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Clinical Utility of the Scooped Curette in Wound Debridement for Ulcer Management: A Prospective Observational Study

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ABSTRACT:

Background and Objectives: Chronic non-healing wounds continue to represent a major challenge in surgical practice because of their prolonged course, associated morbidity, and financial burden on both patients and healthcare systems. Debridement remains a cornerstone in wound management; however, currently available methods possess notable limitations. Sharp surgical debridement requires considerable expertise and may inadvertently damage healthy tissue, while enzymatic methods are expensive and often slow in action. The scooped curette, a hand-held instrument with a concave cutting edge, offers a practical alternative by allowing controlled and selective removal of necrotic tissue through a scooping motion. This study was conducted to evaluate the effectiveness, safety, and clinical applicability of the scooped curette in the treatment of chronic ulcers of varied etiologies in a tertiary care surgical unit.

Methods: A prospective observational study was performed at Saveetha Medical College and Hospital over a period of 18 months. Sixty adult patients with chronic ulcers persisting for longer than four weeks were enrolled after obtaining institutional ethical approval and informed consent. Ulcers included diabetic foot ulcers, venous ulcers, pressure ulcers, and post-traumatic ulcers. Debridement was carried out using a sterilized Fox-pattern scooped curette under local anesthesia at baseline, week 2, and week 4. Outcome measures included wound surface area, Wound Bed Score (WBS), development of healthy granulation tissue, rate of complete epithelialization, pain assessment using the Visual Analogue Scale (VAS), and procedure-related complications. Statistical analysis was performed using IBM SPSS version 25.0.

Results: A marked reduction in wound size was observed during follow-up. Mean wound area decreased from 18.4 ± 6.2 cm^2 at baseline to 3.2 ± 2.1 cm^2 at week 8, corresponding to an overall reduction of 82.6% ($p < 0.001$). Mean Wound Bed Score improved significantly from 7.2 ± 2.1 to 13.6 ± 1.4 by the end of the study period. Healthy granulation tissue was observed in 88.3% of wounds by week 4, while complete epithelialization occurred in 73.3% of patients within eight weeks. Procedural pain remained mild, with an initial mean VAS score of 3.1 ± 0.9 that progressively declined during subsequent sessions. Minor adverse events such as transient peri-wound erythema and superficial bleeding occurred in 21.7% of participants and resolved without major intervention. No serious complications were encountered.

Conclusions: The scooped curette was found to be an effective, safe, and well-tolerated instrument for debridement of chronic ulcers of diverse etiologies. Its advantages include low cost, reusability, technical simplicity, and minimal complication rates,

making it particularly suitable for routine wound care practice in resource-limited healthcare settings. The findings support its incorporation into standardized chronic wound management protocols.

INTRODUCTION

Chronic wounds are generally defined as wounds that fail to progress through the normal phases of healing within an expected period, commonly exceeding three months. These wounds represent a significant clinical burden frequently encountered in surgical practice. Their prevalence is increasing worldwide, particularly among elderly individuals, patients with diabetes mellitus, and those suffering from vascular insufficiency. Apart from physical morbidity, chronic ulcers contribute substantially to prolonged hospitalization, repeated surgical procedures, increased treatment costs, reduced productivity, and impaired quality of life. The pathophysiology of chronic wounds is complex and multifactorial. Persistent inflammation, bacterial colonization, and impaired tissue regeneration play central roles in delaying healing.

Chronic wounds are often characterized by biofilm formation, in which bacteria organize into structured communities protected by extracellular polymeric substances. These biofilms exhibit marked resistance to antibiotics and host immune responses. Additionally, elevated levels of matrix metalloproteinases (MMPs), particularly MMP-1, MMP-2, and MMP-9, contribute to continuous degradation of extracellular matrix components and growth factors essential for tissue repair.

Necrotic tissue and slough further impair wound healing by acting as a physical barrier to epithelial migration and by promoting bacterial proliferation. Debridement is therefore considered a fundamental component of chronic wound management. It involves the removal of devitalized tissue, debris, and microbial contaminants from the wound bed to facilitate healing. Various debridement methods are currently available. Surgical sharp debridement is rapid and effective but may damage viable tissue if performed inadequately. Enzymatic debridement offers selective tissue removal but is relatively expensive and slower in action. Autolytic debridement is less painful but unsuitable when rapid wound bed preparation is required. Traditional wet-to-dry dressings are inexpensive yet non-selective and often painful. More advanced techniques such as hydrosurgery and ultrasound-assisted debridement provide excellent results but are costly and not readily accessible in many healthcare institutions. The scooped curette has emerged as a simple and potentially effective alternative for mechanical debridement. The instrument consists of a concave, sharp-edged blade attached to a handle, allowing controlled scooping and removal of necrotic material. Owing to its curved shape, the curette adapts well to irregular wound surfaces and provides tactile feedback that helps distinguish viable tissue from necrotic tissue during the procedure. This selective action minimizes unnecessary injury to healthy tissue while effectively disrupting wound biofilm and removing slough. Despite these theoretical and practical advantages, limited literature is available regarding the use of the scooped curette in chronic wound management within general surgical practice, especially in Indian tertiary care settings. Most existing studies focus primarily on dermatological or podiatric applications. The present study was therefore undertaken to evaluate the efficacy, safety, and patient tolerability of scooped curette debridement in chronic ulcers of varied etiologies managed in a tertiary care surgical department.

REVIEW OF LITERATURE

The modern concept of wound bed preparation was introduced by Falanga in 2000 through the TIME framework, which categorised the major barriers to wound healing into four components: non-viable tissue, infection or persistent inflammation, moisture imbalance, and non-advancing wound edges. Within this framework, removal of dead and unhealthy tissue was identified as the essential first step in promoting wound healing, thereby highlighting debridement as a therapeutic intervention rather than merely a preparatory procedure. Further evidence supporting the importance of debridement was provided by Steed et al. in 1996 through a multicentre randomised study involving diabetic neuropathic foot ulcers. Their findings demonstrated that wounds subjected to more frequent debridement healed at a significantly faster rate compared to those debrided less often. This study reinforced the concept that regular debridement independently enhances wound healing irrespective of additional treatment modalities. Schultz and colleagues in 2003 explored the biochemical basis underlying chronic wound persistence. Their research showed elevated levels of matrix metalloproteinases, especially MMP-1, MMP-2, and MMP-9, within chronic wound fluid. These enzymes were found to degrade extracellular matrix components and destroy growth factors necessary for tissue repair. Mechanical debridement was shown to reduce the concentration of

these proteolytic enzymes, thereby restoring a more favourable environment for wound healing. Attinger and coworkers contributed significantly to the understanding of surgical debridement in diabetic foot ulcers. They emphasised that successful debridement should continue until a healthy, bleeding wound bed free of necrotic tissue is achieved. Their observations identified incomplete debridement as one of the leading causes of delayed healing and treatment failure in chronic ulcers. The use of curettes for selective tissue removal was described by Brodland and Zitelli in 1992 during their work in dermatologic oncology. They observed that diseased or necrotic tissue offered minimal resistance to curettage, whereas healthy tissue resisted the instrument. This tactile distinction enabled more selective removal of abnormal tissue compared to conventional scalpel techniques. Such findings later supported the application of curettes in chronic wound debridement. Williams et al. in 2005 conducted one of the earliest comparative studies evaluating curette-assisted debridement against scalpel debridement in venous leg ulcers. Their prospective analysis demonstrated significantly greater wound area reduction in patients treated with curette debridement. The authors attributed these improved outcomes to the curette's ability to conform to irregular wound surfaces and effectively remove adherent slough without causing extensive trauma to surrounding healthy tissue. Lebrun, Tomic-Canic, and Kirsner in 2010 investigated the influence of debridement frequency on chronic ulcer healing. Their work revealed that weekly debridement produced substantially better healing outcomes compared with less frequent interventions. The authors suggested that repeated disruption of slough and bacterial biofilm helps maintain the wound in an active healing phase and prevents progression to chronic inflammatory stagnation. Wolcott and associates further strengthened the role of repeated debridement by demonstrating that bacterial biofilms in chronic wounds rapidly reform within 48 to 72 hours after disruption. Since bacteria within biofilms exhibit marked resistance to antimicrobial therapy, regular mechanical debridement was proposed as one of the most effective methods for reducing microbial burden and improving wound healing outcomes. An objective method for assessing wound bed condition was later introduced by Saap and Falanga through the Wound Bed Score (WBS) system in 2002. This validated scoring tool evaluates tissue quality, exudate characteristics, wound edge condition, and peri-wound skin changes on a 16-point scale. The WBS has since become widely accepted in chronic wound research for monitoring wound progression and treatment response. Within the Indian healthcare context, Khanolkar et al. in 2008 studied factors influencing diabetic foot ulcer healing in a tertiary care centre and concluded that adequate debridement played a more decisive role in wound healing than antibiotic selection or dressing type. Similarly, Patil and colleagues in 2015 compared mechanical and enzymatic debridement methods in pressure ulcers and found that mechanical debridement produced comparable healing outcomes at considerably lower cost, making it highly suitable for resource-limited settings. Collectively, available literature strongly supports the role of debridement as a critical component of chronic wound management. Previous studies have highlighted the importance of biofilm disruption, reduction of inflammatory mediators, and removal of devitalised tissue in facilitating healing. However, despite the increasing interest in mechanical debridement techniques, limited prospective data are available regarding the effectiveness of scooped curette debridement across multiple chronic ulcer etiologies in Indian general surgical practice. The present study was therefore designed to evaluate the therapeutic outcomes, safety profile, and clinical practicality of scooped curette debridement in a tertiary care setting.

1. AIMS AND OBJECTIVES

1.1 Aim

To evaluate the clinical effectiveness, safety, and patient tolerability of scooped curette debridement in the management of chronic ulcers at Saveetha Medical College and Hospital.

1.2 Primary Objectives

- To assess changes in wound surface area following scooped curette debridement at baseline, 2 weeks, 4 weeks, 6 weeks, and 8 weeks.
- To evaluate wound bed condition using the validated Wound Bed Score before and after serial debridement sessions.
- To determine the rate of healthy granulation tissue formation and complete wound epithelialization during follow-up.

1.3 Secondary Objectives

- To assess procedural pain using the Visual Analogue Scale.

- To record and classify procedure-related complications and adverse events.
- To compare healing patterns among diabetic, venous, pressure, and post-traumatic ulcers.
- To evaluate the practicality and economic feasibility of routine scooped curette use in chronic wound care.

2. MATERIALS AND METHODS

2.1 Study Design and Setting

This study was designed as a prospective observational investigation conducted in the Department of General Surgery at Saveetha Medical College and Hospital, Chennai, Tamil Nadu, India. The study duration extended over 18 months from January 2022 to June 2023. Institutional Ethics Committee approval was obtained prior to commencement of the study, and written informed consent was obtained from all participants before enrolment.

2.2 Study Population

Patients attending the outpatient and inpatient surgical services with chronic ulcers involving the lower limbs or trunk were screened for eligibility and recruited into the study.

2.3 Inclusion Criteria

- Patients aged 18 years and above.
- Presence of chronic ulcer persisting for more than four weeks.
- Wounds containing slough or necrotic tissue involving at least 25% of the wound surface.
- Willingness to comply with scheduled follow-up visits.
- Provision of written informed consent.

2.4 Exclusion Criteria

- Arterial ulcers with Ankle Brachial Pressure Index less than 0.5.
- Acute spreading soft tissue infection or necrotising fasciitis requiring emergency surgery.
- Patients receiving immunosuppressive therapy or long-term corticosteroids.
- Bleeding disorders or inability to discontinue anticoagulant therapy temporarily.
- Suspicion of malignant transformation within the ulcer.
- Pregnant or lactating women.
- Patients unwilling or unable to participate in follow-up.

2.5 Sample Size

The sample size was calculated using standard statistical methods for proportion estimation. Based on an expected healing rate of 75%, confidence interval of 95%, and precision margin of 10%, the minimum required sample size was estimated at 54 participants. Considering possible attrition, a total of 60 patients were included in the study.

2.6 Instrumentation

A stainless-steel Fox-pattern scooped curette was used for all debridement procedures. Curettes with bowl diameters of 3 mm and 5 mm were selected according to wound size and morphology. All instruments were sterilized by autoclaving prior to use.

2.7 Debridement Procedure

Debridement was performed under aseptic precautions in the wound dressing room by trained surgical personnel. The wound and surrounding skin were initially cleansed with sterile normal saline. Local anaesthesia was achieved using 1% plain lignocaine infiltration around the wound margins. The curette was then applied to the wound surface using controlled

scooping movements from the periphery toward the centre until all visible slough and necrotic tissue were removed, exposing a clean or bleeding wound base. The wound was subsequently irrigated with saline, haemostasis was achieved with manual pressure, and appropriate dressing was applied. Scheduled debridement sessions were performed at baseline, week 2, and week 4, with additional sessions provided whenever clinically indicated.

2.8 Outcome Measures

The following parameters were assessed at baseline and during follow-up at weeks 2, 4, 6, and 8:

- Wound surface area measured in square centimetres using planimetric tracing methods.
- Wound Bed Score assessed on a validated 16-point scale.
- Percentage of healthy granulation tissue within the wound bed.
- Extent of epithelialization and wound closure.
- Pain experienced during debridement measured using the Visual Analogue Scale.
- Occurrence and severity of procedure-related complications.

2.9 Statistical Analysis

All collected data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 25.0. Continuous variables were expressed as mean ± standard deviation, while categorical variables were represented as frequencies and percentages. Paired Student's t-test was used to compare wound area and Wound Bed Score values between baseline and follow-up visits. One-wayANOVA was applied for subgroup comparisons among ulcer etiologies. A p-value of less than 0.05 was considered statistically significant.

3. RESULTS

3.1 Demographic and Baseline Characteristics

A total of 60 patients completed the study, and no participant was lost during the 8-week follow-up period. The mean age of the study population was 54.6 ± 12.3 years, with ages ranging from 22 to 78 years. Male patients constituted the majority of the cohort (63.3%), while females accounted for 36.7%.

Among the various ulcer types, diabetic foot ulcers were the most common, followed by venous ulcers, pressure ulcers, and post-traumatic ulcers. The average duration of ulcer before presentation was 9.4 ± 4.7 weeks. The mean baseline wound area was 18.4 ± 6.2 cm². Common associated comorbidities included diabetes mellitus, hypertension, and nutritional anaemia.

Variable	Value
Total participants	**60**
Mean age (years)	**54.6 ± 12.3**
Age range (years)	**22–78**
Male participants	**38 (63.3%)**
Female participants	**22 (36.7%)**
Mean ulcer duration	**9.4 ± 4.7 weeks**
Mean baseline wound area	**18.4 ± 6.2 cm²**
Diabetes mellitus	**34 (56.7%)**
Hypertension	**23 (38.3%)**

Variable	Value
Nutritional anaemia	**13 (21.7%)**

Table 1: Baseline Demographic and Clinical Characteristics

Ulcer Type	Number of Patients	Percentage
Diabetic foot ulcer	25	41.7%
Venous ulcer	16	26.7%
Pressure ulcer	11	18.3%
Post-traumatic ulcer	8	13.3%

3.2 Reduction in Wound Surface Area

Serial wound assessments showed progressive reduction in wound size throughout the study period. Mean wound area decreased steadily from baseline to week 8, demonstrating statistically significant improvement at each follow-up interval.

Table 3: Mean Wound Surface Area During Follow-Up

Follow-Up Period	Mean Wound Area (cm^2)	Standard Deviation
Baseline	18.4	6.2
Week 2	13.7	5.1
Week 4	9.8	4.3
Week 6	6.1	3.4
Week 8	3.2	2.1

The overall reduction in wound area from baseline to week 8 was 82.6%, which was statistically highly significant ($p < 0.001$).

3.3 Wound Bed Score Improvement

Table 4: Mean Wound Bed Score During Follow-Up

Follow-Up Period	Mean WBS	Standard Deviation
Baseline	7.2	2.1
Week 2	9.4	1.9
Week 4	11.6	1.7
Week 6	12.8	1.5
Week 8	13.6	1.4

Text: The improvement in Wound Bed Score between baseline and week 8 was statistically significant (**$p < 0.001$**).

Significant improvement in wound bed quality was observed during follow-up. The mean Wound Bed Score increased progressively from baseline values, indicating reduction in necrotic tissue, improvement in granulation tissue, and healthier peri-wound skin condition.

3.4 Granulation Tissue Formation and Wound Closure

Healthy granulation tissue formation increased steadily during the study period. By the fourth week, the majority of ulcers demonstrated satisfactory granulation tissue development. Complete epithelialization was achieved in a significant proportion of patients by the end of the study.

Table 5: Granulation Tissue Formation and Complete Wound Closure

Parameter	Number of Patients	Percentage
Healthy granulation tissue at week 2	32	53.3%
Healthy granulation tissue at week 4	53	88.3%
Complete wound closure at week 8	44	73.3%

Table 6: Complete Wound Closure According to Ulcer Type

Ulcer Type	Closure Rate
Post-traumatic ulcer	87.5%
Venous ulcer	81.3%
Pressure ulcer	72.7%
Diabetic foot ulcer	64.0%

Post-traumatic ulcers demonstrated the best healing response, while diabetic foot ulcers showed comparatively slower healing.

3.5 Pain Assessment

Pain experienced during debridement procedures was generally mild and showed progressive reduction with subsequent sessions.

3.6 Adverse Events

Most adverse events observed were mild and self-limiting. No major complications related to the debridement procedure were recorded.

Table 7: Mean Visual Analogue Scale (VAS) Scores

Debridement Session	Mean VAS Score	Standard Deviation
First session	3.1	0.9
Second session	2.4	0.8
Third session	2.1	0.7

Text: No patient discontinued treatment due to pain or discomfort during the study period.

Table 8: Procedure-Related Adverse Events

Adverse Event	Number of Patients	Percentage
Peri-wound erythema	7	11.7%
Minor bleeding	5	8.3%
Superficial wound infection	1	1.7%
Deep tissue injury	0	0%
Neurovascular injury	0	0%

4. DISCUSSION

The present prospective study demonstrated that scooped curette debridement is an effective and safe modality for the management of chronic ulcers. Significant reduction in wound size and marked improvement in wound bed condition were observed during the study period. The overall wound area reduction of 82.6% and the substantial increase in Wound Bed Score indicate that this technique effectively promotes wound healing. The curved design of the scooped curette enables better adaptation to irregular wound surfaces compared to conventional sharp instruments. The scooping action allows selective removal of necrotic tissue while minimizing trauma to healthy granulation tissue. Additionally, tactile feedback provided by the instrument helps distinguish viable from non-viable tissue, thereby improving procedural precision and safety. Pain associated with the procedure remained mild throughout the study. The declining VAS scores over successive sessions suggest progressive reduction in necrotic burden and improved patient tolerance. These findings support the suitability of the procedure for outpatient wound management under local anaesthesia. The complication profile observed in the present study was minimal. Most adverse events consisted of transient erythema and minor bleeding, both of which resolved without major intervention. Only one patient developed superficial wound infection, which responded to local treatment. No severe complications such as tendon injury, neurovascular damage, or deep tissue trauma were encountered. Healing outcomes varied among different ulcer etiologies. Post-traumatic and venous ulcers showed comparatively better healing responses, whereas diabetic foot ulcers healed more slowly due to associated neuropathy, impaired vascularity, and altered immune response. These findings highlight the need for comprehensive multidisciplinary management in diabetic wound care. From an economic perspective, the scooped curette offers significant advantages in resource-limited settings. The instrument is inexpensive, reusable, and easily sterilizable, reducing overall treatment costs compared to advanced debridement technologies and enzymatic agents. Furthermore, the technique is technically straightforward and can be effectively incorporated into routine surgical wound care practice. Despite encouraging outcomes, certain limitations must be acknowledged. The study was conducted at a single centre and lacked a control group for direct comparison with alternative debridement methods. The relatively small sample size may also limit wider generalizability. Future multicentre randomized controlled trials with larger populations and longer follow-up durations are required to further validate these findings.

5. CONCLUSIONS

This prospective observational study conducted at the Department of General Surgery, Saveetha Medical College and Hospital under the guidance of Dr. Rajesh Subramaniam demonstrated that scooped curette debridement is a safe, effective, and well-tolerated technique for chronic wound management. The procedure resulted in significant reduction in wound size, improved wound bed quality, enhanced granulation tissue formation, and satisfactory epithelialization rates. Pain during the procedure remained mild, and complications were infrequent and self-limiting. The scooped curette offers several practical advantages, including ease of use, selective tissue removal, low cost, reusability, and minimal tissue trauma. These features make it particularly useful in tertiary care centres and resource-constrained healthcare settings. Further multicentre randomized studies with larger patient populations are recommended to establish stronger evidence regarding long-term outcomes and comparative efficacy across different ulcer categories.

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