



## Original Research Article

# Role of hybrid reconstruction ladder in management of non-healing ulcer over the right knee

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## ABSTRACT

Non healing ulcers need optimum wound-care practises. Pain and poor quality of life, and poor outcome have significant negative impact on health, psychological and social life. They can last anywhere from a few weeks to several years.<sup>1-3</sup> Cellulitis, osteomyelitis, and malignant transformation are all serious consequences.<sup>4</sup> Although the general occurrence of these ulcers is modest, their refractory nature increases the risk of morbidity and mortality, as well as having a major impact on patient's quality of life.<sup>5,6</sup> Here we report a case of non-healing knee ulcer with the use of hybrid reconstruction ladder to manage the ulcer.

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## 1. Introduction

Ulcers are defined as discontinuity in the epithelium. They can occur due to various systemic or local causes. The term leg ulcer is not a diagnosis but a possible symptom of many different diseases. The majority of leg ulcers occur in the lower leg or foot. In non-venous ulcers, the localization in the foot area is more frequent.<sup>4</sup> The most frequent underlying disease is chronic venous disease. In 354 leg ulcers, Koerber found 75.25% venous leg ulcers, 3.66% arterial leg ulcers, 14.66% ulcers of mixed venous and arterial origin and 13.5% vasculitic ulcers.<sup>4</sup> In the Swedish population of Skaraborg, Nelzen found a venous origin in 54% of the ulcer patients.<sup>5</sup> In a London population excluding diabetic foot ulceration, Moffat et al.<sup>6</sup> found a venous origin in 43% of the ulcers. Koerber found differences in the population between male and female patients. Venous ulcerations were present in 52% of the male 62% of the female population. A mixed venous and arterial origin was present in 18% of the male 12% of the female population and vasculitic ulcers in

12% of the women and in 15% of the men.<sup>4</sup> Doppler ultrasound scanning has become integral part of the physical examination in clinical vascular practice. It is very useful in assessing arterial and venous patency and to ascertain the presence of venous reflux.<sup>7</sup> The reconstructive ladder was a term coined by plastic and reconstructive surgeons to describe levels of increasingly complex management of soft tissue wounds.<sup>7</sup> Theoretically, the surgeon would utilize the lowest rung of the ladder, that is, the simplest reconstruction technique to address a clinical reconstructive problem. The hybrid reconstructive ladder can be used to augments the traditional reconstructive ladder with regenerative medicine modalities.

## 2. Materials and Methods

This study was conducted in the department of Plastic Surgery in a tertiary care institute. Informed consent was obtained from the patient under study. Department scientific committee approval was obtained. It is a single center, non-randomized, non-controlled study. The patient under study was a 17-years-old male, with no other known comorbidities presented with a non-healing ulcer over

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the right knee after a road traffic accident 6 months earlier. He was transferred from the orthopedic department, with an external fixator in situ. Patient and the ulcer were analyzed systematically and was found to have an irregular ulcer of size of 30cm x 10 cm on the right knee with seropurulent discharges on the ulcer base (Figure 1). Wound bed was prepared in accordance with TIMERS<sup>8</sup> concept mentioned in the guidelines, the ulcer was serially assessed and documented according to Bates – Jensen wound assessment tool. Infection was managed with local antimicrobials & antibiotics according to culture sensitivity. Non-viable necrotic tissue was managed with multiple sessions of surgical & hydro debridement. After debridement and preparation of wound bed, various forms of hybrid reconstruction method was applied to the wound. These include, insulin therapy (Figure 2), low level laser therapy (Figure 3), cyclic negative pressure wound therapy (Figure 4) and split thickness skin grafting (Figure 5). He developed new ulcer away from the site of previous raw area. Wound bed preparation was done with autologous platelet rich plasma (Figure 6) and vitamin D granules (Figure 8) and keystone flap type 2A was done (Figure 8). Flap took up well (Figure 9).



**Fig. 1:** Wound on presentation



**Fig. 2:** Insulin therapy applied on the wound



**Fig. 3:** Low level laser therapy applied on the wound



**Fig. 4:** Cyclic NPWT dressing on the wound



**Fig. 5:** Skin graft applied on the wound

### 3. Results

Wound healed up well. Scar Management of Corticosteroid application (Figure 10), silicon sheet (Figure 11)

microdermabrasion application (Figure 12) and compression garment was given and patient was discharged (Figure 13).

### 4. Discussion

Hybrid reconstructions have transformed the management of severe extremity injuries and have offered the extension of indications for techniques available to manage composite tissue loss. The reconstruction options that currently exist to treat such defects frequently fail to satisfactorily address the aesthetic and functional requirements of the resulting



**Fig. 6:** Autologous platelet rich plasma applied on the wound



**Fig. 7:** Vitamin D granules applied to the wound



**Fig. 8:** Keystone flap marking on raw area



**Fig. 9:** Wound healed up after keystone flap



**Fig. 10:** Local application of steroid ointment over scar



**Fig. 11:** Silicon sheet application over healed scar



**Fig. 12:** Microdermabrasion applied on the scar



**Fig. 13:** Well healed wound at the time of discharge

soft tissue defects. Continued research and the development of strategies to address volumetric muscle loss are of continued interest. The utilization of biologic scaffolds may enhance the musculotendinous repair process.<sup>8</sup> Most traditional reconstruction measures are very effective in the management of single-tissue soft tissue loss or addressing minor bone loss. However, composite tissue loss typically results in severely compromised extremity function. While a few functional muscle transfers are available (e.g., functional free gracilis transfers, and so on), many of our wound lack appropriate donor tissues and/or necessary nerves to be successful. The future of dermal regenerates includes enhancing existing technologies and adapting them to single stage procedures to manage soft tissue avulsion injuries. Spray skin technologies are being investigated as a therapeutic measure to address significant skin loss.<sup>9</sup> Spray skin technologies include the use of nonculture autologous cells to promote wound healing and reconstructive procedures. Other dermal regenerate technologies that may have applications in combat casualty care include allogeneic matrices that are embedded with immortal keratinocytes, which is a continuous cell line that is virus free and non-tumorigenic. Future directions in each of the areas discussed are promising in enhancing the management of complex wounds. The future for large peripheral nerve defect reconstruction include tolerance induction and minimal immunosuppression for nerve allografting, cell based supportive therapies and bioengineering of nerve conduits.<sup>10</sup>

## 5. Conclusion

Leg and foot ulceration needs a clinical and anamnestic evaluation. The reconstruction options that currently exist to treat such defects frequently fail to satisfactorily address the aesthetic and functional requirements of the resulting soft tissue defects. The hybrid reconstruction ladder with regenerative modalities can be used to address the challenges of chronic foot and leg ulcerations.

## 6. Source of Funding

None.

## 7. Conflict of Interest

None.

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