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A comparison of the film density using a new computerized tool and dual energy x-ray absorptiometry

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Background: Radiographic density is a parameter that is used to determine the bone mineral density (BMD) in medical imaging; here mean pixel intensity level of radiograph is directly proportional to the BMD. BMD is an important parameter to assess metabolic diseases like osteoarthritis. Although Dual-energy X-ray Absorptiometry (DEXA) is the standard diagnostic method for BMD assessment; it is an expensive method with some diagnostic limitations.

Objectives: To determine the BMD by using Antero-Posterior (AP) lumbar spine radiographs performed at standard peak kilo Voltage (kVp) range used in plain radiography. A Computer-Aided system (CAD) was developed to calculate the BMD and the results were compared against the standard values.

Methodology: Bone density is calculated as a 2D measurement. X-ray images (n=40) of the AP lumbar spine of the phantom were taken in the standard kVp range using conventional X-ray machine with computed radiography image processor and DEXA results of the same phantom were obtained by considering it as an average size Asian woman. Pre-processing techniques were applied before the calculation of mean pixel intensity with the aid of image processing techniques. The mean pixel intensity was used to assess BMD of a relevant vertebra. The relationship between mean T scores and Z scores of conventional image and DEXA scan was calculated using the hypothesis test and graphical representation.

Results: The new CAD method showed appropriate T scores and Z scores for conventional radiographs. There was no statistically significant difference between T scores and Z scores of conventional radiographs with DEXA scan values as $p<0.05$. Graphically both T score and Z score coincide at the 93kVp.

Conclusions: This new CAD system can be used to calculate BMD successfully using plain radiographs. It may need to be further developed with larger sample size with wide range of kVp.

Keywords: *Plain radiography, CAD, DEXA, Image processing, Mean pixel intensity*