Vibration analysis as a tool for bone mineral density assessment in children

RAZAGHI, Hajar, SAATCHI, Reza <http://orcid.org/0000-0002-2266-0187> and OFFIAH, Amaka

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Author information

Names of all authors

Hajar Razaghi (Sheffield Hallam University)
Reza Saatchi (Sheffield Hallam University)
Amaka C Offiah (University of Sheffield)

Name and institution of presenting author

Dr Amaka Offiah
University of Sheffield
E: a.offiah@sheffield.ac.uk

Address for correspondence, including email

Hajar Razaghi
Material and Engineering Research Institute
Sheffield Hallam University
Howard Street
Sheffield
S1 1WB

E: h.razaghi@shu.ac.uk

Title

Vibration Analysis as a Tool for Bone Mineral Density Assessment in Children

✓ Scientific presentation

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Purpose

Dual energy x-ray absorptiometry (DXA) is the current gold standard for assessing bone mineral density (BMD). However DXA uses ionising radiation and has some limitations for assessing BMD in children. In this study, vibration analysis is introduced as a new method to assess BMD in children.

Methods

A computer-controlled vibration analysis device was developed. This consists of a small tapper to induce the vibration, a sensor to capture the signal and a computer to control the tapper and store the bone vibration response. 41 children aged between 7 to 15 years were recruited. The children were clinically suspected of having abnormal BMD and therefore were referred for whole body DXA as part of their routine medical care. The vibration test was carried out on the ulna for all children. The sensor was placed on the skin above the ulnar head and vibration was induced by tapping the olecranon process. Frequency spectra of bone vibration responses were obtained. The frequency parameters together with the participant's sex, height, weight, age and ulnar length were processed using an artificial neural network. The results were compared to the DXA scan values.

Results

The results showed that information related to BMD was contained in frequencies less than 50Hz with a correlation coefficient value between DXA-derived BMD values and the neural network calculated BMDs of 0.79.

Conclusion

Vibration analysis has the potential to be used as a non-invasive rapid technique to assess bone mineral density in children. As compared to the existing bone mineral densitometry methods, it is relatively cost effective, does not use x-rays and does not need sophisticated maintenance.