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THE USE OF TILAPIA SKIN FOR HEALING BURNS

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Abstract: **Introduction**: Burn is any injury to organic tissues caused by direct contact with a source of thermal origin, chemicals, electrical current, or radiation. Such injury affects more than one million people in the country with the most diverse consequences. Due to the expressivity of the numbers and the need for improvement in the treatment of burn victims, studies are being carried out in the search for alternatives, especially with regard to occlusive dressings (those that act as a mechanical barrier sealing the wound). Tilapia skin (Oreochromis niloticus) then emerges as an option with clinical applicability in the treatment of burns. **Objective**: To present the effectiveness of tilapia skin in the burns healing process. **Method:** Scielo (Scientific Eletronic Library Online), Google Scholar, Cochrane and PUBMED (US National Library of Medicine National Institutes of Health) articles were used using the **Results:** effectiveness, tilapia skin, burns. Results: Clinical studies have increasingly shown that the quality of Nile tilapia skin (Oreochromis niloticus) is a viable alternative to be used as occlusive therapy in patients with burn injury who are treated by burn centers. **Conclusion:** The need to develop further studies and research on the use of tilapia skin as a biological dressing in the treatment of burns is perceptible, seeking more knowledge about this practice, enabling this type of treatment to be implemented in the public health network.
Keywords: Efficiency; Tilapia Skin; Burns.

INTRODUCTION

Burn is any injury to organic tissues caused by direct contact with some source of thermal origin (heat or cold), chemical products, electric current or radiation. Even some species of animals (jellyfish, caterpillars, lonomia, etc.) and plants (nettles) cause this lesion(1). The burn can reach different stages depending on the extension and depth as well as the time of exposure or contact with the provoking agent. Such an event, in view of the importance of its consequences, can even lead the human being to death.[1]

According to the Brazilian Society of Burns, in Brazil, there are approximately one million cases of burns each year. Thus, they are among the main external causes of death registered in the country, second only to other violent causes(2).

In view of these numbers, several studies have been carried out in the search for a treatment that reduces the effects of contamination in the lesions, favors the healing process and offers better aesthetic results in the most severe cases. The coverings, materials or products used to treat the wound caused by the burn can be primary, when placed directly over the injury, or secondary, when their function is to cover the primary coverings.[2]

In occlusive dressings (those that do not allow the entry of air or fluids, acting as a mechanical barrier, preventing the loss of fluids, promoting thermal insulation, sealing the wound in order to prevent emphysema as well as the formation of crust) temporary substitutes can be used skin, which are effective materials in the treatment of recent superficial burns and also in covering the skin, while waiting for the definitive graft. [2]

In turn, skin substitutes have been considered very useful in the treatment of superficial burns, as they reduce the frequency of dressing changes. However, the high price has proved to be a real obstacle to its effective use. [2]

In this context, tilapia skin (Oreochromis niloticus) appears as a possible by-product, with clinical applicability of new biomaterials usable in the treatment of burns. This species, originally from the Nile River basin, in East Africa, is widely disseminated in tropical and subtropical regions such as our country. The

skin of this fish is a noble and high quality product, possessing peculiar resistance like leather, however, there are no studies that show its resistance as skin not subjected to tanning.[1]

The characterization of tilapia skin, based on its histomorphological properties, collagen classification and physical characteristics (tensile strength) was carried out by researchers from the Nucleus for Research and Development of Medicines at ''Universidade Federal do Ceará".[1].

It must be noted that the microscopic characteristics of tilapia skin are similar to the morphological structure of human skin, with a dermis composed of compacted, long and organized bundles of collagen, in parallel/ horizontal and transverse/vertical disposition, predominantly type I. Also, the skin of this fish showed high tensile strength and extension in breaking.[1].

OBJECTIVE

To analyze the effectiveness of tilapia skin as an occlusive therapy in the healing process of burns.

METHODS

For the development of the present work, the scientific articles available in full texts, whose theme was in agreement with the theme proposed for the research, were adopted as a selection criterion. The research of scientific articles was carried out through searches in the databases: Scielo (Scientific Electronic Library Online), Google Scholar, Cochrane and PUBMED (US National Library of Medicine National Institutes of Health) through the keywords: efficacy, skin of tilapia and burns.

DISCUSSION AND RESULTS

A burn is an injury to organic tissues, as a result of a trauma of thermal origin, which varies from a small bubble to severe forms, capable of causing systemic responses of proportion to extension and depth. They can lead to disability and even death. The most frequent causes of burns are through fire, contact with boiling water or other hot liquids and contact with heated objects. The occurrence of burns can cause physiological changes in the individual's skin, hindering the ability to heal, because when the organ is affected, it loses protection against infections, and in addition, there may be loss of organic fluids and consequently the reduction of sensory receptors, due to the fact that the sweat and sebaceous glands are destroyed.[3]

Countless studies have been carried out trying to find dressings that can reduce the effects of contamination in the lesions and that favor the healing process, thus offering better aesthetic results. The ideal dressing is one that is easy to obtain, low cost, easy to store, of prolonged stability, which does not present antigenicity, but good flexibility, resistance to stretching, adhesion to the bed, good adaptation to the contour of the wounds and facilitation of joint movements. It is also added that the material must be applied in a single surgical procedure, be easy to manipulate, reduce pain, accompany body growth and maintain body temperature. [4]

In our country, in all burn treatment centers in the public network, we have the following behavior in relation to dressings: in second-degree burns, a bath with 2% chlorhexidine is performed daily and the dressing is applied with topical antimicrobial 1% silver sulfadiazine, until the lesion is completely repaired (superficial 2nd degree around 12 days and deep between 21 and 25 days); in third-degree lesions, the necrotic tissue is debrided in several stages (sequential debridement), with a dressing made with 1% silver sulfadiazine, until the wound bed is prepared for grafting. In the private network, this scenario changes and, depending on the

type of insurance or the patient's financial conditions, biosynthetic dressings and artificial skin are used, all imported and at a high cost. [5]

Nile tilapia skin appears as a possible by-product andsource of biomaterial for grafting with clinical applicability based on its physical characteristics (tensile strength), histomorphologicalcharacteristicsandthetype of collagen composition. Histological studies of tilapia skin demonstrated an epidermis covered by a stratified squamous epithelium, followed by extensive layers of collagen. Collagen is one of the main components of biomaterials, due to its characteristic of guiding and defining most tissues, in addition to enabling biodegradability and biocompatibility, which favor its application.[6] About the histological analysis, in which it has been described that tilapia skin is composed of epidermis represented by stratified squamous epithelium, with cubic or cylindrical basal cells with an oval nucleus and with the possible presence of mucous cells. the dermis, in turn, it is made up of loose (superficial) and dense (deep) connective tissue. In the outermost layer of the deep dermis, horizontal and vertical collagen fibers (perpendicular to the skin surface) have also been shown, and in the inner layer, compacted and thick horizontal fibers, corroborating our findings. Previous studies have also shown, as in this research, melanophores in the superficial dermis.[7]

It is possible to use tilapia skin as a promising biomaterial in regenerative medicine. Its microscopic characteristics, similar to the morphological structure of human skin and high resistance and tensile strength in breakage make this application possible. The dermis of this skin is composed of compact, long and organized collagen bundles, predominantly type I, of considerable importance for its clinical use. However, further studies are needed, particularly in animals, to validate tilapia skin as a temporary biological dressing for burns. [8]

The bundles of dense collagen in tilapia skin are arranged predominantly in a parallel and transverse manner, differing from the organization of the human dermis, in which fibers with increased collagen activity are found in different directions. These aspects could contribute to the understanding of the high capacity of human skin to resist large loads, however, this difference in the arrangement of collagen fibers does not seem to interfere with the elasticity parameter of the tilapia skin, since the values found in both skins in the tensile extension test, measured in centimeters, showed similar means (mean tilapia = 4.442 cm; human average = 4.615 cm). This feature would enable satisfactory manipulation of the fish skin in covering and suturing maneuvers, for example. [9]

In addition to its use for the treatment of burns and wounds, several specialties such as urology, endoscopy, otorhinolaryngology, dentistry, and gynecology are developing projects to start studies with tilapia skin, the latter having successfully performed the first neovagina reconstruction surgery. [10]

In a certain microscopic and histochemical study in the evaluation and analysis of the tensiometric properties of Nile tilapia skin, samples of tilapia skin were selected and, after preparation of the same, with specific substances, they were submitted to tension tests. The evaluated fragments of tilapia skin compared to human skin revealed an extensive area filled with collagen, representing 91.6% and 71.3%, respectively. Quantitative analysis of collagen showed that, in tilapia skin, there was a higher percentage of area filled with type I (mature) collagen than that observed in human skin, in which the area occupied by this type of collagen was 39.2%, revealing a statistical difference between the groups. On the other hand, the percentage of collagen

type III (immature) was significantly higher in human skin, corresponding to 60.8%, while tilapia skin has 47.8%.[11]

Franco et al carried out a comparative study of Tilapia, Pacu and Tambaqui fish skins and concluded that Nile tilapia skin had a higher moisture content (67.14%), lipids (1.96%) and ash (1.82 %), lower thickness (0.68 mm), tensile strength (11.86 N/mm2), progressive tearing (40.18 N/mm), lower elasticity (52.63 %) and lower maximum strength (81.06 %) compared to pacu and tambaqui leathers. Since tambaqui leather has the greatest thickness (0.89 mm) and resistance (traction= 29.49 N/mm2, progressive tearing= 80.01 N/mm and maximum force=224.25), which indicates that tilapia skin is more delicate and unsuitable for making clothing, but not for other purposes. However, pacu and tambaqui leather could be used for this type of production, as they have a thickness within the recommended range for making gloves and clothing. The fragility of tilapia skin is similar to human skin, therefore, among the common fish of the Brazilian fauna, tilapia skin has the most compatible characteristics to act as a biological material in the occlusive treatment of burns.[11]

A comparative clinical study was carried out at Hospital São Marcos, Recife/PE, in patients with superficial and/or deep degree II burns, with a sample field of 30 patients with similar clinical status. Patients would be randomly treated with Nile Tilapia skin and Aquacel AG® silver hydrofiber. The study proved that the average number of days of treatment for patients with Nile Tilapia skin was similar to patients treated with Aquacel AG®. With regard to pain, at the end of the clinical process of applying the dressing, 86.7% of the patients in the Nile Tilapia skin group reported feeling less pain, as evidenced by its indication on the VAS, with a score equal to or lower to five, compared to Aquacel AG® (46.7%). Regarding the dressing change, in 60% with the use of Nile Tilapia skin, there was no need to replace any dressing, while for Aquacel AG®, in 53.3% of the cases, there was at least one replacement.[12]

CONCLUSION

The dressing with tilapia skin consists of a temporary occlusive biological dressing, with the purpose of closing the wound, acting on its healing. From its physical characteristics compared to human skin and the skin of other fish, tilapia skin proved to be efficient when used as a dressing for injuries caused by burns.

This material has high resistance, a greater amount of collagen type I compared to human skin, showed good adherence to the wound bed in the analyzed studies, in addition to providing an improvement in the healing process and a decrease in dressing changes, which also contributed to decrease pain and discomfort during skin treatment.

It is noticeable the need to develop more studies and research on the use of tilapia skin as a biological dressing in the treatment of burns, seeking more knowledge about this practice, allowing this type of treatment to be implemented in the public health network.

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