MIMOSA

e-book series

Skin Integrity

Make the invisible, visible

MIMOSA Pro provides a portable technology, driving efficiency and accuracy in the diagnostic capabilities of clinicians. The advantage of this technology is that its skin pigment, clinical specialty and care setting agnostic, hence providing equitable access.

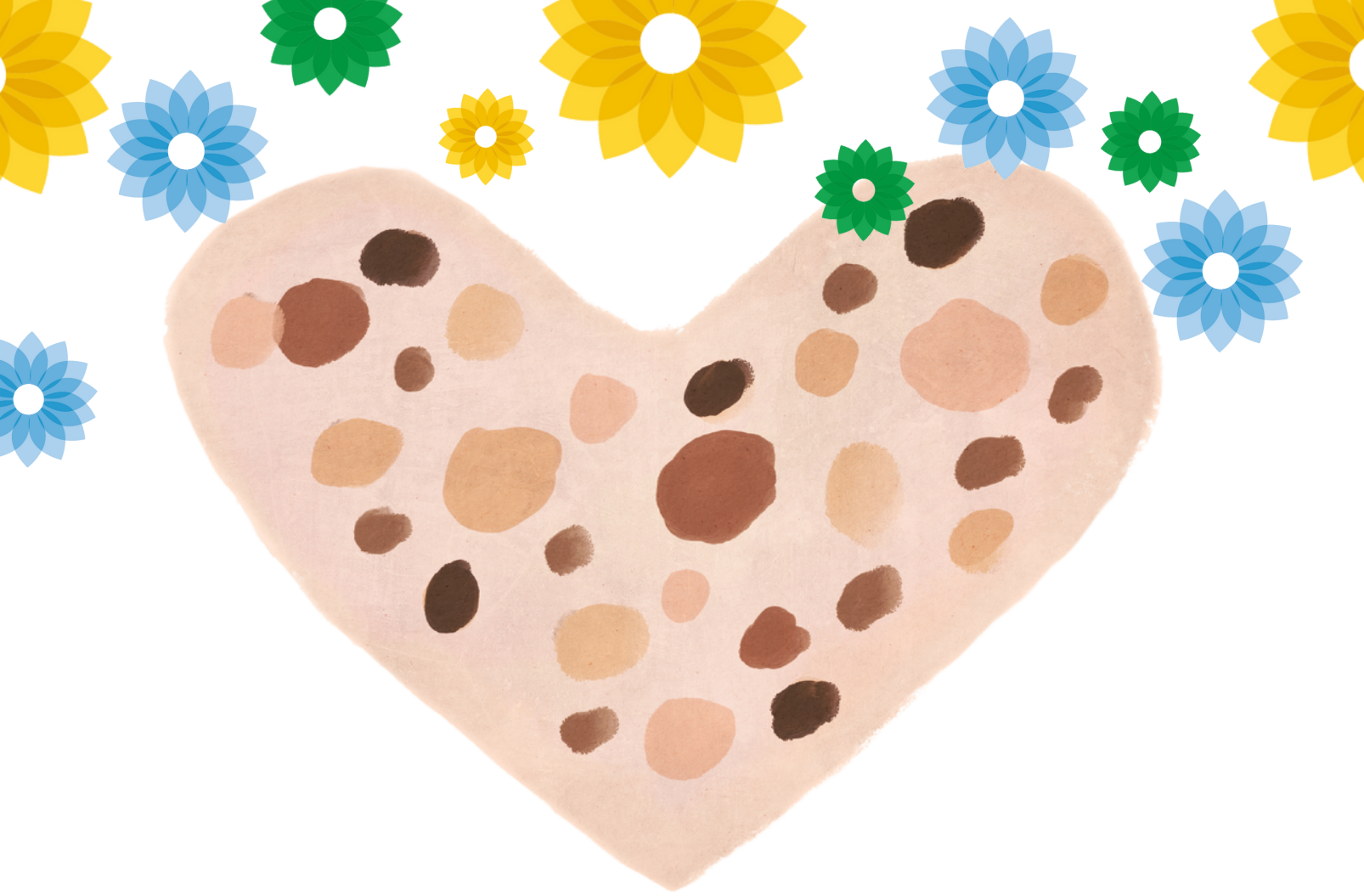
Enable clinicians to assess any patient, anywhere and anytime

Enable clinicians to save limbs and lives through early detection.

Enable clinicians to make the invisible, visible.

"Multispectral imaging represents a game changer for the assessment and management of patients with compromised skin health."

Karen Cross, MD, PhD
Innovator in Residence at the
Nova Scotia Health Authority (NSHA)



“MIMOSA is a game changer.”

Keith Harding
Dean of Medicine
Cardiff University, Wales, UK

Skin and Why Its Health is Important

Your skin says a lot about you as an individual. It is the largest human organ and protector of everything that encapsulates being human. Healthy skin is an asset to the body by being a barrier and regulator. Skin helps regulate body temperature and it acts as a natural filter of elements that can affect your health – so its main action is as a barrier to outward and inward egress. The skin is constantly growing and being replaced due to the rigorous protection it provides every second of ever day. This protection is its main task, keeping us safe and healthy. The multitude of daily human tasks such as eating, drinking, working, leisure and pleasure will have telling effects on the skin in good or bad ways.

We should all be on the lookout for unexpected changes to our skin, and seek medical advice if changes occur. Looking after our skin health helps us stay healthy. Therefore, the importance of skin health all year round cannot be overemphasized.

Skin plays other roles, too. Skin health is important not only for your appearance, but more importantly because your skin performs so many essential tasks for your body. Healthy skin healthy function. Your skin protects your body from the many viruses and bacteria you are exposed to daily. It also protects you from the sun's rays that can damage cells. Healthy skin produces vitamin D when exposed to the sun, and vitamin D is important for many body functions. Having healthy skin also helps your body keep its temperature at a constant level. Healthy skin also helps you react better to important changes around you by feeling pain or pressure.

Skin that is healthy can resist signs of aging, heal faster and even stave off potential disease. It can often manifest underlying diseases and when it’s visually altered or damaged can make a profound effect on one’ quality of life. A red, itchy rash might signal allergies or infections. A yellow tint might indicate liver disease. And dark or unusual moles might be a warning sign of skin cancer.

Skin, An Integrity Not to Compromise

As previously discussed protection is one of the most important functions of our skin. Unfortunately, as we age, our skin health starts to deteriorate becoming less effective in this protective role. This diminishing protection is generally referred to as the loss of skin integrity. Losing skin integrity puts patients at risk making them more vulnerable to skin damage. The consequences of such damage can range from minimally bothersome to life threatening in different circumstances.

The process of ageing can result in a number skin changes. You may notice in the elderly the skin is not as smooth, dries out more quickly and is not as firm or thick. The structure and function of an older person's skin reflects the cumulative effects of "natural" ageing and "environmental" ageing. Natural ageing is the true biological process, whereas environmental refers to the damage caused from exposure to the environment. As a result of ageing the process of cell renewal, within the skin, is slowed down considerably, making it less healthy than younger skin.

Altered skin integrity can have impactful consequences like infection, impaired mobility, and may even result in the loss of limb or life. In addition to the natural and environmental effects, skin is also affected by both intrinsic and extrinsic human factors. Intrinsic factors can include altered nutritional status, vascular disease issues, and diabetes. Extrinsic factors include falls, accidents, pressure, immobility, and surgical procedures. These factors can impact the integrity of the skin, resulting in physical changes and possibly wounds and cancer. Ongoing assessment and management of these factors will optimise skin health.

Change	Consequence
Epidermal turnover slows	Thinner skin more prone to damage
Less effective barrier function	More prone to dryness and infection
Less flexible (weaker collagen)	More prone to wrinkling and shear forces
Less melanin content	More prone to sun damage
Less sebum production	Increased dryness
Fewer sweat glands	Less effective temperature control

These changes can render the skin vulnerable to infection or wounding resulting from trauma, such as a knock or bump, or from sustained unrelieved pressure over bony prominences, shear and friction. Illness, where high temperatures (fevers) and consequent moisture (diaphoresis) can also add to the vulnerability of aging skin, as can incontinence. Therefore, it is vitally important to know the condition of a patient's skin and to monitor for changes regularly.

Skin Changes That Can Occur with Compromise of Skin Integrity

Skin tears are an increasing problem for the elderly. If appropriate treatment is not provided, these injuries may become chronic wounds, causing unnecessary pain and suffering.

For the elderly one of the biggest complications arising from loss of skin health is the greater risk of **pressure injuries**. Most are preventable, and appropriate clinical care can help to prevent their occurrence.

Moisture lesions are often associated with increased age and decreased mobility and the presence of incontinence. Once urine and faeces encounter the skin, its bacterial content can penetrate the skin, potentially leading to infection.

The elderly has generally had a lifetime of exposure to sun resulting in **photodamage**. Such damage makes them more at risk of developing benign or malignant skin cancer.

Moisturizing the skin is the cornerstone to maintain skin integrity in the elderly. This is best achieved using complete emollient therapy. The objective of this approach is to restore the skin barrier function and reduce the likelihood of further damage. Basic skin care strategies including low-irritating cleansers and humectant-containing barrier products are helpful for treating dry skin and improving the skin barrier in the elderly.

Skin integrity assessment is an essential part of nursing care and should be conducted on admission and at least daily depending on the individual's circumstances. For example, The American Diabetes Association states that all individuals with diabetes should receive an annual foot examination to identify high-risk foot conditions that may lead to amputation or foot ulcerations. In addition to performing a thorough medical and foot history, the diabetic foot examination should include an assessment of skin integrity, vascular status, protective sensation, foot structure, and biomechanics. Assessment of skin integrity is not a simple look and see as it involves the assessment of many intrinsic and extrinsic factors to fully understand the compromise to integrity in any one individual.

In addition to the skin integrity assessment, maintaining skin integrity requires a holistic and interdisciplinary approach, and this can include seeing into or under the skin itself.

Multispectral Imaging and its potential in skin health

One innovative diagnostic tool evolving which could be very useful to assess the skin health and the complications of losing skin integrity is multispectral imaging (MSI). Multispectral imaging can determine levels of two major optical signals in biological tissue, these are oxyhemoglobin and deoxyhemoglobin. The signals provide a measure of local oxygenation, providing an assessment of the microcirculatory response to revascularization.

> “MIMOSA is a modern day TRICORDER”
>
> **David Armstrong**
> Prof Surgery, Keck School of Medicine, USC, California, USA

As an emerging imaging modality MSI offers great potential for non-invasive disease diagnosis and guidance when treating patients with compromised skin integrity. Currently, there are several more standard methods for evaluating perfusion of and assessing the health status of skin. These include more visual examination but can include the ankle-brachial index (ABI), Doppler ultrasound, transcutaneous oxygen partial pressure, and segmental limb pressures depending on underlying comorbidities. Each however have limitations and are not necessarily appropriate for all patients. Early detection of skin health status permits clinicians to be more proactive in preventing medical complications arising from compromised skin integrity.

Multispectral imaging can have a major impact in the management of several clinical conditions, by providing insight regarding tissue perfusion. It has been clinically evaluated in the screening of patients who are at risk of developing diabetic-foot ulcerations, tissue breakdown and potential limb loss. MSI also has a role in the prediction of skin breakdown, with a high level of sensitivity and specificity prior to any external visible signs (e.g. wound). This is especially important for those with compromised skin integrity as they are at risk of pressure injury. With multispectral imaging, the perfusion status of any tissue can be seen, which increases the possibility of taking preventative measures before injuries arise. Such assessment technologies allow us to establish a new standard of care in preventative medicine in the area of skin health. MSI makes the invisible, visible.

There is a growing number of MSI devices on the market and many are being further evaluated for their role in tissue perfusion analysis for a variety of clinical situations and conditions. MSI is practical with results being obtained in seconds without direct skin contact, allowing clinicians to obtain results rapidly and independently of care setting. Other more routine assessment technologies require, extended assessment times, skin contact and often an expert practitioner to operate the device. This can be a real game changer in the management of this patient group.

Perfusion is only part of the story; multispectral imaging combines spectroscopy with imaging and provides biochemical and physiologic information of imaged tissues. These include oxygenation, hemoglobin distribution, and water content. This technology enables non-contact, non-invasive real-time tissue microcirculation analysis, making it a rapidly developing imaging modality for in the area of skin health assessment and wound management.

MIMOSA Pro and its potential in Skin Health in Diabetic Patients

MIMOSA Pro is a handheld device that uses near-infrared light to accurately and non-invasively assess tissue health. It can be easily used by a patient or a caregiver, and the images produced will help inform the next steps within patient navigation and management (e.g. you need to see a podiatrist, or a vascular surgeon to help with the blood flow, or you may need more urgent treatment to prevent severe complications like limb loss). One significant area where skin health assessment can have significant clinical impact is in the management of patient with diabetes.

Today, monitoring your diabetes generally takes about three hours a day. Add in inspecting your feet especially if you have difficulty with your sight, or mobility issues, and a loss of feeling, management of this disease can feel overwhelming. This burden and sometimes lack of knowledge can mean that problems become advanced without caregiver or patient knowledge. Family caregivers can help, but they don't always know what they're looking for, and getting to a healthcare provider just may not be possible, especially in rural communities, who patients are two to three times more likely to lose a leg.

Between 15 and 25 percent of people with diabetes will have a foot ulcer at some point. These ulcers often become infected and as a result, diabetics are 23 times more likely than the general population to have a lower limb amputation. Of those who have an amputation, 30 percent die within one year. After five years, the mortality rate jumps to 70 percent. With more accurate monitoring and early diagnosis, patients are getting better treatment, and as a result the amputation rates can be reduced dramatically. Not only can this approach save limbs, but rather lives.

MIMOSA Pro detects tissue oximetry and temperature in tissue by imaging the skin with near infra-red and infra-red light, just beyond the range of human vision. MIMOSA Pro makes the invisible, visible.

This range of light is just above the visible region, so it's safe, but also has deep penetration into the skin. It can see things that humans can't, so it can detect whether the skin is perfused, if it has an adequate oxygen supply, if it's viable, and measure important physiological parameters within the assessment region.

MIMOSA Pro and its potential in Skin Health Assessment

The technology MIMOSA used to monitor wounds isn't entirely new – it was originally developed as an early detector and triage tool for determining burn depth. But what has changed with the invention of MIMOSA Pro is the size – perhaps the most important part for both clinicians and patients. As a result of the increased computing power provided by cell phones, the technology could be miniaturized. So MSI has now evolved from being ten to twelve feet tall to being a small clip-on device for a smartphone.

The novel thing about the MIMOSA Pro and the platform is its capacity to relay images into a web portal for remote viewing. It is a HIPAA compliant & secure cloud-based platform that enables communication amongst clinicians and tracking patient's physiology over time. The mission of the company is to break down barriers in access to care by first removing geographic boundaries. Patients with Vascular disease who live outside an urban area are 2-3 x more likely to lose their leg based on where they live. Access to appropriate care is a fundamental human right.

MIMOSA Pro can help break down these barriers to care by remote monitoring of important parameters that can help clinicians make decisions in real time, communicate with each other and most importantly provide care in a timely manner. At MIMOSA, we are bringing hospital grade medical technology to the patient. MIMOSA Pro will make a huge impact as we move forward in a new normal.

Key Resources Used

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Additional Resources

Wounds Canada: Foundations of Best Practice for Skin and Wound Management [LINK]

International Skin Tear Advisory Panel: [LINK]

National Pressure Injury Advisory Panel: [LINK]

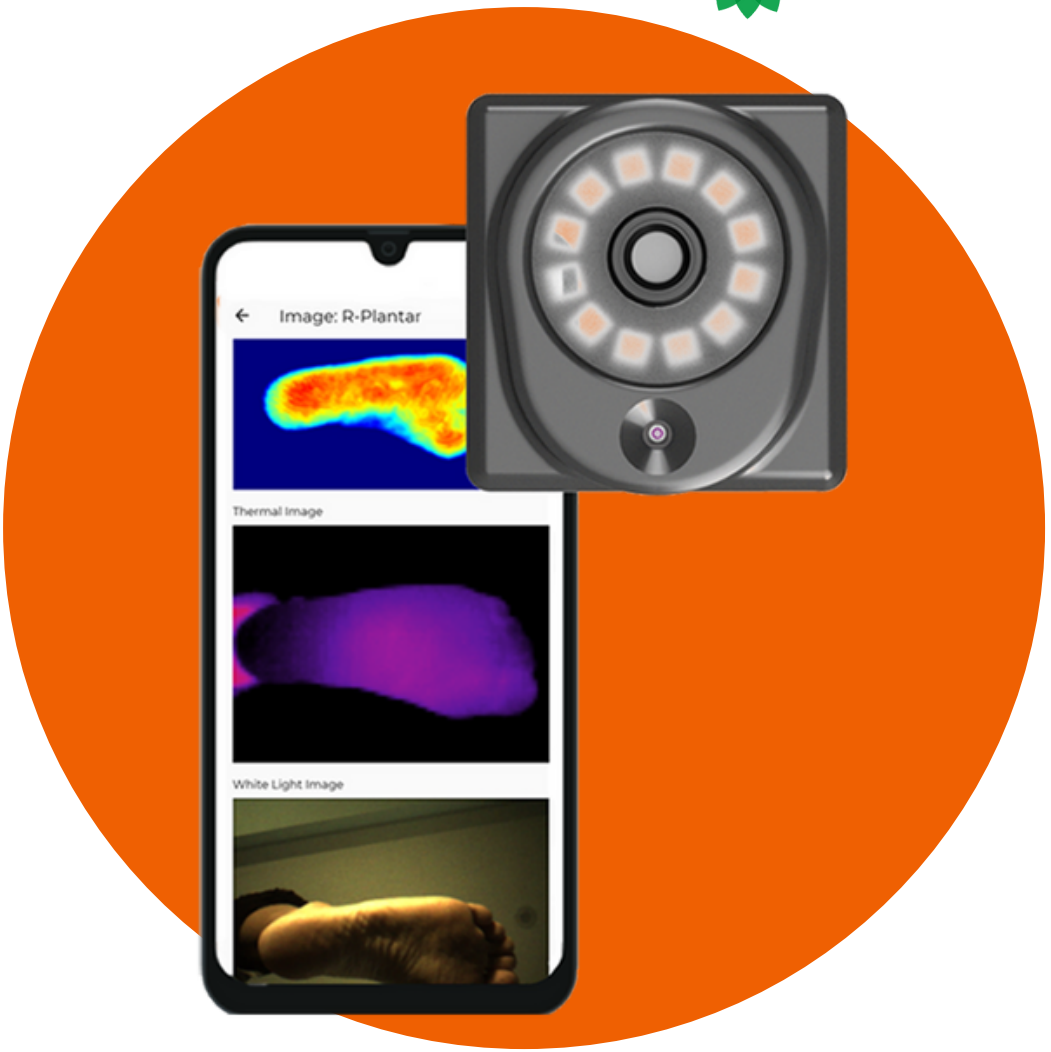
Canadian Pressure Injury Advisory Panel: [LINK]

American Skin Association: [LINK]

Skin Cancer Foundation: [LINK]

Skin Health Program: [LINK]

Ostomy Skin Care: [LINK]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MIMOSA DIAGNOSTICS
MAKING THE INVISIBLE VISIBLE