

## Original Article

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# Clinical evaluation of a formulation with osmotic effect in reducing symptoms after superficial burns: a pilot study

## *Avaliação clínica de formulação de efeito osmótico na redução da sintomatologia pós-queimaduras superficiais: estudo-piloto*

### ABSTRACT

**Introduction:** The treatment of superficial burns is largely symptomatic, aimed at reducing the discomfort arising from the signs and symptoms and promoting skin repair. Some studies have evaluated the osmotic action mechanisms in the inflammatory process. Formulations with osmotic action can decrease the inflammatory exudate, which reduces the symptoms and even the risk of infections.

**Objective:** To evaluate the action of an osmotic action hydrogel for topical use in reducing the symptoms of a superficial, first-degree burn.

**Method:** Thirty-five patients with signs of first-degree burn were evaluated. The study product was applied on the injured area as a monotherapy. The analysis of symptoms (burning sensation), signs (erythema and edema), and clinical evaluation questionnaire were conducted after 5, 15, and 30 days, respectively. To evaluate the skin barrier's restorative effect, transepidermal water loss measurements were also carried out.

**Results:** Thirty-three patients completed the study. There were no adverse reactions. The reduction of symptoms and signs was significant ( $p < 0.001$ ). The complete recovery of the skin barrier was observed at the end of the study.

**Conclusion:** The study product was effective and safe in reducing the signs and symptoms resulting from superficial burns.

**Keywords:** burns; osmosis; symptoms, local.

### RESUMO

**Introdução:** O tratamento das queimaduras superficiais é basicamente sintomático, visando reduzir o desconforto dos sinais e sintomas e promover a reparação cutânea. Alguns estudos vêm sendo desenvolvidos avaliando os mecanismos de ação osmótica no processo inflamatório. Formulações com ação osmótica têm a capacidade de reduzir o exsudato inflamatório, diminuindo a sintomatologia e mesmo o risco de infecções.

**Objetivo:** Avaliar a ação de um hidrogel de ação osmótica de uso tópico na diminuição da sintomatologia da queimadura superficial, considerada de primeiro grau.

**Método:** Foram avaliados 35 pacientes com quadro de queimadura de primeiro grau. O produto teste foi aplicado na área lesada como monoterapia, sendo analisados sintomas (ardência e/ou queimação) e sinais (eritema e edema), por questionário e avaliação clínica, em cinco, 15 e 30 dias. Para a avaliação do efeito restaurador da barreira cutânea, foram realizadas medidas de perda de água transepidermica.

**Resultados:** Trinta e três pacientes terminaram o estudo; não houve reações adversas; a redução dos sintomas e sinais foi significativa ( $p < 0,001$ ); a recuperação completa da barreira cutânea foi registrada ao final do estudo.

**Conclusão:** O produto avaliado demonstrou eficácia na redução de sinais e sintomas decorrentes de queimaduras superficiais, exibindo perfil de segurança adequado.

**Palavras-chave:** queimaduras; osmose; sintomas locais.

## INTRODUCTION

Skin burns are traumatic lesions resulting from thermal (hot or cold), chemical, electrical, or radioactive effects. Depending on the length of exposure, the type of causative agent, and the extent and depth of the affected area, the lesions can assume various proportions.<sup>1</sup>

Burns are classified by four degrees, according to their depth.<sup>2,3</sup> In first-degree burns, only the epidermis – the superficial layer of the skin – is affected; because there is no vascularization in that layer, there is no bleeding. Although there may be pain and hypersensitivity, no blisters are formed. The tissular repair takes <sup>2-7</sup> days, with the desquamation of the epidermis. Treatment is primarily symptomatic, aimed at reducing the discomfort of the signs and symptoms and promoting skin repair.

In second-degree burns, the epidermis and part of the dermis are destroyed, leaving some epithelial islands with hair follicles and sebaceous glands that will serve as a foundation for the regeneration of the skin. Under normal conditions and without infections, tissue heals in <sup>10-14</sup> days in superficial second-degree burns and in <sup>3-5</sup> weeks in deep second-degree burns. The treatment involves local care, analgesics, anti-inflammatories, and possibly antibiotics.

In third-degree burns, the lesion affects the entire thickness of the epidermis, dermis, and subcutaneous tissue, with the possible involvement of the muscles. The wound – called an eschar – will be stiff and inelastic. Healing can only occur with epithelial growth from the edges of the wound; the use of a number of surgical grafting techniques using healthy skin from other areas of the body or skin banks are the treatments of choice in hospitals.

In fourth-degree burns, the lesion extends beyond the subcutaneous fat layer to other underlying tissue. The difference between third-degree and fourth-degree burns is sometimes difficult to determine, especially when there is an infection.

Measuring a burn lesion as a percentage of the body's surface area – with specific mapping for this purpose – is also used to classify burns.

Burns affect individuals of all ages and of both genders. The vast majority of burns are due to small domestic accidents – generally first-degree burns on small areas of the body, for example on the arms or other exposed areas.

Some studies have assessed the physical aspects of the mechanisms of osmotic action in the inflammatory process. Formulations with osmotic action can reduce inflammatory exudate, which in turn reduces the symptoms and the risk of infection.<sup>4,5</sup>

## OBJECTIVE

This study evaluated the action of a topical hydrogel with osmotic action (Osmogel<sup>®</sup>) in reducing the symptoms of superficial first-degree burns.

## METHODS

This prospective and open study evaluated 35 patients of both genders, aged 18-60, who had received first-degree burns of any etiology within the previous 72 hours. The patients were

seen between August and September 2011 at the Dermatology Department of Medcin Instituto da Pele (Osasco, São Paulo, Brazil).

The study was conducted in accordance with international standards for research in humans (Helsinki Declaration) and Resolution no. 196, of October 10, 1996 (and amendments), from the Brazilian National Health Council.

Patients with complications of exulceration, blistering/blisters or secondary infection were excluded. Pregnant women, nursing mothers, and patients with other concomitant dermatoses in the study area were also excluded. All patients were evaluated by a dermatologist physician to confirm the first-degree burn diagnosis, and no lesion exceeded 9% of the tegmental area. The patients were instructed to apply the test product on the affected area as a monotherapy, with light massage, two to three times a day. Patients were also informed that they would be contacted in five days to evaluate their symptoms (burning sensation) and signs (erythema and edema) and to describe any regression of the signs and symptoms using the following classification (0 = no regression; 1 = partial regression, 2 = significant regression, 3 = total regression). In addition to the initial dermatologic assessments, two others were performed (at 15 and 30 days after the procedure), when signs of erythema and edema were analyzed using a four-point scale (0 = absent, 1 = mild, 2 = moderate, 3 = severe).

To evaluate the restorative effect of the skin barrier, transepidermal water loss measurements were taken in the burned area at the beginning of the study, at 15 days and at 30 days (at the end of the study). The equipment used was the Tewameter TM 300 (Courage & Khazaka, Berlin, Germany).<sup>6</sup> Possible adverse events were also classified and followed up according to a four-point scale (0 = absent, 1 = mild, 2 = moderate, 3 = severe).

The Student t-test for paired data was used in the study. A 95% significance level was used to test the efficacy in reducing the criteria, with an 80% test power and a sample of 35 volunteers (drop out already taken into account). A standard deviation of 1.5 was calculated based on the databases of studies that measured the same variable, using the same scale. The difference between medians used to reject the null hypothesis was 0.75 points.

## RESULTS

Thirty-three (of 35) patients completed the study. One of the two excluded patients rapidly developed blisters and was reclassified as a second-degree burn, no longer meeting the inclusion criteria. The other patient was excluded due to missing scheduled visits.

No patients who completed the study presented any adverse reaction, either clinically observed or reported. Women (90%) and young adults were predominant in the sample studied (Figure 1). Regarding the etiology of the burn, 100% of the individuals in the sample studied were treated for thermal burns (stovetop flame, hot water or oil, etc.).

The mean degree of erythema and edema were measured to assess clinical efficacy.

### Erythema

Although the initial erythema was mild to moderate, there was significant improvement in average degree between 15 days ( $p < 0.001$ ) and 30 days ( $p < 0.001$ ).

In the telephone calls at day 7, 94% of the sample reported the total regression of erythema, while 6% had not yet obtained significant regression.

### Edema

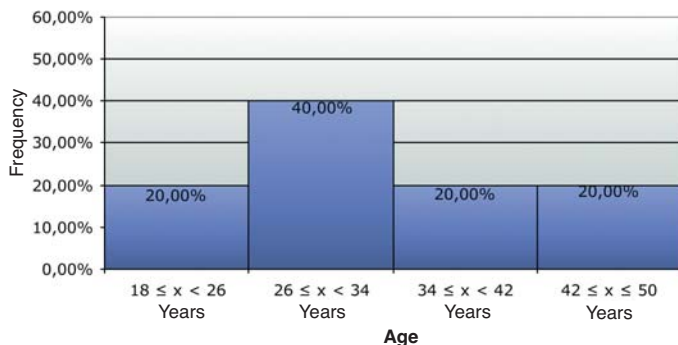
Mild edema was found in most patients, and also presented a significant reduction ( $p < 0.001$ ) at days 15 and 30.

In the telephone calls at day 7, the patients who achieved total improvement of erythema also reported total improvement of edema, while two patients did not observe significant improvement.

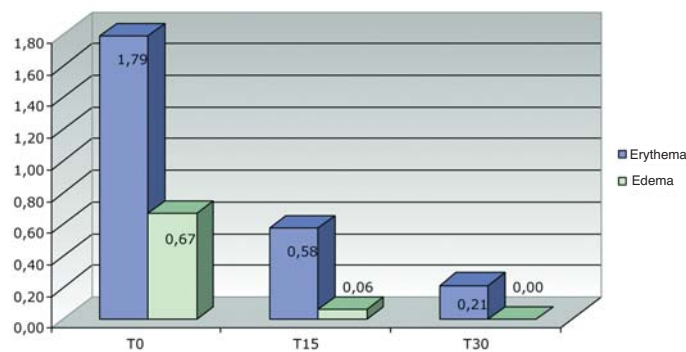
Graph 2 depicts the mean values at baseline (T0), at the intermediate visit (T15d), and at the end of the study (T30d). A reduction in mean value signifies an improvement of the symptoms.

### Burning sensation

The burning sensation was predominantly mild in the studied patients. In the day 7 telephone call, five (15%) patients reported a total improvement of the burning sensation, 18 patients (54%) reported a partial improvement, and 10 (30%) did not report an improvement.



Graph 1: Distribution of patients by age



Graph 2: Clinical evaluation: mean erythema and edema values during the study period

At the day 15 visit, 100% of the patients reported total improvement. The same happened at the final visit (T30), and the difference in means was significant ( $p < 0.001$ ), as shown in Figure 3.

### Transepidermal water loss: instrumental evaluation

Transepidermal water loss was elevated in all patients at baseline. There was a reduction in the mean values of the measurement at the day 15 evaluation (T15), however this reduction was not statistically significant. A significant improvement ( $p = 0.0014$ ) – the average of which was closer to measurements obtained in healthy skin – was obtained at the day 30 measurement (T30). The results are detailed in Graph 4.

### DISCUSSION

Osmosis is the diffusion phenomenon that occurs with the influence of molecular agitation, when two solutions of different concentrations are separated by a semi-permeable membrane that allows the solvent (but not the solute) to pass through, due to hypertonicity, as shown in Figure 1.

By exerting an osmotic effect on the inflamed tissue, the exudate is sequestered, which reduces inflammation, edema, and other signs of inflammation such as erythema and pain.<sup>7</sup>

This osmotic property causes an indirect microbicidal action through the dehydration of micro-organisms, preventing their proliferation. This action is not a physical effect, and therefore does not risk increasing the resistance of bacteria and fungi.<sup>8</sup>

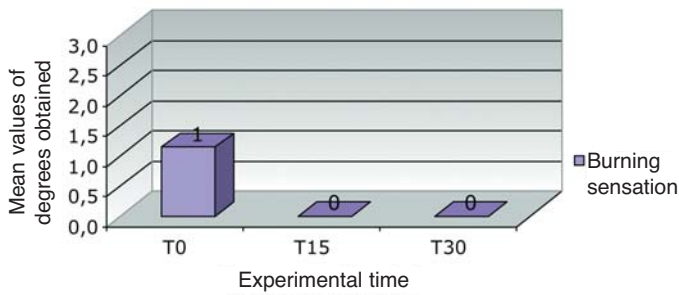
According to the osmolarity of the gel (osmotic effect) a molecular effect can be observed: the capture of water and glycerin. This mechanism attracts water (hygroscopicity) and therefore has a hydrating effect, so that when applied to the skin's surface, it helps to restore the skin barrier's hydric portion. It also helps reduce the local inflammatory response by relieving symptoms with a cooling effect.<sup>9</sup>

Products with osmotic effect have been used to treat chronic ulcers, due to their capacity to help control exudation and reduce the proliferation of micro-organisms.<sup>10</sup>

The study product is composed of molecules of glycerin, polyethylene glycol, octilenoglycol, carbopol, sodium hydroxide, and water in proportions that entail considerably high osmolarity levels, gauged at 1,277 mosmol/kg H<sub>2</sub>O (osmolarity is measured using a Roebbling microsmometer and compares substances to a 0.9% sodium chloride osmotic solution). The osmotic effect lends its characteristic osmotic strength to the substance, which is derived from its other properties.

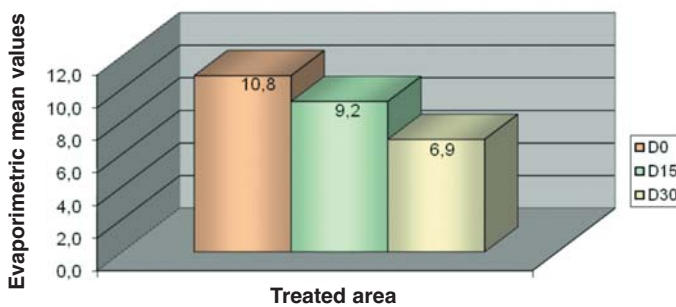
This physical mechanism has proven effective in treating mild to moderate intensity cutaneous inflammatory processes. Since it does not contain an active principle, the risk of adverse effects is minimized. It has also proven effective in repairing the cutaneous barrier, which was demonstrated through the progressive improvement in transepidermal water loss, even when the burn was not clinically evident.

First-degree burns are the most common. While they do not produce sequelae and tend to resolve spontaneously, they



**Graph 3:** Subjective evaluation: mean 'burning sensation' values during the study period

\* Statistically significant reduction ( $p < 0.05$ ) between D0 and D30



**Graph 4:** Transepidermal water loss: mean values at day 15 vs day 30

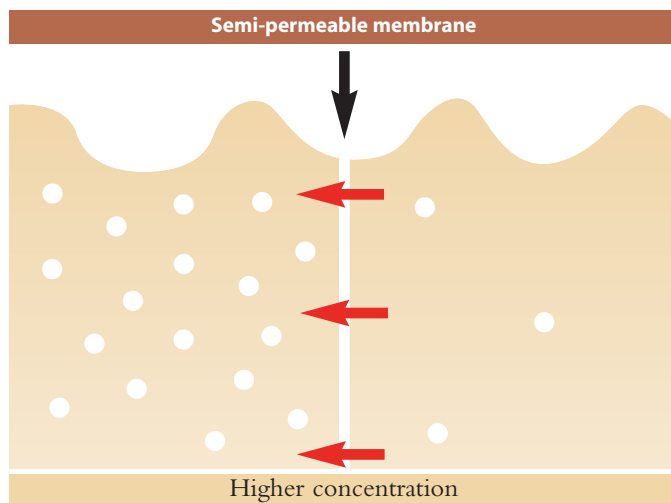
rier can take slightly longer – which may explain the longer duration of the milder burning sensation that was reported.

Patients with first-degree burns seek relief from their symptoms and a reduction in inflammation, which restores the cutaneous integrity. Although wet compresses provide momentary relief, they are inconvenient and only help reduce the temperature and cannot effectively treat inflammation.<sup>12</sup>

This study evaluated the safety and efficacy of a formulation with osmotic effect on inflamed skin. Further comparative studies must be carried out with other treatment modalities, or even second-degree burns or other dermatoses with mild to moderate inflammation, such as insect bites or sunburn.

**CONCLUSION**

The study formulation helped reduce the signs and symptoms resulting from superficial burns, possibly due to its powerful osmotic effect. It was proven to be tolerable and safe in the group studied. ●



**Figura 1:** Movimento osmótico: Esquema ilustrativo

may cause discomfort – especially when involving more extensive areas, such as sunburns.<sup>11</sup>

The results obtained in this study show that the daily use of the evaluated substance significantly reduced the signs and symptoms of first-degree burns. It was also demonstrated that although the signals' strength recedes quickly, repair of the cutaneous bar-

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