INTERNATIONAL SOCIETY FOR DIGITAL IMAGING OF THE SKIN NEWSLETTER ©2009

"MIGRATING SKIN IMAGING TECHNOLOGY INTO CLINICAL PRACTICE"

ISDIS invites you to attend its annual meeting at AAD-San Francisco on Friday, March 6th, 2009. See page 3 for details.

Editor-in-chief: Alon Scope, MD **www.i-s-d-i-s.com**

The International Society for Digital Imaging of the Skin (ISDIS) will be holding its 4th annual U.S. meeting in conjunction with the AAD annual meeting in San Francisco. The ISDIS brings together clinicians, scientists and engineers to allow inter-disciplinary crosstalk that will promote migration of digital imaging technologies into clinical practice. In our experience, engineers need ongoing feedback from clinicians in order to develop imaging instruments that clinicians will find useful. When exposed to the amazing armamentarium of skin imaging modalities in the pipeline, clinicians often devise new, innovative ways of applying these technologies to improve patient care. Indeed, the previous ISDIS meetings have led to fruitful collaborations. Importantly, skin imaging has been increasingly becoming a leading frontier for use of imaging in other medical and surgical sub-specialties.

As always, the newsletter features abstracts of the exciting talks of the upcoming meeting. We look forward to seeing you all in San Francisco. To contact us, please email Elizabeth Kent at kente@mskcc.org

Allan C. Halpern, MD
President of ISDIS
Alexander Zemtsov, MD
Secretary/Treasurer of ISDIS

Figure 1: A SIAscope is a handheld device that is gently apposed to the skin

Spectrophotometry

Spectrophotometric intracutaneous analysis (SIAscopy)

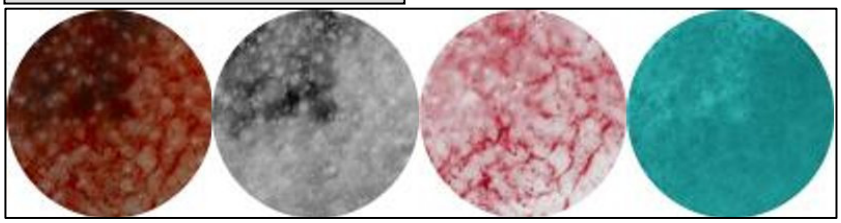
By Symon Cotton, PhD

Scientific Division, AstronClinica, Cambridge, U.K.

Spectrophotometric intracutaneous analysis (SIAscopy) is a technique based on mathematical modeling of the optics of human skin. Such modeling provides an understanding of the manner in which light interacts with skin; the way it scatters and is absorbed by cells. By understanding these interactions and comparing the light sent into skin with that which comes back out, across different wavelengths, the nature and anatomic position of many of the different cells and structures within the skin can be determined.

A portable SIAscopy unit enabling rapid, bedside imaging of the skin has been developed in the past decade (Figure 1). In particular, SIAscopy currently measures the amount of hemoglobin, melanin, collagen and determined whether melanin is located in the epidermis or in the dermis (Figure 2). The information is presented in the form of maps called SIAgraphs which show how these measurements vary over an area of the skin. The SIAgraphs can either be viewed as images or be made available as arrays of floating point numbers for use in statistical analysis programs. Preliminary studies have shown the potential of SIAscopy to serve as a useful adjunct in the diagnosis of skin cancer. In addition, SIAscopy has recently been extended to measure in detail the topography of the skin surface and to provide maps of the hydration level of the skin (Figure 3).

Figure 2: SIAscans showing, from left: color image, melanin, hemoglobin and collagen .



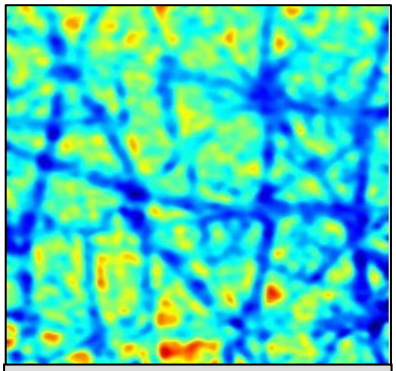


Figure 3: SIAscan showing the hydration state of the skin, red is hydrated blue is dry

In this issue…

Ultrasonography

Melanoma Breslow thickness on Histopathology can be predicted by 75-MHz ultrasonography

By Scott W. Menzies, MBBS PhD

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The most important predictor of prognosis in melanoma is Breslow thickness. The thicker the melanoma, the graver the prognosis. An important potential application of cutaneous ultrasound (US) is assessment of melanoma thickness. However, high frequency US at 20 MHz frequency tends to over-estimate melanoma thickness, which may in turn lead to wider surgical margins than required and to sentinel lymph node sampling. To this end, we sought to assess the efficacy of 75-MHz US for pre-surgical melanoma thickness estimation. We imaged 112 melanocytic lesions, clinically suspicious for melanoma, with a 75-MHz US in A and B modes. This instrument provides acceptable resolution for assessment of melanoma, with penetration of 3 mm and lateral resolution of 21 µm.

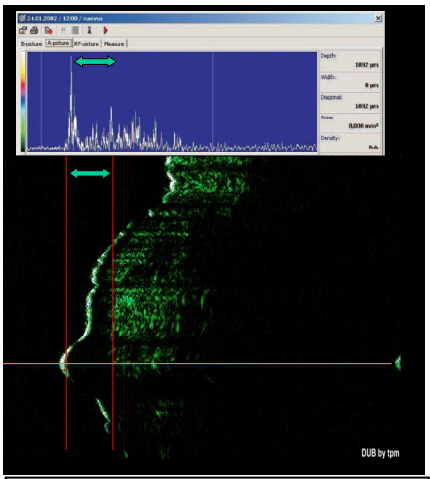

Figure 4: The green arrow shows the measurement of melanoma hypoecogenicity boundaries using 75-MHz US. In this melanoma, thickness estimation by US was 0.74 mm by US. Breslow thickness on histopathology proved to be 0.7 mm.

Since melanocytic lesions appear hypoechogenic compared to the surrounding dermis, depth is determined by identifying the US hypoechogenicity boundary (Figure 4) . All lesions warranted surgical excision which allowed for blinded comparison of the depth assessment with US with the Breslow thickness measurement on histopathology. Forty five of 52 melanomas and 22 of 36 nevi showed clear hypoechogenicity boundaries. The median histological Breslow thickness of melanoma was 0.4 mm and 22 were in situ melanomas. The median percentage error of the ultrasound machine was 13% of the Breslow thickness, with a high correlation (Pearson's r=0.908, p<0.001). Measurement was highly reliable for invasive melanoma, even in the presence of confounding factors such as lymphocytic infiltrate or contiguous nevus.

In summary, there is evidence that 75 MHz US can be useful for pre-surgical non-invasive assessment of melanoma thickness.

Guitera P, Li LX, Crotty K, Fitzgerald P, et al. Melanoma histological Breslow thickness predicted by 75-MHz ultrasonography. Br J Dermatol 2008; 159:364-9

Total Body Photography

Three Dimensional Total Body Imaging

By Allan C. Halpern, MD

Dermatology Service, Memorial Sloan-Kettering Cancer Center, New York

Total body photography is used in dermatology primarily for melanoma surveillance in high risk individuals. It is also used in a limited fashion for photographic documentation of response to dermatologic therapies. Over the past decade, total body photography in dermatology has transitioned from film to digital photography. This has permitted much more efficient and economical storage of total body images as well as the ability to catalog close-up images to their exact location in the whole body photographs using intuitive graphical user interfaces.

There are, however, significant limitations to the use of two dimensional total body photography in dermatology. These include potential cataloging errors due to overlapping areas between images, inability to make accurate size measurements on curved surfaces of the body, and inability to document elevation of lesions.

In recent years, the technical hurdles to the development of three dimensional imagining have been largely overcome. Three dimensional imaging is commonly used for research, industrial, and commercial applications. In medicine, applications include planning for reconstructive surgery and volumetric assessments in radiology. In dermatology, there are multiple commercial products for the three dimensional imaging of the face. To date, however, there have been no efficient and economical commercial products for total body three dimensional dermatologic photography.

We have recently implemented the use of whole body three dimensional imaging as part of an epidemiology study of the development of nevi in adolescence. This SONIC (Study of Nevi in Children) study has tracked the changes in children's nevi from the fifth through eighth grade using two dimensional high resolution overview photography and close up imaging. This past year, we returned to image the same children in the ninth grade using a proprietary three

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dimensional total body imaging system developed by Canfield Scientific, Inc. This system uses passive stereophotogrammetry technology. It combines 12 digital SLR cameras under software control, arranged to capture a complete side of the body in high-resolution 3D in each capture. The actual capture area is 160 cm high, and 80 cm wide, arranged to capture from the top of neck down to the ankles, and including the arms. The image capture time is 10 milliseconds, with each texture pixel in the 3D dataset corresponding to about 0.16 mm on the subject.

Our experience with three dimensional imaging in the context of a research study indicates the potential utility of this approach for epidemiologic and clinical research as well as a future application in clinical practice. While the system is currently expensive and the images require significant processing time on a high end personal computer, once processed, they are easily navigated through the available graphical user interface. In the future, total body three dimensional imaging may serve as a very practical platform for routine medical documentation.

Automated Diagnosis

Melafind: automated diagnosis on the verge of FDA approval

By Harold Rabinovitz, MD

Skin and Cancer Associates,
Plantation, Florida

A promising tool in the clinical evaluation of patients for melanoma is the multispectral imaging units. One such device, the Melafind, utilizes a computerized analysis algorithm for the automatic diagnosis of melanoma. The ultimate objective is an end-to-end, fully automated, diagnostic instrument with the capability of diagnosing pigmented skin lesions without the intervention and assistance from any expert dermatologist. This lecture will review the final phase 3 results for FDA Approval.

The Melafind emits multiple wavelengths of light, captures lesion images (Figure 6), analyzes the images (Figure 7), and separates the pigmented lesion from melanoma. It takes 10 images of each lesion using 10 different narrow spectral bands from 430 to 950 nm. As the wavelength changes variations occur in the reflections of the lesion and of the surrounding skin. At the short wavelength images are darker as shorter wavelengths penetrate less deeply than long wavelengths. At longer wavelengths absorption by melanin decreases, as more light penetrates to the dermis giving

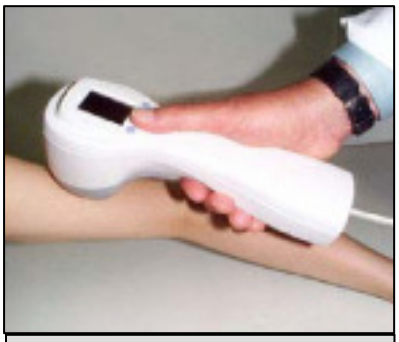

Figure 6: Melafind image capture

the images a lighter appearance. It has been demonstrated that imaging with multiple spectral bands provides important information to separate benign pigmented lesions from melanoma. Some of the important parameters in the algorithm include wavelet technology and gray strip analysis.

The Melafind originally was trained on Kodochrome slides. For the past ten years the data base has been collected on patients at both university and private dermatology centers. Major academic centers in Europe and Australia have also participated in the study. The most recent training set was on 2,265 pigmented lesions. This consisted of 221 melanomas, 87 high grade dysplastic nevi, and 1957 other pigmented skin lesions. The testing set randomly selected was on 562 pigmented lesions. Included in this group were 54 melanomas, 22 high grade dysplastic nevi, and 486 other pigmented skin lesions. The results were sensitivity to melanoma of 98.1% for both the computer and the expert dermatologist. The specificity for the computer was significantly better than for the expert dermatologist, 45% to 20%.

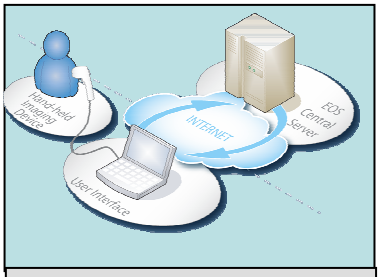

Figure 7: The Melafind system.

These results prompted the clinical trial for FDA approval.

The sample requirements for the final FDA study were a triple blinded study that included 100 melanomas and 1200 pigmented lesions. The primary endpoints included MelaFind being utilized as a diagnostic aid, fully automatic with no physician input. In addition MelaFind's sensitivity to MM is at least 95% at 95% confidence level. This measured sensitivity is at least 99% for the sample of 100 MM. Finally, the specificity of MelaFind is superior to the specificity of study dermatologists. These results will be disclosed in March 2009.

Calendar of Events

4th annual meeting of the ISDIS at the AAD 67th Meeting

March 6th, 2009, 6-9pm

Golden Gate C2 at the San Francisco Marriott, 55 Fourth St, San Francisco, CA

Please confirm participation by email to Elizabeth Kent, kente@mskcc.org

2009 US Technical Symposium of **ISBS -** International Society for Biophysics & Imaging of the Skin

March 18-21, 2009, Dallas, TX

2nd congress of the International Dermoscopy Society

November 12-14th, 2009, Barcelona, Spain

Transillumination Imaging

Nevoscopy: a novel tool for imaging skin lesions

By Atam P. Dhawan, PhD [1] and Nizar Mullani, PhD [2]

[1] New Jersey Institute of Technology, Newark, NJ, USA
[2] Translite Inc., Sugarland, TX, USA

Optical imaging of skin-lesions for early detection and management of skin-cancers has been of significant interest in dermatology. Though there are optical imaging systems available today, such as the "Dermascope", they largely utilize surface illumination for epiluminescence light microscopy (ELM) imaging. Limitations of surface reflectance based imaging systems have been realized in producing images with important vascular and depth dependent information. We have developed a novel optical imaging system, the Nevoscope (Figure 8), that uses transillumination (TLM) as to provide images of skin-lesions showing sub-surface pigmentation as well as vascular architecture based blood volume information.

Figure 8: Handheld nevoscope (top) and nevoscope lens attached to a digital camera (bottom)

We compared non-contact polarized ELM with TLM imaging methods to demonstrate that TLM imaging method provides better vascular information from the subsurface lesion architecture. Figure 9 shows Nevoscope images of a moderately dysplastic nevus. The TLM image demonstrates less pigmentation and less contrast in comparison to the cross-polarization image. However, the TLM image appears larger due to the vascular component at the periphery. Further the increase in the blood volume as obtained from the ratio of the segmented pigment distribution areas of a TLM image and corresponding ELM image of a skin lesion, showed promising correlation with the lesion progression.

Nevoscope based multi-spectral trans-illumination imaging is also aimed at the characterization of skin-lesions with reconstructions of melanin and blood volumes. We will present a shape-based multi-constrained reconstruction algorithm that uses a genetic algorithm based optimization method to find the best possible reconstruction of three-dimensional melanin and blood volumes. A melanocytic skin-lesion is modeled with melanin and blood parts, which are delineated by two cubic tensor-product B-spline surfaces with a few control parameters. The parameters are then coded into a genetic algorithm to find a solution through global optimization. Reasonable constraints are incorporated into the genetic algorithm to stabilize the solution. Initial results of reconstructions of melanin and blood parts will be presented for simulated and real lesions using multi-spectral Nevoscope images at 580 nm and 800 nm wavelengths.

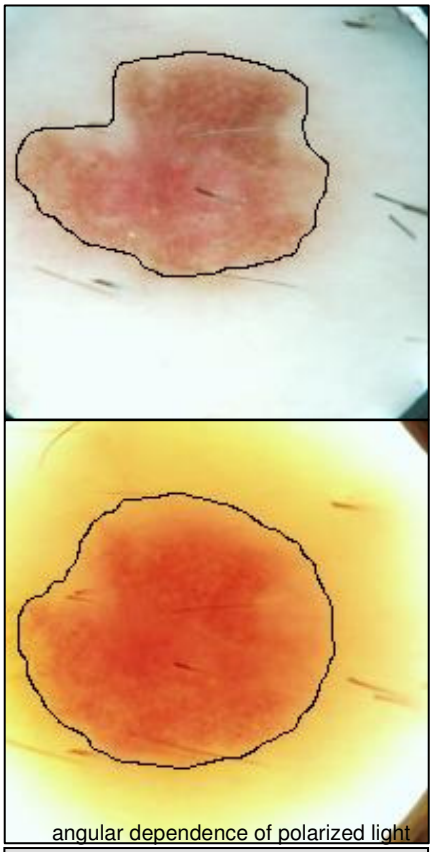

Figure 9: Cross-polarization ELM (top) and TLM (bottom) images of a dysplastic nevus. An automated boundary detection method was used to create the outline shown (black lines).

Sponsors of meeting:

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Acknowledgment: We thank Canfield Scientific, Ltd for their technical support in publishing this newsletter

About the editor: Alon Scope, MD is a dermatologist who is currently a faculty investigator at the Dermatology Service, Memorial Sloan-Kettering Cancer Center, New York. E-mail: **scopea1@gmail.com**