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[Saudi Med J.](#) 2019 Jun;40(6):560-567. doi: 10.15537/smj.2019.6.24234.

Determinants of bone mineral density through quantitative ultrasound screening of healthy children visiting ambulatory paediatric clinics

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Abstract

Objectives: To investigate the determinants of bone mineral density through screening healthy children using a non-invasive quantitative ultrasound measurement device.**Methods:** A descriptive cross-sectional study carried out at King AbdulAziz University Hospital, Jeddah, Kingdom of Saudi Arabia. between May 2018 and January 2019 through interviewing, examining, and screening healthy children visiting general paediatric. Total sample size encompassed 450 children. The inclusion criteria were healthy children between the ages of 2 and 20 years. Exclusion criteria were previous pathological fractures, chronic medical diseases, or long-term medications. Data entry and analysis was conducted using Statistical Package for Social Sciences version 24 (IBM Corp, Armonk, NY, USA). Chi-square tests were used to determine the association between categorical variables, with calculated $p < 0.05$ considered significant. With one-way Anova testing to study the relationship between categorical variables and continuous variables. Results: A significant association with bone mineral density (BMD) was found during first 2 years with height ($p=0.015$), vitamin D supplementation ($p=0.03$), and breastfeeding ($p=0.025$). A directly proportional relationship with BMD was found with pubertal status, physical activity, diet, sun exposure, and calcium supplement intake.**Conclusion:** This is a novel study in the investigation of the dietary, lifestyle and demographic determinants of bone mineral density in the healthy middle-eastern child otherwise unaffected by chronic medical or metabolic disease or exposed to long term medications that could have affected bone metabolism.

Comment in

[Comment on: Determinants of bone mineral density through quantitative ultrasound screening of healthy children visiting ambulatory paediatric clinics.](#)

Al-Mendalawi MD.

[Saudi Med J.](#) 2019 Aug;40(8):850. doi: 10.15537/smj.2019.8.24341.PMID: 31423526 [Free PMC article](#).

Cited by 3 articles

15 references

3 figures

2

[HIV Med.](#) 2016 Nov;17(10):724-727. doi: 10.1111/hiv.12376.

Bone quality assessed using quantitative ultrasound at the distal radius does not differ in antiretroviral therapy-naïve HIV-positive and HIV-negative Rwandan women

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[Free PMC article](#)

Abstract

Objectives: The incidence of fractures appears to be increased in HIV-infected individuals.

Methods: We assessed bone quality using quantitative ultrasound (QUS) in HIV-infected and uninfected Rwandan women. A Sunlight Omnisense 7000 QUS was used to measure the speed of ultrasound (SOS) at the distal radius in 646 antiretroviral therapy (ART)-naïve HIV-infected women and 211 HIV-uninfected women. The Z-scores for SOS were based on data for women of the same age from the manufacturer's reference material.

Results: The mean CD4 cell count was 285 (\pm 166) cells/ μ L in the HIV-positive women. SOS Z-scores adjusted and unadjusted for body mass index did not differ between the groups. SOS did not differ by CD4 count (< 200 vs. ≥ 200 cells/ μ L: 4016 (\pm 117) vs. 4028 (\pm 107) m/s, respectively; $p=0.19$).

Conclusions: In HIV-positive ART-naïve Rwandan women with advanced HIV disease, bone quality at the distal radius was similar to that in HIV-negative controls.

Keywords: HIV; antiretroviral therapy; antiretroviral therapy-naïve; bone mineral density; women.

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Cited by 1 article

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[Osteoporos Int.](#) 2015 Sep;26(9):2319-28. doi: [10.1007/s00198-015-3115-0](#). Epub 2015 Apr 11.

Axial quantitative ultrasound assessment of pediatric bone quality in eastern Nepal

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Abstract

This study presents quantitative ultrasonography (QUS) bone quality data for an underrepresented, south Asian pediatric population from Nepal. Data were collected as part of a longitudinal study of growth and development. This study offers normative data and documents the effect of stunting, wasting, and underweight on the bone properties measured by QUS.

Introduction: The purpose of this study was to (1) examine the bone quality of a rural, non-Western pediatric population using QUS, (2) explore variation in the trajectory of bone quality development between males and females, and (3) examine the impact of growth disruption(s) on bone quality.

Methods: A cross-sectional study of 860 children and adolescents aged 5-18 years from the Jirel ethnic group in eastern Nepal was performed. The Sunlight Omnisense 7000P was used to assess bone quality of the distal 1/3 radius and midshaft tibia. WHO reference standards were used to assess growth disruptions of height, weight, and BMI.

Results: QUS bone quality data for an underrepresented, non-Western pediatric population are presented for the radius and tibia. A sizable portion of the study participants were classified as stunted, wasted, and/or underweight. Despite this prevalence of growth disruption in the study sample, bone quality data conform to other documented populations with less growth disruption. Thus, this study offers normative data and documents the minimal effect of stunting, wasting, and underweight on the bone properties measured by QUS.

Conclusions: Non-Western pediatric populations are significantly underserved with regard to simple, non-invasive screening tools that may help identify developmental disorders and assess bone health. The children and adolescents examined here represent normal growth and

development for an underrepresented south Asian population. While this work demonstrates that stunting, wasting, or underweight status at time of QUS assessment is not associated with poor bone quality, we do suggest that further study is needed to examine possible cumulative effects of persistent disruptions that may lead to compromised bone quality in later adolescence.

Cited by 1 article

38 references

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Biomed Res Int. 2015;2015:232876. doi: 10.1155/2015/232876. Epub 2015 Apr 1.

Radial quantitative ultrasound and dual energy x-ray absorptiometry: intermethod agreement for bone status assessment in children

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PMID: 25922831 PMCID: [PMC4397423](#) DOI: [10.1155/2015/232876](#)

[Free PMC article](#)

Erratum in

Erratum to "Radial Quantitative Ultrasound and Dual Energy X-Ray Absorptiometry: Intermethod Agreement for Bone Status Assessment in Children".

Chong KH, Poh BK, Jamil NA, Kamaruddin NA, Deurenberg P.

Biomed Res Int. 2015;2015:318739. doi: 10.1155/2015/318739. Epub 2015 Jun 4.

PMID: 26146617 [Free PMC article](#). No abstract available.

Abstract

Aim. To validate a radial quantitative ultrasound (QUS) system with dual energy X-ray absorptiometry (DXA), a criterion technique in bone status assessment among children. **Methods.** Bone health was evaluated using a radial QUS system (Sunlight Omnisense 8000P) to measure the speed of sound (SOS) at one-third distal radius of the nondominant hand and DXA (Hologic QDR) was used to assess whole body bone mineral density (BMD). **Results.** Some 29.9% of the children were grossly misclassified according to quartiles of BMD and radial SOS. Poor agreement was observed between Z-scores of radial SOS and whole-body BMD (mean difference = 0.6 ± 0.9 ; 95% limits of agreement = -1.4 to 2.6). With a cut-off value of -1.0, radial SOS yielded satisfactory sensitivity (80%) and specificity (93%) for the detection of children with low BMD. **Conclusion.** The observed poor agreement in the present study suggests that radial QUS and DXA are not comparable and hence are not interchangeable in evaluating bone status of the children.

Cited by 8 articles

30 references

2 figures

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J Clin Densitom. Jan-Mar 2015;18(1):68-75. doi: 10.1016/j.jocd.2013.11.002. Epub 2014 Feb 22.

Bone speed of sound throughout lifetime assessed with quantitative ultrasound in a Mexican population

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PMID: 24565831 DOI: [10.1016/j.jocd.2013.11.002](#)

Abstract

The purpose of this study was to assess the bone speed of sound (SoS) through lifetime of a large Mexican population sample by determining the SoS from the radius and tibia using quantitative ultrasound (QUS). This is a cross-sectional evaluation of participants in the Mexican Health Workers Cohort Study. QUS measurements were performed using Sunlight Omnisense 8000P; Z- and T-scores were calculated for both sexes at the distal third of the radius and midshaft tibia, both on the nondominant side. A locally weighted regression smoothing scatterplot model was used to identify different phases of bone accretion and loss. A total of 9128 participants aged 1-75 yr were measured with QUS. Bone SoS accretion began 5 yr earlier in girls than boys ($p < 0.05$). Maximal SoS or peak bone SoS was noted at 28 yr in

the radius and at 22 yr in the tibia. Postmenopausal women (45-50 yr) showed significant SOS decrease at both sites ($p < 0.05$) compared with men. Using the locally weighted regression smoothing scatterplot model, we found 5 different phases that constitute the biological development of bone over the life course, from ages 1-6, 7-12, 12-25, 25-50, and 50-75 yr ($p < 0.05$). Our study shows the age- and sex-dependent changes and different phases of bone development expressed by SoS measurements of the radius and tibia. The values reported in this study can be used as a reference for urban Mexican population.

Keywords: Bone health; osteoporosis; quantitative ultrasound; reference values.

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Cited by 6 articles

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Multicenter Study J Clin Densitom. Oct-Dec 2014;17(4):534-40. doi: 10.1016/j.jocd.2013.09.017. Epub 2013 Oct 26.

Normative data for multisite quantitative ultrasound: the Canadian Multicenter Osteoporosis Study

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Abstract

Multisite quantitative ultrasound (mQUS) machines are attractive tools for assessing fragility fracture risk as they are often portable, comparatively inexpensive, require little training for their use, and emit no ionizing radiation. The primary objective of this investigation was to generate an mQUS normative database of speed of sound (SOS, in m/s) measures from a large sample of randomly selected community-based individuals. mQUS (BeamMed Omnisense MultiSite Quantitative Ultrasound 7000 S) measurements were obtained and assessed at the distal radius, tibia, and phalanx. All analyses were made separately for men and women and for each anatomical site. Scatterplots (SOS vs age) identified 30-39 yr of age as periods of both maximal SOS and of relative stability for all 3 sites over the age span investigated (30-96 yr of age; 2948 women and 1176 men) and, thus, was used as the "reference" population. For cross-sectional comparison of trends over aging, a number of age groupings were created: 30-39, 40-49, 50-59, 60-69, 70-79, and 80+ yr. In general, there were decreases in SOS over increasing age groupings. The normative data generated can be used to compare a given patient's mQUS measurement with reference to a young, healthy population, assigning them a gender-appropriate T-score.

Keywords: Fracture; normative data; quantitative ultrasound.

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Cited by 2 articles

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Acta Paediatr. 2008 Dec;97(12):1625-30. doi: 10.1111/j.1651-2227.2008.00992.x.

Quantitative ultrasound (QUS): a useful tool for monitoring bone health in preterm infants?

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PMID: 19054850 DOI: 10.1111/j.1651-2227.2008.00992.x

Abstract

Preterm infants are at risk of osteopenia and metabolic bone disease (MBD) of prematurity. There is a need for simple, reliable methods to detect and monitor this condition.

Aims: The aims were first to describe longitudinal changes in speed of sound (SOS) measured using quantitative ultrasound (QUS; Sunlight Omnisense, Israel) in preterm neonates: and second to determine whether SOS predicts the development of MBD.

Methods: SOS was measured in the tibia in 99 preterm infants (mean (SD)) gestation 29.7 (3.6) weeks; birthweight 1340 (550) g, with longitudinal measurements in 75. SOS z-scores were generated for gestation and sex. Clinical data were recorded.

Results: Baseline SOS (but not SOS z-score) was positively associated with gestational age. SOS and SOS z-score fell with age. In multivariate models, peak ALP, minimum phosphate concentrations and markers of illness severity were not predictors of the fall in SOS z-score, and baseline SOS measurements did not predict the development of high peak ALP or low phosphate.

Interpretation: Speed of sound measurements fell with age in all infants, but we found no evidence that this measurement could predict biochemical indicators of MBD. We cannot exclude the possibility that this technique could be useful in monitoring the response to interventions designed to improve bone health in this population.

Cited by 5 articles

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[J Bone Miner Metab.](#) 2008;26(3):248-53. doi: 10.1007/s00774-007-0814-4. Epub 2008 May 11.

The effect of calcium intake and physical activity on bone quantitative ultrasound measurements in children: a pilot study

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Affiliations

PMID: 18470665 DOI: [10.1007/s00774-007-0814-4](#)

Abstract

Environmental factors, such as nutritional status, physical activity, and drug therapy, can affect bone mineralization. Our objective was to evaluate the relationship between nutritional status, physical activity, and bone mineralization as assessed by multisite quantitative ultrasound technology in children. The study group comprised 67 children, aged 6-17 years (mean, 9.4), attending a primary care clinic. Data on calcium intake and physical activity were collected using a detailed questionnaire. Speed of sound measurements were performed at the distal 1/3 radius and the midshaft tibia using Sunlight Omnisense apparatus. The reported mean calcium intake was 1105 mg/day. There was a significant difference in Z-scores at the radius and tibia between the low-and high-calcium-intake groups ($P = 0.004$, $P = 0.035$, respectively). A similar difference was found between the low-and normal-physical-activity groups ($P = 0.015$, $P = 0.036$, respectively). In this pilot study, a positive association was found between calcium intake, physical activity, and bone status, as assessed by the quantitative ultrasound technique.

Cited by 3 articles

35 references

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[J Bone Miner Metab.](#) 2008;26(1):60-5. doi: 10.1007/s00774-007-0798-0. Epub 2008 Jan 10.

An assessment of the use of quantitative ultrasound and the Osteoporosis Self-Assessment Tool for Asians in determining the risk of nonvertebral fracture in postmenopausal Chinese women

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Affiliations

PMID: 18095065 DOI: [10.1007/s00774-007-0798-0](#)

Abstract

This cross-sectional study aims to assess the effectiveness of a simple, noninvasive scoring system, the Osteoporosis Self-Assessment Tool for Asians (OSTA), and quantitative bone ultrasound (QUS) in assessing nonvertebral fracture risk in Chinese postmenopausal women. A group of 513 community-dwelling women including 271 postmenopausal individuals participated in this study. Speed of sound (SOS m/s) at the radius, phalanx, and tibia were assessed by using the Omnisense prototype (Sunlight Ltd., Israel). Body height and weight were measured, and body mass index (BMI) and OSTA indices were calculated. Self-reported fractures were identified using a structured questionnaire. Phalanx SOS was significantly lower among postmenopausal women with a history of nonvertebral fracture occurred after menopause than those without (3755 m/s vs. 3841 m/s, $P = 0.017$, adjusted for age and weight), with an AUC of 0.66. The AUC of the OSTA

for predicting nonvertebral fracture occurred after menopause was 0.64. SOS at the radius, phalanx, and tibia showed a positive correlation with OSTA index ($r = 0.376-0.401$, $P < 0.001$). The prevalence of nonvertebral fractures also increased significantly with the decreasing order of OSTA index ($\chi^2 = 5.432$, $P = 0.02$). The OSTA values of ≤ -1 and phalanx QUS T-score of ≤ -1.95 can differentiate postmenopausal nonvertebral fracture with sensitivity of 75% and 81%, respectively, and specificity of 48% and 40%, respectively. Combining OSTA and phalanx QUS yielded a sensitivity of 83% and a specificity of 84% to detect postmenopausal nonvertebral fracture, with an AUC of 0.64. We conclude that OSTA and phalanx QUS are simple and effective clinical tools for identifying postmenopausal women at increased risk of nonvertebral fractures and can thereby facilitate the appropriate and more cost-effective use of bone densitometry to prevent osteoporotic fractures in developing countries.

Cited by 8 articles

39 references

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Comparative Study J Clin Densitom. Apr-Jun 2008;11(2):295-301. doi: 10.1016/j.jocd.2007.10.003. Epub 2007 Dec 26.

Monitoring bone growth using quantitative ultrasound in comparison with DXA and pQCT

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Abstract

Quantitative ultrasound (QUS) is a safe, inexpensive, and nonradiation method for bone density assessment. QUS correlates with, and predicts fragility fractures comparable to, dual-energy X-ray absorptiometry (DXA)-derived bone mineral density (BMD) in postmenopausal women. However, its validity in monitoring bone growth in children is not well understood. Two hundred and fifty-eight 10-13 yr pubertal girls and 9 37-43 yr adults without diseases or history of medications known to affect bone metabolism were included in the 2-yr prospective study. Calcaneal broadband ultrasound attenuation (cBUA) was assessed using QUS-2 (Quidel, Santa Clara, CA), speed of sound of tibial shaft (tSOS) using Omnisense (Sunlight Technologies, Israel), apparent volumetric BMD (vBMD) of tibial shaft using peripheral quantitative computed tomography (pQCT; XCT2000, Stratec), and femoral neck (FN) and lumbar spine 2-4 (LS) areal BMD (aBMD) using DXA (Prodigy, GE). Over the 2 yr in girls, FN and LS aBMD showed the largest increases ($17 \pm 8\%$ and $20 \pm 8\%$, respectively), followed by tibial vBMD and cBUA ($10 \pm 5\%$ and $9 \pm 9\%$, respectively). There was no apparent change in tSOS ($2 \pm 3\%$). The increase in FN and LS aBMD attenuated 48% and 40%, respectively, after adjustment of the change in body size. The change of cBUA correlated significantly with change in tibial vBMD and FN and LS aBMD ($r = 0.24-0.40$). At the matched location, tSOS correlated only with cortical vBMD, not with cortical thickness, apparent vBMD, or bone size. The long-term reproducibility, assessed using the concordance correlation coefficient of young adults' pre-post measurements, was substantially lower in tSOS than cBUA, tibial vBMD, FN, and LS aBMD (0.65 vs 0.97, 0.95, 0.98, and 0.96; $p < 0.05$). The transverse transmission method-derived calcaneal BUA, but not the axial transmission method-derived SOS, is comparable to DXA and pQCT for monitoring bone densitometric change in pubertal girls. The role of QUS in fracture-risk prediction in children and adolescents needs further investigation.

Cited by 5 articles

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Comparative Study Dtsch Med Wochenschr. 2007 Apr 20;132(16):869-73. doi: 10.1055/s-2007-973630.

[Bone density measurement: quantitative ultrasound of the calcaneus and distal radius. A comparison with dual spectrum X-ray absorptiometry]

[Article in German]

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Affiliations

PMID: 17443442 DOI: 10.1055/s-2007-973630

Abstract

Background and objective: Quantitative ultrasound (QUS) has been successfully used for more than a decade in predicting the risk of osteoporotic fractures. However, the "gold standard" in the diagnosis of osteoporosis is dual-energy X-ray absorptiometry (DXA). The aim of this study was to perform QUS at the calcaneus and distal radius, as well as DXA over the lumbar spine and proximal femur in women and to compare both QUS results with the DXA ones.

Patients and methods: 230 postmenopausal Bulgarian women, aged between 42 and 80 years, took part in this study. QUS was performed at the calcaneus and the radius. At the calcaneus the "quantitative ultrasound index" (QUI) was used, but at the radius the speed of sound (SOS) T-scores (SD's under the mean value for young healthy adults) were calculated.

Results: The highest accuracy was observed at the radius (coefficient of variance 0.59 %), followed by that for the total hip (0.95 %). The lowest mean T-scores were found at the lumbar spine (-1.94), followed by the calcaneus (-1.85) and radius (-1.74). The correlation coefficients between calcaneal QUI and BMD of the lumbar spine and proximal femur were 0.285 and 0.442 ($p=0.059$ and 0.001 , respectively); the corresponding values for radial SOS were 0.201 and 0.061 ($p=0.019$ and 0.513 , respectively: no significant difference). T-scores of -1.0 for the Sahara device and of -0.5 for the Sunlight device identified women without spinal osteoporosis with a 90% probability.

Conclusions: Women with normal bone density of the proximal femur were better identified using transverse QUS at the calcaneus. Both QUS techniques (transverse and axial) are well suited for identifying women without osteoporosis of the lumbar spine.

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Zhonghua Nei Ke Za Zhi. 2006 Dec;45(12):988-91.

[The relationship between quantitative ultrasound and osteoporosis self-assessment tool for Asians (OSTA) score and non-vertebral fracture in postmenopausal Chinese women]

[Article in Chinese]

Bei Tao ¹, Jian-min Liu, Xiao-ying Li, Ji-guang Wang, Wei-qing Wang, Huai-fa Zhou, Hui-feng Guo, Yan Wen, Wei-wei Zhou, Peng-Fei Du, Guang Ning

Affiliations

PMID: 17326996

Abstract

Objective: To assess a simple and non-invasive scoring system, osteoporosis self-assessment tool for Asians (OSTA) and quantitative ultrasound (QUS) measurement to identify Chinese postmenopausal women with non-vertebral fracture.

Methods: Data came from 513 healthy women. Speed of sound (SOS) of the radius, phalanx and tibia was assessed using the instrument of Omniscience (Sunlight Ltd. Israel). Body height and weight were measured. Body mass index and OSTA were calculated. Self-reported fractures were identified using a structured questionnaire.

Results: SOS of radius was significantly lower in women with non-vertebral fracture than those without. SOS of phalanx was significantly lower in women with a history of postmenopausal non-vertebral fracture than those without. Using cut-offs of OSTA -4 and -1 to categorize osteoporosis risk, SOS of radius, phalanx and tibia decreased with increasing risk, while the prevalence of non-vertebral fracture increased. OSTA values of ≤ -1 had a sensitivity of 75% and specificity of 48%, with an area under curve (AUC) of 0.64 to discriminate women with and without a history of postmenopausal non-vertebral fracture. The optimal cut-off T-score of -1.95 for phalanx yielded sensitivity and specificity of 81% and 40%, respectively, with an AUC of 0.66. Combination of OSTA and phalanx QUS gave a sensitivity of 83% and specificity of 84% to identify postmenopausal women with a history of postmenopausal non-vertebral fracture, and an AUC of 0.64.

Conclusions: It is concluded that OSTA and phalanx QUS are effective measures for identifying postmenopausal women at increased risk of non-vertebral fracture. The use of the both parameters could facilitate appropriate and more cost-effective use of bone densitometry to prevent osteoporotic fractures in developing countries.

Cited by 2 articles

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Multicenter Study J Clin Densitom. Jul-Sep 2006;9(3):358-62. doi: 10.1016/j.jocd.2006.03.013. Epub 2006 May 11.

Quantitative ultrasound in the evaluation of bone status in premature and full-term infants

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PMID: 16931356 DOI: [10.1016/j.jocd.2006.03.013](https://doi.org/10.1016/j.jocd.2006.03.013)

Abstract

Metabolic bone disease of prematurity (MBDP) is a common and significant problem that often gives rise to osteopenia, fractures, osteomalacia, and osteoporosis. The purpose of our study is to establish normative data on bone status in premature and full-term infants to help future studies on MBDP. Bone status was prospectively determined as part of a multicenter study among newborns within 96 hours of life. The patients were divided into 2 groups: group 1 included those neonates 25–36 wk gestational age (premature), and group 2 neonates were born at 37–42 wk gestational age (full term). Demographic data were collected. The Omnisense 7000 Bone Sonometer (Sunlight Medical Ltd., Tel-Aviv, Israel) was used to determine the speed of sound (SOS) through the mid tibia, which reflects bone strength. A total of 235 patients were enrolled in this study. Group 1 (i.e., the premature infants) had a statistically lower age-adjusted SOS as compared with group 2 (i.e., the full-term infants) (analysis of variance; $p=0.001$). There was also a correlation between SOS and birth weight ($r=0.3$; $p<0.01$). This study represents the largest database of normative data for bone status measuring in preterm and term infants.

Cited by 8 articles

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Comparative Study *Calcif Tissue Int.* 2006 Jan;78(1):25–34. doi: [10.1007/s00223-005-0175-8](https://doi.org/10.1007/s00223-005-0175-8). Epub 2006 Jan 6.

Peripheral bone status in rheumatoid arthritis evaluated by digital X-ray radiogrammetry and compared with multisite quantitative ultrasound

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Affiliations

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Abstract

The development of secondary osteoporosis in rheumatoid arthritis (RA) has recently become well recognized, characterized by demineralization at axial and in particular periarticular peripheral bone sites. Our aim was to evaluate multisite quantitative ultrasound (QUS) compared to digital X-ray radiogrammetry (DXR) by the quantification of cortical bone loss dependent on the severity of RA. Fifty-three patients with verified RA underwent QUS measurements (Sunlight Omnisense 7000) with estimation of the speed of sound (QUS-SOS) at the distal radius and at the phalanx of the third digit. Also, bone mineral density (DXR-BMD) and metacarpal index (DXR-MCI) were estimated on metacarpals II–IV using DXR technology. Additionally, Larsen score and Steinbrocker stage were assessed. Disease activity of RA was estimated by disease activity score 28 (DAS 28). For the group with minor disease activity ($3.2 \leq \text{DAS} \leq 5.1$), QUS-SOS (phalanx) showed a significant association to DXR-BMD ($R = 0.66$) and DXR-MCI ($R = 0.52$). In the case of accentuated disease activity ($\text{DAS} > 5.1$), QUS-SOS of the radius revealed a significant correlation to DXR-BMD ($R = 0.71$) and DXR-MCI ($R = 0.84$), whereas for QUS-SOS (phalanx) no significant association to the DXR parameters was shown. The DXR parameters and, to a lesser extent, the QUS data also demonstrated pronounced declines in the case of accentuated disease activity ($\text{DAS} > 5.1$). Both DXR-BMD (-25.9% , $P < 0.01$) and DXR-MCI (-38.6% , $P < 0.01$) revealed a notable reduction dependent on the severity of RA. Otherwise, QUS-SOS marginally decreased, with -2.6% (radius) and -3.9% (phalanx). DXR revealed a significant reduction of DXR-BMD as well as DXR-MCI dependent on the severity of RA and surpassed multisite QUS as a promising diagnostic tool.

Cited by 17 articles

15

Comparative Study *Osteoporos Int.* 2005 Dec;16(12):1565–75. doi: [10.1007/s00198-005-1864-x](https://doi.org/10.1007/s00198-005-1864-x). Epub 2005 May 10.

Comparison of questionnaire and quantitative ultrasound techniques as screening tools for DXA

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Affiliations

PMID: 15883661 DOI: [10.1007/s00198-005-1864-x](https://doi.org/10.1007/s00198-005-1864-x)

Abstract

The aim of the study is to assess the sensitivity and specificity of different techniques and their ability to act as screening tools in relation to dual energy X-ray absorptiometry (DXA) in a group of 208 postmenopausal women. In this study we examined eight screening systems for the diagnosis of osteoporosis, the osteoporosis self-assessment tool (OST), the osteoporosis risk assessment instrument (ORAI), the osteoporosis index of risk (OSIRIS), a risk index derived using data from the study of osteoporotic fractures (SOFSTURF), the simple calculated osteoporosis risk estimation (SCORE), patient body weight (pBW), along with two ultrasound based systems, the Sunlight Omnisense (Sunlight Medical, Rehovot, Israel) and the CUBA Clinical (McCue plc, Winchester, UK). The sensitivity and specificity of the different techniques in relation to DXA were plotted as receiver-operating characteristic (ROC) curves at three different levels (DXA T-score -2.5 osteoporosis, -2 and -1 osteopenia). The areas under the curves (AUC) were calculated and showed broadband ultrasound attenuation (BUA) at the calcaneus to provide consistently the highest AUC (0.77-0.81). The velocity of sound (VOS) of the calcaneus (AUC=0.72-0.76) was equally good, but was out-performed by some of the questionnaire systems (AUC=0.66-0.79). Both the questionnaire systems and the CUBA Clinical out-perform the Sunlight Omnisense (AUC=0.58-0.7), which showed comparable performance with body weight (AUC=0.66-0.69). The results show that QUS is capable of selecting patients with low bone density as measured by DXA. A patient displaying a low QUS value should be followed up with a DXA scan to confirm the diagnosis.

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[Ultrasound Med Biol.](#) 2005 May;31(5):625-32. doi: 10.1016/j.ultrasmedbio.2005.02.003.

The ability of peripheral quantitative ultrasound to identify patients with low bone mineral density in the hip or spine

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Abstract

This study aims to assess the sensitivity and specificity of two commercially available quantitative ultrasound (QUS) scanners (CUBA Clinical, Sunlight Omnisense), to differentiate patients with osteoporosis (OP) or osteopenia at the spine and hip confirmed by dual-energy x-ray absorptiometry (DXA) and to investigate the optimum cut-off values to maximize the effectiveness of the screening technique. Participants (n = 268) received DXA scans on their lumbar spine (L1-L4) and hip, with paired QUS scans on their distal radius, proximal phalanx, midshaft tibia and calcaneus. Scanners were evaluated by using receiver-operating characteristics curves and their area under the curve (AUC) values. Measurement of the calcaneus by the CUBA Clinical showed a superior ability to predict DXA, with AUC values between 0.75 to 0.83 in comparison with AUC values of 0.60 to 0.70 for the Sunlight Omnisense. Cut-off values varied according to the technique used and the accuracy of the screening required. Assessment of the calcaneus was the best QUS technique for the prediction of low bone density at the axial skeleton as diagnosed by DXA.

Cited by 8 articles

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[Zhonghua Er Ke Za Zhi.](#) 2005 Feb;43(2):128-32.

[Examination of infant bone status with quantitative ultrasound at birth]

[Article in Chinese]

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PMID: 15833170

Abstract

Objective: Quantitative ultrasound (QUS) is a new method of evaluating Children's bone status, including bone mineral density and bone strength. The bone nutrition during fetal and early neonatal period is very important for the human bone development of whole life. The objective of this study was to evaluate the clinical application of QUS for newborn infants and to obtain the QUS data for normal neonates including premature infants.

Methods: An ultrasound bone sonometer, Omnisense, produced by Sunlight company of Israel, was applied to measure the bone speed of sound (SOS) of tibia in 157 neonates including 68 premature infants in the first week of life.

Results: (1) No significant difference in SOS was found between male ($n = 88$, $SOS = 2968 \pm 115$ m/s) and female infants ($n = 69$, $SOS = 2956 \pm 105$ m/s) ($P = 0.524$). The SOS of premature infants ($n = 68$, mean gestational age 33.0 ± 2.5 weeks) and full-term infants ($n = 89$, mean gestational age of 39.4 ± 1.3 weeks) were 2935 ± 96 m/s and 2984 ± 116 m/s, respectively, at birth and there was significant difference between them ($P = 0.005$). (2) There were significant differences of SOS in neonates who were born in different seasons ($F = 4.377$, $P = 0.005$); the significant difference remained ($F = 3.933$, $P = 0.010$) after the influences of gestational age and birth weight were eliminated. The SOS in neonates born in spring (March, April and May) and summer (June, July and August) were significantly lower than that of those born in autumn (September, October and November) and winter (December, January and February). The SOS in neonates born in summer was about 2.3% (75/2999) was lower than that of those born in winter. (3) Significant difference of SOS was observed between neonates with different birth weight [< 1500 g ($n = 11$), $SOS = 2968 \pm 115$ m/s; and > 2500 g ($n = 86$), $SOS = 2980 \pm 113$ m/s; $P = 0.042$]. (4) Significant correlations were found between SOS and gestational age ($r = 0.270$, $P = 0.005$), and between bone SOS and birth weight ($r = 0.232$, $P = 0.015$) in appropriate for gestational age (AGA) infants ($n = 109$); however, no such significant correlations were found in small for gestational age (SGA) infants or large for gestational age (LGA) infants. Multiple regression analysis showed that gestational age and the birth season were two important factors which may contribute to bone SOS of neonates at birth ($n = 157$, $F = 8.515$, $P < 0.001$, adjusted $R(2) = 0.141$), when the analysis was carried out with SOS as dependent variable and gestational age, birth weight, chronological age, calf length and the birth season as independent variables.

Conclusion: QUS is a new method which is suitable for evaluating the bone status of neonates and it is free of radiation, non-invasive, the machine is portable and easy to manipulate at infant bed side. The present study suggests the need for particular care for the bone status in premature infants and supplement of vitamin D in pregnant women.

Cited by 1 article

18

[Osteoporos Int.](#) 2004 Dec;15(12):942-7. doi: 10.1007/s00198-004-1717-z. Epub 2004 Aug 7.

Bone mineral density-independent association of quantitative ultrasound measurements and fracture risk in women

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Abstract

Osteoporotic fracture is considered to result from reduced bone strength and to be related to decreased bone mass and impaired bone architecture. Quantitative ultrasound measurements (QUS) of bone, that may reflect certain architectural aspects of bone, have been shown to be associated with fracture, but it is not clear whether the association is independent of bone mineral density (BMD). This study was designed to examine the contributions of cortical QUS and BMD measurements to the prediction of fracture risk in postmenopausal Caucasian women. Speed of sound (SOS) at the distal radius, tibia, and phalanx (Sunlight Omnisense) and BMD at the lumbar spine and femoral neck (GE Lunar) were measured in 549 women, aged 63.2 ± 12.3 years (mean \pm SD; range, 49–88 years), including 77 fracture cases. Lower SOS at the distal radius, tibia, and phalanx, which were correlated with each other, were associated with increased risk of fracture. Independent predictors of fracture risk (in multivariate analysis) were distal radius SOS (OR per SD = 1.8; 95% CI, 1.3–2.4), femoral neck BMD (OR per SD = 1.9; 95% CI, 1.4–2.4), and age (OR per 5 years = 1.2; 95% CI, 1.0–1.5). Approximately 30% of the women had distal radius SOS T-scores < -2.5 ; however, only 6.6% of women had both BMD and SOS T-scores < -2.5 . Among the 77 fracture cases, only 14 (18.2%) had both BMD and QUS T-scores below -2.5 . These data in postmenopausal women suggest that speed of sound at the distal radius was associated with fracture risk, independent of BMD and age. The combination of QUS and BMD measurements may improve the accuracy of identification of women who will sustain a fracture.

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[Eur J Radiol.](#) 2004 Jun;50(3):268-72. doi: 10.1016/j.ejrad.2004.01.023.

Discrimination of hip fractures by quantitative ultrasound of the phalanges and the calcaneus and dual X-ray absorptiometry

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Abstract

The aim of the current study was to evaluate the ability of different techniques used for the assessment of bone status to discriminate between postmenopausal women with and without hip fracture. Fifty-one postmenopausal women (mean age 64.5 +/- 6.5) who had sustained a low energy hip fracture and 51 age-matched controls (mean age 64.6 +/- 6.0) were studied. Quantitative ultrasound (QUS) assessment was carried out using the Ubis 3000 device capable of measuring broadband ultrasound attenuation (BUA) and speed of sound at the calcaneus (SOSC) and the Sunlight Omnisense device capable of estimating speed of sound at the phalanges (SOSP). Femoral neck bone mineral density (BMD) was assessed using dual X-ray absorptiometry. Correlations between QUS variables ranged from $r = 0.35$ to 0.72 and between QUS variables and BMD from $r = 0.30$ to 0.36 . BMD was the best discriminator of hip fractures (odds ratio = 3.61, area under curve = 0.824). All QUS variables were significant discriminators of hip fractures with odds ratios ranging from 1.88 to 2.63 and areas under the ROC curves ranging from 0.663 to 0.740. Among the QUS variables, the SOSP showed the best odds ratio and area under curve. Comparison between the areas under the ROC curve did not show any significant difference between SOSP, BUA and BMD. On the contrary, the difference between SOSC and BMD was significant ($P < 0.05$). In conclusion, BMD and QUS variables investigated in the current study were significant discriminators of hip fractures. The differentiation of the hip fractures by BMD was significantly better than that of BUA measured at the calcaneus. Moreover, BMD discriminated fractured patients better than BUA and SOS(P), although the difference did not reach statistical significance.

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Comparative Study *Calcif Tissue Int.* 2004 May;74(5):424-8. doi: [10.1007/s00223-003-0164-8](https://doi.org/10.1007/s00223-003-0164-8). Epub 2004 Feb 17.

Quantitative ultrasound measurements in children and adolescents with: type 1 diabetes

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Abstract

The aim of the current study was to evaluate bone status at the radius and phalanx in children and adolescents with type 1 diabetes by using quantitative ultrasound (QUS) measurements. Thirty pediatric patients, 16 male and 14 female, with type 1 diabetes of duration of 5 to 177 months and mean (+/- SD) age 11.3 +/- 4.6 years were studied. QUS measurements were carried out using the Sunlight Omnisense 7000 S device. Speed of sound (SOS) was measured at the radius and tibia. Diabetic control was assessed by glycosylated hemoglobin (HbA(1c)) measurements. Male and female patients with type 1 diabetes did not have significantly different SOS or HbA(1c) values. SOS Z-scores at both the radius and tibia were negatively associated with duration of disease ($r = -0.41$ and $r = -0.37$ for the radius and tibia respectively, $P < 0.05$ for both correlations). Seven of 15 patients with duration of disease of >6 years had diminished SOS, defined as Z-score of <-1, at either the radius or tibia. SOS measurements at the radius showed moderate correlation with SOS at the tibia ($r = 0.58$, $P < 0.001$). There was no correlation between SOS and HbA(1c). In conclusion, SOS Z-scores at both the radius and tibia show a significant negative correlation with duration of insulin-dependent diabetes in children. No relation was found between SOS and metabolic control of young diabetic patients.

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Bone quantitative ultrasound and nutritional status in severely handicapped institutionalized children and adolescents

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Abstract

Background & aims: Children with cerebral palsy (CP) have a high prevalence of pathologic fractures. Bone quantitative ultrasonography (QUS) has emerged as a radiation-free method for the assessment of bone quality and fracture risk. In this study, we applied QUS technique in order to investigate bone status in handicapped institutionalized children and adolescents.

Methods: This cross-sectional study included 87 handicapped institutionalized patients. Measurements of the velocity of ultrasound wave, speed of sound (SOS), at distal radius and midshaft tibia, were performed using Omnisense 7000S analyser (Sunlight Ltd., Tel Aviv, Israel). In addition, all the participants had a thorough evaluation of nutritional status, demographic and clinical characteristics.

Results: Forty-five of patients had either radius or tibia bone SOS lower than -1 SD, and 21% had either radius or tibia bone SOS lower than -2.5 SD. Using step-wise regression analysis, female gender ($P=0.003$) and stature ($P=0.008$) were correlated with radius SOS. Age ($P=0.03$) and fracture history ($P=0.04$) were negatively correlated with tibia SOS.

Conclusion: In this group of children and adolescents with CP one-fifth had poor bone status as suggested by low tibia/radius SOS assessed by QUS. Female gender, stature, age and fracture history were significantly correlated with poor bone status.

Cited by 10 articles

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[Osteoporos Int.](#) 2004 May;15(5):367-74. doi: [10.1007/s00198-003-1555-4](https://doi.org/10.1007/s00198-003-1555-4). Epub 2003 Dec 18.

Can the WHO definition of osteoporosis be applied to multi-site axial transmission quantitative ultrasound?

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Abstract

Osteoporosis is a highly prevalent but preventable disease and, as such, it is important that there are appropriate diagnostic criteria to identify those at risk of low trauma fracture. In 1994 the World Health Organization (WHO) introduced definitions of osteoporosis and osteopenia using T-scores, which identified 30% of all Caucasian post-menopausal women as having osteoporosis. However, the use of the WHO T-score thresholds of -2.5 for osteoporosis and -1.0 for osteopenia may be inappropriate at skeletal sites other than the spine, hip and forearm or when other modalities, such as quantitative ultrasound (QUS) are used. The aim of this study was to evaluate the age-dependence of T-scores for speed of sound (SOS) measurements at the radius, tibia, phalanx and metatarsal by use of the Sunlight Omnisense, to evaluate the prevalence of osteoporosis and osteopenia at these sites by use of the WHO criteria, and calculate appropriate equivalent T-score thresholds. The study population consisted of 278 healthy pre-menopausal women, 194 healthy post-menopausal women and 115 women with atraumatic vertebral fractures. All women had SOS measurements at the radius, tibia, phalanx and metatarsal and bone mineral density (BMD) measurements at the lumbar spine and hip. A group of healthy pre-menopausal women aged 20-40 years from the pre-menopausal group were used to estimate the population mean and SD for each of the SOS and BMD measurement sites. Healthy post-menopausal women were classified into normal, osteopenic or osteoporotic, based upon the standard WHO definition of osteoporosis and expressed as a percentage. We investigated the age-related decline in T-scores from 20-79 by stratifying the healthy subjects into 10-year age groups and calculating the mean T-score for each of these groups. Finally, we estimated appropriate T-score thresholds, using five different approaches. The prevalence of osteoporosis in the post-menopausal women aged 50 years and over ranged from 1.4 to 12.7% for SOS and 1.3 to 5.2% for BMD. The age-related decline in T-scores ranged from -0.92 to -1.80 for SOS measurements in the 60 to 69-year age group and -0.60 to -1.19 for BMD measurements in the same age group. The WHO definition was not suitable for use with SOS measurements, and revised T-score thresholds for the diagnosis of osteoporosis of -2.6, -3.0, -3.0 and -2.2 and for osteopenia of -1.4, -1.6, -2.3, and -1.4, for the radius, tibia, phalanx and metatarsal, respectively, were recommended.

Cited by 8 articles

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[Osteoporos Int.](#) 2003 Oct;14(10):857-62. doi: [10.1007/s00198-003-1456-6](https://doi.org/10.1007/s00198-003-1456-6). Epub 2003 Aug 12.

Pediatric reference curves for multi-site quantitative ultrasound and its modulators

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Abstract

More than 85% of peak skeletal mass is accrued by the age of 18 years, making bone growth during childhood and adolescence a critical process. The purpose of this study is to establish pediatric reference curves for bone Speed of Sound (SOS) as measured by multi-site quantitative ultrasound. Analysis was performed on a total of 1085 healthy subjects ages 0–18 years (595 females, 490 males). Demographic and anthropometric parameters (height and weight), as well as data on calcium intake and physical activity, were collected. Ultrasound bone measurements were performed at the mid-shaft tibia and the distal third of the radius (Sunlight Omnisense 7000P). An age-related speed of sound (SOS) curve that describes SOS changes at the tibia and radius in both genders was demonstrated. SOS showed a steep increase during the first 5 years of life in both genders at the tibia and radius. The period between the ages of 6–11 years is characterized with a very shallow increase in SOS at both sites. Thereafter, during the pubertal period, there is a second growth burst in SOS, starting at age 11 for girls and age 14 for boys. No significant meaningful correlation was found between the anthropometric parameters (height, weight and BMI) and the SOS measurements after the age parameter was controlled. Subjects who reported low physical activity levels were found to have lower Z-scores than their counterparts ($P < 0.05$). The SOS of pre-menarche girls was significantly lower than that of post-menarche girls at the radius and tibia ($P < 0.05$). The level of calcium intake did not correlate with bone SOS. Intra-operator precision measurements were 0.36% (0.25–0.47%) at radius and 0.30% (0.20–0.40%) at the tibia. To date, there is no widely accepted classification or clinical working guidelines for children's bone health assessment or prediction of fracture risk based on bone strength measurements in children. This study establishes a pediatric reference curve for the Omnisense, and therefore supports the feasibility of using Sunlight Omnisense 7000P, a multi-site bone sonometer, for the assessment of pediatric bone properties. Further studies mainly in different diseased children groups should further support the use of such a basic tool for clinical evaluation, assisting the physician to work towards healthy bones for his patients.

Comment in

[Pediatric reference curves for multi-site quantitative ultrasound and its modulators-reply.](#)

Pluskiewicz W, Halaba Z.

Osteoporos Int. 2004 Mar;15(3):258. doi: [10.1007/s00198-004-1590-9](https://doi.org/10.1007/s00198-004-1590-9). Epub 2004 Feb 7.

PMID: 14767638 No abstract available.

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An investigation of unique and shared gene effects on speed of sound and bone density using axial transmission quantitative ultrasound and DXA in twins

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[Free article](#)

Abstract

The genetic influences of speed of sound (SOS) and BMD were evaluated using 215 pairs of healthy female twins. Genetic influences were found for all SOS and BMD measurements. A combination of shared and unique genetic influences was found to control BMD and SOS at the radius.

Introduction: The aim of this study was to investigate to what extent axial transmission speed of sound (SOS) measurements in cortical bone at multiple, peripheral skeletal sites will be influenced by genetic factors and to estimate the proportion of shared and unique genetic influences controlling bone mineral density (BMD) and SOS at a single site, the radius.

Materials and methods: The study population consisted of 215 pairs of healthy female twins. Of these, 85 pairs were monozygotic (MZ) and 130 pairs were dizygotic (DZ). The twins had measurements of the nondominant third proximal phalanx, one-third radius, midshaft tibia, and fifth metatarsal using the Sunlight Omnisense and DXA measurements of the lumbar spine, nondominant proximal femur, nondominant radius, and whole body using Hologic QDR-4500W densitometers. Calcaneal quantitative ultrasound (QUS) measurements were performed using the McCue CUBA clinical. Intraclass correlations were calculated, and heritability was estimated using multiple regression analysis. Bivariate analysis of site-matched SOS and BMD measurements at the radius was performed using a variance components analysis program.

Results: Age- and body mass index-adjusted heritability estimates ranged from 0.51 (95% CI, 0.32-0.70) to 0.56 (0.37-0.76) for SOS measurements, 0.58 (0.41-0.75) for broadband ultrasound attenuation (BUA), 0.72 (0.58-0.86) to 0.77 (0.63-0.91) for axial BMD, and 0.53 (0.16-0.90) to 0.63 (0.26-1.00) for radius and whole body BMD. The correlation between SOS and DXA at the radius was $r = 0.34$ (0.29-0.47). Thirty-eight percent (16-57%) of the genetic variance explained by SOS at the radius was also explained by BMD (one-third radius region of interest), with 62% being unique.

Conclusion: In conclusion, genetic influences were demonstrated for SOS measurements in cortical bone at multiple sites, axial BMD, calcaneal BUA, radius, and whole body BMD. At the radius, up to 38% of the genetic influence is shared by genes controlling BMD and SOS. Clarifying the site specificity and pleiotropic effects of bone genes should help our understanding of these complex pathways.

Cited by 5 articles

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Ultrasound velocity through the cortex of phalanges, radius, and tibia in normal and osteoporotic postmenopausal women using a new multisite quantitative ultrasound device

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Affiliations

PMID: 12649644 DOI: 10.1097/01.RLI.0000057031.21810.F4

Abstract

Rationale and objectives: To assess a new multisite quantitative ultrasound (QUS) device (Sunlight Omnisense 7000 S) suitable for the measurement of speed of sound (SOS) in the phalanges, radius, and tibia.

Methods: The study group consisted of 270 healthy Caucasian postmenopausal patients (mean age: 60.0 +/- 7.6 years) and 53 Caucasian postmenopausal patients (mean age: 67.2 +/- 7.4 years) with osteoporotic fractures. Measurements of SOS and bone mineral density (BMD) were carried out in all subjects.

Results: Intraobserver in vivo short-term precision was on average 0.76% for the radius, 0.47% for the tibia, and 1.54% for the phalanges. The interobserver precision ranged from 0.77% to 2.39%. Measurements of SOS at the 3 skeletal sites were significantly correlated ($r = 0.28-0.44$; $P < 0.001$). Significant correlations were found between SOS at all sites and BMD ($r = 0.21-0.41$; $P < 0.001$). The odds ratio for fracture prediction for SOS was 1.47 for tibia, 1.69 for radius, and 2.69 for phalanx. The corresponding odds ratios for BMD at the lumbar spine, femoral neck, and total hip ranged from 2.08 to 3.26. The area under the receiver operating characteristic curve ranged from 0.611 to 0.741 for SOS measurements and from 0.745 to 0.797 for BMD measurements.

Conclusions: The Omnisense multisite QUS device exhibits reproducible performance. Among the QUS variables, the phalangeal SOS provides the best discrimination of fracture patients.

Cited by 12 articles

26

J Pediatr Endocrinol Metab. 2001 Feb;14(2):159-64. doi: 10.1515/jpem.2001.14.2.159.

Quantitative ultrasound measurements of bone strength in obese children and adolescents

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Abstract

Very few studies have examined the effect of childhood obesity on bone mineralization. The purpose of the present study was to determine bone strength by quantitative ultrasound (QUS) measurements of bone speed of sound (SOS) in obese children (n = 45; age range 6–17 yr). SOS was measured (by Sunlight Omnisense) in the mid-tibial and radial bones. Data were compared to age- and gender-matched norms of Israeli non-obese children. Radial and tibial SOS was significantly reduced in obese compared to non-obese children ($p < 0.05$). Bone SOS in obese children with BMI > 95th percentile was not significantly different from obese children with BMI from 85–95th percentile. Tibial and radial SOS were correlated with pubertal stage ($r = 0.52$, $p < 0.005$; and $r = 0.35$, $p < 0.01$, respectively), and with chronological age ($r = 0.47$, $p < 0.005$; and $r = 0.32$, $p < 0.025$, respectively). No significant correlation was found between endurance time as an indicator of fitness and bone SOS. Bone strength measured by QUS is reduced in obese children, but is not affected by the severity of obesity.

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Comparative Study J Clin Densitom. Spring 2000;3(1):1–7. doi: [10.1385/jcd:3:1:001](https://doi.org/10.1385/jcd:3:1:001).

A new method for quantitative ultrasound measurements at multiple skeletal sites: first results of precision and fracture discrimination

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Affiliations

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Abstract

We investigated a new multisite quantitative ultrasound device that measures the acoustic velocity in axial transmission mode along the cortex. Using a prototype of the Omnisense (Sunlight Ultrasound Technologies, Rehovot, Israel), we tested the performance of this instrument at four sites of the skeleton: radius, ulna, metacarpal, and phalanx. Intraobserver (interobserver) precision errors ranged from 0.2% to 0.3% (0.3% to 0.7%) for triplicate measurements with repositioning. Fracture discrimination was tested by comparing a group of 34 women who had previously suffered a fracture of the hip, spine, ankle, or forearm to a group of 28 healthy women who had not suffered a fracture. Age-adjusted standardized odds ratios ranged from 1.6 to 4.5. Except for the ulna the sites showed a significant fracture discrimination ($p < 0.01$). The areas under the receiver operating curves (ROC) curves were from 0.88 to 0.89 for radius, metacarpal, and phalanx. A combination of the results from the three sites showed a significant increase of the ROC area to 0.95 ($p < 0.05$). Our results show promising performance of this new device. The ability to measure a large variety of sites and the potential to combine these measurements are promising with regard to optimizing fracture risk assessment.

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Does combining the results from multiple bone sites measured by a new quantitative ultrasound device improve discrimination of hip fracture?

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Free article

Abstract

There is a growing interest in the use of quantitative ultrasound (QUS) measurements as an alternative to current radiation-based bone densitometry techniques for the noninvasive assessment of fracture risk. While most of the commercialized ultrasound devices measure only

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'quantitative ultrasound' [TI] AND (sunlight or beammed) - Search Results - PubMed

single predefined peripheral skeletal sites, the Omnisense prototype (Sunlight Ltd., Israel) can be used on multiple bones, including the spinous processes. In this study, we examined the ability of speed of sound measured at the calcaneus, distal third and ultradistal radius, proximal third phalanx, metacarpal, capitate, patella, and the posterior process of the thoracic spine to differentiate subjects with hip fractures from normal controls. Seventy-nine postmenopausal Caucasian Israeli women who had sustained an atraumatic fracture of the proximal femur within the last 6 months were recruited from the local population (mean age 80 +/- 8.9 years). As controls, 295 postmenopausal Caucasian Israeli women without osteoporotic fractures were also included (mean age 70 +/- 8.7 years). Discrimination of hip fractures with QUS at all ultrasound sites was highly statistically significant (p < 0.01) (odds ratios [ORs] = 1.4-3.0; area under the ROC curve [AUC] 77-92%), except for the hand metacarpal. Distal radius and calcaneus measurements (ORs = 2.4 and 3.0) were the best discriminators of hip fracture patients from controls. Using a forward selective linear regression model, the discriminator values of combined assessment at two sites were investigated. There was moderate improvement in diagnostic value, but the best combination was the calcaneus with the distal radius, which improved the AUC by 3% and raised both the sensitivity and specificity to 94%. These data demonstrate the encouraging potential of improving discrimination of hip fracture by using multiple-site ultrasonic measurements.

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