WINTER 2024
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Wound Care CANADA

THE OFFICIAL PUBLICATION OF WOUNDS CANADA

Using AI-Driven Predictive Models In Wound Care

A Step-by-Step Guide To Packing Hard-to-Heal Wounds

Foot Care Matters: A Cautionary Tale

Aesthetic Procedures And Long-term Wound Management: Enhancing Quality-Of-Life

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Wound Care Canada is published by Wounds Canada. Canada's first publication devoted entirely to wound care, *Wound Care Canada* addresses the needs of clinicians, patients, care partners and industry.

Wounds Canada (www.woundscanada.ca) is a non-profit organization of health-care professionals, industry participants, patients and care partners dedicated to the advancement of wound prevention and care in Canada.

Wounds Canada was formed in 1995 as the Canadian Association of Wound Care. The association's efforts are focused on four key areas: education, research, advocacy and awareness, and partnerships.

News In Wound Care

Resources

National Hybrid Conference: A Wound Care Networking and Educational Experience

Wounds Canada hosted its national hybrid conference at RBC Place in London, Ontario, October 17–19, 2024, with over 400 people in attendance and over 1000 people joining virtually.

The conference theme, *Canada's Wound Care Landscape: Prevention, Healing and Excellence*, offered attendees a diverse selection of wound care topics and workshops to hone their wound care skills.

The three-day conference featured 35 academic sessions, eight sponsored sessions, three workshops and over 40 research posters. Attendees enjoyed meeting with industry representative in the Exhibit Hall to learn about new products, listen to the research findings at the Poster Café and connect with policy facilitators to hear about policy implementation from across Canada at the Policy Café.

The first day of the event included the scholarship presentations celebrating the recipients of these beneficial wound care awards. Congratulations to our winners!

Skin Health Advocate Resource Professional (SHARP) Scholarship Awards

1. **Chu Lin** MD CCFP, Edmonton, Alberta. Scholarship funding donated in memory of Bob Wilson.
2. **Julianne Tower** RN BScN, Ardrossan, Alberta. Scholarship funding in memory of Matt Anderson.

Best Practice Approach to Skin Health and Wound Management: (A100MNN) Knowledge Scholarship

Abigail Andoh RN, Ottawa, Ontario.

Unregulated Care Providers Scholarship

Monica Louisor, Scarborough, Ontario.

The ceremony for the first graduating class of the Wound Care Champion Program in Ontario was also held at the conference with a special tribute by Karima Velji, the Assistant Deputy Minister of Health of Ontario.

Plans are already underway for the next Wounds Canada National Hybrid Conference celebrating our 30th anniversary. Have your say and complete the needs assessment to offer your input in shaping the next conference agenda.
Click here: 2025 Wounds Canada Needs Assessment
We appreciate your input!

Policy Cafés Explore Regional Health Policies

The inaugural Policy Cafés were held during the 2024 Wounds Canada National Hybrid Conference, featuring a series of interactive and casual events that included representatives from various provinces who shared crucial information and participated in useful a dialogue with attendees.

Led by Jane McSwiggan, MSc OT Reg MB IIWCC, the informal sessions had objectives which included: sharing success stories related to advocacy at the organizational and regional level to advance enhanced wound prevention

and care; identifying barriers to implementing policies supporting skin health and wound management; engaging in dialogue to determine best ways to spread successes in wound prevention and management across jurisdictions; brainstorming actionable solutions to overcome gaps in wound care policy across jurisdiction and inspiring a network of advocates committed to promoting policy changes in wound care.

Based on positive post-event feedback the objectives were met.

Four round table sessions were held, led by wound care professionals from each region:

- *British Columbia*: Rosemary Hill
- and Dr. John Hwang
- *Ontario:* Allison Luther
- *Alberta:* Charlene Brosinsky
- *Quebec:* Chantal Lebrecque and Joumana Fawaz.

Each café delivered research data and first-hand accounts of their success stories in issues such as: involving offloading (issues with device equity and distribution, roles, building it into curriculums), turning provincial data requests into reciprocal relationships, clinical care topics as documents of change, and how RMAQ requirements relate to prescribing and reimbursements related to wound care.

Look to the summer issue of *Wound Care Canada* for further details about these Policy Cafés sessions and the insights heard by attendees.

Diabetic Foot Ulcer Roundtable Held At 2024 National Conference

Wounds Canada, in partnership with Memorial University and the Limb Preservation Alliance, hosted the Canadian DFU Policy Roundtable: Moving Recommendations at the 2024 Wounds Canada National Hybrid Conference.

The burden of diabetic foot complications is alarmingly high in Canada. For individuals with diabetes, these devastating foot complications can lead to illness, lower quality of life, amputation, disability and death. A factor contributing to this burden is limited health-care policies that effectively address the prevention and treatment of these complications.

Led by Dr. Zulfiqarali Abbas of D-Foot International and Dr. Kathleen Stevens of Memorial University, this roundtable captured information crucial to efforts to end unnecessary amputations related to diabetes worldwide. This information will provide help to guide immediate recommendations for action steps for policymakers.

Wounds Canada Partnerships

Wounds Canada Teams With CIHI To Address Inequities In Prevention Of Diabetes Related Leg Amputations

An initiative involving Wounds Canada and the Canadian Institute for Health Information (CIHI) is aimed at revealing inequities in care with the goal of preventing diabetes-related leg amputations.

To urgently assist in providing equitable care, Wounds Canada CEO Mariam Botros, DCh DE IIWCC MEd, and Irmajean Bajnok, RN BScN MScN PhD, Wounds Canada Education and Policy Director, have partnered with CIHI researchers on the recently published report *Equity in diabetes care: A focus on lower limb amputation*.

Equity of preventative care is an issue across Canada. Because lower-limb amputations are largely preventable, timely access to care is essential.

The CIHI report was prompted by the 2021 National Framework for Diabetes Act, which called for expanded data collection and reporting on diabetes-related indicators with a focus on health inequities. Wounds Canada speaks for Canadians health-care providers and patients and their care partners to promote prevention and to ensure that all Canadians have the same, and timely, access to

best-practice-based care.

Key findings from the report include:

- From 2020–2021 to 2022–2023, there were more than 3,000 leg amputations and more than 4,500 ankle, foot or toe amputations associated with diabetes annually.
- Patients who received a leg amputation spent a lengthy 19 days in hospital, at an average cost of $47,000 per stay.
- Lower limb amputations related to diabetes disproportionately impact men, those living in neighbourhoods with lower income, lower education and higher social isolation and those living in rural and remote areas.

This report will help focus policy makers and health-care providers on early prevention and effective interventions and provide individuals with diabetes and their families with necessary resources and support programs. Wounds Canada will use these data to advocate across the country for more equitable care for all Canadians.

Wounds Canada Prioritizes The 'Voices Of Patients' By Partnering With Lakehead University

Wounds Canada joined with Lakehead University in Thunder Bay ON to host a national exchange focused on patients experiences and their journies through wound care in Canada, as part of a long-term research project begun in 2022.

The project, called *Our Voices, Our Stories*, kicked off with a unique knowledge mobilization event where patients and patient advocates shared their stories of navigating Canada's health-care systems and social life challenges to access wound care services. Event participants, including health-care providers and researchers, used the shared stories, reflections and dialogue to highlight several key areas of focus, including advocacy, change, collaboration, wound specialists, barriers, cultural safety and accessibility.

Visit: https://www.woundscanada.ca/patient-or-caregiver/patient-stories.

Wounds Canada and the Registered Nurses' Association of Ontario (RNAO) Develop And Deliver Wound Care Champion Program

Through the Wound Care Champion program, which has been funded by the Ontario Ministry of Health, Wounds Canada and clinicians are helping to improve skin health.

Education and training are critical components in closing the wound care knowledge and practice gaps across health systems. The Wound Care Champion Program is creating a critical mass of clinicians ready to lead sustained evidence-based skin and wound management practices and policies in their organizations.

For more information on the Wound Care Champion Program, visit: https://www.woundscanada.ca/programs/wound-care-champion-program-wccp

Publications

Updated Best Practice Recommendations For Skin Health and Wound Management 2025 To Launch in New Year

Best Practice Recommendations for Skin Health and Wound Management 2025 is an invaluable resource available to the public that contains new information that makes it even more useful in a wide variety of scenarios. This essential resource will be available digitally on the Wound Canada website in early 2025.

These updated recommendations: provide guidance on how to implement the recommendations into practice; provide an overview of the structures and physiology of skin and the process of skin healing;

provide general recommendations for all wound types; provide information for specific wound types and factors that may affect wound healing; and use the Wound Prevention and Management Cycle to guide frontline clinicians and health decision makers through a step-by-step process that addresses the assessments, interventions and outcomes.

On publication, the new *Best Practice Recommendations* (BPRs) will be accessible at www.woundscanada.ca

Social Media, Awareness Campaigns, Public Relations

Wounds Canada believes in taking every opportunity to inform our followers and the general public about our crucial mission: raising awareness on the many approaches to effectively tackle wound care. In the past few months, we ran several initiatives:

- A pressure injuries prevention campaign was executed throughout the month of November leading up to Worldwide Stop Pressure Injury Day, November 21, 2024.
- The CN tower in Toronto was lit up with our colours (red and white) on November 21, 2024, to highlight Stop Pressure Injury Day and Wounds Canada.
- Board member Linda Moss, Wounds Canada CEO Mariam Botros and Wounds Canada Director of Education and Policy Irmajean Bajnok were on the TV program *Savvy Seniors*, where they talked about pressure injuries.
- We posted messages on our multiple platforms on November 14, 2024 - World Diabetes Day.
- A number of media releases were sent out to showcase the key events at conference.

- A crucial article in Innovation News was published in November, highlighting our continued efforts.

Editorial deadline for Summer 2025 issue: March 15.

DO YOU HAVE A CASE REPORT, WOUND SLEUTH OR OTHER STORY THAT MIGHT BE OF INTEREST TO OUR READERS?

If so, we'd love to share it with the wound care community.

Please send expressions of interest or inquiries to ian.corks@woundscanada.ca

NEWS FROM OUR INDUSTRY PARTNERS

Arjo Canada

At Arjo, we believe that empowering movement within health-care environments is essential to quality care. Our products and solutions are designed to promote a safe and dignified experience through patient handling, medical beds, personal hygiene, disinfection, diagnostics and the prevention of pressure injuries and venous thromboembolism.

We understand that your health-care organization is dynamic, constantly evolving and responding to its surrounding environment. Patients and patient needs fluctuate as seasons change, making your flexibility in answering challenges even more important. Predicting when you will need more sophisticated systems and which patients will need them isn't easy. Arjo rental solutions are customizable to fit the demands of your health-care environment, now offering a range of products and solutions that includes therapeutic support surfaces, bariatric room solutions, ICU early mobility, dementia care, safe patient handling and specialized seating.

Learn more about our rental solutions here: https://ca.arjo.com/l/918753/2024-10-03/xgm62

Aroa Biosurgery Ltd.

AROA™ is a New Zealand based soft-tissue regeneration company. Our AROA ECM™ technology has been used in over 6 million applications globally. The mission of AROA is to 'unlock regenerative healing for everybody' by developing advanced regenerative medicine technologies for patients suffering from acute and chronic wounds.

Endoform™ Natural Restorative Bioscaffold is a unique extracellular matrix (ECM) for the treatment of acute and chronic wounds. Endoform™ supports all phases of wound healing and is appropriate for use from day one to restore protease balance and advance healing to the proliferative phase.

Endoform™ Antimicrobial Restorative Bioscaffold contains 0.3% ionic silver, appropriate for use in wound treatment where there is an elevated risk of infection.

Endoform™ is fully integrated into the body's own tissue and is perfectly suitable for use with Negative Pressure Wounds Therapy (NPWT) to expedite wound healing.

Link: https://aroa.com/about-aroa/

Biocomposites

At Biocomposites, we are distinct in that our team of specialists is singularly focused on the development of innovative calcium compounds for surgical use. Our innovative products are at the forefront of calcium technology and range from bone grafts to matrices that can be used in the presence of infection. We are proud to be driving improved outcomes across a wide range of clinical applications, in musculoskeletal infection, trauma, spine and sports injuries, for surgeons and patients alike.

Link: https://biocomposites.com/us/

Biomiq Inc.

Biomiq is a Canadian owned and operated company offering a comprehensive suite of advanced solutions to health-care professionals designed to meet the toughest wound care challenges and

maximize patient care.

At Biomiq, we're redefining what's possible in wound care. Our line of PureCleanse™ wound cleansers harnesses pure, stable hypochlorous acid (HOCl) to deliver safe, effective wound cleansing that preserves healthy tissue and accelerates healing. With innovative, proprietary delivery systems tailored for a variety of clinical settings, PureCleanse™ is built to empower physicians and clinicians with the tools they need for better patient outcomes.

But we don't stop there. Biomiq also offers JetOx™ technology for jet lavage wound therapy and Suturegard HEMIGARD© ASRD for surgical wound management, reducing wound dehiscence.

Products available through national GPO contracts, via Biomiq or your preferred Canadian distribution partner. Visit www.Biomiq.health/WoundCare to learn more.

Link: www.Biomiq.health/WoundCare

Classic Health

Classic Health, a second-generation, family-owned company, has been dedicated to providing top-quality medical supplies for over 30 years. Founded by Murray Ellis, Classic Health has grown under the leadership of his children, Denise and Graham Ellis, who continue to honour their father's commitment to exceptional health-care solutions.

Our flagship product, Classic Pads, was specifically designed to address the needs of the wound care market. With an emphasis on superior absorption, durability, and comfort, these secondary absorbent pads provide patients with reliable and effective care during the healing process. Classic Pads have been trusted by health-care professionals for their quality and performance, supporting wound healing while maintaining patient comfort.

As we continue to innovate and expand our product lines, Classic Health remains focused on improving health-care outcomes through advanced wound care solutions. Our goal is to provide medical professionals with the tools they need to deliver the best possible care to their patients, while also ensuring affordability and accessibility.

Visit www.classichealth.com to learn more about our products, including Classic Pads, and how we can help you enhance your wound care treatments.

Link: www.classichealth.com

Coloplast

We work to make life easier for people with wound and skin care needs – and for the health-care professionals who treat them. For more than 40 years, we've been solving wound and skin care challenges. Our wound care products support all stages of the healing process and offer advanced capabilities in managing exudate. Our business includes Ostomy Care, Continence Care, Wound and Skin Care, Interventional Urology and Voice and Respiratory Care.

Link: Biatain Silicone: Foam Dressings for the treatment of wounds (coloplast.ca)

Convatec

Convatec is a global medical products and technologies company, focused on solutions for the management of chronic conditions, with leading positions in advanced wound care, ostomy care, continence and critical care, and infusion care. With around 10,000 colleagues, we provide our products and services in over 100 countries, united by a promise to be forever caring. Our products provide a range of benefits, from infection prevention and protection of at-risk skin, to improved patient outcomes and reduced care

costs. https://www.convatec.ca/

Convatec est une entreprise mondiale de produits et de technologies, chef de file dans le marché des soins pour stomie, des traitements des plaies, de l'incontinence et des soins aigus ainsi que des dispositifs de perfusion. Les produits de Convatec apportent un éventail d'avantages et de bienfaits cliniques et économiques, y compris une protection contre les infections et pour la peau à risque, une amélioration des résultats cliniques et une réduction de l'ensemble des coûts associés aux soins. https://www.fr.convatec.ca/

Link: English: https://www.convatec.ca/ French: https://www.fr.convatec.ca/

Essity

Essity is a leading global hygiene and health company dedicated to improving well-being through innovative and sustainable products, shaping a healthier future for all. We provide high-quality wound and incontinence care, orthopedic and compression products. Our innovative and cost-effective solutions, coupled with our expertise, cutting edge technology, and global coverage, allow for better patient care outcomes. Additionally, our customers and partners value our support through training and educational programs. Essity sells in approximately 150 countries under leading global brands Cutimed®, Hydrofera Blue®, Leukoplast®, JOBST®, Delta-Cast®, Actimove® and TENA®.

Link: https://medical.essity.ca/home.html

Gentell

Gentell is the largest vertically-integrated wound care company in the world. We provide efficient, affordable, patient-specific wound treatments to patients in nursing homes, hospices, hospitals and other settings. We employ clinical specialists throughout the United States and Canada to assist with treatment recommendations and provide education about the proper utilization of wound care products. With production facilities in the United States, Canada and China, we are one of North America's largest manufacturers of wound care supplies.

Link: www.gentell.com

Integra Lifesciences

Integra LifeSciences, a global leader in medical technology, is dedicated to limiting uncertainty for clinicians so they can concentrate on providing the best patient care. Integra offers innovative solutions in advanced wound care, regenerative technologies, neurosurgery and surgical instruments, saving and sustaining lives around the world.

For 35 years, Integra has made an impact in multiple disciplines spanning regenerative tissue technologies such as IDRT, to treatments and care of brain tumors, hydrocephalus, and other neurological conditions. And this legacy of improving the most intricate medical procedures lives on today.

Integra is focused on research and innovation for the management of acute and chronic wounds and burns. We provide a comprehensive suite of evidence-based products designed to support the patients' natural restorative healing process and the clinicians' goals of healing wounds efficiently and effectively at every stage of the wound healing process. We strive to provide quality solutions to achieve the highest level of customer satisfaction.

Integra's Advanced Wound Care portfolio includes **MediHoney** ® Antibacterial Dressings , the global leading medical-grade honey-based product for the management of acute and chronic

wounds and burns and **TCC-EZ** ® Total Contact Cast System, a prefabricated and easy-to-use system designed to provide a protective wound healing environment for diabetic foot ulcers that supports patient offloading compliance.

Integra also offers a line of disposable scalpels and curettes for wound debridement under the **Miltex**® brand – a name synonymous with quality instruments.

To learn more about Integra's Advanced Wound Care Solutions, visit us at www.integralife.com or email us at IntegraCanada RSVP.

Link: https://products.integralife.com/out-patient-clinic-private-office/category/wound-reconstruction-care-outpatient-clinic-private-office

Kane Biotech Inc.

Kane Biotech Kane Biotech (TSXV: KNE) is a Canadian publicly traded home-grown Manitoba company leading the advancement of technologies and products that break up biofilms and destroy bacteria, mainly focused on chronic wound care, such as diabetic foot ulcers, burns, venous and pressure ulcers.

Biofilm impaired healing is the largest unresolved problem in chronic non-healing wounds. As a well-established R&D company, based in the Smartpark Innovation Hub at the University of Manitoba, we are proudly setting new standard in biofilm treatment with our patented Coactiv+™. With our disruptive innovative technology, we are THE biofilm company who thrive efficacity, ease of use and accessibility for our products.

Kane has two leading products: revyve™ Antimicrobial Wound Gel which is now commercialized. It is US FDA 510(k) cleared and reimbursed under Medicare and Medicaid, for which we are starting to receive revenue globally. Kane has distribution partners in the United States, Columbia, Panama, Costa Rica, Qatar and United Arab Emirates with new agreements currently being drafted for South Africa, Australia, Malaysia, and Kuwait.

DispersinB ® Wound Gel is to begin the first of two clinical trials. The development of this product is currently being funded by the US Department of Defense (US DoD).

Kane has recently obtained ISO13485:2016/MDSAP (Medical Device Single Audit Program) certification, required by Health Canada's regulatory process and we anticipate approval of revyve™ Antimicrobial Wound Gel in Canada in the near future.

Link: https://kanebiotech.com/

L&R Canada

L&R (Lohmann & Rauscher) is a leading international developer, manufacturer, and distributor of medical devices and health-care solutions of the highest quality. We have a broad portfolio of more than 60,000 products and services in the area of wound management and compression therapy, including trusted brands like Debrisoft®, Vliwasorb®, ReadyWrap®, TributeNight™ and others.

Debrisoft® is a patented wound cleansing technology which rapidly lifts, binds and removes 90-99% of slough, biofilm and bacterial load with visible results in just 2-4 minutes, all while being virtually painless for the patient.

ReadyWrap® is an adjustable gradient compression wrap whose low-stretch straps deliver effective compression therapy with high working and low resting pressure. ReadyWrap offers a unique colour-coded visual guide for application and alternating strapping system to support one-handed donning as needed.

We are passionate about supporting people and their health care — they have been the heart of everything we do for more than 170 years.

Link: www.lohmann-rauscher.ca

Leika Medical Equipment

With 35 years of experience, Leika Medical Equipment is committed to supporting health-care professionals by providing reliable, high-quality products. Our dedication to being by your side is reflected in the trust we establish with every member of the health-care community, from doctors to occupational, nurses and NSWOCs.

We take pride in being a reference in the field of wound care, consistently offering top-tier solutions that adhere to best practices in patient care.

Leika stands out due to its unwavering commitment to customer service, offering comprehensive guarantees ensuring peace of mind. Our diverse range of products includes advanced technologies such as Negative Pressure Wound Therapy (NPWT), with different pumps options designed to facilitate healing efficiency.

Additionally, Nanogen Aktigel and Aktiv offers advanced healing agents in gel form and as a membrane for quick absorption into the wound, accelerating the healing process. Silgen AG Spray, an innovative and cost-effective method of delivering silver into all wound types, further complements our range.

We also specialize in preventive and curative therapeutic surfaces that promote patient comfort while reducing the risk of pressure injuries. Our specialized technology for curative therapeutic surfaces ensures durability and optimal performance, making our products an essential component in wound care management, whether in hospital or home settings.

At Leika, we remain true to our core values of excellence and customer focus, continually innovating and setting the standard for wound care solutions across Canada.

Link: https://leika.ca/en/

MedQuest Medical

Founded in 2007, MedQuest Medical is a Canadian family owned specialty medical device distribution company. MedQuest partners with leading global brands to provide innovative products and cost-effective patient care solutions to the Canadian market for our customers and their patients. MedQuest is proud to exclusively partner with DeRoyal Industries, to represent DeRoyal's complete Wound Care portfolio in Canada. DeRoyal offers a comprehensive range of solutions including burns and general wound care, advanced dressings, and negative pressure wound therapy systems. DeRoyal's Multidex® wound dressings are a sterile maltodextrin composition with 1% ascorbic acid that supports an optimal wound healing environment across a variety of wound types. Algidex Ag+ ® wound dressings feature a unique combination of silver, alginate and maltodextrin designed to support an optimal moist wound environment.
To learn more about DeRoyal's complete Wound Care Solutions visit us at: www.deroyal.com

Link: www.medquestmedical.com / www.deroyal.com

MedTech Solutions Group (Argentum Medical)

Argentum Medical is a leading provider of proprietary products focused on infection prevention and advanced wound care solutions. Argentum's products are used in a wide variety of applications including surgical wounds, burn care, wound care, negative wound pressure therapy, dressings for IVs and catheters and antimicrobial skin and wound cleansers.

Silverlon® Dressings use a proprietary silver-plating technology which results in every strand of the dressing being plated with pure silver. Containing up to 50 to 100 times the silver ion content of silver impregnated dressings, Silverlon® has been recognized by

numerous peer-reviewed and independent researchers as the leading antimicrobial wound care dressing. Silverlon® produces a broad-spectrum antimicrobial effect that rapidly kills microorganisms, eradicating MRSA in as little as 4 hours in the dressing and keeps working for up to 7 days, without the side-effects of other products including microbial resistance, staining, stinging, and prolonging the inflammatory response.

Anasept® Antimicrobial Wound Cleanser, Gel and Irrigation Solution help in the mechanical removal of debris, while delivering a broad-spectrum antimicrobial to the wound site to inhibit bacterial growth. Anasept formulation is proprietary in both its combination of components and how it is manufactured, resulting in an isotonic formulation whose components synergistically work together to provide multiple mechanisms to kill, eradicate pathogens, and ensure pathogens are unable to reseed or continue to proliferate after the initial kill.

Men's Liberty Acute™, CathGrip® and FreeDerm® are proprietary solutions for urinary management, securement, infection control and skin protection.

Link: https://www.bravidamedical.com/

MIMOSA Diagnostics

MIMOSA Diagnostics Inc. is a leading provider of intuitive, equitable and accessible health-care technology. Their flagship all-in-one wound imaging solution, the MIMOSA Pro, streamlines point-of-care tissue health assessments by capturing four key insights at the point-of-care: wound measurement, tissue oxygenation, thermal, and digital images. With a processing time of less than 1 second, the images captured are automatically uploaded to the accompanying HIPAA-compliant web portal where clinicians can monitor patient progress, make timely clinical decisions, validate the efficacy of chosen treatment modalities and collaborate towards improved patient outcomes.

Link: www.mimosadiagnostics.com

NanoTess

NanoTess is creating new frontiers of opportunity within health care through catalytic innovation, beginning with skin and wound healing. With a vision to end the silent pandemic of complex wounds and improve skin health, NanoTess is on a mission to provide leading edge technology to improve patient outcomes, address the needs of both patients and health-care providers and reduce health-care costs. Their flagship technology, NanoSALV Catalytic, revealed excellent results across a diverse, real-world patient population, showcasing that this technology improved wound healing by 57.6%, reduced wound care costs by ~46%, and improved mental health and quality of life for patients and their families in comparison to currently available best-in-class technologies. To date, NanoSALV Catalytic has helped thousands of Canadians heal.

Link: www.nanotess.com

Quart Medical Inc.

EdemaWear - A novel approach to compression [Quart Medical]

Compression is a recognized cornerstone of management of the venous system, after vascular assessment for healability. EdemaWear is a novel approach that delivers compression under a series of longitudinal ridges running parallel to the limb. In contrast to conventional circumferential compression, longitudinal compression doesn't cause a tourniquet effect that could interfere with limb circulation and lymphatic drainage.

Michael Quart was introduced to EdemaWear by Dr. Gary Sibbald. Both were among the early

architects of what later become Wounds Canada. Quart Medical acts as the exclusive importer for EdemaWear. You can listen to the recent webinar by Dr. Sibbald and Pat Coutts discussing low compression vascular assessment and a peer reviewed study on EdemaWear in Advances in Skin and Wound Care. **Watch the low compression webinar with** Dr. Sibbald & Pat Coutts https://youtu.be/CjXOLhPxlvo

Indications include:

- Edema from venous hypertension
- Post-op edema
- Lymphedema
- Venous leg ulcers
- Skin tears
- Wherever safer, more comfortable and acceptable compression is required.

Traditional circumferential compression can be hot and uncomfortable for the patient, which may compromise adherence to low compression. EdemaWear provides a cool novel approach using longitudinal compression.

Choosing the correct stockinet size is the most important factor in determining the effectiveness and comfort of EdemaWear. Brochures, a sizing guide and clinical information can be found on the Quart Medical website.

Available through all major Canadian healthcare dealer/distributors and for patients through Payless Medical.

Link: https://quartmedical.com/wp-content/uploads/Evaluation_of_Longitudinal_and_Tubular_Compression-Sibbald-et-al-2020-ASWC-distributed-by-WoundPedia-with-permission.pdf

Sigvaris

Sigvaris Group has been committed to helping people feel their best, every day, for nearly 160 years. Our medical compression solutions offer effective and reliable support for vascular and lymphatic conditions.

We offer your patients a product portfolio crafted with the most advanced technology, quality materials and fashionable designs that cater to a wide range of different needs and indications.

Our premium medical compression socks and stockings are designed to ensure precise fit and accurate compression for people with diverse lifestyles.

Our ready-to-wear inelastic compression wraps support the active treatment and management of edemas with adjustable ranges of resting compression in an innovative design for superior fit and easy application.

Sigvaris Group is your ideal partner in patient care and wellness for vascular and lymphatic conditions.

Link: www.sigvaris.ca

Smith+Nephew

Smith+Nephew is a portfolio medical technology company focused on the repair, regeneration, and replacement of soft and hard tissue. We exist to restore people's bodies and their self-belief by using technology to take the limits off living.

Alongside our customers we will not settle until we have solved the challenges of preventing and healing wounds, because they hold back too many lives.

Link: www.smith-nephew.com

Westech Health Care Ltd.

Westech Health Care Ltd. is a Canadian company bringing you unique, high quality, innovative health-care products.

Through our core values of integrity, trust, honesty, knowledge and respect, Westech has created a strong presence in the Canadian health-care market.

With over 30 years of experience in the health-care industry, we are committed to evolving and adapting to Canada's health-care needs, and to providing quality support and service to health-care professionals to assist them in providing the best level of care.

We are very proud to represent high quality products such as Salts Healthcare – Ostomy products, HidraWear- wearable wound care and Seni Incontinence products.

Link: https://www.westechhealth.com/salts-ostomy-products

Depth Matters: A Step-by-Step Guide To Packing Hard-to-Heal Wounds

By Idevania G Costa RN NSWOC PhD, Robert Strachan HBASc HBSc and Maria Girlane SA Brandão RN PhD Student

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Wound healing is a dynamic and multi-phase physiological process, determined by various cellular, chemical, and hormonal mechanisms.[1,2] This process occurs through a complex interplay of growth factors, cytokines and chemokines, which restore the structure and function of the skin through regulated phases: hemostasis, inflammation, proliferation and maturation. These phases overlap and are influenced by systemic responses, such as the release of catecholamines and cortisol, which facilitate tissue perfusion and support the cellular activity necessary for healing.[1,2]

Generally, wound healing occurs through three mechanisms: 1) primary intention, where the wound edges are sutured or stapled together; 2) secondary intention, which involves the gradual filling of an open wound with granulation tissue; and 3) tertiary intention, where the wound edges are deliberately left open for delayed closure, allowing for infection control.[3,4]

In a deep wound, it is common to encounter edge detachment, tunnelling or undermining, complications that affect the continuity of the healing process and timely closure of the wound. Edge detachment (Figure 1) occurs when the margins of the wound are slightly separated from the underlying tissue creating a space that can hide fluids, bacteria, or necrotic tissue, which can delay healing and increase the risk of infection. Tunnelling, on the other hand, refers to the formation of holes beneath the skin (Figure 2), resulting from inflammatory or infectious processes, which delays the proper closure of the wound.[5] Undermining (Figure 3), in contrast, occurs when the tissue under the wound edges becomes eroded, causing a pocket of space underneath the skin's surface. [5, 6]

Figure 1
Wound with edges detachment.
Source: Personal archive - 3rd author

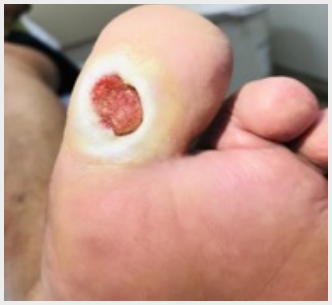


Figure 2
Wound with Tunnel.
Source: Personal archive - 1st author

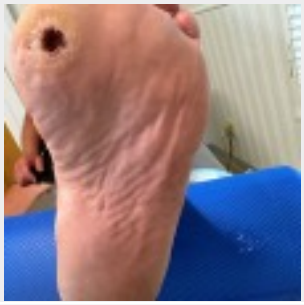
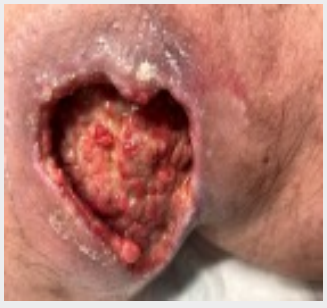


Figure 3
Wound with undermining.
Source: Personal archive - 1st author



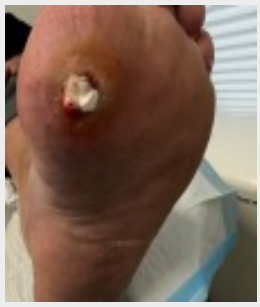
In clinical practice, it is observed that edge detachment, tunnelling or undermining significantly impact healing by delaying tissue repair and compromising treatment progress. A recent expert consensus highlights the importance of assessing not only the size of the wound but also the presence and extent of complications including tunnelling and undermining.[6] Additionally, another consensus on wound healing addresses the TIMERS tool (See box), where one of the key elements of assessment is the wound edge characteristics.[7] The authors report that epithelial advancement is highly unlikely to be accomplished if the wound edge is not properly managed, emphasizing the need to observe for detachment, tunnelling, or epibole.[7]

TIMERS (Tissue, Infection/Inflammation, Moisture, Edge of the wound, Regeneration, and Social factors) can help identify early signs of detachment.[17] TIMERS incorporates a holistic view of wounds healing, ensuring that clinicians address not only the physical aspects of the wound but also the social and emotional factors affecting patient outcomes, ensuring that wound packing and dressings are tailored to the evolving needs of the wound.[17]

Despite the relevance of these factors, they are not systematically evaluated by health-care providers (HCPs), particularly those without formal training in wound care. Anecdotally, documentation of edge detachment, tunnelling or undermining is consistently absent from patient charts, complicating effective monitoring of the healing process. Furthermore, inadequate packing techniques are sometimes employed, a gap that warrants further investigation. We hypothesize that this may stem from an insufficient understanding of the procedure's importance. Additionally, it is important to consider that deep wounds typically produce a significant amount of exudate due to damage to underlying tissues, which require robust and sufficient materials for packing appropriately (Figure 4). Therefore, HCPs must select packing materials that effectively manage moisture balance, especially in highly exudative

wounds. Initially, frequent dressing changes may be necessary, with intervals gradually extended as exudate levels decrease. This strategy is essential for optimizing healing and minimizing complications.

Figure 4
Wound filled/packed appropriatly.
Source: Personal archive - 1st author



It is crucial to address wound packing requirements, as inadequate filling of deep wounds increases the risk of complications and negatively impacts patients' quality of life. [8-10] Issues such as foul odour can cause embarrassment, social isolation and emotional distress for patients, directly reducing their overall well-being.[11] To help mitigate these impacts, the goal of wound packing is to gently fill dead spaces from the base of the wound to the surface, promoting tissue growth from the inside out. Literature supports that dressing material should fit snugly, but neither tightly nor loosely, allowing the dressing to optimally absorb exudate while promoting healing from the base upward.[3,4]

The need for a comprehensive packing guide is underscored by the shortage of HCPs trained in wound care, which has led to wound management being performed by generalist HCPs. Consequently, clear, step-by-step guidance is necessary to assist professionals, patients and care partners in addressing these critical aspects of wound care that are often overlooked. Thus, the objective of this work is to provide a step-by-step guide on wound packing technique and dressing selection in the management of deep, undermining and tunnelling wounds, with a focus on preventing complications such as infection, delayed healing and abscess formation.

Methods

We conducted a critical literature review across multiple databases, including PubMed, CINAHL, Medline and Scopus, from July 2024 to September 2024. Google Scholar was also used to capture additional articles that may not have been indexed in the primary databases. Our search focused on peer-reviewed literature published in English.

The following keywords were used: cavity wound packing, depth of wound packing, deep wound management, wound cavity dressing, packing in undermining wounds and dressing selection for deep wounds, to capture a comprehensive range of studies on wound care and packing techniques. To narrow the search, filters related to time (articles published between 2000 and 2024), wound complications, such as undermining and tunnelling, were applied, resulting in overlapping hits and further refinement of the literature pool.

Initially, broader terms such as wound packing, wound depth and cavity wounds were employed, retrieving 3,582, 4,029, and 1,312 results on PubMed, Google Scholar and CINAHL respectively. This indicated substantial research coverage on wound management, particularly on the clinical aspects of wound healing and the need for effective packing. However, using title and then abstract searches, this review was unable to locate peer-reviewed literature specifically addressing the topic of wound packing depth. Instead, it relied on related studies and employed an integrative approach, combining best practice guidelines with evidence from broader wound management research to fill the gap.

A Step-by-Step Guide For Implementation Of Appropriate Wound Packing Techniques

In this section, we present a step-by-step guide for the implementation of appropriate wound packing techniques. This guide includes crucial aspects such as wound assessment, dressing selection, the packing procedure and follow-up

documentation. Table 1 summarizes the entire process, serving as an easy-to-follow resource for professionals who are new to the field.

Table 1 A step-by-step guide for implementing appropriate wound packing

	Procedure	References
Supplies	Syringe (10-60 mL), needleless adaptor, sterile normal saline or prescribed fluid, sterile dressing tray, sterile forceps, sterile scissors, cotton-tipped applicators, sterile gloves, waterproof pad, outer sterile dressing, packing gauze or recommended packing material (see Table 2) and refuse bag, as per orders.	19-22
Preparation	Gather supplies. Greet the patient and explain the procedure. Position the patient comfortably, ensuring the wound is vertical for drainage. Use waterproof padding under the wound site to protect clothing and bedding.	20-22
Assessment & Cleansing	Remove old dressing with sterile forceps if surgical wound. Note that in contaminated wounds such as diabetic foot ulcer there is no need to use sterile materials as it can be safely done with a clean procedure. If packing sticks, moisten with saline to avoid trauma to the wound bed. Assess the wound using the clock method (12 o'clock at the patient's head, 6 o'clock at their feet). Measure the length, width, depth and check for undermining, tunnelling, or sinus tracts and the condition of the wound bed. Use the **TIMERS** framework (Tissue, Infection/Inflammation, Moisture balance, Edge of the wound, Regeneration and Social factors) to assess the wound healing environment and plan the next steps. Pay special attention to wound edge detachment or tunnelling. Cleanse the wound with saline irrigation or compresses (as prescribed).	5,17,20-22
Irrigation	If irrigation is prescribed, use a 35 mL syringe with prescribed fluid for irrigation, aiming for pressures between 4-14 psi. Irrigate until the return fluid is clear, ensuring no increase in patient discomfort. Proper irrigation helps to manage wound detachment and reduce bacterial load.	7,17,20-22

Packing the Wound	Moisten the packing gauze with the prescribed solution, ensuring it is **damp** but **not soaked**. If using **Foam Dressings**, **Specialized Foam Dressings, Impregnated Dressings** (silver, honey, or iodine), **Calcium Alginate, Gelling Fiber, or Hypertonic Gauze Ribbon**, gently place the dressing into the wound cavity, ensuring that it fills the dead space without being over-compressed. These dressings do not require moistening, as they are designed to absorb exudate and conform to the wound shape. Gently pack a wound using forceps or applicator, ensuring the dressing touches all surfaces of the wound. Avoid overpacking (which can restrict blood flow) and underpacking (which leaves dead spaces that can increase bacterial load and increase the risk of abscess). Ensure the packing supports the wound edge to prevent detachment and promote epithelialization.	7,17,20-22
Dressing Application	Apply a skin protectant to the peri-wound area to prevent maceration from exudate. Place a dry, sterile outer dressing over the packed wound (if surgical wound), ensuring it stays dry to prevent contamination. Ensure the dressing supports wound edges and helps prevent detachment.	6,7,20-22
Post-Procedure	Reposition the patient for comfort, ensuring the wound is secure and the dressing is dry. Discard used materials and perform hand hygiene.	6,20-22
General	If ethically applicable, and consent has been obtained, photograph the wound before and after packing. Document the wound assessment using the clock method to record the location and depth of tunnelling, undermining, or sinus tracts. Record the type of packing used, the dressing applied and the patient's response. Include the length of packing used for wounds with tunnelling or sinuses. Monitor and record the condition of wound edges, especially if there is any detachment, using TIMERS to assess healing progress.	7,17,20-22

Step 1: Wound Assessment

To assess depth, a traditional cotton-tipped applicator can be used for measurement. The cotton tip should be inserted into the wound until it reaches the deepest point.[2] The HCP then pinches the cotton-tipped applicator at the skin surface level and measures the inserted portion's length.[2] When assessing undermining, where tissue separates due to friction or shear, the clock system is again used to identify its location and a cotton-tipped applicator helps determine how far the undermining extends.[2]

To accurately assess deep wounds, HCPs should visualize the wound area as a clock, with 12 o'clock positioned at the patient's head and 6 o'clock at their feet.[2,4] The length of the wound should always be measured from 12 to 6 o'clock, while the width is recorded between 9 and 3 o'clock at the longest and widest points.[4] Use a cotton-tipped applicator to explore edges detachment and undermining, and measure the location where the detachment or undermining is present, documenting it according to the clock position. For example, if edges detachment or undermining is found at the 3 o'clock position, note both the clock location and the depth or size of the undermining. This clock method is beneficial for consistent documentation of wound structures, tissue characteristics and locations, allowing other HCPs to interpret the wound assessment clearly.[2,4] Similarly, tunnelling is assessed by gently probing the wound edges with a cotton-tipped applicator to detect hidden pathways.[2] Although this technique is not frequently reported in the literature, anecdotally, another method for assessing tunnelling involves filling the wound with 0.9% saline solution and then aspirating with a syringe to quantify the volume in millilitres. This approach allows for a sequential volume measurement at each assessment, providing additional insight into the extent of tunnelling.

It is important to recognize that wound assessment is a continuous process, repeated at every follow-up. After each assessment, it is crucial to thoroughly describe and document all observations and measurements in the patient's record (Step 4). Accurate and detailed documentation ensures a clear record of the wound's progress.

Step 2: Packing Procedure And Techniques

The depth of packing depends on the depth of the wound, as well as any presence of undermining or tunnelling. Packing that is too tight can restrict blood flow to the wound bed, impairing the delivery of oxygen and nutrients that are critical for tissue repair.[4,8] Overpacking may also damage newly formed granulation tissue, increasing the risk of necrosis and delaying healing.[8]

Conversely, underpacking can lead to the accumulation of exudate, bacteria and dead space within the wound, fostering an environment conducive to infection and abscess formation.[8-10] To avoid these complications, HCPs must ensure that the packing material is snug but not too tight (Figure 4), filling dead space without exerting excessive pressure on the wound bed.[8-10,12] By doing so, packing supports the growth of granulation tissue, thereby promoting efficient wound closure from the base upwards to the surface (Figure 5 and 6).[8-10,12,13]

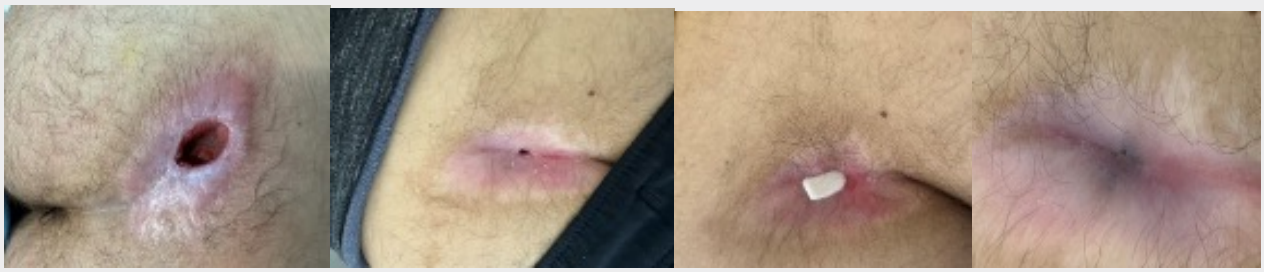


Figure 5
Evolution of a tunnelling pressure injury after applying appropriate packing.
Source: Personal archive - 1st author

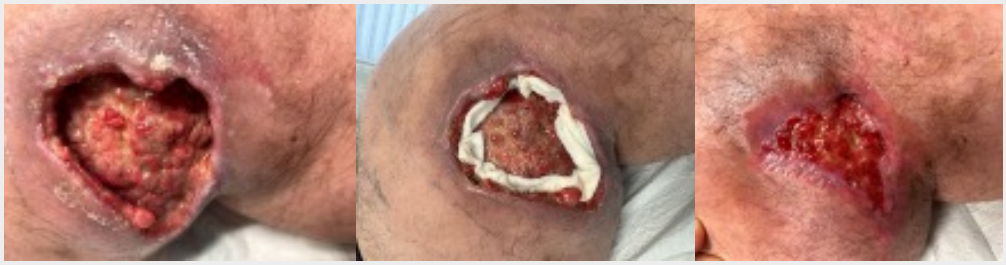


Figure 6
Evolution of a traumatic wound with undermining tissue after applying appropriate packing.
Source: Personal archive - 1st author

However, it is important to consider the need to assess exudate levels, as high exudate levels can reduce the packing material's effectiveness. Furthermore, excessively exuding wounds can cause discomfort and pain, particularly through skin damage in the periwound area and highly absorbent dressings can produce a 'drawing' sensation.[14,15] As wound size, depth and location influence exudate production, deeper and larger wounds or those in lower extremities (such as the legs) tend to produce more exudate.[14,15] When exudate levels decrease, absorbent dressings can exacerbate discomfort. Managing both the wound's drainage and the condition of the surrounding skin is crucial to alleviating patient discomfort and promoting healing.[14] As detailed in Table 2, dressings specifically designed for increased fluid output include foam, gel-forming, and superabsorbent dressings.[15] However, some dressings interact with exudate, and certain types may gel upon contact with moisture, decreasing their size and potentially filling capability.[14,15]

Dressings such as alginates and fibre, upon interacting with exudate, undergo gel formation, which can result in a reduction in volume. This process is effective in absorbing fluid and promoting a moist wound environment. However, as exudate levels diminish, the capacity of these dressings to maintain close contact with the wound bed may be compromised.[15] Importantly, hydrocolloid dressings should not be used in wounds with tunnels, undermining or sinus tracts because they cannot effectively absorb fluid or fill the deep spaces, potentially leaving dead space that may lead to complications.[16] In instances where exudate decreases substantially, alginate and hydrocolloid dressings may fail to sufficiently expand to fill the wound cavity, creating voids where the dressing no longer adheres adequately to the wound bed.[15] This reduction in wound bed contact can compromise the effectiveness of the packing, leaving portions of the wound unsupported, which may impede healing and elevate the risk of infection.[15] To mitigate these risks,

Table 2: Summary of popular packing supplies for wound types that are usually deep

Wound Type	Recommended Packing Supplies	Explanation
Surgical Wounds (Open or Dehisced)	Calcium Alginate Specialized Foam Dressings Gauze	Calcium alginate absorbs exudate and helps maintain moisture. Foam dressings can help fill dead space, and gauze may be used for drainage and short-term management.[4,15,18,19]
Diabetic Foot Ulcers	Gelling Fibre Calcium Alginate	Gelling fibre and calcium alginate maintain a moist environment and absorb excess exudate. This helps manage moisture levels in diabetic foot ulcers, preventing infection and promoting granulation tissue formation.[4,15,18,19]
Stage 3 and 4 Pressure Injuries	Specialized Foam Dressings Calcium Alginate Gelling Fibre	Foam dressings help cushion and absorb moisture, while calcium alginate and gelling fibre dressings support healing by absorbing exudate, preventing dead space, and promoting the formation of granulation tissue.[4,18,19]
Abscesses	Hypertonic Gauze Ribbon Iodine-Based Dressings	Hypertonic gauze helps manage exudate and prevents premature closure. Iodine-based dressings help control infection by reducing bacterial load.[4,18,19]
Traumatic Wounds	Saline-Soaked Gauze Specialized Foam Dressings	Saline-soaked gauze helps cleanse and maintain a moist environment. Foam dressings help fill dead space and cushion the wound, preventing further trauma while simultaneously promoting healing.[4,18,19]
Chronic Wounds (Venous Leg Ulcers)	Hypertonic Gauze Ribbon Gelling Fibre	Hypertonic gauze ribbon manages exudate by pulling moisture out, while gelling fibre helps with autolytic debridement and managing exudate in chronic wounds.[4,15,18,19]

clinicians may need to adjust or replace the dressing more frequently to maintain optimal coverage and wound contact as healing progresses.[15] While gel-forming dressings are advantageous in managing high exudate, their shrinking properties as moisture levels decrease require careful monitoring, particularly in deep, tunnelling, undermining, or cavity wounds.[14,15]

Step 3: Selection Of Dressing Types

Wound packing, along with other wound care techniques, plays a crucial role in preventing and mitigating edge detachment, which occurs when the edges of a wound separate from the underlying tissue, creating spaces where fluid, bacteria, and necrotic tissue can accumulate.[17] Proper dressings and packing techniques fill dead spaces (Figure 4), providing support to the wound bed and reducing the likelihood of edge detachment.[17] In this sense, selecting the appropriate dressing is essential to preserving wound edge integrity. Flexible and moisture-retentive dressings, such as alginates or foam dressings, should be applied to conform to the wound and support the edges, allowing for proper epithelialization. Rigid or poorly fitted dressings may worsen edge detachment by pulling on the wound margins or failing to accommodate changes in exudate levels. Regular assessment of wound edges using frameworks like TIMERS can help identify early signs of detachment.[17] Additionally, applying protective barrier films or ointments around the wound edges can prevent mechanical stress and moisture buildup, further preserving the integrity of the wound margins. By addressing these aspects, wound care professionals can significantly improve wound healing outcomes and minimize the risk of complications related to edge detachment.

Types Of Packing Dressings

Packing deep wounds requires careful selection of dressings that not only fill the wound cavity but also promote optimal healing by managing exudate, maintaining moisture balance and preventing infection. Various types of packing dressings are available, each designed to address specific wound conditions and needs. These dressings, when used correctly, support wound healing by absorbing excess fluid, maintaining the right environment and preventing further tissue damage. The following are some of the most commonly recommended packing dressings for managing deep wounds. Table 2 provides a summary of recommended packing dressings for wound types that are usually deep.

Calcium Alginate: Alginates transform into a gel upon contact with wound exudate, making them ideal for wounds with moderate to heavy drainage.[19] For optimal packing depth, the dressing should be applied in sufficient quantity to fill the wound cavity without overpacking.[10] For deep wounds with significant exudate, calcium alginate helps maintain moisture control, and if impregnated with silver it can also control local infection, but careful application is required to avoid necrosis.[18,19]

Foam Dressings: Foam dressings are designed to manage moderate exudate and are effective in filling wound cavities.[19] The depth of packing ensures that foam absorbs excess fluid without compressing underlying tissue. Foam's ability to conform to the shape of the wound makes it suitable for deep wounds, such as stage three and four pressure ulcers, where both cushioning and moisture balance are necessary.[18,19]

Gauze: Commonly used for mechanical debridement or short-term packing, gauze must be packed at an appropriate depth to avoid over-compression, which could impede blood flow and delay healing.[19] Underpacking leaves dead space, which encourages bacterial growth. Because gauze can dry out and adhere to the wound bed, it is best used for wounds requiring frequent dressing changes, with light packing to avoid excessive pressure.[18,19]

Gelling Fibre: Gelling fibre dressings expand and form a gel when absorbing exudate, making the packing depth essential to allow this transformation.[19] These dressings support moisture retention and autolytic debridement, crucial for managing deep wounds with heavy exudate. Gelling fibres effectively fill dead space and are ideal for wounds requiring moisture management and

debridement.[18,19]

Hypertonic Gauze Ribbon: Hypertonic gauze ribbon creates an osmotic effect that pulls fluid out of the wound, which is especially beneficial for heavily exudating wounds or abscesses.[19] The packing depth must be carefully controlled to avoid over-compression.[18] When used appropriately, hypertonic gauze effectively manages moisture and maintains an environment conducive to healing in wounds with heavy drainage or chronic conditions like venous leg ulcers.[18,19]

Step 4: Follow-up And Documentation

To ensure clarity and continuity of care for incoming HCPs, it is essential to be as accurate as possible with documentation using the clock method, as described previously, to record the location and depth of tunnelling, undermining, or sinus tracts.[20-22] Additionally, it is important to document the type and length of packing, the dressing applied, and the patient's response. When ethically appropriate and with consent, photographing the wound before and after packing can provide a clear visual record of the wound condition and progression (Figures 5 and 6). For wounds with tunnelling or sinuses, specify the length of packing used.[20-22] Regular monitoring and thorough recording of wound edges, particularly any detachment, using the TIMERS framework, are crucial for tracking healing progress and ensuring smooth transitions between shifts.[7]

Comprehensive documentation should also include ongoing assessments of wound progression to detect complications early. Accurate records of the type and length of packing or dressing used are vital for ensuring continuity of care, especially during rotation of professionals or absences. Detailed documentation allows subsequent caregivers to maintain optimal care, track healing and intervene early if necessary. Additionally, as the wound heals, the need for more or less packing should be evaluated and adjusted based on regular assessments during dressing changes. If possible, and ethically justified, photographs can provide valuable visual evidence of the wound's progress.

Discussion

This critical review of the literature revealed and/or reinforced some key points.

During the proliferation stage of wound healing, keratinocytes play a critical role by migrating from the wound edges to the centre, quickly covering the wound surface and forming a new epithelial layer.[1-3] This process is vital because it restores the skin's protective barrier, preventing further damage and contamination. For superficial wounds, the migration of keratinocytes is both efficient and beneficial, as the epidermal layer is restored rapidly with minimal tissue remodelling.[1-3] The newly formed epithelial layer helps maintain the skin's integrity and serves as an essential defence mechanism by sealing the wound and reducing the risk of infection from external pathogens.[2,4,13]

In contrast, large wounds with significant tissue deficits present more challenges during this stage.[4,12,13] In these cases, the wound surface may close before the wound depth has sufficiently reduced, or before tunneling and undermining have resolved. This premature closure leaves dead space beneath the new skin, creating an environment where bacteria can proliferate and increasing the risk of abscess formation.[4,12-14] This is particularly concerning as the hidden infection can progress, complicating the healing process and requiring more intensive interventions such as antibiotic therapy.[2,4]

Wound packing is designed to prevent such premature closure by filling dead spaces, thus promoting proper healing from the base of the wound upwards and reducing the risk of abscess development.[4,12,13] However, improper packing can introduce its own set of complications. Overpacking the wound can block natural drainage, leading to fluid buildup and a higher risk of infection.[8,11-13] Moreover, if the packing material is too tightly packed, it can bunch up, exerting excessive pressure on the wound bed, which may impede blood flow and cut off the oxygen and nutrients required for healthy granulation tissue formation, leading to delayed healing and—in some cases—tissue necrosis.[8]

In this context, it is essential for HCPs to pay

close attention to detailed wound care for wounds with edge detachment and/or tunnelling. This attention is crucial for promoting timely and effective healing. Regular updates in knowledge and the incorporation of scientific evidence into clinical practice, are also fundamental. Additionally, thorough documentation of assessments and interventions in patients with wounds is necessary to ensure continuity of care, especially considering potential shifts in HCPs and the need for consistent follow-up.

Conclusion

The findings of this critical review served as the foundation for developing a step-by-step guide on wound packing techniques and dressing selection for managing deep wounds, with a focus on preventing complications and enhancing quality of life. This guide emphasizes the importance of regularly assessing and reassessing wound healing progress, selecting appropriate dressings, and ensuring proper packing, followed by thorough documentation. It highlights the risks associated with improper packing, stressing the need for ongoing education and training for specialized and non-specialized HCPs to deliver optimal wound care. These insights are invaluable for advancing wound care delivery, contributing to enhanced patient outcomes, improved quality of care and better quality of life in clinical practice.

Premature closure of the wound surface without addressing deeper cavities can lead to abscess formation and infection. To optimize healing, clinicians must carefully assess the wound's depth, tunneling and undermining, and choose appropriate dressing materials for each case. This approach prevents premature closure, supports granulation tissue formation and reduces the risk of infection, ultimately improving patient outcomes. Inadequate packing can leave dead space between the wound base and surface, hindering the healing process. Therefore, health-care providers must select packing materials that maintain moisture balance, particularly for highly exudative wounds. Initially, frequent dressing changes may be necessary, with intervals extending as exudate levels decrease. This strategy is essential for optimizing healing and minimizing complications.

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References

1. Guo S, Dipietro LA. Factors affecting wound healing. J Dent Res. 2010 Mar;89(3):219-29. DOI: 10.1177/0022034509359125
2. Hunt S. Chapter 4: wound care: priorities for nursing. ANCC: EliteCME.com; 2015 Dec 12. Available from: http://s3.amazonaws.com/EliteCME_WebSite_2013/f/pdf/ANCCCA08WCI16B.pdf
3. Chapter 20 wound care. In: Open Resources for Nursing (Open RN); Ernstmeyer K, Christman E, editors. Nursing Skills. 2nd ed. Eau Claire (WI): Chippewa Valley Technical College; 2023. Available from: https://www.ncbi.nlm.nih.gov/books/NBK596725/
4. British Columbia Provincial Nursing Skin and Wound Committee. Guide: Wound Management for Adults & Children. British Columbia Patient Safety and Quality Council; Aug 2018. LINK to come.
5. Ledford K, Washmuth D. Tunneling wound vs undermining wound: definitions, diagnosis, treatment, and risk factors. Study.com. Updated 2023. Available from: https://study.com/academy/lesson/tunneling-wound-vs-undermining-wound.html
6. Murphy C, Atkin L, Vega de Ceniga M, Weir D, Swanson T, Walker A, et al. Embedding Wound Hygiene into a proactive wound healing strategy. J Wound Care. 2022 Apr 1;31(Sup4a):S1-S19. DOI: 10.12968/jowc.2022.31.Sup4a.S1
7. Atkin L, Bućko Z, Montero EC, Cutting K, Moffatt C, Probst A, et al. Implementing TIMERS: the race against hard-to-heal wounds. J Wound Care. 2019;28(Sup3a). DOI: 10.12968/jowc.2019.28.Sup3a.S1
8. Bell MS, McKee D, Hendry PJ. When a pack becomes a plug. Can J Plast Surg. 2009 Winter;17(4):e27-8.
9. Kessler DO, Krantz A, Mojica M. Randomized trial comparing wound packing to no wound packing following incision and drainage of superficial skin

abscesses in the pediatric emergency department. Pediatr Emerg Care. 2012 Jun;28(6):514-7. DOI: 10.1097/PEC.0b013e3182587b20
10. Kumar A, Shah SP, Agrawal CS, Agrawal S. Stop packing abscess: a randomised clinical trial comparing packing with non-packing of the abscess cavity. Int J Ther Appl. 2018;35:12-8.
11. Costa IG, Camargo-Plazas P. The Impact of Diabetic Foot Ulcer on Individuals' Lives and Daily Routine: A Qualitative Study Informed by Social Constructivism and Symbolic Interactionism Frameworks. J Wound Ostomy Continence Nurs. 2023 Jan-Feb 01;50(1):73-77. DOI: 10.1097/WON.0000000000000941
12. Schaffner A. Chronic wound care: a clinical source book for healthcare professionals. 2nd ed. Krasner D, Kane D, editors. Wayne (PA): Health Management Publications, Inc.; 1997. p 427.
13. Woo KY. Wound packing poll results. Words on wounds. Advances in Skin & Wound Care. 2015 Mar 19. Available from: https://journals.lww.com/aswcjournal/blog/wordsonwounds/pages/post.aspx?PostID=18.
14. Dowsett C. Management of wound exudate. Independent Nurse. 2012 Feb 6.
15. World Union of Wound Healing Societies (WUWHS). Wound exudate: effective assessment and management. Wounds International. 2019. Available from: https://woundsinternational.com/world-union-resources/wuwhs-consensus-document-wound-exudate-effective-assessment-and-management/
16. Meyers L, Hudson SL. Wound care: getting to the depth of the tissue. National Center of Continuing Education, Inc. 2013. Available from: https://www.nursece.com
17. Atkin L, Ousey K. TIMERS: the wound assessment and care paradigm updated. J Wound Care. 2016;25(7):377-382.
18. Wounds Canada. wound dressing selection guide. Toronto (ON):Wounds Canada; 2017. Available from: https://www.woundscanada.ca/docman/public/health-care-professional/1114-product-picker-2017-selection-guide-1/file
19. Holloway S, Bradbury S. Wound dressings. Surgery (Oxford). 2024 Sep 28. DOI: 10.1016/j.mpsur.2024.08.009
20. 20. Royal Victoria Regional Health Centre. Wound care: wound assessment and management. Barrie (ON): Royal Victoria Regional Health Centre; 2018. Available from: https://rvrhc.sharepoint.com/Policies/Policies
21. Anderson R, Doyle GR, McCutcheon JA. Advanced wound care: wet to moist dressing, and wound irrigation and packing. In: Clinical procedures for safer patient care. Thompson Rivers University; 2018. Available from: https://pressbooks.bccampus.ca/clinicalproceduresforsaferpatientcaretrubscn/chapter/4-6-advanced-wound-care-wet-to-moist-dressing-and-wound-irrigation-and-packing/
22. Chapter 20 wound care. In: Open Resources for Nursing (Open RN); Ernstmeyer K, Christman E, editors. Nursing Skills. Eau Claire (WI): Chippewa Valley Technical College; 2021. Available from: https://www.ncbi.nlm.nih.gov/books/NBK593201/

Coloplast Sponsored Learning:

Enabling Effective Wound Care Education For Non-specialists: Introducing The Coloplast Wound Type Specific Pathways

Presenters: Paddy Markey, Dr. David Keast MSc MD FCFP (LM) and Melody Yaceyko RN MN:NP NSWOC

The Changing Landscape of Wound Care

1. **Patient and Health-care Practitioner Demographic**

   The estimated burden of wound care in Canada is approximately $12 billion.[4] As the general population ages, the health-care demands and cost increase. An aging population also correlates to an increase in the prevalence of wounds and more complex wounds. For example, a study in the UK found an increase of 11% per annum in the prevalence of wounds from 2012/2013 to 2017/2018.[1] Not only is the general population aging but the health-care professionals (HCPs) are aging as well. Experienced and highly skilled professionals are retiring from their specialties, leaving behind less experienced and potentially less skilled and knowledgeable HCPs dealing with more patients with wounds and more complex wounds.

2. **Health-care Practitioner Workload and Workforce**

   Nurses have been experiencing heavier workloads than ever before. These heavy workloads are contributing to increased burnout and turnover. Statistics Canada reported an increase of registered nursing vacancies from approximately 6,000 in the fourth quarter of 2020 to approximately 10,000 in the third

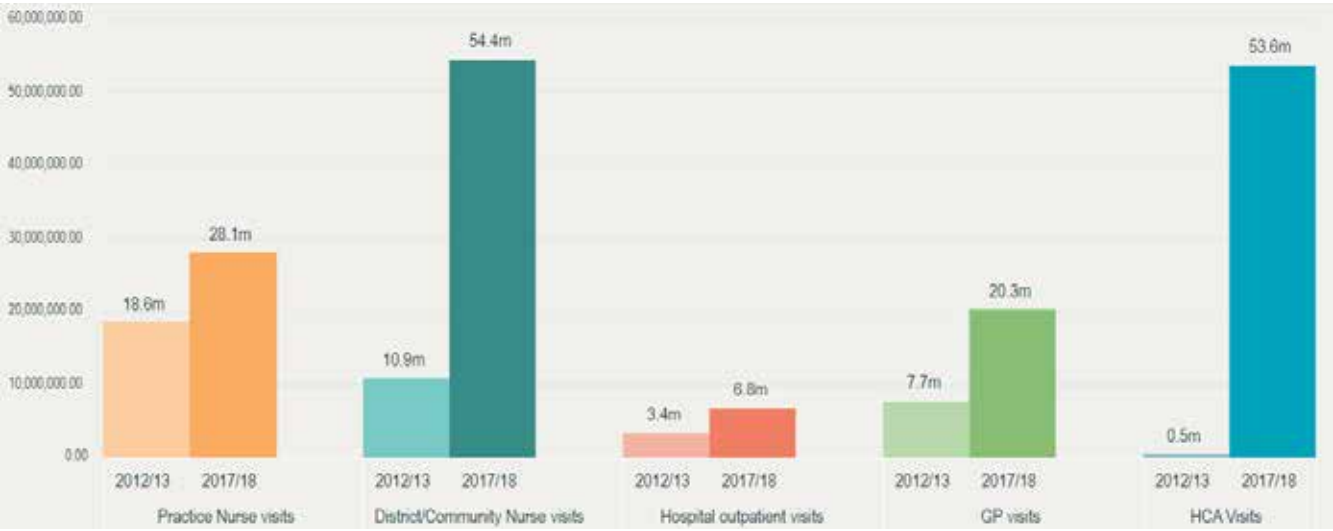
quarter of 2022 in Ontario.[2] Better workplace support and reduced workloads were cited as the top two retention factors for nurses planning to leave the profession.[2] The high turnover of staff combined with the loss of experienced and skilled HCPs contribute to inconsistency in patient care. Guest et al. reported that 30% of wounds remained unhealed in the aforementioned study in the UK.[1] The prevalence of chronic, non-healing wounds have a great impact on patient quality of life and adds to the overall health-care costs.

amount of wound care is now delivered in the community. In the UK, Guest et al. demonstrated a much greater increase in wound care related visits by district/community nurses and health-care aids compared to practice nurses, general physicians, and in a hospital/outpatient setting.[1] Other countries around the world are experiencing this same trend toward wound care in a community setting. More than ever there is a need to equip and support those who provide wound care in the community.

3. Patient Settings

There is also a shift in the patient setting where wound care is delivered. A large

Statistics Canada 2022a. Registered Nurses' Association of Ontario. (2022). Nursing Through Crisis: A Comparative Perspective. May 12.



Take an evidence-based and step-by-step approach towards wound healing

Where there are challenges, there are opportunities. The Wound Care Pathways were developed in response to the educational needs expressed by HCPs who work with patients living with wounds. The Wound Care Pathway – a 5-step guide to wound healing that provides practical, evidence-based guidance on how to assess, treat and monitor wound care patients, and create an optimal healing environment that leads to a shorter way to wound healing.

The Wound Type Specific Pathways:

To support non-generalist nurses with more detailed guidance on specific wound types, the Wound TypeSpecific Pathways have been developed. The pathways cover the most common wound types - diabetic foot ulcers, venous leg ulcers, skin tears, pressure injuries/ ulcers, and surgical wound dehiscence. They contain essential guidance on wound type-specific management and include the following:

- Definition of wound type
- How to assess
- How to diagnose
- How to develop a treatment plan
- How to manage the wound
- How to choose a dressing and additional therapies
- How to monitor progression
- When to consult a specialist or refer.

The Wound Care Pathway was developed to achieve the following objectives:

- Provide clear, concise guidance to help implement best practice wound care at the bedside.
- Create consensus on how to assess, treat and monitor wound care patients to improve standards of care.
- Provide evidence-based practice guidance to help improve patient outcomes and aim to a shorter way to wound healing.

Click here to download the Wound Type Specific

References

1. Guest JF, Fuller GW, Vowden P. Cohort study evaluating the burden of wounds to the UK's National Health Service in 2017/2018: update from 2012/2013. BMJ Open 2020;10:e045253. doi:10.1136/bmjopen-2020-045253
2. Statistics Canada 2022a. Registered Nurses' Association of Ontario. (2022). Nursing Through Crisis: A Comparative Perspective. May 12.
3. Coloplast sponsored survey, N= 62 HCPs. 2023/024
4. Queen D, Botros M. The true cost of wounds for Canadians. Wound Care Canada. 2024;22(1): 16-20. DOI: 10.56885/NXMW2913

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A Patient's Guide to Prevent Lower Extremity Amputations: An American Limb Preservation Society (ALPS) Initiative

By Virginie Blanchette PhD DPM MSc Biomed and Matthew C Bunte MD MS FSVM FSCAI FACC

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DOI: 10.56885/LHYR3902

Recently, the Limb Preservation Alliance,[1] an international collaborative alliance, was formed between four founding organizations: American Limb Preservation Society (ALPS), the Canadian Podiatric Medical Association, D-Foot international and Wounds Canada. The purpose of this alliance is to advance limb preservation, education, advocacy and awareness. With the aim of sharing and mobilizing knowledge within the alliance, the ALPS education committee, with the help of patients who have experienced diabetic foot disease, have developed a patient resource to provide facts about foot and leg wound prevention and management and act against preventable amputation. We therefore introduce this online resource to the wound care community and explain who, how and why it was developed at the ALPS.

The Resource: Guide for Patients To Act Against Preventable Lower Extremity Amputation

The resource is freely available on the ALPS website: https://limbpreservationsociety.org/wp-content/uploads/2024/10/Guide-for-Patients-to-Act-Against-Preventable-Lower-Extremity-Amputation.pdf

The guide has been authored by a geographically and professionally diverse team of interdisciplinary foot and wound care specialists, including international experts in podiatry and vascular care, with content reviewed by patients. The document has four sections: (1) Summary; (2) Patient Experience with Wounds; (3) Foot and Wound Care Standard and (4) Limb Preservation Resources. Key suggested resources are included at the end of the document and will be updated as necessary. Patients (or their caregivers) can simply access and explore these insightful resources via the included active web link.

The document includes a few simple figures and tables to facilitate understanding and rapid aggregation of the information. Finally, a glossary of medical and technical terminology has also been included at the end of the document. For practical use, it is easy to spot the words, included in the glossary, as they have been highlighted in bold red throughout.

Who is ALPS And How Was This Guide Produced?

The American Limb Preservation Society (ALPS) has a vision to eliminate preventable leg amputations over the next generation. ALPS intends to fulfill that objective with a mission to promote interdisciplinary teams to advance the science, clinical care, advocacy, awareness and education of limb preservation through increased access to resources and specialized care that improves patient-centered outcomes.[2] Education and patient engagement are central to the mission of ALPS.

By the end of 2022, ALPS had launched its education committee as an advisory committee to the chief executive officer and board of directors. Their role is to act as a sounding board for creating strategies and educational tools and to provide feedback, as requested by the team, that align with the organization's mission and are consistent with its core values. The committee also facilitates discussion about program priorities for the organization, including public policy and advocacy.

Contributors

The following list features contributors to the committee, along with their specialty and institutional affiliation.

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ALPS Staff:

- Georgia Krehbiel,MBA. CEO of ALPS
- Annkathrin Mathe MSc. Program Director of ALPS

For a complete list of accreditations and affiliations, see: https://limbpreservationsociety.org/education-committee/

In addition, as patient engagement is at the heart of ALPS, this guide was developed in collaboration with the organization's patient partners. Recent studies have demonstrated the added value of developing patient resources with the end users of knowledge, as well as the urgent need to strengthen collaboration and partnership with patients with diabetic foot disease -- at the levels of care, research, organizational, education/academics and policy — to co-produce health.[3,4] Therefore, although the committee formed the original texts of the guide, the definition of content was based on identified patient needs. Patient partners commented on the document during the process and reviewed the final version to ensure readability and comprehension of the information.

We can thus affirm that this guide was co-constructed. There were seven patients partners involved for this project, all of whom had at least one of the following conditions: at-risk diabetic feet, peripheral vascular disease, a history of lower extremity amputation and/or diabetic foot ulcers. The patients' expertise in these challenges added first-hand experience and wisdom to inform and inspire this work. ALPS was also careful to include patients from the context of vulnerability, as well as be concerned about representativeness in terms of equity, diversity and inclusion (e.g., socio-economic background, ethnicity, gender). It is well known that these variables influence the evolution of the diabetic foot and amputations.[5-7]

Finally, given the importance of adapting to the target audience and its level of health literacy and education, the guide has been written in clear and synthetic language. The language level used -- between grades six and seven -- is recommended for the public and patients.[8] Therefore, we have developed the resources along with an online software that enables us to reach this level of language. Recent studies have demonstrated that there is an association between health literacy and diabetic foot disease, its risk factors and outcomes. Optimal diabetic foot education for self-management improves the level of knowledge and behaviour of patients with diabetes, without affecting their self-efficacy.[9,10]

Why Was The Guide Developed?

The production of this guide stems from the need identified by the ALPS Board of Directors and by the organization's patient partners. It should also be remembered that, although the organization is young, the experience and accumulated expertise of the various ALPS stakeholders are well placed

to meet — at least try to meet— the needs of their patients, the limb preservation community and the interprofessional limb preservation team. This is in alignment with the international collaborative alliance formed between four founding organizations: American Limb Preservation Alliance (ALPS), the Canadian Podiatric Medical Association, D-Foot international and Wounds Canada, during fall 2023.[1]

This guide was developed to address key aspects of wound treatment to equip patients with knowledge to promote patient confidence when seeking care. The goal of this document was to guide patients and their advocates in understanding the causes and potential consequences of lower extremity wounds, key elements to consider when seeking care, where to seek care in the community and what to expect during treatment.

We hope these resources provide patients and their advocates with the opportunity to understand the circumstances of their condition and receive care that promptly heals the wound. The presence of lower extremity wounds can contribute to uncertainty and anxiety for the patient.[11,12] Even more, many patients with lower extremity wounds are not adequately informed about treatment options, experience uncertainty on where to seek care and may receive poorly coordinated care even after wound treatment is initiated.

Conclusion

The ALPS intent with this guide is to support patients, their advocates and their aligned healthcare and social providers to work together to maximize the opportunity to preserve the lower extremity and avoid unnecessary amputations. We hope these resources may be useful in your practice and to be disseminated without limit in the community to achieve maximum knowledge mobilization to act against amputation.

Conflict of Interest

Dr. Bunte is a consultant to Abbott, Shockwave Medical, Inari Medical and Amgen and has received research funding from Johnson & Johnson and Inari Medical. Dr. Blanchette has no conflicts of interest to declare.

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References

1. Corks I, Papadopoulos P. Limb Preservation Alliance: behind a new global initiative in limb preservation education, advocacy and awareness. Limb Preservation Journal. 2024;5(1):16-20. DOI:10.56885/MFGT6621
2. Crews RT, Lepow BD, Mills JL, Conte MS, Najafi B, Steinberg JS, et al. A limb is a peninsula and no clinician is an island: Introducing the American Limb Preservation Society (ALPS). Foot & Ankle Surgery: Techniques, Reports & Cases. 2021;1(1).
3. Kovacs Burns K, Bellows M, Eigenseher C, Gallivan J. 'Practical'resources to support patient and family engagement in healthcare decisions: a scoping review. BMC health services research. 2014;14:1-15.
4. Blanchette V, Todkar S, Brousseau-Foley M, Rheault N, Weisz T, Poitras M-E, et al. Collaboration and partnership in a five-level engagement framework for diabetic foot ulcer management: a patient-oriented scoping review. Canadian Journal of Diabetes. 2023; 47(8): 682-694.e17
5. Martinez OP, Storo K, Provenzano Z, Murphy E, Tomita TM, Cox S. A systematic review and meta-analysis on the influence of sociodemographic factors on amputation in patients with peripheral arterial disease. Journal of Vascular Surgery. 2024;79(1):169-78. e1.
6. McDermott K, Fang M, Boulton AJ, Selvin E, Hicks CW. Etiology, epidemiology, and disparities in the burden of diabetic foot ulcers. Diabetes Care. 2023;46(1):209-21.
7. Gasoyan H, Hussain SR, Wright WG, Sarwer DB. Disparities In Diabetes-Related Lower Extremity

Amputations In The United States: A Systematic Review: Systematic review examines disparities in diabetes-related lower extremity amputations in the United States. Health Affairs. 2022;41(7):985-93.
8. Lipari M, Berlie H, Saleh Y, Hang P, Moser L. Understandability, actionability, and readability of online patient education materials about diabetes mellitus. American Journal of Health-System Pharmacy. 2019;76(3):182-6.
9. Chen P, Elmer S, Callisaya M, Wills K, Greenaway T, Winzenberg T. Associations of health literacy with diabetic foot outcomes: a systematic review and meta-analysis. Diabetic Medicine. 2018;35(11):1470-9.
10. Yıldırım Ayaz E, Dincer B, Oğuz A. The effect of foot care education for patients with diabetes on knowledge, self-efficacy and behaviour: systematic review and meta-analysis. The International Journal of Lower Extremity Wounds. 2022;21(3):234-53.
11. Jiang F-H, Liu X-M, Yu H-R, Qian Y, Chen H-L. The incidence of depression in patients with diabetic foot ulcers: a systematic review and meta-analysis. The International Journal of Lower Extremity Wounds. 2022;21(2):161-73.
12. Ahmad A, Abujbara M, Jaddou H, Younes NA, Ajlouni K. Anxiety and depression among adult patients with diabetic foot: prevalence and associated factors. Journal of clinical medicine research. 2018;10(5):411.

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The use of this dressing regime can help optimise:

- Effective management of exudate.[1,2]
- Help prevent peri-wound maceration.[6]
- Protect peri-wound skin.[6]
- Promote wound healing.[7]
- Manage biofilm and infections[4,5]

This may improve patient comfort and clinical outcome.[3]

References:
1. PARTNER observational study: Preliminary results on the utility of the combination of two dressings in the management of acute and chronic wounds in private practice. TOMASI, J, Yvon, C, Lucas, A. P20, poster presented at Journees Cicatrisations, Paris, France, 26-28 Jan 2020 **2.** Visual Assessment of Fluid Handling by Aquacel® Extra covered by Different Foam Dressings WHRI5397 MS147. Data on le, ConvaTec Inc. **3.** Mixing Wound Dressings: Does it Affect Clinical Outcomes, Tickle. J. Poster presented at World Union of Wound Healing Societies, Florence, Italy 2016. **4.** Bowler PG, Parsons, D. Combatting wound biofilm and recalcitrance with a novel antibiofilm Hydrofiber® wound dressing. Wound Medicine. 2016; 14: 6-11. **5.** Newman, G.R., et al., Visualisation of bacterial sequestration and bactericidal activity within hydrating Hydrofiber wound dressings. Biomaterials, 2006. 27(7): p. 1129-39. **6.** Robinson BJ. The use of a Hydrofibre dressing in wound management. J Wound Care. 2000;9(1):32-34. **7.** Bishop SM et al. Moisture balance: optimising the wounddressing interface. J Wound Care. 2003;12:125-128

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Urgo Sponsored Learning:

Can There Be Gentle Yet Effective Ways For Slough Removal? What Does The Evidence And Experience Say?

Presenters: Dr. Christine Murphy PhD RN BSc(Hons) Tissue Viability, MClSc(WH), PhD, NSWOC, WOCC(C), Michelle Labbie RN MN NP and Debashish Chakravarthy PhD

The 'Chronic Wound' Dilemma

Chronic wounds are wounds that have not progressed through the phases of healing properly and in a sequential and predictable manner. Traditionally, chronic wounds have been thought to be trapped in the inflammatory phase of healing. In actual fact, hyperinflammation is the main contributor to chronic wounds, rendering them hard-to-heal. Research has shown that bacterial biofilm is largely responsible for this hyperinflammatory state. To properly manage chronic wounds, clinicians must adequately address the cause of hyperinflammation (i.e., biofilm).

From Gingivitis to Granulitis – Wound Hygiene & Oral/Dental Hygiene

Gingivitis a classic example of hyperinflammation of the gum due to dental plaque biofilm build up. Granulitis, inflammation of the granulation tissue, is essentially "gingivitis of the wound". It is a hyperinflammatory state of the wound caused by bacterial biofilm. Biofilm is the preferred way of being for bacteria and requires ongoing management. Parallels can be drawn between anti-biofilm strategies in oral/dental hygiene and wound hygiene.

	Oral/Dental Hygiene	Wound Hygiene
Routine cleansing	Cleansing with toothpaste	Cleansing wound and peri-wound with anti-biofilm solution
Physical removal	Regular cleansing with toothbrush and flossing	Regular cleansing with intent
Regarding biofilm regrowth	Toothpaste and mouth wash	Advanced antimicrobial dressings
Optimizing health	Professional cleaning (i.e., dental hygienists)	Debridement
Promoting environment	Fluoride, sealants etc.	Advanced dressings (e.g., protease modulators, extracellular matrices, negative pressure wound therapy)

Vashe® - The Ideal Wound Cleanser

Wound cleansing is an essential part of wound hygiene, especially in the management of chronic, hard-to-heal wounds. Various best practice guidelines cite the importance of wound cleansing as part of routine wound care practice. An ideal wound cleanser should:

- Be **effective** in eradicating pathogens
- Be **non-cytotoxic** to cells in the wound/healed tissues
- Have a **pH** range close to that of intact skin (i.e., to not disrupt the skin's acid mantle)
- Be suitable for **everyday** use
- Be effective in disrupting **biofilm**.

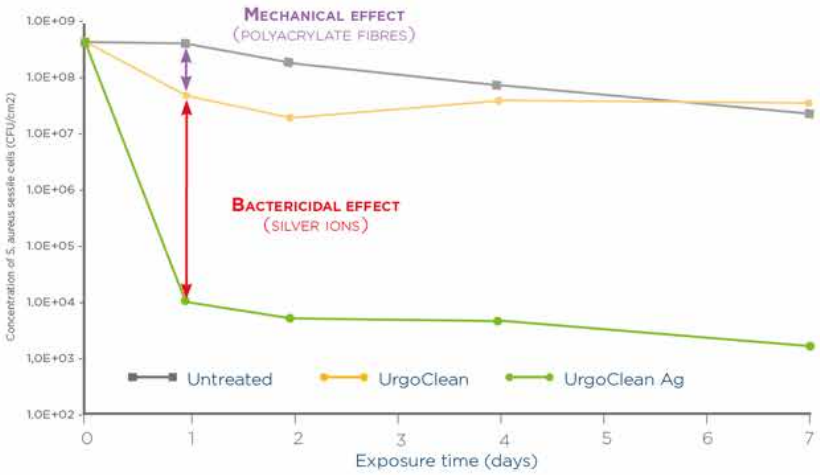
HOCl is a naturally occurring substance found in the human – it is produced by white blood cells (i.e., neutrophils) to combat pathogens. Vashe® is a hypochlorous acid (HOCl) wound cleanser. It has been found to be effective against various multi-drug resistant bacteria, viruses, fungi and spores. It can penetrate and disrupt biofilm – it has been demonstrated to be more effective in disrupting Methicillin-Resistant *Staphylococcus aureus* and *Pseudomonas aeruginosa* biofilms than chlorhexidine and normal saline.[1] Compared to conventional antiseptics and wound cleansers, HOCl is non-cytotoxic.[2] Specifically, Vashe® has been shown to be non-toxic, non-mutagenic and non-cytotoxic.[3,4]

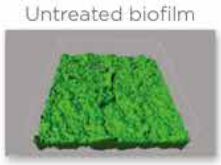
Wound Debridement as Part of Wound Hygiene

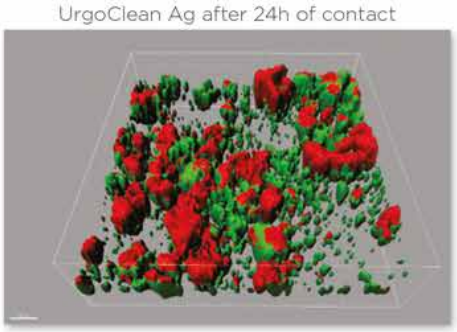
Much like regular brushing is essential to oral health, wound debridement (when appropriate) is an integral part of wound hygiene. Current wound debridement methods include, but are not limited to, conservative sharp debridement, mechanical debridement, autolytic debridement (via advanced interactive dressings), and enzymatic debridement. Studies have shown that microbial colonies and associated debris begin to re-form 24 hours after wound debridement.[5] Slough and necrotic tissue in the wound can promote bacteria growth and delay wound healing. More frequent debridement has been associated with improved wound healing.[6] Autolytic debridement via advanced interactive dressings alone has shown to be insufficient to meet the requirements of wound hygiene as it takes a longer time to occur, requires numerous dressing changes, and can increase the risk of infection in hard-to-heal wounds.[7]

UrgoClean Ag – A New Way to Debride

Continuous debridement of slough is the solution. It must be effective, continously removing slough and wound debris, mitigating reformation of microbial colonies post sharp debridement. It must be accessible, all caregivers can harness the benefits of sharp debridement, throughout the continuum of care. Lastly, it must be easy to use by healthcare providers and well tolerated by patients. UrgoClean Ag supports the continuous debridement of slough with its negatively charged fibers that remove slough as the slough is positively charged. Moreover, The TLC-Ag matrix with silver provides broad-spectrum, antimicrobial properties. It promotes healing and atraumatic, pain-free dressing removal. UrgoClean Ag has been shown to have fast and effective anti-biofilm action - it can reduce 99.99% of biofilm in just 24 hours and block biofilm re-attachment for up to seven days. UrgoClean Ag has been clinically proven in

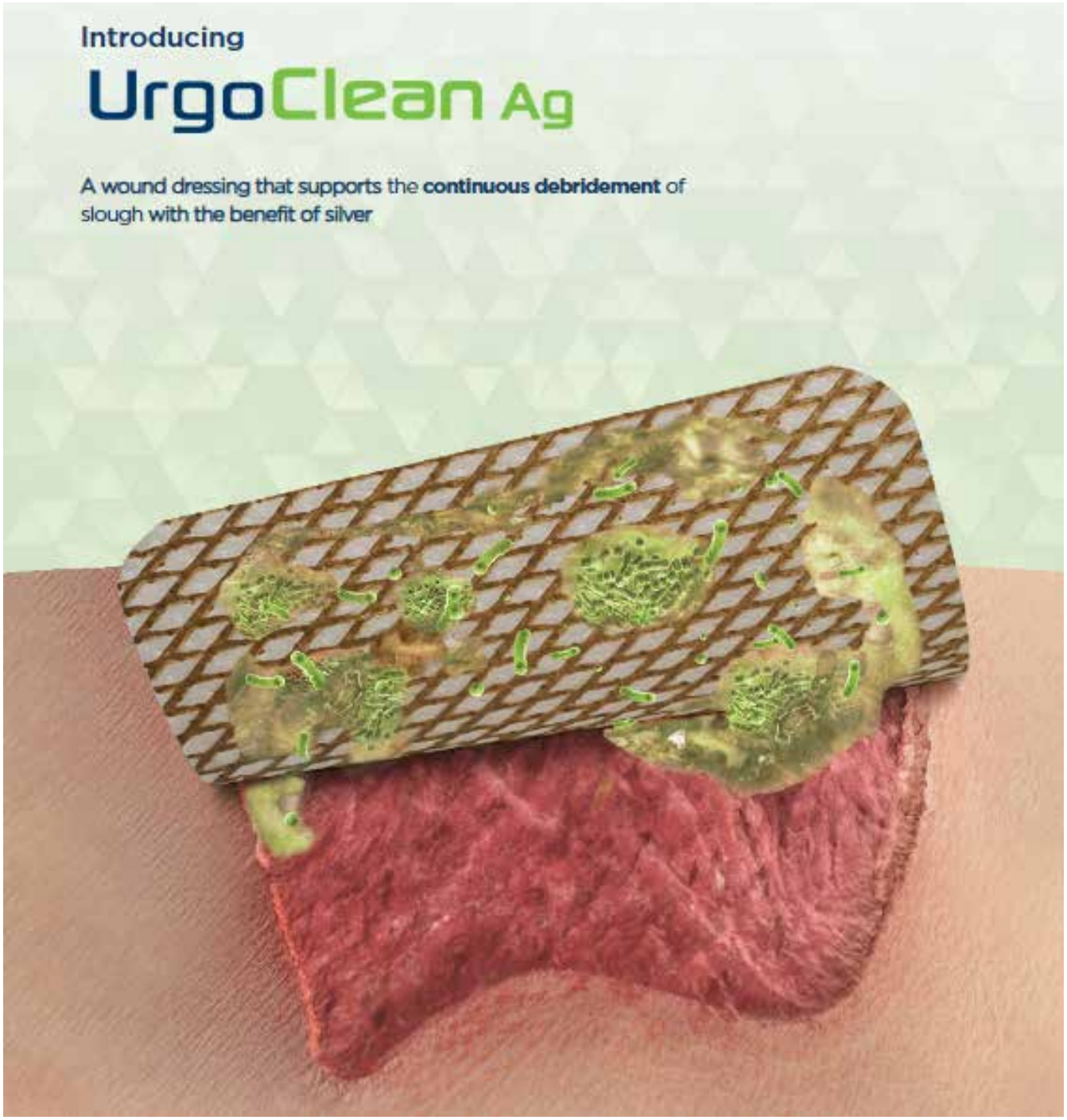






Red-labelled cells are dead cells (bactericidal activity of Ag+)

Clear zones = biofilm that was destroyed and removed (synergistic action of Ag+ and polyacrylate fibres)



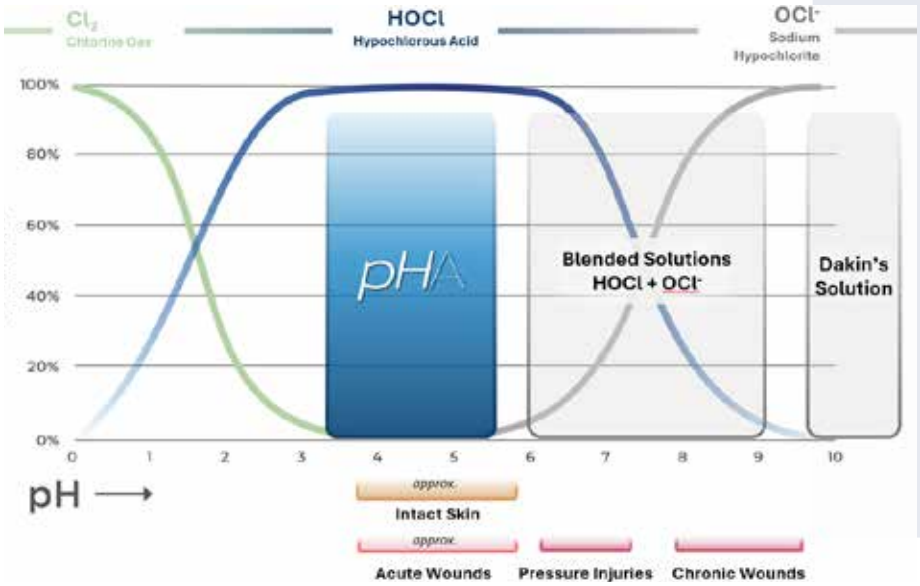
one RCT showing +50% greater debridement of slough compared to Hydrofiber technology, and in the largest observational study ever conducted for a silver dressing (2200+ patients) showing 90.6% of wounds treated demonstrated improvement of the healing process and UrgoClean Ag reduces exudate level by 70%.

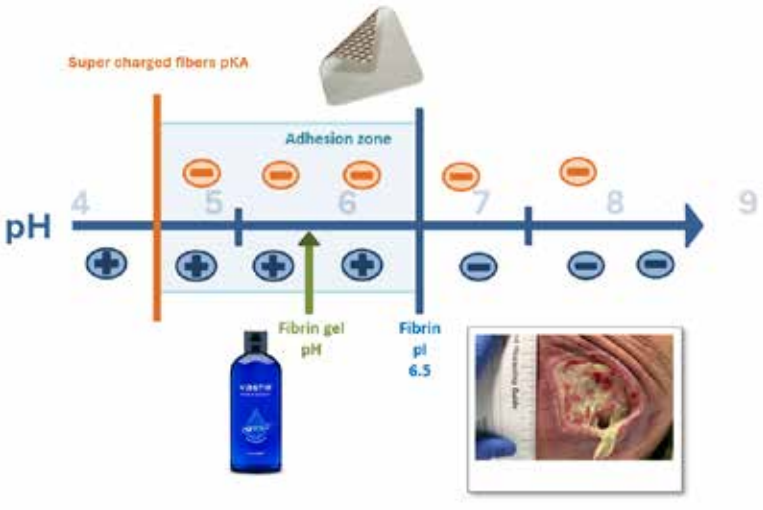
The Synergistic Effects of Vashe® and UrgoClean Ag

The pH of intact skin is from 3.5 to 5.5. The pH of wounds can range from 3.5 to 9.5. Acute wounds are usually closer to intact skin pH where chronic wounds are typically more alkaline. To heal chronic wounds we need to acidify them using Vashe which has the same pH as intact skin.

(Hypochlorous) HOCl ⇌ H^+ + OCl^- (hypochlorite)

Slough can be positively or negatively charged depending on the pH. In an acidic wound environment, slough is positively charged – this is when the negatively charged UrgoClean Ag is most effective as opposite charges attract. Vashe® is a HOCl solution that is stabilized at a pH of 3.5 to 5.5. Using Vashe on a wound lower the pH rendering it more acidic and the slough is more positively charged. UrgoClean Ag is even more efficient. This is the synergistic effect of Vashe and UrgoClean Ag.





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Dr. Debashish Chakravarthy is a PhD with a techno-commercial specialty in the subject of wound/skin care and tissue regeneration. His primary focus is on Development and Commercialization, Evidence Creation, Medical and Regulatory Affairs, publication strategy development, KOL engagement, and product life cycle management. Dr. Debashish is an author of over 24 papers and several product patents.

References

1. Day, Alkhalil, Carney, Hoffman, Moffatt, Shupp. Disruption of Biofilms and Neutralization of Bacteria using Hypochlorous Acid Solution: An In Vivo and In Vitro Evaluation.
2. Block SS. Disinfection, sterilization, and preservation. Philadelphia: Lea & Febiger; 2000.
3. Sampson CM, Sampson MN. Hypochlorous acids: A safe and efficacious new wound therapy. Poster presented at: World Union of Wound Healing Societies; 2008. Toronto, Ontario, Canada.
4. Data on file with Urgo Medical North America
5. Schultz, G. et al (2017), Consensus guidelines for the identification and treatment of biofilms in chronic non-healing wounds. Wound Rep and Reg, 25: 744-757
6. European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The International Guideline. Emily Haesler (Ed.). EPUAP/NPIAP/PPPIA: 2019
7. Murphy C, et al. International consensus document. Defying hard-to-heal wounds with an early antibiofilm intervention strategy: wound hygiene. J Wound Care 2020; 29 (Suppl 3b):S1-28.
8. UrgoClean Ag data on file
9. Percival S. L. (2018). Restoring balance: biofilms and wound dressings. Journal of wound care, 27(2), 102–113
10. Percival SL, et al., Slough and biofilm: removal of barriers to wound healing by desloughing. J Wound Care. 2015 Nov;24(11):498, 500-3, 506-10
11. Desroche N, Dropet C, Janod P, Guzzo J. Antibacterial properties and reduction of MRSA biofilm with a dressing combining polyabsorbent fibres and a silver matrix. J Wound Care. 2016 Oct 2;25(10):577-584. doi: 10.12968/jowc.2016.25.10.577. PMID: 27681588.

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AI-Driven Predictive Models For Wound Deterioration: A Pilot Study

By Heba Tallah Mohammed PhD MD, Robert DJ Fraser MN RN WOCC© NSWOC, Rishabh Gupta PhD, Sheila Wang PhD and Amy Cassata BSN WCC

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Introduction

Chronic wounds, particularly diabetic foot ulcers, venous leg ulcers and pressure injuries, pose a substantial health challenge, affecting 1-2% population in developed countries.[1] These wounds are at increased risk of infection and complications,[2] leading to a substantially high annual treatment costs estimated between $28 billion and $96 billion (all figures in USD) in the US.[3] Despite advancements in wound care management, the assessment and prediction of healing outcomes remain hindered by the subjective evaluations of clinicians,[4] whose varying levels of accuracy can lead to inconsistent treatment approaches.[5]

Artificial intelligence (AI) has emerged as a

transformative force in wound care, significantly enhancing the prediction of healing outcomes. AI-driven algorithms have demonstrated remarkable effectiveness in measuring wound dimensions accurately and identifying key prognostic features such as tissue composition, granulation, slough, eschar and exudate, all of which are critical for determining wound burden and healing trajectory.[6] Evidence shows machine learning (ML) predictive algorithms evaluate various aspects of wound attributes—such as size, tissue composition, edges, location and exudate—to predict healing trajectories more accurately and flag deteriorating wounds early.[7]

For instance, Berezo and colleagues in 2021 found that ML algorithms could integrate multiple wound characteristics with patient data, resulting in a far more accurate prediction of delayed healing than traditional assessment methods.[8] This enhancement positions AI as a valuable resource for clinicians aiming to implement timely interventions in wound management. Similarly, Patel et al. (2024) utilized a large dataset to explore the effects of AI-driven analytics on wound care. Their findings revealed that AI models could effectively monitor wound progress, detecting subtle changes in healing patterns, thereby providing more reliable predictions than conventional models.[9]

A home health (HH) enterprise operating across 40 states has opted for the AI-powered HealingIndex™ (HI) feature (Swift Medical Inc., Toronto, Canada) – hereafter referred to as the AI Model - which leverages deep-learning and machine learning to analyze a range of wound characteristics, including wound size, tissue composition—such as granulation, slough, epithelialization and eschar—and wound exudates to predict healing trajectories as part of its digital wound care solution to improve the quality of wound care. The AI Model uses advanced deep ML algorithms to assess various factors, such as wound size, tissue types within wounds—including granulation, slough, epithelialization and eschar—and wound exudates to determine healing trajectories. Automating wound assessments and pinpointing deteriorating trends based on these factors enables early detection of declining conditions. This timely alert system allows clinicians to intervene quickly, reducing the risk of overlooked complications and ensuring better patient outcomes.

This quality improvement pilot study aimed to assess feedback from clinicians and branch managers regarding the effectiveness and functionality of this AI technology in identifying deteriorating cases, despite clinicians reporting improvements within the home health enterprise. Furthermore, the study examined clinicians' satisfaction and perspectives on the AI Model escalation reports and their perceived benefits.

Methods

Methodology

Study Design and Setting: This quality improvement pilot study took place in May 2023 at two branches of a home health enterprise specializing in in-home care services. The integration of the AI Model feature was implemented within the wound management workflow at both locations, primarily focusing on scanning wounds that clinicians had documented as showing improvement.

Wound Assessment Using HealingIndex™ (HI): The HI AI Model uses a deep learning model to analyze patient wound records, images and characteristics, generating a hazard ratio that assigns a score between 0 and 100 for each wound. A higher AI Model score signifies an increased risk of delayed healing or deterioration (Gupta et al., 2024). Wound evaluations were flagged based on the following criteria:

- A change in the AI Model score greater than 20 points over a 7- to 14-day period.
- The wound size was greater than 1 cm^2.

When these conditions were met, the individual wound was flagged as deteriorating and included in a report generated for branch managers and clinicians. This report prompted a comprehensive review of the patient's record and plan of care.

Sample and Data Collection: This pilot study was conducted in May 2023. During the pilot period, a total of 900 wound evaluations were performed across the two participating branches. Clinicians

recorded that 595 of these wounds showed improvement. Therefore, these wounds were subsequently scanned using the AI Model feature. According to the predetermined thresholds, 4.5% of the wound assessments originally recorded as improving were flagged by HI as deteriorating, indicating a need for further review by the branch managers. Clinicians feedback on each escalation report was collected.

To evaluate clinicians' perspectives on the AI Model escalation reports, an online survey was administered using SurveyMonkey. This survey consisted of seven quantitative questions aimed at gathering feedback from both clinicians and branch managers regarding their experiences with the flagged reports and the AI-driven recommendations. The survey was sent to all seven clinicians and branch managers who had received and reviewed the escalation reports during the pilot study.

The survey was available for two weeks starting on February 26, 2024, providing participants adequate time to share their feedback. All clinicians and branch managers who received the survey completed it.

Results

The survey results indicated that 85.7% of respondents were satisfied with their overall experience in receiving and using escalation reports. Also, 85.7% of participants believed the automated AI Model escalation reports to be accurate in monitoring wound progress and identifying clinical concerns. Furthermore, they agreed that these reports effectively identify potential misinterpretations of wound progress.

Additionally, 85.7% of respondents acknowledged that using the AI Model escalation reports enhances the efficiency of patient care management and improves the quality of care provided to large patient populations within the organization. They also noted that the reports facilitate better care coordination among health-care professionals and are particularly useful in identifying deteriorating wounds. Moreover, these escalation reports can prevent adverse events by ensuring timely flagging of wound deterioration.

Out of the 595 wounds recorded as having improved, 27 assessments were flagged by the AI Model as deteriorating and requiring further review by branch managers. Among these, clinicians who reviewed the cases agreed that 14 instances (52%) showed signs of deterioration rather than improvement after further examining the reports and patient records. In nine cases (33%), the wound alerts did not indicate actual deterioration but highlighted the need for quality improvements, such as better education on documentation to prevent misinterpretation. In the remaining four cases, the reviewers concluded that the deterioration flags were not sufficient to warrant a change in status in their clinical judgement.

Sample: Confirmed Case of Deterioration 1

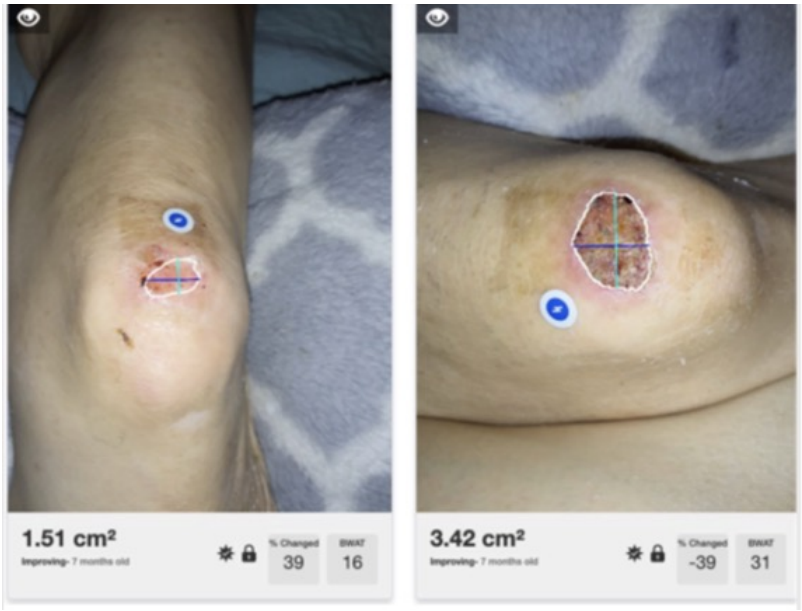

Figure 1: Images of wound marked as improving and flagged as deteriorating by the AI Model.

Figure 1 illustrates an image to the right, taken nine days after the left image, was marked as improving. The documentation noted 75%-100% soft black eschar, with wound depth obscured by necrosis, and the AI Model flagged the wound as deteriorating. Upon further review, the branch manager agreed with the signs of deterioration and suggested orders changes (antimicrobial and moisture promoting dressing for dry wound bed).

Sample: Confirmed Case of Deterioration 2

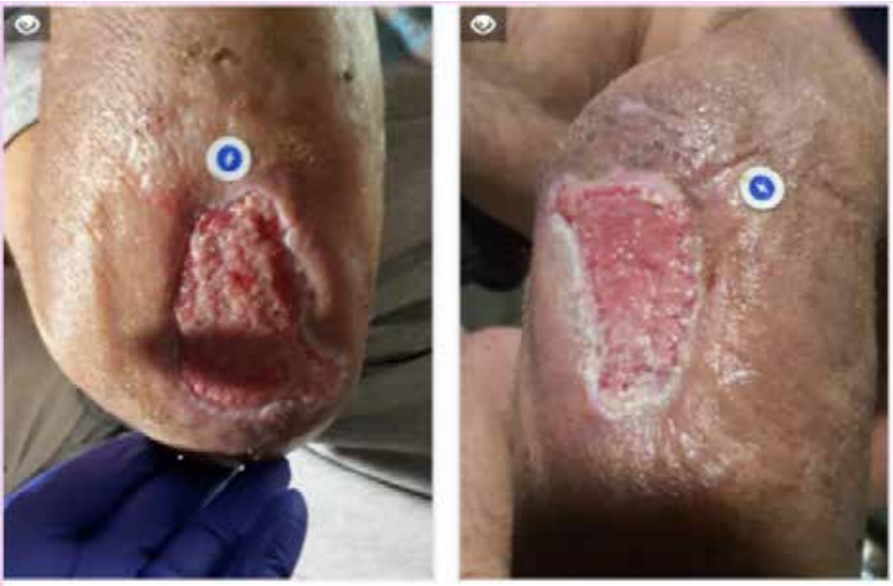

Figure 2: Images of wound marked as improving and flagged as deteriorating by the AI Model.

Figure 2 illustrates a wound that was initially marked as improving, but the AI Model escalation report flagged a deterioration. Upon review, it was found that the wound depth measurement was inaccurately documented as partial thickness instead of full thickness, and the wound edges were incorrectly documented as not attached when they were clearly attached.

Discussion

The current study assessed the acceptance and accuracy of this AI technology in identifying deteriorating wounds that had initially been recorded as improving within a home health setting. One key finding from this research is that 4.5% of the 595 wounds, which were originally classified as improving, were subsequently flagged by the AI Model system for further review due to signs of deterioration. After further evaluation by clinicians and branch managers, it was found that 52% of the cases identified by the AI Model system were indeed experiencing deterioration. This underscores the important role of AI technologies in reducing subjectivity in wound assessments. Traditional evaluation methods often depend heavily on clinicians' interpretations, leading to inconsistencies.[4] This finding aligns with Smith et al. (2021), which highlights the superior precision of AI algorithms compared to traditional assessment methods in predicting delays in healing.[8]

This percentage of identified deteriorations becomes particularly significant when applied to an enterprise with a large wound care population. For instance, in an organization managing 100,000 wound episodes each year, this data translates to around 4,500 flagged cases annually.

Among these, 2,340 cases have been identified by the AI Model solution as experiencing true deterioration, highlighting a critical opportunity for early intervention. By recognizing these cases, which might otherwise remain unnoticed, we can significantly enhance patient outcomes by preventing or reducing adverse events through timely clinical actions. Research emphasizes the importance of early detection in wound care. Untreated or overlooked wounds can lead to serious complications, including infections, increased hospitalization rates, and escalating health-care costs. [1,10]

Research indicates that the average cost of treating a chronic wound can vary significantly, ranging from around $3,000 for non-complicated cases to $50,000 or more for those with severe complications, including infections or hospital readmissions.[2,3] This highlights the substantial clinical implications and potential cost savings associated with early interventions, which are crucial for health-care systems.

If the AI tool flags 2,340 cases that are subsequently confirmed to be deteriorating and receives timely intervention, a significant reduction in complications—such as hospital readmissions, long-term care, and the need for advanced treatments—could be achieved. According to Yap and colleagues, early intervention in deteriorating wounds can prevent up to 30% of hospital readmissions.[7] Applying this statistic to our study, we could potentially avoid approximately 702 hospital readmission cases at a HH enterprise. Given that the average cost of a wound-related hospital stay is approximately $20,000.[3] the overall cost savings from these avoided hospitaliza-

tions could reach around $14.04 million.

Additionally, early identification of a deteriorating wound often allows for the prevention of its progression to more severe stages, which typically require intensive treatment. These treatments—such as surgical debridement, extended antibiotic courses, or specialized therapies—can add significant costs, ranging from $10,000 to $15,000 per patient.[3,10] If the AI tool can successfully prevent 50% of the flagged truly deteriorating cases from advancing to these severe stages, approximately 1,170 patients could avoid intensive treatments, resulting in estimated cost savings of around $11.7 million to $17.55 million to the health-care system.

Moreover, research indicates that 10-20% of chronic wounds, especially those that deteriorate, may advance to stages necessitating prolonged care if left untreated.[1,2] This long-term care can incur costs of about $30,000 annually per patient.[1] Consequently, if the AI tool can help avert long-term care needs in approximately 234 patients, it could yield additional savings of roughly $7.02 million.

The HH enterprise stands to gain significantly from indirect financial benefits associated with enhanced resource allocation and a reduction in adverse events, such as hospital readmissions. These improvements can positively influence HH performance metrics and result in higher reimbursements under value-based purchasing models, including Medicare's Home Health Value-Based Purchasing models.[11]

While Canadian data on episodic wound care spending is difficult to find, US spending illuminates the financial burdens of wound care. With an estimated 60,000 Patient-Driven Groupings Model (PDGM) episodes managed annually by a HH enterprise,[12] and Medicare reimbursements for a typical 60-day care episode ranging from $3,600 to $4,000,[13] the projected annual revenue could reach between $216 million and $240 million. Under the HHVBP model, enterprises that meet or exceed quality metrics—such as decreased readmissions and improved patient outcomes—can receive bonuses of up to 5% on their Medicare revenue.[11] For an enterprise generating $216 million to $240 million in Medicare revenue, this bonus could translate to an additional $10.8 million to $12 million annually.

Moreover, by consistently achieving high-quality outcomes, the reputation of the HH enterprise would improve, driving an increase in referrals and providing a competitive edge in the marketplace.[14]

Another key finding is the identification of flagged cases, which reveal potential areas for quality enhancement. Although these cases did not demonstrate any real deterioration of wounds, they underscored a crucial secondary benefit of the tool of enhancing the accuracy and consistency in wound documentation. This observation aligns with other research demonstrating that AI tools can bolster clinician training and support continuous quality improvement. For example, a study in *BMC Medical Education* highlighted that AI tools enrich clinical education by providing real-time feedback, enabling medical trainees to make informed decisions and enhance care accuracy.[15]

The cumulative impact of AI-driven tools extends beyond mere outcomes and cost efficiency; it significantly improves the quality of care, ultimately easing the strain on health-care resources. Our findings highlight the transformative potential of AI-driven tools like the AI Model in the field of wound care. By adeptly identifying clinical challenges and fostering continuous enhancements in documentation practices, the AI Model minimizes variability in wound care assessments, leading to more consistent and accurate evaluations. This consistency facilitates timely interventions, reduces the risk of wound deterioration and supports personalized treatment approaches, all of which contribute to better patient outcomes. Furthermore, enhanced accuracy in tracking wounds and planning interventions reduces preventable complications, hospital readmissions, and the necessity for more intensive therapies.

Limitation

While the insights obtained from the sample were valuable in evaluating the functionality of the AI tool, the results are limited to the two participat-

ing branches and may not accurately reflect the tool's effectiveness in other home health environments. This limitation hinders the ability to generalize the findings to broader health-care settings. Future research should focus on larger sample sizes and diverse patient demographics, as well as varying wound types, to further validate these findings. Additionally, although clinicians reported a general satisfaction with the AI tool, ongoing training and enhancements to documentation processes will be crucial for optimizing the effective integration of AI in wound management.

Conclusion

This study highlights the significance of AI-driven tools like HealingIndex™ in enhancing wound care management. By facilitating the detection of deteriorating wounds and improving the quality of documentation, these technologies foster better care coordination and ultimately lead to improved quality of care.

Future research should prioritize exploring the effects of AI-driven tools on wound care outcomes and their potential applications in diverse health-care environments.

Research Ethics and Patient Consent

This study adhered to the Declaration of Helsinki guidelines for research involving human subjects. The home health agency implementing the technology did not require formal research ethics board approval as it was part of a quality improvement program under the oversight of the clinical operations leadership. In the program analysis, no personal or identifiable information was accessible to the researchers.

Conflict of Interest

HTM is the Associate Director of Clinical Innovation at Swift Medical. **RDJF** is employed by Swift Medical as the Vice President of Clinical Innovation. **RG** was formerly employed by Swift Medical as Head of AI. **SW** is Chief Medical Officer at Swift Medical. **AC** is employed by Swift Medical as the Senior Vice President of Client Success.

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That's A Wrap On Chronic Wounds: Using An Advanced, Non-cytotoxic Wound Therapy Approach To Heal Venous Leg Ulcers With Compression

Presenters: Dr. Michael Stacey MBBS Doctor of Surgery FRACS and Amanda Loney BScN RN IIWCC NSWOC WOCC(C)

Canadian Consensus Statement: Management of Venous Leg Ulcers

The Canadian Consensus Statement: Management of Venous Leg Ulcers was drafted in January/ February and finalized in June 2024. Nineteen health-care providers with experience in treating venous leg ulcers (VLUs) and in new therapies were involved in the development process. This Conesus document was intended to serve as an up-to-date guide for health-care providers managing patients with VLUs. It incorporates the following key elements of VLU management:

- Clinical assessment
- Investigations
- Diagnosis
- Treatment of underlying cause (i.e., impaired calf muscle pump function)
- Management of the ulcer
- Options when not entering a healing trajectory
- Management post-ulcer healing.

The Consensus document also includes new clinical research findings for VLU management – for example, Neuromuscular Electrical Stimulation.

Neuromuscular Electrical Stimulation of the common peroneal nerve using a muscle pump activator (MPA) has been shown to improve venous and arterial flow, microcirculation and VLU healing in conjunction with standard of care.[1] The Consensus document also highlights the T.I.M.E. principle (i.e., tissue, infection, moisture, edge) for wound bed preparation and outlines an algorithm for advanced therapies in progressive steps when VLUs are not healing as expected despite optimal care. These sequential steps include addressing biofilm and bacteria; reducing protease activity; improving the wound bed; adding growth promoting factors; and addition of new cells.[2]

Management Of Venous Leg Ulcers Using The T.I.M.E. Principle

The Consensus document outlines the wound bed preparation strategies for VLUs. These strategies are founded on the aforementioned T.I.M.E. principle. The recommendations are as follows:

- **Cleanse the ulcer and surrounding skin** using an antimicrobial solution (e.g., hypochlorous acid)
- **Debride devitalized tissue** if vascular perfusion is normal
- **Treat infection in deep and surrounding tissue** with antibiotics and antimicrobial dressings
- Apply a dressing that ensures **adequate moisture balance**
- **Manage pain** if present (i.e., may need to reduce or delay compression until pain is reduced)
- **Treat surrounding skin** irritation or dermatitis; protect surrounding skin from excess exudate; and maintain good skin care
- **Measure and re-evaluate wound** with a consistent method weekly or at each visit if seen less often.

Treat The Cause – Compression Therapy

Compression therapy is one of, if not the, most important component of VLU management as it addresses the underlying causes of the disease. Practitioners must first evaluate the patient's arterial status prior to applying compression. There are various modes of compression therapy, including but not limited to multi-layer bandaging systems and adjustable compression garments. Practitioners must always remember that when indicated, any compression is better than no compression in the management of VLUs. Also, the best compression system is one that the patient can tolerate and will actually wear.

The JOBST® Compri2 is a two-layer, short stretch bandaging system. It has a high working pressure (for when the patient ambulates) and a low resting pressure. It has a long wear time (seven days) and can be repositioned. There are clinical indicators for ease of application. These features enhance patient independence and improve adherence. The JOBST® Compri2 lite offers a lower compression for those unable to tolerate or wear optimal compression.

The JOBST® FarrwoWrap® is an adjustable compression garment that can be used for the management and prevention of VLUs. It is a compression system made with special short-stretched bands of multi-layered fabrics. It provides sustained resting compression and augments the calf muscle pump to deliver high working pressure. It is easy to apply and re-apply, which promotes patient independence and improve adherence.

Addressing the T(issue) of T.I.M.E. - Cutimed® DebriClean®

Wound hygiene (e.g., cleansing and debridement when appropriate) is essential to wound healing and the management of VLUs. The Cutimed®

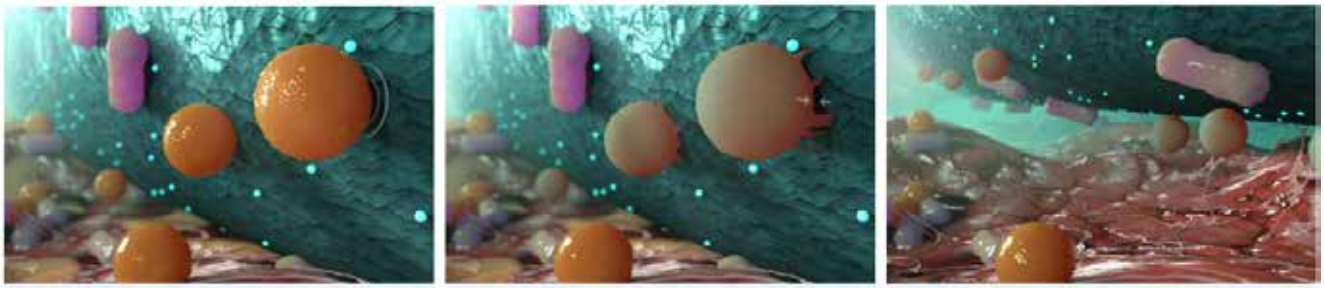
DebriClean® is an innovative product for wound debridement. It consists of both gentle looped monofilaments and more abrasive looped monofilaments (Product Update - The old version of Cutimed Debriclean had Blue and white sides, the new & upgraded version is white with an abrasive side and soft side separated by a blue line).[3] It can absorb bacteria and remove slough from the wound bed. It allows for gentle, mechanical debridement of the wound bed and peri-wound skin. Practitioners can safely "scrub" the wound as part of wound hygiene practices without the use of sharps.

Addressing the I(nfection) of T.I.M.E. - Cutidmed® Sorbact® -

Cleansing of the wound and peri-wound skin and debridement of devitalized tissue when appropriate can aid in the management of bacteria burden. Antimicrobial dressings can also be used to lower bacterial burden and prevent wound infections. Cutimed® Sorbact® is a non-cytotoxic antimicrobial dressing. The Sorbact® technology binds bacteria with a purely physical mode of action (i.e., hydrophobic interaction). The dressing removes bacteria without releasing active substances into the wound – development of antimicrobial resistance is not expected and there is no risk of skin allergies.

Addressing the M(oisture) of T.I.M.E. - Cutimed® Sorbion® Border and Sorbion® Sachet XL

VLUs are typically exudative due to the underlying disease processes. Compression therapy, an essential treatment for VLUs, can further increase wound exudate. Excessive exudate can cause wound and peri-wound maceration, slowing down wound closure. It promotes bacterial growth and increase the risk of infections as well. Not to be neglected, excessive wound exudate can affect the patient's quality of life. The Cutimed® Sorbion® Border and Sorbion® Sachet XL are engineered with a hydration response® technology. They contain hydroactive gel forming polymers that adapt to varying levels of exudate. These dressings can maintain a moist wound healing environment and facilitate soft (autolytic) debridement. They have excellent fluid absorbency and retention under compression – this extends the wear time and allows the wound to rest (i.e., undisturbed wound healing).



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Inhibit
Bacteria are irreversibly bound, and growth is inhibited. Development of bacterial or fungal resistance is not expected.

Remove
Bound bacteria, fungi and endotoxins are safely removed.

Addressing the E(dge) advancement of T.I.M.E. - Hydrofera blue CLASSIC®

For proper healing to occur, careful attention must be paid to not just the wound bed but the edge of the wound. When applied slightly beyond the margins of the wound, Hydrofera blue CLASSIC® can help flatten the wound edge and facilitate epithelial migration. This dressing can remove debris from the wound bed and wick moisture from the wound bed and peri-wound skin. It is non-cytotoxic and has antimicrobial properties.

Maintenance Compression – Edema Management Made Simple for Self-Care

Patients must have lifelong compression therapy to prevent recurrence of VLUs. Ideally, patients should wear fitted compression stockings (below knee in most cases). The JOBST® UlcerCare™ 2-in-1 system is available in ready-to-wear or made-to-measure versions.[4] It is a two part system that provides 40 mmHg of graduated compression.[4] It contains a silky liner and a low-friction stocking for easy donning.[4] It is compatible with common footwear and is less bulky than conventional compression bandages. These features support patient independence and improve adherence. In addition to maintenance compression therapy, practitioners must reinforce patient education regarding venous disease and prevention of ulcer recurrence. Patients should also be encouraged to ambulate and perform calf muscle contraction exercises.

Dr. Michael Stacey MBBS Doctor of Surgery FRACS is a vascular surgeon who came to Canada from Australia in 2014 as the Surgeon in Chief at Hamilton Health Sciences and Professor in the Department of Surgery at McMaster University. He was the Chief Medical Executive and Executive Vice President Academic at Hamilton Health Sciences until mid-2023. He completed his medical degree at the University of Western Australia, is a Fellow of the Royal Australasian College of Surgeons, and is licensed with the College of Physicians and Surgeons of Ontario.

Amanda Loney BScN RN IIWCC NSWOC WOCC(C) earned a BScN from the University of Western Ontario, acquired her WOCN designation from Albany Medical Center in New York and has completed the IIWCC at the University of Toronto Amanda has spent the last 23 years specializing in the areas of wound, ostomy, and continence and is currently a Certified Nurse Specialized in Wound, Ostomy and Continence. In her role with Bayshore Home Care Solutions, as well as in her private practice, Amanda is known as a passionate educator, consultant, and for her extensive clinical knowledge.

References:

1. Stacey MC, Sibbald RG, Evans R. Continuous muscle pump activation by neuromuscular electrical stimulation of the common peroneal nerve in the treatment of patients with venous leg ulcers: A position paper. Int Wound J. 2024 Sep;21(9):e70040. doi: 10.1111/iwj.70040. PMID: 39223104; PMCID: PMC11368661.
2. Stacey MC. Biomarker directed chronic wound therapy - A new treatment paradigm. J Tissue Viability. 2020 Aug;29(3):180-183. doi: 10.1016/j.jtv.2019.12.006. Epub 2019 Dec 20. PMID: 32007337.
3. Back to Basics: Debridement – Guide to wound bed preparation. Essity.
4. "UlcerCare." n.d. Jobst. Accessed November 2, 2024. https://www.jobstcanada.com/products/medical-compression/venous-solutions/jobst-ulcercare.html.

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Peripheral Arterial Disease And Diabetes In Canada: Is Health Care Really Equitable?

By Wendy L Bowles MSN NP F and Samantha Holloway SFHEA MSc RN

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Introduction

In Canada's current health-care system, the intersection of patient expectations and outcomes has created a situation of inequity, especially for those with peripheral arterial disease and diabetes. Phillips et al.[1] stated that demands on the health systems were likely to increase due to expanding wound care needs and other chronic conditions. Similarly, Gottrup[2] noted that non-healing wounds accounted for a significant portion of health-care budgets. Today, health-care demands are rapidly outstripping resources due to ageing populations with increasing multimorbidity,[3] requiring the examination of our health systems.[4] If health care is to be sustainable, it needs to focus on value, stewardship and equity.[5]

Peripheral arterial disease (PAD) has high morbidity and mortality[6,7] and is often linked to other highly complex diseases such as diabetes,[8,9] cardiovascular disease and stroke.[10] PAD is associated with high resource use and costs related to interventions, medical treatments and chronic wounds. The worldwide prevalence of PAD is over 200 million individuals,[8] with an increase of 25% over the past decade alone.[6] Additionally, diabetes and PAD are increasing in prevalence, creating a pandemic for the 21st century.[11] PAD, even without diabetes, is associated with significant inequities resulting in disparate outcomes.[12,13] If populations, including people with multimorbidity, are to be ensured health and health-related quality of life (HRQoL), a culture shift is needed towards value-based health care and stewardship.[4,11] This article will examine the realities of certain Canadian populations with PAD and diabetes in the 21st century, their outcomes and some strategies to bring Canada back to our original health-care principles for all Canadians, not just the few.

- In Canada health-care demands are currently outstripping resources
- Chronic diseases are associated with high resource use and costs
- Diabetic Foot Ulcers are the most common cause of hospitalization for those with diabetes
- PAD combined with diabetes results in a fourfold increase in minor and major limb amputations
- The elderly and Indigenous are populations in Canada with high rates of amputations secondary to PAD and diabetes

The Canadian Health System

Canada is a vast country with approximately 39,000,000 people in 13 provinces and territories. It has a universal medical system known, informally, as medicare, which is taxation based, publicly funded and, generally, administered by individual provinces and territories. This is in contrast to the USA, which has the most expensive health care in the world,[14] covering a population of just over 340,000,000, nearly ten times that of Canada. Medicare's founding principle was access for all based on need rather than ability to pay.[15] The system originated in 1947 in the province of Saskatchewan[16] and was adopted country-wide by the 1960s, becoming federal law in 1984 via the Canada Health Act.[5,17] This act declared that health care should be funded for medically necessary care, hospitals, diagnostics and physician services.[18,19] Despite its principles, it has not been without controversy. For example, it has been criticized for only covering a narrow range of services, producing long wait lists for elective procedures and being more decentralized than universal[20,21] This last point denotes that funds are transferred from the federal budget to the provinces/territories, which are ultimately responsible for health-care delivery.[22]

Further, the system has profound inequities, especially regarding vulnerable populations such as Indigenous and immigrant populations[23,24] and those of low socio-economic status (SES).[21] These populations have the greatest health-care burden related to PAD, diabetes and their subsequent comorbid conditions.[6,8,12]

Epidemiology Of Peripheral Arterial Disease And Diabetes

PAD is increasing worldwide,[25] for example, its prevalence is as high as 50% in older people with diabetes and is associated with several co-morbid conditions. When combined, PAD and diabetes result in a four-fold increase in foot complications including minor and major limb events (MALE).[8,12,13,26] Contrastingly, while the prevalence of diabetes and PAD are escalating, the rate of lower extremity amputations (LEA) declined in the late 20th century.[27] However, the last decade has shown LEA rates plateauing or escalating, highlighting a possible resurgence of LEAs in those with PAD and diabetes.[27,28] Currently in Canada,[7] 405 LEA are preformed each year with primary etiologies of diabetes and PAD.[29] In fact, diabetic foot ulcers (DFU) are the most common cause of hospitalization associated with diabetes and 85%

of all LEAs in those with diabetes are preceded by a DFU.[30] The potential effect on the system will be profound due to the costs, both direct and indirect, of amputation, and these costs will continue to rise.[10] A 2015 cost analysis predicted that, by 2023, diabetes would cost over $16.9 billion, 17% of Canada's 2023 health-care budget.[31]

The Canadian Institute for Health Information (CIHI) provides disease and health statistics for Canada; however, statistics specific to PAD are not well reported. Nevertheless, we know that in 2022, there were 5,579,200 people with hypertension and 2,372,700 people with diabetes. In contrast, only 160,441 people over the age of 18 self-reported physical activity of 150 minutes per week.[32] Due to the lack of Canadian-specific data, figures from the USA are often used to determine disease effects, costs and resource allocation. However, there are many glaring differences between Canada and the USA, including race, SES, and education;[14,15,33,34] therefore, these data must be interpreted with caution. In the USA, the incidence of PAD is highly impacted by race, geography, SES, education level and income.[8,35]

The American Heart Association (AHA) describes atherosclerosis (AS) as a, "chronic, reparative, inflammatory process that affects the arterial tree systematically".[8] PAD, as a consequence of AS and associated with diabetes, is highest in marginalized demographics[6,10,35] and is associated with ageing, with a prevalence of over ten percent in those aged 60-70 and even higher in those over 80.[7]

A pivotal review of Canadian ageing and health care by Wister and Speechley[20] examined the health-care system and its demands. They identified tensions in three areas: increasing life expectancy with concurrent multimorbidity, interrelationships of the Baby Boomer (1945-1965) generation's health status and health-care improvements and, finally, the disconnect between health-care demands, system efficiencies and patient expectations. The authors identified health costs in 1975 as nine billion, which increased to 148.2 billion in 2013, far exceeding prior projections. They also recognized that older adults consume the majority of those costs, with those over 65 years old (15% of the population in 2011) responsible for 44% of health-care costs. These authors cited five leading contributors to health-care costs in Canada: smoking, alcohol use, lack of exercise, obesity and stress. In looking at the boomer generation, they found that while these individuals had lower smoking and alcohol consumption, they were more sedentary and had more obesity and stress. This resulted in an improvement in some costs, i.e. for lung and liver disease, but increases in others, such as cardiovascular diseases and diabetes.[20] Moreover, in an article by Sun and Rieder,[36] chronic wounds, often associated with PAD and diabetes, were a significant cause of personal stress.

In Canada, much of the research regarding PAD, health-care demands and disparities has been done in vulnerable and rural populations. For example, in a retrospective review by Shah et al.,[9] the authors found that more than 80% of LEAs in Canada were a result of diabetes and were preceded by non-healing wounds. In Ontario, they found that First Nations (FN) people, also referred to as Indigenous, have a high and escalating prevalence of diabetes. Despite similar rates of MALE for Indigenous and nonindigenous people, Indigenous individuals still had higher rates of LEAs despite age or gender. The authors used CIHI data for Ontario, excluded non-PAD-related amputations and followed these people forward for all-cause mortality finding that they also had a higher rate of mortality than non-indigenous people with LEAs. The median survival of FN people after LEAs was 3.5 years, compared to 4.1 years for nonindigenous Ontarians.[9]

In another Canadian study, using a retrospective cohort design from a purely geographic perspective, the authors found that LEA occurred most often in people living in a rural location (northern Ontario).[37] Specifically, there was an inverse relationship between the number of chiropodists and podiatrists per 100,000 population and amputation rates. Moreover, access to vascular specialists supported lower rates of LEAs. These findings highlight the existence of health-care inequities for people with PAD and diabetes related complications, especially in non-urban areas. The

authors identified three strategies to best address these inequities: screening those with diabetes for PAD, improving access to specialists and timely revascularization when required.

Referrals to specialist care in Canada vary greatly.[38] However, strategies to address these inequalities could include virtual care, satellite multidisciplinary clinics and preventative initiatives to lessen the burden of disease, thereby lessening the burden on the system.[39,40]

Equity And Health-care Demands

Worldwide, amputations related to diabetes occur at a rate of one every 30 seconds.[12] In a study by de Mestral et al.,[37] the authors undertook a complex analysis of health-care services in Ontario, focusing on LEAs related to diabetes and PAD. By linking databases to best reflect the population and using a detailed costing analysis, they were able to identify regional variations in outcomes and health-care provision. This study also showed that Ontarians living in remote regions, who are often Indigenous, did not have access to the same health care as regions where amputation rates were lower. However, they were unable to quantify how many LEAs may have been avoided if individuals had lived in a region with better access to care. Another limitation of the study was the inability to adjust for confounding variables, such as smoking, comorbid conditions and SES.

Further, the study by Shah et al.,[9] which also focused on an Indigenous population, found that despite the region, this population had a greater prevalence of diabetes compared to nonindigenous Ontarians. Their data corroborated the existence of differences in the provision of and access to health care between urban and rural settings, despite ethnicity. They also showed that while the rate of revascularization procedures was not dissimilar, LEA rates were higher in people of Indigenous origin. This was regardless of region, potentially supporting the concept that race alone may affect the incidence of atherosclerosis. However this study's limitations were a lack of SES data, its retrospective methodology and that it did not distinguish between diabetes types. Ultimately, the conclusion was that health inequities related to the care of diabetes and PAD exist for Indigenous Canadians. This inequity is likely associated with a decreased HRQoL. Despite there being only a few studies on PAD and HRQoL, those that exist have shown that PAD produces a significant decline in HRQoL.[41,42]

Health literacy also plays a part in addressing equity, with a person's ability to access accurate, understandable information either supporting or detracting from their ability to satisfy their expectations.[43] In one article, health literacy was noted as essential for managing illness and promoting self- agency towards wellness.[44] In another article by Wister and Speechley,[20] these authors also recognized the role of health literacy and education as being protective of health while expectations and a sense of entitlement potentially increased system stressors. However, they contrastingly noted that the boomer cohort was highly heterogeneous and included many without health literacy or education. Vomos et al.[44] noted that nine out of ten Canadian seniors were unable to interpret, understand and participate in health-care decisions on their own. By addressing these issues, both HRQoL and equity can be impacted to help manage health-care demands and improve HRQoL.

Patient Expectations And HRQoL

People with PAD report fatigue, loss of activity, social isolation, loss of productivity and depressive moods.[45,46] Patient-related outcome measures (PROMs) are a powerful way to translate symptoms into understandable data.[47] PROMs have been utilized to help gain the patient's perspective and capture HRQoL data, leading to improved guidelines and registry information related to PAD.[41,48] Additionally, a therapeutic empathic approach by clinicians has been shown to impact patient satisfaction and further improve HRQoL.[49-51] These strategies to include patients in research and decision making, especially those with PAD and diabetes, can profoundly impact their HRQoL.[7,45]

Amputation-free survival (AFS) is an important outcome for HRQoL in persons with PAD and diabetes, as AFS is associated with decreased

mortality and improved productivity.[10] However, in a multicentre retrospective cohort analysis, the authors included no PROMs.[52] Despite the authors going into extensive detail on definitions, guidelines, treatments, and outcomes, the lack of PROMs limits the validity of their results. Research including PROMs in this group of patients could ensure that they, not just clinicians, see outcomes as successful. Moreover, engaged patients are often more likely to be invested in outcomes, which can reduce costs associated with late diagnoses and complications.

Strategies For Sustainability

While it is challenging to calculate costs associated with health care for PAD and diabetes in Canada, research has shown that prevention would be less expensive than treatment. In the study by de Mestral et al.,[37] total costs one year prior to amputation were between $51,189 and $74,532 per person and by region (2017 dollars), higher than those for the average Canadian with PAD and diabetes who did not have an amputation.[53] These costs included hospital and home care, procedures and diagnostics, physician fees, rehabilitation, allied care, assistive devices and funded podiatry. These authors proposed that multidisciplinary teams could not only prevent LEAs, but also contain costs with early recognition and standardization of care.

PAD and diabetes create a heavy burden on the health-care system, necessitating early recognition and preventative strategies.[8,54] Guidelines were first issued in the 1980s to aid clinicians and patients in decisions about appropriate care for specific conditions such as diabetes.[55,56] The uptake of guidelines, however, was not standardized,[35] and the USA and the United Kingdom introduced a variety of methods to push for their use.[57] As a result of such initiatives, guidelines have evolved and become a standard part of many practices. Today, organizations such as the AHA,[8] the Canadian Diabetes Association,[58,59] Wounds Canada,[60] the World Federation of Vascular Societies[61] and the International Wound Group on the Diabetic Foot,[40,62] have all created evidence-informed guidelines and/or best practice recommendations to address the burden of PAD and diabetes. Ideally, the use of these will improve practice and contain costs. The standardization and utilization of these guidelines are needed to ensure the sustainability of the Canadian health-care system. Nevertheless, in Canada, only Ontario, Alberta, British Columbia and Quebec have undertaken major system reforms, with varying degrees of effectiveness,[5] and guidelines are still not standardized into practice. In 2011, a review of primary care reforms in Ontario identified little value for dollars spent.[22] In contrast, longer term data from the same review showed improved access to primary care teams and diabetes screening, suggesting time is needed to indeed see effect. Supporting this, patient-reported experience did not improve in the time frame of the study. HRQoL, value-based care, and standardization are all needed to create a sustainable health-care system in Canada today and into the future.

Conclusion

PAD and diabetes, their comorbidities and complications, such as hard to heal wounds, result in significant health-care expenditure. Determining actual costs beyond just efficacy, is needed to determine value.[63] Beyond redesigning the health-care system, a culture shift is needed as the demands on the system are neither unidirectional nor easily predictable. Lack of improvements in health literacy, education and SES in some demographic groups, are creating an increasing divide between those with and those without these benefits. This is causing a convergence of multidimensional demands stressing the system.[64,65] Health-care systems need to be proactive and responsive, focusing on prevention, collaboration and efficiency while not letting quality suffer.[20,35,63] PAD, diabetes and their subsequent comorbid conditions, including wounds, are, and will be, drivers of these system demands.[8,66] Early diagnosis and management that takes the patient's experience and knowledge into account requires system redesign. The original Canada Health Act needs to evolve to achieve sustainability. This must involve multi-

disciplinary teams, the use of evidence-informed guidelines, improving health literacy and ensuring equitable access for all.[8,10,15]

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References

1. Phillips CJ, Humphreys I, Fletcher J, Harding K, Chamberlain G, Macey S. Estimating the costs associated with the management of patients with chronic wounds using linked routine data. Int Wound J. 2016 Dec;13(6):1193-1197.
2. Gottrup F, Dissemond J, Baines C, Frykberg R, Jensen PØ, Kot J, et al. Use of oxygen therapies in wound healing: focus on topical and hyperbaric oxygen treatment. Journal of wound care. 2017 May 1;26(Sup5):S1-43.
3. Sakib MN, Shooshtari S, St John P, Menec V. The prevalence of multimorbidity and associations with lifestyle factors among middle-aged Canadians: an analysis of Canadian Longitudinal Study on Aging data. BMC Public Health. 2019 Feb 28;19(1):243.
4. Gray M, Rae M. Population health management. United Kingdom: Oxford Press; 2022.
5. Hutchison B, Levesque JF, Strumpf E, Coyle N. Primary health care in Canada: systems in motion. Milbank Q. 2011 Jun;89(2):256-88.
6. Eid MA, Mehta KS, Goodney PP. Epidemiology of peripheral artery disease. Semin Vasc Surg. 2021 Mar;34(1):38-46.
7. Arman EB, Augustin M, Mohr N, Debus SE, Breuer P, Blome C. Development and validation of a disease-specific quality of life questionnaire for patients with peripheral artery disease (QOLPAD). J Patient Rep Outcomes. 2022 May 27;6(1):54.
8. Allison MA, Armstrong DG, Goodney PP, Hamburg NM, Kirksey L, Lancaster KJ, et al. Health disparities in peripheral artery disease: a scientific statement from the american heart association. Circulation. 2023 Jul 18;148(3):286-296.
9. Shah BR, Frymire E, Jacklin K, Jones CR, Khan S, Slater M, et al. Peripheral arterial disease in Ontario First Nations people with diabetes: a longitudinal population-based cohort study. CMAJ Open. 2019 Dec 10;7(4):E700-E705
10. McDermott KM, Srinivas T, Abularrage CJ. Multidisciplinary approach to decreasing major amputation, improving outcomes, and mitigating disparities in diabetic foot and vascular disease. Semin Vasc Surg. 2023 Mar;36(1):114-121.
11. Gray M. How to get better value healthcare. 4th ed. United Kingdom: Oxford Press; 2023.
12. de Jager E, Gunnarsson R, Ho YH. Disparities in Advanced peripheral arterial disease presentation by socioeconomic status. World J Surg. 2022 Jun;46(6):1500-1507.
13. McDermott MM, Ho KJ, Alabi O, Criqui MH, Goodney P, Hamburg N, et al. Disparities in diagnosis, treatment, and outcomes of peripheral artery disease: JACC scientific statement. J Am Coll Cardiol. 2023 Dec 12;82(24):2312-2328.
14. Osborn R, Squires D, Doty MM, Sarnak DO, Schneider EC. In new survey of eleven countries, us adults still struggle with access to and affordability of health care. Health Aff (Millwood). 2016 Dec 1;35(12):2327-2336.
15. Forest P-G, Stoltz L. The CHA And Beyond: The Role Of Legislation In National Reform In Health Care. The School of Public Policy Publications. 2022.
16. Raza D, Jabbar A, Ansloos J, Hope K, Marchildon G. Medicare 2.0. Broadbent Institute; 2020. Available from: https://d3n8a8pro7vhmx.cloudfront.net/broadbent/pages/7800/attachments/original/1602191312/Medicare2.0_-_Report.pdf
17. Ministry of Justice. The Canada health act. In: Canada RSo, editor. Ottawa (CA): Ministry of Justice; 1984.
18. Allin S, Rudoler D. The Canadian Health Care System. International Profiles of Health Care Systems. 2020:27.
19. Tikkanen R, Osborn R, Mossialos E, Djordjevic A, Wharton G. International Profiles Of Health Care Systems. Commonwealth Fund; 2020. Available from: https://www.commonwealthfund.org/international-health-policy-center/system-profiles
20. Wister AV, Speechley M. Inherent tensions between population aging and health care systems: what might the Canadian health care system look like in twenty years? Journal of Population Ageing. 2015 Dec;8:227-43.
21. Martin D, Miller AP, Quesnel-Vallée A, Caron NR, Vissandjée B, Marchildon GP. Canada's universal healthcare system: achieving its potential. Lancet. 2018 Apr 28;391(10131):1718-1735.
22. Marchildon GP, Allin S, Merkur S. Canada: health system review. Health Systems in Transition. 2020;22(3).
23. Antonipillai V, Baumann A, Hunter A, Wahoush O, O'Shea T. Health inequity and "restoring fairness" through the canadian refugee health policy reforms: a literature review. J Immigr Minor Health. 2018 Feb;20(1):203-213.
24. Nguyen NH, Subhan FB, Williams K, Chan CB. Barriers and mitigating strategies to healthcare access in indigenous communities of canada: a narrative review. Healthcare (Basel). 2020 Apr 26;8(2):112.
25. Ricco JB, Roiger RJ, Schneider F, Guetarni F, Thaveau F,

Illuminati G, et al. Editor's choice - infra-inguinal endovascular revascularisation and bypass surgery for chronic limb threatening ischaemia: a retrospective European multicentre cohort study with propensity score matching. Eur J Vasc Endovasc Surg. 2023 Oct;66(4):531-540.
26. Brechow A, Slesaczeck T, Münch D, Nanning T, Paetzold H, Schwanebeck U, et al. Improving major amputation rates in the multicomplex diabetic foot patient: focus on the severity of peripheral arterial disease. Ther Adv Endocrinol Metab. 2013 Jun;4(3):83-94.
27. McDermott KM, Bose S, Keegan A, Hicks CW. Disparities in limb preservation and associated socioeconomic burden among patients with diabetes and/or peripheral artery disease in the United States. Semin Vasc Surg. 2023 Mar;36(1):39-48.
28. Dua A, Rothenberg KA, Lee JJ, Gologorsky R, Desai SS. Six-month freedom from amputation rates and quality of life following tibial and pedal endovascular revascularization for critical limb ischemia. Vasc Endovascular Surg. 2019 Apr;53(3):212-215.
29. Sureshkumar A, Payne MW, Viana R, Hunter SW. An eight-year analysis of participant characteristics at admission to inpatient prosthetic rehabilitation following a lower limb amputation: a Canadian perspective. Disabil Rehabil. 2024 Jul;46(14):3037-3047.
30. Moore Z, Avsar P, Wilson P, Mairghani M, O'Connor T, Nugent L, Patton D. Diabetic foot ulcers: treatment overview and cost considerations. J Wound Care. 2021 Oct 2;30(10):786-791.
31. Hopkins RB, Burke N, Harlock J, Jegathisawaran J, Goeree R. Economic burden of illness associated with diabetic foot ulcers in Canada. BMC Health Serv Res. 2015 Jan 22;15:13.
32. 32. Expert Advisory Group. CIHI Hospital Frailty Risk Measure (HFRM). Canadian Institute of Health Information; 2023. Available from: https://www.cihi.ca/sites/default/files/document/cihi-hospital-frailty-risk-measure-meth-notes-en.pdf
33. Lalonde M. New perspective on the health of Canadians: 28 years later. Rev Panam Salud Publica. 2002 Sep;12(3):149-52.
34. Terris M. Newer perspectives on the health of Canadians: beyond the Lalonde report. The Rosenstadt lecture. J Public Health Policy. 1984 Sep;5(3):327-37.
35. Barnes JA, Eid MA, Creager MA, Goodney PP. Epidemiology and risk of amputation in patients with diabetes mellitus and peripheral artery disease. Arterioscler Thromb Vasc Biol. 2020 Aug;40(8):1808-1817.
36. Sun MD, Rieder EA. Psychosocial Stress and Mechanisms of Skin Health: A Comprehensive Update. J Drugs Dermatol. 2021 Jan 1;20(1):62-69.
37. de Mestral C, Hussain MA, Austin PC, Forbes TL, Sivaswamy A, Kayssi A, et al. Regional health care services and rates of lower extremity amputation related to diabetes and peripheral artery disease: an ecological study. CMAJ Open. 2020 Oct 27;8(4):E659-E666.
38. Liddy C, Moroz I, Affleck E, Boulay E, Cook S, Crowe L, et al. How long are Canadians waiting to access specialty care? Retrospective study from a primary care perspective. Can Fam Physician. 2020 Jun;66(6):434-444.
39. Agarwal P, Kithulegoda N, Umpierre R, Pawlovich J, Pfeil JN, D'Avila OP, et al. Telemedicine in the driver's seat: new role for primary care access in Brazil and Canada: The Besrour Papers: a series on the state of family medicine in Canada and Brazil. Can Fam Physician. 2020 Feb;66(2):104-111.
40. Bus SA, Sacco ICN, Monteiro-Soares M, Raspovic A, Paton J, Rasmussen A, et al. Guidelines on the prevention of foot ulcers in persons with diabetes (IWGDF 2023 update). Diabetes Metab Res Rev. 2024 Mar;40(3):e3651.
41. Raja A, Spertus J, Yeh RW, Secemsky EA. Assessing health-related quality of life among patients with peripheral artery disease: A review of the literature and focus on patient-reported outcome measures. Vasc Med. 2021 Jun;26(3):317-325.
42. Vogel TR, Braet DJ, Kruse RL, Bath J, Wang J, Gosch K, et al. Level of disease and association with health status in patients presenting with claudication from the PORTRAIT registry. J Vasc Surg. 2020 Dec;72(6):2017-2026.
43. Jimenez C. Health literacy and public health. Canadian Public Health Association. 2018 Jun 4. Available from: https://www.cpha.ca/health-literacy-and-public-health
44. Vamos S, Okan O, Sentell T, Rootman I. Making a case for "education for health literacy": an international perspective. Int J Environ Res Public Health. 2020 Feb 24;17(4):1436.
45. Prévost A, Lafitte M, Pucheu Y, Couffinhal T. Education and home based training for intermittent claudication: functional effects and quality of life. Eur J Prev Cardiol. 2015 Mar;22(3):373-9.
46. Larsen ASF, Reiersen AT, Nådland IH, Wesche J. Self-reported health status and disease-specific quality of life one year after treatment for peripheral arterial disease in clinical practice. Health Qual Life Outcomes. 2020 Jul 17;18(1):235
47. Wagle NW. Implementing patient-reported outcome measures. NEJM Catalyst. 2017 Oct 12;3(5).
48. Poku E, Duncan R, Keetharuth A, Essat M, Phillips P, Woods HB, et al. Patient-reported outcome measures in patients with peripheral arterial disease: a systematic review of psychometric properties. Health Qual Life Outcomes. 2016 Nov 24;14(1):161.
49. Norvell DC, Turner AP, Williams RM, Hakimi KN, Czerniecki JM. Defining successful mobility after lower extremity amputation for complications of peripheral vascular disease and diabetes. J Vasc Surg. 2011 Aug;54(2):412-9.
50. Keshtkar L, Madigan CD, Ward A, Ahmed S, Tanna V, Rahman I, et al. The effect of practitioner empathy on patient satisfaction : a systematic review of randomized trials. Ann Intern Med. 2024 Feb;177(2):196-209.
51. Howick J, Bizzari V, Dambha-Miller H. Therapeutic empathy: what it is and what it isn't. J R Soc Med. 2018 Jul;111(7):233-236
52. Morisaki K, Matsuda D, Guntani A, Kinoshita G, Yoshino S, Inoue K, et al. Infra-inguinal bypass surgery vs endovascular revascularization for chronic limb-threatening ischemia in average-and high-risk patients. Journal of Vascular Surgery. 2024 Mar 24.

53. National Health Expenditure Expert Advisory Group. National health expenditure trends 1975 to 2019. Canadian Institute for Health Information; 2019. Available from: https://www.cihi.ca/sites/default/files/document/nhex-trends-narrative-report-2019-en.pdf
54. Li B, Lin A, Huang J, Xie J, Liu Q, Yang C, et al. Total contact casts versus removable offloading interventions for the treatment of diabetic foot ulcers: a systematic review and meta-analysis. Front Endocrinol (Lausanne). 2023 Sep 26;14:1234761
55. Shekelle P, Woolf S, Grimshaw JM, Schünemann HJ, Eccles MP. Developing clinical practice guidelines: reviewing, reporting, and publishing guidelines; updating guidelines; and the emerging issues of enhancing guideline implementability and accounting for comorbid conditions in guideline development. Implement Sci. 2012 Jul 4;7:62.
56. Woolf S, Schünemann HJ, Eccles MP, Grimshaw JM, Shekelle P. Developing clinical practice guidelines: types of evidence and outcomes; values and economics, synthesis, grading, and presentation and deriving recommendations. Implement Sci. 2012 Jul 4;7:61.
57. Andrews EJ, Redmond HP. A review of clinical guidelines. Journal of British Surgery. 2004 Aug;91(8):956-64.
58. Canadian Diabetes Assn. Clinical practice guidelines for the prevention and management of diabetes in Canada. Can J Diabetes. 2008;32:S32.
59. Canadian Diabetes Assn. Clinical practice guidelines for the prevention and management of diabetes in Canada. Can J Diabetes. 2018;42:S1-S325.
60. Botros M, Kuhnke J, Embil J, Goettl K, Morin C, Parsons L, et al. Prevention and management of diabetic foot ulcers. Wounds Canada. 2019.
61. Conte MS, Bradbury AW, Kolh P, White JV, Dick F, Fitridge R, et al. Global vascular guidelines on the management of chronic limb-threatening ischemia. Eur J Vasc Endovasc Surg. 2019 Jul;58(1S):S1-S109.e33.
62. Monteiro-Soares M, Russell D, Boyko EJ, Jeffcoate W, Mills JL, Morbach S, et al. Guidelines on the classification of diabetic foot ulcers (IWGDF 2019). Diabetes Metab Res Rev. 2020 Mar;36 Suppl 1:e3273.
63. Carter MJ. Health economics information in wound care: the elephant in the room. Adv Wound Care (New Rochelle). 2013 Dec;2(10):563-570.
64. Chan CWT, Gogovor A, Valois MF, Ahmed S. Age, gender, and current living status were associated with perceived access to treatment among Canadians using a cross sectional survey. BMC Health Serv Res. 2018 Jun 19;18(1):471.
65. Law S, Ormel I, Babinski S, Kuluski K, Quesnel-Vallée A. "Caregiving is like on the job training but nobody has the manual": Canadian caregivers' perceptions of their roles within the healthcare system. BMC Geriatr. 2021 Jun 30;21(1):404
66. Shishehbor MH, Aronow HD, Bartholomew JR, Beckman JA, Froehlich JB, Lookstein R, et al. Vascular specialist response to medicare evidence development coverage advisory committee (MEDCAC) panel on peripheral artery disease of the lower extremities. Catheter Cardiovasc Interv. 2016 Jun;87(7):1181-6

Mölnlycke Sponsored Learning:

Do Not Disturb: The Power Of Undisturbed Wound Healing

Presenters: Michelle Labbie RN MN NP

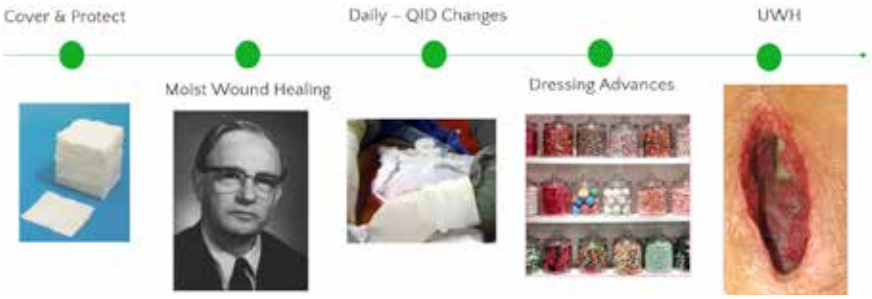
Wound Healing Takes Time

Wound healing is a complex physiological phenomenon. A series of sequential and concerted processes must occur for proper healing to occur in a timely and predictable manner. Wound healing is often compared to building a house – work disruptions may occur with inefficient or insufficient workers, lack of supplies, or workers coming at the wrong time. When these happen, the house cannot be built properly, efficiently, or at all. Similarly, each phase of healing must occur undisturbed.[1] Stable wound temperature (at 35-35 °c) is conducive for wound healing.[1] The wound must be moist – it must not be too dry nor too wet.[1] Tissue that is healing or newly healed should also be protected from trauma, shear, friction and pressure.[1] The aim of local wound care should optimize these conditions and support the body's normally healing processes. Local wound care includes wound hygiene, debridement (when appropriate), managing inflammation and/or infection, and maintaining moisture balance (when appropriate). Most importantly, wound care practitioners must understand the etiology and underlying causes of the wound and establish wound healing goals **with** their patients.

Essential elements of optimal wound healing environment[1]

- Each phase of healing occurs undisturbed
- Temperature remains stable (35-37°c)
- Moist but not wet conditions for all healing processes
- Protection from trauma, shear, friction, and pressure

The Evolution of Undisturbed Wound Healing (UWH)[2,3,4]



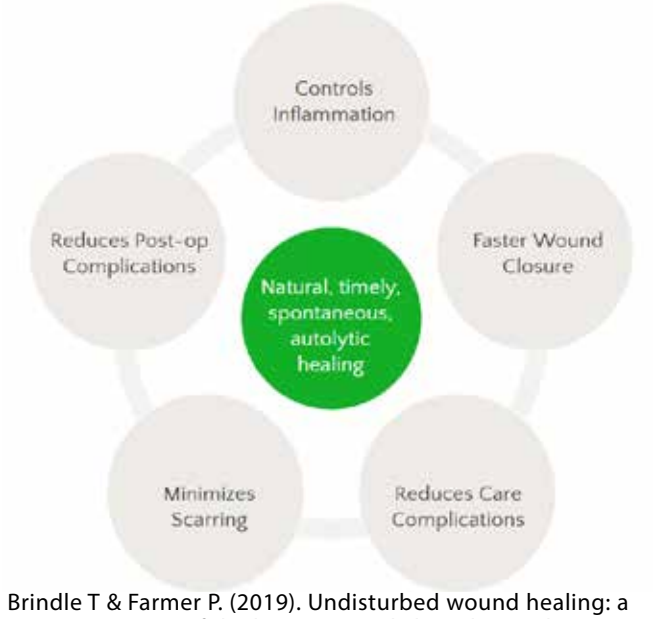
Gauzes were the earliest and most common dressing in the early days of wound care. Gauzes were primarily used to cover and protect the wound. Wet-to-dry dressing was a common practice in wound care. However, studies have shown that bacteria can penetrate up to 65 layers of moist gauze. Gauzes are also non-insulating – they can-

not maintain optimal healing temperature. Wet-to-dry dressing with gauzes can also traumatize the wound and elicit pain. In the 1960's, there was a paradigm shift in wound care practices as a result of the work of *George Winters* (often known as the Father of Moist Wound Healing). Maintaining a moist wound environment is essential to support and expedite healing. Dressing changes used to occur frequently, sometimes as often as four times daily. This was highly labour intensive and can lead to decrease in wound temperature – it can take up to 6-8 hours to regain optimal wound temperature. Since then, dressing technologies have advanced significantly, allowing for longer wear times and less frequent dressing changes. These advanced interactive dressings are an essential component of undisturbed wound healing (UWH).

An ideal wound dressing should:

- Promote a moist healing environment
- Provide an effective barrier against trauma and micro-organisms
- Manage bacterial load, including wound biofilm
- Absorb and transfers exudate away from the wound bed
- Minimize wound and peri-wound trauma; Supports peri-wound healing
- Stay in place and conforms to the skin contours
- Support and maintains optimal wound temperature

The term "undisturbed wound healing" (UWH) is relatively new, but the concept in practice is quite common. It is basically allowing the wound to "rest" by alleviating unnecessary dressing changes. UWH is founded on the principle of moist wound healing – it supports natural, timely, spontaneous and autolytic healing processes.[4] UWH can accelerate wound closure; reduce care and post-operative complications; minimize scarring; and control inflammation.[4]



Brindle T & Farmer P. (2019). Undisturbed wound healing: a narrative review of the literature and clinical considerations. Wounds International. 10(2), 40-48.

Choosing The Right Patient, Situation And Wound for UWH[4]

Wound management plans must be individualized and unique to each patient and their circumstances. Wound care practitioners must understand the etiology of the wound, the wound history and the patient's wound goal(s). Each management plan must balance optimized wound outcomes with individual patient needs. Practitioners must also consider the patient's access to provider care and ability to perform self-care. In addition, bacterial burden and wound infections must be addressed and managed accordingly.

When adopting UWH practices, practitioners must consider the **patient**. Dressings should be selected to ensure patient comfort and minimize pain; reduce frequency of wound interruption; and alleviate potential stress or anxiety related to wound trauma. Dressings should also be atraumatic to the **wound**, ensuring no damage, or impact, to the wound bed and developing extracellular matrix. Practitioners should also consider the **caregivers** involved. Dressings chosen should instill performance confidence such that frequency of changes is based on clinical assessment rather than a fear of dressing failure. Last but not least, practitioners must consider the resources available (i.e., **time and money**). A dressing should be chosen to decrease overall cost of care.

Considerations for Undisturbed Wound Healing for Different Types of Wounds[1]

Type of Wound	Dressing considerations for UWH	Examples of Dressings Click on the product name for details
Pressure injuries	• Adjunct to preventative measures to mitigate pressure, shear and friction and excessive moisture (e.g., offloading, repositioning)	Mepilex® Border Sacrum https://www.molnlycke.ca/products-solutions/mepilex-border-sacrum/ Mepilex® Border Heel https://www.molnlycke.ca/products-solutions/mepilex-border-heel/ Z-Flo Positioner™ https://www.molnlycke.ca/products-solutions/molnlycke-z-flo-fluidised-positioner/ Z-Flex™ Boot https://www.molnlycke.us/products-solutions/molnlycke-z-flex-heel-boot/
	• Increase rate of closure and minimize other care complications	Negative pressure wound therapy (NPWT)
Traumatic wounds (e.g., skin tears)	• Reduce dressing-related pain • Minimize wound disturbance • Manage exudate by allowing exudate to pass through to a secondary absorbent dressing	Mepitel® https://www.molnlycke.ca/products-solutions/mepitel/
	• Address bacterial burden • Provide extended wear time	Contact layer with antimicorbial (Mepitel® Ag) https://www.molnlycke.ca/products-solutions/mepitel-ag/
Burns	• Address bioburden as these wounds are a high risk for infections • Manage exudate • Minimize pain if higher dressing frequency is needed	Contact layer with antimicrobial (Mepitel® Ag) https://www.molnlycke.ca/products-solutions/mepitel-ag/
Surgical incisions	• Provide extended wear times • Manage exudate • Provider a barrier against bacteria • Protect peri-wound skin injury	Mepilex® Border Post Op https://www.molnlycke.ca/products-solutions/mepilex-border-post-op/
Dehisced surgical incisions	• Manage exudate and promote moist wound healing environment • Manage bacterial burden • Facilitate autolytic debridement • Decrease wound pain and dressing frequence • Provide peri-wound management and support	Foam with silicone contact layer and antimicrobial (Mepilex® Border Ag) https://www.molnlycke.ca/products-solutions/mepilex-border-ag/

Diabetic foot ulcers	• Support moist wound healing • Address bioburden • Compatibility with offloading modality wear time (e.g., total contact casting)	Foam with silicone contact layer (Mepilex® Border Flex) https://www.molnlycke.ca/products-solutions/mepilex-border-flex/ Exufiber® https://www.molnlycke.ca/products-solutions/exufiber/
Venous leg ulcers	Compatibility with compression bandages Frequency of compression bandage (and dressing) changes Manage exudate as these wounds are typically highly exudative Manage wound pain	Mepilex® XT https://www.molnlycke.ca/products-solutions/mepilex-xt/
Atypical wounds (where etiology and underlying cause are known and managed)	Manage moisture Reduce dressing frequency Reduce actual and anticipatory pain and dressing-related stress	Foam dressing for challenging areas of the body (Mepilex® Border Flex Oval) https://www.molnlycke.ca/products-solutions/mepilex-border-flex-oval/

Michelle Labbie RN MN NP is a Nurse Practitioner who is passionate about complex wound management in the context of chronic disease management particularly in people with lower leg ulcerations and diabetic foot complications. She has focused her expertise in this area for over 35 years and is actively involved in clinical research, pathway and practice guideline development and in implementation of evidence-based care. Michele practices in an out-patient wound clinic and is involved in ambulatory intravenous and infusion therapy. She is also an instructor at MacEwan University in Edmonton.

References

1. Beitz, J. Wound Healing. (2016). Wound, Ostomy and Continence Nurses Society Core Curriculum: Wound Management. Wolters Kluwer, 24-37.
2. Davies, P., Stephenson, J., & Manners, C. (2019). Understanding undisturbed wound healing in clinical practice — a global survey of healthcare professionals. Wounds UK, 15(4), 56-65
3. Rippon, Mark, Waring, Mike and Bielfeldt, Stephen (2015) An evaluation of properties related to wear time of four dressings during a five-day period. Wounds UK, 11(1). pp. 45-54. ISSN 1746-6814
4. Brindle, T., & Farmer, P. (2019). Undisturbed wound healing: a narrative review of the literature and clinical considerations. Wounds International. 10(2), 40-48.

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Canadian Consensus Statement:
The management of venous leg ulcers

A panel of 19 Physicians, NSWOCCs, Wound Specialists, and Therapists with experience in treating VLUs, using the Muscle Pump Activator device, and advanced wound treatments.

This panel agreed that the geko™ device (Muscle Pump Activator) should be added to the treatment plan when:

- A patient cannot tolerate compression
- A patient is not in optimal compression
- No progress is seen in a wound after 2-4 weeks
- A wound has not healed 30% in 30 days

*The geko™ device demonstrated greater than two-fold **increase in wound healing rate**[1] and a **reported reduction of pain**[2] in venous leg ulcers vs compression alone.*
Harding et al, 2023


Professor Keith Harding

Leads:


Dr Michael C. Stacey


Dr Robyn Evans


Dr Gary Sibbald

- *Dr Asem Saleh*
- *Dr John Hwang*
- *Rosemary Hill*
- *Josee Senechal*
- *Michele Langille*
- *Bev Smith*
- *Carly St Michel*
- *Paulo da Rosa*
- *Amanda Loney*
- *Michele Labbie*
- *Sheri McPhee*
- *Allison Luther*
- *Maryse Beaumier*
- *Helen Arputhanathan*
- *Shannon Handfield*

Read the VLU consensus here:
https://sites.google.com/view/VLUconsensus
or scan the QR code below

1. Bull R et al. Int Wound J. 2023; 1–9
2. Jones N et al. Br J Nurs 2018; 27(20): S16-S21.

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Current Canadian Consensus Statement On The Management Of Venous Leg Ulcers

Presenters: Dr. Robyn Evans BSc Med CCFP FCFP, Amanda Loney BScN WOCN IIWWCC, NSWOC, Dr. Gary Sibbald MD MEd DSC (Hon) FRCPC (Med (Derm) FAAD MAPWCA JM and Dr. Michael Stacey MBBS, FRACS, Doctor of Surgery

The Canadian Consensus Statement on the Management of Venous Leg Ulcers

The Objective

The objective of this project was to incorporate new clinical research findings on the management of venous leg ulcers (VLUs) into a Consensus Statement. This document is intended as an up-to-date practical guide for health-care providers (HCPs) managing patients with VLUs. It is a short, easy to understand, document that can be used in a clinical setting.

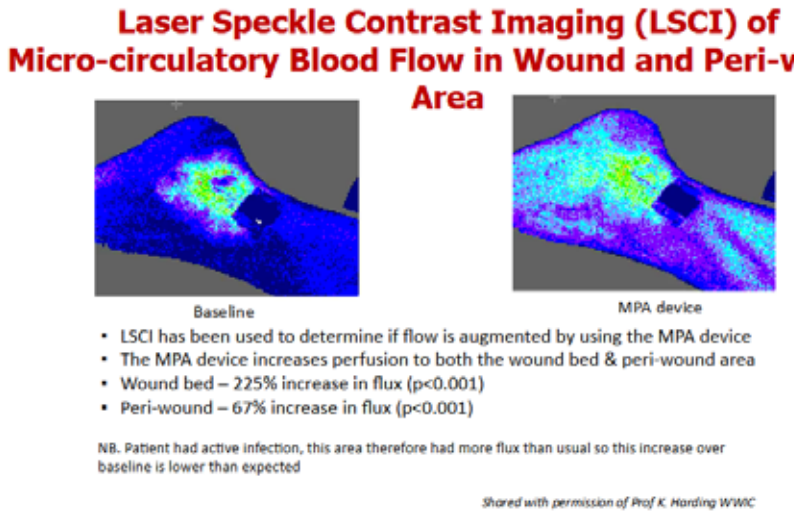
The Development Process

Nineteen HCPs of varying clinical backgrounds (e.g., physicians, nurses, NSWOCs, therapists) and different regions in Canada were involved in the development of this document. These HCPs have experience managing VLUs, with muscle pump activator device (MPA) and advanced wound treatments.

There are 23 sections in the Consensus Statement. The goal of the development process was to achieve at least 80% agreement by panelists on each section. The panel was able to achieve consensus on 20 of 23 sections and greater than 85% consensus on the remaining 3. The development of this document was independent of input from any wound care companies.

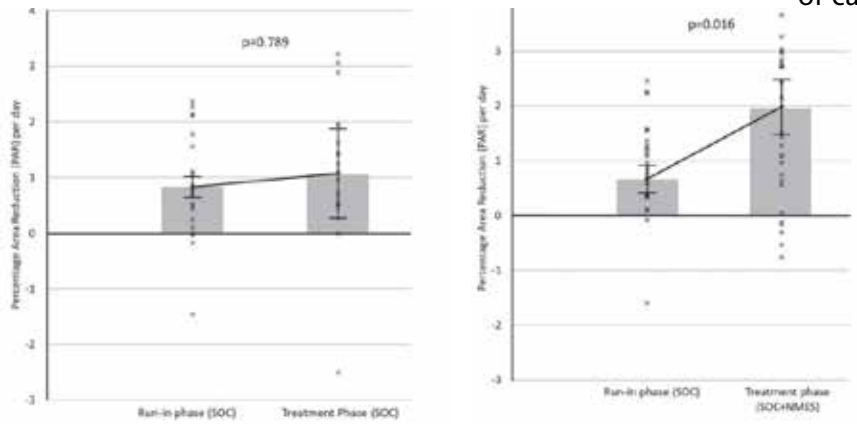
New Research Findings

The Conensus Statement incorporates new clinical research data on the management of VLUs. One major area of focus was the use of muscle pump activators (MPAs). MPAs address the underlying cause of VLUs by stimulating the common peroneal nerve and enhancing calf muscle pump function. The geko™ device, a muscle pump activator (MPA), has been shown to increase venous volumetric flow up to 100%;[1] increase arterial volumetric by up to 75%;[1] and increase microcirculatory flux by up to 400%.[2] MPA devices may also increase blood volume and velocity up to 60% of walking – without having to move or exert energy.[3]



A study by Das et al. in 2020 demonstrated that the use of geko™ increased peak venous velocity in the popliteal vein pre-bifurcation with the patient in recumbent position (baseline) and when seated.[4] Another study by Das et al. in 2021 showed that geko™ increased microcirculatory pulsatility not just in the wound bed but also in the periwound.[5]

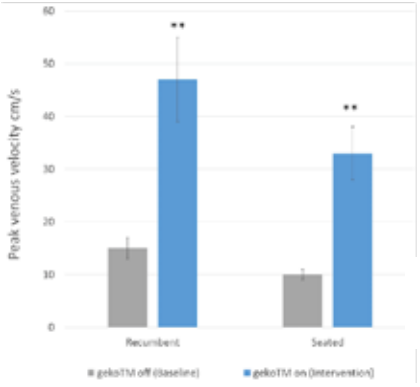
Percentage area reduction of wound with SOC alone (left graph) and with SOC plus MPA (right graph)[6]



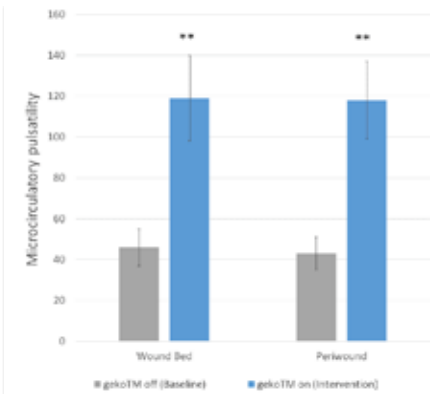
Bull et al. evaluated the difference between standard of care (SoC) alone and SoC with MPA. After four weeks of treatment, there was a significantly higher percentage area reduction (PAR) per day for patients receiving SoC with MPA compared to SoC alone.[6] The healing rate was also twice as fast when MPA was added to SoC.[6]

More recently (in 2024), Sibbald et al. evaluated 127 chronic wound patients (i.e., VLUs, diabetic foot ulcers, ischemic/mixed arterial venous ulcers, post-surgical/traumatic leg ulcers) in multi-centre clinics.[7] They found that MPA was effective in improving wound healing outcomes, including reduced pain, reduced edema, and enhanced patient quality of life.[7]

Changes in venous velocity with MPA[4]



Changes in micro-circulation with MPA[5]



The Key Components

The following section outlines the key components of the Consensus Statement and brief highlights for each:

Diagnosis of VLU: HCPs must first assess the cause of the wound and consider the patient's health literacy, environmental factors, and goals of care prior to initiating treatment. HCPs must conduct a thorough history of the ulcer, arterial and/or venous disease, underlying medical conditions and medications. A thorough examination of the patient (e.g., pedal pulses, ankle range of motion, gait, footwear, skin etc.) should also be performed.

Clinical features: HCPs should assess the location of the wound, the ulcer appearance, the surrounding tissue and for pain

Investigations: Non-invasive lower limb venous duplex ultrasound can be utilized for the diagnosis of venous disease. If there is limited access to such testing, management may start prior to investigation as long as **arterial status has been established**. HCPs should also investigate other co-existing medical conditions. Arterial status should be evaluated with ankle-brachial pressure index (ABPI) and/or toe-brachial index or toe pressures. In areas without access to these tests, a handheld Doppler can be utilized to assess the waveform of pedal

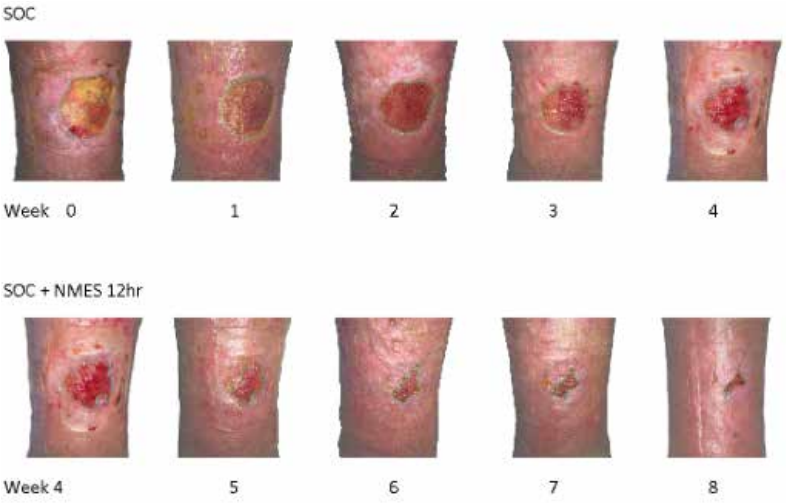
pulses; a multiphasic waveform is indicative of adequate arterial supply. HCPs should also investigate other co-existing health conditions (e.g., rheumatoid arthritis, lymphedema) and employ laboratory studies (e.g., blood panel, renal function, hemoglobin A1C). Not to be neglected, HCPs should assess the patient's gait and ankle mobility as these may impair the patient's calf muscle pump function.

Treatment of VLU – Treat the underlying cause of impaired calf muscle pump function

The key to treating VLU is to address the underlying cause – impaired calf muscle pump function. Compression therapy is the mainstay for the management of VLU. There are various compression system options, including but are not limited to inelastic bandages, elastic stockings, and adjustable wrap systems with hook and loop fasteners. Selection of modality may depend on patient mobility, pain, tolerance, ability to apply, environment, access and patient history and assessment findings seen below:

Patient history and assessment findings	Management considerations
Normal ABPI (0.9-1.4) or TBPI or toe pressures are normal if elevated ABPI or If hand-held Doppler waveform is multiphasic	Apply optimal multi-layer bandage system (30-40 mmHg at the ankle) Encourage calf muscle contract exercises, especially a daily walking regiment, to improve calf muscle pump function If limited ankle motion, strength, mobility or impaired gait, consider physiotherapy or rehabilitation medicine and daily leg elevation
If unable to tolerate optimal compression or ABPI is reduced but greater than 0.5 or If the patient has significant congestive heart failure that requires cardiologist evaluation	Apply a lower compression multilayer system that the patient will tolerate (with the aim to progress to optimal compression as symptoms and tolerance allow) Use caution at ABPI between 0.65 to 0.9 and extra caution between 0.5 and 0.65 Consider stockinette with tubular or longitudinal compression instead of compression wraps Add muscle pump activator (MPA) to enhance calf muscle pump function
If unable to tolerate any compression due to pain or other causes	Add muscle pump activator (MPA) to enhance calf muscle pump function Recommend daily leg elevation above the level of the heart and regular exercise regimen (especially daily walking) to improve calf muscle pump function Consider physiotherapy or rehabilitation medicine

Weekly ulcer appearance with SOC alone (weeks 0 to 4) and with SOC and MPA (weeks 4 to 8)[6]



Treatment of VLU – Treat the wound:

The treatment recommendations are founded on the concepts of the Wound Bed Preparation and the T.I.M.E. (tissue, infection, moisture, edge) principle.

The recommendations are as follows:

- Cleanse the wound and surround skin
- Debride devitalized tissue if vascular perfusion is normal
- Apply a dressing that ensures adequate moisture balance
- Treat infection in deep and surrounding tissue
- Manage pain if present
- Treat surrounding skin
- Treat wounds deemed to be non-healable
  - Cleanse with saline, clean potable water or antimicrobial solution; Use dressings to support wound maintenance goals
- Assess and measure the wound using a consistent method weekly or at each visit if seen less often.

Actions if not on a healing trajectory: The treatment plan should be revisited if there is no wound size reduction in 2-4 weeks or if reduction is less than 30% four weeks after initiating treatment. HCPs should reassess the patient and the diagnosis of ulceration to exclude other etiologies of impaired healing (e.g., malignancy, autoimmune disorders, medications etc.). HCPs should also assess whether the treatment plan is properly implemented and adhered to or whether infection is present and being managed properly. Once all of these have been assessed, HCPs should review and optimize treatment of calf muscle pump function, including reassess the compression system; review the exercise and walking regimen; add MPA if not already in place; consider surgical referral.

Once the diagnosis is confirmed and calf muscle pump function is optimized, HCPs can consider the introduction of advanced wound treatments depending on local availability and in a sequential manner with assessment of healing responses at each step.

- Address biofilm and bioburden with:
  - An antimicrobial dressing that can disrupt or eradicate biofilm
- Address increased wound protease activity with:
  - A dressing with protease inhibition properties
- Improve the wound bed with:
  - Negative pressure wound therapy (NPWT) or matrix substitutes
- Add growth promoting factors by:
  - Delivering growth factors through dressings that release physiological growth factor levels
- Add new cells to the wound via:
  - Skin grafts, cultured cells, skin substitutes etc.
- Consider other adjunctive therapies (e.g., oral pentoxifylline, electrical stimulation of the wound bed, topical oxygen therapy, therapeutic ultrasound etc.).

Prevent Ulcer Recurrence

After wound closure is achieved, HCPs should reinforce patient education regarding venous disease and prevention of ulcer recurrence. Patient education should focus on:

1. Protecting the skin from trauma.
2. Lifelong compression:
   a. Compression bandages should be continued for at least two weeks or longer to ensure full ulcer healing. Fitted compression

stockings (below knee in most cases) ideally at 25-40 mmHg should be used in most instances. A lower pressure should be considered for patients with coexisting arterial disease and/or cannot tolerate high compression.

3. Calf muscle contraction exercises:
   a. Patients should be encouraged to continue with calf muscle contraction exercises, especially a daily walking regimen, to improve calf muscle pump. HCPs should consider recruiting physiotherapy or rehabilitation medicine for patients with limited mobility.

A limited subset of patients may also benefit from superficial venous ablation by surgery or other less invasive techniques if appropriate. Surgical referrals should be made accordingly in these cases.

Dr. Robyn Evans BSc Med CCFP FCFP is the Medical Director of the Wound Healing Clinic at Women's College Hospital, who is involved in research and teaching. She is also a full-time family physician in the community and part of the faculty of the International Interprofessional Wound Care Course (IIWCC) through the University of Toronto. She is senior faculty for Wounds Canada supporting the development of interprofessional education programs for clinicians.

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Dr. Gary Sibbald MD MEd DSC (Hon) FRCPC (Med (Derm) FAAD MAPWCA JM is a dermatologist and internist with a special interest in wound care and education. He is a professor of Medicine and Public Health at the University of Toronto, co-founder of the Canadian Association of Wound Care and former Director of the Wound Healing Clinic, Women's College Hospital. He is also a previous president of the World Union of Wound Healing Societies (2012 – 2016). Professor Sibbald received the Queen Elizabeth II Diamond Jubilee medal in 2013 and Honorary Doctor of Science from Excelsior College in 2014.

Dr. Michael Stacey MBBS, FRACS, Doctor of Surgery is a vascular surgeon who came to Canada as Surgeon in Chief at Hamilton Health Sciences and Professor in the Department of Surgery at McMaster University. He was the Chief Medical Executive and Executive Vice President Academic at Hamilton Health Sciences until mid-2023. He was the first Chair of the Australian Wound Management Association and the founder and first President of the World Union of Wound Healing Societies (2000-2004).

References

1. Williams KJ, Moore HM, M Ellis and Davies AH. Haemodynamic changes with the use of a neuromuscular stimulation device compared to intermittent pneumatic compression. Phlebology. 2015;30(5):365–72
2. Williams KJ , Moore HM, Ellis M, Davies AH. Pilot Trial of Neuromuscular Stimulation in Human Subjects with Chronic Venous Disease. Vasc Health Risk Manag. 2021;17:771-8.
3. Tucker AT, Maass A, Bain DS, Chen L-H, Azzam M, Dawson H, Johnston A. Augmentation of venous, arterial and microvascular blood supply in the leg by isometric neuromuscular stimulation via the peroneal nerve. Int J Angiol 2010;19(1):e31–e37.
4. Das SK, Dhoonmoon L, Chhabra S. Neuromuscular stimulation of the common peroneal nerve increases arterial and venous velocity in patients with venous leg ulcers. Int Wound J. 2021;18(2):187-93.
5. Das SJ, Dhoonmoon L, Bain D, Chhabra S. Microcirculatory changes in venous leg ulcers using intermittent electrostimulation of common peroneal nerve. J Wound Care. 2021; 30(2):151-5.
6. Bull RH, Clements D, Collarte AJ, Harding KG. A Novel Randomized Trial Protocol for Evaluating Wound Healing Interventions. Adv Wound Care (New Rochelle). 2023

Dec;12(12):671-679. doi: 10.1089/wound.2023.0058. Epub 2023 Sep 5. PMID: 37526355; PMCID: PMC10615036.
7. Sibbald RG, Geng RSQ, Slomovic J, Stacey M. The muscle pump activator device: From evidence to lived experiences. Int Wound J. 2024 Aug;21(8):e14949. doi: 10.1111/iwj.14949. PMID: 39072891; PMCID: PMC11284258.

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The Role Of Aesthetic Procedures In Long-term Wound Management

By Dr. Samuel Hetz BSc MSc MD CCFP GPDerm

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Aesthetic Procedures As A Key To Enhanced Wound Healing

Wound care is undergoing significant advancements as aesthetic procedures are increasingly integrated into the long-term management of various injury types. Traditionally, wound management has focused on ensuring functional recovery and infection prevention, but recent trends have shifted towards enhancing patients' aesthetic outcomes as well. Aesthetic procedures, such as micro-needling, platelet-rich plasma (PRP) injections and laser therapy, play a pivotal role in reducing scarring and promoting tissue regeneration, particularly during the proliferation and maturation stages of wound healing. Burns, in particular, often present complexities in healing due to the depth and extent of tissue damage, which makes their long-term management challenging. Aesthetic procedures like laser therapy and micro-needling have shown promise in reducing scarring and improving skin texture in burn injuries, especially in the later stages of healing when scar refinement is a key focus.

Aesthetic interventions play a significant role in wound healing, particularly during the later stages when collagen production and scar refinement are critical. As wounds progress from the inflammatory phase, aesthetic procedures can help accelerate healing, prevent excessive scarring and improve overall skin quality. While these treatments are not universally applicable to all wounds—particularly those stuck in the inflammatory stage—they offer considerable benefits when applied appropriately and are, therefore, worth exploring.

Understanding The Stages Of Wound Healing: Proliferation And Maturation

The wound healing process can be divided into several stages, each critical to recovery. After the initial inflammatory phase, the body enters the proliferation stage, where tissue regeneration occurs. During this phase, fibroblasts produce collagen, a crucial protein that forms the structural basis of the new tissue. Other processes, such as angiogenesis (formation of new blood vessels), also play an essential role in delivering nutrients

to the healing wound.

The proliferation stage sets the foundation for scar formation, which is further refined during the maturation stage. During this phase, collagen remodelling occurs, strengthening the new tissue and enhancing its functionality. Wound contraction, led by specialized cells called myofibroblasts, reduces the wound size, while collagen undergoes structural changes to become more organized and aligned with the skin's natural fibres.[1,2]

Aesthetic procedures can intervene at these stages to optimize the healing process. For example, micro-needling and PRP injections stimulate additional collagen production, while laser therapy helps refine the scar tissue, reducing its appearance and improving skin texture. It is important to specify that the effectiveness of these procedures on wounds in the inflammatory phase, or that are complicated by chronic conditions, such as diabetes, is reduced as these conditions hinder the healing process.[3]

The Role Of Micro-Wounds And Collagen Production In Healing

Micro-needling, a popular aesthetic procedure, involves creating controlled micro-wounds in the skin to stimulate collagen production. This technique is particularly useful during the proliferation and maturation stages of wound healing, as it promotes the regeneration of healthy skin tissue while minimizing scar formation. The controlled injuries caused by micro-needling activate the body's natural healing mechanisms, prompting fibroblasts to produce more collagen and elastin.[4]

Collagen, the most abundant protein in the human body, is vital for wound healing. It provides the structural framework for new tissue, strengthening the wound site and helping it resist future damage. During the proliferation and maturation stages, increasing collagen synthesis is critical for scar prevention and overall wound recovery. Micro-wounds created by micro-needling trigger a localized healing response, which accelerates the maturation process and results in smoother, more functional skin.[1]

Clinical studies support the efficacy of micro-needling in reducing scar visibility and improving skin texture in patients with both acute and chronic wounds. This procedure is especially effective when used in conjunction with other aesthetic treatments, such as PRP injections, which further enhance collagen production and tissue regeneration over the long term.[4]

Reshaping Scar Tissue And Improving Skin Surface Through Laser Therapy

Laser therapy is another aesthetic procedure commonly used in long-term wound management. Non-ablative and fractional laser treatments target scar tissue and encourage the production of new, healthy skin cells. By delivering controlled energy to the wound site, lasers can stimulate collagen production and promote the remodelling of scar tissue. This makes laser therapy particularly effective during the maturation phase of wound healing, when the goal is to refine the scar and improve skin texture.[3]

Fractional lasers, in particular, work by creating microthermal zones in the skin, which trigger a healing response and encourage the formation of new tissue. This can significantly reduce the appearance of hypertrophic and atrophic scars, making the skin smoother and more uniform. Non-ablative lasers, which do not remove layers of the skin, are gentler and have a shorter recovery time, making them suitable for patients with more sensitive skin or less severe scarring.[2]

While laser therapy is generally safe, it does carry some risks, including hyperpigmentation, infection and incomplete wound closure. These side effects are more likely in patients with darker skin tones or underlying health conditions, such as diabetes. Therefore, a thorough evaluation of the patient's skin type, wound characteristics and overall health is necessary before initiating laser treatment.[3]

Platelet-rich Plasma (PRP) Injections For Tissue Regeneration

Platelet-rich Plasma (PRP) injections are another cutting-edge aesthetic procedure used to

enhance wound healing. PRP is derived from a patient's own blood, which is processed to concentrate the platelets. These platelets contain growth factors that play a crucial role in tissue repair and regeneration. When injected into a wound site, PRP can accelerate collagen production, improve skin texture and reduce the risk of scarring.[1]

PRP injections are particularly effective during the proliferation and maturation stages of wound healing, as they help speed up the formation of new tissue and promote scar refinement. By enhancing the body's natural healing mechanisms, PRP can lead to faster recovery times and better aesthetic outcomes for patients with surgical wounds, traumatic injuries, or chronic ulcers.[4]

Although PRP is generally safe, it is important to note that its effectiveness can vary depending on the type of wound and the patient's overall health. Some studies have shown that PRP may be less effective in treating chronic wounds, particularly those that remain stuck in the inflammatory phase. However, when used in combination with other aesthetic procedures, such as micro-needling or laser therapy, PRP can significantly enhance long-term wound healing outcomes.[2]

Considerations And Cautions For Aesthetic Procedures In Wound Management

When incorporating aesthetic procedures into long-term wound management, it is essential to tailor treatments to the specific needs of the wound and the patient's overall health. Factors such as the type of wound (e.g., surgical, traumatic, chronic), the patient's skin type, age and any underlying conditions, such as diabetes or vascular disease, must be carefully considered.[1]

Potential risks associated with aesthetic procedures in wound management include infection, hyperpigmentation and improper wound closure. These risks are particularly prevalent in patients with compromised immune systems or poor circulation. Therefore, a multi-disciplinary approach involving dermatologists, wound care specialists and other health-care providers is crucial to ensure the best possible outcomes.[4]

Integrating aesthetic procedures into wound care offers a unique opportunity to improve both the physical and aesthetic outcomes of wound healing.

As advancements in wound care continue, the collaboration between wound care teams and aesthetic specialists will be essential in optimizing treatment plans. By combining therapeutic and aesthetic interventions, health-care providers can offer comprehensive care that addresses both the functional and cosmetic aspects of wound recovery.[3]

As aesthetic procedures become more refined and widely accepted, they are likely to play an increasingly important role in wound management. Future innovations in this field will continue to enhance patient outcomes, improving both the physical appearance and quality of life for individuals recovering from traumatic or surgical wounds.[4]

A Future Where Healing Meets Aesthetics

Traditionally, aesthetic procedures, such as micro-needling, laser therapy and PRP injections, are solidifying themselves as techniques for long-term wound management. These treatments not only improve the visual outcomes of healing wounds but also contribute to overall skin health and patient satisfaction. By bridging the gap between therapeutic and aesthetic practices, health-care providers can ensure comprehensive care that addresses both the functional and cosmetic needs of patients.[1]

As the field continues to evolve, wound care professionals are encouraged to explore the potential benefits of integrating aesthetic procedures into their practice to enhance patient outcomes and quality of life. Consulting with practitioners in the field of aesthetics is an important step in bridging these two disciplines to work in unison toward more desirable patient outcomes.

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References

1. Iqbal A, Jan A, Wajid MA, Tariq S. Management of chronic non-healing wounds by hirudotherapy. World J Plast Surg. 2017 Jan;6(1):9-17.
2. Johns Hopkins Medicine. Platelet-rich plasma (PRP) injections. 2024. Available from: https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/plateletrich-plasma-prp-treatment.
3. Ji W, Li B, Li N, Xing C. Design strategy of microneedle systems for skin wound healing: based on the structure of tips and therapeutic methodologies. ACS Appl Bio Mater. 2024 Jul 15;7(7):4254-4269.
4. Nobari NN, Tabavar A, Sadeghi S, Dehghani A, Kalantari Y, Ghassemi M, et al. A systematic review of the comparison between needling (RF-needling, meso-needling, and micro-needling) and ablative fractional lasers (CO2, erbium YAG) in the treatment of atrophic and hypertrophic scars. Lasers Med Sci. 2023 Feb 7;38(1):67.

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*As demonstrated in vitro.

1. Dowsett, C, et al. Wounds Int. 2020. 2. Guest, J. et al. CATALYST Health Economics Consultants Ltd; UK. 2017. 3. Schultz, G. et al.. Wound Repair Regen. 25, 744–757 (2017). 4. Malone, M. et al. J. Wound Care 26, 20–25 (2017). 5. Guest, J. et al. Int. Wound J. 15, 43–52 (2018). 6. Wright JB, et al. Am J Infect Control. 1998;26(6):572 - 577. 7. Wright JB, et al. Am J Infect Control. 1999;27(4):344 - 350. 8. Cuttle L, et al. Burns. 2007;33(6):701 - 707. 9. Smith+Nephew 2020. Internal report. EO.AWM.PCS105.001.v2. 10. Smith+Nephew 2020. Internal report. EO.AWM.PCS105.002.v2. 11. Smith+Nephew 2020. Internal report. EO.AWM.PCS105.003.v2. 12. Smith+Nephew 2020. Internal report. EO.AWM.PCS105.004.v2. 13. Gago M, et al. Wounds. 2008;20(10):273 - 278. 14. Demling RH, et al. Burns. 2002;28(3):264 – 266. 15. Smith+Nephew 2008. Internal report. DOF 0810018. 16. Smith+Nephew 2008. Internal report. DOF 0810014. 17. Yin HQ, et al. J Burn Care Rehabil. 1999;20(3):195 - 200. 18. Wright JB, et al. Wounds. 1998;10(6):179 - 188. 19. Smith+Nephew 2008. Internal Report. DS/08/062/R1. 20. Westaim Biomedical 2000. Internal Report. 001213. 21. Westaim Biomedical 2001. Internal Report. 010322. 22.Hartill D, Styche T. Impact of the introduction of a nanocrystalline silver dressing for wound infection across a clinical commissioning group in the UK. Poster presented at Wounds UK Annual Conference 2020 Virtual. 9–11 November 2020; Harrogate, UK. 23. Smith + Nephew 2018. Internal Report. 1801001. 24. Smith & Nephew 2018. Internal Report. 1801002. 25. Fitzgerald DJ, et al. Wound Repair Regen. 2017;25(1):13-24. 26. Smith & Nephew 2008. Internal Report. 0804007. 27. Roche ED, et al. Int Wound J. 2019;1-10 [in press]. 28. Phillips PL, et al. Int Wound J. 2015;12(4):469-483. 29. Schultz G, et al. Microbicide Effects of Three Daily Treatments of a Carboxymethylcellulose Silver Dressing or a Cadexomer Iodine on Mature Bactericidal Biofilms Grown on Pig Skin Explants. 2016; Florence. 30. Schultz G, et al. Wound Repair Regen. 2017;25(5):744-757. 31. Lantis J.C. Cadexomer Iodine on a biofilm in diabetic foot ulcers: A Pilot study. Paper presented at: WUWHS; 2016; Florence. 32. Oates JL, et al. Effect of a Cadexomer Iodine Wound Dressing on a Chronic Wound Multi-Species Biofilm Model with Comparison to a Silver Hydrofiber Antibiofilm Dressing. Paper presented at: SWC; 2016; Las Vegas, USA. 33. Malone M, et al. J Antimicrob Chemother. 2017;72(7):2093-2101. 34. Forrest EC, et al. Cadexomer Iodine delivers rapid and sustained broad spectrum antimicrobial activity and substantial biofilm disruption and kill in a clinically relevant wound model. Paper presented at: EWMA; 2019; Gothenburg, Sweden. 35. Akiyama H, Oono T, et al. The Journal of Dermatology. 2004;31:529-534. 36. Woo K, et al. Int Wound J. 2021;[Epub ahead of print].

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Solventum Sponsored Learning:

Advancements In Wound Care For Improving Patient Outcomes: The Latest Innovations In Negative Pressure Wound Therapy

Presenters: Dr. Paul Kim DPM MS FACFAS and Britney Ann Butt MClSc-WH BScN RN NSWOC WOCC(C)

The Wound Healing Equation and Pyramid

Wound healing is a complex physiological process and, as a result, wound care is a complex problem. A wound's healing potential is dependent on many factors, including bacteria bioburden, perfusion, tissue mechanics and more importantly, the host.[1]

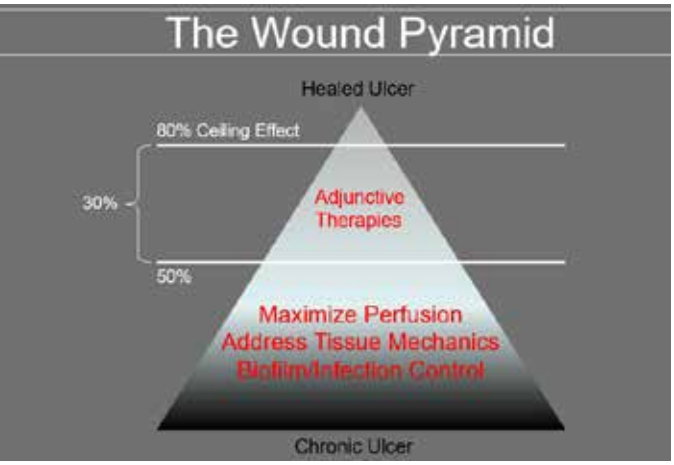
$$\text{Healing Potential} = \frac{1}{\frac{\text{Bacteria x Perfusion x Tissue Mechanics}}{(\text{Host})^{X}}}$$

X= Unknown

Source: Kim PJ (Guest Editor): The Diabetic Foot. "Diabetes and the Impact on the Lower Extremity". Clinics in Podiatric Medicine and Surgery. Vol 36 (3). July 2019.

The biggest driver of healing potential is the 'host'. (e.g., medical history, medication, social history etc.). Host factors are complicated and vary from patient to patient. These factors present the greatest challenges to all wound care providers. Even when perfusion is maximized, tissue mechanics addressed and biofilm/infection managed, only 50% of chronic wounds will achieve healing. With adjunctive therapy, an additional 30%

of chronic wounds will heal. There is a ceiling effect of what wound care providers can do to help patients achieve complete wound healing. The reality is that 20% of chronic wounds will just never heal, regardless. This is largely due to the host-related factors that we don't yet understand well.[1]



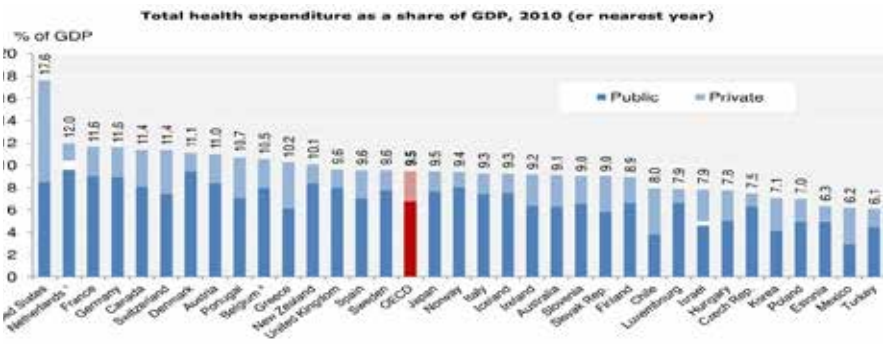
Source: Kim PJ (Guest Editor): The Diabetic Foot. "Diabetes and the Impact on the Lower Extremity". Clinics in Podiatric Medicine and Surgery. Vol 36 (3). July 2019.

The Drivers Of Care

The drivers of health care (including wound care) are universal. Policy makers, funders, and administrators are interested in the economics, efficiency, and efficacy/effectiveness of care:

- Economics: How much does/will it cost/save?
- Efficiency: Can it be delivered quickly and economically?
- Efficacy: Does it work in a controlled experimental environment?
- Effectiveness: Does it work in the real world?

Canada has one of the highest health expenditures as a share of gross domestic product (%GDP) among Organisation for Economic Co-operation and Development (OECD) countries.[2] According to the Canadian Institute for Health Information (CIHI), Canada's total wound care expenditure in 2014 was $3.9 billion CAD.[3] An estimate of $500 million CAD was spent on compromised wound (e.g., chronic wounds, skin barrier breaches, iatrogenic wounds).[3] According to Wound Care Alliance Canada, wound care expenditure was expected to grow by 30% by 2020.[4]



Source: Organization for Economic Co-Operation and Development (OECD), 34 Member Nations. 2011 Report.

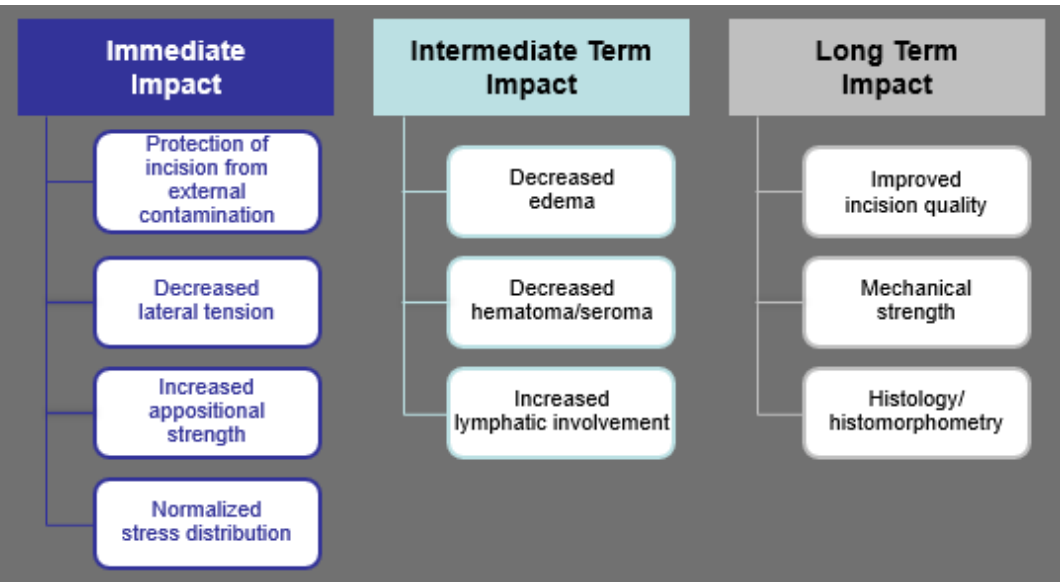
The estimated prevalence of diabetes mellitus (DM) is expected to increase by 44% from 2015 to 2025.[5] The cost of diabetes management is expected to grow by 25% in the same time frame. Diabetic foot ulcers (DFUs) are associated with increased number of, and length of, hospital stays. According to Hopkins et al. (2015), the estimated annual cost associated with DFU-related care across all care settings is $547 million CAD.[6] More than half of the cost is associated with acute care ($320.5 million CAD).[6] A single admission costs $11,492 in the first year; a cumulative 3-year admission cost is $18,957.[6] More importantly, DFUs and other types of wounds, are not just costly to the health-care system but to the patients and their families. Living with a wound can negatively affect the patient's quality of life, physically (e.g., muscle atrophy, joint stiffness), mentally and emotionally (e.g., sleep deprivation, stress, learned helplessness).

The Next Evolution In Negative Pressure Wound Therapy – The 3M™ V.A.C® Peel And Place Dressing

Negative pressure wound therapy (NPWT) has fundamentally changed how wound care is practiced. Vacuum assist closure (V.A.C. Therapy), an example of NPWT, was first introduced in 1994. There was a slow period of adoption within the first 10 years. Since then, negative pressure

wound therapy (NPWT) has been robustly studied and has become a standard of care. Different technologies (e.g., instillation therapy, portability, incisional management) have since been added to traditional NPWT to improve application and achieve better outcome. When deciding on which type of NPWT to use, wound care providers must consider factors such as anatomical location, depth, and the host.

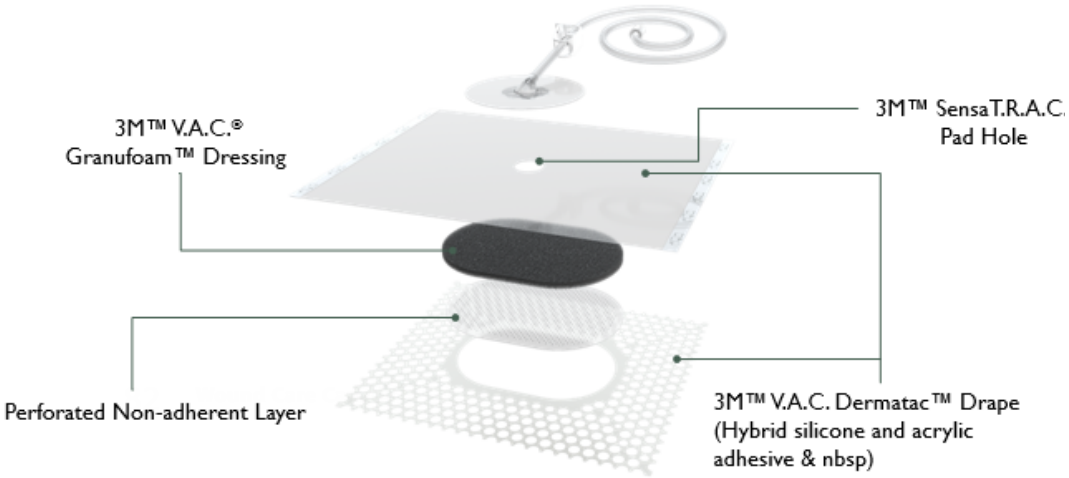
The 3M™ V.A.C® Peel and Place Dressing is the next evolution in V.A.C. Therapy. It combines the benefits of traditional NPWT with incision NPWT. The benefits of incisional NPWT can be seen below:[7]



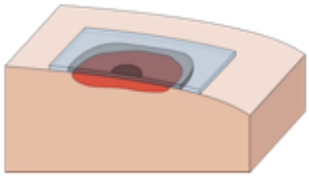
Source: Reference #7.

Wound care providers should take a holistic approach when managing patients living with wounds. A critical aspect of wound care is to optimize the local wound environment. It involves wound cleansing and debridement, managing bioburden, and controlling moisture levels. The use of appropriate dressing and advanced therapies to accomplish these objectives is essential. The 3M™ V.A.C® Peel and Place Dressing does just that – it can effectively address of all aspects of local wound management for certain patient populations.

The 3M™ V.A.C® Peel and Place Dressing has an all-in-one, integrated design. It contains a 3M™ Dermatac™ Drape made with an acrylic top layer and a perforated silicone layer. The acrylic layer provides a tight seal and keeps the silicone against the skin. Meanwhile, the silicone layer minimizes wrinkles and leaks, allows for easier handling and repositioning, and supports patient comfort at dressing changes. The perforated non-adherent bottom layer also allows for up to seven days of wear[8] by mitigating tissue ingrowth and reducing foam adhesion to the wound and pain upon removal. Application of the 3M™ V.A.C® Peel and Place Dressing takes less than two minutes.[9] Unlike traditional V.A.C. there is no cutting of materials involved. The pre-cut hole at the top of the dressing minimizes practitioner errors – a common issue of NPWT machines is blocked tubing when the hole is insufficiently sized. Not having to cut the Granufoam™ dressing reduces application time and minimizes iatrogenic adverse events such retained pieces of foam in the wound. The 3M™ V.A.C.® Peel and Place Dressing comes in different sizes to cover a variety of wound depths. Practitioners should select a foam size larger than the wound to cover the peri-wound skin and ensure the foam can accommodate the depth of the wound.

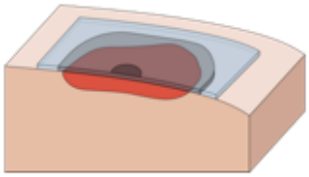


Small



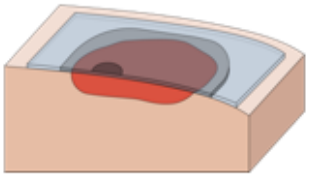
- **Foam:** 6.1 cm x 8.6 cm
- **Overall Dressing:** 16.9 cm x 20.6 cm
- **Max Wound Depth:** 2 cm

Medium



- **Foam:** 11.1 cm x 16.6 cm
- **Overall Dressing:** 23.7 cm x 29.2 cm
- **Max Wound Depth:** 4 cm

Large

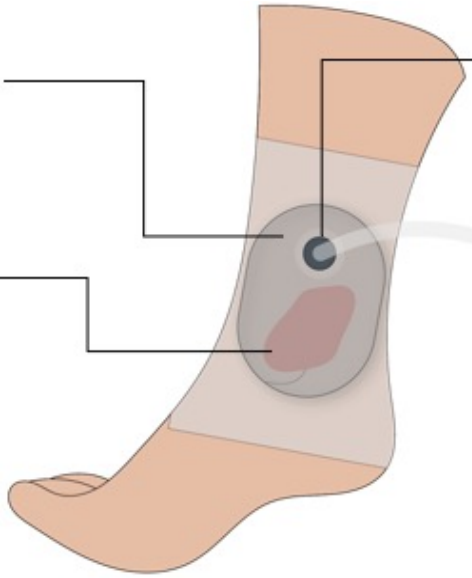


- **Foam:** 13.6 cm x 24.2 cm
- **Overall Dressing:** 26 cm x 35.6 cm
- **Max Wound Depth:** 6 cm

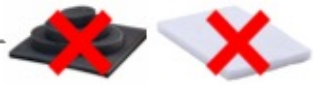
1. Foam should extend beyond wound and touch periwound skin.

2. To offload, select the Large dressing size

3. Undermining must be ≤2 cm, and no tunneling can be present.



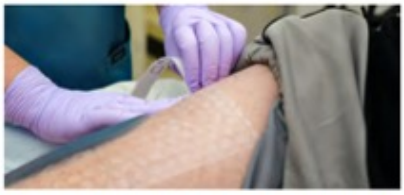
4. Don't combine with other dressings.
The use of additional foam fillers is prohibited.



Place

Place the dressing with the pre-cut SensaT.R.A.C. Pad hole facing up. Leave at least 5 cm of drape border for sealing.

Check



Check the initial placement and reposition if needed. Once ready, smooth any wrinkles, press down on the drape border, and remove the handlebars to establish a seal.

Connect

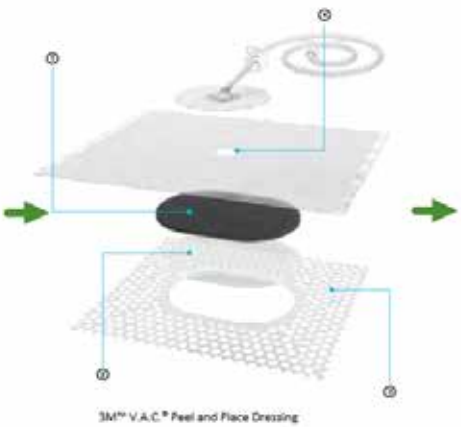
Remove both backing layers and apply the SensaT.R.A.C. Pad over the center of the pre-cut hole. Connect tubing to the V.A.C.® Therapy unit and begin therapy.

Removal

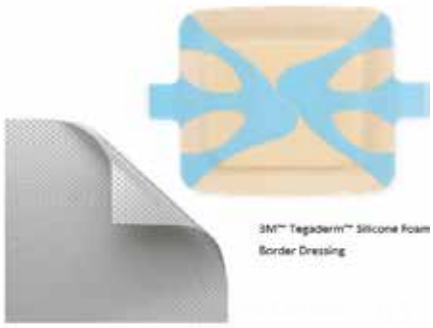
The integrated design of the V.A.C.® Peel and Place Dressing allows the dressing to be worn for up to seven days. When it's time to remove or change dressing, gently remove the dressing from the wound, using sterile water or normal saline if the dressing adheres to the wound.

Complete Solution Bundle

3M™ Veraflo™ Cleanse Choice Complete™ Dressing



3M™ V.A.C.® Peel and Place Dressing



3M™ Tegaderm™ Silicone Foam Border Dressing

3M™ Silvercel™

Dr. Paul Kim DPM MS FACFAS is the Medical Director of the Wound Program at the University of Texas Southwestern Medical Center in Dallas, Texas. He is also a Professor in the Departments of Plastic Surgery and Orthopaedic Surgery at UT Southwestern

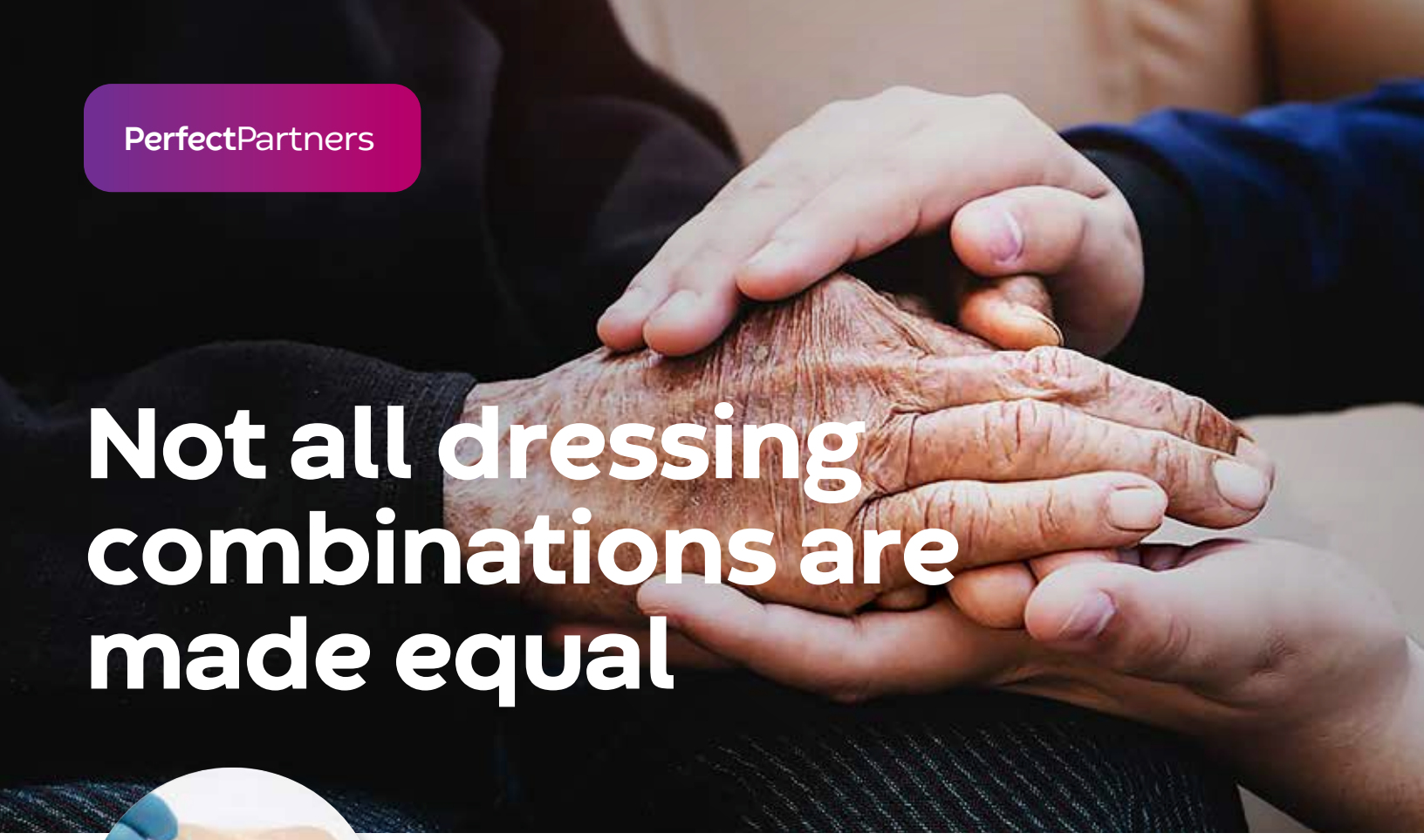
Britney Ann Butt MClSc-WH BScN RN NS-WOC WOCC(C) is an ostomy wound specialist and has has worked until recently at North York General Hospital. Britney is currently working at the USC Centre in California.

References

1. Kim PJ (Guest Editor): The Diabetic Foot. "Diabetes and the Impact on the Lower Extremity". Clinics in Podiatric Medicine and Surgery. Vol 36 (3). July 2019.
2. Organization for Economic Co-Operation and Development (OECD), 34 Member Nations. 2011 Report.
3. Compromised Wounds in Canada: Summary. CIHI. 2014
4. Wound Care Alliance Canada. 2012
5. Diabetes Canada Clinical Practice Guidelines Expert Committee, Houlden RL. Diabetes Canada 2018 Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada: Chapter 1 Overview. Can J Diabetes. 2018;42(Suppl 1):S1-S325.
6. Hopkins RB, Burke N, Harlock J, Jegathisawaran J, Goeree R. Economic burden of illness associated with diabetic foot ulcers in Canada. BMC Health Serv Res. 2015 Jan 22;15:13. doi: 10.1186/s12913-015-0687-5. PMID: 25608648; PMCID: PMC4307900.
7. Wilkes RP, Kilpadi DV, Zhao Y, et al. Closed incision management with negative pressure wound therapy (CIM): Biomechanics. Surgical Innovation. 2012;19(1):67-75.
8. Evaluation of 3M™ V.A.C.® Peel and Place Dressing Concepts in Full-Thickness Excisional Wounds. 2023 Allen D, Robinson T, Schmidt M, Kieswetter K. Preclinical assessment of novel longer-duration wear negative pressure wound therapy dressing in a porcine model. Wound Rep Reg. 2023;31;S3:349-359.

In a simulated use test with 12 nurse and surgeon users. Average time of 01:48. SAT-MTF-05-995965 Marketing study for 3M™ V.A.C.® Peel and Place dressing. 2023.

PerfectPartners



Not all dressing combinations are made equal

– only Aquacel® Foam dressing has been designed to work in synergy with the Aquacel® family of primary dressings, to help achieve optimal performance.[2,5]

The use of this dressing regime can help optimise:

- Effective management of exudate.[1,2]
- Help prevent peri-wound maceration.[6]
- Protect peri-wound skin.[6]
- Promote wound healing.[7]
- Manage biofilm and infections[4,5]

This may improve patient comfort and clinical outcome.[3]

References:
1. PARTNER observational study: Preliminary results on the utility of the combination of two dressings in the management of acute and chronic wounds in private practice. TOMASI, J, Yvon, C, Lucas, A. P20, poster presented at Journees Cicatrisations, Paris, France, 26-28 Jan 2020 **2.** Visual Assessment of Fluid Handling by Aquacel® Extra covered by Different Foam Dressings WHRI5397 MS147. Data on le, ConvaTec Inc. **3.** Mixing Wound Dressings: Does it Affect Clinical Outcomes, Tickle. J. Poster presented at World Union of Wound Healing Societies, Florence, Italy 2016. **4.** Bowler PG, Parsons, D. Combatting wound biofilm and recalcitrance with a novel antibiofilm Hydrofiber® wound dressing. Wound Medicine. 2016; 14: 6-11. **5.** Newman, G.R., et al., Visualisation of bacterial sequestration and bactericidal activity within hydrating Hydrofiber wound dressings. Biomaterials, 2006. 27(7): p. 1129-39. **6.** Robinson BJ. The use of a Hydrofibre dressing in wound management. J Wound Care. 2000;9(1):32-34. **7.** Bishop SM et al. Moisture balance: optimising the wounddressing interface. J Wound Care. 2003;12:125-128

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Photodynamic Therapy Associated With Mesalt® In The Treatment Of Hypergranulation In Diabetic Foot Ulcer

By Maria Girlane SA Brandão RN PhD Student, Maria Aline M Ximenes RN PhD Student, Robert Strachan HBASc HBSc and Idevania G Costa RN NSWOC PhD

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Introduction

Diabetic foot ulcers (DFUs) are a significant source of morbidity in adults with diabetes mellitus (DM).[1] The standard treatment for DFU care includes regular follow-ups by specialized professionals for ulcer assessment, cleaning and debridement, removal of calluses, selection of dressings and off loading devices to control exudation and maintain a moist environment, as well as infection control.[2] However, in people with DM, this standard treatment has often proven insufficient to achieve healing in a satisfactory timeframe.[3]

The delay in healing may be partly due to DM itself, as this disease impairs the three phases of healing (inflammatory, proliferative and remodelling),[4] and also because most DFUs have polymicrobial cultures, with the presence of *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Proteus spp*., *Streptococcus*, *Escherichia coli* and *Enterococcus spp.*, which delay the healing process.[5] Furthermore, colonization by these microorganisms can prolong the wound's inflammatory phase and trigger excessive granulation, also known as hypergranulation which delays the healing process.[6]

Clinically, hypergranulation is identified as a friable, red, shiny, soft tissue that extends beyond the level of the surrounding skin and physically impedes the migration of epithelial cells to the wound bed.[7] The exact mechanism in which this cell migration better works remains unclear in the literature. However, it is still accepted that ulcers usually do not heal appropriately when hypergranulation tissue is present, as it becomes difficult for epithelial tissue to migrate across the wound surface. In this sense, contraction is generally interrupted or delayed.[8]

Despite being an important phenomenon in the healing process, hypergranulation is underexplored in the literature and its treatment is marked by controversy. Currently, there is a range of treatment reports, such as silver nitrate, 20% sodium chloride, and topical corticosteroids, among others.[6] With the advent of new adjunct technologies for wound treatment, other options should be tested in the treatment of hypergranulation. Therefore, in this study, we opted for the antimicrobial photodynamic therapy (PDT) associated with Mesalt® (Mölnlycke)*, a technological dressing specifically designed to treat excessive granulation.

PDT involves a light source (Laser or LED) that transfers energy to a photosensitizer, such as methylene blue, which reacts with intracellular substrates to form free radicals that interact with molecular oxygen to form reactive oxygen species.[9] This energy transfer to molecular oxygen produces singlet oxygen, which acts as an essential element in the PDT oxidative process, producing an antimicrobial effect.[9] Mesalt® is a dressing made from soft nonwoven, viscose/polyester material impregnated with sodium chloride, which is released when in contact with moisture. Sodium chloride gradually reduces hypergranulation and absorbs exudate, creating a hypertonic environment in the ulcer bed.[10]

The relevance of this study is grounded in its use of an adjunct technology in association with an innovative dressing for treating hypergranulation in people with DFUs, aiming to reduce infectious agents, promote tissue repair in a timely manner, and prevent infection and further complications such as amputation. Thus, this study aims to describe the use of PDT associated with Mesalt® in the treatment of hypergranulation in people with DFUs using a descriptive study of a single case study.

Methods

The study setting was the vascular surgery outpatient clinic of the Hospital Beneficência Portuguesa, located in the city of Ribeirão Preto, in the state of São Paulo, Brazil. The clinic operates from Monday to Friday by vascular surgeons and residents, as well as a research nurse from the graduate program at the doctoral level of the School of Nursing at the University of São Paulo, Ribeirão Preto campus, who provide nursing assessments and laser treatments at this setting.

The case study was conducted from October 2023 to January 2024. The participant was a 62-year-old woman who was living with DFU with a great amount of exudate for three months, which led to the developed of hypergranulation.

For data collection and measurement of baseline variables, a semi-structured instrument was used, including sociodemographic and clinical data of the participant (age, gender, occupation, birthplace, marital status and income), and an assessment of risk factors (associated systemic diseases, duration of DM and medications).

The ulcer assessment was conducted using the Bates-Jensen Wound Assessment Tool (BWAT), validated for Brazilian Portuguese, which allows for practical, objective and conclusive application to monitor the healing progress of wounds.[11] The scale evaluates the lesion based on 13 parameters: size, depth, edges, sloughing, type and amount of necrotic tissue, characteristics and amount of exudate, edema and perilesional induration, colour of the perilesional skin, quality of granulation tissue, and epithelialization. Each item is scored from one to five, where one indicates the best condition and five indicates the worst condition of the wound.[11]

In each assessment, the lesion was measured using the Imito® smartphone application. Additionally, at the initial moment, blood was collected to evaluate glycated hemoglobina (A1C), and the Ankle-Brachial Index (ABI) was assessed on the same day as the first treatment session.

The ABI was measured using a Portable Vascular Doppler (DV 610 MegaMED) for locating arterial pulses, employing a transducer with a frequency of 10 MHz with a high sensitivity level and a sphygmomanometer to measure systolic pressure. With the participant in a supine position, and after five minutes of rest, systolic pressure measurements were collected from the dorsalis pedis artery and the brachial artery bilaterally. The result was obtained by calculating the ratio between the highest pressure in the dorsalis pedis artery at the ankle and the highest pressure in the brachial artery of the upper limb, thus obtaining the ABI.

Additionally, a tissue biopsy was conducted to evaluate the microorganisms present in the lesion. The procedure was performed in the outpatient clinic and the sample was stored in a sterile plastic collector and labelled. Then it was promptly sent to the hospital's Microbiology Laboratory for identification of microorganisms present in the tissue, following the BrCAST standardization guidelines.

For PDT procedure, a 1% methylene blue solution was used, formulated upon request by a registered pharmacist. This photosensitizer was applied to the lesion (0.5 cm from the edge and central portion) with the aid of a disposable 3 mL pipette; the amount used depended on the size of each lesion (0.5 ml for lesions up to 4 cm^2 and 1 ml for areas above 4 cm^2). After application, a five-minute absorption period was observed, timed using a smartphone.

Following this period, light irradiation was performed using the Therapy EC equipment from DMC (ANVISA Registration 80030819013), with a wavelength of 660 nm, a dose of 9 Joules, and an irradiation time of 90 seconds per point (following manufacturers recommendations).[12] The point technique was used in contact, with a standardized distance of 1 cm between points around the lesion and 0.5 cm from the lesion's edge, ensuring that the entire extent of the ulcer received light irradiation. It is important to note that this procedure was reported as painless by the patient (pain scale 0-10).

The data were organized using a printed data collection instrument and analyzed by the researcher, being described narratively, with sequential images to illustrate the healing progress.

Ethical principles were respected, with the ethical approval of the study granted by the Research Ethics Committee of the School of Nursing of Ribeirão Preto at the University of São Paulo, under opinion no. 5.802.182, and consent was recorded through the signature of the Informed Consent Form (ICF).

Results and Discussion

The patient, a 62-year-old female, was married and originally from a city in the state of Sao Paulo, Brazil. She lived with her husband and a youth child, with a lower income rate. The diagnosis of diabetes was made 34 years ago, and she has been using insulin therapy since then. Her glycated hemoglobin level (A1c) was 7.3%. During the assessment of the Ankle-Brachial Index,

she exhibited normal circulation in both lower limbs. The DFU started in August 2023 on the left hallux, shortly after amputation at the same site. Inadequate care and footwear probably led to the formation of a new ulcer. The DFU had a circular shape and was being treated with collagenase, using dressing changes performed at home by family members. The left foot (with the lesion) was dry, and both feet had positive protective plantar sensitivity as assessed with a 10 g monofilament.

On October 6, 2023, the initial evaluation of the case was conducted. The lesion exhibited partial loss of skin thickness, involving both the epidermis and dermis, with a small amount of devitalized tissue and hypergranulation. It presented moderate to high exudate with serous characteristics and the lesion area measured 6.1 cm^2 (3.5 cm in height and 2.6 cm in width) (Figure 1). A biopsy identified the presence of *Staphylococcus aureus*, though no signs or symptoms of infection were observed.

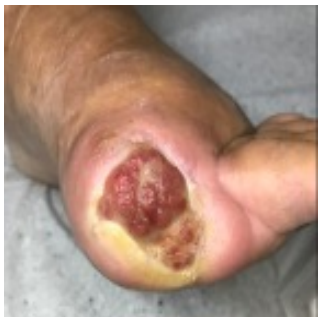

Figure 1 – 1st evaluation (Oct 6, 2023)

In the second and third evaluations, conducted on October 11 and 18, respectively, there was slight improvement in lesion size and drainage; however, hypergranulation persisted (Figures 2 and 3). Given the limited response to the initial treatment approach, a revised protocol was implemented.

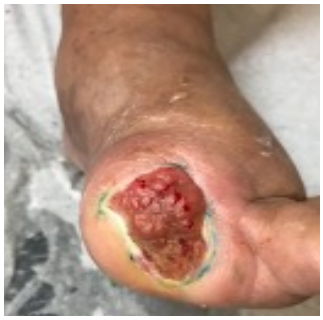

Figure 2 – 2nd evaluation (Oct 10, 2023)

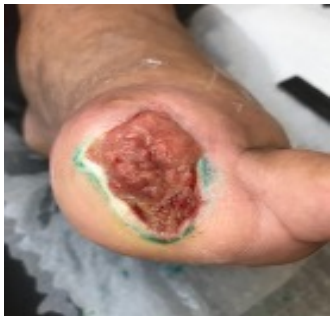

Figure 3 - 3rd evaluation (Oct 18, 2023)

This new care planning approach involved self-management by the patient's sister-in-law, who was trained by the first author, a nurse specialized in wound care. The protocol included daily wound cleansing with normal saline and the application of wet gauze with 20% sodium chloride over the wound bed for five minutes, followed by Mesalt® as a secondary dressing. This method was selected to help reduce the amount of exudate through the hypertonic effect of sodium chloride. Sodium chloride (20%) has a hypertonic effect when used on wounds, meaning that it has a higher concentration of solutes compared to normal body fluids. This hypertonic effect can help reduce the amount of exudate in the wound, decrease tissue tension and allow the wound edges to close together.[13] Weekly follow-up occurred at a wound care clinic, where PDT was performed and Mesalt® was reapplied as the secondary dressing.

Following the implementation of this new approach, the lesion showed significant improvement. On October 25, 2023, there was a noticeable reduction in both exudate and hypergranulation tissue. By the following evaluation on November 1, 2023, the ulcer area had decreased to 3.9 cm^2 (2.9 cm in height and 2.1 cm in width) (Figure 4).

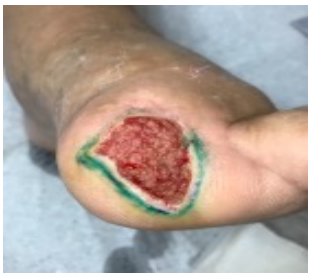

Figure 4 - 5th evaluation (Nov 1, 2023)

Improvement continued progressively. On November 8, 2023, the lesion size reduced further to 3.6 cm^2, measuring 2.7 cm in height and 1.9 cm in width. At this point, the exudate was serosanguineous (thin and watery) and reduced in quantity (Figure 5). On November 17, 2023, the ulcer continued to reduce in size, now measuring 2.4 cm^2 (2.3 cm in height and 1.5 cm in width) (Figure 6).

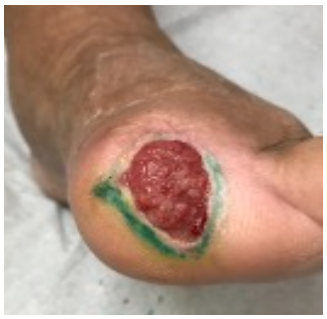

Figure 5 – 6th evaluation (Nov 8, 2023)

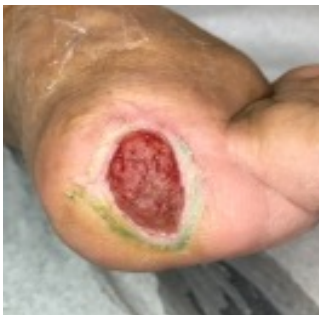

Figure 6 – 7th evaluation (Nov 17, 2023)

Figures 7 and 8 illustrate the final stages of the healing process. On December 14, 2023, during a home visit, substantial healing progress was noted, with the lesion area reduced to 0.5 cm^2 (1.1 cm in height and 0.7 cm in width), and physiological moisture present. Daily use of a hydrogel with alginate dressing was recommended solely for moisture maintenance, accompanied by a single session of laser therapy on December 14 (2 J, punctual, red-light laser). Complete healing of the ulcer was achieved on January 4, 2024, marking two months and 29 days since initial treatment.

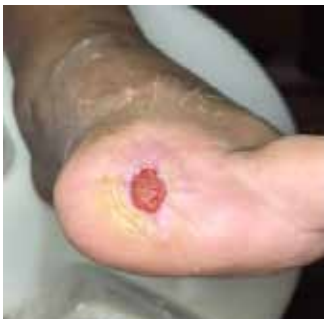

Figure 7 – 8th evaluation (Dec 14, 2023)

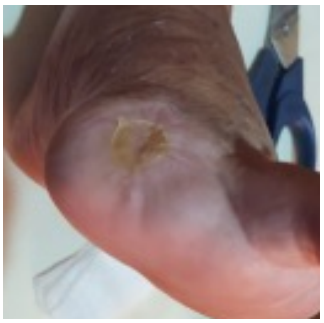

Figure 8 – 9th evaluation (Jan 4, 2024)

Source: Maria Girlane S. A. Brandão

Table 1 provides a summary of the treatment protocols used in this clinical case, including the type of dressing, application period, frequency of change, rationale for choice, and observed effects.

Table 1: Treatment protocol applied for the management of hypergranulation in diabetic foot.

Treatment Protocol	Application Period	Frequency of secondary dressing change	Rationale for Choice	Observed Effects
Cleaning with 0.9% saline solution + weekly PDT + calcium alginate	1st evaluation (Oct 6, 2023) until two weeks after the protocol start	Daily	Control of exudate, promoting a physiologically moist environment for healing	Slight improvement after two weeks, with high exudation and hypergranulation still present
Cleaning with 0.9% saline solution + gauze moistened with 20% sodium chloride (5 min) + weekly PDT + Mesalt®	3rd evaluation (Oct 18, 2023) until 8th evaluation (14/12/2023)	Daily	Reduce exudate level and hypergranulation through hypertonic effect	Significant improvement in the lesion, with reduced exudate and absence of hypergranulation by the 8th evaluation
Laser therapy every 15 days + Hydrogel with alginate	After the 8th evaluation (Dec 15, 2023) until 9th evaluation (Jan 4, 2024)	Daily	Maintain moisture and support healing with laser therapy	Small amount of exudate, with complete healing by the 9th evaluation

Discussion

The amount of exudate plays a crucial role in the healing process, helping to maintain a moist environment in the wound bed, which is essential for cell migration and new tissue formation. It also provided good hydration for the granulation tissue.[14] However, when exudate levels are moderate to high, excessive moisture hinders healing, promoting the formation of hypergranulated tissue, which can delay healing.[6]

Hypergranulation is a significant phenomenon in wounds, particularly in DFUs, but its therapeutic approach remains contradictory. This highlights the importance of conducting studies that seek effective solutions for hypergranulation management, as it can impede the healing process and lead to complications.[15]

Considering the exudate level, treatment was initiated with calcium alginate, a highly absorbent dressing derived from algae, suitable for wounds with moderate to high exudate levels.[16] However, in this case it was not as effective as we expected, which led the team to discuss the need for another approach approach. In DFU, it is essential to choose a dressing that can absorb excess exudate and maintain a physiologically moist environment.[17]

Observing that the patient had *Staphylococcus aureus* in the microbiological analysis and knowing that high levels of bacteria can promote chronic inflammation and increase exudate production, the need for an adjuvant therapy with antimicrobial action was considered. Therefore, we introduced the photodynamic therapy (PDT) in combination with calcium alginate. PDT was selected due to its antimicrobial potential, acting through the production of reactive oxygen species that help eliminate *S. aureus* and reduce the bacterial load in the wound.[9,18,19]

However, after two weeks of using the new treatment protocol (i.e., PDT + calcium alginate), wound progression continued to be limited, with sustained moderate exudate and the presence of hypergranulation. Given this, 20% saline solution was introduced to the treatment protocolo this cliente. For this product, it is important to allow it to sit on the wound bed (wet gauze) for five minutes after cleaning with 0.9% saline solution. A daily dressing with 20% sodium chloride (Mesalt®) was also chosen to help control exudate and hypergranulation.

Another study also showed that the healing process showed satisfactory progress after the application of the hypertonic solution (20%), with improvement in hypergranulation. Mesalt® contains mainly two components: 20% sodium chloride, which provides a hypertonic environment for the wound, and absorbent polyester fibre, capable of absorbing a large amount of secretion. The hypertonic nature of the Mesalt® dressing plays a vital role in the healing process in wounds with hypergranulation by effectively absorbing exudate, thereby preventing excessive moisture accumulation, which can exacerbate excessive granulation.[20]

In fact, after implementing this new treatment protocol, the DFU showed substantial improvement, with a reduction in exudate levels and hypergranulation. The combination of a dressing that promotes a hypertonic environment and PDT has a great potential to accelarate healing. In line with findings of Cesar and colleagues[21], our study supports that PDT also aided DFU treatment, with notable reductions in wound size and exudate levels.

After the resolution of hypergranulation and exudate controle, it was decided to use hydrogel with alginate to maintain physiological moisture levels in the wound bed. The hydrogel is a dressing that hydrates the wound bed, accelerates the healing process and promotes tissue ephitelization.[22] In addition, laser therapy was applied biweekly to support the maintenance of granulation,[23] intentionally limiting its frequency to avoid overstimulation of the granulation tissue, which could lead to recurrency of hypergranulation. This strategic use of laser therapy allowed for controlled granulation without risking excessive tissue growth, aligning to promote balanced and sustained wound healing.

These findings collectively emphasize the importance of an integrated treatment approach combining PDT with hypertonic dressings, such as Mesalt,® to optimize wound healing outcomes. In

summary, the association of PDT and hypertonic dressings (in this case, Mesalt®) provided a promising therapeutic strategy for managing hypergranulation in a clinical case of DFU. Future studies should continue to explore the effectiveness of these modalities and their impact on various wound characteristics to establish standardized protocols for clinical practice.

Conclusion

Hypergranulation in foot ulcers among individuals with diabetes is detrimental to healing and can lead to negative outcomes due to delays in the tissue repair process. In this case study, the combination of an antimicrobial adjuvant technology (PDT) with a 20% sodium chloride dressing (Mesalt®) facilitated progressive improvements in the clinical aspects of the ulcer. Additionally, hydrogel with alginate dressings were employed as the wound bed and exudation evolved throughout the healing process. These variations necessitate careful management, as different wound conditions may require dressings with distinct mechanisms of action. The decrease in hypergranulated tissue and complete healing further support the potential of the protocol used in this clinical case. We recommend that further studies on this topic be conducted to enhance the scientific evidence regarding the effectiveness of combining PDT and hypertonic dressings in the treatment of hypergranulation in individuals with DFUs.

Editor's note: *Mölnlycke did not have any financial involvement in this study.*

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References

1. McDermott K, Fang M, Boulton AJM, Selvin E, Hicks CW. Etiology, epidemiology, and disparities in the burden of diabetic foot ulcers. Diabetes Care. 2023 Jan 1;46(1):209-221.
2. Schaper NC, van Netten JJ, Apelqvist J, Bus SA, Hinchliffe RJ, Lipsky BA; IWGDF Editorial Board. Practical guidelines on the prevention and management of diabetic foot disease (IWGDF 2019 update). Diabetes Metab Res Rev. 2020 Mar;36 Suppl 1:e3266.
3. Ananian CE, Davis RD, Johnson EL, Regulski MJ, Reyzelman AM, Saunders MC, et al. Wound closure outcomes suggest clinical equivalency between lyopreserved and cryopreserved placental membranes containing viable cells. Adv Wound Care (New Rochelle). 2019 Nov 1;8(11):546-554.
4. Fuchs C, Stalnaker KJ, Pham L, Wang Y, Dalgard CL, Cho S et al. Unique physiology and intrinsically delayed wound healing in plantar skin. In: 2022 WHS Annual Meeting/ SAWC Spring Meeting Program; 2022 Apr 6-10; Phoenix, Arizona. Available from: https://woundheal.org/Meeting/Program/2022/
5. Złoch M, Maślak E, Kupczyk W, Jackowski M, Pomastowski P, Buszewski B. Culturomics approach to identify diabetic foot infection bacteria. Int J Mol Sci. 2021 Sep 3;22(17):9574.
6. Gomes C, Menoita E, Santos V, Santos AS, Testas C. Approaching wounds with hypergranulation. J Aging Innovation. 2013; 2(2): 16-24. Available from: https://journalofagingandinnovation.com/pt-pt/manuscript/4870/
7. Johnson S. Overcoming the problem of overgranulation in wound care. British Journal of Community Nursing. 2009 Jun;14(Sup3):S6-s12.
8. Garten AJ. Keys to diagnosing and addressing hypergranulation tissue. Podiatry Today. 2015 Jun 29.
9. Nesi-Reis V, Lera-Nonose DSSL, Oyama J, Silva-Lalucci MPP, Demarchi IG, Aristides SMA, et al. Contribution of photodynamic therapy in wound healing: A systematic review. Photodiagnosis Photodyn Ther. 2018 Mar;21:294-305.
10. da Costa Santos CM, de Mattos Pimenta CA, Nobre MR. A systematic review of topical treatments to control the

odor of malignant fungating wounds. J Pain Symptom Manage. 2010 Jun;39(6):1065-76.
11. Alves DF, Almeida AO, Silva JL, Morais FI, Dantas SR, Alexandre NM. Translation and adaptation of the Bates-Jensen wound assessment tool for the Brazilian culture. Texto & Contexto-Enfermagem. 2015;24(3):826-33.
12. Gomes Moura JP, Brandao LB, Pinheiro Barcessat AR. Study of photodynamic therapy (PDT) in the repair of tissue injuries: clinical case study. Estacao Cientifica-UNIFAP. 2018 Jan 1;8(1):103-10.
13. Quelemente BA, Morita AB, Balbi AT. Use of hypertonic solutions of sodium chloride in hypergranulating wounds. Rev Enferm UFPE On Line. 2009 Apr 1;3(2):107-12.
14. Li Y, Zhang Y, Wang Y, Yu K, Hu E, Lu F, Shang S, Xie R, Lan G. Regulating wound moisture for accelerated healing: A strategy for the continuous drainage of wound exudates by mimicking plant transpiration. Chemical Engineering Journal. 2022 Feb 1;429:131964.
15. Lima FA, Barbosa CPL, Basílio EEF, Fernandes NMS, Menezes AB. Aplicação de espuma de poliuretano com prata no tratamento da hipergranulação: um relato de experiência. In: Anais do II Congresso Brasileiro de Ensino em Ciências da Saúde 2017; Campina Grande, Brazil. Available from: https://editorarealize.com.br/artigo/visualizar/29069
16. Pinheiro Lda S, Borges EL, Donoso MT. Uso de hidrocolóide e alginato de cálcio no tratamento de lesões cutâneas [Use of hydrocolloid and calcium alginate in the treatment of skin lesions]. Rev Bras Enferm. 2013 Sep-Oct;66(5):760-70.
17. Kavitha KV, Tiwari S, Purandare VB, Khedkar S, Bhosale SS, Unnikrishnan AG. Choice of wound care in diabetic foot ulcer: a practical approach. World J Diabetes. 2014 Aug 15;5(4):546-56.
18. Brandão MGSA, Ximenes MAM, Cruz GS, Brito EHS, Veras VS, Barros LM, et al. Photodynamic therapy in the treatment of infected wounds on the feet of people with diabetes mellitus. Revista Enfermagem Atual In Derme. 2020 Jun; 92(30): 138-145.
19. Brandão MGSA, Ximenes MAM, Sousa DF, Veras VS, Barros LM, Rabeh SAN, et al. Photodynamic therapy for infected foot ulcers in people with diabetes mellitus: a systematic review. Sao Paulo Med J. 2023 May 12;141(6):e2022476.
20. Liu Z, Xiong Z, Wu J, Wang F. Clinical curative effect of Mesalt combined with Mepilex dressing in postoperative infection of inguinal hernia. Med Sci Monit. 2015 Apr 9;21:1038-42.
21. Cesar GB, Winyk AP, Sluchensci Dos Santos F, Queiroz EF, Soares KCN, et al. Treatment of chronic wounds with methylene blue photodynamic therapy: a case report. Photodiagnosis Photodyn Ther. 2022 Sep;39:103016.
22. Cruz RA, Costa IM, Almeida FD, Guimarães KS, Ferreira TM, Nascimento WS. Percepção de enfermeiros acerca dos cuidados e a utilização de hidrogel em lesões por pressão. Enfermeria Actual En Costa Rica. 2020;(39).
23. Brandão MG, Ximenes MA, Ramalho AD, Veras VS, Barros LM, Araújo TM. Effects of low-level laser therapy on the healing of foot ulcers in people with diabetes mellitus. Braz J Enterostomal Ther. 2020 May 15;18(e0320):1-8.

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Wound Hygiene: The Basics, The Impact And A New Surgical Consensus Document

Presenters: Dr. Christine Murphy PhD RN BSc(Hons) Tissue Viability MClSc(WH) PhD NSWOC WOCC(C)

Wound Hygiene – A Proactive Way to Treat Wounds

Wounds that have failed to respond as expected to evidence-based standard of care are commonly known as 'chronic wounds'. These wounds were thought to be 'stuck' in the inflammatory phase of healing. A more appropriate way to describe these types of wounds is 'hard-to-heal wounds'. One potential cause of hard-to-heal wound is granulitis – a hyperinflammatory state of the granulation tissue in the wound bed. This is analogous to gingivitis of the gum. Granulitis and gingivitis are both caused by bacteria biofilm, the preferred way of living for bacteria. Biofilm is a key reason why wounds stall or fail to close. Biofilm microbiome is heterogenous. It changes according to one's health and is different for everyone. For example, underlying factors like ischemia affects the environment and biofilm can take advantage of this and stalls healing.

Wound Hygiene is a four-step protocol to proactively address biofilm which delays healing. It is consistent and repetitive. It decontaminates, optimizes and prepares the wound environment for proper healing. The Wound Hygiene Protocol (WHP) includes:

1. Cleansing (of the wound and surrounding skin)
2. Debridement of the wound bed (i.e., initial debridement, if necessary, as well as maintenance debridement)
3. Refashioning (the wound edge)
4. Dressing (the wound with biofilm-targeted management (or anti-biofilm therapies) and prevention).

The four-step Wound Hygiene protocol can be applied by all clinicians regardless of scope by adapting to match level of skill and professional competency. Despite wound cleansing and debridement and refashioning of the wound edge, biofilm can re-form rapidly. Application of antimicrobial, especially antibiofilm, agents after biofilm has been physically disrupted can help tackle the residual biofilm and suppress re-formation. The dressing chosen must be able to:

1. Kill biofilm bacteria
2. Dismantle the protective extrapolymeric substance (EPS) layer

3. Repel biofilm re-formation
4. Absorb and retain exudate to protect peri-wound skin.

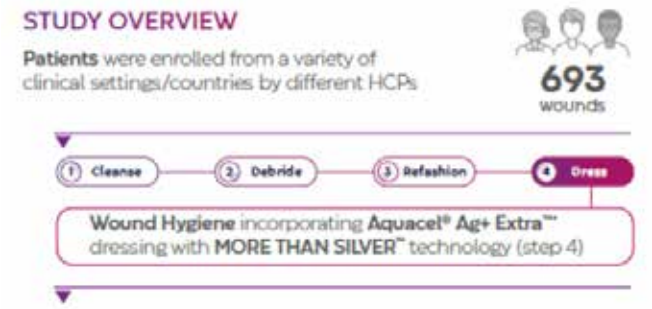
Real World Analysis Of The Wound Hygiene Protocol[1]

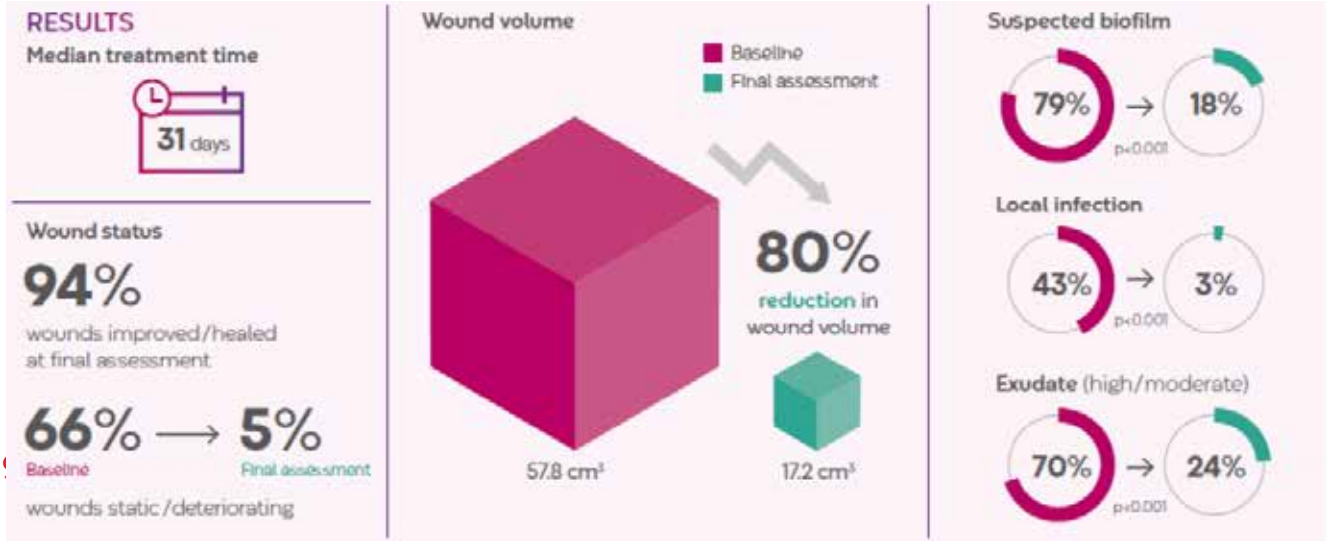
In 2024, Torkington-Stokes et al. published a prospective, real-world analysis of hard-to-heal wounds managed with the Wound Hygiene protocol (WHP). Aquacel® Ag+ dressing was incorporated as part of the WHP. The protocol was initiated through a structured education programme.

A total of 693 wounds in 669 patients from Spain, Italy, the UK, Poland, the Netherlands and Portugal were included in the study. Venous leg ulcers (VLUs) and pressure injuries (PIs) were the most common wounds. Twenty-one percent of the wounds have a duration greater than 12 months. Thirty-three percent of the patients were receiving antibiotic treatments. The predominant setting of the study was in community and home care settings. The study demonstrated that WHP successfully treated hard-to-heal wounds by addressing key barriers to wound healing. WHP was associated with a reduction of mean wound volume, suspected biofilm, local infection and exudate. At baseline, 66% of wounds were either static or deteriorating. This decreased to 5% at final assessment; 94% of the wounds showed improvement or have healed. Almost all of the clinicians involved (98.8%) responded that they would continue to adopt WHP as part of their wound care practice.

The Impact Of Surgical Site Infections[2]

Surgical site infections (SSIs) are a leading cause of postoperative morbidity and mortality. A study by G. Dobson in 2020 showed that of 310 million annual surgeries worldwide, 15% had serious postoperative morbidity. SSIs can lead to further complications, including but not limited to, stalled or reversed wound healing, wound dehiscence and system sepsis. SSIs place a significant burden on the health care system – they can cost up to three to four times the surgical procedures themselves. More importantly, SSIs can negatively affect the patient's quality of life.

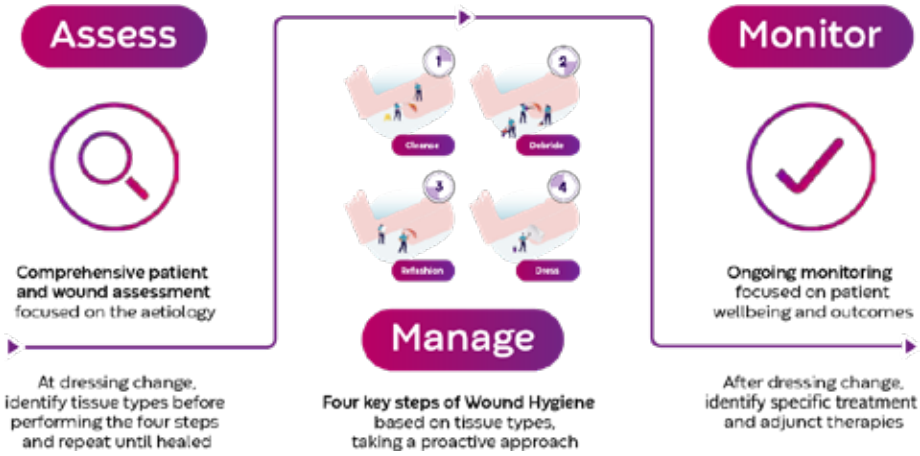




A Proactive Healing Strategy For Tackling Biofilm-Based Surgical Site Complications: Wound Hygiene Surgical[3]

Surgical wounds normally progress along an expected trajectory of healing. However, healing can be impaired by a variety of complicating incidents. SSIs behave very similarly to hard-to-heal wounds. The preoperative risk factors for surgical wound complications, including SSIs and dehiscence (See Table), closely overlap those of hard-to-heal wounds. Similar to hard-to-heal wounds, surgical wounds can be complicated by biofilm impairing healing and causing infections. Surgical complications and delayed healing can have significant impact on the health system (e.g., lengthen hospital stay, increase care human resource and cost) and the patient's quality of life. Therefore, a proactive approach should be undertaken to overcome the barriers of healing for SSIs, such as the presence of biofilm.

The Wound Hygiene Protocol (WHP) was developed for use in any setting, it is also suitable in a surgical context. A surgery specific version of the WHP is Wound Hygiene Surgical. It is a modified , patient-centric approach to wound hygiene. The first phase, "Assess", is to perform a comprehensive patient and wound assessment. The original four-step WHP is situated within the second phase, "Manage". "Monitor" is the last phase – ongoing monitoring should focus on patient well-being and outcomes.



Surgical Wound Management And Wound Hygiene

Primary intention:

Definition:

- When the wound edges of a surgical incision are brought together (approximated) and remained close throughout the healing process

Application of Wound Hygiene Protocol:

- Focus on preventing any planktonic bacteria in the closed incision from seeding and resulting in biofilm formation
- Implement Step 1 (cleanse) and Step 4 (dress) of the WHP

Secondary intention:

Definition:

- When dermal edges are not fully approximated, leaving the wound open

Application of Wound Hygiene Protocol

- Open wounds resulting from SSI or dehisce should be managed with all four steps of the WHP (cleanse, debride, refashion, dress)

Tertiary healing (i.e., delayed primary closure):

Definition: Deliberately leaving a wound open

before surgically approximating it at a later date
Application of Wound Hygiene Protocol:

- Implement Steps 1 to 4 of the WHP
- Refashioning should include the entire wound bed, including healthy tissue, and not just the wound edges

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References

1. Torkington-Stokes R, Moran K, Martinez DS, Granara DC, Metcalf DG. Improving outcomes for patients with hard-to-heal wounds following adoption of the Wound Hygiene Protocol: real-world evidence. J Wound Care. 2024 May 2;33(5):304-310. doi: 10.12968/jowc.2024.33.5.304. PMID: 38683779.
2. Dobson GP. Trauma of major surgery: A global problem that is not going away. Int J Surg. 2020 Sep;81:47-54. doi: 10.1016/j.ijsu.2020.07.017. Epub 2020 Jul 29. PMID: 32738546; PMCID: PMC7388795.
3. Murphy C, Banasiewicz T, Duteille F, Ferrando PM, Jerez González JA, Koullias G, Long Z, Nasur R, Salazar Trujillo MA, Bassetto F, Dunk AM, Iafrati M, Jawień A, Matsumura H, O'Connor L, Sanchez V, Wu J. A proactive healing strategy for tackling biofilm-based surgical site complications: Wound Hygiene Surgical. J Wound Care. 2024 May 1;33(Sup5a):S1-S30. doi: 10.12968/jowc.2024.33.Sup5c.S1. PMID: 38787336.

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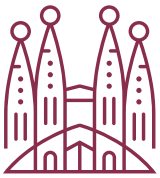

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Skin And Soft Tissue Infections In Persons Who Inject Drugs - Dressing Choices: A Quality Improvement, Community-based Case Series

By Janet L Kuhnke RN BA BScN MS NSWOC FCN DrPsychology, Sharon MacKenzie BScN MN, Avery Tremblett RD BScN and Sarah Wilson BScN (student)

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Introduction

The National Harm Reduction Coalition (2024) states that persons who inject drugs are at risk of bacterial, viral and other infections that may be life-threatening. These include contaminated injections, bacteremia, endocarditis, tetanus, necrotizing fasciitis, wound botulism, hepatitis, human immunodeficiency virus, injection-related injuries such as tracking, bruising, vein collapse, abscesses and or emboli.[1,2]

Persons who inject drugs may develop a skin or soft tissue infection (SSTI) or abscess that may develop into cellulitis or more serious infection in various anatomical locations (neck, forearm, hand, wrist, feet, toes, thigh, calf).[3-11] In a recent study, Benribi et al. (2023) report that as many as 63% (n=297) of persons describe having an injection-related abscess at the drug injection site within their lifetime.[12]

An abscess is an infection (bacterial) that forms into a pocket of pus underneath the skin; this may lead to an abscess that is caused by bacteria collecting under the skin.[13] An abscess may be caused by bacteria in the drugs, on injection equipment or through the process of injecting. The healing of an abscess may be complicated by a person's multiple comorbidities (e.g., immunosuppression, nutritional compromise, depression, mental health challenges, diabetes mellitus, heart and lung issues) and from psychosocial challenges such as experiencing homelessness, discrimination and stigma.[2,14]

In part one of this community-based study, we learned that individuals access care for their abscess from a variety of sources and there are many barriers to care. Clients described being reluctant at times to access care from formal

health-care services (e.g., acute, emergency care).[12,15] We also learned that persons who develop an abscess engage in self-treatment of their wound at home, on the street or by asking friends to help with wound care. If the wound becomes more serious, persons may then access formal health-care services and community-based health programs that include interdisciplinary teams of social workers, physicians, pharmacists, laboratory technicians and nurses).[16] As a result of this study, the centre adopted (with permission) the *British Columbia Centre for Disease Control: Skin Infections (Harm Reduction Resource)*.[17] We also learned that clients prefer wound care services and intravenous antibiotic delivery in a setting where there are trust-filled relationships.[17]

This paper reports on part two of the study. We share our quality improvement strategy and report on three client cases from the clinic community-based team focused on abscess prevention and management. This centre where this study took place provides care to vulnerable persons, often marginalized, oppressed or unsheltered.[18,19] In this part of the study, staff at a community-based health clinic explored steps to improve assessing and managing wounds related to abscesses. Specifically, we wanted to explore our skin and wound care practices including assessment and documentation. Second, we wanted to review our use of, and access to, wound care dressings.

Materials/Method

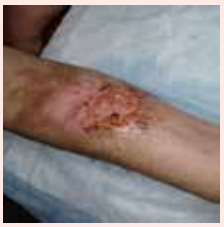
A qualitative, case-based research approach was used to review our current client-centred wound care practices.[20,21] We also embedded quality improvement principles to guide changes in our documentation practice.[22] University research ethics were applied for and approved. Approval for the study was gained from The Ally Centre and funding for a trial of a dressing was approved from Mölnlycke Health Care.[23] Team members included the clients, emergency department staff, the Continuing Care Department, Victoria Order of Nurses, and the physician and nurses at the health clinic.

This study is framed within Nova Scotia's Opioid Use and Overdose Framework (2019).[24] We also grounded our change in the best practice recommendations for the prevention and management of wounds.[25] Therefore, the objective of the study was to embark on a quality improvement initiative related to wound assessment and documentation. A second objective was to report on three clients piloting an all-in-one dressing.

Results

To establish a baseline, the clinic team reviewed present wound assessment and documentation of skin and wound care through chart audits. We identified that clients may have multiple wounds and there was no validated wound documentation tool in use. As well, from client feedback, we learned that they prefer a dressing that they can lift and reapply over the wound area, as some persons continue to inject drugs within the wound bed. This was and remains a challenge in this study. We also reviewed the use of various wound care dressings available to the clinic. From our discussions, we proposed several changes to support the delivery of best practices in wound care.

First, between January and June 2024, we adopted and educated the staff on the use of the Bates-Jensen Wound Assessment Tool (BWAT) to document wound care.[26] The team's adminis-

Client 1: Male, 60's, uses substances, and has access to safe supply, lives with diabetes mellitus and is experiencing homelessness. Oral and IV antibiotics. Wounds on right forehands and foot (four-year history of open wounds with clinic team) Infection control, wound cleansing and MFSF dressing utilized. *Care is ongoing and remains complex*.			
Client 2: Male, 20's uses substances. Wound right forearm (weeks to months) multiple injections and is experiencing homelessness. Oral and IV antibiotics. Infection control, wound cleansing and MFSF dressing utilized. *Taught self-care, wound closed.*			
Client 3: Female, 30's, uses substances. Wound on the right forearm (near elbow) and lower thigh related to missed injections, lives housed. Oral and IV antibiotics. Infection control, wound cleansing and MFSF dressing utilized. *Multiple wounds closed.*			

ical record. Second, between January and June 2024, we adopted the use of the PDF fillable Inlow's 60-second Diabetic Foot Screen.[27] Third, we embedded a foot care nurse assessment and charting tool. Education on the BWAT and Inlow tool continues and is being audited.

Finally, we searched the literature,[28] and then partnered with Mölnlycke Health Care to trial a multidimensionally flexible silicone-coated foam (MFSF) dressing (Mepilex Border Flex™, Molnlycke Health Care) as it is conformable, discrete, and able to be lifted and reapplied.[29] The following three cases synopses are purposely shared as they reflect the complexity of wound care service and that clients may have multiple wounds. For privacy, client information has been modified.

Discussion And Implications For Practice

Improved communication: Skin and soft tissue infection related to the injection of substances remain a significant concern in the community care.[2,12] Healing of these wounds is often complicated by other co-occuring health issues,[31] stereotyping and stigmatization of persons injecting drugs.[2,32] Education on safe injection in needle exchange programs continue to be key to prevention.[2]

In this quality improvement study, the team was able to educate and embed the BWAT and Inlow validated tools in the electronic charting system, as well as a nursing foot care assessment (non-validated). The use of validated tools is important for clear and consistent sharing of skin and wound care information between team members, for monitoring progress of the wound healing and risk of developing diabetes-related foot complications.[27]

Challenge of multiple wounds: Consistent with the literature, in the population this clinic serves, clients may have an abscess related to injection drug use and other wounds at various stages of healing such as those related to falls, trauma (fractures), burns (sunburn), insect bites and being nutritionally compromised. [33,34] We also learned that clients may also have foot complications such as soft-tissue injuries, corns, callous, and nail pathologies and infections.[31]

Assessment of wounds using the BWAT has begun to standardize assessment and communication of wound progress. Also, the use of a MFSF dressing is versatile and suitable for wounds at multiple healing stages. The dressing offered both absorption, moisture control, protection and stayed in place for multiple days making them ideal for managing challenging wounds, especially when the client's returns for care may be sporadic. Clients comment that the materials used in the outer layer of the dressings are discrete rather than bright white. Some report the dressing didn't always stay in place /adhere for multiple days as hoped.

We continue to have challenges caring for clients with wounds as the population we serve is mobile and not all persons return for wound care as planned. We offer self-care dressing kits as appropriate.

Interprofessional collaboration: Partnering with industry to trial products has been of benefit to our team. This partnership has supported our access to trial an all-in-one dressing.

Staff feedback includes:

Staff A:* The MFSF dressings offer superior adherence compared to standard dressings, remaining in place for longer durations. Their surface allows for easy labeling, enabling health-care providers to write dates and instructions directly on the dressing. Clients have expressed a preference for these dressings due to their ability to be peeled back and reapplied, offering greater convenience. Additionally, their absorbency facilitates easier monitoring of wound discharge, contributing to improved wound management and care.

Staff B:* The MFSF dressings offer an ideal solution for clients that can't return regularly for wound care and maintenance. As a dressing that can stay in place for more than 24 hours, has good drainage capacity and allows for readjustment by our clients as necessary, MFSF dressings are a versatile option in our wound care toolkit.

**Editors note: The opinions expressed are those of the staff involved in the study. They do not constitute a guarantee or endorsement of any kind by Wound Care Canada or Wounds Canada.*

Conclusion

This case study series is part of a larger research study. We wanted to share our progress to encourage other teams to partner, collaborate and embed validated tools into practice.

Regardless of the barriers to care, we continue to aim to provide wound care to all populations. The persons we serve are vulnerable and trust-filled relationships are foundational to care. Vulnerable and unsheltered populations need skin health assessment and timely wound care.[15,17]

Utilizing the MFSF dressing provided an opportunity to provide timely dressing changes. In a case-by-case approach we continue to partner with industry to ensure we can trial this all-in-one dressing for clients with intravenous abscesses.

This is a key reminder that skin health and wound care issues cross all populations, including those identified as vulnerable and experiencing homelessness. Finally, interprofessional teamwork is essential for prevention and to initiate proactive wound care.

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References

1. National Harm Reduction Coalition. Getting off right: a safety manual for injection drug users. Available from: https://harmreduction.org/issues/safer-drug-use/injection-safety-manual/potential-health-injections/
2. Canadian Centre on Substance Abuse. Needle exchange programs (NEPs) FAQs 2019. Available from: https://www.ccsa.ca/sites/default/files/2019-04/ccsa-010055-2004.pdf
3. Hope VD, Parry JV, Ncube F, Hickman M. Not in the vein: 'missed hits', subcutaneous and intramuscular injection and associated harms among people who inject psychoactive drugs in Bristol, United Kingdom. Int J Drug Policy 2016;28:83–90.
4. Asher AK, Zhong Y, Garfein RS, Cuevas-Mota J, Teshale E. Association of self-reported abscess with high-risk injection-related behaviors mong young persons who inject drugs. J Assoc Nurses AIDS Care. 2019;30:142–150.
5. Sanchez DP, Tookes H, Pastar I, Lev-Tov H. Wounds and skin and soft tissue infections in people who inject drugs and the utility of syringe service programs in their management. Adv Wound Care 2021;10:571–582.
6. Ramakrishnan K, Salinas RC, Higuita NIA. Skin and soft tissue infections. Am Fam Physician 2015;92:474–488.
7. Sahu KK, Tsitsilianos N, Mishra AK, Suramaethakul N, Abraham G. Neck abscesses secondary to pocket shot intravenous drug abuse. BJM Case Report 2020;13:1–2.
8. Pastorino A, Tavarez MM. Incision and drainage. Treasure Island, FL: StatPearls Publishing; 2020.
9. Stevens DL, Bisno AL, Chambers HF, Dellinger EP, Goldstein EJC, Borbach SL, et al. Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Disease Society of America. IDSA Guideline 2014;59:e1-e52.
10. Lavender TW, McCarron B. Acute infections in IDU. Royal College Physicians 2013;13:511–513.
11. Maloney S, Keenan E, Geoghegan N. What are the risk factors for soft tissue abscess development among injection drug users? Nursing Times 2010;106. Available from: https://www.nursingtimes.net/clinical-archive/substance-misuse/what-are-the-risk-factors-for-soft-tissue-abscess-development-among-injecting-drug-users-14-06-2010/
12. Benrubi LM, Silcox J, Hughto J, Stopka TJ, Palacios WR, Shrestha S, et al. Trends and correlates of abscess history among people who inject drugs in Massachusetts: A mixed methods exploration of experiences amidst a rapidly evolving drug supply. Drug Alcohol Depend Rep. 2023; 8, 2772-7246. DOI: https://doi.org/10.1016/j.dadr.2023.100176
13. National Alliance of State and Territorial AIDS Directors. Wound care and medical triage for people who use drugs and the program that serve them. 2023. https://nastad.org/sites/default/files/2023-04/PDF-Wound-Care-And-Triage.pdf
14. Tsybina P, Kassir S, Clark M. Skinner S. Hospital admissions and mortality due to complications of injection drug use in two hospitals in Regina, Canada: retrospective chart review. Harm Reduct J 2021;18:44. DOI: 10.1186/s12954-021-00492-6
15. Kuhnke JL, Jack-Malik S, Maxwell S, Bickerton J, Porter C, Kuta-George N. Self-treatment of abscesses by persons who inject intravenous drugs: a community-based quality improvement inquiry. WCET Journal, 2023:43(1), 28-34.
16. British Columbia Centre for Disease Control. Skin infections. 2022. Available from: http://www.bccdc.ca/resource-gallery/Documents/Statistics%20and%20Research/Statistics%20and%20Reports/Overdose/Skin%20Infections%2024Jan22_FINAL.pdf
17. Bickerton J. Ally Centre outreach street health pilot: final

report 2022. Available from: https://www.allycentreofcapebreton.com/images/Files/Final-report-Outreach-Street-Health.pdf
18. Liamputtong P. Researching the vulnerable. London: Sage Publishing; 2007. DOI: 10.4135/9781849209861
19. Freire P. Pedagogy of the oppressed. London: Continuum; 2011.
20. Creswell JW. A concise introduction to mixed methods research. London: Sage Publishing; 2015.
21. Braun V, Clarke V. Successful qualitative research a practical guide for beginners. London: Sage Publishing; 2013.
22. Patton MQ. Evaluation flash cards: embedding evaluative thinking in organizational culture. Otto Bremer Trust; 2018.
23. Global Medical Affairs at Mölnlycke Health Care. Available from: https://www.woundscanada.ca/health-care-professional/publications/dfc-2
24. Nova Scotia Government Department of Health and Wellness. Nova Scotia's opioid use and overdose framework; 2017. Available from: https://novascotia.ca/opioid/
25. Wounds Canada. Foundations of Best Practice for Skin and Wound Management. 2017.
26. Wounds Canada. Bates-Jensen Wound Assessment Tool. Available from: https://www.woundscanada.ca/docman/public/health-care-professional/1428-bwat/file
27. Blanchette V, Kuhnke JL, Botros M, McCallum C, Evans R. Inlow's 60-second diabetic foot screen: update 2022. Limb Preservation Journal. 2023;4(1): 22-28. DOI: 10.56885/HRJU7789
28. Santamaria N, Gerdtz M, Kapp S, Wilson L, Gefen A. A randomised controlled trial of the clinical effectiveness of multi-layer silicone foam dressings for the prevention of pressure injuries in high-risk aged care residents: The Border III Trial. Int Wound J. 2018 Jun;15(3):482-490. DOI: 10.1111/iwj.12891. Epub 2018 Apr 10. PMID. Available from: https://pubmed.ncbi.nlm.nih.gov/29635842/
29. Molnlyche. Mepilex border flex. Available from: https://www.molnlycke.ca/products-solutions/mepilex-border-flex/
30. Cazalis A, Lambert L, Auriacombe M. Stigmatization of people with addiction by health professionals: Current knowledge. A scoping review. Drug Alcohol Depend Rep. 2023;9:100196. Published 2023 Oct 24. DOI: https://doi.org/10.1016/j.dadr.2023.100196
31. Kuhnke JL, Telegdi E, Hansen K. Foot health and footwear for persons experiencing homelessness: a resource. Limb Preservation Journal. 2024;5(1):48-59. DOI
Canadian Centre on Substance Abuse. Needle exchange programs (NEPs) FAQs 2019. Available from: https://www.ccsa.ca/sites/default/files/2019-04/ccsa-010055-2004.pdf
32. Woolley E. What are the top 10 health issues homeless people face? Available from: https://homelesshub.ca/blog/2015/what-are-top-10-health-issues-homeless-people-face/
33. Gilbert AR, Hellman JL, Wilkes MS, Rees VW, Summers PJ. Self-care habits among people who inject drugs with skin and soft tissue infections: a qualitative analysis. Harm Reduc J 2019;16:1–11.
34. Tarusuk J, Zhang J, Lemyre A, Cholete F, Bryson M, Paquette D. National findings from the Tracks survey of people who inject drugs in Canada, Phase 4, 2017–2019. Can Commun Dis Rep. 2020 May 7;46(5):138-148. DOI: 10.14745/ccdr.v46i05a07

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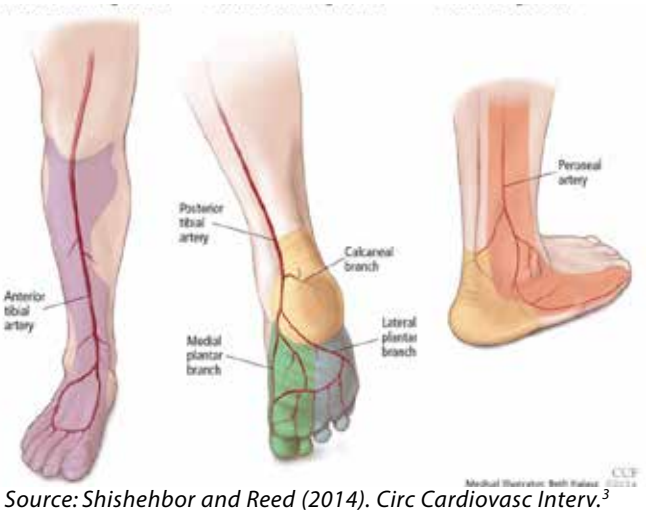
The Concept Of Angiosomes

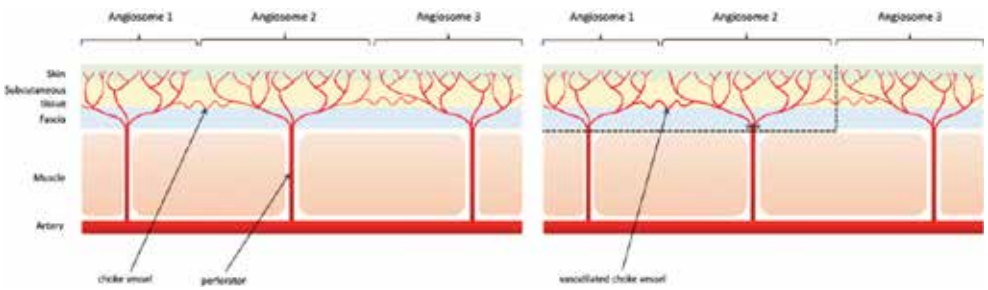
An angiosome is defined as a block of tissue (i.e., skin, muscle, tendon, and/or bone) supplied by a particular course of arteries.[1] There are connections between angiosomes known as choke arteries.[1] These connections provide safety conduits to enable blood flow between border zones if the source artery in a particular angiosome is injured.[1] There are six angiosomes in the foot and ankle supplied by three main arteries (i.e., posterior tibial artery, anterior tibial artery and peroneal artery). Understanding of angiosome is crucial in surgical planning, particularly in revascularization and patient outcomes. Fifteen percent of ischemic lower extremity wounds fail to heal despite adequate arterial bypass surgeries.[2] A direct revascularization approach is preferred over an indirect approach. Direct revascularization is when the bypassed vessel directly feed the source artery of the angiosome where the wound is.[2] The failure rate and amputation rate are much lower when the revascularization is direct.[2]



Source: Shishehbor and Reed (2014). Circ Cardiovasc Interv.[3]

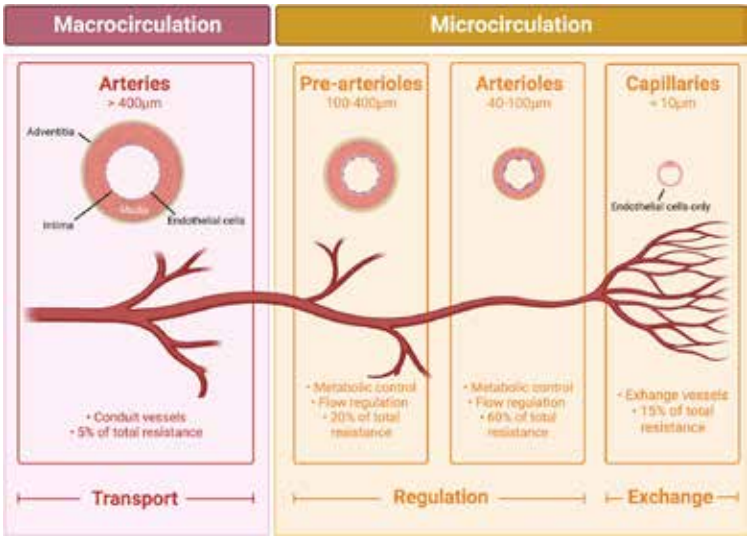
Macrocirculation, Microcirculation And Wound Healing:

Adequate perfusion is crucial for proper and timely wound healing. The macrocirculation (i.e., arteries) are responsible for bringing oxygenated blood from the heart to the microcirculation. The microcirculation (e.g., pre-arterioles, arterioles and capillaries) then deliver oxygenated blood to the skin and the wound bed. Compromised macro- and microcirculation delay wound healing, rendering them chronic or non-healable. Over the past 20 years, advances in research have recognized and emphasized the importance of



Source: Eccles et al. (2020). Standards for the Management of Open Fractures[1]

not just microcirculation, but microcirculation in wound healing.



Source: Merdji H et al. (2023). Ann Intensive Care.[4]

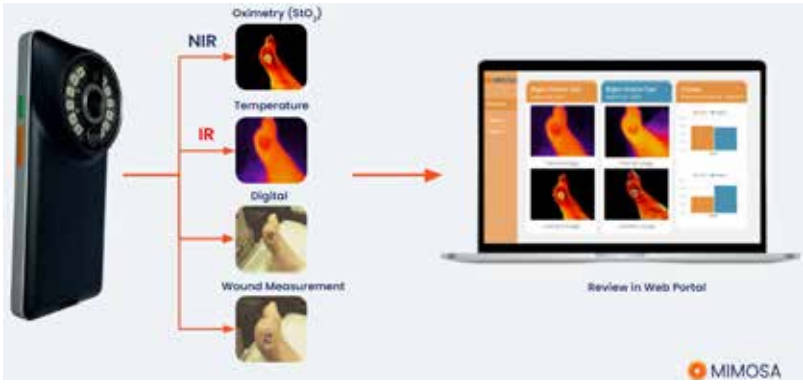
Macro- and microcirculation can be assessed by two broad categories of vascular imaging – optical and non-optical. Optical imaging involves light-based technologies, whereas non-optical imaging does not. Table 1 summarizes the common optical and non-optical imaging techniques for the assessment of macro- and microcirculation.

Table 1. Imaging Techniques for the Assessment of Macro- and Microcirculation

		Microcirculation
Optical Imaging	Doppler (Duplex) Ultrasound Angiography	Laser Doppler Flowmetry (LDF) Near-Infrared Spectroscopy (NIRS)
Non-Optical Imaging	Ankle-Brachial Index (ABI) Pulse Volume Recording (PVR)	Transcutaneous Oximetry ($TcPO_2$) Skin Perfusion Pressure (SPP)

MIMOSA Pro

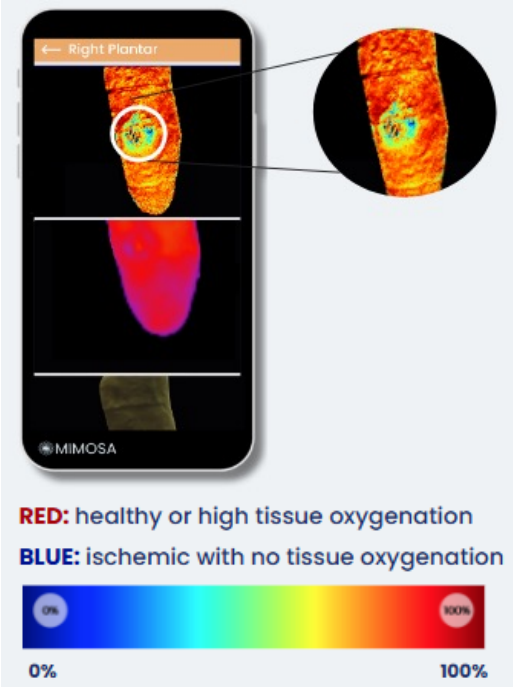
The MIMOSA Pro is an FDA-approved (and recently Health Canada-approved) pocket-sized medical device that enhances clinical decision-making in wound care. MIMOSA Pro provides four key functionalities available at the point of care: near infrared spectroscopy (NIRS), infrared spectroscopy (IR), digital wound photography and wound measurement. MIMOSA Pro is smart and agile – wound images and data are stored and can be viewed on a web portal.

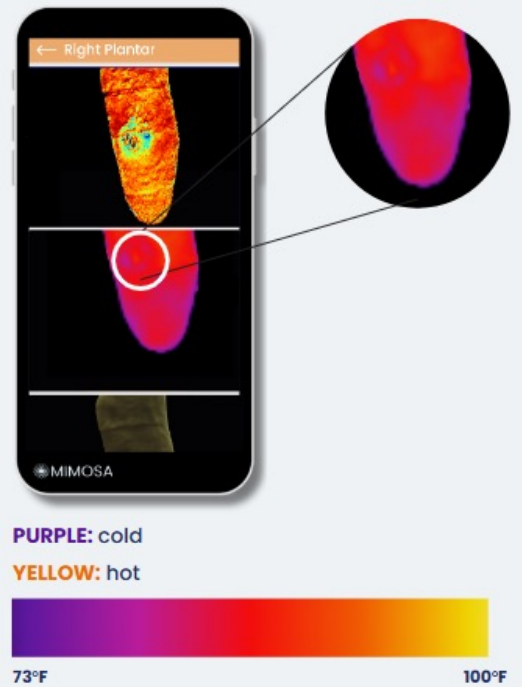


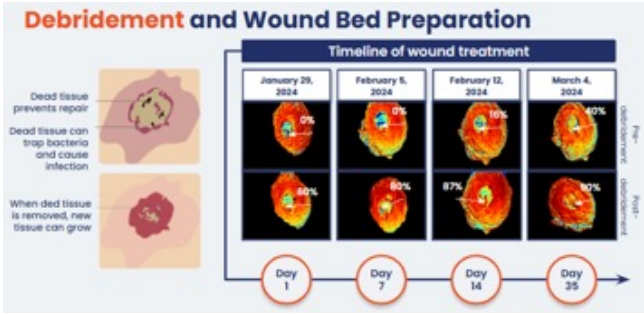
NIRS a fibre-based technology that is commonly used in health care (e.g., pulse oximeter) and provides information beyond what the naked eye can see. The light emitted by the MIMOSA Pro goes below the surface of the skin and is absorbed by the hemoglobin in red blood cells. The light that is not absorbed will bounce back and the signals are detected by the camera system. This creates a digital fingerprint – a surrogate marker for tissue oxygenation (StO_2). Clinicians can visualize wound and peri-wound tissue oxygenation at the point of care. It provides information on healing trajectories and enables clinical decision-making (e.g., debridement, pre- and post-intervention evaluation). Skin temperature is an important clinical indicator for wound infection and inflammatory conditions (e.g., Charcot neuroarthropathy). Through the integrated infrared spectroscopy (IR), clinicians can assess temperature variations in and round the wound. Clinicians can also capture digital images of the wound at point of care. MIMOSA Pro can also provide wound measurements. These features simplify and improve the accuracy of documentation. This also enables clinicians to track wound healing progression.

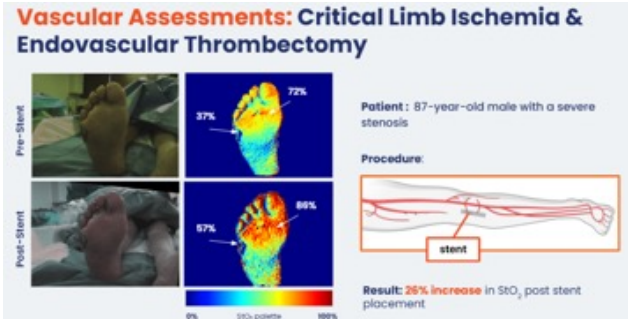
Clinicians can utilize MIMOSA Pro to guide wound bed preparation. For example, NIRS imaging provides real-time feedback and offers insights to the efficacy of debridement. Clinicians can also use MIMOSA Pro to instantly assess the

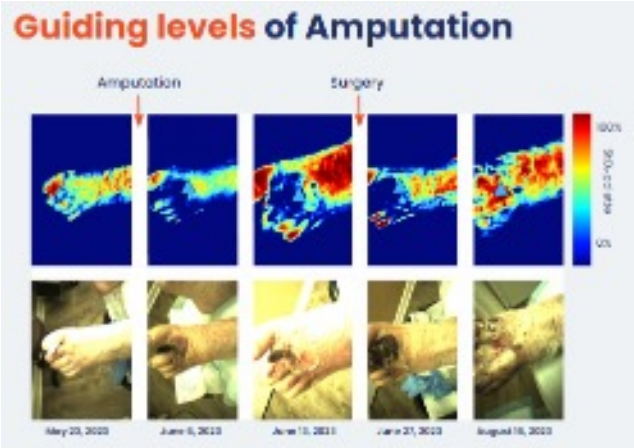
effectiveness of invasive vascular procedures at the bedside. Surgeons can utilize MIMOSA Pro to guide surgical decision (e.g., level of amputation) and predict post-operative necrosis and flap failure.

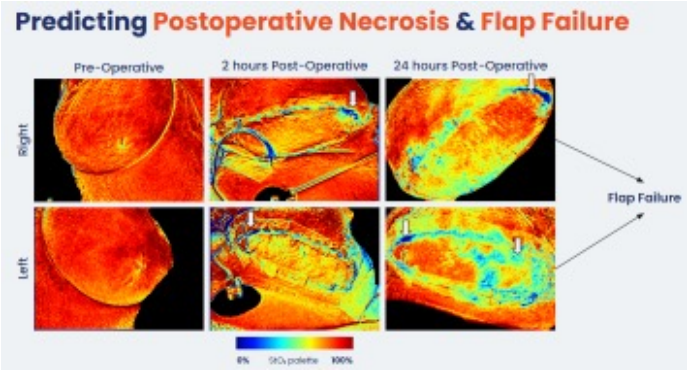










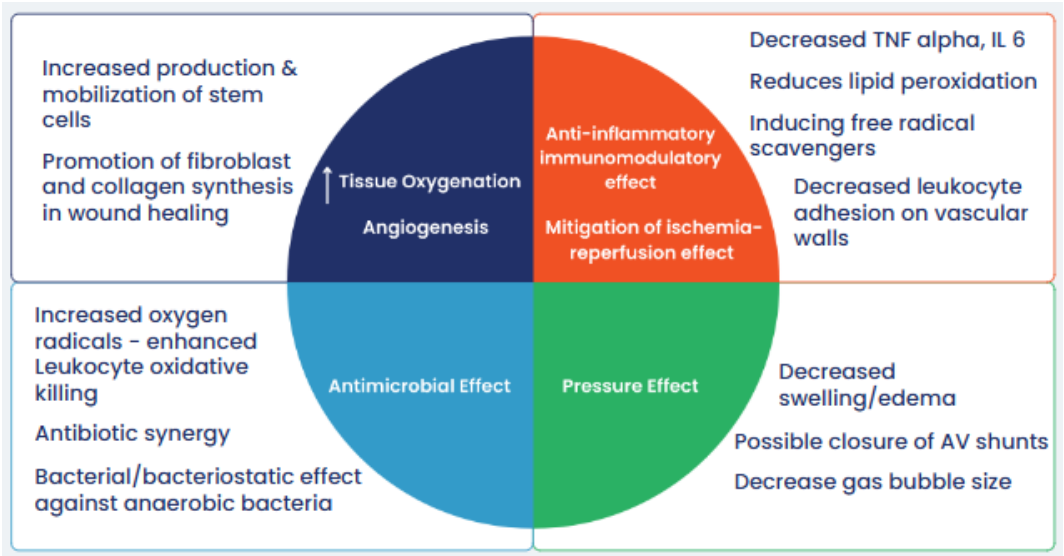


The Value Of Imaging In Hyperbaric Oxygen Therapy (HBOT)

Hyperbaric oxygen therapy (HBOT) is the delivery of high concentrations of oxygen at pressures significantly higher than ambient air. HBOT is indicated for deep infections (i.e., osteomyelitis, acute ischemia, compromised surgical flaps and grafts, and complex non-healing wounds. While it is an adjunctive therapy, HBOT does not replace good wound care. There are, however, many benefits to HBOT in wound healing, some of which are highlighted in Figure 1

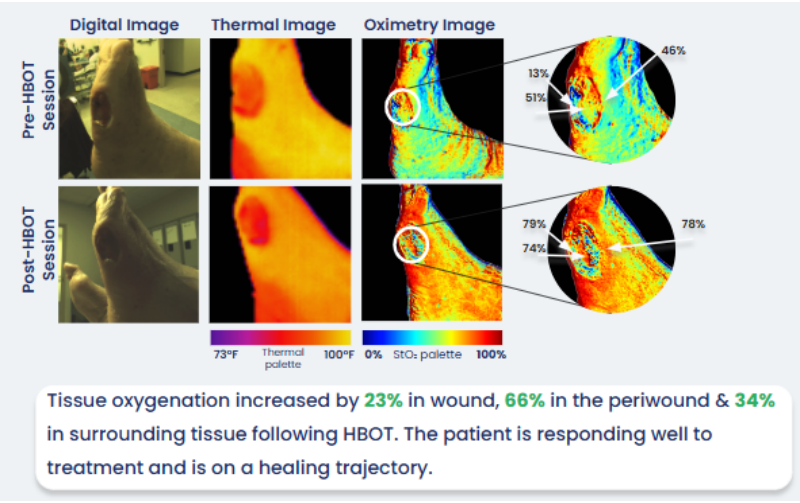
A common misconception about HBOT is that the effects are temporary (i.e., only when the patient is in the hyperbaric chamber). The human body responds to hypoxia by producing hypoxia-inducible factor-1-alpha (HIF-1-alpha). When the patient steps out of the hyperbaric chamber and breathes ambient air, the body is 'tricked' by thinking it is in a hypoxic state and subsequently releases HIF-1-alpha. This is how HBOT provides the short-term and prolonged effects beneficial to wound healing stated above.

Figure 1. The Benefits of Hyperbaric Oxygen Therapy



The following is an example of a patient with a diabetic foot ulcer (DFU) receiving HBOT to enhance healing. Wound images were taken pre- and post-HBOT using the MIMOSA Pro.

The use of MIMOSA Pro not only provided a digital image of the wound, but valuable information such as real-time qualitative validation of HBOT as evidenced by increased in wound and peri-wound oxygenation. These types of objective visualizations may enhance patient adherence and allows for more accurate documentation. They also allow clinicians to track progression and project healing, especially pre- and post-intervention. They can also aid in streamlining clinical decision making, including when to discontinue a particular treatment (e.g., HBOT).



Innovative Approaches to Wound Care Across Canada

New Brunswick – The Healthy Seniors Pilot Project

The median age in New Brunswick is 45.7 years, the second highest in Canada. Approximately 22.8% New Brunswickers are 65 years or old – 27% of them live alone and 10% are living in poverty. Forty-seven percent of those who are 65 years or older live in a rural/remote area. Individuals living in rural/remote areas have a three to four times higher chance of amputation due to delayed access to care. Diabetes contributes to 70% of non-traumatic leg and foot amputations. Approximately 85% of these were preceded by a diabetic foot ulcer (DFU). More importantly, 80% of lower extremity amputations (LEA) related to diabetic foot complications can be prevented with the integration of prevention and interdisciplinary

care.

The *Healthy Seniors Pilot Project* was a partnership between the University of New Brunswick and the Horizon Health Network. The project aimed to gain a better understanding of the needs of seniors wanting to age in place/at home; improve diabetic foot health among isolated seniors; and reduce self-reported loneliness and social isolation. The project included six foot risk assessment and foot care visits (every four to six weeks) by registered nurses (RNs). MIMOSA Pro was used for foot and wound monitoring and to aid clinical decision-making. Registered social worker (RSWs) provided baseline and periodic patient assessments and information about accessing health care resources. The interdisciplinary team also included, but not limited to, dietitians and occupational therapists.

A total of 313 seniors completed all of the foot assessment and care visits – 53.8% of them were at a high or urgent risk based on diabetic foot risk scores and 6% had an active ulcer.[5] On average, the foot risk scores decreased after three visits compared to baseline.[5] The patients' mental health also improved – anxiety and depression scores decreased significantly after 3 months compared to baseline.[5] This pilot project demonstrated the importance of early intervention and patient engagement. It also highlighted the importance of collaborative efforts to achieve better patient outcomes.

Nova Scotia – The Wound Innovation Collaborative

The Nova Scotia Health Innovation Hub is part of the Nova Scotia Health Authority. They bring technology and solutions into the health-care system through industry partnerships. They also support clinicians in search of health technology solutions or are on a quest to create their own. The *Wound Innovation Collaborative* (*WIC*) aims to improve patient outcomes by empowering communities with the tools and knowledge to deliver equitable wound care. Their projects are founded on four strategic pillars embedded in its vision: 1) Annotated meaningful data; 2) Impactful products and partnerships; 3) Knowledge translation and integration; 4) Community connection.

One of *WIC*'s projects is to create a provincial wound registry. This will serve as a data collection platform for wounds across Nova Scotia. The goal of this project is for clinicians to have access to this database, leading to better patient outcomes (e.g., more personalized care, faster rate of healing). The *WIC* also creates partnerships with companies like MIMOSA Diagnostics to bring the latest wound care innovations to Nova Scotians and ensure optimal care for all. Clinicians (i.e., NSWOCs) in the Central Zone of the Nova Scotian Health Authority will be the first to be trained to utilize and implement MIMOSA Pro in the management of complex wounds.

The *WIC* strives to support clinical nurse educators in wound care. They ensure alignment and collaboration on initiatives with Interprofessional Practice & Learning (IPP&L) colleagues within the provincial wound care program. They also support the implementation of new roles in wound care, including the wound care clinical nurse educators and pressure injury support nurses. These roles are integral to knowledge translation and integration in the front lines within the health system. Lastly, *WIC* aims to bridge the gap between hospital and community wound care to ensure a seamless transition of care to achieve better patient outcomes. This is accomplished through building new and strengthening existing community partnerships. Afterall, majority of wound care is practiced in the community and collaboration is the key to achieving optimal patient outcomes.

Dr. Karen Cross MD PhD FRCSC is a Plastic & Reconstructive Surgeon and PhD Scientist. Dr. Cross leads the *Wound Innovation Collaborative*, a centre of excellence in wound innovation and the data registry for the province of Nova Scotia. As an Innovator in Residence at the Nova Scotia Innovation Hub. She was recently named one of Atlantic Canada's Top 50 CEOs of the Year, Innovator of the Year in 2024, and one of Canada's Top 14 Entrepreneurs to Watch in 2023.

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References

1. Eccles, Simon, and others (eds), Standards for the Management of Open Fractures (Oxford, 2020; online edn, Oxford Academic, 1 Aug. 2020), https://doi.org/10.1093/med/9780198849360.001.0001
2. Attinger CE, Evans KK, Bulan E, Blume P, Cooper P. Angiosomes of the foot and ankle and clinical implications for limb salvage: reconstruction, incisions, and revascularization. Plast Reconstr Surg. 2006 Jun;117(7 Suppl):261S-293S. doi: 10.1097/01.prs.0000222582.84385.54. PMID: 16799395.
3. Shishehbor MH, Reed GW. Personalized approach to revascularization of critical limb ischemia. Circ Cardiovasc Interv. 2014 Oct;7(5):642-4. doi: 10.1161/CIRCINTERVENTIONS.114.001923. PMID: 25336603.
4. Merdji H, Levy B, Jung C, Ince C, Siegemund M, Meziani F. Microcirculatory dysfunction in cardiogenic shock. Ann Intensive Care. 2023 May 6;13(1):38. doi: 10.1186/s13613-023-01130-z. PMID: 37148451; PMCID: PMC10164225.
5. Rickards T, Roberts C, Smith T, Shittu S, Boodoo C, Cross K. Using Near-Infrared Spectroscopy and Education to Support Older Adults with Diabetic Foot Ulcers to Age-in-Place: A Case Series. Adv Skin Wound Care. 2024 Aug 1;37(8):422-428. doi: 10.1097/ASW.0000000000000146. PMID: 39037096.

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A Pressure Injury Prevention (PIP) Quality Improvement Pilot Of Sub-Epidermal Moisture Scanning In Acute Care

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Introduction

A pressure injury is defined as localized damage to the skin and/or underlying tissue, due to pressure or pressure in combination with shear.[1] Patients with activity/mobility impairment are at highest risk due to their inability to safely reposition or mobilize themselves, leaving them exposed to prolonged unrelieved pressure and/or shear.[2,3] In Canada, the prevalence of pressure injuries is 26% with 25.1% acute care, 29.9% non-

acute care, 22.1% mixed health-care settings and 15.1% in community care settings.[4] Hospital-acquired pressure injury treatment costs range from $44,000 for Stage 2 to $90,000 for Stage 4.[5] The cost to treat pressure injuries is substantially higher than prevention.[6,7] The burden on those living with pressure injuries[8] and those engaged in efforts to prevent and treat them is enormous.[9] While a zero-pressure injury rate is desirable, it also is very unlikely,[10] however there is consensus that most pressure injuries are preventable.[11]

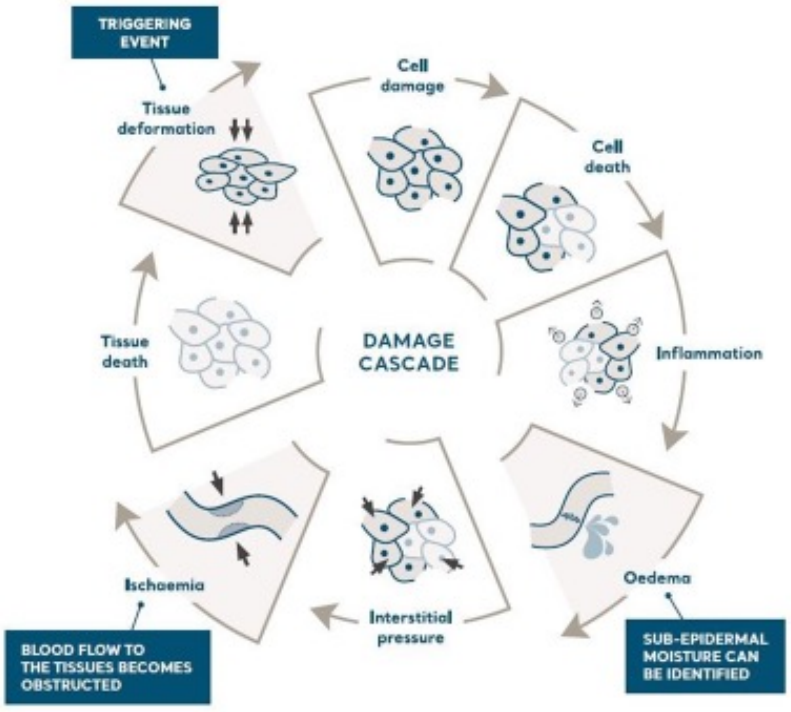
Risk And Skin Assessment

The use of a validated risk assessment tool is recognized as the initial crucial step in prevention.[1] Risk assessment tools are subjective and not anatomy specific, with low sensitivity and specificity (50.6% and 60.1%), depend on independent factors such as age, nutrition, activity, mobility, and skin status[12-14] and are weighted the same, diluting the impact of immobility on pressure injury development.[15] Visual skin assessments offer limited predictive validity[16] and are limited to visible and palpable changes to the skin, and are expertise dependent.[17] Darkly pigmented skin rarely shows a blanching response, and erythema may be hard to detect,[18] potentially contributing to more severe outcomes in these populations.[19] Risk and visual assessments are not intended to assess or identify existing pressure damage[16, 20-22] and risk assessments do not provide information on how patients are responding to adverse events of pressure and shear forces. The visual and physical signs of tissue damage are usually only visible on the skin surface 3-10 days after damage occurs[23] suggesting that skin health can significantly deteriorate before interventions. The current approach of visual skin assessment is a macroscopic observation attempting to identify microscopic changes and identifies existing damage rather than preventing it.[24-26] Relying solely on the current standard of care means that early detection and timely appropriate, anatomy specific interventions are often impossible.

Pressure Injury Damage

Early pressure-induced cell and tissue damage begins at the cellular level (Figure 1).[27] Ischemic damage caused by occlusion of blood vessels can take several hours to develop, however, cell deformation occurs within minutes when tissue is exposed to high pressure strains.[27-30] There may be clinically significant tissue damage before visual or tactile manifestations are observed. The contemporary understanding of the pathophysiology of pressure injuries reveals that tissue inflammation, the first response to damage, causes increased dilation and permeability of surrounding blood vessels.[31] Increased vascular permeability allows fluid to enter the extravascular space causing a build-up of edema or sub-epidermal moisture (SEM) which is invisible to the naked eye.[31] SEM is therefore a biophysical marker, which if raised, enables the detection of pressure injuries before visual manifestation.[23, 26]

Figure 1: Damage Cascade



Cycle of Pressure Injury: adapted from Gefen A, 202038. The SEM Scanner for Early Pressure Ulcer Detection: A 360-degree Review of the Technology. Wounds International. Vol 11, Issue 3: p22-30.

Method

The Provizio™ SEM Scanner (Bruin Biometrics LLC, USA), a CE marked class 11a, FDA approved, non-invasive, handheld skin assessment device, is recognized as an objective method for detection of early invisible tissue damage,[32-35] and was selected based on a review of available technology.[36] (See Figure 2.)

Figure 2: SEM Scanner

Source: Bruin Biometrics LLC

The current clinical practice guidelines recommend the use of SEM as an objective biomarker of risk in adjunct to clinical skin assessment and when assessing individuals with dark pigmented skin[1] given the inherit subjectivity of these methods.

Clinical studies have determined that a SEM Delta (Δ) <0.6 can indicate lower risk for pressure injury while a SEM Delta (Δ) <0.6 is suggestive of increased risk.[32] The device supports identification of specific anatomical areas at increased risk of pressure injury development on average of five days earlier than visual skin assessment.[25,26,32,37,38] By implementing targeted prevention strategies earlier to specific areas of concern, tissue damage identified in the preventable stage may cease progression to tissue death.[24]

The six-week pilot was designed as a quality improvement (QI) process to be used with minimal modifications to existing care pathways and was not required to be subject to institutional review board oversight and ethics committee approvals. Local operational approval was obtained to conduct the pilot on one Medicine unit at a large urban acute facility in Alberta, Canada. The pilot was guided by the *Promoting Action on Research Implementation in Health Services* framework,[39] which proposes that successful implementation is dependent on the interplay of evidence, implementation context and facilitation. Local pressure injury data was collected by the local team using the standardized provincial audit tool. A medical unit with at-risk patients and strong leadership engagement in prevention was chosen for the pilot. The pilot was facilitated by one Clinical Nurse Specialist (CNS) and one Clinical Nurse Educator (CNE) implementation lead. A team comprising six front line nursing champions was identified in collaboration with the CNE and Unit Manager to facilitate implementation.[40] Additional implementation strategies included engaging with participants at multiple levels, fostering local ownership, employing improvement tools to generate practice-based evidence, conducting Plan-Do-Study-Act cycles to develop and refine implementation strategies and support capacity to implement evidence-based intervention.[41]

Six in-person 45-minute training sessions were offered to participants to choose from. Training was supported by industry in collaboration with the CNE and CNS and included a PowerPoint presentation detailing the technology, the standard operating procedure, the significance of SEM Delta (Δ) values and a review of the SSKIN+ bundle. Participants completed one scan on sacrum (Figure 3) and heel locations (Figure 4) of an anatomical model and one supervised return demonstration with a consenting patient. Three scanners and the single patient use sensors were placed in accessible locations on the unit. Pressure injury prevention pamphlets were made available for patients and families in a public area on the unit.

Figure 3: Sacral Scanning Locations

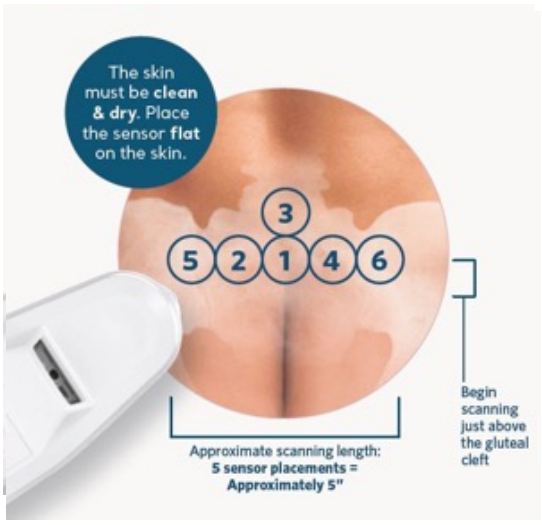


Figure 4: SEM Scanner Applied To Heel

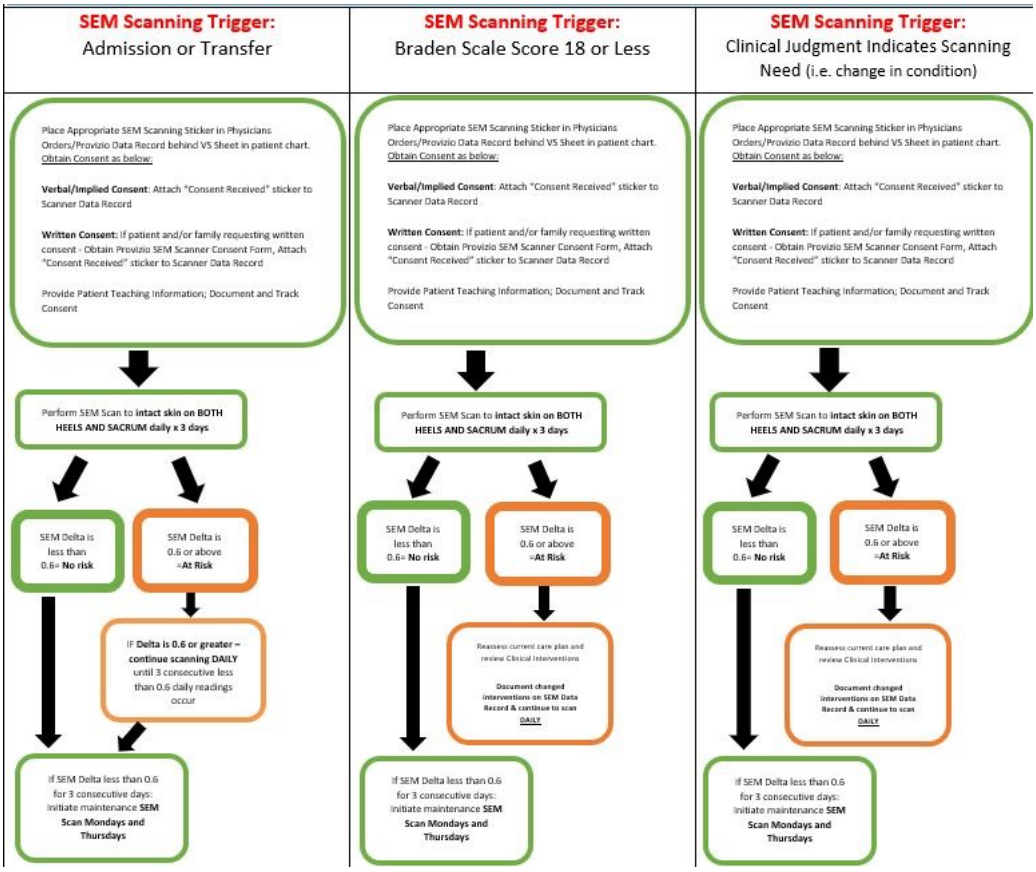
Scans were conducted according to the manufacturer's instructions. A process map (Figure 5) and inclusion criteria (Figure 6) were developed based on review of the literature and in collaboration with the distributor of the device and pilot team. Inclusion criteria included: minimum age 18, Braden Score ≤18, implied consent, scanning locations accessible to scanning and intact skin. Exclusion criteria included Braden score >18, non-intact skin, safety risk to provider for restless or combative patients, patient conditions not appropriate for scanning, sites not accessible to scanning and refusal to participate. Written consent was available if desired from patients or families, otherwise implied consent was obtained.

SEM assessments were performed on the sacum and both heels daily, in the morning during assessments. Standard of care was followed during SEM assessments including risk assessment with the Braden Scale and skin assessment to determine skin changes or redness. Assessments were documented on a data collection form. Scans were completed on included patients daily until three consecutive SEM Delta (Δ) <0.6 were achieved at the sacrum and both heels. Then patients were transitioned to maintenance scanning Mondays and Thursdays. Following assessments, staff determined if the SEM scanner changed their clinical decision-making and documented subsequent interventions.

Figure 6: Inclusion/Exclusion Criteria

INCLUSION CRITERIA	EXCLUSION CRITERIA
• Minimum age 18 • New admission to unit • Braden Scale Total Score 18 or less, or if clinical judgment indicates • Patient, family, or legal representative able to provide verbal implied consent (written optional) • Heels and sacrum accessible to scanning and skin is intact	• Physical act of performing inspections and measurements contraindicated due to patient condition (for example, safety risk or end of life)

Figure 5: Initial Process Map



SEM Delta (Δ) readings were documented on a communication board, and nursing report for facilitated communication. Data was anonymized, scanned, removed from the unit and stored in a locked room. Anonymized data was sent to industry for analysis. During the first four weeks, one ARJO representative was on site for staff support for additional education for staff who did not attend the pre-education. A paper and electronic evaluation form was collected from the team, patients and families to obtain feedback on the experiences with the technology. The Clinical Sustainability Assessment Tool (CSAT)[42] was administered to the implementation team one week after the pilot to obtain feedback.

Results

A total of 78 nursing staff attended the training sessions representing 75% of the unit level nursing program workforce. Two members of the leadership team attended the education; Nursing was the only discipline who attended education sessions, conducted scans and implemented interventions. Allied health teams were provided one education session upon request during week four of implementation but did not participate in the pilot. A total of 97 patients were evaluated over the six-weeks with a total of 2,039 scans completed. Seventy-four per cent of clinical decision-making was changed during assessments (Figure 7 and 8). SEM Delta (Δ) results in the sacral and heel locations trended downwards throughout the pilot (Figure 9). A total of 1,119 total scans had a SEM Delta (Δ) <0.6 indicating raised SEM levels detected, yet 73% of those patients were identified at low risk with the Braden Scale (Scores 15-18).

Figure 7: SEM Delta Results

Anatomical Site	SEM ▲ ≥ 0.6	SEM ▲ ≥ 0.6 (%)	SEM ▲ ≥ 0.6 at anatomical site, with no discolouration (%)	SEM ▲ ≥ 0.6 at anatomical site, identified as 'low risk' via Braden score* (%)	Total scans
Sacrum	437	65.5%	68.6%	73.7%	667
Heels	682	49.7%	78.0%	53.5%	1372
All sites (total)	1119	54.9%	41.0%	73.0%	**2039**

71% (69) total patients with SEM ▲ ≥ 0.6 Identified as 'low risk' via Braden Score, AND had no skin discoloration

*Where risk scores were provided

Figure 8: Clinical Decision-Making

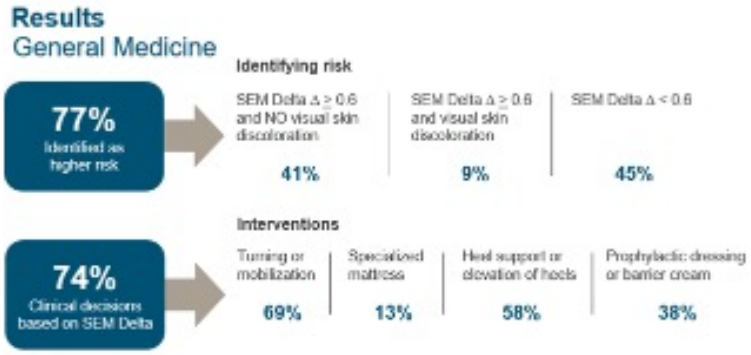
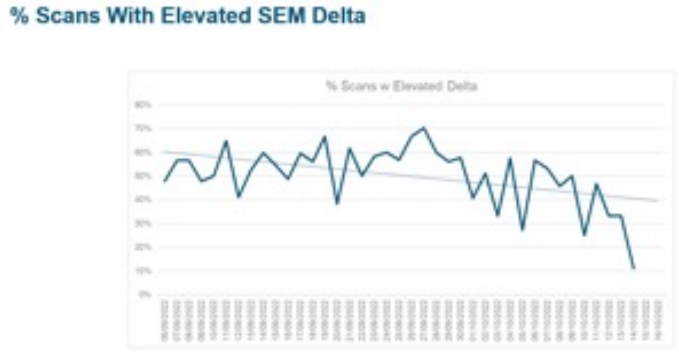


Figure 9: SEM Delta Trending



The baseline facility-acquired pressure injury rate was 9% and after the pilot was 0%: a 100% reduction rate. This was translated in collaboration with the distributor into an annual cost savings of $426,903 for the unit. Cost savings was modeled based on predicted facility acquired rate from historical data from two previous audits, the estimated cost of pressure injuries in Canada,[5] daily scanning and a conservative estimate of 75% reduction of heel and sacrum hospital-acquired pressure injuries from a baseline estimate of 54 HAPI's per year (SEM scanning averages a 90% reduction in acute care,[43] of which would yield a cost savings of $563,099). The estimated cost savings were indicative of material costs.

Upon review of the data from week one-three, the implementation team observed that prophylactic dressings were the first choice for interventions. The implementation team encouraged

basic preventative interventions first, such as increasing turning frequency, repositioning and mobilization prior to application of prophylactic sacral dressings. Some scans were not completed, typically on weekends, and there was a lack of documentation related to skin assessment and skin tone. When there was no documentation on skin assessment, these values were not included in the data analysis. Although the technology appeared to integrate into the current workflow processes, staff suggested that the timing of the scans be changed to reduce workload during day shift. Scan times were changed to one side of the unit scanning patients on day shift and the other side on evening shift during week five. The implementation team recognized self organization[4] by the local team as modifications were recommended by participants and changes were made. Adaptations were made to the process map during week five. The threshold of three consecutive days of normal SEM Delta (Δ) was reduced to two consecutive days to limit sensor consumption and sensor cost within the local pilot budget.

Figure 10: SEM Participant Survey

Provizio SEM Scanner Feedback	Healthcare Providers (Total =20)			Students (Total =8)		
Question	Yes (%)	No (%)	Blank/NA (%)	Yes (%)	No (%)	Blank/NA (%)
In my experience, it was easy to learn to use and operate the device.	100%			100%		
Scanning each patient was quick and I was able to scan each patient easily.	80%	20%		100%		
Assessing patients with a deviation (delta) of 0.6 alerted me to take appropriate clinical action.	100%			100%		
The device adds value and provides additional information to support my decision-making about my patient's pressure injury prevention care.	90%	10%		100%		
The device gave me immediate feedback as to whether the area was improving or not.	90%	10%		100%		
The device provides clinically meaningful data about tissue damage.	85%	15%		100%		
The device can replace risk assessments.	45%	55%		12%	88%	
The pilot increased awareness and engagement of the problems and solutions around pressure injury prevention with Physicians.	80%	15%	5%	100%		
The pilot increased awareness and engagement of the problems and solutions around pressure injury prevention with NPs.	25%		75%	100%		
The pilot increased awareness and engagement of the problems and solutions around pressure injury prevention with Allied Health teams.	90%	10%		100%		
Would you adopt the device into your clinical practice?	85%	15%		100%		
Do you believe the pilot was successful?	80%	20%		88%	12%	
Do you believe the pilot was worth the implementation effort on your part?	85%	15%		75%	12%	12%

The scanning trigger of a Braden Score of 18 or less was amended to <18. A queue for referral to the allied health team was added for independent patients with a SEM Delta (Δ) <0.6 on admission. This change should also have included patients with mobility issues and is recommended for future process maps.

Twenty evaluations were completed by participants, eight by students (Figure 10) and one by a patient (Figure 11) with positive results indicating acceptability of technology. The CSAT identified organizational readiness as a domain with the largest variability, highlighting opportunities to support future implementation including establishing systems to support various practice needs, ensuring that the practice is feasible and has sufficient resources to achieve goals, adequate staffing to achieve goals and integration into operations. This feedback supported a greater practical and scientific understanding of critical contextual factors that support clinical practices over time.

Adverse Events

No adverse or serious adverse events were reported during the pilot relating to the use of the Provizio™ SEM Scanner. Two patients developed pressure injuries during the pilot, but these were determined to be unavoidable through non-adherence to interventions due to complexity of the individual patients.

Discussion

The introduction of SEM scanning illuminated

Figure 11: SEM Patient Survey

Provizio SEM Scanner Feedback	Patients (Total = 1)	
Question	**Yes (%)**	**No (%)**
I know more about what pressure injuries are and how they can happen.	100%	
I know more about the factors that increase my risk of developing a pressure injury.	100%	
I know more about strategies to help me prevent a pressure injury from developing.	100%	
I have learned about the Provizio™ SEM Scanner technology and how that can help prevent pressure injuries.	100%	
After learning about the Provizio™ SEM Scanner technology I am confident that my care team can help prevent pressure injuries from developing while I am in care.	100%	
I know that I or my family or caregivers can actively participate in pressure injury care planning if able to keep my skin safe.	100%	
I know who to communicate with on my care team if I have concerns or questions about pressure injury prevention.	100%	

educational opportunities to strengthen documentation and critical thinking surrounding the SSKIN+ bundle application, and the importance of multidisciplinary engagement and management of front-line resources. Risk and skin assessments, including skin tone variance, were not consistently documented. The Provizio™ SEM scanner can upload data results into the Electronic Medical Record system, mitigating challenges with consistent documentation. Support surface selection was based on a list of current available support surfaces prompting the need for an up-to-date algorithm to support decision-making. Turning and repositioning was identified as an intervention, however on the ground support identified opportunities for additional education related to turning frequencies and side-lying positioning, which is significant for appropriate offloading of pressure. Incontinence associated dermatitis (IAD) on two occasions observed by the project lead were not diagnosed. IAD is frequently misdiagnosed as a stage one or two pressure injury[45] as visual skin assessments are unreliable.[16]

Prior to the pilot, the current standard of care of risk assessments and skin assessments led to inconsistencies in SSKIN+ bundle utilization. This was apparent with the introduction of the SEM assessment as well; however, clinical participants increased their clinical decision-making by 74% after scanning with the addition of objective SEM Delta (Δ) assessments. Participants developed care plans using the SSKIN+ bundle and reliable objective SEM assessments and were able to focus their time and resources amongst the patient groups with elevated SEM Delta (Δ) scores. There were challenges with participants reviewing previous SEM Delta (Δ) scores and SSKIN+ interventions to either increase or decrease the interventions. The implementation team communicated this gap to participants during week four and reinforced the SSKIN+ bundle to the participants by providing a new reference tool to stratify the interventions on a continuum of low, moderate and high risk to aid in decision-making.

This change shifted participants from choosing sacral prophylactic dressings as a first line of intervention to considering other options, such as mobilization or turning and repositioning. Health-care provider compliance rates to prevention strategies and guidelines in acute care vary, suggesting that there is opportunity to improve the implementation of basic strategies including repositioning, heel elevation, nutrition support, and moisture management.[46] Future education for subsequent implementation should include documentation, reinforcement of landmarking, scanning technique, SSKIN+ bundle implementation, evaluation of care planning and a review of maintenance case studies to support evaluation of interventions.

There was limited discussion of abnormal SEM assessments at rapid round discussions, which was an opportunity for improvement. An interprofessional approach is required to mitigate risk factors such as mobility, nutrition and moisture management as part of a comprehensive pressure injury prevention care plan.[47] Health-care leaders must consider the importance of interprofessional collaboration and role clarity to ensure patients are receiving the necessary care from the care team. Developing team skills and interprofessional relationships can positively impact pressure injury prevention.[47] The implementation team observed that participants and student discussion of SEM Delta (Δ) results with patients and families raised awareness of pressure injuries and the technology for early detection.

The pilot started with two hundred sensors that needed to be reordered weekly, which was a stressor for the implementation lead to coordinate. The team did not project sensor consumption, therefore weekly incremental sensor costs were a concern for the operational leadership team, prompting discussions related to reducing sensor consumption prompting better adaptation into staff workflow, and enhanced interventions including consultations to allied health. Full implementation could alleviate challenges with re-ordering sensors, as the unit could see increased financial and quality of care benefit through the reduction of facility-acquired pressure injuries. Imbedding innovation requires people to work together to solve problems using give-and-take and this was achieved through open dialogue, strong leadership and openness to change.[44] The implementation team harnessed feedback productively and viewed differing perspectives as the raw ingredients for multifaceted solutions.[44]

Additional opportunities identified through team communication and voluntary written evaluations included needing more time dedicated to addressing pressure injury risk factors through implementation of strategies with a team approach, workload challenges limiting ability to attend to prevention due to competing priorities and confidence in technology. The pilot took place September 2022 when the team was experiencing post-pandemic fatigue, which may have translated into a task-focused approach to care. Staff were positive during the pilot as the technology was, "motivational, helped us to make a difference and took our mind off the pandemic." Third year nursing students were eager to learn about the technology and brought positive energy while integrating SEM into their practice.

There is a constant and large drive to implement changes without a thorough assessment of the environmental and establishment organizational readiness,[48] a critical step in the implementation process.[49] Organizational readiness refers to the extent to which organizational members are psychologically and behaviourally prepared to implement organizational change including internal support and resources to effectively manage the practice change.[50] Leadership, facilitation, organizational and staff commitment, evaluation and feedback and resources dedicated to the pilot were significant contextual factors identified as important facilitators. Staff recognized the impact on decision-making through measuring SEM and interpreting and implementing the SSKIN+ bundle to support resource stewardship while improving quality care.

Limitations

Innovation may be hindered by tensions in the innovation process inherent to health care, such

as risk aversion, lack of agility and nimbleness, along with challenges with testing innovations.[51] Within the current pilot, our implementation and leadership teams took this opportunity head-on to test out innovation to improve pressure injury prevention and are exploring the multi-factorial resources for future implementation. Documentation of risk and skin assessments and communications related to the transitions to maintenance scanning were inconsistent limiting analysis. The implementation of the SSKIN+ bundle was limited to the nursing discipline.

Conclusion

Current literature suggests the use of SEM to objectively assess the skin and underlying tissues for early pressure damage.[1, 24] The results demonstrated that targeting elevated SEM Delta (Δ) with early and anatomy-specific, evidence informed prevention strategies, reduce SEM Delta (Δ) and could eliminate preventable facility-acquired pressure injuries resulting in improved patient outcomes and higher quality care. The seamless inclusion of an objective assessment into the current standard of care, along with adaptations, were successfully implemented. An understanding of contextual factors is necessary for supporting the translation of evidence into practice. Future work will focus on sharing results with teams and consideration of future adoption of SEM technology.

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References

1. European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of pressure ulcers/injuries. Clinical Practice Guideline. The International Guideline. Emily Haesler (Ed). EPUAP/NPIAP/PPPIA: 2019.
2. Anrys C, Van Tiggelen H, Verhaeghe S, Van Hecke A, Beeckman D. Independent risk factors for pressure ulcer development in a high-risk nursing home population receiving evidence-based pressure ulcer prevention: Results from a study in 26 nursing homes in Belgium. Int Wound J. 2019 Apr;16(2):325-333.
3. Moore Z, Cowman S, Conroy RM. A randomised controlled clinical trial of repositioning, using the 30° tilt, for the prevention of pressure ulcers. J Clin Nurs. 2011 Sep;20(17-18):2633-44.
4. Woodbury MG, Houghton PE. Prevalence of pressure ulcers in Canadian healthcare settings. Ostomy Wound Manage. 2004 Oct;50(10):22-4, 26, 28, 30, 32, 34, 36-8.
5. Chan B, Ieraci L, Mitsakakis N, Pham B, Krahn M. Net costs of hospital-acquired and pre-admission PUs among older people hospitalised in Ontario. J Wound Care. 2013 Jul;22(7):341-2, 344-6.
6. Demarré L, Van Lancker A, Van Hecke A, Verhaeghe S, Grypdonck M, Lemey J, et al. The cost of prevention and treatment of pressure ulcers: A systematic review. Int J Nurs Stud. 2015 Nov;52(11):1754-74.
7. Padula WV, Pronovost PJ, Makic MBF, Wald HL, Moran D, Mishra MK, et al. Value of hospital resources for effective pressure injury prevention: a cost-effectiveness analysis. BMJ Qual Saf. 2019 Feb;28(2):132-141.
8. Chapman S. Preventing and treating pressure ulcers: evidence review. Br J Community Nurs. 2017 Mar;22 Suppl 3(Sup3):S37-S40.
9. Varga MA, Holloway SL. The lived experience of the wound care nurse in caring for patients with pressure ulcers. Int Wound J. 2016 Apr;13(2):243-51.
10. Pittman J, Beeson T, Terry C, Dillon J, Hampton C, Kerley D, et al. Unavoidable pressure ulcers: Development and testing of the Indiana university health pressure ulcer prevention inventory. J Wound Ostomy Continence Nurs. 2016 Jan 1;43(1):32-8.
11. Black JM, Edsberg LE, Baharestani MM, Langemo D, Goldberg M, McNichol L, et al. Pressure ulcers: avoidable or unavoidable? Results of the National Pressure Ulcer Advisory Panel Consensus Conference. Ostomy Wound Manage. 2011 Feb;57(2):24-37.
12. Waterlow J. From costly treatment to cost-effective prevention: using Waterlow. Br J Community Nurs. 2005 Sep;10(9):S25-6, S28, S30.
13. Bergstrom N, Braden BJ, Laguzza A, Holman V. The Braden Scale for predicting pressure sore risk. Nurs Res. 1987 Jul-Aug;36(4):205-10.
14. Qaseem A, Mir TP, Starkey M, Denberg TD; Clinical Guidelines Committee of the American College of Physicians. Risk assessment and prevention of pressure ulcers: a clinical practice guideline from the American College of Physicians. Ann Intern Med. 2015 Mar 3;162(5):359-69.
15. Byrne S, Patton D, Avsar P, Strapp H, Budri A, O'Connor T,

et al. Sub epidermal moisture measurement and targeted SSKIN bundle interventions, a winning combination for the treatment of early pressure ulcer development. Int Wound J. 2023 Aug;20(6):1987-1999.
16. Moore ZE, Patton D. Risk assessment tools for the prevention of pressure ulcers. Cochrane Database Syst Rev. 2019 Jan 31;1(1):CD006471.
17. Bryant RA, Moore ZE, Iyer V. Clinical profile of the SEM Scanner - Modernizing pressure injury care pathways using Sub-Epidermal Moisture (SEM) scanning. Expert Rev Med Devices. 2021 Sep;18(9):833-847.
18. Grimes PE. Management of hyperpigmentation in darker racial ethnic groups. Semin Cutan Med Surg. 2009 Jun;28(2):77-85.
19. Gunowa NO. Skin tone bias and wound care: highlighting the current evidence and addressing the gaps in knowledge of dark skin tones. Wounds UK. 2022 Jan 1;18(1).
20. Pieper B, Mott M. Nurses' knowledge of pressure ulcer prevention, staging, and description. Adv Wound Care. 1995 May-Jun;8(3):34, 38, 40 passim.
21. Pancorbo-Hidalgo PL, Garcia-Fernandez FP, Lopez-Medina IM, Alvarez-Nieto C. Risk assessment scales for pressure ulcer prevention: a systematic review. J Adv Nurs. 2006 Apr;54(1):94-110.
22. Hiser B, Rochette J, Philbin S, Lowerhouse N, Terburgh C, Pietsch C. Implementing a pressure ulcer prevention program and enhancing the role of the CWOCN: impact on outcomes. Ostomy Wound Manage. 2006 Feb;52(2):48-59.
23. Moore Z, Patton D, Rhodes SL, O'Connor T. Subepidermal moisture (SEM) and bioimpedance: a literature review of a novel method for early detection of pressure-induced tissue damage (pressure ulcers). Int Wound J. 2017 Apr;14(2):331-337.
24. Budri AMV, Moore Z, Patton D, O'Connor T, Nugent L, Avsar P. Sub-epidermal moisture measurement: an evidence-based approach to the assessment for early evidence of pressure ulcer presence. Int Wound J. 2020 Dec;17(6):1615-1623.
25. O'Brien G, Moore Z, Patton D, O'Connor T. The relationship between nurses assessment of early pressure ulcer damage and sub epidermal moisture measurement: a prospective explorative study. J Tissue Viability. 2018 Nov;27(4):232-237.
26. Okonkwo H, Bryant R, Milne J, Molyneaux D, Sanders J, Cunningham G, et al. A blinded clinical study using a subepidermal moisture biocapacitance measurement device for early detection of pressure injuries. Wound Repair Regen. 2020 May;28(3):364-374.
27. Oomens CW, Bader DL, Loerakker S, Baaijens F. Pressure induced deep tissue injury explained. Ann Biomed Eng. 2015 Feb;43(2):297-305.
28. Gawlitta D, Li W, Oomens CW, Baaijens FP, Bader DL, Bouten CV. The relative contributions of compression and hypoxia to development of muscle tissue damage: an in vitro study. Ann Biomed Eng. 2007 Feb;35(2):273-84.
29. Fletcher J, Barrett S. Improving holistic assessment of chronic wounds: how to meet patient expectation using the new Best Practice Statement. Wounds UK. 2018 Nov 1;14(5).
30. Gefen A. The future of pressure ulcer prevention is here: detecting and targeting inflammation early. EWMA J. 2018 Oct 1;19(2):7-13.
31. Gefen A, Alves P, Ciprandi G, Coyer F, Milne CT, Ousey K, et al. Device-related pressure ulcers: SECURE prevention. J Wound Care. 2020 Feb 1;29(Sup2a):S1-S52.
32. Gershon S, Okonkwo H. Evaluating the sensitivity, specificity and clinical utility of algorithms of spatial variation in sub-epidermal moisture (SEM) for the diagnosis of deep and early-stage pressure-induced tissue damage. J Wound Care. 2021 Jan 2;30(1):41-53.
33. Harrow JJ, Mayrovitz HN. Subepidermal moisture surrounding pressure ulcers in persons with a spinal cord injury: a pilot study. J Spinal Cord Med. 2014 Nov;37(6):719-28.
34. Clendenin M, Jaradeh K, Shamirian A, Rhodes SL. Inter-operator and inter-device agreement and reliability of the SEM Scanner. J Tissue Viability. 2015 Feb;24(1):17-23.
35. Oliveira AL, Moore Z, O Connor T, Patton D. Accuracy of ultrasound, thermography and subepidermal moisture in predicting pressure ulcers: a systematic review. J Wound Care. 2017 May 2;26(5):199-215.
36. Scafide KN, Narayan MC, Arundel L. Bedside technologies to enhance the early detection of pressure injuries: a systematic review. J Wound Ostomy Continence Nurs. 2020 Mar/Apr;47(2):128-136.
37. Bates-Jensen BM, McCreath HE, Patlan A. Subepidermal moisture detection of pressure induced tissue damage on the trunk: the pressure ulcer detection study outcomes. Wound Repair Regen. 2017 May;25(3):502-511.
38. Kim CG, Park S, Ko JW, Jo S. The relationship of subepidermal moisture and early stage pressure injury by visual skin assessment. J Tissue Viability. 2018 Aug;27(3):130-134.
39. Kitson A, Harvey G, McCormack B. Enabling the implementation of evidence based practice: a conceptual framework. Qual Health Care. 1998 Sep;7(3):149-58.
40. Rogers E. Diffusion of innovations. 5th ed. New York: Free Press; 2003.
41. Leeman J, Rohweder C, Lee M, Brenner A, Dwyer A, Ko LK, et al. Aligning implementation science with improvement practice: a call to action. Implement Sci Commun. 2021 Sep 8;2(1):99.
42. Malone S, Prewitt K, Hackett R, Lin JC, McKay V, Walsh-Bailey C, Luke DA. The Clinical Sustainability Assessment Tool: measuring organizational capacity to promote sustainability in healthcare. Implement Sci Commun. 2021 Jul 17;2(1):77.
43. Burns M (2020). Real World Evidence Accepted and presented at EWMA Conference.
44. Lanham HJ, Leykum LK, Taylor BS, McCannon CJ, Lindberg C, Lester RT. How complexity science can inform scale-up and spread in health care: understanding the role of self-organization in variation across local contexts. Soc Sci Med. 2013 Sep;93:194-202.
45. Voegeli D. Incontinence-associated dermatitis: new insights into an old problem. Br J Nurs. 2016 Mar 10-23;25(5):256, 258, 260-2.

46. Edsberg LE, Cox J, Koloms K, VanGilder-Freese CA. Implementation of pressure injury prevention strategies in acute care: results from the 2018-2019 International Pressure Injury Prevalence Survey. J Wound Ostomy Continence Nurs. 2022 May-Jun 01;49(3):211-219
47. Heerschap C, Woo KY. Formal caregiver experiences of caring for individuals at risk for or with a pressure injury: a metasynthesis. Adv Skin Wound Care. 2022 Dec 1;35(12):680-7.
48. McMillan K. A critical organizational analysis of frontline nurses' experience of rapid and continuous change in an acute health care organization [PhD thesis]. Ottawa: University of Ottawa; 2018.
49. Greenhalgh T, Robert G, Macfarlane F, Bate P, Kyriakidou O. Diffusion of innovations in service organizations: systematic review and recommendations. Milbank Q. 2004;82(4):581-629.
50. Weiner BJ, Amick H, Lee SY. Conceptualization and measurement of organizational readiness for change: a review of the literature in health services research and other fields. Med Care Res Rev. 2008 Aug;65(4):379-436.
51. Haring M, Freigang F, Amelung V, Gersch M. What can healthcare systems learn from looking at tensions in innovation processes? A systematic literature review. BMC Health Serv Res. 2022 Oct 28;22(1):1299.

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Foot Care Matters: A Cautionary Tale

By Wound Care Canada Staff

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The following is a story shared via interview with a daughter, in the presence of her mother, regarding the loss of their father/husband. It illustrates the importance of, and diligence required to, consistently assess and reassess skin and the risks of skin associated issues, specifically as they relate to foot care, across all health-care settings.

The interview was conducted by *Wound Care Canada* staff (WCC) with KT and MT, the daughter and wife, respectively, of the late CT. Contributions were also made by CT's other daughter; MGT. Full names and locations are not being used in order to protect the confidentiality of the individuals and institutions involved.

CT's Story

WCC: Can you tell us about your father?

KT: My dad had soft, small and delicate feet. He was diagnosed with Peripheral Vascular Disease (PVD) in 1993 and after a number of surgeries he had to leave his job to go on disability. All was good until 2011 when blockages returned. In 2014 he had an auxiliary bi-femoral bypass repair (we like to say he was "re-plumbed"). Then in 2017, one of his old grafts became infected. He was transferred by ambulance to a larger hospital and had surgery to remove the graft and infection – it was a scary few days, but he recovered. The health-care staff taking care of him may have thought my mother (MT), my sister and I were slightly odd – we were completely amazed by the fact that dad had warm, pink feet after the surgery. It had been decades since Dad's circulation had been good enough to warm up his feet and we showed them off to anyone who came in the room!

Then, just before his transfer back to our local hospital he complained about his vision. It was assumed he was having issues with the long hospitalization, and he completed the transfer. Within

the first day of being back in the original hospital it became clear that something had happened, and it was revealed that he experienced an occipital lobe stroke and had lost some vision. Despite this setback, he recovered from this, went home and was adapting to his vision changes. We set him up with audio books from the library, he had his beloved television and life settled down. Then the seizures started, setting off multiple trips to hospital, inpatient stays, ebbs and flow with recovery and home care. Eventually, his neurologist determined that it was likely he had amyloid angiopathy, due, in part, to his use of Warfarin over the past 30 years since his PVD diagnosis.

We made friends with the ambulance care team, got to see the demanding work done by healthcare professionals behind the scenes in ERs and other units and it became our new way of life. As a family we adapted to the new normal (and the new dad we had) then in the spring of 2021, I got a phone call at 2:00 am from my mother, panicked because my father had fallen out of bed and was on the floor. I broke several speed limits to get to the house and determined that this was definitely another ambulance call. All this happened during the COVID hospital restrictions, so I went with him to the hospital while my mother and sister stayed home. Unfortunately, our worst fear came true, although he never got out of bed without help before, he had this night and had fallen and broken a bone in his hip. I swapped places with my mother and Dad went off to surgery. Mum got to see him after surgery and then we had a COVID surge, and the hospital was locked down to any visitors. On her final visit to see him two days after surgery she noticed a red spot on his foot and reported it to the nurse who put a pillow under his foot and noted the issue.

Foot Care Failures

During previous hospitalizations we visited Dad daily, we did some of his regular care and we were obsessive about keeping an eye on his feet, specifically his heels. Those delicate feet I mentioned, could get red and irritated overnight just from the fabric of the sheets as he moved around. We made sure to keep an eye on this and let the nursing staff know when we started to see irritated skin. They would then get him in heel protectors and make sure he was getting solid foot care and regular checks of the skin. Unfortunately, during this surgical recovery period this time we could not be with him and were not able to keep an eye on his feet. My mother checked in on him daily (often between 9-10pm), calling the nursing desk to get an update and asking about his feet and whether they were okay. This went on for a full month (April-May - during the pandemic). We checked in every day and asked about his feet. We were told everything was great. Then Dad was transferred to a transition unit in preparation for going into long-term care. When he arrived there, my mother received a phone call from the charge nurse who wanted to know what was going on with his foot – we had no idea what they were talking about. It turns out that my father had a pressure sore on one of his heels that was slightly larger than a Loonie but was not documented anywhere on his chart.

We were stunned, this was exactly what we had questioned hospital staff about for over a month. We mentioned how tender his feet were and that the sheets often irritated the skin; we talked about small wounds he had developed during previous admissions and my mother noted a red spot appearing two days post-surgery. Dad ended up having to be seen by the wound care team multiple times, this required an ambulance trip to the clinic every time. He was upset at the pain in his foot and found it difficult to keep his boot on. He eventually was transferred to a long-term care facility and the staff there did all they could to care for his wound. Then in November he received a CAT scan which showed that the infection had moved up into the bone and nothing could be done to treat it other than amputation. At his point he was admitted to the community hospital for treatment of his wound, as well as complications from his seizures. His last day there was terrible; he was in pain from the foot infection moving up his leg and was very confused. That evening his condition had deteriorated to the point that he was transferred to palliative care, the last time we saw him conscious was just

before he was put in the ambulance.

His week in palliative care was difficult for us. While we always knew his issues could result in death, his passing was still unexpected. Particularly because his main issue was the massive infection moving through his body from his infected pressure ulcer. During this last week of his life the nurses had to keep his leg wrapped because it was becoming necrotic. My family still has a tough time with his death, it feels like it did not have to happen, that the infection that killed him could have been avoided if health-care staff had listened to our concerns and checked his feet. His hospital records clearly showed that he had issues with the skin on his heels at every admission in the last four years. We had asked repeatedly for updates when we were not able to check his feet ourselves – for over a month we were told that the skin on his feet was fine. We really felt let down. Why didn't they listen to us? Didn't anyone check his foot? How did it get so bad without anyone noticing?

He was on an orthopedic post-surgical unit and was immobile in a bed for over a month; how was skin and wound care not something the staff would check on? While we knew Dad would not live for decades, we believe he certainly would have had the chance to live a few more years if he had not developed the wound and subsequent infection.

My mother was not comfortable reporting this issue to the hospital, she was still coming to terms with my father's death and big life changes in the year or so following. This article is our chance, not to assign blame, but to share our story and ask health-care professionals to listen to family concerns. We know your workload is high, but we expressed legitimate concerns that were documented in his patient chart. We would also like to encourage inter-disciplinary training in wound care. My dad was treated by surgeons, hospitalists, nurses, LPN's, CCA's and physiotherapists, and no one caught this large wound on his heel. It is not just the job of a 'wound nurse' to care for patient skin, it should be the responsibility of the entire health-care team. Training on pressure sores and skin care should be standard for health-care professionals and everyone who has a role in keeping patients safe.

My father certainly had a variety of long-term health conditions that were going to shorten his life; however, he died because of the infection from his pressure sore, which started as irritated skin. We cannot underestimate the danger and health issues that arise from skin issues. My mother sums it up like this, "that foot was his nemesis his last few months, it was painful and draining and made his life miserable."

KT, MT and MGT live in Atlantic Canada.

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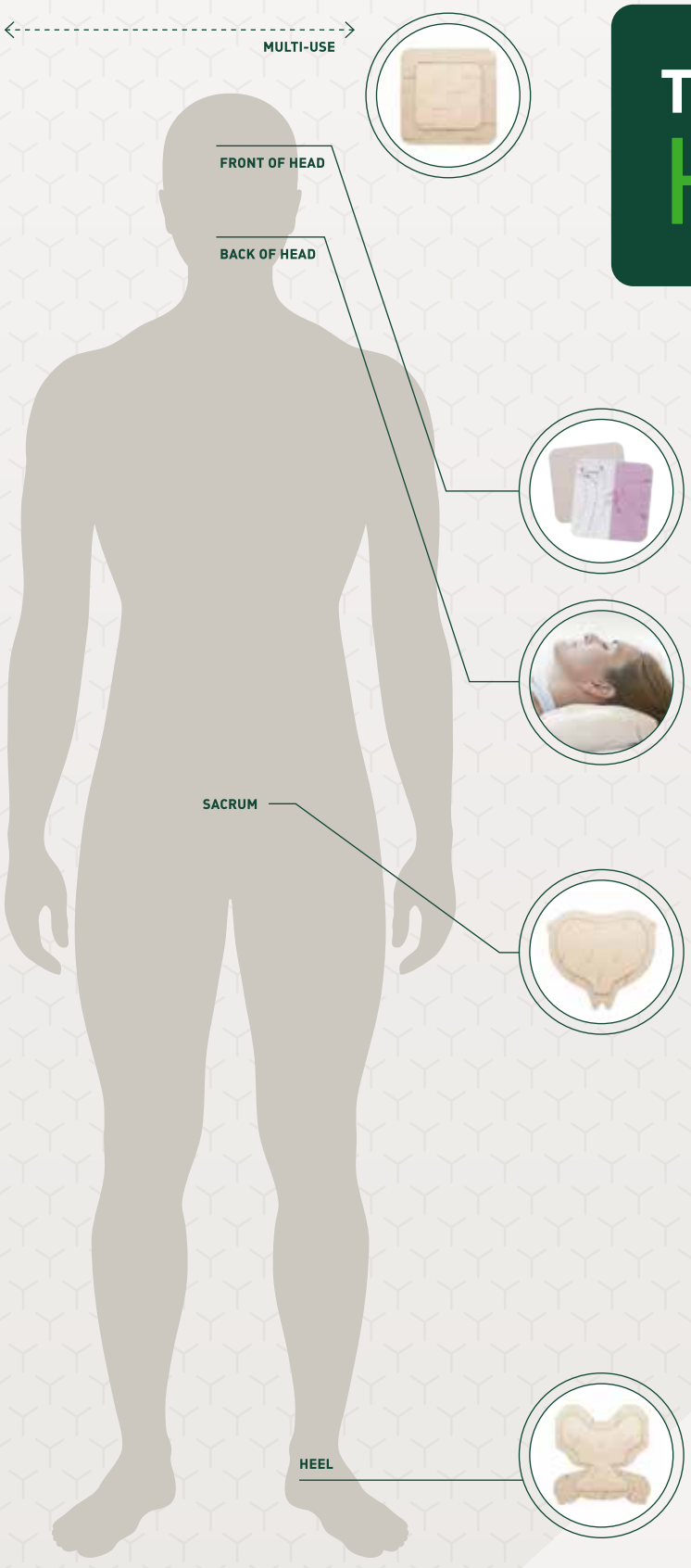

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References: 1. Katzengold, R., & Gefen, A. (2017). What makes a good head positioner for preventing occipital pressure ulcers. International Wound Journal, 15:243–249. **2.** Barakat-Johnson, M., Lai, M., Gefen, A., Coyer, F. (2018). Evaluation of a fluidized positioner to reduce occipital pressure injuries in intensive care patients: A pilot study. International Wound Journal, 1–9. DOI: 10.1111/iwj.13051 **3.** Famorca, M.M., Boyes, C., & Peworski, C. (2019). Not my head, please! Preventing hospital-acquired pressure injury to the occiput and ear. Mayo Clinic. Poster Presentation: NPIAP 2020. Houston, TX **4.** Padula William V. Effectiveness and value of prophylactic 5-layer foam sacral dressings to prevent hospital-acquired pressure injuries in acute care hospitals an observational cohort study. J Wound Ostomy Continence Nurs. 2017;44(5):1-6. **5.** Cooper, M., et.al., Bundling for Change: Implementing Pressure Injury Prevention, Poster WOCN 2017 Conference. **6.** Sullivan, R. (2017). Use of a diagnosis-driven heel pressure injury algorithm. MEDSURG Nursing Journal, 26(6), 399-402 **7.** Santamaria, N. (2015). Clinical effectiveness of a silicone foam dressing for the prevention of heel pressure ulcers in critically ill patients: Border II Trial. Journal of Wound Care, 24(8), 340-345. **8.** Recke, C., Davis, T., & Clemmons, T. (2019). Keeping It Heeled – Heel Pressure Ulcer Prevention and Treatment in Long Term Care. Ethica Health. Poster: SAWC 2019. **9.** Boesch RP, Myers C, Garrett T et Al Pediatrics, 2012; 129 e792-E797. **10.** Cohen LP, Ovadia-Blechman Z, Hoffer O, Gefen A. Int Wound J 2019; 1-4. **11.** Sullivan, R., Davies, P. A Prospective, Observational Study of Pressure Injury Prevention, Caregiver Protection, and Workflow Benefits of a Novel Lift-Compatible Safe Patient Handling Support Surface in U.S. Hospitals . Poster Presentation: EPUAP 2022

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