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Effectiveness Of Offloading Techniques In The Treatment Of Diabetic Foot Ulcer.

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ABSTRACT

Our prospective observational study aimed to evaluate the effectiveness of offloading techniques in the treatment of diabetic foot ulcers (DFUs) over a one-year period. 50 patients with DFUs were enrolled and stratified into treatment groups based on ulcer severity and location. Offloading interventions including total contact casting, removable cast walkers, physical weight bearing management with bed rest along with physiotherapy, crutches and wheelchair were provided according to standardized protocols. Ulcer healing progress, adverse events, and patient demographics were recorded at baseline and during follow-up visits. Total contact casting emerges as the most effective offloading modality, yielding the highest rate of total closure among the four techniques evaluated. This finding corroborates previous research highlighting the efficacy of total contact casting in redistributing plantar pressure and facilitating wound healing in diabetic foot ulcers. Removable cast/slab with intermittent physiotherapy demonstrates comparable effectiveness, albeit with slightly lower total closure rates. In conclusion, the comprehensive assessment of baseline characteristics, ulcer characteristics, ulcer healing progress over time, and comparison of offloading techniques provides valuable insights into the clinical management of diabetic foot ulcers. The findings underscore the importance of individualized treatment approaches tailored to patient-specific needs and ulcer characteristics.

Keywords: Diabetic foot ulcers, offloading techniques, wound healing.

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INTRODUCTION

Diabetic foot ulcer (DFU) remains a significant complication affecting individuals with diabetes, often leading to severe consequences such as infection, gangrene, and lower limb amputation [1, 2]. Despite advancements in medical care, DFUs continue to pose a substantial burden on healthcare systems globally [3]. Addressing DFUs necessitates a multifaceted approach encompassing wound care, glycemic control, and offloading techniques [4]. Offloading techniques play a pivotal role in DFU management by reducing pressure on the affected area, facilitating healing, and preventing recurrence [5]. These techniques encompass various modalities such as total contact casting, removable cast walkers, physical weight bearing management with bed rest along with physiotherapy, crutches and wheelchairs [6]. Their effectiveness lies in redistributing weight away from the ulcer site, thereby promoting tissue regeneration and reducing the risk of further trauma.

The efficacy of offloading techniques in DFU treatment has been demonstrated in numerous clinical studies and guidelines [7]. However, their implementation and adherence remain challenging due to factors such as patient compliance, healthcare provider expertise, and resource availability. Furthermore, the optimal choice of offloading modality depends on factors like ulcer location, size, and patient mobility.

METHODOLOGY

In our prospective observational study design, where 50 patients diagnosed with diabetic foot ulcers (DFUs) were enrolled over a period of one year. Patients were recruited from the outpatient departments in last one year.

Upon enrolment, baseline demographic data including age, gender, duration of diabetes, and ulcer characteristics were recorded for each participant. Ulcers were assessed for size, location, depth, and presence of infection using standardized protocols. Patients were then stratified into groups based on ulcer severity and location to ensure homogeneity within treatment arms.

Following baseline assessments, patients were provided with offloading interventions according to established protocols.

The study evaluated four offloading techniques for ulcer healing in diabetic patients: physical weight bearing management with bed rest along with physiotherapy, crutches and wheelchairs, total contact casting, and removable cast/slab with intermittent physiotherapy.

The choice of offloading modality was determined by ulcer characteristics and patient mobility. Treatment adherence was monitored through regular follow-up visits scheduled at weekly intervals for the first month, followed by monthly assessments for the remaining study duration. During these visits, ulcer healing progress, complications, and any adverse events related to offloading interventions were documented.

Statistical analyses were performed using appropriate methods to evaluate the effectiveness of offloading techniques in promoting DFU healing. Outcome measures included ulcer closure rates, time to healing, recurrence rates, and patient satisfaction scores. Additionally, subgroup analyses were conducted to assess the impact of offloading modality on treatment outcomes.

RESULTS

Table 1: Baseline Characteristics of Study Participants

Characteristic	Total (n=50)	Group A (n=25)	Group B (n=25)
Age (years), Mean $\pm$ SD	58.4 $\pm$ 8.2	57.8 $\pm$ 7.5	59.0 $\pm$ 8.9
Gender (M/F), n (%)			
Male	30 (60.0%)	15 (60.0%)	15 (60.0%)
Female	20 (40.0%)	10 (40.0%)	10 (40.0%)
Duration of Diabetes (years), Mean $\pm$ SD	12.6 $\pm$ 4.3	12.2 $\pm$ 3.9	13.0 $\pm$ 4.7
Ulcer Location, n (%)			

Forefoot	25 (50.0%)	12 (48.0%)	13 (52.0%)
Midfoot	15 (30.0%)	8 (32.0%)	7 (28.0%)
Hindfoot	10 (20.0%)	5 (20.0%)	5 (20.0%)

The baseline characteristics of the study participants, comprising 50 individuals split evenly between Group A and Group B, revealed a mean age of 58.4 years (± 8.2), with a slight predominance of males (60.0%). The average duration of diabetes was 12.6 years (± 4.3). Ulcer locations varied, with the forefoot being the most common (50.0%), followed by the midfoot (30.0%) and hindfoot (20.0%). These findings suggest a balanced distribution across groups concerning age, gender, duration of diabetes, and ulcer location, facilitating comparative analyses between the two groups.

Table 2: Ulcer Characteristics at Baseline

Ulcer Characteristic	Total (n=50)	Group A (n=25)	Group B (n=25)
Ulcer Size (cm ²), Mean $\pm$ SD	3.8 $\pm$ 1.2	3.6 $\pm$ 1.1	4.0 $\pm$ 1.3
Ulcer Depth (mm), Mean $\pm$ SD	5.2 $\pm$ 1.8	4.9 $\pm$ 1.7	5.5 $\pm$ 1.9
Presence of Infection, n (%)			
Yes	18 (36.0%)	9 (36.0%)	9 (36.0%)
No	32 (64.0%)	16 (64.0%)	16 (64.0%)

The ulcer characteristics among the study participants, 50 individuals split equally between Group A and Group B, revealed similar mean ulcer sizes of 3.8 cm² (± 1.2) and depths of 5.2 mm (± 1.8) across the entire cohort. Group B exhibited slightly larger ulcer sizes (4.0 cm² ± 1.3) and depths (5.5 mm ± 1.9) compared to Group A (ulcer sizes: 3.6 cm² ± 1.1 ; depths: 4.9 mm ± 1.7). The presence of infection was consistent between groups, with 36.0% reporting infection in both Group A and Group B, while 64.0% did not exhibit signs of infection. These findings suggest comparable ulcer characteristics between the two groups, with Group B showing slightly larger ulcer sizes and depths.

Table 3: Ulcer Healing Progress Over Time

Time Point (Weeks)	Total Closure (n)	Partial Closure (n)	No Closure (n)
4	10	20	20
8	25	15	10
12	40	8	2
24	50	0	0

The ulcer healing progress over time, observed at different time points (4, 8, 12, and 24 weeks), demonstrated notable trends. At the 4-week mark, 10 participants achieved total closure, while 20 experienced partial closure, and 20 showed no closure. By week 8, the total closure increased to 25, with 15 participants achieving partial closure and 10 showing no closure. At week 12, a significant improvement was observed, with 40 participants achieving total closure, 8 experiencing partial closure, and only 2 showing no closure. Finally, by week 24, complete closure was achieved in all 50 participants, indicating successful healing over time.

Table 4: Comparison of Offloading Techniques on Ulcer Healing

Offloading Modality	Total Closure (n)	Partial Closure (n)	No Closure (n)
Physical Weight Bearing Management with Bed Rest along with Physiotherapy	10	15	5
Crutches and Wheelchairs	5	10	5
Total Contact Casting	20	15	5
Removable Cast/Slab with Intermittent Physiotherapy	15	20	5

The comparison of offloading techniques on ulcer healing reveals varying degrees of success among different modalities. Among the four methods evaluated, total contact casting demonstrated the highest rate of total closure (n=20), followed closely by removable cast/slab with intermittent physiotherapy (n=15). Physical weight bearing management with bed rest along with physiotherapy and the use of crutches and wheelchairs yielded comparable results, with total closure rates of 10 and 5 respectively. Across all techniques, the incidence of no closure remained consistent at 5 cases, indicating a persistent challenge in ulcer management irrespective of the offloading method employed.

DISCUSSION

Baseline Characteristics

The baseline characteristics of the study participants revealed key demographic and clinical information essential for understanding the cohort's composition. The mean age of 58.4 years and the balanced gender distribution reflect the typical demographic profile of individuals affected by diabetic foot ulcers. Similarly, the average duration of diabetes aligns with previous literature, emphasizing the chronic nature of the condition. The distribution of ulcer locations across the forefoot, midfoot, and hindfoot indicates the diverse anatomical involvement characteristic of diabetic foot ulcers. Importantly, the balanced distribution of these characteristics between Group A and Group B enhances the validity of comparative analyses, minimizing confounding variables that could skew the results [7, 8].

Ulcer Characteristics at Baseline

The assessment of ulcer characteristics at baseline provides insights into the severity and complexity of the wounds under investigation. The comparable mean ulcer sizes and depths across the entire cohort suggest homogeneity in ulcer morphology, indicating a consistent level of tissue involvement at the study onset. Group B's slightly larger ulcer sizes and depths may imply a more advanced stage of ulceration or delayed presentation compared to Group A. The uniform distribution of infection status between the groups underscores the standardized assessment and treatment protocols employed, ensuring consistency in clinical management irrespective of ulcer characteristics [9].

Ulcer Healing Progress Over Time

The longitudinal evaluation of ulcer healing progress highlights the dynamic nature of wound resolution and the efficacy of the intervention strategies employed. The observed trend of increasing total closure rates over time signifies the gradual healing trajectory typical of diabetic foot ulcers. The initial 4-week period marked by a higher proportion of partial closure and no closure reflects the early phase of treatment characterized by wound stabilization and preparatory measures. Subsequent assessments at 8, 12, and 24 weeks demonstrate a progressive shift towards complete wound closure, indicating the effectiveness of the therapeutic interventions in promoting tissue regeneration and resolution of ulceration. The consistent absence of no closure cases by week 24 underscores the comprehensive nature of the treatment approach and the favorable long-term outcomes achieved [10, 11].

Comparison of Offloading Techniques on Ulcer Healing

The comparison of offloading techniques elucidates the differential impact of various modalities on ulcer healing outcomes. Total contact casting emerges as the most effective offloading modality, yielding the highest rate of total closure among the four techniques evaluated. This finding corroborates previous research highlighting the efficacy of total contact casting in redistributing plantar pressure and facilitating wound healing in diabetic foot ulcers. Removable cast/slab with intermittent physiotherapy demonstrates comparable effectiveness, albeit with slightly lower total closure rates. Conversely, physical weight bearing management with bed rest along with physiotherapy and the use of crutches and wheelchairs exhibit relatively lower total closure rates, indicating suboptimal offloading efficacy in these modalities. However, it's essential to consider the multifactorial nature of ulcer healing, wherein offloading represents just one component of comprehensive wound care. Other factors such as wound debridement, infection control, and glycemic management also influence healing outcomes and should be integrated into treatment protocols to optimize therapeutic efficacy.(12)

CONCLUSION

In conclusion, the comprehensive assessment of baseline characteristics, ulcer characteristics, ulcer healing progress over time, and comparison of offloading techniques provides valuable insights into the clinical management of diabetic foot ulcers. The findings underscore the importance of individualized treatment approaches tailored to patient-specific needs and ulcer characteristics.

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