LASER SPECKLE IMAGING FOR OSTEOPOROSIS EVALUATION

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Osteoporosis is a common disease characterized by the reduction on Bone Mineral Density (BMD), leading to weakening of bone structure, Chronic pain, deformities and loss of quality of life. In addition to the clinical evaluation, dual-energy X-ray absorptiometry is one of the main techniques to diagnose it. However, this technique uses ionizing radiation to assess the bone structure and therefore cannot be used very often by patients, due to radiological safety reasons. On the other hand, optical techniques are known for its safe use, due to non-ionizing radiation, however, optical techniques do not easily allows the analysis of bone tissue. This limitation could be circumvented in the oral cavity area. In this work we used the Laser Speckle Imaging (LSI) technique to evaluate maxilla and mandible bones after demineralization prosses in an animal *in vitro* model. Osteoporosis lesions were simulated in sixteen mandible and twelve maxilla slabs using Ethylenediaminetetraacetic Acid (EDTA) 0.5 M for 0 (control) 7, 15 and 30 days. The roughness parameters Ra and Rq were analyzed with optical profilometry (ZeGage, Zygo, USA) to characterize the demineralization process. The LSI images were measured by custom experimental setup. A collimated laser beam at 635 nm and 1.3mW (Thorlabs CPS635R), expanded by a diverging lens (-75 mm), illuminates the sample. The scattered signal was imaged by a CCD camera (Thorlabs - DCC1645-HQ), an adapter (Thorlabs MVLCMC) and objective lens (Thorlabs/Navitar - MVL12X3Z) setting. A custom software was implemented to measure the speckle patches ratio and the speckle contrast ratio from speckle images obtained by a custom LSI setup. The speckle contrast ratio method only differentiate sound from osteoporotic tissue. The speckle patches ratio method presented a negative correlation with the roughness parameter, and consequently with the demineralization level. It was concluded that LSI is a promissory technique for assessment osteoporosis lesions on alveolar bone and, for that, the patches ratio is the best methodology for detecting and differentiating several degrees of demineralization.