

ORIGINAL PAPER

ACCEPTANCE OF MAGGOT WOUND THERAPY IN A GROUP OF PEOPLE WITH CHRONIC WOUNDS

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Summary

Introduction: To evaluate the level of acceptance of maggot debridement therapy (MDT) and selected variables that potentially affect the acceptance of the method in a group of patients with chronic wounds.

Material and methods: The study was conducted among patients qualified for MDT. All participants gave informed consent to participate in the study. The collected data were statistically developed using IBM SPSS v20 software. A diagnostic survey and estimation were used as the research method; the research tool was a protocol consisting of 3 parts (questionnaires).

Results: The study included 94 subjects, including 41.5% ($n = 39$) women and 58.5% ($n = 55$) men, ranging in age 34–86 years. The mean age was 70.09 ± 13.12 years. The time of wound formation varied, ranging 1.5–38 months. Wound area ranged from 24 to 225 cm². The clinical evaluation reported chronic wounds, such as pressure injuries 31.9% ($n = 30$), mixed ulcers 22.3% ($n = 21$), venous ulcers 13.8% ($n = 13$), and arterial ulcers 11.7% ($n = 11$). The medium (average) level of acceptance was recorded in 41.5% of the respondents ($n = 39$) and a high level of acceptance in 57.4% ($n = 54$). It was not confirmed that such variables as age, gender, and type and area of the wound determined the level of acceptance ($p > 0.05$).

Conclusions: Acceptance of MDT in the study sample was at above average levels. Longer time since wound onset determined a high level of acceptance of this form of therapy. Variables such as age, gender, pain intensity, and type and area of wound had no effect on the level of MDT acceptance.

Key words: acceptance, chronic wound, maggot debridement therapy, *Lucilia sericata*.

Introduction

Chronic wounds pose a major challenge to healthcare systems worldwide. In Europe, an estimated 1.5–2 mln people suffer from acute or chronic wounds [1]. Based on a systematic review by Martinengo *et al.*, the incidence of wounds of vascular aetiology in the general population accounts for 1.51–2.21 *per* 1000 inhabitants [2]. One of the main problems related to the healing process that experts point to is the elimination of biofilm and increasing antibiotic resistance. A meta-analysis by Malone *et al.* confirmed the presence of biofilm in 78.2% of chronic wounds [3]. Excessive and unwarranted antibiotic therapy contributes to the development of a subpopulation of persister cells; thus, allowing the biofilm population to re-establish. Increasing bacterial resistance prolongs

healing time, increasing the overall cost of patient care and society's overall financial expenditure [4, 5]. Research by Sherman *et al.* on the elimination of bacterial flora, including methicillin-resistant *Staphylococcus aureus*, by larvae placed in the wound, has created new opportunities for wound debridement and microbial elimination for researchers and clinicians worldwide [6].

According to guidelines and recommendations, elimination of devitalised, necrotic tissue is a basic procedure in the treatment as well as management of the wound [7, 8]. The debridement of a wound in which regenerative processes are found to be inhibited is not subject to clear "rigid" guidelines. The method of eliminating non-physiological tissue is multifactorial and related to the area, location, and depth of the damaged structures, the amount

of exudate, coexisting pain, and the patient's general condition and preferences [9]. Mechanical (acute) wound debridement (rubbing, scraping, plucking, excising) is the simplest, cheapest, and fastest method of biofilm elimination performed by trained medical personnel [7, 10]. Nevertheless, in most chronic wounds with coexisting biofilm, more advanced preventive measures are required, as well as consideration of intervention in the form of bio-autolytic measures, followed by consideration of implementation of controlled negative pressure in local wound therapy [11, 12]. One of the methods of effective wound debridement is maggot debridement therapy (MDT) based on medical maggots. Currently, the larvae of the common green bottle fly, *Lucilia sericata* species, which feed only on necrotic tissues while keeping living tissues intact, are used in medicine [10, 13]. The eggs of the flies are sterilised several times, and the young broods are reared according to a strict protocol under aseptic conditions on sterile media before they reach the patient [6, 14]. The mechanism of MDT is based on 3 fundamental benefits that result from the larvae activity in the wound: bacteriostatic and bactericidal action (disinfection), mechanical debridement, and facilitation of the healing process [13, 15]. Maggot debridement therapy can be used in patients treated on an outpatient or inpatient basis. It is a simple, efficient, well-tolerated, and inexpensive way to treat hard-to-heal wounds in the debridement phase recommended the Polish Wound Management Association (PTLR) [10, 16]. Negative sensations and the sense of a foreign body can predispose to reluctance in the use of MDT. Patients often feel disgusted by the presence of living creatures in the wound. Larvae are associated with poor hygiene, dirt, and rotten food. A plausible explanation of the mechanism of action of maggots in the wound and pointing out the specific advantages of the therapy helps reduce negative thinking in the patient [17]. The authors report that most patients want to actively participate in the process of their treatment. Proper patient education will increase the patient's sense of autonomy. The patient-nurse relationship is one of the main factors affecting the patient's quality of life and acceptance of this form of therapy. The patient's level of readiness and acceptance of therapy can be assessed by questionnaire methods [15, 18]. Recognition of health problems allows the planning of the actions of medical personnel, minimising negative psychosomatic effects. Emphasising health-promoting behaviours and building the patient's trust positively influence the willingness to implement innovative topical therapy. The purpose of this study was to assess the level of acceptance of MDT therapy, as well as selected variables potentially affecting acceptance of the method in a group of patients with chronic wounds.

Material and methods

The prospective study included 94 patients undergoing chronic wound management in non-residential care

(long-term care, consultations as part of an ongoing statutory study at the University of Rzeszow in 2019–2020). Selection criteria were defined (informed consent, chronic wound 3/4° according to National Pressure Injury Advisory Panel (NPIAP), presence of necrotic tissue in the wound at least 50% according to colour classification: red, yellow, black (RYB), wounds located in the lower extremities and pelvic girdle, and pain not exceeding 4 points according to numerical rating scale (NRS). Patients whose pain intensity was more than 4% according to NRS, wounds in a location other than the pelvic girdle and lower extremities, atypical wounds, and wounds of neoplastic aetiology were excluded from the study. All patients were verbally instructed about the purpose of the study, gave written consent to participate in the study, completed a questionnaire evaluation, and signed a consent form for the application of maggots for wound debridement. Education on the principles of dressing application and observation was carried out for 10–15 min, each subject had the opportunity to contact the therapist by phone. The treatment protocol was based on the guidelines by the PTLR [10]. The protocol included keeping the maggots in the wound for 3 days (72 hours). A designated person with medical training who was licensed to treat wounds conducted supervision of the patient either in person or using teleinformation systems (WhatsApp, Messenger). Loose medical maggots by Biolab, Poland of 50–100 pieces were used in the therapy process.

A diagnostic survey method and estimation were used to construct the assumptions. The research tool was the proprietary questionnaire for collecting sociodemographic data and the Barthel scale assessing fitness [19]. The second part of the questionnaire was the wound assessment, in which a person qualified in wound prevention and treatment annotated the time of wound formation, location, depth of wound damage and area assessment based on the classification; RYB, NPIAP, WAGNER. A questionnaire developed by Bazalinski [20] was used to measure the MDT acceptance score. The tool consists of 10 questions, of which 2 general questions relate to coping with functioning with a chronic wound, while the remaining 8 questions relate to the patient's feelings following chronic wound therapy with *Lucilia sericata* larvae. The subject scored answers to each question: 1 – strongly disagree, 2 – disagree, 3 – have no opinion, 4 – agree, 5 – strongly agree. The patient's acceptance level score was determined based on 3 (low, average, high) levels of acceptance. Low level (10–30 points) means that the person does not accept this form of wound debridement and should not be qualified for MDT without physical and mental preparation. Medium level (31–40 pts) is characterised by the patient's indecision to undertake MDT, the patient requires education and physical preparation. A high level (41–50 pts) is associated with full acceptance of the method, demonstrates familiarity with the method, and requires the provision of instruction on dressing application and control. The configuration of the questionnaire was designed to be applica-

ble to assessing the degree of acceptance in MDT in any wound that meets the criteria of a difficult-to-heal and/or chronic wound. The questionnaire was methodologically tested on a sample of adults. The reliability of the scale is high, with an α -Cronbach coefficient of 0.83 [20].

The study was conducted by the wound care outpatient clinic of the Subcarpathian Oncology Centre in Brzozow in 2021 as a part of the statutory research conducted at the University of Rzeszow at the Institute of Health Sciences. The study protocol was approved by the Bioethics Commission at the University of Rzeszow (Resolution no. 30/06/2017, 30 June 2017). Moreover, the guidelines of the Helsinki Declaration were adhered to during the conducted study. Participants were informed about the purpose of the study and that they could withdraw at any point without giving a reason, and they provided informed consent before starting the study.

IBM SPSS v20 program was used to statistically process the collected material. Parametric and non-parametric tests were used to prepare the analysis of variables. The conformity of the distributions to the normal distribution was verified using the Kolmogorov-Smirnov test. The standard deviation (SD), median (Me), mean (M), maximum (Max), minimum (Min), lower quartile (Q1), and upper quartile (Q3) were calculated. The results obtained were presented in percentages. The Kruskal-Wallis H test was used to analyse the significance of differences in fitness across age categories. Friedman's ANOVA analysis was used to verify the significance of differences in pain levels. After obtaining a statistically significant difference, an additional *post hoc* test was used. The Wilcoxon rank-sum sign test was used to assess significance. All analyses were performed assuming $p < 0.05$.

Characteristics of the respondents

The records of 94 subjects, including 58.5% ($n = 55$) men and 41.5% ($n = 39$) women, were submitted for statistical analysis. The youngest subject was 34 years old,

Table 1. Basic information about the study group ($N = 94$)

Parameters	<i>n</i>	Percentage
Gender		
Woman	39	41.5
Man	55	58.5
Age		
34–64 years	24	25.5
65–69 years	15	16.0
70–79 years	28	29.8
80–86 years	27	28.7
Residence		
City	33	35.1
Village	61	64.9

the oldest 86. The average age was 70.09 ± 13.12 years. The subjects mainly resided in rural areas 64.0% ($n = 61$), while 35.1% ($n = 33$) were urban dwellers (Tab. 1). The level of self-care among the subjects varied, with the greatest dysfunction presented by the elderly and those with pressure injuries. Full capacity was confirmed in 13.8% ($n = 13$), 67.0% ($n = 63$) showed limitations in self-care, and 19.1% ($n = 18$) were inefficient in self-care.

Results

Selected data on skin damage in the study sample

The time of wound formation varied, ranging 1.5–38 months. The wound area ranged 24–225 cm². The clinical evaluation recorded chronic wounds such as pressure injuries 31.9% ($n = 30$), mixed ulcers 22.3% ($n = 21$), venous ulcers 13.8% ($n = 13$), arterial ulcers 11.7% ($n = 11$), and other types of wound (infected surgical wounds, trauma) 20.2% ($n = 19$) (Tab. 2).

Based on RYB, the following were confirmed; yellow wounds 63.8% ($n = 60$), red-yellow wounds 25.5% ($n = 24$), and black wounds 8.5% ($n = 8$). Each of the qualified

Table 2. Selected data on wounds in the study sample of patients ($N = 94$)

Parameters	<i>n</i>	Percentage
Wound type		
Decubitus ulcer	30	31.9
Mixed ulceration	21	22.3
Arterial ulceration	11	11.7
Venous ulceration	14	14.9
Diabetic foot ulcer	18	19.1
Time since the onset		
1.5 months	14	14.9
2–2.5 months	19	20.2
3 months	16	17.0
4–6 months	24	25.5
Over 6 months	21	22.3
Location		
Foot	18	19.1
Sacral region	11	11.7
Trochanter	6	6.4
Ischial tuberosity	25	26.6
Lower leg	24	36.2
Wound area		
Up to 24 cm ²	22	23.4
24–35 cm ²	24	25.5
36–50 cm ²	26	27.7
51–225 cm ²	22	23.4

Table 3. Maggot debridement therapy acceptance scale – descriptive statistics

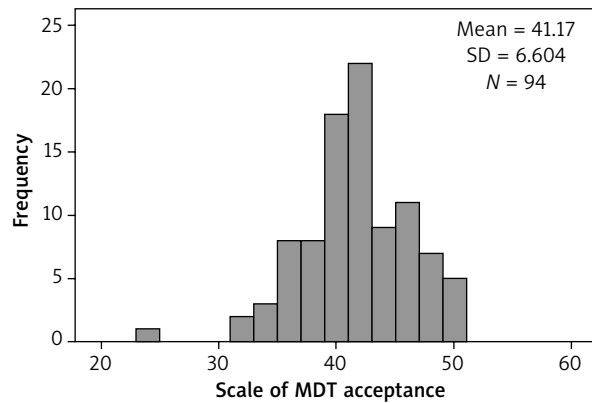
Scale 10–50	Average	SD	Median	Min.	Maks.	Q1	Q3	N
MDT acceptance questionnaire	41.2	4.6	41	24	50	39	44	94

MDT – maggot debridement therapy

Acceptance of larval therapy in the study sample

The maggot debridement therapy Acceptance Questionnaire was used to assess acceptance of larval therapy. The scale takes values of 10–50 points. The mean value in the study sample was 41.2 points (41.2 ±4.6) (Tab. 3). The distribution of the MDT questionnaire measures can be considered normal based on the Kolmogorov-Smirnov test: $D(94) = 0.088, p > 0.05$.

On the basis of statistical analysis, the method used was evaluated by high, average, or low level of acceptance of MDT therapy. A medium (average) level of acceptance was noted in 41.5% of the subjects ($n = 39$), a high level of acceptance was noted in 57.4% ($n = 54$), and 1.1% ($n = 1$) had a low level of acceptance of the therapy. The data are shown in a histogram (Fig. 1).



MDT – maggot debridement therapy, SD – standard deviation

Fig. 1. Histogram of maggot debridement therapy acceptance distribution in the study sample

Table 4. Acceptance of maggot debridement therapy vs. gender

MDT acceptance	Gender					
	Woman		Man		Total	
	n	Percentage	n	Percentage	N	Percentage
Low acceptance	1	2.6	0	0.0	1	1.1
Average acceptance	15	38.5	24	43.6	39	41.5
High acceptance	23	59.0	31	56.4	54	57.4
Total	39	100.0	55	100.0	94	100.0

MDT – maggot debridement therapy

Table 5. Acceptance of maggot debridement therapy vs. age

MDT acceptance	Age									
	Up to 64 years		65–69 years		70–79 years		80+ years		Total	
	n	Percentage	n	Percentage	n	Percentage	n	Percentage	N	Percentage
Low acceptance	0	0.0	0	0.0	1	3.6	0	0.0	1	1.1
Average acceptance	10	41.7	5	33.3	9	32.1	15	55.6	39	41.5
High acceptance	14	58.3	10	66.7	18	64.3	12	44.4	54	57.4
Total	24	100.0	15	100.0	28	100.0	27	100.0	94	100.0

MDT – maggot debridement therapy

wounds covered full skin thickness (3° NPIAP) or penetrating to bone structures 4° NPIAP. Most of the qualified wounds were full-thickness skin lesions 61.7% ($n = 58$). Of all the subjects, 19.1% ($n = 18$) with foot wounds were graded according to the WAGNER scale (2–4°).

Selected variables determining acceptance of maggot debridement therapy in the study sample

Gender

The variables of gender and level of acceptance were tabulated. The relationship was checked using the χ^2 test.

For this purpose, one case of low acceptance of therapy was eliminated from the analysis. The test confirmed that there was no relationship; $\chi^2 (1) = 0.160, p = 0.689$ (Tab. 4). It was confirmed that women and men show a similar level of acceptance of the therapy, and the hypothesis that gender determines the level of acceptance was rejected ($p > 0.05$).

It was assumed that the elderly have a low level of acceptance regarding the debridement of wounds by biological methods. The relationship was also checked using the χ^2 test. For this purpose, one case of low acceptance of therapy was eliminated from the analysis. The test confirmed the lack of correlation; $\chi^2 (3) = 3.334, p = 0.343$ (Tab. 5). The hypothesis that age determines the level of acceptance was rejected ($p > 0.05$).

Type of wound

There was no confirmed relationship between variables like wound type and acceptance of MDT ($\chi^2 (4) = 3.211, p = 0.523$) (Tab. 6).

Wound area

In the analysis of the wound area and acceptance level, no statistical relationship was confirmed. The relationship was checked using the χ^2 test ($\chi^2 (3) = 3.188, p = 0.364$) (Tab. 7). For this purpose, one case of low acceptance of therapy was eliminated from the analysis. The test confirmed the lack of correlation. The hypothesis that wound area determines the level of acceptance of therapy was rejected ($p > 0.05$).

Pain intensity

It was assumed that pain intensity (qualifying pain up to 4 points according to NRS) could determine the level of acceptance. The distribution of pain scores on the day of therapy is shown in Table 8. Five cases with missing data on pain intensity were excluded from the table. The variable does not have a normal distribution, as confirmed by the Kolmogorov-Smirnov test ($D(98) = 0.231, p < 0.001$).

Table 6. Acceptance of maggot debridement therapy vs. wound type

MDT therapy acceptance scale	Wound type									
	Decubitus ulcer		Mixed ulceration		Arterial ulceration		Venous ulceration		Different	
	n	Percentage	n	Percentage	n	Percentage	n	Percentage	n	Percentage
Low acceptance	0	0.0	0	0.0	0	0.0	1	7.7	0	0.0
Average acceptance	16	53.3	7	33.3	3	27.3	5	38.5	8	42.1
High acceptance	14	46.7	14	66.7	8	72.7	7	53.8	11	57.9
Total	30	100.0	21	100.0	11	100.0	13	100.0	19	100.0

MDT – maggot debridement therapy

Table 7. Acceptance of maggot debridement therapy vs. wound area

MDT therapy acceptance scale	Wound area							
	21–27 cm ²		28–35 cm ²		36–50 cm ²		51–225 cm ²	
	n	Percentage	n	Percentage	n	Percentage	n	Percentage
Low acceptance	0	0.0	0	0.0	0	0.0	1	4.5
Average acceptance	8	34.8	9	40.9	15	55.6	7	31.8
High acceptance	15	65.2	13	59.1	12	44.4	14	63.6
Total	23	100.0	22	100.0	27	100.0	22	100.0

MDT – maggot debridement therapy

Table 8. Maggot debridement therapy acceptance scale vs. pain on the day of therapy

MDT acceptance scale	Pain level on the day of treatment							
	1		2		3		4	
	n	Percentage	n	Percentage	n	Percentage	n	Percentage
Low acceptance	0	0.0	0	0.0	1	5.6	0	0.0
Average acceptance	10	40.0	12	37.5	11	61.1	5	35.7
High acceptance	15	60.0	20	62.5	6	33.3	9	64.3
Total	25	100.0	32	100.0	18	100.0	14	100.0

MDT – maggot debridement therapy

The relationship was checked using the χ^2 test. For this purpose, one case of low acceptance of therapy was eliminated from the analysis. The test confirmed the lack of correlation; $\chi^2(3) = 4.052, p = 0.256$. Thus, the hypothesis of intensity as a factor affecting the level of acceptance of larval therapy was rejected ($p > 0.05$).

Time from wound onset

To test the relationship between the level of acceptance of MDT and the time of wound formation, the χ^2 test was used. One case with a low level of acceptance and 3 cases with no information on the time of wound formation were eliminated from the analysis. The result of $\chi^2(4) = 12.431, p < 0.05$, shows that there are grounds to conclude that there is a significant relationship between the variables. With increasing time from wound onset, the proportion of respondents declaring a high level of acceptance of this form of therapy increases significantly. A downward trend can be seen in those declaring a medium level of acceptance of MDT therapy. The category of respondents with a wound created 4–6 months before therapy stands out significantly. The correlation coefficient between variables, Kendall's tau-c, amounts to 0.265, $p < 0.05$. The results are shown in Figure 2.

Discussion

This prospective study included 94 patients undergoing chronic wound care in ambulatory care. Most of the study group were male, i.e. 58.5% (female, 41.5%). The youngest person was 34 years old, while the oldest was 86 years old. The average age was 70.09 ± 13.12 years. Eligible patients had a pain level of no more than 4 points according to NRS. Among the subjects, the time of wound formation ranged from 1.5 to 38 months. The wound area varied between 24 and 225 cm². The largest number of wounds with an aetiology of decubitus ulcers was recorded in 31.9% of the subjects. Based on the RYB, it was shown that more than half were yellow wounds: 63.8% ($n = 60$). Most of the eligible wounds were full-thickness skin lesions – 3° NPIAP 61.7% ($n = 58$). Respondents with foot wounds (diabetic foot disease wounds) were rated according to the WAGNER scale (2–4°) (19.1%, $n = 18$). The average acceptance of larval therapy in the study sample was 41.2 points (41.2 ± 4.6). An average level of acceptance was recorded in 39 patients, while a high level of acceptance was declared by 54 patients, and only one patient had a low level of acceptance of the therapy. In the statistical analysis, the hypothesis of variables such as age, gender, and type and area of wound to determine the level of acceptance was rejected. However, it was noted that respondents who declared a long time of wound treatment clearly presented a higher level of acceptance compared to the rest of the group. The above observa-

tions indicate that people who deal with a wound that interferes with quality of life in certain areas over a long period of time are more open to non-conventional methods of local treatment. At the Subcarpathian Cancer Centre's wound care clinic, larval therapy is a recommended and standard method of wound debridement for devitalised necrotic tissue, wounds infected with *Pseudomonas aeruginosa*, or *Staphylococcus aureus*, as well as to stimulate wound repair processes during healing. Each patient qualified for TLR is evaluated using the MDT questionnaire, signs a written consent form, and is mentally and physically prepared in terms of pain reduction. For more than 3 years of operation of the facility, it has been noted that each year the number of patients declaring themselves for local larval therapy increases. These observations are associated with satisfactory therapeutic effects. Unfortunately, certain factors interfere with the effectiveness of this form of therapy – somatic sensations and fear of maggots can reduce interest in the method [21]. In 2023 [16], the PTLR expert team prepared guidelines for the use of TLR in Poland; despite the practical indications, every effort should be made to strengthen the education and preparation of the patient for this form of therapy in the psychological as well as somatic aspects. Our observations clearly indicate that the intensity of pain increases during larval therapy, and similar observations are presented by other authors dealing with this issue [22–24].

Spilsbury *et al.* noted some correlation of acceptance of larval therapy relative to gender and age. Those who mainly would not consider TLR/MDT were older women. They related their concerns mainly to visual imagery [25]. In our study, we did not confirm such a relationship; however, opinions regarding disgust associated with the sight of creeping maggots are common among patients, regardless of gender and age. The use of maggot therapy in the process of chronic wound debridement is slowly becoming a standard method of management in outpatient

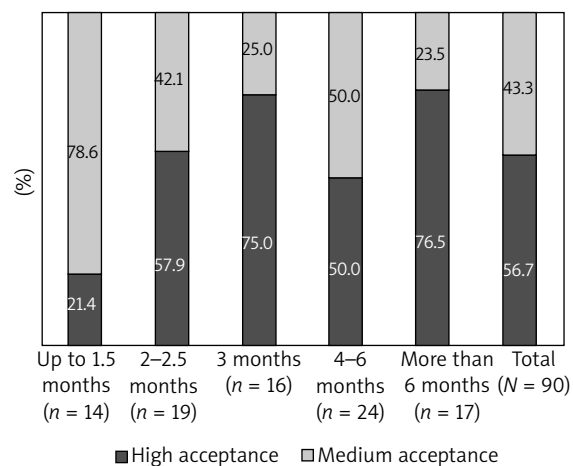


Fig. 2. Level of acceptance of maggot debridement therapy vs. time of wound formation

and inpatient home settings, and it is recommended that further studies and observations be conducted and protocols be established related to the potential complications of the method to strengthen the scientific basis in terms of practical implications and to reduce patients' fear of this form of therapy.

Conclusions

Acceptance of larval therapy in the study sample was at above average levels. Longer time from wound onset determines the high level of acceptance of this form of therapy. Variables such as age, gender, pain intensity, and type and area of wound have no effect on the level of acceptance of MDT. This was a single-centre study with a small sample of patients, so it is advisable to expand the study.

Disclosure

1. Institutional review board statement: Not applicable.
2. Assistance with the article: None.
3. Financial support and sponsorship: None.
4. Conflicts of interest: None.

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