

CHEMICAL BURN SEVERITY AND HEALING: Impact of the decontamination

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AIM

Chemical eye/skin burns results in serious injuries. Traditional decontamination solutions such as water can decrease the severity of such burns, but do not always prevent injury. Presented here are the results obtained with an active chemical splash decontamination solution, Diphoterine[®] versus water or saline solution. Diphoterine[®] is an amphoteric and hypertonic washing solution, active on corrosives and irritants. Specifically for HF burns, decontamination methods are also evaluated. Hexafluorine[®], an active washing solution specific to HF splashes is compared to 2 reference solutions: tap water and a calcium gluconate solution.

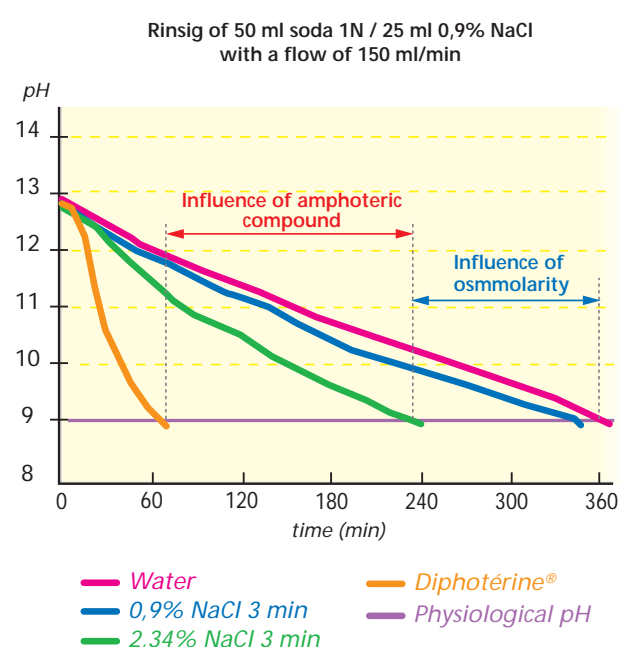
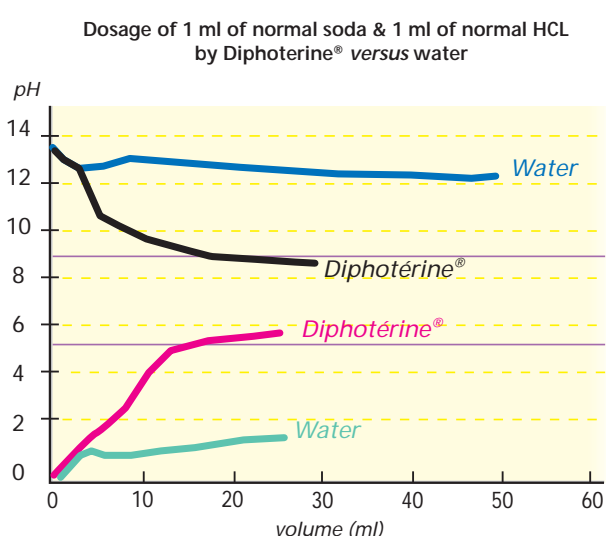
METHODS

A review of published literature and other available information on eye/skin chemical splash decontamination was conducted:

- first with Diphoterine[®] versus water and normal saline,
- and then with Hexafluorine[®] versus tap water and calcium gluconate.

RESULTS

1. IN VITRO STUDIES

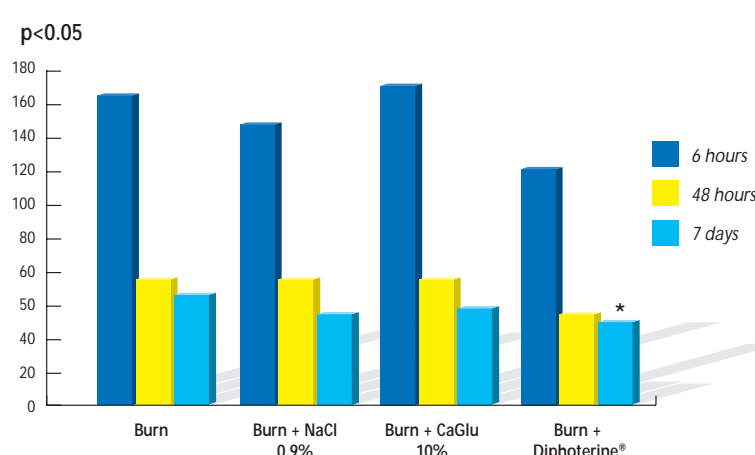
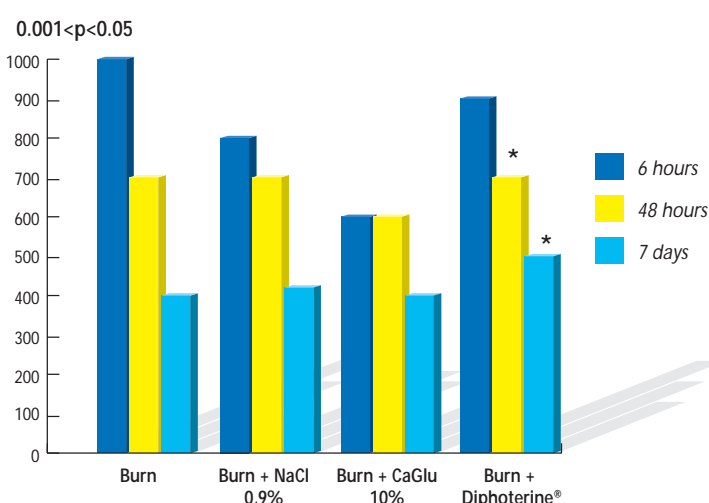


Diphoterine[®] versus water or saline solution permitted a rapid return to a physiological pH value [1].

2. IN VIVO STUDIES

IL₆ significantly decreased and different (*) with Diphoterine[®] compared to all the treatments at 48 h, and 7 days

β-endorphin increased and is significantly different (*) with other groups after 7 days, p < 0.05



Recent in vivo studies in rats [2] have showed that when an active decontamination solution, Diphoterine[®], was used instead of normal saline, the chemical burning process was stopped, inflammation and pain were significantly decreased and tissue repair was improved.

3. CASE REPORTS

> EFFECTIVENESS OF DIFFERENT DECONTAMINATION SOLUTIONS ON SPLASHES DUE TO BASES.

RINSING SOLUTION	DIPHOTERINE [®]	ACETIC ACID	WATER
No secondary care ^a	100% ± 15	0% ± 15	0% ± 15
Simple secondary care	0% ± 15	80% ± 15	25% ± 15
Medical secondary care	0% ± 15	20% ± 15	75% ± 15
Number of days of work loss	0.18% ± 0,4	2,91% ± 4,3	8% ± 8,12

Secondary care : care required other than initial decontamination.

> EVALUATION OF WATER VS. DIPHOTERINE[®] RINSING AT ATOFINA (TOTAL PETROCHEMICALS), FRANCE

RINSING	WATER	DIPHOTERINE	P
With lost work time	7 (3,4%)	0	<0.05
Without lost work time	198	170	
No need for secondary care	68 (52%)	88 (33%)	<0.05
Need for secondary care	137	82	

> REPORTED CASES DECONTAMINATED WITH DIPHOTERINE[®]: NO SEQUELAE

YEAR	CASES	FIRM/COUNTRY	EXPOSURE	BODY SURFACE AREA
1999	1	Knoll AG, Germany	96% sulfuric acid	Cheek
1998	1	Giesecke & Debrient, Germany	100% nitric acid	Hand
1995	1	Metaleurop, Germany	96% sulfuric acid	Face + neck
1994	1	Stockhausen, Germany	100% acrylic acid	Leg
1993	1	Mewa, Germany	50% soda ^{a,b}	Forearm
1991	1	Aluisse, France	Soda flakes	Left eye
1991	2	Orgachim, France	98% sulfuric acid	Face + neck + shoulders; face + neck + shoulders + legs

a : Soda = sodium hydroxyde / b : cream ointment for the first exposure

In the work place, Diphoterine[®] versus water proved to be more efficient for emergent decontamination.

4. CLINICAL STUDY^[3]

Use of Diphoterine[®] in delayed washing at the hospital in the initial hours following an accident. In this protocol a first rinsing is carried out as soon as the patient is treated at the hospital. The study compares, for equivalent grades of ocular burns, the differences which occur after rinsing with Diphoterine[®] versus rinsing with saline solution before treatment of a burn due to an alkaline chemical.

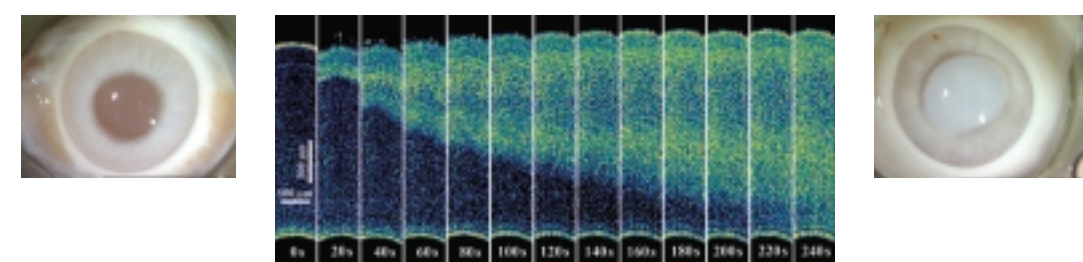
> RESULTS OF A CLINICAL STUDY IN MARTINIQUE OF OCULAR BURNS DUE TO BASES

RE-EPITHELIALIZATION TIME IN DAYS	DIPHOTERINE [®]	SALINE SOLUTION	P-VALUE
Grade I	1.9 ± 1	11.1 ± 1.4	p < 10 ⁻⁷
Grade II	5.6 ± 4.9	10 ± 9.2	p < 0.02
Grade III	20 ± 14.1	45.2 ± 23	0.21 NS

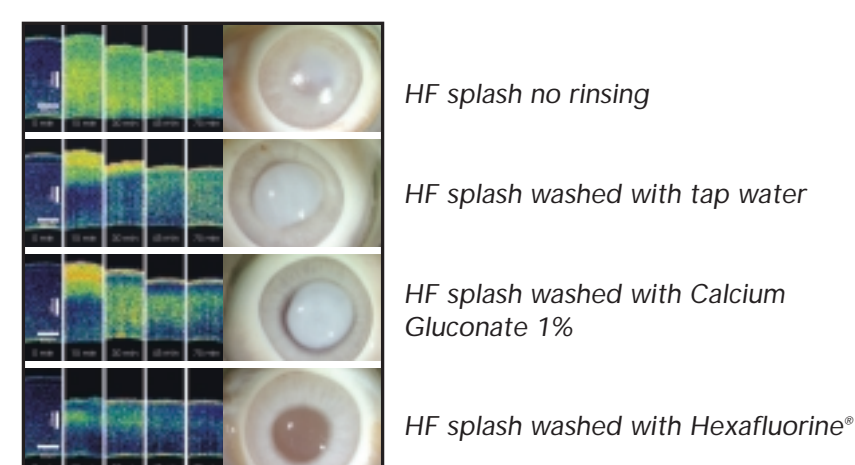
5. HF BURNS

> HF PENETRATION THROUGH THE CORNEA: EX VIVO STUDY

OCT time series after topical application of 25 µl of 2.5% HF. The change in the scattering cross section induced by the chemical is imaged.



The penetration velocity is decreasing with time due to dilution. Full corneal penetration is observed 240 s after topical application.



This study shows a clear cornea, even one hour after the end of the washing, only when Hexafluorine[®], an active washing solution, specific for HF and its derivatives, was used.

REFERENCES

- [1] Mathieu L & al., JCHAS, 2007, 14(4), 32-39 - [2] Cavallini M & al., Anesthesiology 2004; 21:389-392 - [3] Merle H & al, Burns 2005; 31:205-211 - [4] Spöler F & al, Burns, 2007 Sep 13; [Epub]
- Conflicts of Interest and Financial Disclosures
- Hexafluorine[®] is manufactured by PREVOR.
- The authors are employed by PREVOR

CONCLUSION

Compared to traditional references, recent studies of eye/skin chemical splash decontamination with active solutions such as Diphoterine[®] or Hexafluorine[®] have demonstrated improved efficacy.

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