AbstractID: 13673 Title: Design and Evaluation of an Optical Tactile Imaging Device for Tumor Detection

Purpose: To present a novel tactile imaging device for cancer detection. **Method and Materials:** Unlike traditional tactile devices, which are formed of pressure sensor array, this new device uses an optical waveguide and total internal reflection principle to maximize the tactile resolution. In order to emulate the detection range of the human tactile sensation, a multi-layer polydimethylsiloxane waveguide has been fabricated as a sensing probe. The elastic modulus of each layer has been matched to the dermis, epidermis, and subcutaneous of the human finger. The light is illuminated under the critical angle for full reflection within the waveguide. When a waveguide is compressed by an object, the contact area of the waveguide deforms, which causes the light to scatter. The scattered light is then captured by a high resolution camera. The applied forces can be detected by measuring changes in the amount of diffused light. To test the performance of the proposed device, a realistic tissue phantom with hard inclusions is developed. Total of nine inclusions with different diameters and depth were placed in the phantom. We estimated the diameter and the depth of the inclusions with the tactile imaging device. We also performed experiments using the mice with globus tumors. We grew three different sizes of tumors and imaged them using the proposed device. **Results:** The result showed that the proposed sensor can estimate the inclusion diameter within 4.09% and the inclusion depth within 7.55%. The mice test results show that the proposed device successfully detects the tumors. In the animal study, the sensor detected a subsurface tumor as small as 2.74 mm. **Conclusion:** A novel tactile imaging device for tumor identification has been designed and experimentally evaluated to be effective.