Interest of an active rinsing solution for the decontamination of ocular corrosive splashes

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Introduction

Severe eye burns occur rarely, but are related to a poor prognostic in rehabilitation. An emergency treatment has been identified as a decisive factor for decreasing burns (1), *in vitro* and *in vivo* experiments have been performed to show the interest of the use of an emergency active rinsing solution, as Diphotérine® (2), in comparison with water and saline solution.

Materials and methods

The *in vitro* studies are performed to show the mechanical effect of a rinsing solution, the influence of its hypertonicity (3) and its efficacy of decreasing the aggressiveness of common corrosives. Among the vitro studies described, the first step is to evaluate the efficacy of the rinsing solution on the aggressiveness of a chemical product by a simple dosage of 1 milliliter of a corrosive, sodium hydroxide or hydrochloric acid by an increasing volume of the rinsing solution, Diphotérine versus water. A model of semi-permeable membrane was used to simulate both external and complete rinsing of the eye and cells culture were used to show the influence of hypertonicity on the diffusion and the necrotic effects of corrosives. The following carrying up represents the experiment of the simulation of the external rinsing (Fig. 1) where the pH value is measured each two seconds and the simulation of a complete rinsing (Fig. 2). In this experiment 50 milliliters of sodium hydroxide 1N and 25 milliliters of saline solution (NaCl 0.9%) are put in contact through a semi-permeable membrane. The sodium hydroxide is the chemical aggressor and the saline solution represents an internal physiological compartment.

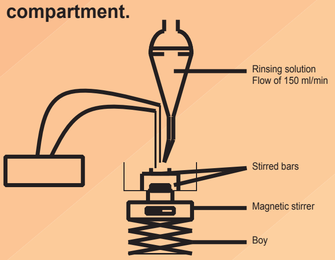


Fig. 1 : Simulation of an external rinsing

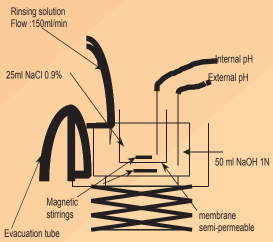


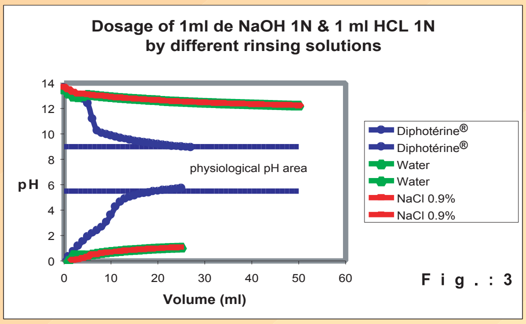
Fig. 2 : Simulation of a complete rinsing

An experimental study (4) on New Zealand albino rabbits was conducted to analyse the delay for ocular rinsing in the treatment of severe ocular burns due to ammonia 15.3%. Two solutions of ocular wash, saline solution and Diphotérine® were compared.

Results

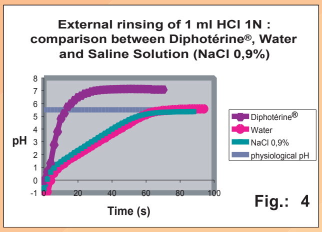
In vitro experiments

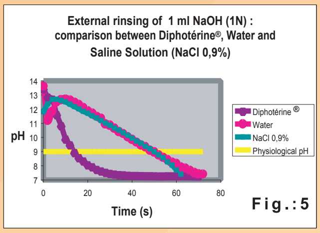
1. COMPARATIVE DOSAGE OF CORROSIVES



Results : Only a small volume of Diphotérine® is needed to return to a physiological pH value where no chemical burn can appear. With the water or saline rinsing, there is no effect on the corrosivity of the chemical product.

2. SIMULATION OF AN EXTERNAL RINSING





Results : For both acid (Fig.: 4) and base (Fig.: 5) rinsing, it takes less than 20 seconds to return to a physiological pH value with Diphotérine®, and about 50-60 seconds to reach the same physiological pH value with a water or saline rinsing.

3. SIMULATION OF A COMPLETE RINSING

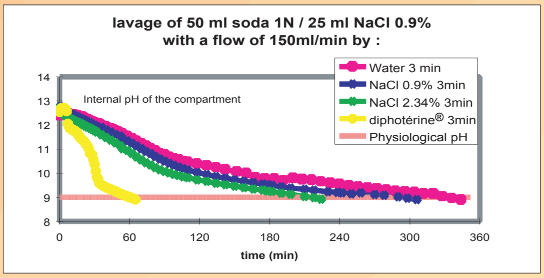
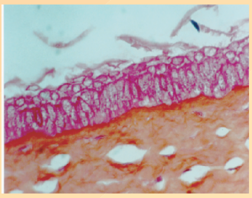


Fig.: 6

Results : This experiment (Fig.: 6) shows the effects of the osmotic pressure and absorption properties of the rinsing solution. The results show that the hypotonic solution, water, is less efficient. The isotonic solution (NaCl 0.9%) is a little bit better than water but the use of an hypertonic solution (NaCl 2.34%) improves the quality of the rinsing. With the same osmotic pressure, the decontamination with Diphotérine® is quicker thanks to its amphoteric properties.

In vivo experiment



Results : An inflexion of the pH was observed for Diphotérine® rinsing as compared to the *in vitro* experiments described above. No stromal oedema was observed for Diphotérine® rinsing but it was observed for saline solution.

Fig. 7: Pathological anatomy of the cornea with a saline solution rinsing, 3 minutes after the burn with ammonia 15.3%

Conclusion

The *in vitro* and *in vivo* experiments showed the importance of using an active rinsing solution such as Diphotérine® (5). It allowed a quick return to a physiological pH, stopping both the penetration and the aggressiveness of the corrosive. No oedema was observed when a rinsing with Diphotérine® was used for the decontamination of the ammonia burn and it was observed in the case of saline rinsing solution.

References

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