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Healing of Wounds by use of Spider threads in comparison with healing by Tetracycline ointment, an Experimental Analytical Study

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Abstract

Background: Spiders are distributed worldwide except in Arctic and Antarctica. More than 45,700 species of spiders and 114 families have been identified. Spiders produce silk in order to capture their prey. reported that people of the Carpathian Mountains used spider webs from Atypus spiders as bandages. Experiments showed that silk from spider house is bio-degradable, non-antigenic and non-inflammatory. These are ideal properties for healing wounds. We aimed to identify the effect of spider threads on healing wounds and injuries compared to healing of wounds by application of tetracycline ointment.

Methods: This is an experimental analytical study in which we investigated ten participants tested in three groups. Group A participants were treated with tetracycline and group B were treated with spider threads. wooden rulers used to collect spider silk threads along with sterilizer, tissue, paper, bandages, and Tetracycline ointment.

Silk was collected from four types of spiders: Cellar Spider, Salticidae Spider, Venatoria Hetropoda, and Galeodes Arabs. These spiders are the mostly distributed in Sudan. Silk was collected by using wooden rulers from cracks and corners of walls at Alzaiem Alazhari University and then placed on clean, soft tissue paper.

Results: revealed that spider threads heal surface injuries without leaving scars in 90% of participants. The healing process with spider threads lasts between 8 -24 hours. The comparison between three tests showed that the percentage of wound healing was highest by 70% by using spider threads in comparison with tetracycline and self-healing.

Conclusion: It was observed that healing of injuries by using spider threads was 70% faster than healing by using tetracycline ointment. Self-healing was observed to be faster than healing by use of tetracycline ointment.

Introduction

Spiders are a large under-represented group that can be found worldwide except in Arctic and Antarctica.in houses, gardens, farms, on roofs, and cracks of buildings. They can also be found between rocks, near shores and seas. There are more than 45,700 species of spiders and 114 families worldwide [1]. Spiders possessing 8 legs with body divided into 2 parts; cephalothorax and abdomen. All spiders are predators that feed on other arthropods. Spiders' length ranged from 0.5 to 90 mm. Female spider is larger than the male one. Small spiders secrete long silk strands that can carry the spider for a great distance. This behavior is called ballooning which enables spiders to drift through the air at heights from 3 to 800 meters. Spiders are predators of insects and have been used to control insects in apple orchards and rice fields. Although many spiders produce venom in capturing their prey, few species are toxic to humans. The venom of the black widow (Genus Latrodectus) acts as a painful nerve poison [2]. After mating the female spider kills and eats the male after sex. In other species the female may eat its offspring. Webs can trap up to 250 insects in one day. The siders either hide under layers of webbing or in between two layers waiting for the prey to appear, then it bites it through the silk and pulls it inside [3]. Cristiana Almeling from University of Hanover, Germany had observed that spiders produce webs secreted from one of the seven glands and that the quantity of threads produced depends on the size of the spider as well as the type of food that it ingests [4]. A study by Anand Jagatia reported that people of the Carpathian Mountains used spider webs from Atypus spiders as bandages. Experiments showed that silk from spider house is bio-degradable, non-antigenic and non-inflammatory. These are ideal properties for healing wounds [5]. Another study revealed that spider web ointment 2.5%w/W showed 30.65% increase in tensile strength compared to normal healing [6].

Zahra Seetoni et al., studied the healing of wounds by using spider silk. New Zealand female rabbits were used for the test as an animal model and identical wounds on the back of the rabbit were created. In their study, they divided the participants into 3 groups; group one was a control group receiving Vaseline and saline, group two was treated with phenytoin ointment, and the third group received a thin film of spider silk protein. Their results revealed that spider silk may benefit as a possible effect of nanoparticles in wound healing [7].

In this study, we aimed to identify the effect of spider threads on healing wounds and injuries compared to healing of wounds by application of tetracycline ointment.

Methods

This was an experimental analytical study undergone to observe the effect of spider threads on healing of wounds and to compare the healing by use of spider threads with healing by application of tetracycline ointment. We included 10 university students (from different grades) from the faculty of public health enrolled at Al Zaiem Alazhari University, Khartoum, Sudan. We used wooden rulers to collect spider silk threads along with sterilizer, tissue, paper, bandages, and Tetracycline ointment.

Sample collection*:* we collected silk was from four types of spiders: Cellar Spider, Salticidae Spider, Venatoria Hetropoda, and Galeodes Arabs. These spiders are the mostly distributed in Sudan. Silk was collected by using wooden rulers from cracks and corners of walls at Alzaiem Alazhari University and then placed on clean, soft tissue paper.

Types of wounds: We applied the test on surface wounds and deep wounds.

Testing effectivity of spider threads: we tested the speed of wound healing along with the sensitivity of skin. We applied spiders' threads on the wounds of all participants and then covered by a bandage. The wounds were tested after 72 hours to observe any changes after healing.

Testing sensitivity to Tetracycline ointment: we applied this test to observe wound healing time by using Tetracycline ointment on surface wounds for all participants, then the wound was covered with a bandage and left. Then, after 72 hours we observed wounds to examine the healing and scars on skin.

Testing self-healing of wounds: we needed this test to compare self-healing time with time needed to heal in all tests. We covered wounds by a bandage without application of ointment.

Experiments showed that silk from spider house is bio-degradable, non-antigenic and non-inflammatory. These are ideal properties for healing wounds [5]. Thus, spider threads were applied according to their healing ability. Ten university students participated in the test. A small wound was cut on the skin of the participants. Some wounds were surface wounds, and the others were deep wounds. Experiments were applied as follows:

1-Testing effectivity of spider threads: The speed of wound healing along with the sensitivity of skin was tested. Spiders' threads were applied on the wounds of all ten participants and then covered by a bandage. The wounds were tested after 72 hours to observe any changes after healing.

2-Testing sensitivity to Tetracycline ointment: This test was applied to observe wound healing time by using Tetracycline ointment on surface wounds for all ten participants, then the wound was covered with a bandage and left. After 72 hours wounds were observed to examine the healing and appearance of any scars on skin.

3-Testing self-healing of wounds*:* This test was applied to compare self-healing time with time needed to heal in all tests. Wounds were covered with a bandage and left without the application of ointment. Results were recorded for all three tests.

Spider thread collection*:* Silk was collected from four types of spiders: Cellar Spider, Salticidae Spider, Venatoria Hetropoda, and Galeodes Arabs. These spiders are the mostly distributed in Sudan. Silk was collected by using wooden rulers from cracks and corners of walls from Alzaiem Alazhari University and then placed on clean and soft tissue paper.

Results

Table 1 shows three tests where the participants were tested three times firstly by application of spider threads, then tetracycline ointment and lastly by observation of self-healing.

Types of tests	Number of participants (%)
Spider silk threads	10 (33.3%)
Tetracycline Ointment	10 (33.3%)
Self-healing of wound	10 (33.3%)
Total	30 (100%)

Table 1: Types of tests and sample size (Total No. 30).

Figure 1 shows the application of spider threads on all participants. The application of spider threads on 10 participants revealed no results after 4 hours. After 8 hours healing was observed in 7 samples followed by healing of two samples after 12 hours and healing of one sample after 16 hours.

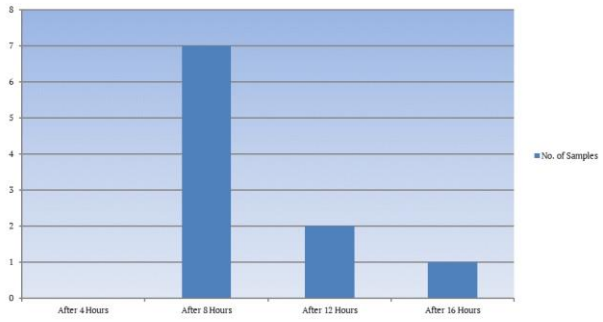

Figure 1: Application of spider threads on all participants.

Figure 2 shows healing of wounds by use of tetracycline. It was revealed that healing of 1 sample was observed after 8 hours. After 12 hours 3 samples healed, and six samples were observed to heal after 16 hours.

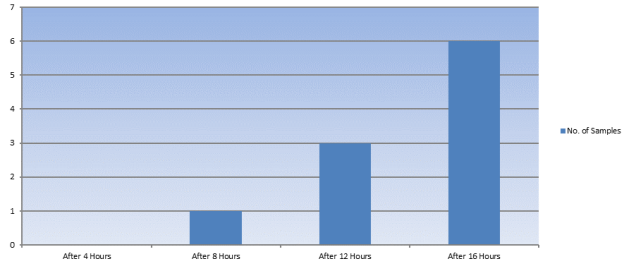

Figure 2: Application of Tetracycline ointment on all participants.

Figure 3 shows self-healing of wounds observed in all participants which revealed that there was no healing observed after 4 hours. After 8 hours, healing was observed in 2 samples followed by healing of 3 samples after 12 hours. Then, healing of 5 samples occurred after 16 hours.

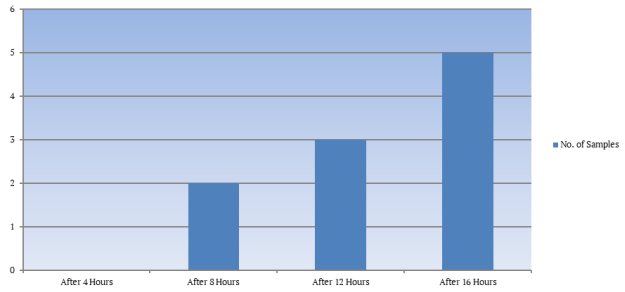

Figure 3: Self-healing of wounds observed in all participants.

Figure 4 showed the comparison between three tests where the percentage of wound healing was highest by 70% by using spider threads after 8 hours in comparison with tetracycline (10%) and self-healing (20%) after 8 hours.

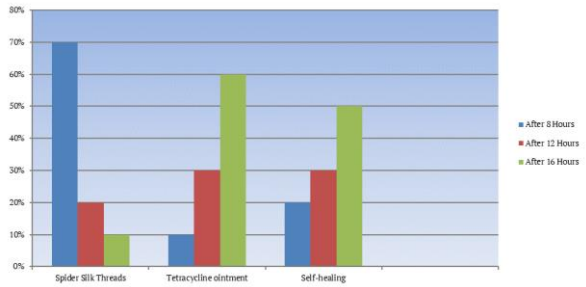

Figure 4: Wound Healing percentages for three tests.

Figure 5 shows the percentage of healing of wounds when taking average hours of healing. The highest percentage was recorded by use of spider threads (90%) followed by self-healing (50%) and tetracycline ointment (40%).

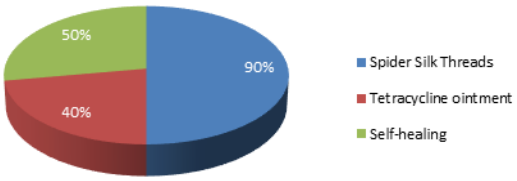

Figure 5: Comparison between percentages of healing in the three tests.

Figure 6: A: Showing injured participant before any treatment. **B:** showing the same participant immediately after application of spider threads. **C:** Showing the same participant after 8 hours from application of spider threads. (Here appears complete healing of wound with no scar).

Figure 7: Showing participant wound, sterilized and left to selfheal in 12 hours.

Figure 8: Showing participant wound treated with tetracycline ointment. Healing of all samples occurred after 16 hours with a scar left on the skin.

Discussion

From the results and analysis, the study revealed that spider threads are effective in curing and healing wounds. Spider threads are 70% effective in healing wounds by 70% when compared with tetracycline ointment and self-healing. When taking the average of test hours of all three tests, spider threads were found to be the fastest in healing by 90% followed by self-healing 50% and lastly tetracycline by 40%. Spider threads were effective in healing wounds without leaving any scars on skin after healing while tetracycline healing left scars on the skin also self-healing left scars on skin that took a long time to disappear. A study by Anand jagatia,2017, revealed that silk from spider house is biodegradable, non-antigenic and non-inflammatory. Thus, they are ideal properties for healing wounds which agrees with the findings of this study where spider threads were found to cure and heal wounds [6]. Another study by Preeti Kumari et al., 2013, revealed that spider web ointment 2.5%w/W showed 30.65% increase in tensile strength compared to normal healing this also agrees with the findings of this study where spider threads were observed to be faster in healing of wounds than self-healing [5]. It is highly recommended to undergo further studies on spider silk threads for the treatment of wounds, especially for diabetic patients. A study by Woong-jin et al., revealed that the efficiency of a fibroin bio-adhesive derived from spider web silk can be effective in closing surgical wounds especially in bone fractures. This agrees with the findings of this study where spider threads were found to heal wounds efficiently [8]. Several studies have revealed that spider silk has shown unique potential in wound healing applications. It was observed that spider silk fibers improved the development of epidermal layers over fibers and also supported keratinization. Spider silk was also found to treat and heal burns [9-13]. Robin Fearon stated that spider silk is a natural wonder material more flexible than nylon and stronger than steel it is explored as an environmentally friendly material that can be used in tissue generation; artificial ligaments, surgical sutures and in tissue repair. Researchers are now producing spider silk by injecting arachnid genes into E.coli bacteria to produce artificial spider silk which is more elastic but weaker than spider silk [14].

Author Contributions

Najla Siddig Nasir, Conception of the work, Ranya Hafez Abdelrahman, Design of work, Monzer Abass Fadul, Acquisition of data, Fatima Fadul Ali Analysis of data, Mohammed Osman Elamin, accountable for all aspects of the work in ensuring that questions related to the accuracy, Omer Siddig Nasir, ensuring all parts of the work are appropriately investigated and resolved, Hatim. A. Natto, interpretation of data, Hatim Badri,

Drafting the work, Wahaj. A. Khan, general revision of work, Ahmed. A. Osman, revising it critically for important intellectual content, Nazik Mubarek Hassan Muath Aldomini, Final approval of the version to be published.

Conflict of Interest

The authors declare that there is no conflict of interestregarding the publication of this paper.

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