THE EFFECT OF CASTOR OIL ON THE HEALING OF AN EXPERIMENTALLY INDUCED MUCOSAL WOUNDS IN RATS

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ABSTRACT

Castor oil is a substance that can be easily absorbed by the skin and when it is absorbed, it stimulates the thymus gland and/or the lymphatic tissue. By doing this, it increases the number of white blood cells flowing through the body, which is important in the treatment of wounds of various animal species during the different stages of the healing process. For that reason, it will be used in this study to evaluate its effectiveness in the healing of the buccal mucosa. Thirty adult male rats will be included in our study. An incisional wound of (1cm) will be made on the buccal mucosa and the sample will be divided into two groups:

The control group included 15 rats that is divided into 3 healing period intervals (1,3 and 7 days) and an experimental group that included 15 rats that were treated with (5µL) of Castor oil and divided into 3 healing period intervals (1,3 and 7 days). All tissue specimens were fixed in 10% neutral formalin and processed in routine paraffin blocks. Each paraffin-embedded block from all the studied samples were prepared in 4µm thickness serial sections and mounted on a clean glass slide for routine H&E staining. Histological analysis of wound healing was done in all healing period intervals (1,3,7). Epithelial thickness, inflammatory cells and blood vessels account were measured in 1,3,7 days for the control and the experimental groups. Castor oil group showed completely formed epithelial layer than control group in 7 days and recorded a high significant difference than the control group. Castor oil has been reported as an alternative treatment for wounds since it acts against gram-positive and gram-negative bacteria. In addition to being indicated as a chemical debridement and healing agent, it is able to maintain the bed of the wound moist and accelerate neo-angiogenesis and granulation process.

Key words: Castor oil, buccal mucosa.

I. INTRODUCTION:

The oral mucosa can be defined as a mucous membrane lining the inner part of the mouth, it composes of a stratified squamous epithelium that is called the oral epithelium with an underlying connective tissue which is called the lamina propria. The oral cavity is considered as a mirror that can reflect the individual health. Signs or symptoms of a disease can be seen as changes in the mucosa of the mouth, and it can reveal a systemic condition such as diabetes mellitus, vitamin deficiency or a local effect of chronic alcohol or tobacco use.

The oral epithelium is composed of a functional compartment, known as the progenitor basal and parabasal cells, which is the site of the cell division. This compartment is a maturation compartment which contain granular and spinous cells in which the cells will become more terminally differentiated (either orthokeratotic or parakeratotic). In areas with a non nonkeratinized mucosa such as the cheek/buccal and the floor of the mouth, granular cells are absent which are responsible for overkeratinization and the surface cells are found to be flattened, with an elongated nuclei. The mucosa can be divided into (1) masticatory, (2) lining mucosa, and (3) specialized mucosa.

wound etiology: wounds are caused by an act like surgical procedure, gun shot, fall, infection or any other systemic conditions e.g. obesity, liver disease, hypo-albuminemia, systemic infection or malignancy. It can caused by any injurious agent and it can involve any structure or tissue.

process of wound healing:
All the stages of the wound healing occur in an organized way and it follow four stages: hemostasis, inflammation, proliferation and maturation. Although these stages are linear, the wounds can progress forward or backward depending on the internal and external patient condition [6].

Hemostasis can be defined as closure of the wound by clotting. It starts when the blood leaks out of the vessels. Inflammation is a recognized second stage of the wound healing and it begins immediately after the injury and when the injured blood vessel leaks transudate (which is made of water, protein and salt) causing a localized swelling. Inflammation can both controls the bleeding and prevents infections [7]. The proliferative phase usually starts at the third day after the occurrence of the woundand it lasts for about 2 weeks. It is characterized by the initiation of fibroblast migration with the deposition of the newly synthesized extracellular matrix and acting as a provisional network replacement composing from fibrin and fibronectin [8]. The maturation phase is also called the remodeling phase of wound healing, it occurs when the collagen is remodeled from type III to type I and full closure of the wound. Cells that had been used for the repair of the wound but are no longer needed will be removed by apoptosis (a programmed cell death). The collagen that is laid down during the proliferative phase is disorganized and the wound seems to be thick. During the maturation stage, the collagen is re lined along the tension lines and the water is reabsorbed and enabling the collagen fibers to lie closer together and cross-linked [8].

**Castrol oil:** Castor oil has been used for a long time commercially as a good renewable source for the chemical industry [9]. It is a vegetable oil that can be obtained from the seeds of the castor oil plants (*Ricinus communis* L.). It is mainly found in Africa, India and South America [10].

**Castor Oil Properties:**

Castor oil is a nonvolatile, pale yellow and nondrying material. It consists up to 90% from ricinoleic, 3% oleic, 4% linoleic, 1% stearic and less than 1% linolenic fatty acid. Castor oil is so valuable due to its high content of ricinoleic acid (RA), which is usually used in a wide variety of applications of chemical industry [11].

Castor oil is usually served in packs, it can be easily absorbed by the skin (for this reason, it is widely used acne remedy). When it is absorbed, it can stimulate the thymus gland and/or the lymphoid tissues and increases the number of lymphocytes (white blood cells from the lymphatic system are called lymphocytes) flowing through the body. Derivatives of herbals of ricinoleic acid that is extracted from castor beans (*Ricinus communis*), is considered to be an important ally in treatment of the wounds of many animal species during different stages of the process of healing [12].

**Aim of study:**

Evaluation of the effects of Castrol oil on healing of the oral mucosa histologically.

**II. MATERIALS AND METHODS:**

Thirty adult male rats were used in our study, an incisional wound of (1cm) was made on the buccal mucosa and treated according to research ethics committee of college of Dentistry /university of Baghdad No:260. The thirty rats were divided into two groups:

- Control group: contains 15 rats that were divided into 3 healing period intervals (1,3 and 7 days).
- Experimental group: contains 15 rats which were treated with (5µL) of Castrol oil and they were divided into 3 healing period intervals (1,3 and 7 days).
- Histological analysis of wound healing was done in all healing period intervals (1,3,7). Epithelial thickness measured in Mm by Image J [13], inflammatory cells account [14] and blood vessels account [15] were measured in 1,3,7 days for the control and the experimental groups.

**III. RESULT:**

*Clinically*, there was no signs of inflammation, allergy or complication in all groups in each period interval (1,3,7) and the experimental group showed complete healing at the seventh day while the control group showed an incomplete healing for the same period interval, fig (1).
Histological results:

After 24 hours:

In the experimental group, there was inflammatory cells, migration of epithelial cells and a new blood vessel formation was observed, while the control group showed infiltration of inflammatory cells and an obvious cutting edge fig(2).

After 72 hours:

The control group recorded a high account of inflammatory cells and the beginning of an epithelial layer formation, while in the experimental group there was an incomplete epithelial layer formation, a high blood vessel account and fibroblast cells.
Fig(3): A: Experimental group, x20 showed (NE): New epithelial formed incompletely, (IC): inflammatory cells  
C: Control group, x40 showed (GT): granulation tissue, (IC): inflammatory cells.  
D: Control group, x40 showed (NE): New incompletely formed epithelium (FB): fibroblast cells, (IC): inflammatory cells.

After a week: 

The control group showed a new epithelial layer that was still incompletely formed with a high account of blood vessel, fibroblast cells. The experimental group showed complete formation of the epithelial layer with an obvious collagen fiber.

Fig(4): A: Experimental group, x40 showed New epithelial layer completely formed.  
B: Control group, x40 showed new epithelial layer incompletely formed.

Statistical result:
After 24 hours: the experimental group recorded a high mean value in epithelial thickness, inflammatory cell account and blood vessels and there was a high significant difference in the inflammatory cells account and epithelial thickness between the experimental and the control groups, while there was a significant difference in the blood vessel account as shown in table (1).

Table (1): A: Inflammatory cells account. B: Blood vessel account. C: Epithelial thickness

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean value</th>
<th>sd</th>
<th>se</th>
<th>pvalue</th>
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<tbody>
<tr>
<td>A) Inflammatory cells</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>9.2</td>
<td>1.23</td>
<td>0.31</td>
<td>0.001</td>
</tr>
<tr>
<td>Experimental</td>
<td>28.7</td>
<td>3.8</td>
<td>1.54</td>
<td></td>
</tr>
<tr>
<td>B) Blood vessel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>0.8</td>
<td>2.43</td>
<td>0.12</td>
<td>0.003</td>
</tr>
<tr>
<td>Experimental</td>
<td>2.7</td>
<td>3.2</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>C) Epithelial thickness in µm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>0.4</td>
<td>0.1</td>
<td>0.1</td>
<td>0.000</td>
</tr>
<tr>
<td>Experimental</td>
<td>2.5</td>
<td>1.8</td>
<td>0.4</td>
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After 72 hours:
Table (2) is showing that the experimental group recorded a high mean value in inflammatory cells account, blood vessel account and epithelial thickness. There was a high significant difference between the experimental and the control groups regarding the epithelial thickness with a significant difference in blood vessels account.

Table (2): A: Inflammatory cells account. B: Blood vessel account. C: Epithelial thickness

<table>
<thead>
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<tbody>
<tr>
<td>A) Inflammatory cells</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Control</td>
<td>23.3</td>
<td>2.43</td>
<td>0.92</td>
<td>0.008</td>
</tr>
<tr>
<td>Experimental</td>
<td>26.8</td>
<td>3.2</td>
<td>0.69</td>
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<tr>
<td>B) Blood vessel</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>3.1</td>
<td>0.62</td>
<td>0.33</td>
<td>0.002</td>
</tr>
<tr>
<td>Experimental</td>
<td>6.2</td>
<td>0.96</td>
<td>0.53</td>
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<tr>
<td>C) Epithelial thickness in µm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>8.1</td>
<td>0.87</td>
<td>0.41</td>
<td>0.000</td>
</tr>
<tr>
<td>Experimental</td>
<td>22.8</td>
<td>2.25</td>
<td>1.38</td>
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After a week: As shown in table (3) there was a high significant difference between the experimental and the control groups in inflammatory cells account and epithelial thickness. While the experimental group recorded a higher mean value than the control group in the blood vessel account.

Table (3): A: Inflammatory cells account. B: Blood vessel account. C: Epithelial thickness

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean value</th>
<th>sd</th>
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<th>pvalue</th>
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<tbody>
<tr>
<td>A) Inflammatory cells</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>21.23</td>
<td>2.9</td>
<td>0.97</td>
<td>0.000</td>
</tr>
<tr>
<td>Experimental</td>
<td>10.94</td>
<td>1.8</td>
<td>0.59</td>
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<tr>
<td>B) Blood vessel</td>
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<tr>
<td>Control</td>
<td>6.25</td>
<td>1.62</td>
<td>0.63</td>
<td>0.007</td>
</tr>
<tr>
<td>Experimental</td>
<td>5.98</td>
<td>0.71</td>
<td>0.46</td>
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The wound healing is a sequence of complex physiological and biochemical events. It involves many cellular activities that includes chemotaxis, phagocytosis, mitogenesis, migration, and ECM synthesis/remodelling. The oral mucosal Wounds and the skin usually proceed through identical stages of healing process which are: hemostasis, inflammation, proliferation, and remodeling (16,17).

The Castor oil is used in the current study, it is a nonvolatile and nondrying material (20). It usually consist of oleic, linoleic, ricinoleic, stearic, and a little amount of olinolenic fatty acid. It has an anti-inflammatory, antibacterial and anti-tumor properties. Castor oil is so valuable due to its high content of the ricinoleic acid (RA), which has been used in a variety of the applications in the chemical industries (21). After 24 hours of the castor oil administration group, it showed a significant decrease of purulent secretion which is indicative of a receding contamination due to anti bactericidal effect of castor oil (22) and this agrees with (Peres et al., 2015), current study revealed that blood vessels appeared early in the castor oil group than the control group, because the castor oil can accelerate neo-angiogenesis and granulation process (19) and the inflammatory cells appeared in a high amount earlier in the castor oil group than the control group due to the anti-inflammatory effect of the castor oil.

In this study, the buccal mucosa showed complete healing after a week in the castor oil group while the control group was still having an incomplete healing for the same period. The rapid re-epithelialization and remodeling especially in the castor oil group was due to its antibacterial and anti-inflammatory effect on wound healing (23) and this agrees with (Peres et al., 2015)

Conclusion: Castor oil has been reported as an alternative treatment for wounds since it acts against gram-positive and gram-negative bacteria. In addition to being indicated as a chemical debridement and healing agent, it is able to maintain the bed of the wound moist and accelerate neo-angiogenesis and granulation process. It is nontoxic and can be applied both in open and closed wound. It has the ability to act as a chemotactic agent for neutrophils and promotesmitosis and cell proliferation and reduce the development of resistance. It has an anti-inflammatory, repellantand larvicide properties. Castor oil was effective in promoting the healing of the oral mucosal wounds. It has been proven to have a great performance since it is easy to apply and provides good antiseptic action and wound healing at low cost.

REFERENCE:


