Original Article

Matrix Rhythm Therapy in Chronic Lower Limb Ulcers: A Novel Adjunct in Wound Healing

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Abstract

Background: Chronic lower limb ulcers, especially diabetic foot and venous ulcers remain a therapeutic challenge due to impaired microcirculation and prolonged inflammation. Matrix Rhythm Therapy (MRT) has emerged as a novel noninvasive technique promoting cellular oscillation, enhancing tissue perfusion, and supporting extracellular matrix reorganization. **Objective:** To evaluate the efficacy of MRT in reducing ulcer dimensions and improving the quality of life in patients with chronic lower limb ulcers. **Materials and Methods:** A pre–post experimental study was conducted in 33 patients at KAHER Hospital, Belagavi. Eligible participants received three sessions of MRT using the Matrixmobil® device over 7 days. Ulcer dimensions were measured using the IMITO Measure App. Ulcer severity and quality of life were assessed using Site, Ischemia, Neuropathy, Bacterial Infection, Area, Depth (SINBAD) and Wound-QoL questionnaires, respectively. Pre- and post-intervention data were analyzed statistically. **Results:** MRT led to significant reductions in ulcer length (mean reduction: 1.08 cm, $P < 0.05$), width (0.69 cm, $P < 0.05$), area (30.77%, $P < 0.05$), and circumference (18.42%, $P < 0.05$). Wound-QoL scores improved significantly (mean difference: 9.27, $P < 0.05$). No adverse effects were reported. **Conclusion:** MRT is a promising, safe, and effective adjunct in the management of chronic lower limb ulcers. It significantly enhances wound healing and patient-reported outcomes, warranting larger randomized trials.

Keywords: *Chronic wounds, diabetic foot ulcer, Matrix Rhythm Therapy, noninvasive therapy, venous ulcer, wound healing*

Introduction

Chronic lower limb ulcers, including diabetic foot and venous leg ulcers, pose a persistent healthcare burden due to delayed healing, high recurrence, and rising prevalence, especially in diabetic and vascular disease populations. Traditional wound care approaches often fail in managing chronic nonhealing ulcers. Matrix Rhythm Therapy (MRT) (MaRhyThe®) is a novel, noninvasive modality using the low-frequency mechanical oscillations (8-12 Hz) to enhance microcirculation and promote extracellular matrix (ECM) remodeling. Preliminary studies suggest benefits in pain relief and tissue regeneration. This study evaluates the efficacy of MRT in reducing the ulcer dimensions and improving the quality of life, supporting its role as an adjunct to standard care.

Materials and Methods

Study design and setting

A prepost, interventional, and experimental study was conducted at KLE Prabhakar Kore Hospital, Belagavi, over a 1-year period. The study was approved by the Institutional Ethics Committee and written informed consent was obtained from all the participants.

Sample size

The study included 33 patients. Patients were recruited using convenience sampling.

Inclusion criteria

- Adults (>18 years) of any gender
- Patients with chronic venous or diabetic lower limb ulcers persisting for more than 6 weeks

Exclusion criteria

1. Active wound infection or cellulitis
2. Uncontrolled diabetes mellitus (DM)
3. Deep-vein thrombosis (confirmed by color Doppler)
4. Systemic illnesses (e.g., autoimmune, renal, and hepatic)
5. Traumatic ulcers or those with underlying osteomyelitis

Intervention protocol

Each patient underwent three sessions of MRT (MaRhyThe®) using the

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Matrixmobil® device, spaced over a week (Day 1, Day 4, and Day 7). Each session lasted 60 min and was divided equally across the three anatomical zones:

- 20 min: plantar aspect of the foot
- 20 min: anterior and lateral aspects of the leg
- 20 min: calf and popliteal region.

The device delivered mechanical oscillations at a frequency of 8–12 Hz. Patients were positioned supine or prone depending on the ulcer location. Talcum powder was used to minimize friction, and ulcers were cleaned and dressed postsession.

Assessment tools and outcome measures

- Wound dimensions: Length, width, area, and circumference were measured using the IMITO Measure App, a mobile-based tool validated for digital wound measurement
- Ulcer Severity: Graded using the SINBAD score, comprising six parameters – Size, ischemia, neuropathy, bacterial infection, area, and Depth
- Quality of Life: Assessed using the Wound-QoL questionnaire (17 items, score range 0-68), with higher scores indicating the poorer quality of life.

Statistical analysis

Data were analysed using SPSS (IBM Corp., Armonk, NY, USA) and R software (R Foundation for Statistical Computing, Vienna, Austria).

- Normality was assessed using the Shapiro–Wilk test
- Parametric data were analyzed with paired *t*-tests, and results expressed as mean ± standard deviation
- Nonparametric data were analyzed using the Wilcoxon signed-rank test and expressed as median with interquartile range (IQR). $P < 0.05$ was considered statistically significant.

Results

A total of 33 patients with chronic lower limb ulcers were included in the study. Of these, 19 (57.6%) were male and 14 (42.4%) were female [Figure 1 and Table 1]. The majority of patients belonged to the 41–60 years age group, as shown in Figure 2 and Table 2.

Diabetic foot ulcers constituted the predominant etiology (78.8%), followed by venous leg ulcers (21.2%) [Figure 3 and Table 3]. Baseline ulcer severity assessment using the SINBAD (Site, Ischemia, Neuropathy, Bacterial Infection, Area, Depth) scoring system revealed that most patients presented with advanced disease, with grade 6 ulcers accounting for 30.3% of cases, followed by grade 4 ulcers in 21.2% of patients [Table 4].

Following Matrix Rhythm Therapy (MRT), a statistically significant reduction was observed in all wound dimensions. Mean ulcer length reduced from 4.93 ± 1.98 cm pre-intervention to 3.84 ± 1.57 cm post-intervention, with a mean reduction of 1.08 ± 0.89 cm ($P < 0.05$) [Figure 4 and Table 5]. Similarly, mean ulcer width decreased from 3.33 ± 1.86 cm to 2.64 ± 1.53 cm, corresponding to a mean reduction of 0.69 ± 0.67 cm ($P < 0.05$) [Figure 5 and Table 6].

Median ulcer area demonstrated a significant reduction from 9.80 cm² (IQR 19.2) before treatment to 8.00 cm² (IQR 12.9) after therapy, representing a 30.77% decrease ($P < 0.05$) [Figure 6 and Table 7]. Ulcer circumference also showed a statistically significant reduction, with a mean percentage decrease of 18.42% following intervention ($P < 0.05$) [Figure 7 and Table 8].

Quality of life assessment using the Wound-QoL questionnaire revealed significant improvement following MRT. Mean Wound-QoL scores decreased from 38.36 ± 7.17 pre-intervention to 29.09 ± 8.95 post-

Table 1: Distribution of patients by gender

Sex	*n* (%)
Male	19 (57.6)
Female	14 (42.4)
Total	33 (100.0)

Table 2: Descriptive statistics of age

Age	Mean±SD
-	46.242±8.853

SD=Standard deviation

Table 3: Distribution of patients by cause of ulcer

Cause of ulcer	*n* (%)
DM	26 (78.8)
Varicose	7 (21.2)
Total	33 (100.0)

DM=Diabetes mellitus

Table 4: Distribution of patients by SINBAD grading

SINBAD grading	*n* (%)
0	3 (9.1)
1	3 (9.1)
2	4 (12.1)
3	4 (12.1)
4	7 (21.2)
5	2 (6.1)
6	10 (30.3)
Total	33 (100.0)

SINBAD=Site, Ischemia, Neuropathy, Bacterial Infection, Area, Depth

Table 5: Comparison of pre- and post-test length of ulcer

Length of ulcer (cm)	Mean±SD	Paired difference, mean±SD	*t*	*P*
Pre	4.925±1.975	1.084±0.889	7.008	<0.05*
Post	3.840±1.566			

*Significance is obtained by Paired *t*-test. SD=Standard deviation

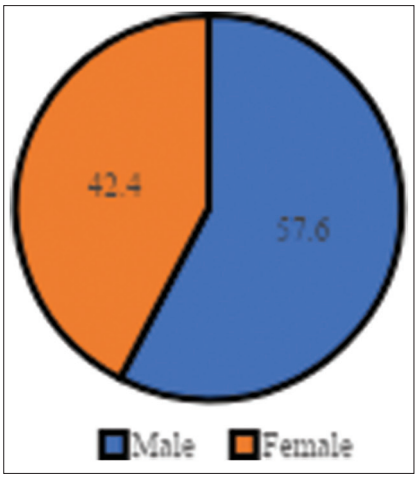

Figure 1: Distribution of patients by gender

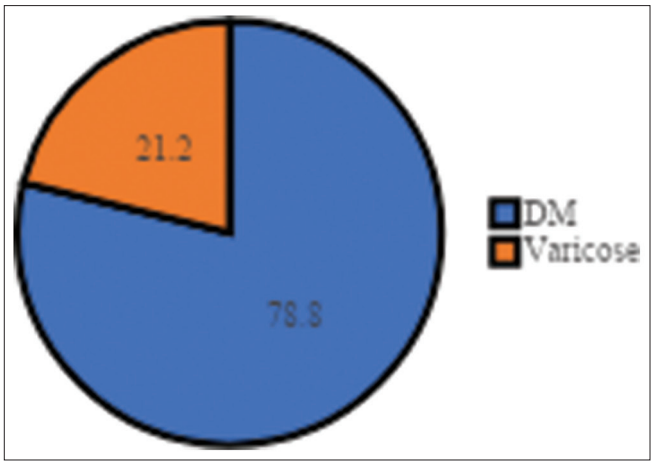

Figure 2: Distribution of patients by cause of ulcer

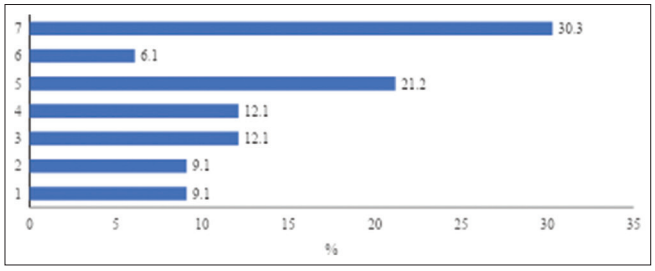

Figure 3: Distribution of patients by Sinbad grading

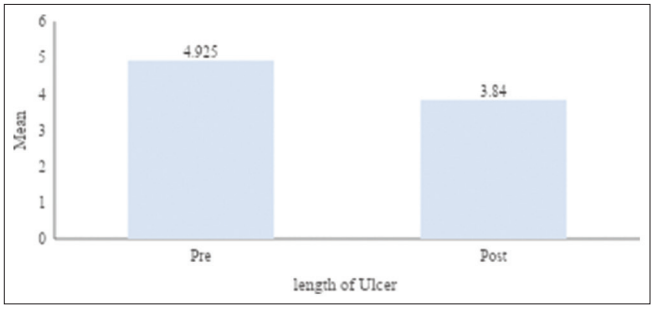

Figure 4: Comparison of pre and posttest length of ulcer

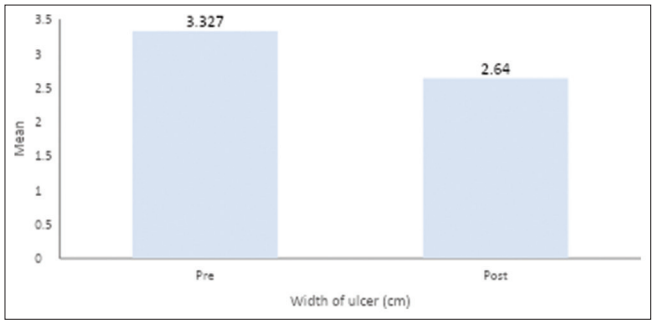

Figure 5: Comparison of pre and posttest width of ulcer (cm)

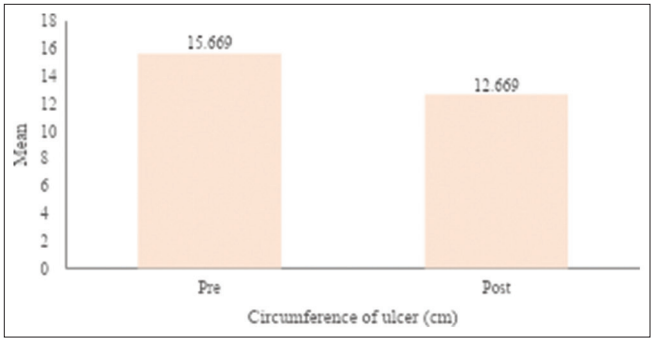

Figure 6: Comparison of pre and posttest circumference of ulcer (cm)

Table 6: Comparison of pre- and post-test width of ulcer (cm)

Width of ulcer (cm)	Mean±SD	Paired difference, mean±SD	*t*	*P*
Pre	3.327±1.858	0.686±0.673	5.855	<0.05*
Post	2.640±1.530			

*Significance is obtained by Paired *t*-test. SD=Standard deviation

intervention, with a mean difference of 9.27 ± 8.63 ($P < 0.05$) [Figure 8 and Table 9]. No adverse events related to the intervention were reported.

Discussion

Chronic lower limb ulcers continue to represent a significant clinical challenge, particularly in patients with diabetes and vascular disease. Earlier work by Reiber *et al*. and Jeffcoate and Harding established the substantial burden and chronicity of diabetic foot ulcers, findings that are consistent with the predominance of diabetic ulcers observed in the present study.[1,2]. Sen *et al*. further emphasized the escalating public health impact of chronic wounds, a concern reflected in the advanced ulcer severity noted at presentation in our cohort.[3] Comparable challenges have also been described in venous leg ulcers by Franks and Moffatt, aligning with the venous ulcer subgroup included in this study.[4]

Previous studies by Armstrong *et al*. and Kirsner and Vivas highlighted the limitations of conventional wound care and the frequent recurrence of lower extremity ulcers despite standard management.[5,6] In this context, the significant reductions in ulcer dimensions observed in our study suggest

Table 7: Comparison of pre- and post-test circumference of ulcer (cm)

Circumference of ulcer (cm)	Mean±SD	Paired difference, mean±SD	*t*	Percentage reduction	*P*
Pre	15.669±5.901	3.001±1.951	5.855	18.42	<0.05*
Post	12.669±4.732				

*Significance is obtained by paired *t*-test. SD=Standard deviation

Table 8: Comparison of pre- and post-test area of ulcer (cm²)

Area of ulcer (cm²)	Median	IQR	Percentage reduction	*P*
Pre	9.80	19.2	30.77	<0.05*
Post	8.00	12.9		

*Significance is obtained by Wilcoxon signed-rank test. IQR=Interquartile range

Table 9: Comparison of pre- and post-test wound quality of life score

Wound-QoL score	Mean±SD	Paired difference, mean±SD	*t*	*P*
Pre	38.364±7.167	9.273±8.625	6.176	<0.05*
Post	29.091±8.946			

*Significance is obtained by paired *t*-test. SD=Standard deviation, QoL=Quality of life

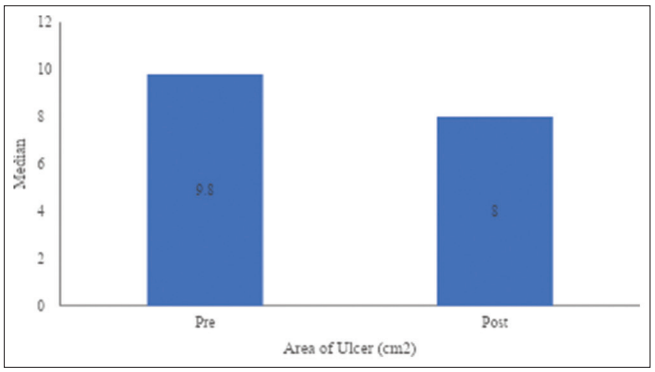

Figure 7: Comparison of pre and posttest area of ulcer (cm²)

that Matrix Rhythm Therapy (MRT) may offer additional benefit when used as an adjunct to standard wound care.

The theoretical basis of MRT, as described by Randoll and later by Randoll and Machetanz, centers on restoration of physiological microcellular oscillations to improve tissue perfusion and extracellular matrix mobility.[7,8] The significant reductions in ulcer length, width, area, and circumference observed in the present study [Figures 4-7 and Tables 5-8] are consistent with the circulatory improvements reported by Taspinar *et al*. following MRT application.[9] Similarly, the wound healing response observed in our patients aligns with the mechanistic observations of Sharma *et al*., who reported enhanced cellular metabolism and tissue regeneration with rhythmic mechanical stimulation.[10]

Clinical outcomes in our study are comparable to those reported by Naik *et al*., who demonstrated improvement in diabetic foot ulcer healing using MRT in both case-based and clinical study settings.[11,12] While their studies focused primarily on diabetic ulcers, our study extends these findings to a broader cohort that included venous ulcers and demonstrated consistent improvement across ulcer types. The reduction in wound dimensions observed in our cohort is also supported indirectly by the work of Maiya *et al*., who reported improvements in neuropathic pain and plantar pressure distribution with MRT, factors known to influence ulcer healing and recurrence.[13] Deshmukh and Sheth similarly described MRT as a promising adjunctive modality in wound care, supporting its feasibility and clinical applicability.[14]

An important distinguishing feature of the present study is the inclusion of patient-reported quality of life outcomes. The significant reduction in Wound-QoL scores observed parallels improvements in wound healing outcomes reported by Mulder *et al*. and Armstrong and Lavery in studies evaluating advanced wound care interventions.[15,16] These findings suggest that MRT not only facilitates wound size reduction but may also contribute meaningfully to overall patient well-being.

Despite these encouraging results, the limitations of this study—including the absence of a control group and a modest sample size—are comparable to those noted in early evaluations of emerging wound therapies. As emphasized by Frykberg and Banks, larger randomized controlled trials are necessary to establish definitive efficacy and to position adjunctive therapies such as MRT within standardized chronic wound management protocols.[17]

Conclusion

MRT (MaRhyThe®) appears to be a safe, noninvasive, and effective adjunct in the management of chronic lower limb ulcers. In this study, patients demonstrated significant reductions in ulcer size length, width, area, and circumference after just three sessions of MRT. In addition, notable improvement in the quality of life was observed, highlighting both physical and psychosocial benefits.

These results support the role of MRT in enhancing local microcirculation, promoting granulation tissue formation, and restoring ECM balance – key mechanisms in chronic wound healing. Its ease of use, lack of adverse effects, and compatibility with conventional wound care make it particularly useful in the low-resource settings and among patients with delayed or nonhealing ulcers.

While the findings are promising, further large-scale, randomized studies with longer follow-up are necessary to

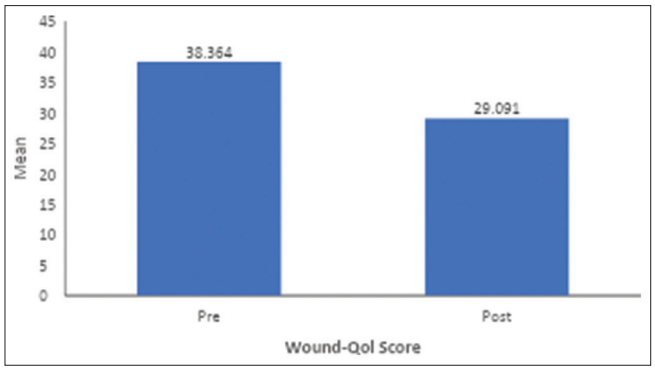

Figure 8: Comparison of pre and posttest Wound-QoL Score

confirm its long-term efficacy and to establish standardized protocols. Nevertheless, this study provides a strong foundation for considering MRT as a valuable component in comprehensive chronic wound care strategies.

Acknowledgments

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Nil.

Conflicts of interest

There are no conflicts of interest.

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