Beneficial Effects of Some Myiasis – Inducing Maggots in Wound Therapy

A Thesis

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INTRODUCTION

Maggot therapy is a simple and highly successful method for cleansing infected and necrotic wounds **(Sherman *et al.*, 2000).** The beneficial effects of maggots on human wounds have been noted in literature for hundreds of years **(Greenberg, 1973).**

Maggots were used extensively in hospitals during the 1930, s as a treatment for serious skin and soft tissue infections **(Sherman & Vulpe, 1795)**.

In traditional medical practice, the larvae of some Diptera; Calliphoridae; notably *Lucilia* species have been employed for maggot therapy, i.e., to help clean lesions antiseptically, especially for treatment of chronic osteomyelitis **(Sherman & Pechter, 1988)**.

The mechanisms by which maggots aid in wound-healing or therapy are not fully understood. **Livingston & Price (1932)** showed that filtered extracts of larvae when brought into contact with pyogenic organism in petri dishes, destroyed the cultures. However, others have suggested that in some fly species, the anti-microbial activity may not be due to secretions produced by the larvae themselves, but from metabolites

produced by the bacteria such as *proteus* species that are commensal bacteria of the insect gut **(Erdmann *et al*., 1984)**. More recent work **(Hoffman, 1995)** has shown that, following injury, some insects produce a battery of potent anti–microbial peptides/polypeptides which are secreted into the haemolymph where they act synergistically to kill invading micro-organisms.

Aim of the Study

The present study aimed to evaluate the antibacterial activity of the secretion/excretion (S./E.) from three fly maggot species namely; *Musca domestica* (linneaus) , *Chrysomya albiceps* (wiedemann) and *Lucilia sericata* (Meigen) in vitro, and consider whether this activity might be responsible for wound – healing following the use of maggots in the treatment of infected wounds . Also, the study aimed to identify the proteins which are responsible for the antibacterial activity.

REVIEW OF LITERATURE

1. Role of myiasis-causing flies in wound therapy:

Sherman and Pechter, (1988) studied therapeutic application of fly larvae in human medicin, especially for treating osteomyelitis,and recorded that larvae of some diptera; *calliphoridae, notably lucilia illustris* (Meigen), *L.sericata* (Meigen) and *phormia regina* (Meigen), have been employed for maggot therapy, i.e. to help clean lesions antiseptically, especially for treatment of chronic osteomyelitis. This mode of treatment remains appropriate for cases where antibiotics are ineffective and surgery impracticable.

Sherman and *tran* (1995) developed a simple, sterile food source for rearing the larvae of *Lucilia sericata* (Diptera: *Calliphoridae*), they found that Larvae of the sheep blowfly *Lucilia sericata* (Meigen) were reared on various mixtures of pureed liver, agar, brewer's yeast and trypsin, in order to develop a simple, sterile, tissue-based diet. Growth and survival rates of larvae reared on a sterile 1:1 mixture of pureed liver with 3% bacto agar equalled or exceeded those of larvae reared on raw liver. The addition of yeast and/or trypsin to the medium was of no additional benefit. This sterile, homogenous, tissue-

based substrate offers a simple, convenient, inexpensive growth medium for rearing larvae for maggot therapy, and for testing the effects of various chemicals and dietary constituents on necrophagous insect larvae. It may be useful, therefore, in studies of myiasis, forensic entomology, and toxicology. This rearing medium also has the advantage that it can be stored for many months at room temperature without progressive decomposition or offensive odour.

Maggot therapy for treating pressure ulcers in spinal cord injury patients was studied by **Sherman *et al.*, (1995);** they found that 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.

Mumcuoglu *et al*., (1999) used maggot therapy for the treatment of intractable wounds, and they found that fly maggots have been known for centuries to help debride and heal wounds.

Medicinal maggots: An ancient remedy for some contemporary afflictions was studied by **Sherman *et al*., (2000);** He found that certain fly larvae can infest corpses or the wounds of live hosts. Those which are least invasive on live hosts have been used therapeutically, to remove dead tissue from wounds, and promte healing. This medicinal use of maggots is increasing around the world, due to its efficacy, safety and simplicity. Given our low cultural esteem for maggots, the increasing use and popularity of maggot therapy is evidence of its utility. Maggot therapy has successfully treated many types of chronic wounds, but much clinical and basic research is needed still. In this review, the biology of myiasis

and the history of maggot therapy are presented, the current status of our understanding and clinical use of medicinal maggots is discussed, and opportunities for future research and applications are proposed.

Wollina *et al.*, (2000) used biosurgery in wound healing – the renaissance of maggot therapy, and they noted that chronic wounds are a challenge for modern health care. A basic principle of treatment is the removal of sloughy, necrotic, devitalized tissue to prevent wound infection and delayed healing. Biosurgery (syn. maggot or larval therapy) is a promising adjunct to the whole spectrum of topical treatment methods, in particular for debridement. The term 'biosurgery' describes the use of living maggots on wounds to remove devitalized tissue, decrease the risk of infection and improve wound healing. The present paper gives a brief review of history, entomology, biochemistry and medical indications of biosurgery and the practical handling of maggots. We also provide some clinical data from the literature and our own experience in a wound care unit. Biosurgery is an effective and safe treatment option for debridement and disinfection.

Bowler (2002) studied wound pathophysiology, infection and therapeutic options, and he found that wound healing is a complex and highly regulated process that can be compromised

by both endogenous factors (pathophysiological) and exogenous factors (micro-organisms). Microbial colonization of both acute and chronic wounds is inevitable, and in most situations endogenous bacteria predominate, many of which are potentially pathogenic in the wound environment. The risk of wound infections increases as local conditions favour bacterial growth rather than host defence. Consequently a primary objective in wound management is to redress the host bacterial balance, and this is most effectively achieved by ensuring that the wound is cleared of devitalized tissue and foreign bodies, the bacterial load and inhalation are controlled, and that adequate tissue perfusion is maintained.. Although surgical debridement is the most rapid and effective technique for removing devitalized tissue, topical enzymes, moisture-retentive dressings, biosurgicall therapy and vacuum therapy have been used as alternative approaches to wound cleansing and preparation. Topical antimicrobial agents continue to be used widely for preventing wound infection and current interest is focused on alternatives to antibiotics, such as antimicrobial moisture- retentive dressings, honey, essential oils and cationic peptides. In addition to the need to control wound micro organisms, unregulated inflammation caused by both micro-organisms and underlying abnormal path physiological conditions is a major factor associated with poor healing in