

A new measuring device for quantifying the amount of bone mineral in the heel bone

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Introduction

When photon absorptiometry methods are used for determining bone mineral, a three-tissue-component system composed of bone mineral, lean soft-tissue, and adipose tissue is analysed. To obtain a unique solution for this three-tissue-component system, three independent relations must be used.

Materials and methods

We investigated the characteristics of a new portable device, called CalScan DEXA-T[®] (Figure 1), using for measuring bone mineral in the calcaneus. The technique is based on the concepts of dual-energy X-ray absorptiometry. In addition, the total width of the measured heel also is utilized. The *in vitro* and the *in vivo* precisions were assessed. The accuracy of the measured bone mineral values also was examined.

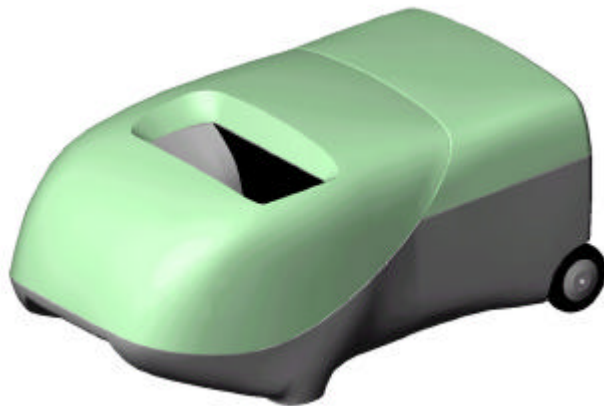


Figure 1. The measuring device (20 kg, L×W×H: 79×42×32 cm). The photons (two mean energies at 30 and 60 keV) are detected with a semiconductor array detector, and the measurement time is 35 seconds.

Results

The precision in the *in vitro* and in the *in vivo* analyses gave a coefficient of variation (CV) of 0.8% (n=60) and 1.4% (Table 1), respectively. The accuracy in the measured bone mineral values was 1.6%, expressed as standard error of estimate (SEE), (Figure 2).

Table 1. Reproducibility in *in vivo* measurements.

Subject	Repeated measurements (g/cm ²)					CV (%)
	1	2	3	4	5	
1	0.671	0.678	0.672	0.681	0.677	0.6
2	0.583	0.571	0.580	0.584	0.589	1.1
3	0.744	0.721	0.753	0.728	0.722	1.9
4	0.791	0.802	0.777	0.779	0.781	1.3
5	0.568	0.577	0.569	0.560	0.571	1.1
6	0.602	0.599	0.608	0.618	0.594	1.5
7	0.722	0.725	0.748	0.731	0.722	1.5
8	0.519	0.531	0.511	0.527	0.532	1.7
9	0.671	0.657	0.670	0.663	0.661	0.9
10	0.487	0.479	0.481	0.494	0.470	1.9
11	0.533	0.540	0.548	0.531	0.542	1.3
12	0.413	0.420	0.413	0.408	0.432	2.2
						Mean: 1.4

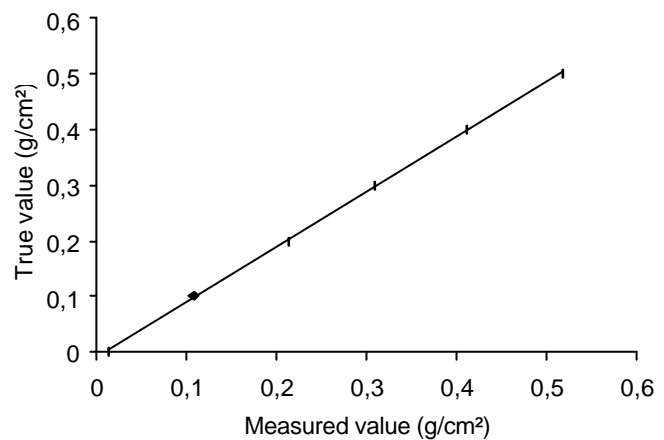


Figure 2. Linearity between true and measured bone mineral values. $y=0.991x-0.009$, $r=0.999$, $P<0.001$, $SEE=1.6\%$

Conclusion

This work showed that the amount of bone mineral in the heel bone can be accurately and precisely determined using this new measuring device. The measurement time is relatively short so examinations are rapid.

Reference

Jonson, R. et al. 1990. Dual-photon absorptiometry for determination of bone mineral content in the calcaneus with correction for fat. *Phys. Med. Biol.* **35**: 961 - 969.