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# A COMPARISON OF OUTCOME OF SOFT AND HARD DRESSING AFTER TRANS TIBIAL AMPUTATION

*Original Research*

**Mairajuddin[1]*, Syed Muhammad Khalid Karim[2], Adeel Ahmed Siddiqui[3], Sunil Kumar[4], Muhammad Noman[2], Ali Ekram[1], Junaid Khan[1]**
[1]Dow University of Health Sciences, Karachi, Pakistan.
[2]Assistant Professor, Orthopedic Unit-II, Dow University of Health Sciences, Karachi, Pakistan.
[3]Professor, Orthopedic Unit-II, Dow University of Health Sciences, Karachi, Pakistan.
[4]Associate Professor, Department of Orthopaedic, Dow University of Health Sciences, Karachi, Pakistan.
**Corresponding Author:** Mairajuddin, Dow University of Health Sciences, Karachi, Pakistan, mairajuddinsoomro7@gmail.com
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## ABSTRACT

**Background:** Trans-tibial amputation (TTA) is a common surgical procedure performed for trauma, peripheral vascular disease, diabetes, and severe infections. Postoperative management of the residual limb plays a decisive role in functional recovery and quality of life. Dressings are central to this process, with soft dressings favored for ease of application and wound inspection, while rigid dressings provide compression, reduce edema, and may accelerate healing. However, limited evidence exists comparing the outcomes of these approaches in local healthcare settings.

**Objective:** The objective of this study was to compare the postoperative outcomes of soft versus hard dressings in patients undergoing trans-tibial amputation.

**Methods:** This randomized controlled trial was conducted at the Department of Orthopaedic Unit II, Dr. Ruth Pfau Civil Hospital, Karachi, following institutional review board approval. A total of 108 patients aged 30–60 years, of either gender, undergoing below-knee amputation under vascular or orthopedic services were enrolled using non-probability consecutive sampling. Participants were randomly allocated into two equal groups: Group S received soft dressings (n=54) and Group H received hard dressings (n=54). Outcomes assessed included wound healing time, pain, length of hospital stay, time to prosthetic fitting, knee joint contracture, wound infection, and wound dehiscence. Data were analyzed using SPSS version 26, with $p<0.05$ considered statistically significant.

**Results:** The mean wound healing time was significantly shorter in the hard dressing group (47.12 ± 19.6 days) compared to the soft dressing group (67.3 ± 30.9 days, $p<0.0001$). Pain scores were lower in the hard dressing group (4.08 ± 1.09) than in the soft dressing group (5.9 ± 1.1, $p<0.0001$). Length of hospital stay was reduced for the hard dressing group (9.73 ± 3.3 days) versus the soft dressing group (12.2 ± 3.8 days, $p<0.0001$). No statistically significant differences were found in time to prosthetic fitting ($p=0.089$), knee joint contracture ($p=0.83$), wound infection ($p=0.159$), or wound dehiscence ($p=0.41$).

**Conclusion:** Rigid dressings significantly enhanced wound healing, pain reduction, and shortened hospitalization compared to soft dressings, without increasing the risk of postoperative complications. These findings highlight the clinical benefits of rigid dressings in optimizing early recovery after trans-tibial amputation.

**Keywords:** Amputation, Pain, Postoperative care, Prosthesis fitting, Rigid dressing, Trans-tibial amputation, Wound healing.

## INTRODUCTION

Trans-tibial amputation (TTA) is a major surgical procedure commonly performed for trauma, peripheral vascular disease, diabetes mellitus, and severe infections. Despite advances in surgical techniques and prosthetic design, the postoperative management of the residual limb remains a crucial determinant of functional recovery, mobility, and quality of life in amputees (1). Appropriate postoperative care is essential to ensure optimal wound healing, reduce complications, and facilitate timely prosthetic fitting, which ultimately enhances independence and reintegration into daily activities (2). A key aspect of postoperative rehabilitation in TTA patients is the selection of suitable stump dressings. Broadly, these are categorized into soft and rigid dressings. Soft or semi-permeable dressings are widely used because they are flexible, easy to apply, and allow frequent inspection of the wound. This makes them particularly suitable for patients with a higher risk of infection or those requiring close monitoring (3,4). However, evidence suggests that soft dressings may be associated with prolonged wound healing, increased risk of stump edema, and higher incidence of joint contractures (5). For example, one study reported that the mean time to healing with soft dressings was 64.7 ± 29.5 days, which was significantly longer compared to patients treated with rigid dressings (6). Rigid dressings, including Immediate Postoperative Prosthesis (IPOP) and Removable Rigid Dressings (RRD), provide structural support and uniform compression, thereby reducing swelling, controlling pain, and preventing joint contractures. These dressings have been associated with faster wound healing, averaging 51.2 ± 19.4 days, and earlier prosthetic readiness, reducing rehabilitation time by approximately 30 days compared with soft dressings (5,7). Importantly, rigid dressings may also decrease the frequency of postoperative infections, a crucial factor in preventing complications and improving long-term outcomes (8,9). Despite these advantages, their application can be technically demanding, may cause discomfort, and often requires skilled rehabilitation teams, limiting their widespread adoption in many healthcare settings (10,11). Given these varying outcomes, there remains a lack of consensus regarding the optimal postoperative dressing method following TTA, particularly in resource-constrained healthcare systems where expertise and infrastructure may be limited. Thus, the objective of this study is to compare the outcomes of soft and hard dressings in the postoperative management of transtibial amputations, with a focus on wound healing, infection control, prevention of complications, and readiness for prosthetic rehabilitation.

## METHODS

This randomized controlled trial was conducted at the Department of Orthopaedic Unit II, Dr. Ruth Pfau Civil Hospital, Karachi, after obtaining ethical approval from the Institutional Review Board (IRB). All procedures followed the principles outlined in the Declaration of Helsinki, and written informed consent was obtained from every participant prior to recruitment. A total of 108 patients who had undergone trans-tibial (below-knee) amputation under the orthopedic or vascular surgery services were enrolled through a non-probability consecutive sampling technique. Eligible participants were male and female patients aged between 30 and 60 years. Patients with previous below-knee amputation, malignancy, or those undergoing surgical procedures unrelated to amputation were excluded from the study. After recruitment, participants were randomly allocated into two groups using a computer-generated random number table to ensure equal distribution and reduce selection bias. Group S (n=54) received soft dressings, which were elastic and semi-permeable, allowing easy wound inspection. Group H (n=54) received rigid dressings, including immediate postoperative prosthesis (IPOP) or removable rigid dressings (RRD), which provided firm compression and structural support. All dressings were applied immediately after surgery in the operating room under the supervision of the operating surgeon, with dressing type decided according to random allocation.

Baseline demographic and clinical data, including age, gender, weight, height, and body mass index (BMI), were recorded using a predesigned proforma. Height was measured in meters using a wall-mounted stadiometer, while weight was measured to the nearest kilogram with a calibrated weighing machine. BMI was calculated using the standard formula (weight in kilograms divided by the square of height in meters). Information regarding comorbidities such as hypertension and diabetes mellitus was also documented (12,13). Primary study outcomes included time to wound healing, time to prosthetic fitting, intensity of residual limb pain, incidence of wound infection, occurrence of knee joint contracture, and presence of wound dehiscence. These outcomes were assessed at baseline (immediately postoperatively), 15 days, 1 month, 3 months, 6 months, and 12 months. The final outcomes were recorded at 6 and 12 months of follow-up. Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 26. Continuous variables, such as age, weight, height, BMI, and healing duration, were presented as mean ± standard deviation. Categorical variables, including

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gender and comorbidities, were expressed as frequencies and percentages. Comparisons between Group S and Group H were performed using the independent samples t-test for quantitative variables and the chi-square test for categorical variables. A p-value of <0.05 was considered statistically significant.

## RESULTS

A total of 108 participants who underwent trans-tibial amputation were included in the study, with 54 allocated to the hard dressing group and 54 to the soft dressing group. The mean age of participants in the hard dressing group was 47.4 ± 8.8 years, while the soft dressing group had a slightly younger mean age of 44.4 ± 9.3 years, and this difference was not statistically significant (p=0.122). Gender distribution was comparable between the two groups, with 31 males (57%) and 23 females (43%) in the hard dressing group, and 35 males (65%) and 19 females (35%) in the soft dressing group (p=0.438). The mean body weight was significantly higher in the soft dressing group (78.8 ± 14.4 kg) than in the hard dressing group (72.3 ± 13.1 kg, p=0.025). The mean height was slightly lower in the soft dressing group (1.71 ± 0.15 m) compared to the hard dressing group (1.75 ± 0.13 m), though this difference did not reach statistical significance (p=0.115). Body mass index (BMI) was significantly higher among participants in the soft dressing group (27.3 ± 6.8 kg/m²) compared with those in the hard dressing group (23.8 ± 6.06 kg/m², p=0.006). Hypertension was present in 23 patients (43%) in the hard dressing group and 26 patients (48%) in the soft dressing group (p=0.606). Diabetes mellitus was present in 32 participants (59%) in each group (p=1.0).

With regard to primary outcomes, wound healing time was significantly shorter in the hard dressing group (47.12 ± 19.6 days) compared to the soft dressing group (67.3 ± 30.9 days, p<0.0001). Pain scores were also significantly lower in patients receiving hard dressings (mean 4.08 ± 1.09) than in those treated with soft dressings (mean 5.9 ± 1.1, p<0.0001). The length of hospital stay was reduced in the hard dressing group (9.73 ± 3.3 days) relative to the soft dressing group (12.2 ± 3.8 days, p<0.0001). In contrast, no statistically significant differences were observed between the two groups with respect to time to prosthetic fitting (47.7 ± 15.9 days vs. 54.5 ± 23.9 days, p=0.089), incidence of knee joint contractures (24% vs. 22%, p=0.83), wound infection rates (28% vs. 17%, p=0.159), and wound dehiscence rates (15% vs. 9%, p=0.41). These findings indicate that while rigid dressings may accelerate wound healing, reduce pain, and shorten hospitalization, other postoperative outcomes such as prosthetic fitting, joint contracture, infection, and wound dehiscence did not differ significantly between the two approaches.

**Table 1: Demographic parameters of the study participants**

| Parameters | Group Hard dressing (n=54) | Group Soft dressing (n=54) | P value |
|---|---|---|---|
| Age | 47.4±8.8 | 44.4±9.3 | 0.122 |
| Gender | | | 0.438 |
| Male | 31 (57%) | 35 (65%) | |
| Female | 23 (43%) | 19 (35%) | |
| Weight (kg) | 72.3±13.1 | 78.8±14.4 | 0.025 |
| Height (m) | 1.75±0.13 | 1.71±0.15 | 0.115 |
| BMI kg/m$^2$ | 23.8±6.06 | 27.3±6.8 | 0.006 |
| Co-morbidity | | | |
| Hypertension | 23 (43%) | 26 (48%) | 0.606 |
| Diabetes | 32 (59%) | 32 (59%) | 1 |

**Table 2: Outcome variables of the procedure in the study participants**

| Parameters | Group H (n=54) | Group S (n=54) | P Value |
|---|---|---|---|
| Wound Healing Time (days) | 47.12±19.6 | 67.3±30.9 | <0.0001 |
| Time to Prosthetic Fitting (days) | 47..7±15.9 | 54.5±23.9 | 0.089 |
| Pain Score | 4.08±1.09 | 5.9±1.1 | <0.0001 |
| Length of Stay (days) | 9.73±3.3 | 12.2±3.8 | <0.0001 |

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| Parameters | Group H (n=54) | Group S (n=54) | P Value |
|---|---|---|---|
| Knee Joint Contracture | 13 (24%) | 12 (22%) | 0.83 |
| Wound Infection | 15 (28%) | 9 (17%) | 0.159 |
| Wound Dehiscence | 8 (15%) | 5 (9%) | 0.41 |

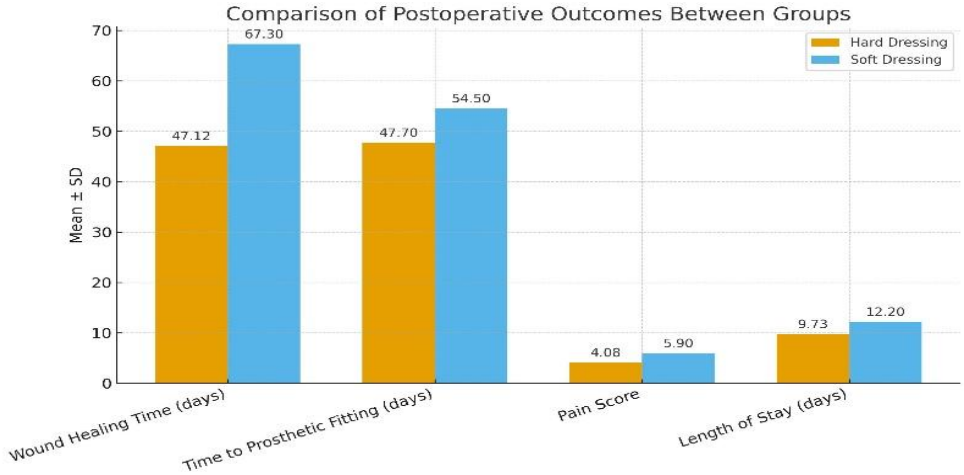


*Figure 1 Comparison of Perspective Outcomes Between Groups*

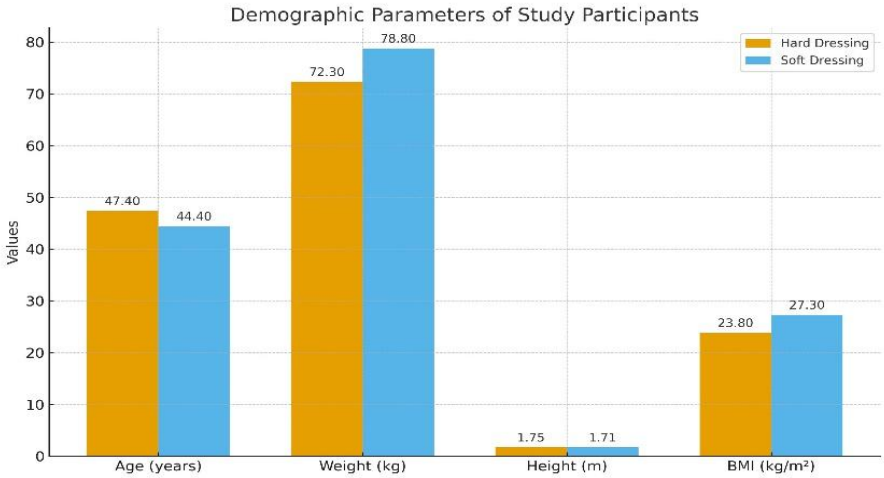


*Figure 2 demographic Parameters of Study Participants*

## DISCUSSION

The present study demonstrated that the application of rigid dressings following trans-tibial amputation was associated with a significant reduction in wound healing time, lower pain scores, and shorter hospital stays when compared to soft dressings. These findings align with previous reports that rigid postoperative dressings facilitate earlier wound closure by providing uniform compression, reducing residual limb edema, and enhancing vascular flow (14,15). The accelerated wound healing observed in this trial, with an average of 47.12 ± 19.6 days in the rigid dressing group versus 67.3 ± 30.9 days in the soft dressing group, is comparable to earlier investigations that highlighted a healing advantage of approximately two weeks to one month when rigid techniques were applied (16). Pain control was another significant benefit noted in the rigid dressing group, where mean pain scores were considerably lower compared to those

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managed with soft dressings. This observation is consistent with prior studies suggesting that rigid dressings reduce friction, minimize residual limb movement, and provide stable support, thereby decreasing postoperative discomfort (17,18). Reduced pain not only improves patient comfort but may also contribute to earlier mobilization and psychological well-being during rehabilitation. The reduction in hospital stay further reinforces the clinical utility of rigid dressings. In this study, patients in the rigid group had an average stay of 9.73 ± 3.3 days compared with 12.2 ± 3.8 days for the soft dressing group. Earlier discharge has been attributed to faster wound healing and fewer complications in settings where rigid dressings are routinely implemented (19). While significant differences were observed in wound healing, pain, and hospital stay, no substantial variation was detected in time to prosthetic fitting, knee joint contracture, wound infection, or wound dehiscence. These findings suggest that although rigid dressings accelerate the early recovery process, long-term outcomes in terms of functional rehabilitation and complication rates converge between the two methods, provided comprehensive rehabilitation services are available (20,21). This highlights the importance of rehabilitation infrastructure, as dressing technique alone may not determine ultimate functional success.

The strengths of this study include its randomized controlled design and the inclusion of a relatively homogenous patient cohort with comparable demographic and comorbidity profiles across groups. The systematic follow-up at multiple intervals up to one year also strengthened the validity of outcome assessment. However, several limitations must be acknowledged. The study was conducted in a single tertiary care hospital, which may limit the generalizability of the findings to broader populations or healthcare settings with differing resources. Furthermore, the exclusion criteria were restricted, and long-term prosthetic outcomes beyond one year were not evaluated, leaving gaps in understanding the sustained benefits of rigid dressings. Patient comfort, ease of dressing application, and cost implications were also not assessed, although these factors often influence clinical decision-making and adoption across healthcare systems. Despite these limitations, the findings support the preferential use of rigid dressings in suitable candidates, particularly where early wound healing, pain reduction, and shorter hospitalization are priorities. Future studies with larger multicenter samples should incorporate cost-effectiveness analyses, patient-reported outcomes, and long-term prosthetic function. Comparative evaluations of rigid subtypes, such as immediate postoperative prostheses versus removable rigid dressings, may further refine recommendations for clinical practice. Overall, this study reinforced the evidence that rigid dressings provide superior short-term outcomes after trans-tibial amputation without compromising long-term complication rates. Integration of these practices, especially in centers equipped with trained rehabilitation teams, may contribute to improved recovery trajectories and more efficient utilization of healthcare resources.

## CONCLUSION

This study concluded that the use of rigid dressings in the postoperative management of trans-tibial amputation offers clear advantages over soft dressings, particularly by enhancing wound recovery, reducing discomfort, and facilitating a smoother rehabilitation process. The findings emphasize the clinical importance of adopting rigid dressing techniques in suitable settings, where resources and expertise allow, as they contribute to improved short-term outcomes without adding long-term risk. Broader studies across diverse populations are warranted to strengthen the evidence base and support standardized protocols for optimal postoperative care in amputation management.

### AUTHOR CONTRIBUTION

| Author | Contribution |
|---|---|
| Mairajuddin* | Substantial Contribution to study design, analysis, acquisition of Data<br>Manuscript Writing<br>Has given Final Approval of the version to be published |
| Syed Muhammad Khalid Karim | Substantial Contribution to study design, acquisition and interpretation of Data<br>Critical Review and Manuscript Writing<br>Has given Final Approval of the version to be published |
| Adeel Ahmed Siddiqui | Substantial Contribution to acquisition and interpretation of Data<br>Has given Final Approval of the version to be published |
| Sunil Kumar | Contributed to Data Collection and Analysis<br>Has given Final Approval of the version to be published |

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| Author | Contribution |
|---|---|
| Muhammad Noman | Contributed to Data Collection and Analysis<br>Has given Final Approval of the version to be published |
| Ali Ekram | Substantial Contribution to study design and Data Analysis<br>Has given Final Approval of the version to be published |
| Junaid Khan | Contributed to study concept and Data collection<br>Has given Final Approval of the version to be published |

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