Digital Epiluminescence Microscopy – New Advances in Early Detection of Melanoma

a report by
Derma Instruments

At the height of the information age, it is hard to believe that the most widely used method for detecting skin cancer – the fastest-growing form of all cancers – is the human eye.

Whilst dermatologists agree on the visual criteria that point to skin cancer, a diagnosis based on surface screening is subjective. It relies on the doctor's ability to differentiate between often minute subtleties in the shape, colour and size of skin lesions. The standard, therefore, has become that dermatologists perform biopsies and excisions whenever there is any question about a mole's potential for skin cancer. Certainly, biopsies and excisions are necessary measures but it is estimated that at least one-half of all biopsies and excisions are unnecessary. This means that many patients undergo excisions – which often leave scars and are sometimes painful – only to find out subsequently that they were needless.

In 2001, dermatologists will diagnose one million new cases of skin cancer, and more than 40,000 of these will result in malignant melanoma. It is estimated that one person dies every hour from malignant melanoma. By 2002, the lifetime risk of developing skin cancer is expected to increase to one in 75 in the Western world, and loss of life and related healthcare costs could skyrocket.

As the fastest-growing form of cancer, malignant melanomas have an equally serious impact on rising healthcare costs. With a more than 1,800% increase in new cases reported today, as compared with 1930 figures, the US alone will spend more than US$0.5 billion this year on melanoma skin cancer treatment.

Prevention and early detection of skin cancer is, irrefutably, the most life-saving tactic known in combating death from melanoma. Likewise, prevention and detection are the greatest defences against huge future healthcare costs related to skin cancer.

About 20 years ago, so-called hand-held dermatoscopes using epiluminescence microscopy (ELM) became available to dermatologists for detecting and diagnosing early-stage skin cancer. ELM is a non-invasive method that allows seeing through the surface of the skin to pigmented areas beneath. The *in vivo* technique of ELM – also known as dermatoscopy or skin-surface microscopy – magnifies the skin in such a way that colour and structure in the epidermis, dermoepidermal junction and papillary dermis become visible. These are extra criteria that cannot be seen with the typical magnification that clinicians use and have been shown to increase the diagnostic accuracy of melanoma and other pigmented skin lesions significantly with both melanocytic and non-melanocytic cases.

To be able to see underneath the skin surface, the traditional dermatoscopes need to use immersion oil and a light source. The benefits of ELM/dermatoscopy are as follows:

- differentiation of melanocytic from non-melanocytic skin lesions;
- differentiation of benign from malignant skin lesions and thus melanoma;
- helps to plan surgery;
- avoidance of unnecessary surgery;
- follow patients with dysplastic nevi; and
- patient reassurance.

A new generation of ELM, however, takes early skin cancer detection to another plane. Based on several years of research conducted by the University of Vienna Medical School's Department of Dermatology, the world's first digital epiluminescence system was developed in 1996.

Digital epiluminescence microscopes (DELMs) can capture an ELM image and store it electronically as a computer file. Besides the fact that DELMs utilise the technique of dermatoscopy, they also host other critical benefits, such as:

- computer-aided diagnostic tools that help improve doctors' diagnostic accuracy;

Figure 1: View with Traditional Microscopy

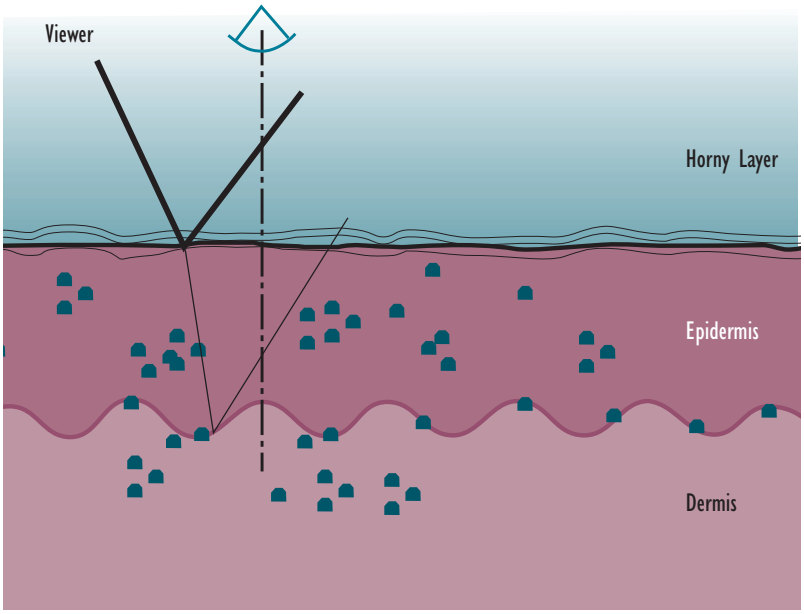


Figure 2: View with the Help of ELM

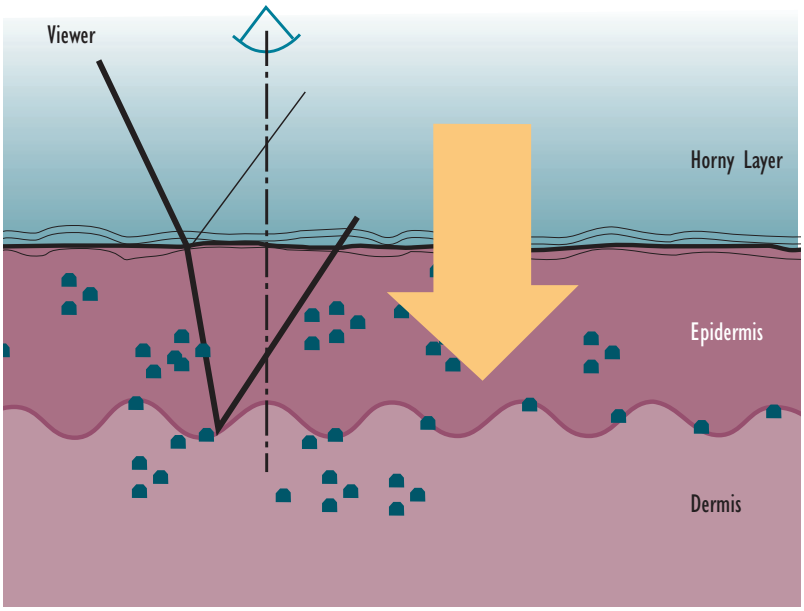
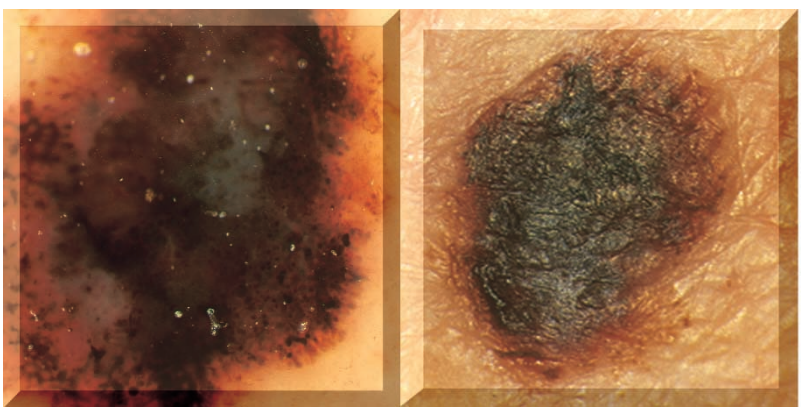


Figure 3: Digital ELM (Left) and Clinical (Right) Images of the Same Invasive Melanoma



- a micro video camera for on-screen live imaging – allowing patient and doctor simultaneous viewing;
- database storage and retrieval software, providing a patient 'baseline' for comparison;
- macro-imaging peripherals for localising and enlarging skin lesions; and
- teleconsulting support, including data transmission of the patient images to pre-eminent centres of expertise, should they be required.

Although only available since two years ago, currently, more than 500 DELMs are in use throughout Europe, Australia and North America.

One of the critical benefits that DELMs provide is a patient's ability to participate in his or her own dermatological examination. However, despite years of extensive public education programmes on the importance of self-examination and the need for routine dermatological examinations, less than one-third of adults protect themselves from the sun regularly, according to the American Cancer Society. By seeing a live image of the questionable areas of one's own skin, comparing them with healthy samples and looking at what can happen if the situation worsens, a patient is more likely to take proactive prevention measures against skin cancer.

Figure 3 shows both clinical and digital ELM images of the same invasive melanoma. The clinical image on the right lacks the 'ABCD' criteria suggestive of melanoma. With digital dermatoscopy/ELM there is a great deal of asymmetry of colour and structure that is not visible with the naked eye, suggesting the diagnosis of melanoma.

To summarise, DELM is the newest and most advanced method for detection and evaluation of pigmented skin lesions. With DELM, dermatologists have a clearer view than ever before of the subsurface layers of the skin, as well as a method for comparison, analysis and consultation of all types and stages of skin conditions. DELM technology increases the likelihood that doctors can spot lesions and assess the need for biopsies accurately. Decreasing unnecessary biopsies can help restrain healthcare costs and redirect efforts towards treatment breakthroughs for malignancies that may have gone unnoticed without DELM technology. Any method for relationship-building between dermatologists and their communities will have a trickle-down effect on lowering skin cancer mortality rates and costs related to treatment. DELM systems are a revolutionary step towards raising the priority of skin cancer prevention and detection worldwide.