Oscar: A Tool for Therapeutic Education to Approach the Pharmacokinetic Concepts in haemophilia

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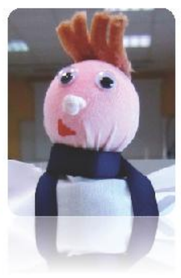
INTRODUCTION AND OBJECTIVES

- Therapeutic education (TE) aims to teach young haemophiliacs **key-concepts allowing comprehension of substitution strategies and respect of treatment plan in order to improve adherence to clotting factor concentrates (CFC) injection**.
- For this purpose, we conducted a study to develop an educational tool and a playful TE session.

METHODS

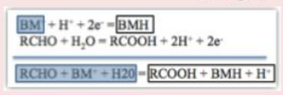
- To picture these concepts to an audience of 6 to 12 years children, a bottle disguised as a Muppet represents the child.
- We used colored solutions of different concentrations in plastic bottles and a redox chemical trick known as "the blue bottle reaction" to illustrate major pharmaceutical considerations in haemophiliacs: **substitution of lacking factor, its degradation kinetic within the body and therapeutic attitude towards an inhibitor.**



RESULTS

Preparation step before TE session

- First, prepare a **stock solution of methylene blue (MBS)** for steps 1, 2 and 3. The blue colour represents the VIII/IX clotting factor (biological or drug)
  → Add 15 mg of methylene blue powder to 100 ml of purified water.
- Then, prepare a **range of 3 blue coloured solutions** in 250 ml G5 bottles (glucose 5%) for steps 1 and 2.
  → Add 12, 3 and 0,5 ml of MBS in each G5 bottle, respectively. A colorless bottle will picture severe haemophiliac (<1% VIII or IX factor) or a complete elimination of CFC.
- Finally, prepare the **redox reaction** bottle ("the blue bottle reaction") for the step 3.
  → Add 6 ml of 30% sodium hydroxide solution to 250 ml G5 bottle.
  → After injection of 2 to 10 ml of MBS, the blue colour gradually fades-out, picturing an inhibitor's effect on CFC.
  → The reaction may be reproduced with addition of MBS and/or simultaneous vigorous agitation.
  → Prepare a second coloured solution with another dye that does not react with glucose or in a basic solution (e.g., erythrocin for a red color or patent blue).

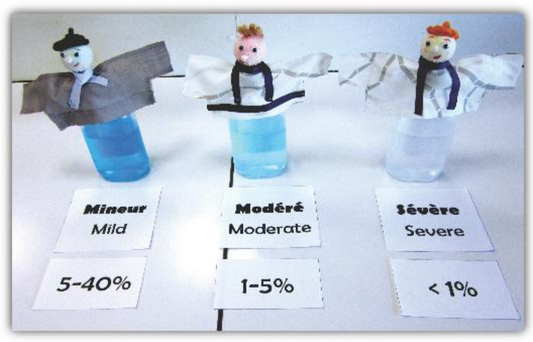


1 The TE session was divided in three parts:

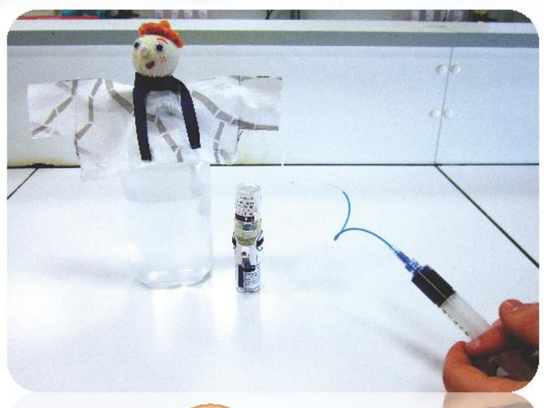
haemophilia severity degrees and replacement therapy concepts

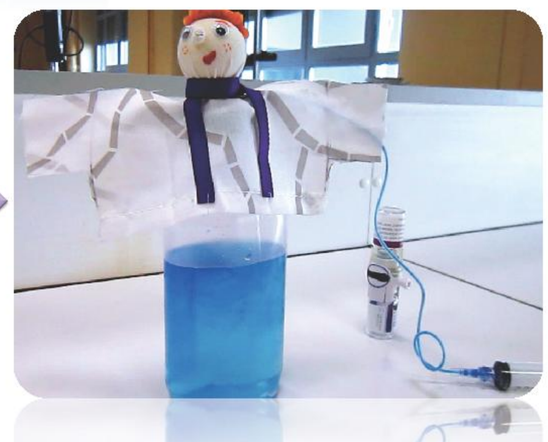
A dark blue coloured bottle pictures the non-haemophiliac, who has clotting factors and a blue-to-transparent colorimetric scale figures haemophiliacs of different severity degrees that could be supplemented by CFC injection (i.e., addition of MBS).

haemophilia and severity degrees



Replacement therapy

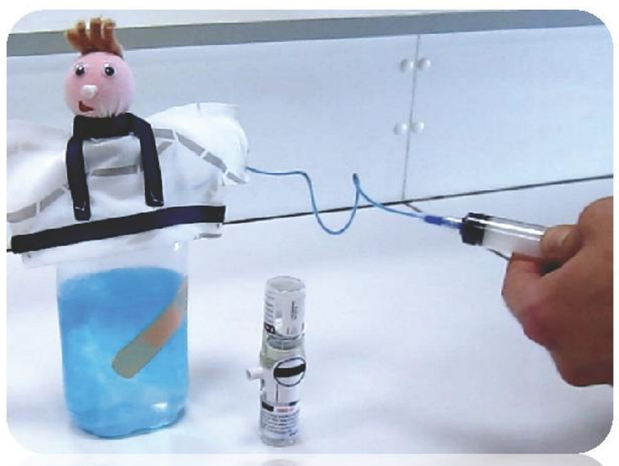




2 Drug elimination in the human body and therapeutic strategies concepts

Degradation kinetic of injected CFC was illustrated with a blue-to-transparent colorimetric scale in bottles. Each child treated by prophylaxies was individually invited to arrange bottles on a weekly time-line according to its own treatment plan. The visualization of drug elimination helps to explain the need of a new CFC injection.

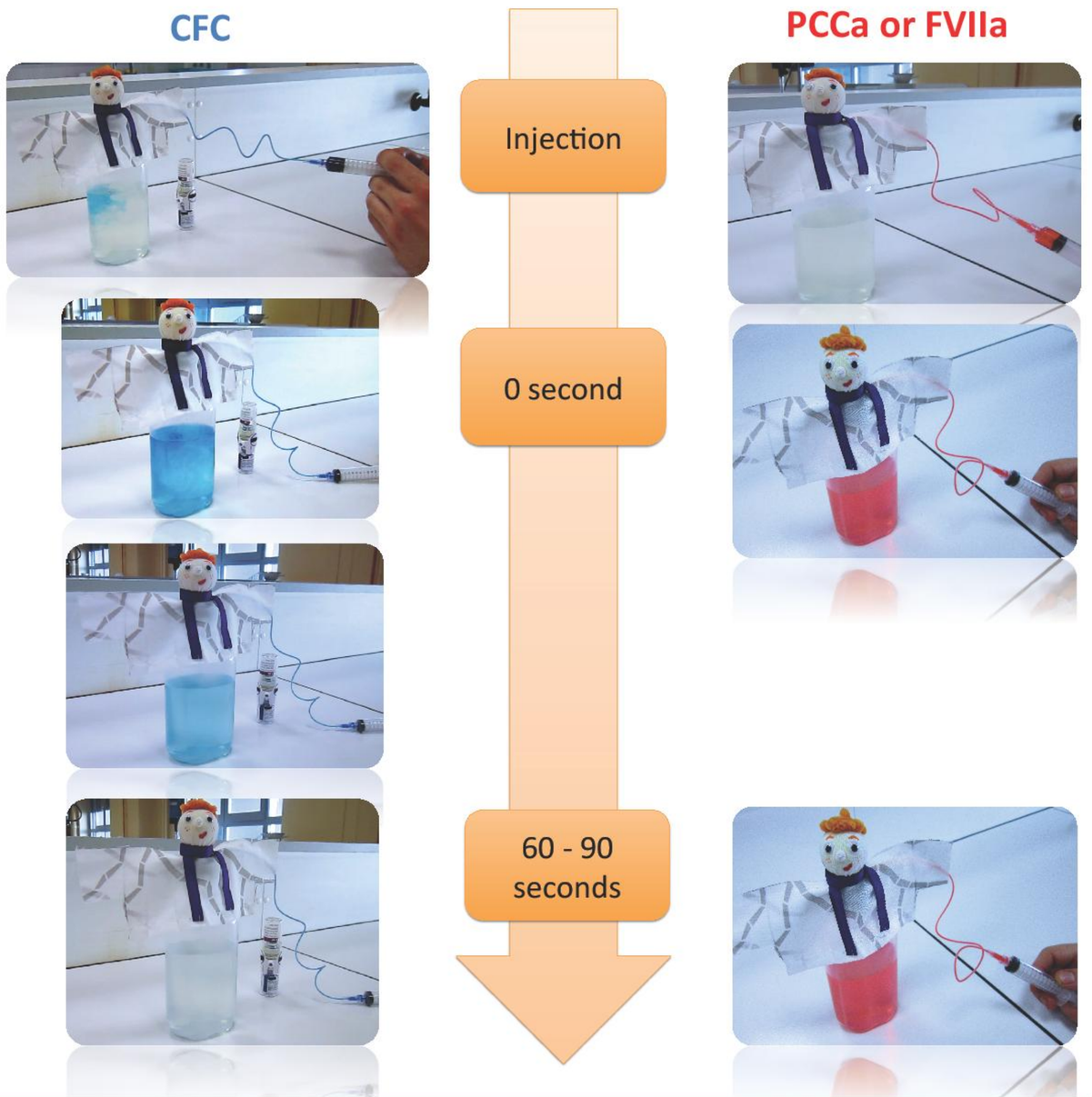
On demand treatment



Prophylactic treatment and kinetic degradation

3 Visualizing the inhibitors effect (antifactor VIII or XI antibodies)

A slow redox reaction progressively turning injected blue dye to transparent illustrates the action of an inhibitor upon injection. Afterwards, the addition of another non-reacting dye illustrates the injection of activated prothrombin-complex concentrates (PCCa) or activated VII factor (FVIIa).



CONCLUSION

Children positively responded to this new TE session. They especially enjoyed the possibility to demonstrate their skills in the second part of the session under the supervision of TE team. This step allows immediate assessment of concept acquisition. Furthermore, the real-time dynamic illustration of CFC clearance and inhibitor's action facilitate the comprehension of complex pharmacokinetics processes. To validate this workshop, an evaluation of long-term benefit to the patient should be conducted.

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WFH world congress: 11-15 may, Melbourne, Australia