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Developing Motorized Spectroscopy System for Tissue Scanning

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Abstract : The aim of the presented study was to develop a newly motorized spectroscopy system. Our system is composed of probe and motor parts. The probe part consists of bioimpedance and fiber optic components that include two platinum wires (each 25 micrometer in diameter) and two fiber cables (each 50 micrometers in diameter) respectively. Probe was examined on tissue phantom (polystyrene microspheres with different diameters). In the bioimpedance part of the probe current was transferred to the phantom and conductivity information was obtained. Adjacent two fiber cables were used in the fiber optic part of the system. Light was transferred to the phantom by fiber that was connected to the light source and backscattered light was collected with the other adjacent fiber for analysis. It is known that the nucleus expands and the nucleus-cytoplasm ratio increases during the cancer progression in the cell and this situation is one of the most important criteria for evaluating the tissue for pathologists. The sensitivity of the probe to particle (nucleus) size in phantom was tested during the study. Spectroscopic data obtained from our system on phantom was evaluated by multivariate statistical analysis. Thus the information about the particle size in the phantom was obtained. Bioimpedance and fiber optic experiments results which were obtained from polystyrene microspheres showed that the impedance value and the oscillation amplitude were increasing while the size of particle was enlarging. These results were compatible with the previous studies. In order to motorize the system within the motor part, three driver electronic circuits were designed primarily. In this part, supply capacitors were placed symmetrically near to the supply inputs which were used for balancing the oscillation. Female capacitors were connected to the control pin. Optic and mechanic switches were made. Drivers were structurally designed as they could command highly calibrated motors. It was considered important to keep the drivers' dimension as small as we could (4.4x4.4x1.4 cm). Then three miniature step motors were connected to each other along with three drivers. Since spectroscopic techniques are quantitative methods, they yield more objective results than traditional ones. In the future part of this study, it is planning to get spectroscopic data that have optic and impedance information from the cell culture which is normal, low metastatic and high metastatic breast cancer. In case of getting high sensitivity in differentiated cells, it might be possible to scan large surface tissue areas in a short time with small steps. By means of motorize feature of the system, any region of the tissue will not be missed, in this manner we are going to be able to diagnose cancerous parts of the tissue meticulously. This work is supported by The Scientific and Technological Research Council of Turkey (TÜBİTAK) through 3001 project (115E662).

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