Eye rinsing after severe eye burn:

The effect of different rinsing substances on burnt eyes and tissues

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Introduction: Eye burns should be treated immediatly with rinsing. Besides water there are special solutions being designed or recommended for emergency rinsing. We wanted to compare and evaluate their buffering capacity, the effect on intraocular pH and the effect on healthy cells in vitro.

Methods: Buffering capacity was measured by means of titration of 0.5 mol HCl or NaOH in steps of 5 ml addition of the rinsing solution in a beaker glass.

Eye burns were simulated by 20 sec corneal exposure to 2 n NaOH soaked into a filter paper taking exactly 50 ul. Each 5 rabbit corneas freshly taken from abbatory. Rinsing started immediately after burn with 66 ml/min for 15 minutes. Anterior chamber pH was measured by means of a needle pH electrode placed directly behind the corneal central endothelium (Fig. 3).

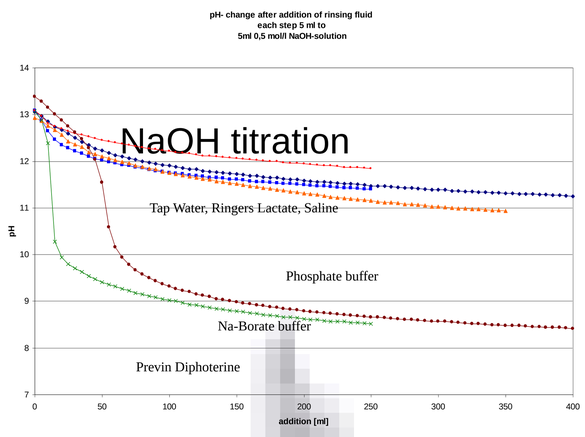
Materials: We used Ringers Lactate, Cedderoth Eye Wash solution, Diphoterine, isotonic phosphate buffer, Previn, 0.9% Saline solution and Tap water. As controls we used non treated burnt eyes.

Results: In Beaker experiments with alkali NaOH (Fig. 1) we found water, saline and phosphate buffer as diluting agents and Cedderoth Eye wash, Previn and Diphoterine with high buffer capacities;

In acid experiments with HCl (Fig 2) we found water and saline diluting. Previn and Diphoterine showed high buffering capacities.

In alkali eye burns of rabbit eyes we could give proof of slow diffusion. There was no buffering at all in saline (Fig. 6) and phosphate buffer (Fig 7). Water diluted and showed in the beginning of rinsing lower intracameral pH (Fig. 5). Most effective buffering was shown by Diphoterine (fig. 10), Previn (Fig 9) and Cedderoth eye wash solution (Fig. 8).

Discussion & Conclusion: Effectiveness of buffering is one major characteristic to return the intraocular pH to normal. This cannot be achieved by diluting but by active components like diphoterine or the alkali binding borate buffer. Phosphate buffer in the here used concentration was not effective. We recommend as first aid in eye burns polyvalent rinsing solutions treating acid and alkali burns.



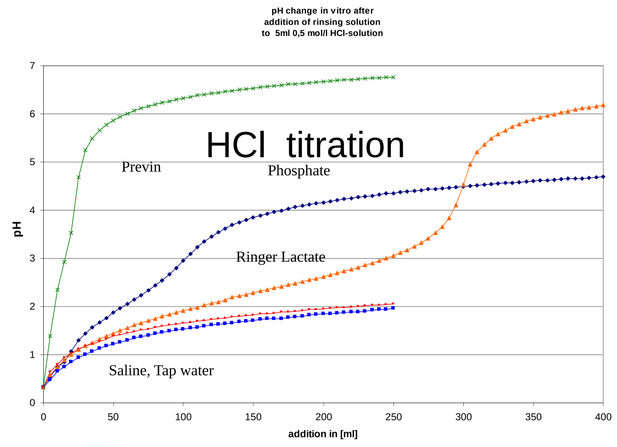
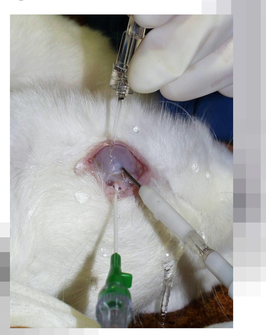
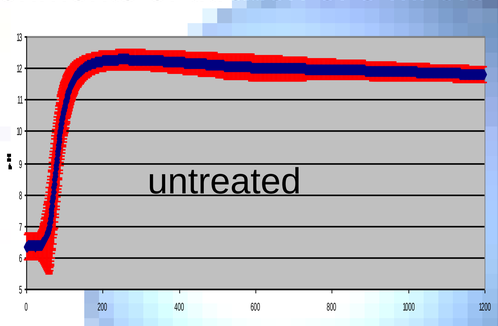


Fig 1&2: beaker experiments of titration of 5 ml 0.5 mol NaOH and HCl





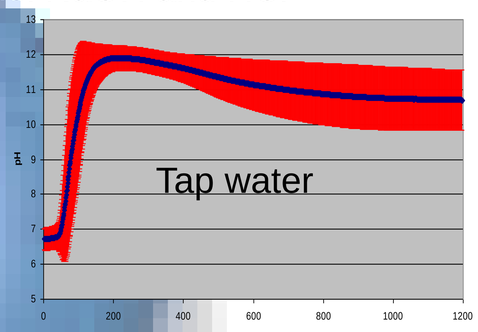
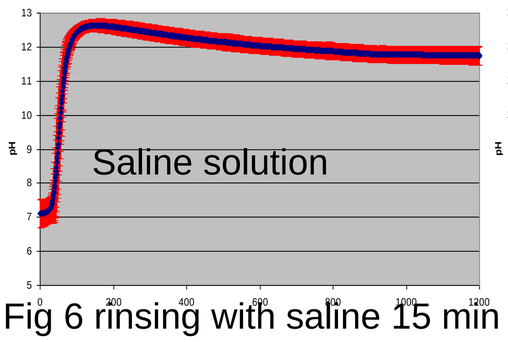
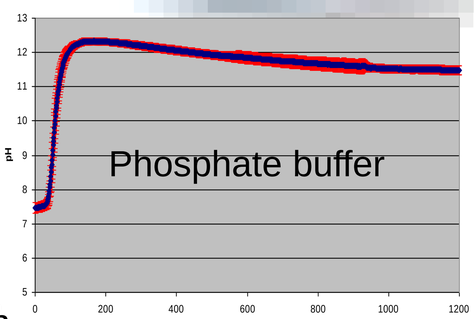


Fig 3: Eye burns experiments on rabbit heads, Electrode placed beyond the central endothelium in anterior chamber.

Fig. 4: Untreated eye burnt with 2 n NaOH 20 sec. 50 ul filter paper, n=5 mean and STD

Fig. 5: Treatment after burn with 15 min rinsing with Tap water 66 ml /min n=5 mean and STD





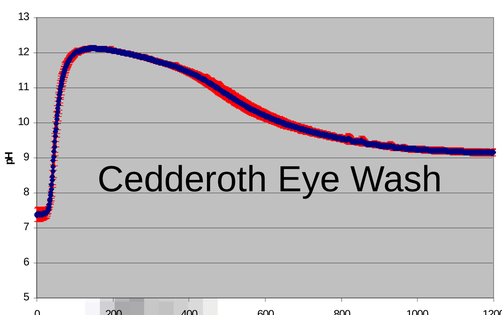
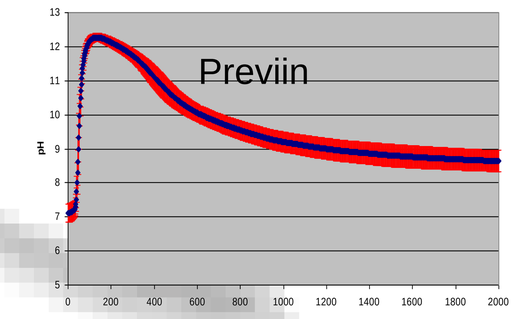
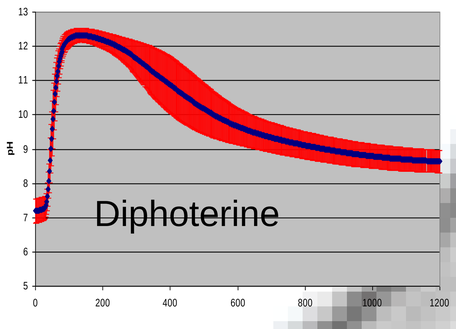


Fig 6 rinsing with saline 15 min n=5 mean and STD

Fig. 7: rinsing with phosphate buffer 15 min n=5 mean and STD

Fig. 8: rinsing with Cedderoth Eye Wash solution 15 min n=5 mean and STD





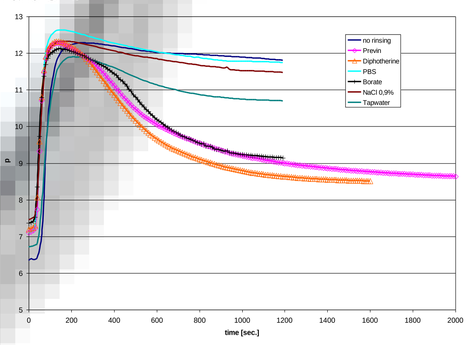


Fig. 9 rinsing with Previn 15 min n=5 mean and STD

Fig. 7: rinsing with Diphoterine 15 min n=5 mean and STD

Fig. 8: comparison of all rinsing fluids leaving out standard deviations

Financial interest: All work has been supported by donations of Cedderoth, Prevor, Winzer.

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Publications:

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