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Research Article

Role of External Tissue Expansion and Wound Closure Technique in the Management of Sacral Pressure Sore

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Abstract

The reconstruction of pressure sore defects remains a significant challenge in plastic surgery especially in moribund patients. External Tissue Expansion (ETE) has garnered attention for its capacity to regenerate soft tissues, including skin, subcutaneous fat, and breast tissue. As a minimally invasive and cost-effective tissue engineering approach, ETE demonstrates great potential in wound regeneration. Despite promising outcomes, several challenges must be addressed before its routine clinical application can be realized. Basic in vivo and in vitro studies have explored the mechanisms underlying ETE-mediated tissue regeneration. Findings suggest that ETE facilitates cell proliferation and migration, enhances adipogenesis, promotes angiogenesis, and provides a favorable environment for soft tissue growth. Understanding the mechanical and chemical signals involved in ETE-induced tissue regeneration could enable its broader adaptation in clinical practice. This article reviews the clinical applications of ETE, examines preclinical animal models, and evaluates the potential mechanisms by which ETE promotes tissue regeneration, offering insights into its future integration into clinical settings.

Keywords: external tissue expansion (ETE); tissue regeneration; wound closure; pressure sore; raw area; sacral region

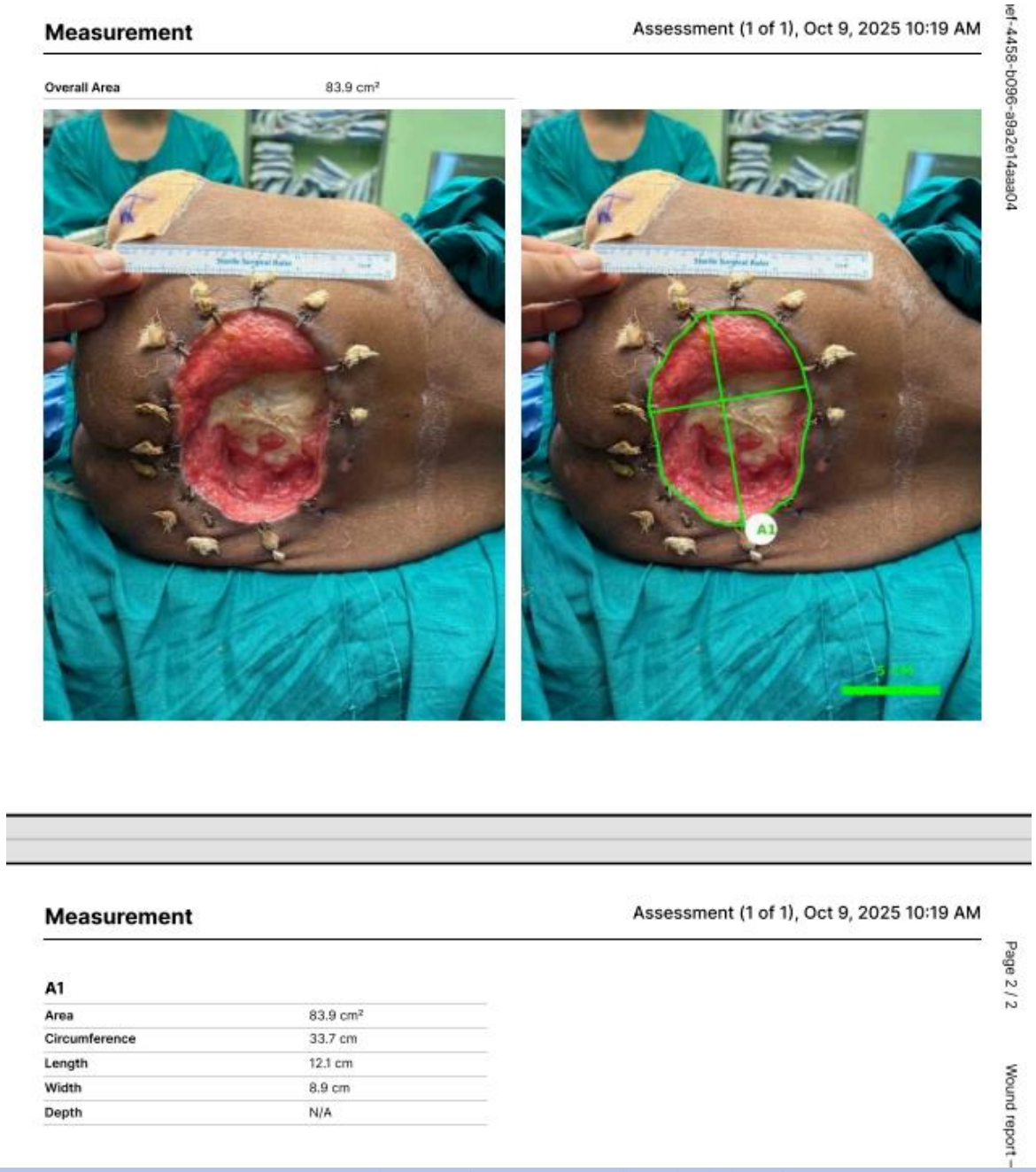
Introduction

Reconstructing extensive pressure injury in long term bedridden patients causes bone deep ulcers over the pressure points including sacrum, posing significant challenges. Pressure sores due to less blood supply, local oxygenation and delayed wound healing in such patients due to decreased sensation often necessitates more than basic subcutaneous undermining to achieve both functional and aesthetically pleasing closure and also limits local skin usage as such patients may require reconstruction serially. Within the field of plastic and reconstructive surgery, soft tissue expansion is widely regarded as the gold standard for addressing pressure sore defects. Despite its effectiveness, this approach is not yet widely adopted or commonly utilized by many surgeons. This article outlines a straightforward external tissue expansion technique, which demonstrates low complication rates and yields excellent cosmetic outcomes, enhancing patient satisfaction.

Materials and Methods

This study was conducted in the Department of Plastic Surgery at a Tertiary Care Centre following approval from the departmental ethics committee. Informed consent was obtained prior to the study. The subject was an 55-year-old female, known case of parotid carcinoma, diabetic, hypertensive with bilateral lower limb weakness for 1 month who presented with pressure sore over the sacral region grade 4. She was admitted to the plastic surgery ICU and underwent wound debridement under general anaesthesia, followed by the application of negative pressure wound therapy (NPWT). Multiple debridements alongwith regenerative therapies were done. Once wound was found to be healthy with slough and necrotic tissue ETEWC was planned. Preprocedure wound measurements documented using imito software (figure1). Readily accessible blouse hooks and rubber bands were utilized to set up an external tissue expansion technique after sterilization. The rubber bands were sterilized using ethylene oxide gas. Over the debrided raw area, biological scaffold and Vac dressing applied. The skin hooks were sutured to the healthy skin edges of the wound using non-absorbable stitches. The hooks were strategically placed circumferentially around the wound. Rubber bands were then attached to the hooks and applied under controlled tension across the vacuum sponge. This setup facilitated the gradual advancement of the wound edges, promoting closure. (figure 3). The tension was maintained just enough as to avoid the cut through of the hooks. Negative pressure wound therapy done. During the next dressing,

after on 7th postoperative day, wound measurements again documented using imito software (figure 4). To sustain the tension and ensure continued advancement of the wound edges, new rubber bands were periodically reinforced over the existing ones. This helped maintain the effectiveness of the external tissue expansion technique throughout the healing process.



Measurement

Assessment (1 of 1), Oct 9, 2025 10:19 AM

Overall Area 83.9 cm²

ref-4458-b096-a9a2e14aaa04

A1

Measurement

Assessment (1 of 1), Oct 9, 2025 10:19 AM

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Wound report –

A1

Area	83.9 cm²
Circumference	33.7 cm
Length	12.1 cm
Width	8.9 cm
Depth	N/A

Figure 1: Preprocedure wound measurements taken using imito software

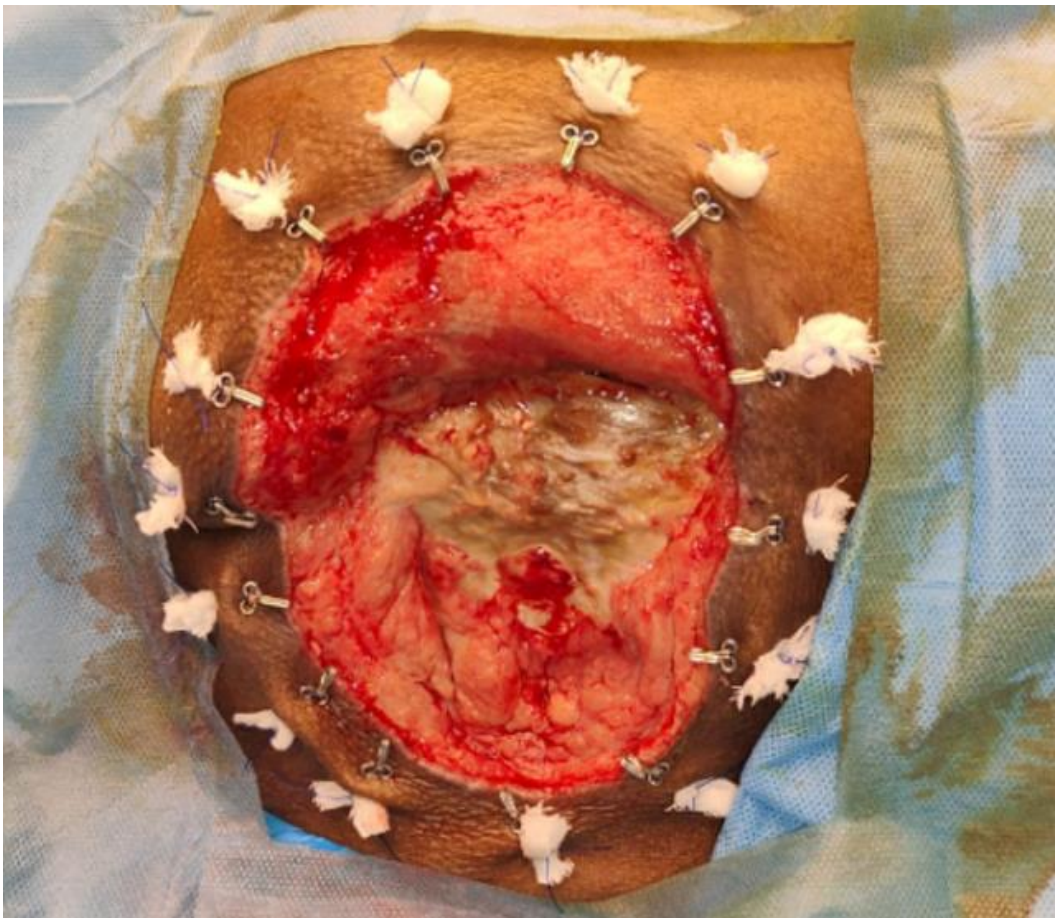

Figure 2: After applying hooks

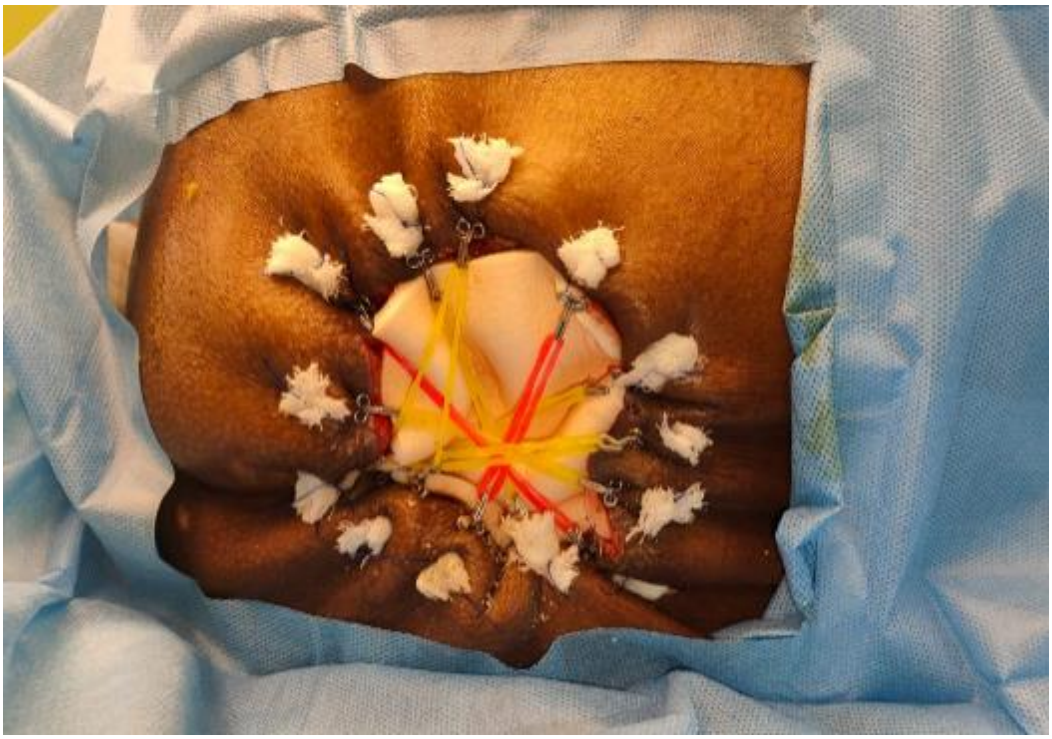

Figure 3: Application of hooks and rubber bands over vac sponge

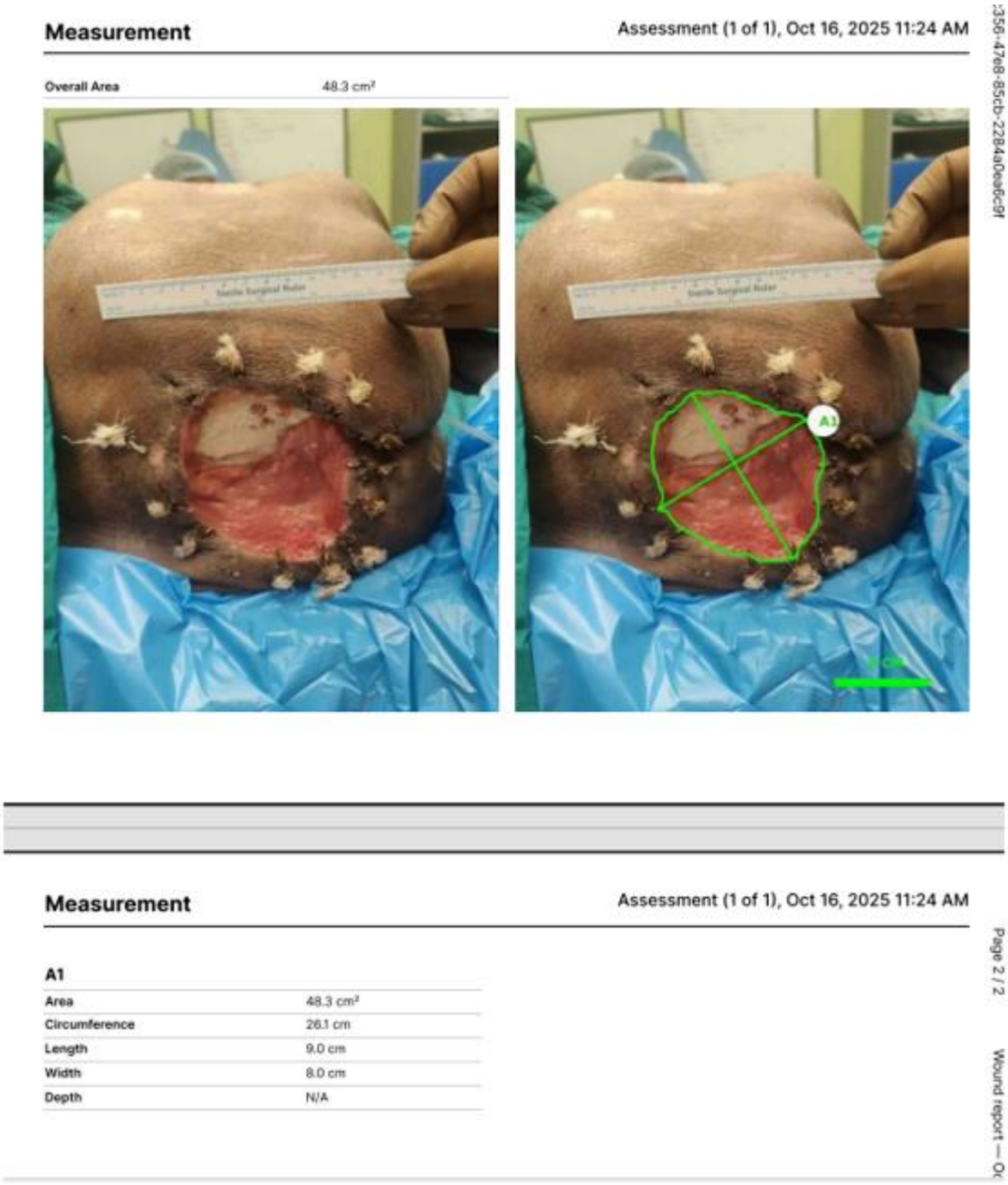

Figure 4 : Postprocedure wound measurements using imito software

Results

A significant reduction in wound size was observed, with approximately 58% decrease and noticeable epithelialization progressing circumferentially from the wound edges. Wounds managed with External Tissue Expansion (ETE) demonstrated faster granulation and healing compared to those treated with conventional methods. Additionally, this technique contributed to a reduced hospital stay, reflecting its efficiency. Overall, the surgical outcomes were markedly improved with the use of ETE.

Discussion

Tissue expansion operates on the principle that living tissues adapt dynamically to mechanical stress. This technique leverages the concepts of biological creep and physiological creep to achieve tissue growth. Initially introduced by Neumann and later popularized by Radovan and Austad, tissue expansion has seen increasing utilization in various applications. While primarily associated with skin expansion, these principles have also been successfully applied to bone regeneration.[4,5] However, internal tissue expansion is not without its challenges. Key limitations include the prolonged treatment duration, the potential for cosmetic deformities, and the necessity for an infection-free surgical field. These drawbacks restrict its utility, particularly for covering raw wound areas. These limitations led to the development and adoption of external tissue expansion as an alternative approach. Many techniques of external tissue expansion were published including negative pressure[6] and other expansion devices like Wise Bands,[7] DermaClose.[8] A significant limitation of commercially available tissue expansion devices is their high cost. To address this, we developed a cost-effective alternative using easily accessible materials like blouse hooks and rubber bands, costing approximately Rs. 5 per setup. These materials can be applied bedside by either a nurse or a doctor. Remarkably, the outcomes achieved with this method were comparable to those of commercial devices.

Looking ahead, we plan to conduct a controlled study with statistical analysis to further validate this approach. However, there are certain drawbacks to this technique. It is unsuitable for use on inflamed or indurated skin surrounding the wound and cannot be applied in areas lacking sufficient skin laxity.

Conclusion

External Tissue Expansion with Hooks and Rubber Bands (ETEWC) is a simple, cost-effective technique that can be applied bedside by healthcare providers. The results achieved with this method are comparable to those of commercially available ETEWC devices. Treatment with this modality has been shown to promote faster wound healing, enhance granulation, and improve the overall patient condition, ultimately reducing the hospital stay. However, to further validate these findings, a controlled study with a larger sample size and statistical analysis is necessary.

Conflict of Interest: None declared.

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