COMPARISON OF DXL OF CALCANEUS AND DXA OF SPINE AND HIP INCLUDING FEMORAL GEOMETRIC PARAMETERS IN PATIENTS WITH VERTEBRAL FRACTURES

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Objectives:

DXA measurements of spine and hip are used to identify patients with low BMD who are at substantial risk for osteoporotic fracture. A T-score ≤ -2.5 at these measured sites is regarded as osteoporotic but BMD at spine is often distorted by conditions such as scoliosis, osteoarthritis, degenerative conditions or compression fractures. DXL of calcaneus provides additional information of a different skeletal site that is comparable to a vertebrae.

Material & Methods:

This cross sectional population-based study is comprised of 530 patients (448 women, 82 men, age 66.2 ± 14.8 years). 131 patients with vertebral fractures (mean age 73.1 ± 12.2 years) were verified by x-ray examinations of the spine (Table 1).

T-Score	Vertebral fracture	No vertebral fracture
	n=131 (109♀/22♂)	n=399 (339♀/60♂)
Population (years)	73.1 ± 12.2	66.2 ± 14.8*
Females (years)	74.2 ± 11.5	67.0 ± 14.7*
Males (years)	67.6 ± 14.3	61.6 ± 15.1*
DXL Heel	-2.67	-1.92**
L1 - L4 BMD	-2.04	-1.51**
Fem Neck BMD	-2.00	-1.33*
Total Hip BMD	-1.80	-1.16*
		*P <0.05 **P < 0.0001

Table 1: Patient specific Data - Demographics

BMD was obtained using DXL Calscan (Demetech AB) for calcaneus scans and the iDXA device (GE Lunar) for scans of the femur and lumbar spine. Lowest BMD results of spine and hip and geometric parameters of the hip such as femur strength index (FSI), cross sectional area (CSA) and cross sectional moment of inertia (CSMI) were compared to DXL results. The patient database was identical for both scanners.

The area under the receiver-operating curve (AUC) was calculated for each measurement site and scanner to show the ability of each scanner and measurement site to discriminate between the vertebral fracture patients and the control group of 399 patients without vertebral fractures (sensitivity and specificity).

Results:

The strongest correlation coefficient of the two measuring methods was found between DXL of the calcaneus and DXA of femoral neck (Table 2).

T-Score	DXL Heel	L1-L4	L Tot Hip	L Fem Neck
DXL Heel		0.588*	0.665*	0.645*
L1- L4	0.588*		0.646*	0.603*
Left Total Hip	0.665*	0.646*		0.908*
Left Fem Neck	0.645*	0.603*	0.908*	
Correlations calculated with 95% CI				*P < 0.0001 for all sites

Table 2: Scanning Sites - Correlation Coefficients

In identifying vertebral fracture patients the AUC results (g/cm^2) of the calcaneus (0.70) were equal to the femoral neck (0.70), but the calcaneus and hip results were clearly superior to the lumbar spine in the analysis of the female stratum (Table 3).

g/cm^2	Females & Males		Females	
	AUC	SD	AUC	SD
DXL Heel	0.70	0.026	0.72	0.028
Left Femoral Neck	0.70	0.027	0.71	0.029
Left Total Hip	0.69	0.027	0.70	0.029
L1 - L4	0.63	0.029	0.62	0.032
L Fem Neck & L Total Hip	0.65	0.026	0.68	0.028
L1 - L4 & L Fem Neck	0.65	0.028	0.62	0.031
L1 - L4 & Total Hip	0.64	0.029	0.62	0.031
			AUC calculated with 95% CI	

Table 3: Identification of vert FX patients

The AUC comparison of DXL and femoral geometric parameters demonstrated a relationship between DXL (0.70) and CSA (0.60), but were weaker at FSI (0.53) and CSMI (0.50) (Table 4).
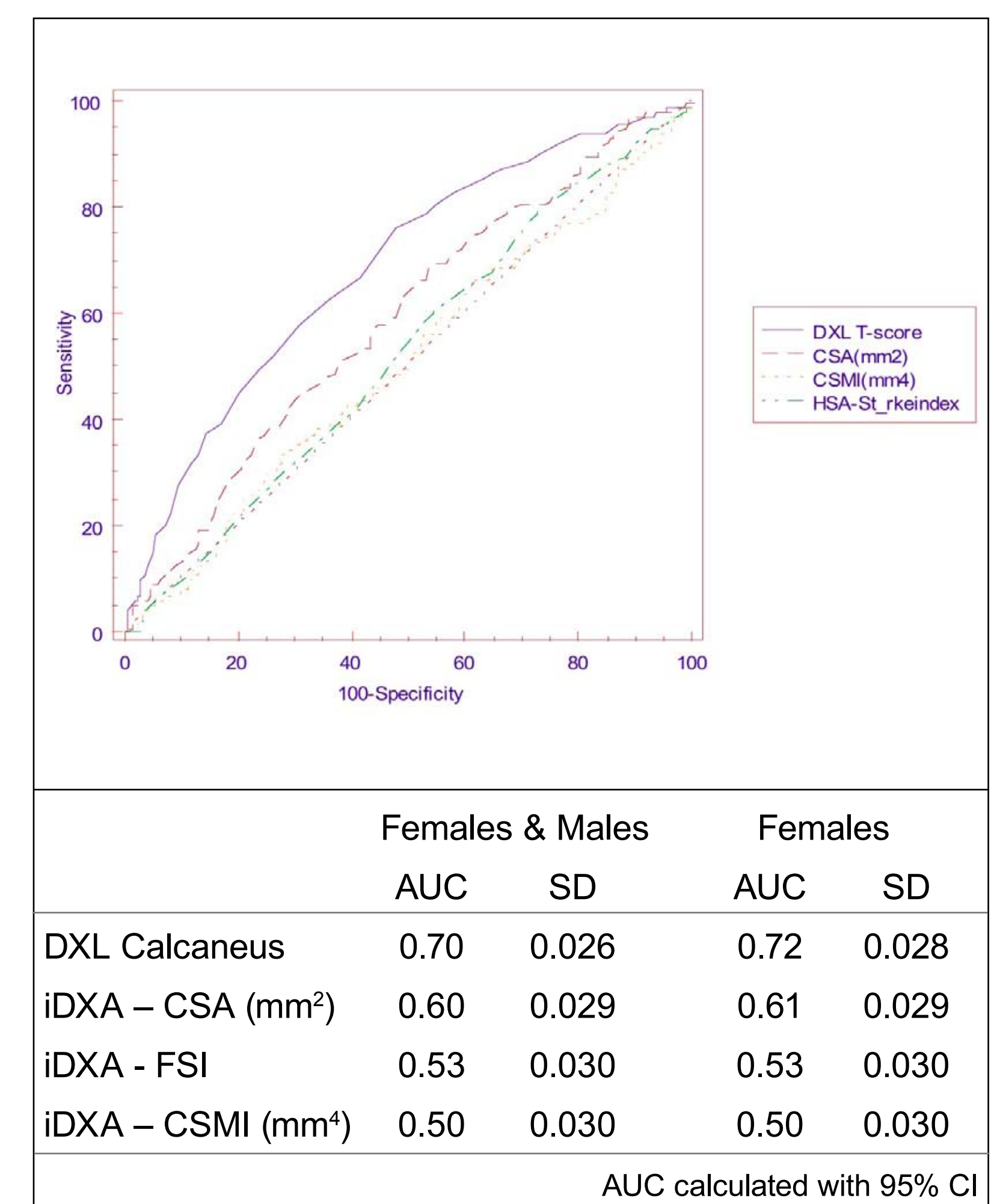

	Females & Males		Females	
	AUC	SD	AUC	SD
DXL Calcaneus	0.70	0.026	0.72	0.028
iDXA – CSA (mm^2)	0.60	0.029	0.61	0.029
iDXA - FSI	0.53	0.030	0.53	0.030
iDXA – CSMI (mm^4)	0.50	0.030	0.50	0.030
			AUC calculated with 95% CI	

Table 4: Geometric Parameters of Bone Strength

Conclusion:

The results indicate that the DXL of calcaneus is comparably effective as DXA of the hip to identify spine fracture patients but more effective than DXA of the spine.

Calcaneus scans can be used as an effective diagnostic aid in clinical practice where hip and/or spine BMD results are suspect or not readily available or possible.

Keywords: Vertebral fractures, DXL calcaneus, DXA spine & hip, DXA geometric hip parameters

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