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Using Maggot Therapy in Treatment of Wounds: A Review of Its Effectiveness and Patients' Experiences

Authors

David A. Agom[1], Joy D. Agom[2], Anyigor C.N[3]

[1]RN, BNSc (Nig), MSc Nursing (UK) PhD Student (UK); Lecturer at Ebonyi State University, Abakaliki Nigeria Email: *davinson4u01@yahoo.com, +2347032140509*

[2]RN, RM, BNSc (Nig) MSc Midwifery (UK) Lecturer at Ebonyi State University, Abakaliki Nigeria, PhD Student (UK)

[3]RN, BSc (Nig), MSc Nursing, (UK) Fellow High Education Academy (UK); Lecturer at Ebonyi State University, Abakaliki

Corresponding Author

David A. Agom

RN, BNSc (Nig), MSc Nursing (UK) PhD Student (UK), Lecturer at Ebonyi State University, Abakaliki Nigeria

Email: *davinson4u01@yahoo.com, +2347032140509*

ABSTRACT

Wound treatment is one of the major areas in medical and nursing practice that has attracted attention of health professionals because of the rising incidence of chronic wounds coupled with their numerous associated socioeconomic consequences to individuals and governments. The objective of this work was to investigate the effectiveness and patient's experiences of maggot therapy in the treatment of wounds. A Systematic review of qualitative and quantitative research literature was adopted for this work. Seven electronic databases were systematically searched using relevant key words. A total of 17 articles which met the inclusion criteria were selected and critically appraised and analysed using CASP tool. Seventeen studies were reviewed to ascertain the effectiveness and patient's experiences of maggot therapy. The findings for effectiveness of maggot therapy show that maggot therapy is better in wound debridement compared to conventional therapy. Patients treated with maggot therapy had varied experiences of pain, tingling sensation, loss of appetite, eerie feelings and itching. However, despite all these negative experiences, many patients remarked on speedy visible improvement on their ulcer wound and odour reduction. Besides, they considered maggot therapy acceptable and would recommend it to others. It could be concluded that maggot therapy is excellent in debriding chronic wounds and has greater potential to reduce healing time compared to conventional way of wound treatment.

Key words: *maggot therapy, wounds, effectiveness, experiences*.

INTRODUCTION

Maggot therapy is the use of live maggots from the green bottle fly (*Lucilia sericata*) on a wound to remove dead tissues in order to promote healing (NHS, 2009). It is also known as larval therapy, biosurgery, therapeutic myiasis, maggot debridement therapy (MDT), biodebridement (Snyder, 2009). It has been used by several ancient cultures such as Northern Myanma, aboriginal Ngemba tribes and Mayan healers several hundred years ago in the treatment of wounds (Parnes & Legan, 2007). However, its use declined in 1940s due to introduction of antibiotics and surgical procedures in the treatment of wound (Chan *et al*., 2007). In medical practice today, the incidence of chronic wounds and its associated socioeconomic consequences is rising despite effort and advances in wound management (Beasley & Hirst, 2004). This has caused concern for nurses and physicians, therefore, research is been directed towards finding the most effective intervention in treating wounds. No wonder WHO (2012) stated that antibiotic resistance has become a major threat to public health and a global concern especially to clinicians and government. They raised concern that many infectious diseases may become uncontrollable and could disrupt the effort and progress made towards achieving health related targets of United Nations Millennium development Goals set for 2015. The author deemed it paramount to investigate on alternative treatment to wound, therefore if larval therapy is found effective and patients willing to consent for its use, it would encourage the health professionals to consider it as a first or second line of treatment in wound management which would be alternative to use of antibiotics.

MacDougall et al (2004) reported that there has been resurgence in the use of maggot therapy in wound treatment in 1980s in a few developed countries. This is due to alarming failure/resistance of antibiotics and quest to find best treatment option for wound treatment (Kapil, 2005). It is reported that larval therapy can be used in so many types of wound such as infected wounds containing Methicllin-resistance Staphylococcus aureus (MRSA), pressure ulcer, infected wounds, leg ulcers, amputation sites, traumatic wounds and burns (Barker *et al*., 2010). Its use was also recommended in non-healing necrotic skin and soft tissue wounds such as diabetic foot ulcer, venous stasis ulcer, post-surgical wounds, and non-healing traumatic (US DH, 2007).

Larval therapy has not gained global recognition; it's reluctantly used by clinicians probably because its effectiveness compared to conventional therapy of wound treatment is still in doubt, coupled with the fact that it is seen as unconventional therapy. Besides, most patients' perceived it as psychologically repelling and eerie (Thomas, 2002). Although Maggot is not widely used, their benefit in clinical practice is gradually drawing the attention of clinicians. Evidence suggests that larval therapy aids wound healing, helps in reduction of wound pain and odour (Kitching, 2004; Green, 2004). Hall (2010) reported that it promotes angiogenesis. Furthermore, Synder (2009) reported that it is a cost effective way of debriding wound compare to use of hydrogel. However, Gray (2008)

opposed Synder by positing that there is limited clinical evidence to suggest that maggot therapy is more cost effective than conventional therapy. Hence, this is one of the focuses investigated in this review.

Mechanism Of Action

The actions of medicinal maggots is suggestive of wound disinfection (Sherman *et al.*, 2007; Tantawi *et al*., 2007), stimulation of wound healing (Horobin *et al*., 2006) and biofilm inhibition and eradication (Van der plas *et al*., 2008). Wound debridement decreases bacteria load by removal of death tissues, thus, it stimulates the production of growth factors required to promote wound healing (Snyder, 2009). Maggot is suggested to have potential in wound debridement because it feeds on the death tissues, exudate and cellular debris in the wound (Parnes & Legan, 2007).

Lerch *et al.,* (2003) reported that during feeding, maggot ingest bacteria within the nectrotic tissues within the wound, thus disinfecting the wound. Furthermore, maggots (*Lucilia sericata*) secrete proteolytic enzymes and alkaline such as calcium, urea, and ammonium bicarbonate which further inhibit bacteria growth (Chan *et al*., 2007). Although, maggot therapy is suggested to promote wound healing in some current studies, its effectiveness compared to standard therapy is still under argument. This review therefore explored in detail the effectiveness of larval therapy in wound treatment and patient experiences by systematic review and analyses of the current studies.

Method

Search Strategy

The methodology adopted for this work is a systematic review of the relevant literature on the subject area. This is because Systematic reviews are considered as a corner stone for evidence based practice (EBP) for effective clinical practices (Stevens *et al*., 2009). The authors used a comprehensive systematic approach in searching electronic data bases by combining different key words like larval, maggot therapy, *Lucilia sericata*, ulceration, Diabetic foot, wound treatment, biosurgery, effectiveness, patient's acceptability, experiences, effectiveness of larval therapy, and experiences of maggot therapy. These terms were searched as key words, then combined with "and" "or" command as a single search. The data bases and journal used for this search include MEDLINE, internurse, SAGE, Science Direct, Allied and Alternative Medicine (AMED), CINAL plus British Medical Journal. Also Google Scholarly articles were searched. Furthermore, the author however conducted additional search known as reference list searching (Thompson *et al.*, 2005). This was done by searching through the references of the key literatures.

The search initially produced a large number of articles that were both relevant and unrelated to the study. Reading of the abstract online was adopted to screen the result of the search initially and the relevant ones were retrieved using the inclusion and exclusion criteria. The retrieved studies were again, screened to ensure that they are relevant in answering the research questions for this study

which finally reduced the number of articles to 17. Only primary articles published in English language was included in this research.

Article Appraisal and Key Data Extracted

The selected articles were critiqued to determine the strengths and weaknesses, its relevance in answering the research question by adopting a structured process known as critical appraisal. There are different critical appraisal tools, however, the author used the tools from Cormack (2000) and UK NHS Public health resources unit (2012) because it provides check list for all type of research studies.

Having read through the articles which met the inclusion criteria and considered useful for this dissertation, coding process was used to narrow down different information from the articles into a more simplified set of common attributes. This method was used because Newman et al., (2006) opined that use of codes helps in easy review of the information from articles, hence summarising articles with similar conclusions. The author categorised different codes by assigning numerical value to information from each articles. The codes were collapsed into broader categories depending on how similar and often they appeared to form themes. Two themes emerged; effectiveness of larval therapy with subthemes (clinical outcomes, cost effectiveness and effectiveness of larval therapy compared to conventional therapy) and patients' perception and experiences of larval therapy.

Results/Findings

Eleven studies were explored to find out if larval therapy is effective in terms of clinical outcomes, cost-effective and to ascertain whether maggot therapy is more effective than conventional therapy. Furthermore, six studies were analysed to ascertain patients' perception and experiences of larval therapy.

Effectiveness of Larval Therapy

Clinical Outcomes

Clinical outcomes of maggot therapy was investigated using five studies; Tantawi *et al*., (2007), Jarczyk *et al*., (2008**a**), Jarczyk *et al*., (2008**b**), Cazander *et al*., (2009) and Margolin & Gialanella (2010). The finding by Tantawi *et al*., (2007) showed that 13 ulcers treated with maggot therapy achieved complete debridement in short period of time which resulted to decreased ulcer surface. This was further supported by Jarczyk *et a*l., (2008 **a&b**), but added that patients' limbs were saved due to this therapy.

These three studies are prospective interventional cohort studies. In these studies, small sample sizes were achieved coupled that methodology lacked control group which would have acted as check to this study. Elwood (2007) highlighted that in cohort study, people exposed to intervention are compared to people not exposed. However, the methodology by Tantawi *et al*., (2007) is explicit as patients' recruitment, procedure for administration of the therapy were clearly explained unlike studies by Jarczyk and colleague.

The laboratory experiment by Cazander *et al.,* (2009) concluded that there was no direct antimicrobial effects of maggots and/excretion in vitro but Margolin & Gialanella (2010) opposed this finding by affirming that complete lysis of the bacterial and fungal culture cultures in the area of maggot application were seen 24hrs after application of live maggots.

The finding by Cazander *et al.,* (2010) is arguably more reliable because the study used a control group which resulted to objective measurements/assessment which helps to minimize bias. Cowan (2009) acknowledged that using a control group is a characteristic of good experimental studies which made the integrity of their paper high.

Cost Implication (Cost Effectiveness of Maggot Therapy Compared to Conventional Therapy)

The three studies that investigated on cost implication of maggot therapy found different results. The study by Wayman *et al.,* (2000) shows that for the period of one month, the median cost of treatment of the maggot group was £78.64 compared to £136.23 for the conventional therapy. However, O' Soares *et al.,* (2009) in their Randomised Control Trial (RCT) found that treatment with larval therapy cost on average of £96.70 more than treatment with hydrogel. Dumville *et al.,* (2009) in a similar RCT suggest that larval therapy and hydrogel have a similar cost in the treatment of necrotic or sloughy leg ulcers.

The study by Wayman et al., (2000) were limited as it does not consider the cost of buying maggots and hydrogel coupled with lack of independent assessors of the outcome measures which may have resulted to bias. There were high uncertainties in the findings by Dumville *et al.,* (2009). However, the methods used for this two randomised studies (Dumville *et al.,* 2009 and O'Soares *et al.,* 2009) are very explicit as both studies have clear information on the cost of debriding agents (larvae and hydrogel) coupled that they were independent assessor blinded to the studies.

Effectiveness of Maggot Therapy Compared to Conventional Therapy (Hydrogel)

Two studies show no statistics difference in wound debridement between patients treated with maggot therapy and hydrogel (Sherman, 2003 & Armstrong *et al.,* 2005) as opposed by Dumville *et al*., (2009) who found that time to debridement was shorter for patients treated with maggot therapy. However, Armstrong *et al.,* (2005) added that there were shorter healing times for patients that received maggot therapy compared to hydrogel as opposed by Dumville *et al.,* (2009) who reported that healing time did not differ between larval therapy and conventional therapy.

The retrospective study by Sherman (2003) and Armstrong *et al.,* (2005) has limitation of being difficult to make accurate comparison between the exposed and the control because data reviewed for this study from medical record may be inaccurate which increases the bias of the reliability of this finding as suggested by Parahoo (2006). However, the methodology by Armstrong et al (2005) was explicit. Dumville *et al.,* (2009) conducted RCT

coupled that they achieved excellent sample size which increased validity and transferability of their findings.

Patients' Perception and Experiences of Larval Therapy

Majority of the participants in the studies by Pethrick *et al.,* (2006), Spilsbury *et al*., (2008) and McCaughan *et al*., (2013) perceive larval therapy as being acceptable to them. This was further supported by findings from Kitching (2004) and Steevoorde *et al.,* (2005) who affirmed that all the patients selected for larval therapy agreed.

Patients treated with larval therapy majorly experienced pain (wolff & Hansson, 2003; Kitching, 2004; Spilsbury *et al.,* 2008; McCaugh *et al.,* 2013). Other experiences include tingling sensation, loss of appetite, eerie (wolff & Hansson, 2003; Kitching, 2004; Steevoorde *et al.,* 2005), itching (Spilsbury *et al.,* 2008), more offensive smell (Steevoorde *et al.,* 2005; wolff & Hansson, 2003).

Despite, these negative experiences McCaughan *et al.,* (2013) reported that patients who received maggot therapy remarked on the speedy visible improvement that ensued in their leg ulcer. This was further supported by Spilsbury *et al.,* (2008) that reported positive experiences of odour reduction and exudate while others commented on success of this therapy in wound healing as they would recommend it to others.

Discussion and Implications

Effective wound debridement is established as one of the clinical outcomes in the use of larval therapy in wound treatment (Tantawi *et al.*, 2007, Jaczyk *et al.*, 2008**a** and Jaczyk *et al.*, 2008**b**). This was further supported by the research findings of Dumville *et al*., (2009), Armstrong *et al.,* (2005), Wolff & Hansson (2003) and Sherman (2003) that larval therapy significantly reduced time to debridement compare to conventional therapy. In wound treatment, wound debridement is clinically vital because it is the first and the most important step which initiates wound healing (Brem *et al.,* 2004; Wolcott *et al*., 2009). Due to high antibiotic resistance (WHO, 2013), larval therapy can be used alternatively to conventional ways of wound treatment.

Furthermore, finding from Jarczyk *et al.,* (2008**b**) showed that larval therapy saved the legs of patients at risk of leg amputation after the failure of conventional therapy, as Sherman (2003) stated that maggot therapy is used as a last resort or alternative to amputation. This was further supported by Armstrong *et al.,* (2005) who reported that patients who received standard wound care compared to maggot therapy in their study were three times more likely to undergo amputation (33% versus 10%). Based on the findings, maggot therapy should be considered by governments and clinicians in developing countries as it would help to reduce the number of amputations and associated psychological implications.

Besides, the World Health Organization (WHO) (1998) has estimated that about 228million people

would be diagnosed with diabetic mellitus by year 2025 in developed countries which is the leading cause of chronic diabetic foot ulcer (chronic wound). This implies that they would be rise in incidence of chronic wound which often lead to limb amputation. If clinicians adopt the use of larval therapy, it would help to reduce the potential risk of amputation which is often seen as one of the outcomes of chronic wound.

It is not conclusive as to whether larval therapy is more or less expensive than conventional therapy though to the authors' opinion based on this review, it is suggestive that larval therapy is more expensive though the cost difference might not be significant. However more research is needed to establish this assumption. Despite inconclusive results on cost of larval therapy compared to conventional therapy in treatment of wound, larval therapy would still be considered as highly clinically relevant in wound treatment, even if it is more costly. NHS would always subsidise the cost because of the relevance and effectiveness in wound treatment.

The choice of treatment may be driven by patients' wishes and experiences (Dumville *et al.*, 2009). It cannot be concluded that an intervention is effective until patients show their willingness to accept such treatment. Across most of the research articles reviewed in this work, it was found that many patients experienced severe pain during larval therapy unlike conventional therapy though some patient did not experienced pain. Besides, McCaughan *et al*., (2013) observed that pain can be resolved by the use of oral or parenteral analgesic.

In addition, patient experience ranges from loss of appetite, tickling sensation, feeling of itching, increased odour and discomfort during larval therapy. Despite these experiences, Kitching (2004), Steevoorde *et al.*, (2005) and Spilsbury *et al.*, (2008) found from their studies that patient accepted to use larval therapy again and would even recommend it to others. This is suggestive that maggot therapy could be rated as being effective though there are some methodological limitations noted.

Small sample sizes were limitation of some of the articles reviewed. Wood & Ross-Kerr (2006) stated that the larger the sample size, the closer the outcome will be suitable to the research study population. Due to small sizes, the finding could be argued to have little tendency for generalizability. Besides, across the papers reviewed on effectiveness of larval therapy, the study design/method is more of cohort studies, case studies though few RCT. Hay (2002) cited in Cowman (2007) stated that RCT is a "gold standard" and remain the best for judging the effectiveness of intervention. This implies the need for more RCT, as limited research paper on this subject matter was also a major challenge in this review. It will also be necessary to investigate if maggots (Lucilia sericata) are readily available for use when needed and not focusing on its effectiveness.

Conclusion

Based on the evidence from this review, it could be concluded that maggot therapy is an excellent

debriding agent for chronic wounds as it can reduce the time of wound debridement compared to conventional therapy. Its clinical benefits are strictly on patients with chronic wounds as it promotes the formation of healthy granulating tissue. However, it is not yet established that it has direct effect on quickening the healing rate of wound compared to conventional therapy of wound treatment.

These cost effectiveness analysis shows that the cost benefit of using larval therapy compared with conventional therapy in treatment of chronic wound has not been established. This could be attributed to fact there are few research work that addressed this issue.

Finally, it also found that patients are willing and perceived larval therapy as acceptable and would recommend it to others due to its benefits despite some of their negative experiences. The conclusions from this review indicate that larval therapy is effective alternative in treatment of chronic wounds.

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