

Maggot Therapy for Treating Pressure Ulcers in Spinal Cord Injury Patients

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ABSTRACT

For centuries, maggot therapy (MT) has been recognized as an aid to wound healing. By including live blowfly larvae in wound dressings, earlier physicians noted thorough debridement which hastened wound healing. We initiated a prospective controlled study to evaluate the utility of maggot therapy for treating pressure ulcers in spinal cord injury patients in the modern era. Eight of our patients received MT after a baseline assessment of healing under conventional therapy (defined as any therapy prescribed by the patient's primary care team). Surface area, tissue quality and healing rates were monitored weekly. MT debrided most of the necrotic wounds within one week, which was more rapid than all other non-surgical methods. Wound healing was more rapid during MT than during antecedent conventional therapy ($p=0.01$). No complications were seen. We have demonstrated that MT can be beneficial in the treatment of pressure ulcers in persons with spinal cord injuries. MT was significantly more effective and efficient than the current, conventional treatment alternatives being used. MT was also safe, simple and inexpensive. MT can be a valuable modality in the treatment of pressure ulcers. (*J Spinal Cord Med*;18:71-74)

Key words: pressure ulcer, wound healing, spinal cord injury, maggot therapy.

INTRODUCTION

Pressure ulcers are a major source of morbidity among spinal cord injured (SCI) persons. As many as 20-90 percent of hospitalized SCI patients may have or develop pressure ulcers.^{1,2} The average cost of treating a single pressure ulcer can range from \$30,000 - \$70,000; one to six months of additional hospital stay is often required.³⁻⁶ Infectious complications of pressure ulcers, such as cellulitis, osteomyelitis, sepsis and endocarditis account for more than 60,000 deaths annually.³

Over the past two years, we have investigated a long utilized adjunct to wound healing — maggot therapy.⁷ For centuries, maggot therapy (MT) has been recognized as an aid to wound healing.^{8,9} In fact, just sixty years ago MT was routinely used in over 300 hospitals around the country for treating bone and soft-tissue infections.¹⁰ MT is highly effective because

the maggots liquify necrotic tissue but not healthy tissue,¹¹ they disinfect the wound and they stimulate tissue growth.¹² During the 1970's and 1980's, MT was used as salvage therapy for skin and soft tissue wounds which did not respond to surgical and antimicrobial therapy. Case reports described the successful use of MT for treating temporal mastoiditis,¹³ necrotizing facial tumors,¹⁴ Fournier's gangrene¹⁵ and a serious leg wound in a paraplegic woman.¹⁶

In this report, we describe the preliminary results of our prospective controlled study of pressure ulcers in SCI patients treated with MT.

METHODS

Maggot Preparation. Fly larvae of the species *Phaenicia sericata* were sterilized by washing the eggs for eight minutes in 0.05 percent sodium hypochlorite and placing them in a sterile container to hatch. Within 24 - 48 hours after hatching, they were ready to place on wounds. The young, 2 mm long maggots were covered with porous sterile dressings, and left in place for 48-72 hour "cycles." One or two cycles were applied each week.

Patient Selection and Treatment. This project was approved by the Research and Development Committee, and the Human Studies Protection committee. All pressure ulcers existed for at least one month before patients were enrolled in this study. Patients with underlying osteomyelitis or acute cellulitis were excluded from the study.

Of the 20 patients treated with MT, eight were first followed for three-four weeks while still receiving the wound treatments prescribed by their primary

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care teams. The specific treatments within the conventional therapy group were chosen by the patients' primary care providers in order to eliminate any potential investigator bias. Patients were then treated with a course of maggot therapy. In between cycles of MT, they received either sodium hypochlorite (if their wounds were still necrotic) or normal saline (if their wounds were relatively clean) wet-to-dry gauze dressings every eight hours.

Wound Evaluations. Neither the patients nor the investigators could be blinded with respect to the treatments being administered. The individuals performing the wound assessments, however, were unaware of the associated treatment modality.

Ulcers were evaluated visually and photographically every week. Ulcer length, width, circumference and surface area were calculated precisely from each digitized photographic image, using the Image Analyst software package (Automatrix, Inc.). Rate of wound healing was calculated as the percent change in surface area per week. Wound quality (i.e., necrosis, drainage, purulence) was also recorded. Demographic and general medical information was collected on all patients, including age, sex, percent ideal body weight, smoking history, level of spinal cord injury, other underlying medical illnesses, creatinine clearance, hemoglobin and serum albumin.

RESULTS

It was possible to follow only eight of 20 wounds for as long as three or four weeks prior to initiating MT. During this baseline evaluation period, patients continued to receive the conventional treatment prescribed by their primary team of internists, surgeons, and nursing personnel. These patients were predominantly paraplegic men, 44-68 years old, of relatively good nutritional status (Table 1). Their ulcers, which were either stage three or four, ranged in size from 5-30 sq cm and occurred primarily on the pelvis or foot. All of the ulcers had existed at least four weeks prior to evaluation.

Conventional treatment modalities included thrice daily sterile normal saline, 0.5 percent sodium hypochlorite (1/4 Dakin's solution), or povidone iodine dressings, combined with surgical debridement as needed (Table 2). One patient was prescribed a topical antimicrobial ointment (Bacitracin, Fougera, Inc). One wound was dressed daily with Adaptic (Johnson & Johnson).

Of the ulcers with a 20 percent or larger necrotic base, none were more than half debrided by the time MT was initiated. All such ulcers were completely debrided within one-two weeks (average 1.4 weeks) afterwards, however.

The average change in surface area prior to the initiation of MT was an increase of 21.8 percent per week (Figure 1). The average change in surface area during MT was a decrease in size by 22 percent per week ($p < 0.001$). MT reversed the progression of each worsening ulcer, and increased the average rate of healing for those wounds which were slowly improving.

No complications resulted from our MT treatments. Neither infection nor discomfort was reported by our SCI patients. Occasionally, larvae escaped from the dressings, producing some anxiety among the nursing staff. This reaction was usually short-lived, however, and was always unwarranted.

Characteristics	# Range
Age	58 (44-68)
Sex	
Males	8
Females	0
Level of Spinal Injury	
Quadriplegic	1
Paraplegic	7
Laboratory Values	
% IBW [†]	118% (86-145)
CrCL* [*]	104 (75-171)
HGb	13.0 (9.6-15.3)
Albumin	3.54 (3.0-4.1)
Cigarette smokers	3/8 (37.5%)

[†]Ideal Body Weight

*Creatinine clearance, calculated as:
(140-Age) X Weight (in Kg) / 72 X Creatinine

Table 1. Patient characteristics. Total=8.

DISCUSSION

MT debrided most necrotic pressure ulcers within one week, which was more rapid than all other non-surgical methods. Wound healing was more rapid in patients treated with MT than in patients receiving only conventional dressings. Ulcer surface areas before MT increased by an average of 22 percent per week; ulcer surface areas during MT decreased by an average of 22 percent per week ($p < 0.001$). Thus, MT would appear to be a useful adjunct in the treatment

Characteristics	# (Range)
Ulcer Location:	
Sacrum	2
Lateral Foot	2
Ischium	1
Trochanter	1
Heel	1
Other	1
Ulcer Stage:	
II	2
III	3
IV	3
Initial Surface Area	13.0 sq.cm (4.8-29.96)
Necrotic tissue (% of initial surface area):	
0 - 25%	5
26 - 50%	0
51 - 100%	3
Initial Therapy (non-surgical, pre-MT):*	
NS Dressings	2
Dakin's Dressings	2
Povidone iodine	2
Other	2

* NS = Sterile normal saline dressings, changed every 8 hours
 Dakin's = 0.0125% sodium hypochlorite dressings, every 8 hours
 Other = Adaptic (Johnson & Johnson), Bacitracin (Fougera)

Table 2. Wound characteristics. Total=8.

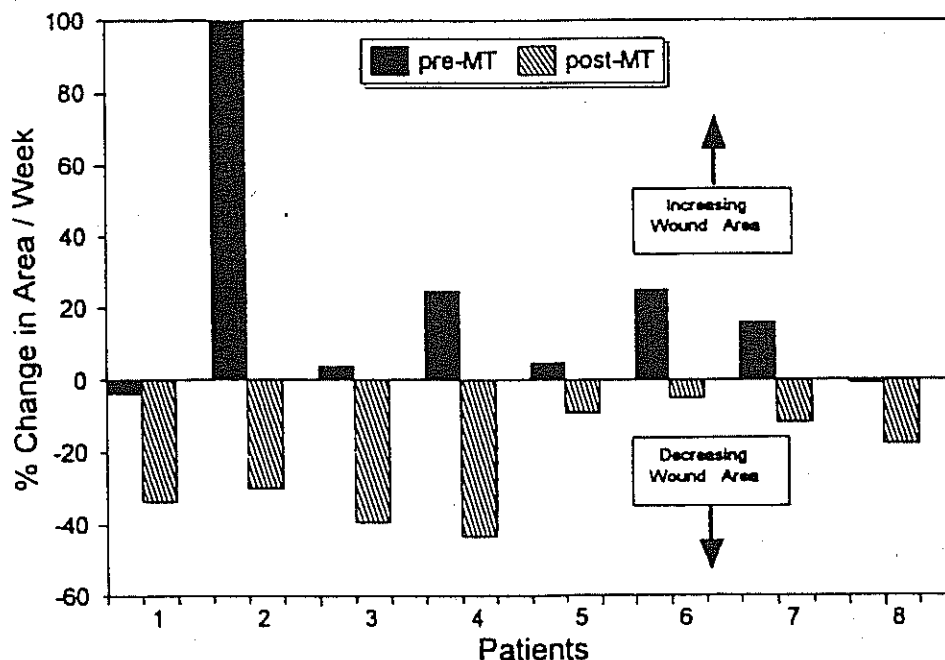


Fig 1. Pre- and post-maggot therapy (MT) healing rates for each of the eight wounds. Wound healing is measured as the percent change in surface area per week. Positive numbers represent increasing wound areas; negative numbers indicate decreasing surface areas.

of pressure ulcers, at least in male veteran SCI patients. No complications of MT were seen during our study.

In only one case report¹⁶ has MT ever been described for pressure ulcer therapy. Our report is the first published series of MT used for pressure ulcer treatment, and the first prospective controlled trial comparing MT to modern wound therapy. Earlier studies described the successes of MT for treating osteomyelitis as compared to historical outcomes of conventional therapy at that time.^{7,8} As was typical of medical research in that era, the studies were not controlled. During the 1970's and 1980's, several case reports described the successes of MT.¹³⁻¹⁶ Yet, by themselves they cannot be considered anything more than anecdotal evidence of the value of MT for treating wounds recalcitrant to conventional modalities.

The design of this study was unique in the history of maggot therapy, but the results were not. Earlier accounts of maggot therapy have described the debriding, disinfecting and wound healing actions of maggots.^{11-14,17,18} In order to guarantee a ready supply of maggots, we raised our own. *P. sericata* was chosen because of its abundance in our area; we began our colony with local wild flies. Other species have been used successfully in the past, too.^{12,15} Other recent

practitioners have obtained their maggots on a case by case basis from universities, from research institutes or from the wild.

Although the number of patients in our study is small, its design (prospective interventional study) gains power by eliminating the potential confounding variables that would otherwise result from subject variability. The fact that such a significant improvement over conventional therapy in ulcer healing was seen with MT in our small study demonstrates the value of this modality as a treatment for pressure ulcers in these patients.

Based on the demonstrated utility of MT for the

treatment of pressure ulcers in SCI patients, we believe MT to be a valuable therapeutic option for the treatment of pressure ulcers, and perhaps other non-healing skin and soft-tissue wounds as well. While research continues, the clinical use of MT has found its way back as an accepted therapeutic modality at our institution.

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