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Evaluation of Wound Healing Effect of Gelatin and Polyethyleneglycol (PEG) Containing Cicatrin® Powder.

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The healing effect of gelatin and polyethylenglycol (PEG) containing a cicatrin® powder has been evaluated *in vivo* using the burn healing model, on rats. The material was obtained locally, the films was used to treat burns inflicted on the expiremetal animals. The healing effects of the mixture were compared to that of individual and methylated spirit which serve as negative control. The burns healing effect were in the following order: gelatin +PEG +cicatrin > gelatin + PEG> Cicatrin alone>control at the 15th day, the result shows that combined of the agents has synergistic effect.

Keywords: cicatrin powder ®, Burns, gelatin, polyethylene glycol.

INTRODUCTION

Wound healing is an important biological process involving tissue repair and regeneration. A wound is described as a break in the continuity of tissue, from violence or trauma and is regarded as healed if there is restoration to the wound or inflamed tissue to normal condition. Wound healing can be by primary, secondary and third intention depending on the nature of the edges of the healed wounds [1] There are four distinct stages of wound healing namely - inflammatory stage, debridement stage, proliferation stage and maturation/remodeling stage [2].

Some factor play major roles in wound healing such factors are: bacteria infection, nutritional deficiency, drugs, site of wound, and heath condition of patient [3]. Several agents has been used in wound healings these range from antibiotics especially in post operative surgery, the simple reason is to prevent secondary infection and to aid early healing. Other includes the uses of combination of plants and polymer material both natural and synthetics with a know antibiotics for possible retention at the site of the wound and enhance healing.

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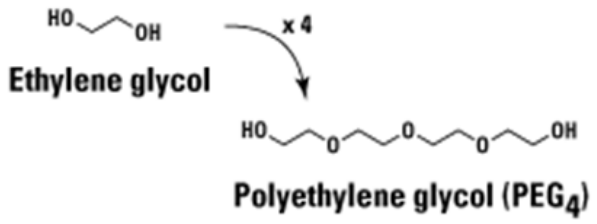
Gelatin

Gelatin is a protein derivative, often classed as a scleroprotein or albuminoid, obtained by evaporating an aqueous extract made from skins, tendons, and bones derived from various domestic animals such as ox (Bos Taurus Linn) and sheep (Ovis aries, Linn) [4]. It is a mixture of reversible gel-forming proteins derived from certain animal tissues, particularly skin and bones with hot water. The process converts insoluble collagens into soluble gelatin, the solution of which is then purified and concentrated to a solid form. The initial stages of the preparation vary with the starting material, bones, for example being defatted with an organic solvent and sometimes decalcified by treatment with acid. Two types of gelatin are characterized in the BP-type A, which is obtained by partial acid hydrolysis of animal collagen, and type B by partial alkaline hydrolysis; mixtures of both types are also permitted. Gelatin is colourless or pale yellow, translucent and has little odour or taste. It is insoluble in cold water but absorbs a considerable volume of liquid; it dissolves on heating and a 2 % solution forms a jelly on cooling. The gelatinizing power of gelatin is reduced by long boiling. The quality of gelatin is largely judged by its “jelly strength” or “Bloom strength”, which is determined by a Bloom gelometer.

Polyethylene glycol PEG

Polyethylene glycols (PEGs) are water-soluble synthetic polymers, non-toxic, non immunogenic, water soluble with a general formulae HO-$(CH_2CH_2O)_n$-H [5]. PEGs have found various applications in the pharmaceutical and biotech industry and are widely used as cosolvents, as lubricants and stabilizers, as bases in topical products, as precipitants and crystallization agents for proteins, and as chemical agents for pegylation of proteins [6]. In addition, PEGs have been shown to stabilize proteins during freeze drying [7]. Most recently, stable formulations of dry protein powders have been developed by using PEG precipitation and vacuum drying [8]. PEG is the common abbreviation for polyethylene glycol – or, more properly, poly (ethylene glycol) – which refers to a chemical compound composed of repeating ethylene glycol units:



Depending on how one chooses to define the constituent monomer or parent molecule (as ethylene glycol, ethylene oxide or oxyethylene), PEG compounds are also known as PEO (polyethylene oxide) and POE (polyoxyethylene). Hence this study is to evaluate the effect of admixture of gelatin, polyethylene glycol (PEG) and cicatrin powder in wound healing.

MATERIALS AND METHOD

Materials

The following materials were collected from Nsukka market, gelatin type A (Super cook, U.K), polyethylene glycols 1000 (BDH chemical limited, Poole England), Cicatrin power (Glaxowelcome, Nigeria) and Diazepam (Roche, England). All the reagents were of analytical grades.

Animals

Mature wistar albino rats of both sex of an average weight of 130 g obtained from the Department of Biochemistry, University of Nigeria and fed on 'chicks marsh'(Top Feed, Nigeria) were used for the study. After the purchase, all the rats were allowed to equilibrate in standard conditioned animal houses at the Department of Biochemistry, University of Nigeria for a period of one week before use.

Preparation of pegylated mucin

A 0.2 g of polyethylene glycol dissolve in 20ml distilled water and also 0.2 g of mucin was also dissolved in 20 ml cold distilled water, then the two solutions were allowed to stand for 72 h to hydrate. After the two are now mixed together and allowed for another 72 hr, this is to allow molecular bond interaction between the polymers. The mixtures were then precipitated using chilled acetone and evaporated to dryness under room temperature to form a film.

Table 1. Quantities of the polymers used in drug film preparation.

Group	Amount of polymer		Drug (mg)
	PEG (mg)	Gelatin (mg)	
I	200	200	0
II	200	200	200
III	0	0	200
IV	0	0	0

Key: C: Positive control, D: Negative control (methylated spirit)

Preparation of the wound sites in the experimental animal

The animals were anaesthetized with 2mg/kg diazepam, intraperitonially, the back and right flank of each animal were then depilated using a depilatory cream® to ensure thorough and uniform removal of the animal's fur. Using a venier caliper, a 10 mm^2 marked was made on each of the rats (Albino rats), then partial – thickness skin burnt were inflicted on them using a metallic templates heated in dry heat. The templates were heated 2 h prior to the injury at constant temperature. The templates were heated concurrently and alternatively, one for each injury and then returned to the heat to a steady temperature.

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II	200	200	200
III	0	0	200
IV	0	0	0

Key: C: Positive control, D: Negative control (methylated spirit)

Table 2, Show the healing rate versus various duration

Groups	Percentage wound healing (mean ± sem) after days of post surgery (mm)					
	0	3rd	6th	9th	12th	15th
I	0.00	21.00 ± 0.85	33.20 ± 0.35	51.40 ± 0.18	60.70 ± 0.88	76.80 ± 0.42
II	0.00	27.00 ± 0.28	55.00 ± 0.03	76.60 ± 0.33	82.90 ± 0.12	99.40 ± 0.78
III	0.00	17.00 ± 0.78	25.00 ± 0.23	44.60 ± 0.56	42.90 ± 0.73	65.40 ± 0.99
IV	0.00	11.00 ± 0.28	21.00 ± 0.67	26.60 ± 0.53	32.90 ± 0.73	45.40 ± 0.84

Determination of healing rate

The animals were divided into four groups (two control groups and two experimental groups). The experimental groups were treated topically with measured volumes of the films formulated. (group one were treated with film containing PEG + Gelatin, Group II, were treated with film containing PEG + Gelatin + Cicatrin powder, Group III were treated with cicatrin powder alone. And those in Group IV were not treated with any of the test agents, the wound area of the animal were all cleaned with methylated spirit before applying the test agent. The treatment was repeated every 2 days for up to 15 days. The wound diameter from 0 – 15 days of each burn injury was measured and recorded using viewgraph paper of clear transparencies. The percentage wound healing on these days were also determined and recorded.

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RESULTS AND DISCUSSION

Table 2, shows the results of the wound healing rates of the various film formulations. The average healing rate of all injuries appears to decrease gradually from day 1 up to day 15. However, compared with control group that received no treatment. This reduction appeared to be more significant in burns treated with PEG + Gelatin + Cicatrin. The reduction in the total area represented a contraction process from day one. It appears that contractions and epithelialization values following treatment with PEG+ Gelatin + Cicatrin powder (group II) has the highest reduction rate, followed by treatment with PEG + Gelatin (group I), compared with positive (cicatrin alone) and negative (methylated spirit alone) control group. The tissue morphology on the termination of the experiment day revealed that a very thin layer of epidermis was visible in the control group. A similar result was obtained in PEG + Gelatin + Cicatrin powder treated animals. In animals treated with PEG + Gelatin, thick epidermis and also well-developed skin appendages were observed. Healing in this untreated group IV, negative control may be due to it self immunity which is natural in a healing process. Many physiological factor play role in healing process such as, cytokines and other growth factors can directly regulate wound healing by affecting the chemotactic attraction of inflammatory cells. Mitosis of fibroblasts, kertinocytes, endothelial cells as well as neovascularization [8].

In some cases wound healing may be delayed due to the amount and concentration of certain cytokines and growth factors level that come into play, such cases could lead to secondary infection and worsen the wound healing. In chronic cases such as pressure wounds, diabetes, or ulcer wounds the levels of some growth factors were diminished or absent, resulting in slow or non-existence repair of chronic wounds [9].

In the past, various topical agents and bandages were used, but topical treatment with PEG + Gelatin + Cicatrin powder film has not been studied previously. The present study tested the effect of PEG +Gelatin film containing cicatrin powder demonstrating that topical administration of the extract enhanced wound healing. It is important to note that throughout the period of wound treatment, the samples did not cause any form of irritation or pain to the animals as the rats neither show any signs of restlessness or scratching or biting of wound site when the samples were placed on the wound sites.

The result indicated that the effect of PEG + Gelatin + cicatrin powder was most beneficial with regard to all criteria tested.

REFERENCES

1. Ihedioah, JI, Chinneme CN. Fundamental of Systemic Veterinary Pathology Great Ap Expresses Publisher Ltd. 2004; pp 1-4.
2. Churchill K., Hoegate ST. Humna Subject Clin. Eap. Allera. 1996; 16: 1371-1379.
3. Cooper DLI, Hennessey P., Am. Sura , 1994; 291: 688-92.
4. Lowbury, ES, Ayliffe CA. Drug Resistant in Antibiotics therapy Charles Thomas Publication. Melissa, Brayman, Amantha., 1974.
5. Niazi S. *Journal of pharm sci.*1976;65:302-308.
6. Mi Y, Wood G. *PDA J Pharm ScI Technol*. 2004; 58:192-202.
7. Sharma VK, Kalonia DS. *AAPS, Pharm. Sci*. 2004; 6:3
8. Mellin TN., Mennie RJ. Chashen DE. Dermal Wound Healing. Growth Factors. 1992; 7: 1-14.
9. Montesano. R, Vassalli JD. Proc. At. Accd. Sci. USA.1993; 83: 7297-301.