A NEW RESPIRATORY TRAINING SYSTEM WITH CONTROLLED CO_2 ELIMINATION FOR H.A.T.

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BACKGROUND

High altitude training (HAT) is often implemented by athletes as a means to increase erythrocyte count, which is believed to enhance endurance. In fact, this training regimen is commonly encountered in sport science either as a stamina boosting technique, or as a post-injury recovery time accelerant.

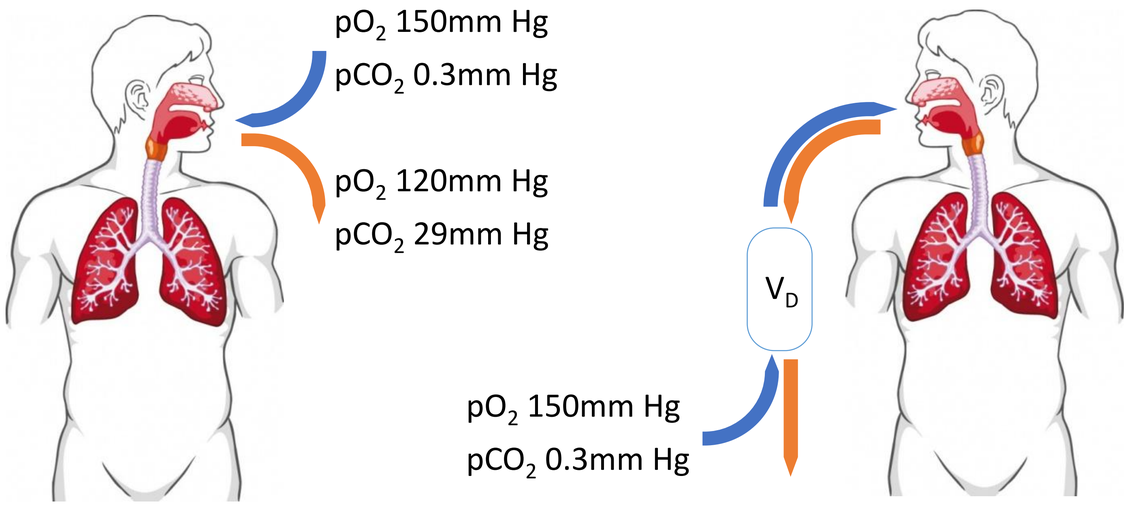

Fig. 1. The principle of active re-inhalation.

All HAT systems currently available aim at reduced oxygen delivery during inhalation (Fig. 1), without however taking respiratory CO_2 into consideration, which physiologically is equally vital in the determination of appropriate inspiratory conditions. Furthermore, existing devices are characterized by an inherent lack of user control, which is essential for an individually tailored training regimen.

OBJECTIVES

1. Ever-improving Performance & Endurance
2. Individual Training Regimen Optimization
3. Small & Light Portable Device
4. Doping-free sports

METHODS & MATERIALS

A closed loop system built around a capillary membrane gas exchange device, permits CO_2 elimination and O_2 uptake during inhalation through diffusion (Fig. 2). Experimentation with various system parameters provides an insight into the significance of each variable (membrane material, effective surface area, gas flow rate). Measurements have been obtained by means of continuous data acquisition (O_2 sensor) and by intermittent sample analysis by a blood-gas analyzer.

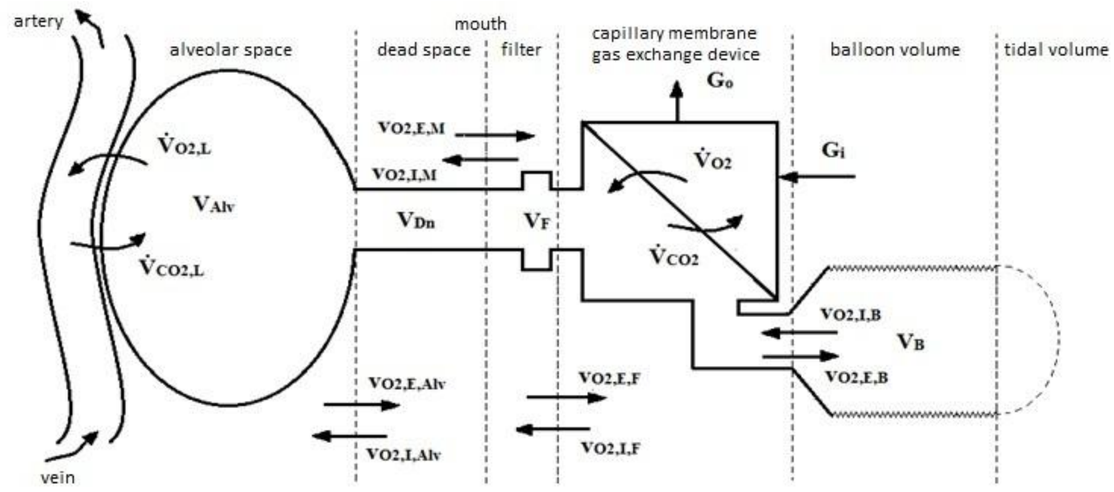

Fig. 2. Graphical representation of the closed loop system, indicating the various volumes and the local gas exchanges.

RESULTS

Gas partial pressure and oxygen saturation along with heart rate data are used as validation technique of the mathematically estimated theoretical performance. In addition, a comparison between the disparate system variations (C.M.G.E. device with different membrane material; two identical C.M.G.E. modules connected sequentially; ventilation rate alteration) yields the efficacy of each parameter in terms of gas exchange.

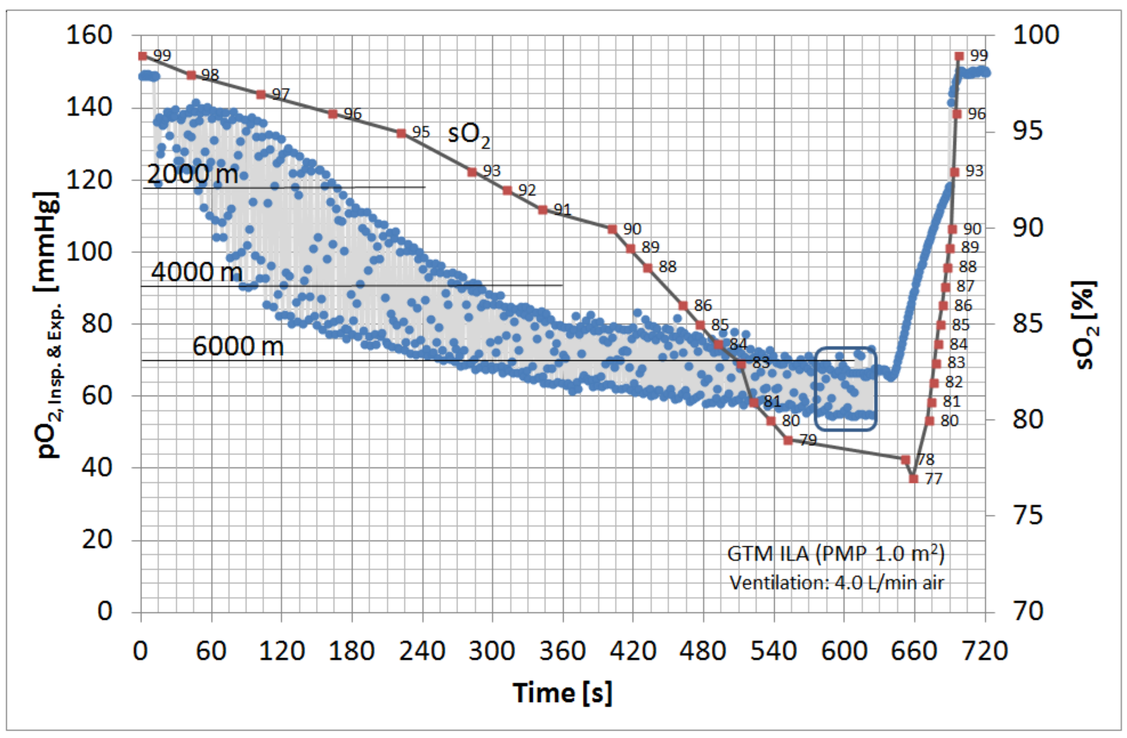

Fig. 3. Inspiratory - Expiratory pO_2 and arterial oxygen saturation, during an investigation with the currently introduced HAT solution.

CONCLUSION

As Fig. 3 denotes, the capillary membrane based HAT achieves remarkable efficiency levels, and simultaneously provides limitless versatility in adjusting the input conditions. Thusly, it offers individualized settings for each user, which by itself amounts to a significant improvement in HAT quality and its applicability in diverse sports.

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