DERMOSCOPY AND SKIN IMAGING

LESION ROUGHNESS FOR DETECTION OF MELANOMA USING A HANDHELD LASER SPECKLE DEVICE

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Introduction: Recently, skin surface roughness has been evaluated as a potential diagnostic marker in skin cancer detection. Objective quantification of surface roughness has typically been done indirectly by measuring skin replicas created from silicone impressions. We have developed an alternative in vivo laser speckle technique to directly measure lesion surface roughness using an optical handheld laser speckle device. Laser speckle is the interference pattern produced within backscattered light when coherent incident light is used to illuminate a surface. Laser speckling has been shown to vary according to surface roughness.

Objective: To evaluate lesion surface roughness parameters derived from laser speckle imaging in the detection of skin cancer.

Methods: We conducted a study measuring 309 skin lesions with a laser speckle device, including actinic keratosis (11), basal cell carcinoma (38), malignant melanoma (36), nevus (88), squamous cell carcinoma (27), and seborrheic keratosis (109). We then calculated the root-mean-square (RMS) roughness of each lesion using parameters from the speckle images. To evaluate how well roughness can differentiate lesions, we carried out statistical analyses comparing the RMS roughness of the 6 lesion types.

Results: The mean RMS roughness values ranged from 16 to 40 microns. Malignant melanoma (16 microns) was ranked as the smoothest and squamous cell carcinoma (40 microns) as the roughest lesion type. A Kruskal-Wallis test confirmed that malignant melanoma had significantly lower roughness values than the other lesion types ($p < .01$).

Conclusions: Lesion roughness could be a potential diagnostic tool in the detection of skin cancer, particularly melanoma. We have developed an in vivo technique to measure skin roughness based on laser speckle. On average, malignant melanoma ranked the smoothest among the tested lesions. This outcome is consistent with clinical findings and supports the use of skin surface roughness in differentiating malignant melanoma from other clinically significant lesion types.