Submission Title:
The impact of breath-controlled gaming on the quality of airway clearance treatments in children with cystic fibrosis during Project Fizzyo

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Abstract

Primary Category

PHYSICAL & RESPIRATORY THERAPY

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- No

Best Abstract Awards for Junior Investigators Competition

- No

Background

Although regularly prescribed by physiotherapists, airway clearance techniques (ACTs) are stressful for people with CF and their families, adherence can be low and the quality of treatment poor [1]. Undertaking more good quality ACT treatments is associated with better clinical outcomes [1]. Gamification has been suggested as a way to make ACTs more enjoyable for children, and providing real time interactive feedback during ACTs as a potential way to improve patient experience and treatment quality [2].

The aim of this analysis was to assess the impact of a bespoke gaming app on ACT treatment quality by children and young people with CF during Project Fizzyo.

Methods

A bespoke sensor and breath-controlled gaming app were developed for use with compatible positive expiratory pressure (PEP) and oscillatory PEP (OPEP) devices. Games were introduced after a run-in period of 4 months and were available for 8 months, their use was not mandatory. Games were designed to optimise ACT treatments, in particular to encourage slightly longer expired breath lengths.

The percentage of treatments that were conformant with current ACT recommendations based on expiratory breath pressure (10-20 cmH_2O ±5) and/or length (age related threshold [1]) were compared between treatments where gaming was used and those where it was not.

Results

ACT data from 37 children and young people with CF who played games during a minimum of 20 ACT treatments were analysed. This amounted to 6,074 treatments without gaming (55% OPEP) and 3,646 treatments with gaming (48% OPEP). Gaming increased the percentage of treatments that were conformant with recommendations overall for both breath pressure (75% to 85%) and length (32% to 38%), but the effect was different for PEP and OPEP devices (Table 1);

- *Without games:* expired ACT breath lengths with OPEP devices were shorter than those with PEP devices, which were more often conformant [1].
- *OPEP gaming*: A higher percentage of treatments were conformant with gaming, as short breaths increased in expiratory length into the desired range and high pressure breaths decreased.
- *PEP gaming:* Conversely, a lower percentage of treatments were conformant with gaming. Gaming reduced the quality of PEP treatments by encouraging longer breaths that were sometimes too long, it had no impact on breath pressure.

Conclusions

This is the first study to develop breath-controlled ACT games which has demonstrated the potential for improving ACT quality that is associated with better clinical outcomes [1].

Breath-controlled ACT games developed for Project Fizzyo increased expiratory breath length for both PEP and OPEP devices. An increased expiratory breath length was beneficial for OPEP, more than doubling the number of conformant breaths. However, in some children using PEP devices, the increase in breath length encouraged a higher percentage of non-conformant treatments.

Importantly, future gaming designs in this field must consider the specific impact of gaming mechanics that manipulate breath pressure or length in relation to the desired improvements to technique. These may need to be ACT device specific.

Acknowledgements

References

[1] Filipow N, *et al.* Real world effectiveness of ACTs in children with cystic fibrosis, ERJ. 2023:2300522.doi.org/10.1183/13993003.00522-2023

[2] Balli F. Developing Digital Games to Address Airway Clearance Therapy..., JMIR Serious Games. 2018;6(4):e18 doi.org/10.2196/games.8964

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		OPEP			PEP		
		Non-Gaming	Gaming	Difference (Gaming-non gaming)	Non-Gaming	Gaming	Difference (Gaming-non gaming)
Length	Optimal range	19%	42%	23%	46%	32%	-14%
	Too short	73%	45%	-28%	23%	9%	-14%
	Too long	6%	11%	5%	29%	58%	29%
Pressure	Optimal range	62%	80%	18%	90%	90%	0
	Too high	38%	20%	-18%	10%	10%	0
	Too low	n/a			n/a		

Table 1- Percentage of treatments with or without gaming in the optimal range from recommendations by expiratory breath length or pressure