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Title : **LIBS for Smart Laserosteotomy**

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Abstract

Over the past several years laserosteotomes have become a generally accepted device in various surgical applications. In laserosteotomy, the type of tissue being cut has to be identified, otherwise critical structures of the body under or near the focal spot of the laser beam are prone to inadvertently ablation. Laser-Induced Breakdown Spectroscopy (LIBS) is a potential tool for detecting the type and properties of the ablating tissue. This study examines the applicability of LIBS as a potential technique to differentiate bone from surrounding soft tissue (fat, muscle and bone marrow). Moreover, LIBS has been evaluated to detect the bone carbonization during the ablation process. In these experiments, fresh porcine femur tissues were used as samples. A beam of a nanosecond frequency–doubled Nd:YAG laser was used to ablate the tissue samples and generate the plasma. The plasma light emitted from the ablated spot, which corresponds to the recombination spectra of ionized atoms and molecules, was collected with a collection optic (including a reflective light collector and a UV-enhanced fiber optic) and was sent to an Echelle spectrometer to resolve the atomic composition of the ablated sample. Several spectra from different points of different samples of each group were collected. Then, to determine the elemental composition of the ablated tissues, the atomic emissions in the recorded LIBS spectra of all classes were compared to known spectra of atoms available in the NIST atomic emission database. Afterward, Discrimination Function Analysis (DFA) was employed to classify different groups of the samples. Finally, the Receiver Operating Characteristic (ROC) was performed, and the Area Under Curve (AUC) were calculated. Differences in the recorded spectra of the results are potentially enabled a real-time tissue classification in smart laserosteotomy.