International Journal on Dermatology and Cosmetics

Current Alternative Approaches on The Prevention of Deep Tissue Injuries

Mini Review

Volume 2 Issue 1- 2026

Author Details

*Ebru Bulut**

Department of Medical Nursing, Aydın Adnan Menderes University, Türkiye

*Corresponding author

Ebru bulut, Aydın Adnan Menderes University, Faculty of Nursing, Department of Medical Nursing, Aydin, Türkiye

Article History

Received: February 24, 2026 Accepted: February 27, 2026 Published: March 11, 2026

Introduction

Deep tissue injury is a type of subcutaneous tissue damage, affecting muscle where present, that originates close to bone and is the result of a mechanical load, such as pressure, applied to the skin. A mechanical load can have several effects that may ultimately damage tissue and cause tissue breakdown and cell necrosis. The mechanical load has a direct effect on tissue cells, damaging cell membranes and disrupting internal cell structure to cause cell death. The mechanical load can compress capillaries causing partial or complete occlusion. This reduces the delivery of oxygen and nutrients to tissues. If the rate of delivery is below the physiological demands of the tissues, ischaemia will occur. If the ischaemia is sustained for long or at high enough levels, tissue death can occur due to a change in metabolism and the accumulation of waste products [1-6].

A deep tissue injury is occurs most commonly at the heels, sacrum and buttocks. May deteriorate rapidly to an open wound, resolve before the skin breaks or remain static. The mechanical load causes tissue necrosis by producing direct structural damage to cells and by reducing blood flow and drainage of fluids and waste products. Return of blood flow may add to the tissue damage. Deep tissue injuries start at the bone, tissue interface and develop from the inside out [1-7].

Risk factors of a deep tissue injury are restricted mobility, immobility, impaired sensation, altered posture, reduced tissue perfusion due to heart or lung disease, smoking, diabetes, incontinence, increased age, poor nutrition, poor general health and reduced tissue tolerance. The prevention of deep tissue injury requires the implementation of targeted interventions based on identified risk factors. Strategies such as promoting circulation through increased muscle activity, enhancing blood flow via local thermotherapy, and supporting tissue oxygenation are considered effective approaches in reducing the risk of deep tissue injury [1-7].

Prevention of deep tissue injuries is crucial for improving patient care quality and optimizing healthcare resource utilization. Tissue perfusion can be enhanced through several physiological mechanisms, including increased venous return via rhythmic muscle contractions, improved microcirculation, nitric oxide release stimulated by endothelial activation, local heat generation, vasodilation, and decreased sympathetic activity. Neuromuscular electrical stimulation (NMES), Low-Level Laser Therapy (LLLT) / Photobiomodulation, Ultrasound Therapy (Micro and Macro Acoustic Waves), Vibration Therapy, Pressure-Redistributing Mattress and Cushion Systems, Topical Vasodilators or Antioxidants, Molecules Supporting Angiogenesis and Tissue Repair, Pulsed Electromagnetic Field (PEMF) Therapy, High-Frequency Vibration (HFV), and combined physical therapy modalities such as NMES + LLLT or TENS + Ultrasound can enhance tissue perfusion and thereby help prevent deep tissue injuries [6,8-20].

Neuromuscular electrical stimulation (NMES) activates peripheral nerves to induce muscle contractions, thereby enhancing local blood circulation. Low-Level Laser Therapy (LLLT) utilizes photobiomodulation to stimulate cellular metabolism, reduce inflammation, and promote tissue repair [8,9,11,12]. LFV promotes peripheral blood flow via vasodilation by producing nitric oxide and protects muscle tissue. Despite these benefits, experimental evidence on the preventive role of LFV in deep tissue injuries is lacking. HFV does not merely heat the tissue passively; it also "stimulates" the nervous system and liquefies the tissue [13-16]. Ultrasound Therapy triggers the "self-repair" signals of cells at the micro level, while increasing tissue temperature and flexibility at the macro level, creating a biomechanical protective shield [17].

Pressure-Redistributing Mattress and Cushion Systems are specialized mattresses, overlays and integrated systems that are designed to redistribute pressure, reduce friction and shear, and aid microclimate management. Some support surfaces have characteristics through which they achieve microclimate management, which refers to control of the humidity/moisture at the interface between the individual and the support surface [6]. Topical vasodilators increase blood flow,

warming the tissue, improving flexibility, and reducing the risk of ischemia. Antioxidants minimize cellular damage by neutralizing free radicals and slow down tissue breakdown after exercise. Molecules Supporting Angiogenesis, enhance tissue nutrition by increasing capillary vascularization [18-20]. PEMF therapy combines the mechanical effect of ultrasound, the flow effect of vasodilators, and the protective effect of antioxidants in a single electromagnetic signal. It stabilizes the tissue "electrically" not only superficially but also down to its deepest layers [10].

References

1. National Pressure Ulcer Advisory Panel. Deep Tissue Injury.
2. (2017) Wounds UK Consensus Document. Recognising, managing and preventing deep tissue injury (DTI). London: Wounds UK.
3. Stewart T, Black J, Alderden J, Yap TL, (2022) The past, present, and future of deep-tissue (pressure) injury. Advances in Skin & Wound Care 35(2): 78-80.
4. Black JM, Berke CT (2020) Deep tissue pressure injuries identification, treatment, and outcomes among critical care patients. Critical Care Nursing Clinics 32(4): 563-572.
5. Black JM, Brindle CT, Honaker JS (2015) Differential diagnosis of suspected deep tissue injury. Int Wound J 13(4): 531-539.
6. (2025) Prevention and Treatment of Pressure Ulcers/Injuries: Quick Reference Guide Prevention Recommendations, The International Guideline, Fourth edition.
7. Wynn M, Stephens M, Pradeep S, Kennedy R (2022) Risk factors for the development and evolution of deep tissue injuries: A systematic review. J Tissue Viability 31(3): 416-423.
8. da Silva AM, Silva GM, Martins JC, Bavaresco T, Echevarria-Guanilo ME (2025) Photobiomodulation and photodynamic therapy in the treatment of pressure injuries: a scoping review. Rev Lat Am Enfermagem 17(33): e4488.
9. Macedo SPR, de Almeida Mota MS, Fagundes CF, de Souza MR, Navarro NS (2021) Effects of photobiomodulation in the treatment of pressure ulcers: Integrative review. Research, Society and Development 10(2).
10. Mayer Y, Shibli JA, Saada HA, Melo M, Gabay E, et al. (2024) Pulsed electromagnetic fields therapy: Literature review and current update. Braz Dent J 25(35): e24-6109.
11. Qin X, Shen H, Chen R, Ye R, Hu C (2024) Reliability of evidence supporting the role of electrical stimulation in the treatment of pressure ulcers. Int Wound J 21(2): e14620.
12. Baron MV, Silva PE, Koepp J, Urbanetto JS, Santamarina AFM, et al. (2022) Efficacy and safety of neuromuscular electrical stimulation in the prevention of pressure injuries in critically ill patients: a randomized controlled trial. Ann Intensive Care 12: 53.
13. Haba D, Ohmiya T, Sekino M, Qin Q, Takizawa C, et al. (2023) Efficacy of wearable vibration dressings on full-thickness wound healing in a hyperglycemic rat model. Wound Repair Regen 31(6): 816-826.
14. Haba D, Qin Q, Takizawa C, Tomida S, Minematsu T, et al. (2023) Local low-frequency vibration accelerates healing of full-thickness wounds in a hyperglycemic rat model. J Diabetes Investig 14(12): 1356-1367.
15. Syabariyah S, Nurachmah E, Widjojo BD, Prasetyo S, Sanada H, et al. (2023) The effect of vibration on the acceleration of wound healing of diabetic neuropathic foot ülcer: A Prospective Experimental Study on Human Patients. Healthcare (Basel) 11(2): 191.
16. Haba D, Nakagami G, Minematsu T, Sanada H (2021) Low-frequency vibration promotes AMPK-mediated glucose uptake in 3T3-L1 adipocytes. Heliyon 7(9): e07897.
17. Yang H, Li X, Yu Y, Li Q, Zheng Y, Xia D, (2025) Ultrasound-responsive hydrogels for bone and cartilage tissue engineering. Materials Today Bio 35:102540.
18. Zhang N, Meng Q, Xiao M, Zhou L, Leng H, et al, (2025) Advances in biomaterials for sports injury prevention and rehabilitation: current status and future perspectives. Nanoscale Advances 8(3): 811-828.
19. Yuan Y, Takashi E, Hou P, Kamijo A, Miura D, et al. (2024) Topical skin application of small-molecule antiplatelet agent against pressure injury in rat models. International Journal of moleculer sciences 25(3):1639.
20. Jin C, Jin Y, Ding Z, Nuch KS, Han M, et al. (2025) Cellular and Molecular Mechanisms of Wound Repair: From Biology to Therapeutic Innovation. Cells 14(23):1850.