Design of an Improved Optical Measurement Method for Spinal Deformation in Spinal Metastatic Disease

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Spinal cord compression, displacement, and collapse are some of the most debilitating complications of cancer and other spinal metastatic diseases. There are currently limited methods for healthcare providers to predict the probability and severity of spinal cord load-bearing failure due to deformation caused by metastasized tumors. In order to remedy this issue, this project aimed to explore different methods to conduct stress and deformation analysis on 2-3 vertebral segments under variable load. By conducting a research review on the current methods to measure deformation, the team compared the feasibility of application to the human spine and concluded Digital Image Correlation (DIC) analysis was the best approach to record accurate data within 5 microns without significant physical alterations to the spine segments. The team then designed a 4-camera DIC array to conduct contactless measurements for use in the lab. The data gathered will be analyzed through an algorithm in MATLAB that will produce real-time stress distribution of the disks and vertebra, which would be validated and corroborated with simulations conducted on models previously by the lab. Our novel application of this data acquisition strategy allows us to better understand the various ways in which the location and size of metastases can affect the dynamics of the spine, leading to a more quantifiable analysis of risk factors, leading to more personalized care and improved patient outcomes.