ELECTROSPUN, BIODEGRADABLE, NON-WOVEN DRESSING WITH ADDITION OF PROPOLIS FOR DIFFICULT-TO-HEAL WOUND TREATMENT

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Introduction

The selection of the optimal dressing is crucial for the wound healing process. Traditional dressings including gauze, adhesive tapes and bandages are used to protect against contamination and mechanical damage of the wound. However, modern dressings are designed not only to cover the surface of the wound, but also to interfere with the complex healing process, accelerate it and minimize complications. Furthermore it should provide a moist wound environment, accelerate reepithelialisation, accelerate angiogenesis and synthesis of connective tissue, allow gas exchange between the wound and the environment, provide optimal wound temperature to increase blood flow within it, pose barrier to infection, do not adhere to the wound , minimize unpleasant smell, support the migration of leukocytes and enzymes, be transparent, allow to observe the healing process, be sterile, non-toxic and non-allergic [1-3].

A very interesting alternative for simple dressings are complex dressings containing a polymer with an incorporated active compound. As a result, not only the optimal wound healing parameters related to the influence of the active compound can be obtained, but advanced manufacturing systems, like electrospinning process, allow to control the pharmacokinetic processes in such a way as to achieve a prolonged action of the drug within the healing wound [1-3].

Propolis is a natural resin and wax substance produced by honey bees as a repair and protective material. This substance has proven activities such as: antioxidant, anti-inflammatory immunomodulatory, antiviral, antineoplastic, antibacterial, antifungal, stimulates reepithelialisation and shortens wound healing time [4].

The aim of this study was to obtain a wound dressing from a biodegradable polymer containing propolis, for the treatment of difficult-to-heal wounds, which releases propolis in a controlled manner throughout the treatment and creates favorable conditions for the regeneration of damaged cells, while ensuring a sterile wound environment, and after the end of treatment, it degrades, which allows you to avoid discomfort associated with the removal of the dressing.

Materials and Methods

Wound dressings has been obtained by electrospinning from a poly(lactide-co-glycolide) copolymer solution (mutual molar ratio of comonomers: 85% lactidyl units to 15% glycolidyl units. Propolis content: 5 wt% and 10 wt% relative to the polymer. Solvent: 1,1,1,3,3,3-hexafluoro-2-propanol. Potential difference: 27kV. Distance between the electrodes: 15cm. Solution dose rate: 1.5 ml/h, volume: 22ml [2].

The *in vitro* drug release conditions: shaking in Phosphate Buffered Saline (PBS), in an incubator at 37ºC, through 40 days. Propolis amount was measured via HPLC method.

For *in vivo* research, two White Ursus pigs, were used. The 21-day experiment consisted in observation of healing 3º burn wounds supplied with tested mats. Research was made according to the standard Hoekstra model. 4 research groups was set: 2 study groups: wounds supplied with 5 wt% of propolis mats, wounds supplied with 10 wt% of propolis mats and 2 control grups: wounds supplied with mats without propolis and wounds supplied with NaCl twice a day. Healing processes were compared basing on the macroscopic changes.

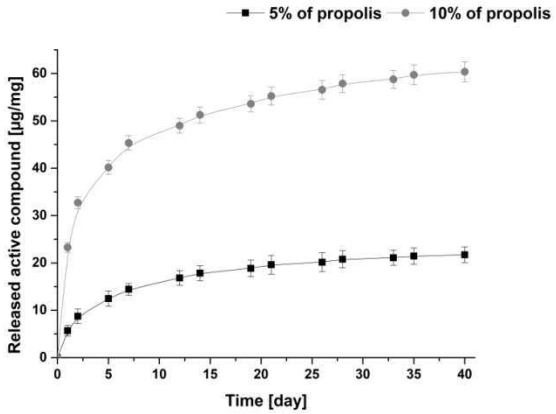

FIG. 1. Release of propolis from PLGA 85/15 electrospun wound dressings. Results are presented as amount of released propolis [µg] per 1 mg of polymer mat (MEAN±SD, N=3).

Results and Discussion

FIG. 1 presents release of propolis from electrospun polymer mats. After initial intensive release (which is beneficial for saturation with the active compound), the further release proceeded evenly. The experiment showed the most beneficial effect of dressings containing 5% addition of propolis, then dressing dressings with 10% addition, in relation to dressings without added propolis and wounds healing with “the forces of nature”. Furthermore, the applied dressings caused a better therapeutic effect than the usual 5% propolis ointment or the silver sulfadiazine salt used usually in the treatment of burns (external control groups from previous studies).

Conclusions

Biodegradable, non-woven dressings with the addition of propolis allow the release of the apitherapeutic in a controlled manner, allowing the patient to avoid discomfort associated with the change of dressing or daily local administration of the drug substance, at the same time giving a better therapeutic and aesthetic effect, which makes them a potentially beneficial solution for treating difficult-to-heal wounds for the future.

References

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