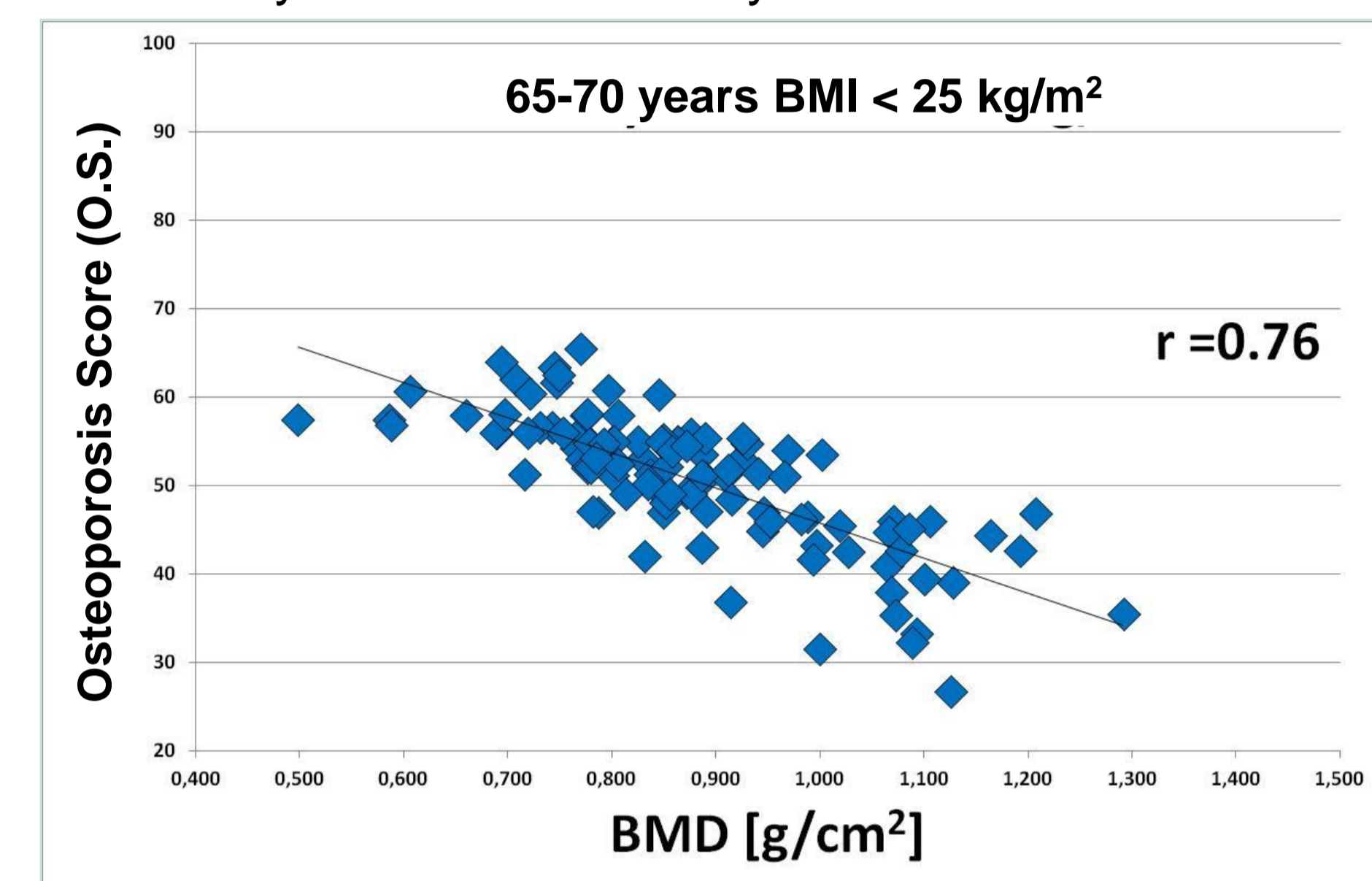- **Automatic RF signal analysis**

- **Automatic spectral comparison with previously built spectral models**

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DIAGNOSTIC OUTPUT: OSTEOPOROSIS SCORE (O.S.)

Results

For 83.8% of the patients US diagnosis was the same of the corresponding DXA one (k = 0.752, p<0.0001). Significant correlations (see Figures below) were also found between O.S. and BMD values in single age intervals: r = 0.76 in 65-70 y, r = 0.72 in 70-75 y, r = 0.75 in 75-80 y (p<0.001 for all). The diagnostic agreement between O.S. and DXA resulted to be very good, although it was slightly inferior to recently published data on O.S. measurements in younger patients [1]: this can be at least partially attributed to degenerative changes in the lumbar spine region, which may affect the accuracy of DXA scan.

65-70 years BMI < 25 kg/m^2
r =0.76

70-75 years BMI < 25 kg/m^2
r =0.72

75-80 years BMI < 25 kg/m^2
r =0.75

Conclusions

We presented a novel US-based approach for spinal bone densitometry documenting its significant agreement with the gold-standard DXA technique.

The O.S. is a potentially powerful parameter for osteoporosis diagnosis also in elderly people because of its significant correlation with DXA-measured BMD. Future studies, including computed tomography as a gold standard reference, will assess in detail the diagnostic discordance cases.

REFERENCES:
1.Ultrasound Med Biol 2015;41(1):281-300