Application for 2015-2016- Burnell Student Research Award

Office of Associate Dean for Research and Innovation
Nova Southeastern University College of Osteopathic Medicine

Project Title: Characterizing Dielectric Properties of Malignant and Non-Malignant Skin Lesions

Applicant (s): Print each name and class (i.e., OMS I, II, III, or IV):

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1. **Signature:** _____ **Date** 11/3/15
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Print Name

By 4 p.m. Monday, November 9, 2016 submit completed application electronically to levyleon@nova.edu **or deliver to Office of Associate Dean for Research and Innovation**

Summary of Proposal

TYPE FONT NO LESS THAN 12 and provide an abstract of 500 words or less including:

1. **Hypothesis**
2. **Background/Significance**
3. **Methodology**
4. **Evaluation**

HYPOTHESIS: We hypothesize that the tissue dielectric constant (TDC), measured at 300 MHz in cancerous skin-lesions differs from noncancerous-lesions and from unaffected skin.

BACKGROUND/SIGNIFICANCE: Skin cancer includes basal cell (BCC), squamous cell (SCC) and melanoma (MEL). Early detection is important for survival and disfigurement prevention. Currently diagnosis includes visual screening and histopathological evaluations of atypical lesions. However, many benign lesions are unnecessarily excised causing discomfort and increased infection risk. Some published data suggests there is an electrical signal signature potentially unique to each cancer type that depends on differences in cell structure, components and arrangements in healthy tissue vs. cancerous tissue. Electrical impedance differences may thus facilitate a diagnostic decision. However, implementation of this method is expensive, unproven and time consuming. An alternative to assessing impedance differences would be to assess differences in TDC values of these tissues. Indeed encouraging results for this concept have been reported for breast, lung and liver but has not been tested in skin. Thus the goal of this pilot study is to determine if there is a reasonable likelihood of discovering a characteristic TDC signature to distinguish among skin cancer types and non-cancerous lesions and provide a potential method of aiding in non-invasive skin cancer diagnosis.

METHODOLOGY: Participants will be recruited from patients who present at a dermatology clinic for skin lesion assessments and subsequent biopsy. All will have the research study explained and will sign an approved informed consent. Because this is a pilot study we plan to initially limit enrollment to incorporate at least 10 patients who have one of the following biopsy confirmed conditions; BCC, SCC and MEL and nonmalignant lesions. All measurements are done before the biopsy on the lesion and on a contralateral or non-lesion skin site. Prior to measurements the lesion is outlined and photographed for reference. Measurements include lesion/skin temperature and TDC values of lesion/skin in triplicate to a depth of 0.5 mm and 2.0 mm below the surface. The biopsy is done by the attending physician and the results provided for analysis along with the quantitative temperature and TDC data.

EVALUATION: The primary data set will include at least 10 TDC values (at two depths) obtained for each of 5 different conditions (normal skin = NRM, non-malignant lesion = (NML), BCC, SCC and MEL. Because each patient will have a lesion measurement and a NRM measurement the first research question is; do TDC values of any lesion type differ from NRM? This is tentatively answered by testing paired-values (Lesion-NRM) using the non-parametric Wilcoxon Signed Rank Test for each lesion type. The other major question of interest is; do cancer-types differ from each other or from non-cancerous lesions? This is tentatively answered by testing among lesion groups using the Kruskal-Wallace one-way ANOVA. In this non-parametric test the null-hypothesis is that all group medians are equal and the alternate-hypothesis is that at least one group median is different from at least one other group median. The threshold for accepting a statistical difference is to be $p<0.05$.