The chemical burn

The aggressive chemicals

Two categories of chemicals can provoke a burn by a direct contact: corrosives and irritants. The seriousness of the chemical burn depends on the number of cells destroyed and will be more significant in the case of corrosives. In some cases, the aggressive product can also have toxic or harmful effects, the consequences of which should not be neglected.

The mechanism of a chemical burn

The action of soda NaOH:

A chemical burn is caused by the capability of corrosives and irritants to create an exchange (ion, proton, electron...) with the tissues of the skin or the eye. The degree of the burn will depend on the number of molecules destroyed and on the type of modification (reversible or irreversible).

* Picture source: ACTO, Prof. Norbert Schrage, Aachen.
The principles of emergency washing

To stop the aggressive reactions

- There are 6 types of aggressive chemical reactions

- Acid
- Basic
- Oxidising
- Reducing
- Solvent
- Transfer

To be effective regardless of the type of accident and to avoid the risk of error for the victim, it is necessary to be able to stop these 6 aggressive reactions.

A POLYVALENT PRODUCT IS ESSENTIAL

To stop the evolution of the burn

A chemical burn is initiated by the contact between the aggressive product and the skin or the eye. Following this contact, a part of the aggressive chemical will penetrate into the tissue and cause destruction of the cells.

To effectively decontaminate the splash, it will be necessary, not only to decontaminate the product on the surface, but also to control its penetration inside the tissue.

A PRODUCT ABLE TO STOP THE AGGRESSIVE CHEMICAL IS ESSENTIAL

- Factors influencing the penetration
  - The type of product and its concentration
  - The temperature
  - The length of exposure time
First-aid treatment: From water...

- **The principles of washing with water**
  - a washing of the surface to remove quickly the aggressive product
  - the dilution of the chemical to reduce its aggressiveness
  - a universal product avoids the risks of error at the time of the accident

- **What are its limitations?**
  - the concentrated products which penetrate very quickly
  - the intervention time of 10 seconds which is not always achievable
  - the washing comfort: risk of hypothermia under a water shower
difficulty to open the eye

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**Healthy cells as seen under a microscope.**

**The beginning of washing: water penetrates inside the cells and makes them expand.**

**The end of washing: cells are destroyed because water causes them to burst.**

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**Ex vivo test on the eye**

**Efficacy of the active washing with DIPHOTERINE® solution:**

**Ex Vivo EVEIT Model - OCT**

Rabbit corneas, 16 minutes after an application of 500 µL 1M NaOH for 20 s.

- a) without any washing
- b) with DIPHOTERINE® solution washing

Corrosive penetration is stopped. The structural changes in the stroma are negligible. The endothelium is completely preserved.

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**The ideal product in case of a chemical splash must:**

- Retain the advantages of water:
  - Fast washing of the surface
  - Single protocol

**DIPHOTERINE® solution is recognized as a reference solution by the SFO, French Society of Ophthalmology and the DOG, Deutsche Ophthalmologische Gesellschaft.**

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**EXPERIENCE FEEDBACKS:**

**Result on the eye with a delayed washing**

**DIPHOTERINE® solution a better healing**

> Ammonia ocular burn, washed with 1 litre of DIPHOTERINE® solution within one hour after the splash and 6 months of appropriate care, the victim regained a visual acuity of 14/20 without requiring a corneal graft, a first in the history of medicine.

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*photo: ACTO, Pr. Norbert Schrage, Aix la Chapelle*

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*Sources: Burgher, Mathieu, Fosse, Rihawi, Gérard, Merle, Schrage, Ocular chemical burn: Experimental proof of the influence of key parameters on the diffusion and the decontamination. 114<sup>th</sup> Congress of the SFO Paris May 2008.*

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*Rabbit corneas, 16 minutes after an application of 500 µL 1M NaOH for 20 s.*

a) without any washing

b) with DIPHOTERINE® solution washing

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*photo: ACTO, Pr. Norbert Schrage, Aix la Chapelle*
...to DIPHOTERINE® solution

- The principles of washing with DIPHOTERINE® solution

- It is a liquid which enables it to obtain the same effect as water on the surface of the skin or eye.
- DIPHOTERINE® solution is an amphoteric chelating agent, which enables it to stop the aggressiveness of the chemicals in a polyvalent way (for HF and its derivatives, use the HEXAFLUORINE® solution).
- DIPHOTERINE® solution mechanism can be illustrated as follows:

1. The principles of washing with DIPHOTERINE® solution
   - ACID
     DIPHOTERINE® solution will attract the chemical in contact with the tissues.
   - BASE
     The acid site of DIPHOTERINE® solution will fix bases to make them harmless.
   - ACID
     The basic site of DIPHOTERINE® solution will fix acids to make them harmless.

- DIPHOTERINE® solution, unlike water, will stop the penetration of the chemical.

Healthy cells as seen under a microscope.

Beginning of the washing with DIPHOTERINE® solution: the cells contract slightly.

End of the washing: the cells are preserved.

EXPERIENCE FEEDBACK:
Results on the skin in emergency

Independent retrospective study conducted by Dr Donaghue, chief medical officer of Alcoa Australia (alumina refineries). It covers 180 cases studied from May 1st 2005 to April 30th 2008, specifically on the skin.

- Assessment before washing with DIPHOTERINE® solution: grade IV burn on the Roper-Hall scale, which usually requires a corneal graft to achieve healing.
- After a washing with 1 litre of DIPHOTERINE® solution within one hour after the splash and 6 months of appropriate care, the victim regained a visual acuity of 14/20 without requiring a corneal graft, a first in the history of medicine.

Results on the eye with a delayed washing

DIPHOTERINE® solution retains an interest in delayed washing for:

- Guarantee a total efficacy whatever the product
- Increase the intervention time
- Improve washing comfort to increase the effectiveness


Severity scale and associated signs

<table>
<thead>
<tr>
<th>Severity scale and associated signs</th>
<th>FIRST AID EMERGENCY SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (no sign)</td>
<td>First washing with a DIPHOTERINE® DAP</td>
</tr>
<tr>
<td>2 (erythema)</td>
<td>52,9% (73 cases)</td>
</tr>
<tr>
<td>3 (blisters)</td>
<td>39,1% (54 cases)</td>
</tr>
<tr>
<td>4 (more serious)</td>
<td>7,2% (10 cases)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100% (138 cases)</td>
</tr>
</tbody>
</table>

Criteria used:

1 : Time elapsed between the chemical splash and clinical evaluation.
2 : Time elapsed between the chemical splash and application of DIPHOTERINE® solution.
3 : Percentage of skin surface affected by the chemical.
How to use
A sterile washing solution

Dispensers for the skin, in the form of micronised sprays (optimising the surface of contact)

1/ Go away from the danger
2/ Get undressed

> To decontaminate an entire body
Typical equipment for locations where there are large quantities of chemicals:
- Production areas
- Warehousing areas
- Off-loading and decanting areas

> To decontaminate a face or an arm
An ideal complement for a Wall Mounted Eyewash, where the quantities of chemicals are limited:
Laboratories

> To decontaminate a hand
Ideal personal equipment for small splashes:
Workshops
Maintenance personnel

Washing must begin within the first minute following the splash

ALL THESE PACKAGES MEET THE NEW EUROPEAN STANDARD EN 15154 PARTS 3 AND 4
DIPHOTERINE® solution?
To be used immediately after the accident

Dispensers for the eyes, equipped with an ergonomic eyecup, which assists the opening of the eye for a more effective washing.

OPEAN STANDARD EN 15154 PARTS 3 AND 4

> Kit for chemical splashes
In areas where fixed equipments are appropriate:
- Laboratories
- Production areas
- Warehouse areas
- Decanting areas

> To decontaminate an eye
To carry on oneself or to put in the work area:
- Laboratories
- Warehousing areas
Portable eyewash: when the equipment must be mobile: first aid kits, emergency vehicles, infirmaries

> Personal equipment to decontaminate an eye:
Ideal for the maintenance personnel
Imperatively worn by individual

Washing must begin within the first minute following the splash

Protocol for the first aid intervention with DIPHOTERINE® solution in the event of a chemical splash

1/ Alert
2/ Wash as quickly as possible, from your face to your feet, by using the eyewash
3/ Wash as quickly as possible, respecting the instructions for use of DIPHOTERINE® solution
4/ Alert
5/ Seek medical advice
WE HELP YOU TO FACE CHEMICAL HAZARDS

01 Understand chemical products
   - DIAGNOSE
   - MASTER
   - DEEPEN
   - ANALYZE

02 Find solutions
   - SAFETY
     - DECONTAMINATION
     - PROTECT
   - HEALTH
     - ANTICIPATE
     - SAVE
   - ENVIRONMENT
     - NEUTRALIZER/
       - ABSORBER
     - MAKE THE
       - COLLECTION EASIER
     - MANAGEMENT
       - ASSISTANCE

03 Advise
   - ACCOMPANY
   - UNIVERSITY TEACHING
     - TRANSFER
       - KNOWLEDGE
     - SHARE
     - STANDARDISATION
     - TRAIN

References
They are trusting us

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