Contribution ID: **1245** Type: **Poster (Student, In Competition) / Affiche (Étudiant(e), inscrit à la compétition)**

Multi-modality Bone Mineral Density Measurements in the Presence of Bone Seeking Elements Accumulated in Bone

Tuesday 14 June 2016 19:02 (2 minutes)

Dual-energy X-ray Absorptiometry (DXA) is currently the "gold standard"for measuring bone mineral density (BMD). Due to dependency of DXA on the atomic composition of bone, deposition of bone seeking elements that differ in atomic numbers from calcium (Ca, Z=20) can cause inaccurate estimation of BMD. One of the most notable elements of concern is strontium (Sr, Z=38), which is used to treat osteoporosis in the form of strontium ranelate. Because the atomic number of Sr is higher than that of Ca, Sr has higher attenuation coefficients than Ca for the photon energy range relevant to DXA. Therefore the BMD value of Sr can be overestimated. Other elements of interests are lead (Pb, Z=82) that accumulates in bone due to chronic occupational exposure or poisoning, and aluminum (Al, Z=13) which accumulates in human bone due to dialysis or administration of aluminum-containing medications. Although the accumulation of these elements occurs in relatively small concentrations, it is known to have adverse effects on bone health. Because Pb has higher atomic number and Al has lower atomic number in comparison to Ca, overestimation of BMD due to Pb and underestimation of BMD due to Al are of potential concern.

Quantitative Ultrasound (QUS) offers an alternative method of assessing bone health by measuring speed of sound (SOS), broadband ultrasound attenuation (BUA), and a derived quantity called the stiffness index (SI). Because QUS depends on the macroscopic acoustic properties and is not influenced by the microscopic changes in the atomic composition of bone, we are hypothesizing that the QUS should not be subjected to inaccurate estimation of the BMD measurement in the presence of these bone seeking elements.

In this study, hydroxyapatite that mimics bone mineral was synthesized with partial substitution of calcium with individual bone mimicking element (Sr, Pb and Al). The synthesized minerals were mixed homogeneously with gelatin to produce trabecular bone-mimicking phantoms that are compatible with both BUA and QUS, with volumetric BMD of 200 mg/cm^3 and varying analyte concentrations. The phantoms were then measured with a Hologic Discovery® DXA system, a Hologic Sahara® QUS system and an in-house research QUS system. The relationship between the concentration of the bone seeking elements and BMD as assessed by each modality will be presented.

Author: Mr JANG, Deok Hyun (Department of Physics, Ryerson University, Toronto, Ontario, Canada)

Co-authors: Dr PEJOVIĆ-MILIĆ, Ana (Department of Physics, Ryerson University, Toronto, Ontario, Canada); Dr CHEUNG, Angela M. (University of Toronto, Centre of Excellence in Skeletal Health Assessment, Toronto, Ontario, Canada); Mr DA SILVA, Eric (Department of Physics, Ryerson University, Toronto, Ontario, Canada); Dr TAVAKKOLI, Jahan (Department of Physics, Ryerson University, Toronto, Ontario, Canada / Institute for Biomedical Engineering, Science and Technology (iBEST), Keenan Research Centre for Biomedical Science, St. Michael' s Hospital, Toronto, Ontario, Canada); Dr SLATKOVSKA, Luba (University of Toronto, Centre of Excellence in Skeletal Health Assessment, Toronto, Ontario, Canada)

Presenter: Mr JANG, Deok Hyun (Department of Physics, Ryerson University, Toronto, Ontario, Canada)

Session Classification: DPMB Poster session, with beer / Session d'affiches DPMB, avec bière

Track Classification: Physics in Medicine and Biology / Physique en médecine et en biologie (DPMB-DPMB)