Effect of Capsule-Based Dry Powder Inhaler User Training on In-vitro Performance

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Introduction

Patient technique plays an indisputable role in the effective treatment delivered by orally inhaled products for bronchial asthma, chronic obstructive pulmonary disease, and other respiratory illnesses. Numerous clinical studies have demonstrated that the correct use of inhalation devices with an appropriate drug product significantly improves treatment outcome and the life quality of the patient in general [1,2]. Therefore, the aim of this semi-observational study is to evaluate the impact of a single short hands-on demonstration training on the handling of a capsule-based DPI and its quantitative effects on aerodynamic particle size distribution (APSD) parameters between two groups of unexperienced volunteers (trained and untrained) and laboratory analysts experienced on the use of dry powder inhalers.

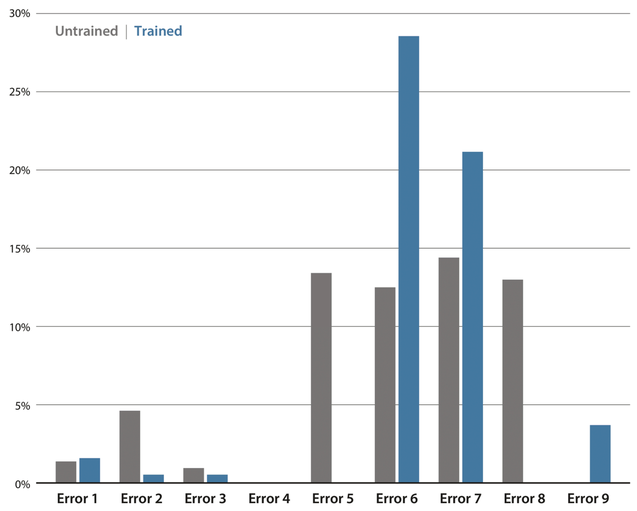
Methods

The present research was performed with 21 participants: 7 experienced analysts and 14 volunteers, who were divided into two groups. The first group of volunteers received the HandiHaler® device with the corresponding instruction leaflet and a recommendation to read it ('untrained group'). The second group received practical training in addition to the instruction given to the untrained group ('trained group'). All volunteers replaced human inhalation by actuation through a Next Generation Impactor (NGI). The handling errors made by both patient groups were recorded by the analyst with error checklist.

Error	Description
1	Not closing the device correctly (no 'click' sound)
2	Double piercing
2	Shake prior to use
4	Maintain the piercing button
5	Incorrect inhaler position during piercing
6	One breath
7	Not forcefully and deeply inhale through the device (no capsule rotation)
8	Closing the dust cup during piercing
9	Not piercing the capsule at all

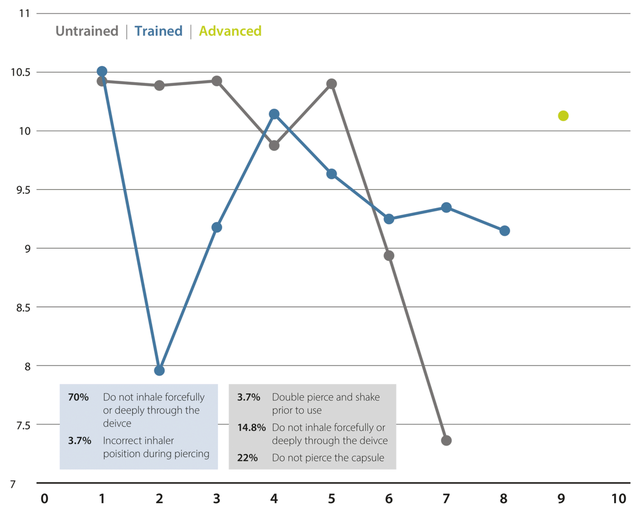
Results and Discussion

Percentage of handling errors in the untrained and trained groups at the beginning of the study



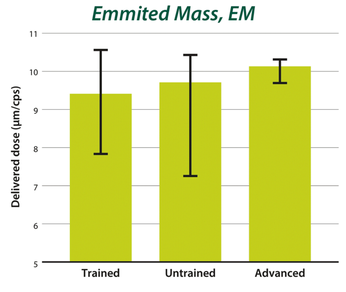
According to the Handihaler leaflet instructions, the patients must inhale the product twice and pay attention to the capsule swirling noise during inhalation. Errors were recorded at the highest rates for those two actions for the untrained group, with 28.6 % and 21.2 % of participants, respectively, failing to fulfill those instructions. Although less frequent, the percentage of these errors was also relatively high in the trained group (12.5 % and 14.4 %). Previous studies [3] have shown that at least 80% of the target dose is being delivered by the Handihaler on the first actuation, mitigating the impact that single actuations can have on the general *in-vitro* performance of the device. However, failure to notice capsule swirling could potentially indicate insufficient inhalation flow, and lead to a drastic loss of dose delivered by the Handihaler.

EM (Delivered dose µm/cps)

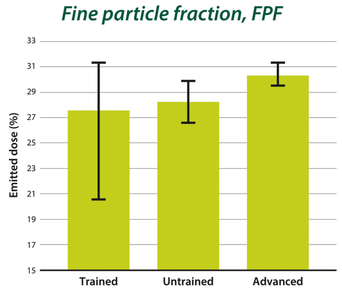


The individual data of the participants shows a high variation of results. Most noticeably, failure to notice capsule swirling, which could potentially indicate insufficient inhalation flow, lead to a drastic loss of dose delivered by the Handihaler. Likewise, failure to pierce the capsule, which happened for 22% of actuations for untrained participant no. 7, could drastically impact the amount of dose delivered and therefore the effectiveness of the therapy and the success of the treatment.

Emmited Mass, EM



Fine particle fraction, FPF



The impact of a single frontal training has shown to have a limited impact on the *in-vitro* performance of the device, with unsignificant difference ($p>0.05$) in the average delivered dose and the average particle fraction below 5 µm delivered by the device between the untrained group and the trained group (28.2% and 27.5%, respectively).

Nonetheless, the results obtained by the two groups of participants are significantly lower than those obtained by the advanced user (30.3%, $p<0.05$), highlighting the impact that extensive inhaler experience can have on the *in-vitro* performance of the device and, ultimately, on the outcome of the treatment.

Conclusion

The study results suggest that one-time patient training can have a negative impact on the *in-vitro* performance of the device as, contrary to expectations, trained participants performed overall poorer than the untrained participants. It is speculated that limited single face-to-face trainings, in absence of repetition, could lead to overconfidence in the patient technique and thus lower attention to the complete device instructions, compared to patients that only received the inhaler leaflet as instruction. This assumption is corroborated with the observations made by Selestini et Al in their study on Prescription Bias and Factors Associated with Improper Use of Inhalers [4], showing that 95% of DPI patients are "Feeling to be able to use the inhaler well".

However, extensive inhaler technique training has shown to have a positive impact on the general device *v* performance and shown by the higher fine particle fraction obtained by the advanced user compared to the study participants. Further studies on a larger pool of participant would be required to confirm the study observations.

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