2. Abstract

Soft tissue sarcomas are cancers that originate from mesenchymal progenitor cells and commonly arise in muscles and soft tissues of the trunk extremities. The mainstay of treatment is complete surgical resection of the entire tumor bed, and the primary goal of surgery is to "leave no tumor cell behind." Despite this goal, local recurrence (i.e., reappearance of a tumor mass despite initial surgical resection) remains a major problem in soft tissue sarcomas if they are not completely removed with negative resection margins. Intraoperative histologic analysis by pathologists of H&E-stained frozen sections from tissues in the surgical resection site is the conventional means of assessing margin status in soft tissue sarcoma surgery. Despite its widespread use, this technique is time- and labor-intensive, prone to sampling errors, and only assesses a tiny fraction of the surgical resection site. Thus, there is an unmet clinical need to develop a system that can more quickly and reliably determine if surgical margins of sarcomas are negative, and thus allow the surgeon to quickly close the wound. Raman spectroscopy is a non-invasive technique, which generates spectra that can reveal structural fingerprints of molecules in tissues by inelastic scattering of photons. We have examined if Raman spectroscopy can correctly distinguish tumor tissue from adjacent benign skeletal muscle, dermal collagen and fat in frozen sections from resected tumors from 4 different patients and compared the results with the histologic findings in adjacent H&E-stained frozen sections. Our preliminary results are very promising and show a high correlation between the histologic findings and analysis of the Raman spectroscopic data using a novel computer-generated algorithm. These preliminary findings provide support for the development of Raman spectroscopy as a real-time in-vivo tumor/non-tumor discrimination tool in surgical resection of sarcomas. Seed funding will permit us to complete two aims: (1) to acquire additional data for analysis of samples from 12 more patients with soft tissue sarcomas, and determine if our proposed methods can robustly distinguish these tissue types from one another; and (2) to determine if a portable Raman probe with a significantly larger size of imaging spot can be used on fresh non-frozen samples with similar accuracy as our current instrument. This research has been a collaboration among PIs from Engineering, Orthopaedics and Pathology.

The OVPR Seed funding will allow us to conduct experiments to acquire more data on more patients with soft tissue sarcoma to verify our proposed methods and to extend our research to the use of a portable Raman probe, which will provide initial results for grant applications to be submitted to NIH and NSF for further funding.