Digital Objective Automated Feedback On Inhalation Technique

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Results and Conclusion

Findings suggest that objective feedback on inhalation time and flow can help patients to improve their inhalation technique.

In addition to regular subjective assessment, 27 patients (71%) report that the objective feedback was useful, and they felt that they improved their inhalation technique. All of the 6 operators reported that the automated feedback was a useful tool when they assessed inhalation technique.

Table 1. Results of tests

Dry Powder Inhaler		Metered Dose Inhaler	
Number of subjects	33		7
Female n (%)	9 (27%)		3 (43%)
Weight mean, kg	51		45
Height mean, cm	158		152
Number of subjective assessments	37		9
1. Inhaler kept in upright position	33 (89%)	1. Shook the inhaler and opended the cap	6 (67%)
2. Opened the cap of the inhaler correctly	35 (95%)	2. Kept the inhaler in upright position	6 (67%)
3. Actuated one dose / loaded capsule	34 (92%)	3. Breathed out before slow inhalation	6 (67%)
4. Breathed out before inhaling	25 (68%)	4. Breathed out and away from the mouthpiece of the inhaler	6 (67%)
5. Breathed out and away from the mouthpiece of the inhaler	23 (62%)	5. Placed the inhaler mouthpiece correctly in mouth	7 (78%)
6. Inhaler correctly placed in mouth	30 (81%)	6. Inhaled slowly	4 (44%)
7. Inhaled forcefully through the mouth after firing dose	34 (92%)	7. Kept inhalation slow after dose fired	3 (33%)
8. Inhaled with lips sealed around the mouthpiece	35 (95%)	8. Inhaled through the mouth after dose fired	7 (78%)
9. Inhaled without interruption	35 (95%)	9. Inhaler was correctly placed in mouth during the entire inhalation	6 (67%)
10. Breathed out and away from the mouthpiece of the inhaler	23 (62%)	10. Inhaled without interruption	7 (78%)
		11. Breath-holding more than 3 seconds after inhalation	6 (67%)
		12. Breathed out and away from the mouthpiece of the inhaler	6 (67%)
Successful subjective assessment of inhalation technique n (%):	18 (49%)		2 (22%)
Number of measurements	37		9
Inhalation time (s), mean	2.5		4.0
Inhalation volume (L), mean	2.4		3.9
PIF (L/min), mean	63		41
Inhalation flow profile agreed to tested inhaler after training n (%)	35 (95%)		9 (100%)

PIF=Peak Inspiratory Flow

Table 1. Results. To perform the test each test subject selected their prescribed inhaler and were allowed to train inhalation technique. Two subjects could not manage to achieve correct flows to use their DPI even with training.

Background and Aim

Correct inhalation technique is important. Metered dose inhalers (MDIs) and dry powder inhalers (DPIs) require different inhalation techniques. In addition inhaler devices may have different properties with regard to inhalation flow required to achieve optimum depostition. Usually evaluation and subsequent training of inhalation technique is subjective and performed by nurses, doctors or pharmacists. Peak inspiratory flow (PIF) meters and training devices give some information on flow but lack in data on time length of inhalation and the timing during inhalation when PIF is reached. This pilot study aims to evaluate a new digital device that measures inspiratory flow over time and provides automated feedback on inhalation technique.
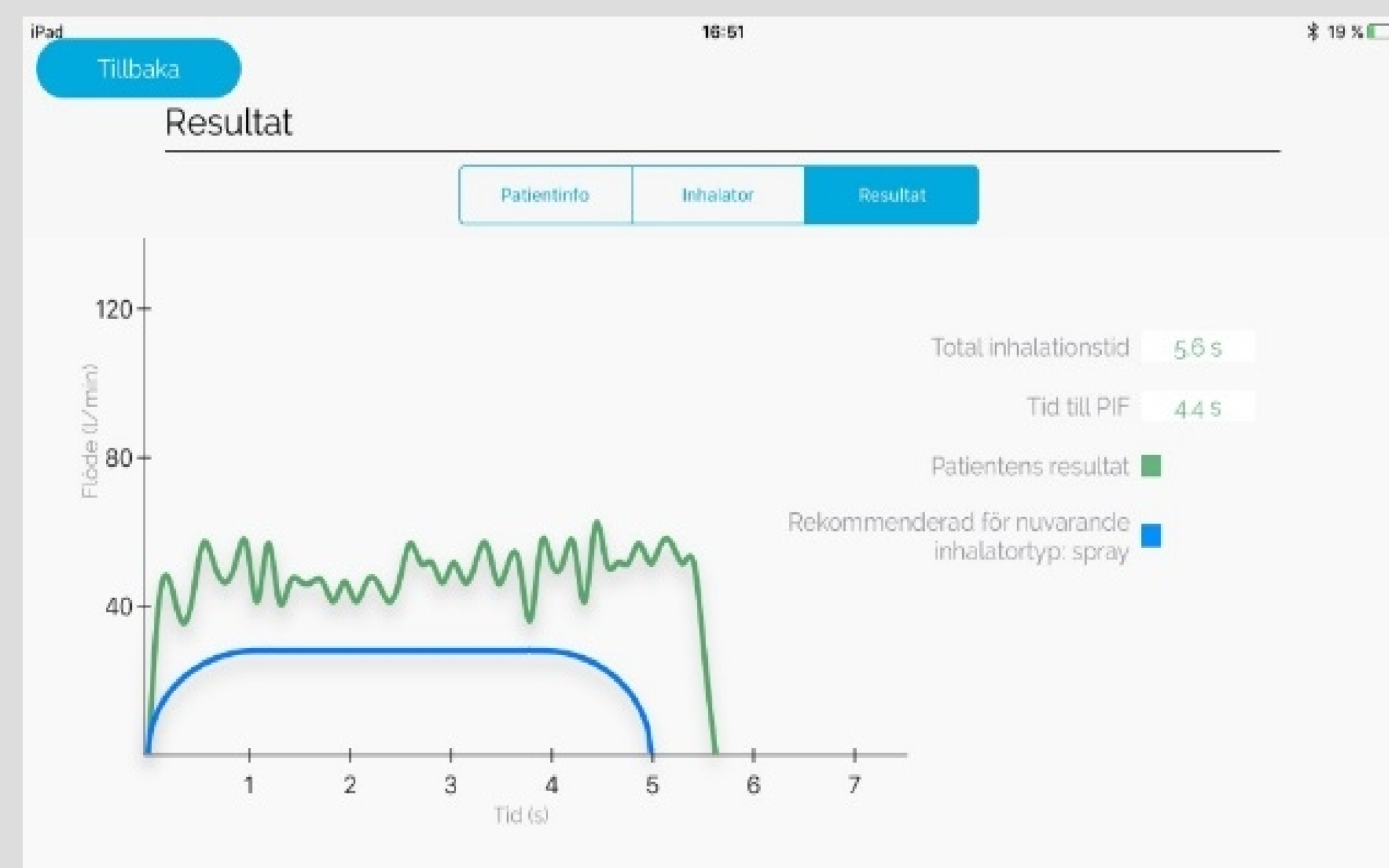

Fig 1. iPad screen shot (flow vs time). This patient has inhaled correctly (green), matching the suggested inhaler profile (blue).

Method

Teenagers (n=40) who used inhalers for asthma treatment inhaled through a disposable mouthpiece connected to variable resistance (In-Check DIAL) and a spirometer (MIR Spirobank II). Software was developed by Medituner AB. Data was collected to an iPad via Bluetooth and an algorithm gave immediate visual and text feedback if the inhalation technique was suitable to the inhaler selected. If the subject's inhalation was near to the inhaler device manufacturers specifications the software suggested how the inhalation technique could be improved in terms of length or force of inhalation. If criteria were not met, the software suggested an inhaler that was better suited to the patients inhalation. A respiratory nurse also performed a subjective assessment of inhalation technique including device handling. Subjects and respiratory nurses filled out questionnaires about the experience of objectively measuring the inhalation technique.
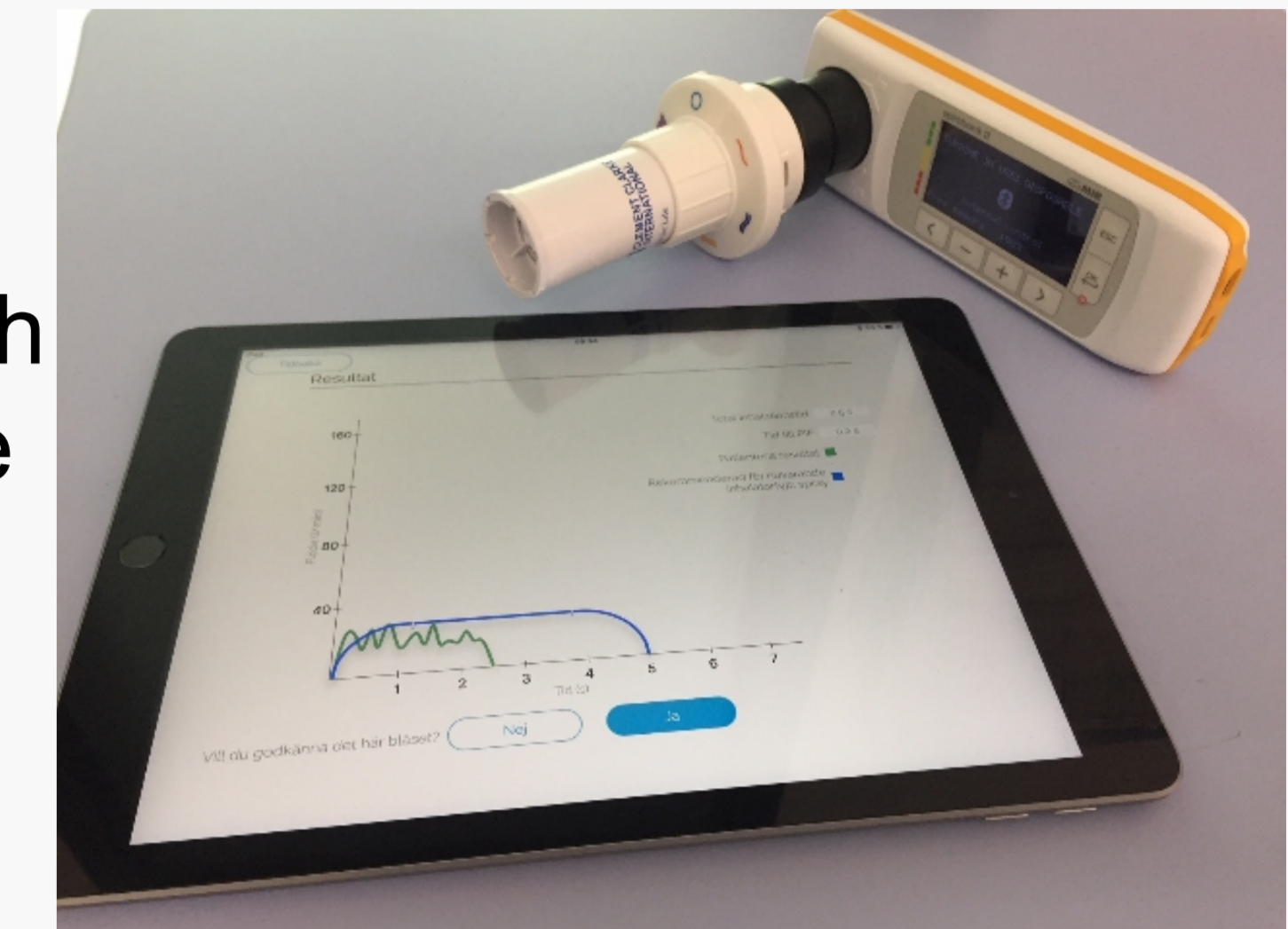
Next steps: We are now using the device to further test inhalation technique in different age groups in patients with COPD and asthma.

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