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Maggot Debridement Therapy: Harnessing A Physiological Phenomenon

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Abstract: *Revitalization of the idiosyncratic technique known as Maggot Debridement Therapy (MDT) in recent decades has resulted in perfervid contention over its efficacy in comparison to conventional modalities. Various case reports and studies have demonstrated the surpassing success of MDT in treating a range of chronic wounds. Nonetheless, a paucity of investigative evidence is witnessed when addressing the explicit factors contributing to the effectiveness of MDT. Subsequently, this paper seeks to illustrate the efficacy of MDT in comparison to modern therapeutic procedures by evaluating the following components—promotion of substantial growth of granulation tissue and reduction of wound surface area. In this paper, three neoteric studies, incorporating an aggregate number of 225 participants and 252 wounds, were examined to reach the conclusion that MDT contains the preceding capacity of stimulating growth of granulation tissue and reducing wound surface area across a condensed period when contrasted with conventional techniques, thus reinforcing its efficacy, potency, and simplicity within the periphery of modern therapeutics.*

Keywords: *Maggot debridement therapy, conventional techniques, granulation tissue, wound surface area, hydrogel.*

Subject: *Therapeutics / Medical Science*

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I. Introduction

Entrenched in antiquity and enduring across millennia, Maggot Debridement Therapy (MDT) is historically associated with the Ngemba Aboriginal nation of Australia as well as the Mayan healers of Mesoamerica, and has since gained prominence in contemporary medicine, revealing a plethora of conspicuous benefits that can be derived from this phenomenon. During the process of debridement, sterilized, medical-grade fly larvae, mostly obtained from greenbottle blowflies (*Lucilia sericata*) of the Calliphoridae family, are deliberately applied to sloughy, infected, or necrotic wounds, contributing to the removal of fluids, discharge, and putrescent tissue (Choudhary et al., 2016). However, as with all medical modalities, there are certain complexities involved in MDT, such as irritation located at the application site, which may potentially necessitate oral analgesics. Consequently, MDT has been exposed to public scrutiny and opprobrium when viewed contemporaneously with techniques that have emerged in recent years, including the implementation of hydrogel dressings in chronic wound management.

In response to this, a miscellaneous collection of case series has materialized to evaluate the efficacy of MDT in comparison to conventional techniques, accompanied by research into the cellular mechanisms and physiological factors involved in MDT. Most of these studies describe the successful implementation of MDT in treating a range of ulcers. Dumville et al. (2009) and Mudge et al. (2014) reported reduced debridement time for wounds treated with MDT when contrasted with hydrogel therapy. Likewise, a randomized multicenter trial led by Opletalová et al. (2012) demonstrated significantly faster debridement associated with MDT, although this was restricted to the first week of application. Of the few that do not fall under this category, "no significant difference" is generally reported. Several systematic reviews have also sought to outline the effectiveness of MDT in comparison to conventional techniques, preponderantly favoring the former; of these, the necessity for more suitably designed investigations is often stated as a prerequisite. Zubir et al. (2020) concluded that "a small number of studies have yielded favorable debriding outcomes" linked to MDT, although "there is a limited number of level II studies ["excellent"] that have shown positive results in the use of [MDT] for debriding devitalized tissue compared to standard care, with results differing across wounds of different etiology". Hence, a shortfall corresponds with the number of comparative clinical trials that have been used to examine MDT, which tend to be more generalized, regulated, and impartial.

When considering the factors contributing to the efficacy of MDT, such as bacterial disinfection, growth of granulation tissue, and complete healing, a paucity of investigative evidence is observed. As such, an explicit

emphasis on these elements reverberates throughout this paper, which seeks to demonstrate that in comparison to conventional forms of treatment, MDT is shown to be effective in promoting substantial growth of granulation tissue and reduction of wound surface area across a shortened period, thus illuminating its efficacy, potency, and simplicity within the periphery of modern therapeutics.

II. Materials & Methods

The examination of three methodical studies conducted in recent decades, which correspond to an aggregate number of 225 participants and 252 wounds, is included in this study to explore the efficacy of MDT regarding two specific factors: stimulation of granulation tissue and reduction of wound surface area. Studies were selected according to their measurement of the aforementioned parameters, and if MDT was compared to conventional debridement techniques, such as hydrogel, hydrocolloid dressings, and local antibacterial agents. The sources can be classified into:
(i) a retrospective cohort study,
(ii) a clinical trial, and
(iii) a case review.

All studies had to allude to debridement and/or healing as an outcome variable. To ensure the analogousness of the evaluated data, studies utilizing maggot species divergent from *L. sericata* were excluded. Secondary sources, predominantly encompassing systematic reviews addressing the topic of MDT, were scrutinized alongside the data collection process, consequently contributing to a comprehensive final analysis on the topic.

III. Results & Discussion

Stimulation of Granulation Tissue

Following the remarkable epoch in medicine referred to as the 20th-century, R. P. Hobson began a pioneering investigation that demonstrated the proteolytic activity of *L. sericata* larval digestive enzymes, which play a paramount role in the stimulation of granulation tissue during the healing process (Sherman, 2014). Tryptase, peptidase, and lipase enzymes secreted by the necrophages interact with the surrounding extracellular matrix to influence fibroblast proliferation, migration, and tissue remodeling (Jukema et al., 2002; Horobin et al., 2005). Additionally, the physical movement of the maggot over a wound as it simultaneously spreads alimentary secretions has been shown to act as "a mechanical stimulus for growth of granulation tissue" (Jukema et al., 2002, para. 6).

Case Study on Diabetic Ulcers

To evaluate the efficacy of MDT regarding pressure ulcers, R. A. Sherman conducted a retrospective cohort study consisting of 67 participants with an accumulated total of 92 injuries: 49 wounds were treated solely with conventional therapy, and 43 wounds were treated with MDT (Gieroń et al., 2018). Conventional therapy encompassed local antimicrobial agents, hydrogel, hydrocolloid dressings, alginates, wet-to-dry dressings, chemical debriding agents, surgical debridement, or an amalgamation of these techniques (Sherman, 2002). Administration of MDT included the application of aseptic *L. sericata* to the wound for cycles extending to approximately 48 hours, with the repetition of two cycles per week. Measurement of parameters such as change in wound area, presence of necrotic tissue, amount of granulation tissue, and debridement rate was facilitated once every week.

Within a median duration of 4.8 weeks, wounds treated with MDT showed evidence of 80% debridement, as opposed to 48% in the control group across an extended time frame of 5.5 weeks (Gieroń et al., 2018). At the termination of 3 weeks, larval-treated wounds contained one-third the necrotic tissue and twice the granulation detected in wounds subject to conventional therapy. On average, the percentage of granular tissue area increased by 13% per week in the experimental group compared with 3.3% in the control group, representing statistically significant differences that indicate the notable role of MDT in hastening growth of granulation tissue.

Hence, it must be acknowledged that research reveals the association of MDT with more rapid substantial growth of granulation tissue when contrasted with conventional procedures—an indispensable merit contributing to accelerated healing rates within the complex physiological process of wound repair.

Reduction of Wound Surface Area

At present, there exists an evident correlation between tissue regeneration and percentage reduction of wound surface area, prompting the latter to be identified as one of the most effectual methods of predicting salubrious outcomes pertaining to therapeutics.

Clinical Study on Diabetic Foot Ulcers

At the culmination of the 20th-century, Markevich et al. (2002) published a randomized comparative clinical trial consisting of 140 patients suffering from diabetic foot ulcers, bisected into dichotomous groups: 70 patients received MDT, and 70 patients were treated with hydrogel dressing. Results demonstrated that wound surface area reduction greater than 50% was achieved in 51% (36/70) of patients in the experimental group subjected to MDT, in comparison to the 27% (19/70) observed in the control group, which involved the implementation of hydrogel dressings, hence constituting a statistically significant difference (Zarchi & Jemec, 2012).

Case Review on Diabetic Foot and Leg Ulcers

Between the years 1990-1995, R. A. Sherman conducted a study with the objective of assessing the efficacy of MDT on diabetic foot and leg ulcers (Zarchi & Jemec, 2012). 18 patients with a total of 20 wounds were selected: 6 wounds were treated solely with conventional therapy, 6 wounds received MDT, and 8 wounds were treated initially with conventional therapy followed by MDT. Conventional therapy consisted of hydrogels, hydrocolloid dressings, local antibacterial agents, wet-to-dry dressings, surgical debridement, or a combination of these discrete methods (Gieroń et al., 2018). MDT was administered via application of disinfected L. sericata to the wound for a 48-hour cycle, with the repetition of 1-2 cycles per week. During the first 14 days of treatment, a 4.1 cm2 average reduction of necrosis was recorded in the MDT group, as opposed to negligible results in the control group. By the ninth day, a 50% reduction in necrotic surface area could be observed in the experimental group, whereas wounds subject to conventional treatment were unable to arrive at this stage by 29 days. Within 5 weeks, complete debridement was perceived in the MDT group, in contrast with less than 67% debridement in the control group.

As can be seen, two studies aimed at examining diabetic ulcers, conducted by Markevich et al. and Sherman respectively, concluded that MDT contributes to the swifter reduction of wound surface area in comparison to conventional debridement techniques, denoting the former's precedence within the ambit of convalescent recovery and recuperation.

IV. Conclusion

Ultimately, the evaluation of methodical studies conducted in recent decades, which incorporate an aggregate number of 225 participants and 252 wounds, has illuminated the surpassing capacity of MDT in stimulating substantial growth of granulation tissue and rapidly reducing wound surface area in comparison to conventional methods of treatment, thus presenting a crystallized, efficacious remedy for individuals afflicted with chronic maladies. When considered in conjunction with the advantages of cost effectiveness, accelerated healing, and perspicuity of procedure, it becomes incontrovertible that MDT—an antecedent of conventional therapeutic techniques—will continue to serve as a startling successor and remarkable requisite of contemporary medicine.

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