Hydrofluoric acid (HF) burns: a new efficacious model with *ex vivo* BIO-EC human skin explants

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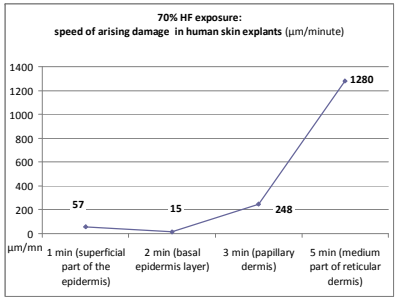
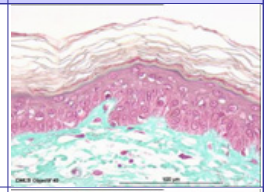
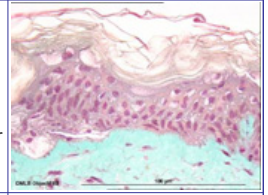
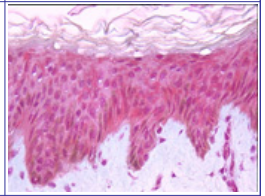
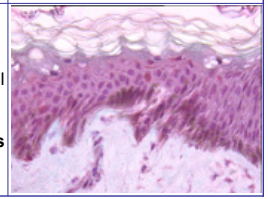
Objective

Hydrofluoric acid (HF) very hazardous properties are due to a double mechanism of action: corrosivity (H^+), local and systemic toxicity (F^-). A new efficient skin model will allow a better understanding of burn mechanisms and in the future a comparison of first care treatments.

Results

Duration of exposure	Microscopic morphology
1 min	Beginning of the attack in the higher part of the epidermis
2 min	Attack of the basal layer of the epidermis
3 min	Epidermis completely damaged. First lesions of the papillary dermis (superficial part of the dermis)
4 min	Epidermis completely damaged. Clear attack of the papillary dermis
5 min	Epidermis completely damaged. Beginning of attack of the reticular dermis (deeper layer of the dermis)



Time of exposure	Description	Histological views
20 seconds	Good morphology (No cellular alteration)	
5 min	Epidermis and papillary dermis clearly altered. Some pyknotic nuclei in the reticular dermis. **Alterations reach slightly reticular dermis.** Beyond ten minutes, all four layers present significant alterations.	
1 hour	Pyknotic nuclei and acidophilic cytoplasm in all layers. **Lesions remain stable until the final observation**	
24 hours	Epidermis totally necrotic. Pyknotic nuclei and acidophilic cytoplasm in all layers. **Total epidermal necrosis can be observed.**	

Methods

59 human skin explants prepared from abdominoplasties were preserved alive during all the experiments in a specific BIO-EC medium at 37° C in a moist atmosphere with 5 % CO_2.

HF exposure: By topical route from filter paper disks (9 mm diameter) previously saturated with 30 µl of 70 % HF.
Control group: no exposure.

Histological sampling at different times, from 1 minute up to 24 hours.
Observations were performed by optical microscopy X40.

Reproducibility guaranteed by triplicate for the early part (20s to 5 minutes) and duplicate for the later observations (5 minutes to 24 H).

Conclusion

Under these experimental conditions the human skin explant model is reproducible and describes the first cellular deteriorations due to 70 % HF that appear within the first minute. Full penetration is observed within 5 minutes.

The study confirms the severity and the speed of penetration of 70 % HF burns and the lesions showed by our model are in perfect accordance with both experimental data and reports of previous accidental situations. It underlines the need for early decontamination.

Moreover, this model, reacting very similarly to the practice concerning HF burns, is in accordance with new European regulations such as REACH or Cosmetics regulations. Further experiments will be performed to show the efficacy of various decontamination solutions.