Differences in symptoms and cardiopulmonary responses to Treadmill versus Cycle cardiopulmonary exercise testing and comparison with the 6MWT in ILD

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Background and rationale for the study

- Cardiopulmonary exercise testing (CPET) -non-invasive method to assess exercise limitation and prognosis of ILD
- Cycle and Treadmill CPET modes used to derive important cardiopulmonary parameters
- The 6 minute walking test (6MWT)- submaximal test but reflects functional ex tolerance
- Holland *et al* reported greater desaturation during walking (6MWT) than Cycle CPET

Holland A.E. et al. BMC Pulm Med 2014, 14: 136

- Previous studies in COPD compared cycle ergometry with walking and reported differences in symptoms limiting exercise

Man et al. Am J Resp Crit Care Med 2003, 166; 562-567
Mahler et al. Chest 2011, 140; 351-358.

- Aim of this study: to compare cardiopulmonary responses and symptoms between Cycle and Treadmill CPET and between CPET and 6MWT in patients with ILD.

Study protocol

- Single-centre, observational study
- 18 ILD patients underwent Cycle and Treadmill CPET in random order on a single session

Session 1:

- 30-45 min between tests
- Incremental ramp protocol

Session 2:

6MWT according to ATS guidelines-performed 3-7 days from Session 1

We recorded: CPET parameters, perceived breathlessness (BORG scale) and exertion (RPE scale) at rest, at peak exercise and at the 3 minute recovery period

Patient characteristics

ILD patients were grouped into 3 groups: IPF/CTD-ILD/CHP

No evidence of generalised peripheral or respiratory muscle weakness

Variables	Total Group (n= 18)
Age (years)	65.4 (12.6)
Gender (male) (number (%))	12 (66.7%)
ILD Type (number (%))	
· IPF	7 (38.8)
· CTD-ILD	7 (39.8)
· CHP	4 (22.2)
BMI (kg/m^2)	26.3 (3.3)
FEV_1 (%,predicted)	71.8 (22.3)
FVC (%,predicted)	72.7 (20.7)
DLCO (%, predicted)	42.2 (13.4)
Comorbidities (number (%)	
· Cardiac	5 (27.8)
· Hypertension	6 (33.3)
· Diabetes	1 (5.6)
· High Cholesterol	3 (16.7)
Prednisolone medication (number(%)	
· < 5mg	5 (27.8)
· 5-10 mg	6 (33.3)
· >10 mg	1 (5.6)
Smoking status (number (%))	
· Current smoker	4 (22.2)
· Former smoker	3 (16.7)
· Never smoked	11 (61.1)
SNIP (cmH_2O)	103.5 (29.3)
PImax (cmH_2O)	105.9 (28.5)
PEmax (cmH_2O)	119.1 (30.4)
Handgrip (dominant hand) (kg)	31.5 (8.6)
Quads extension (dominant side) (kg)	22.3 (4.1)

Data are mean (SD) unless otherwise stated

Results- CPET parameters

	Cycle Ergometer	Treadmill	p value
Total exercise time (sec)	522.9 ± 128.5	454.6 ± 199.5	0.2
Peak Load (W)	80.5 ± 45.7	91.6 ± 78.2	0.6
Peak VO_2 (L/min)	1.01 ± 0.4	1.1 ± 0.5	0.6
VO_2 % predicted	61.7 ± 17.3	61.4 ± 21.1	0.9
AT (L/min)	0.8 ± 0.3	0.9 ± 0.4	0.3
Peak VE/VCO_2	41.05 ± 9.45	41.7 ± 10.4	0.8
Peak VE/VO_2	44.6 ± 7.9	44.0 ± 9.7	0.9
Peak PET,O_2 (mmHg)	118.1 ± 3.8	118.6 ± 4.1	0.7
Peak PET,CO_2 (mmHg)	33.6 ± 5.7	32 ± 4.8	0.4

No difference in cardiopulmonary values derived from CPET results

Results

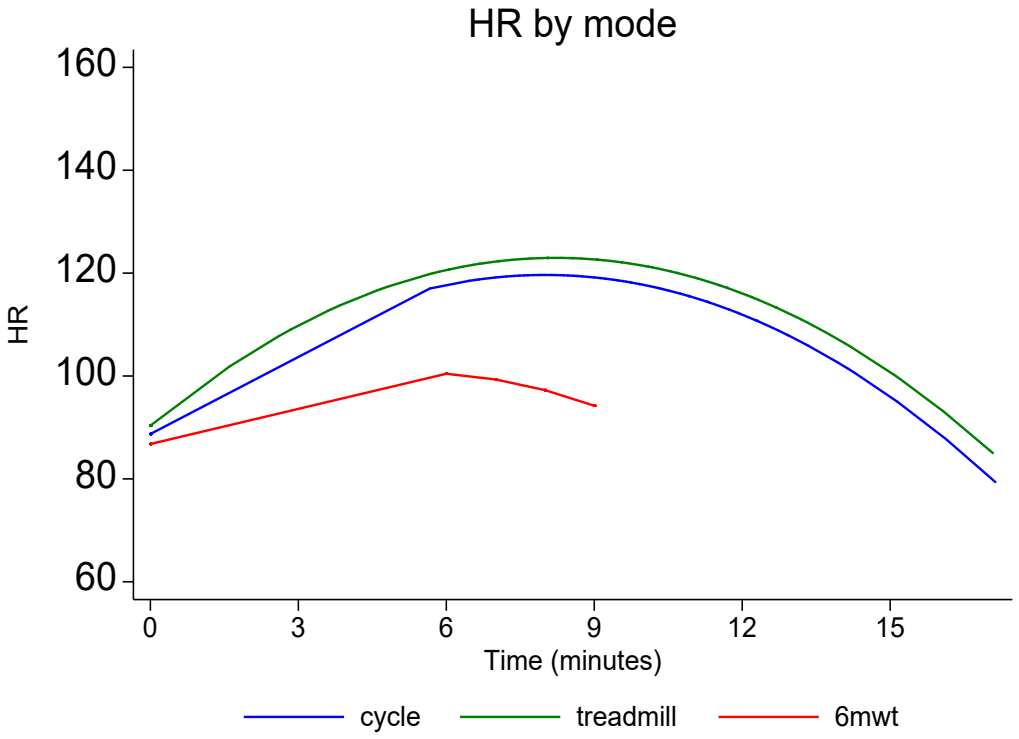
Heart Rate (HR)

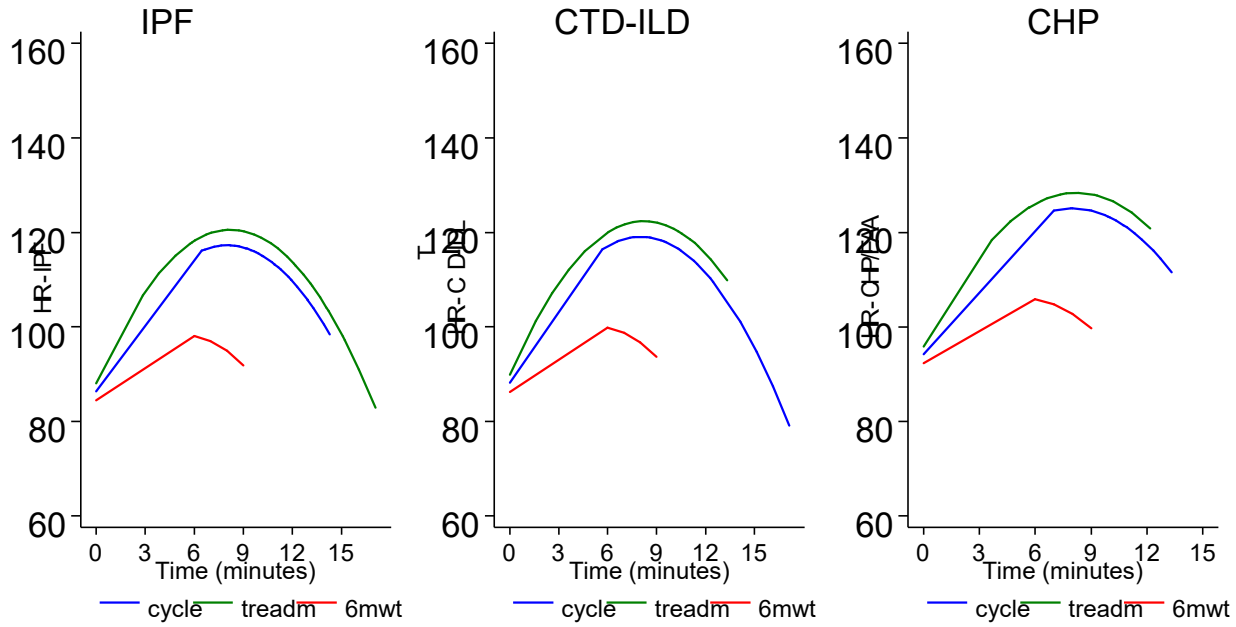
SpO_2

Perceived Breathlessness (BORG scale)

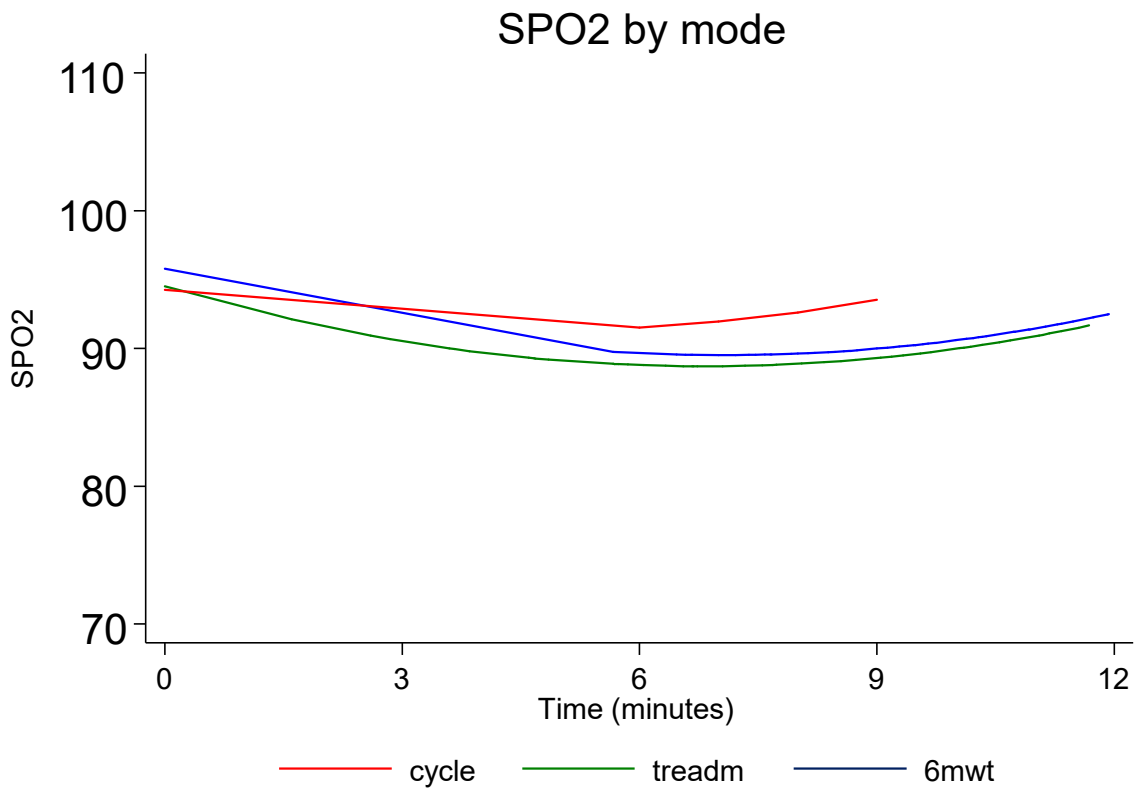
Perceived Exertion (PRE scale)

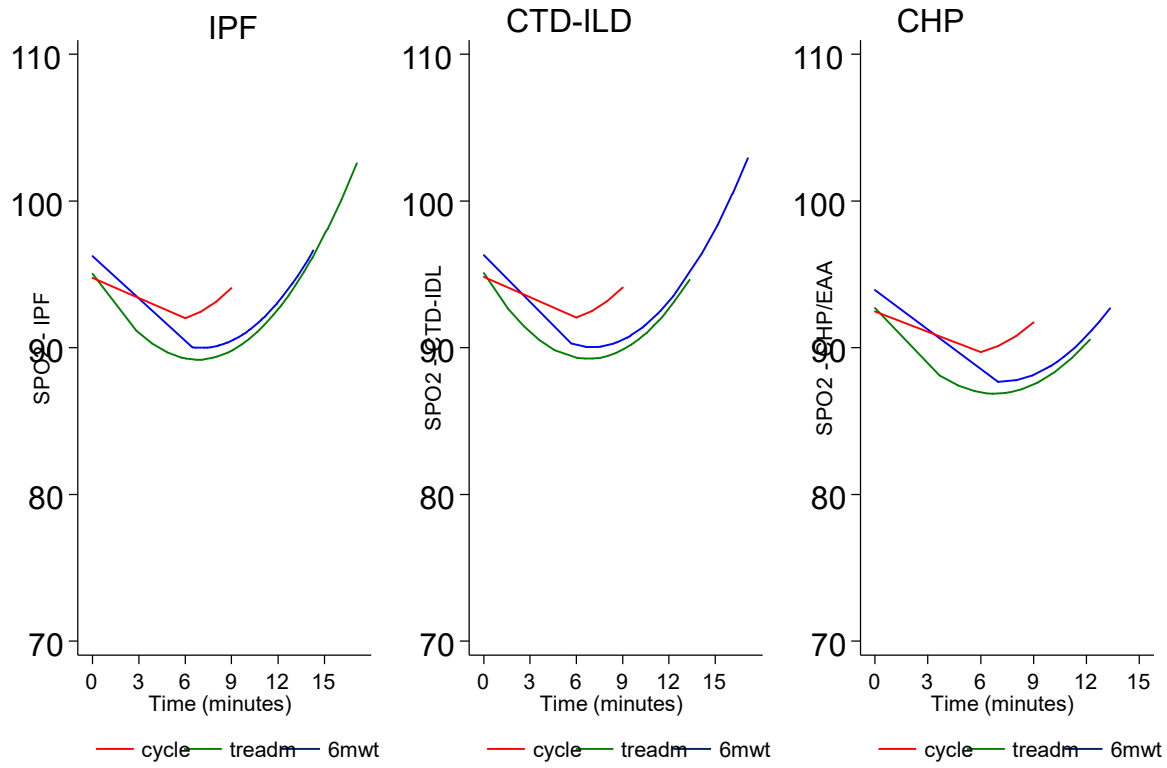
Mixed modelling (random intercepts and slopes)-allowed each individual to have their own trajectory- mean values presented



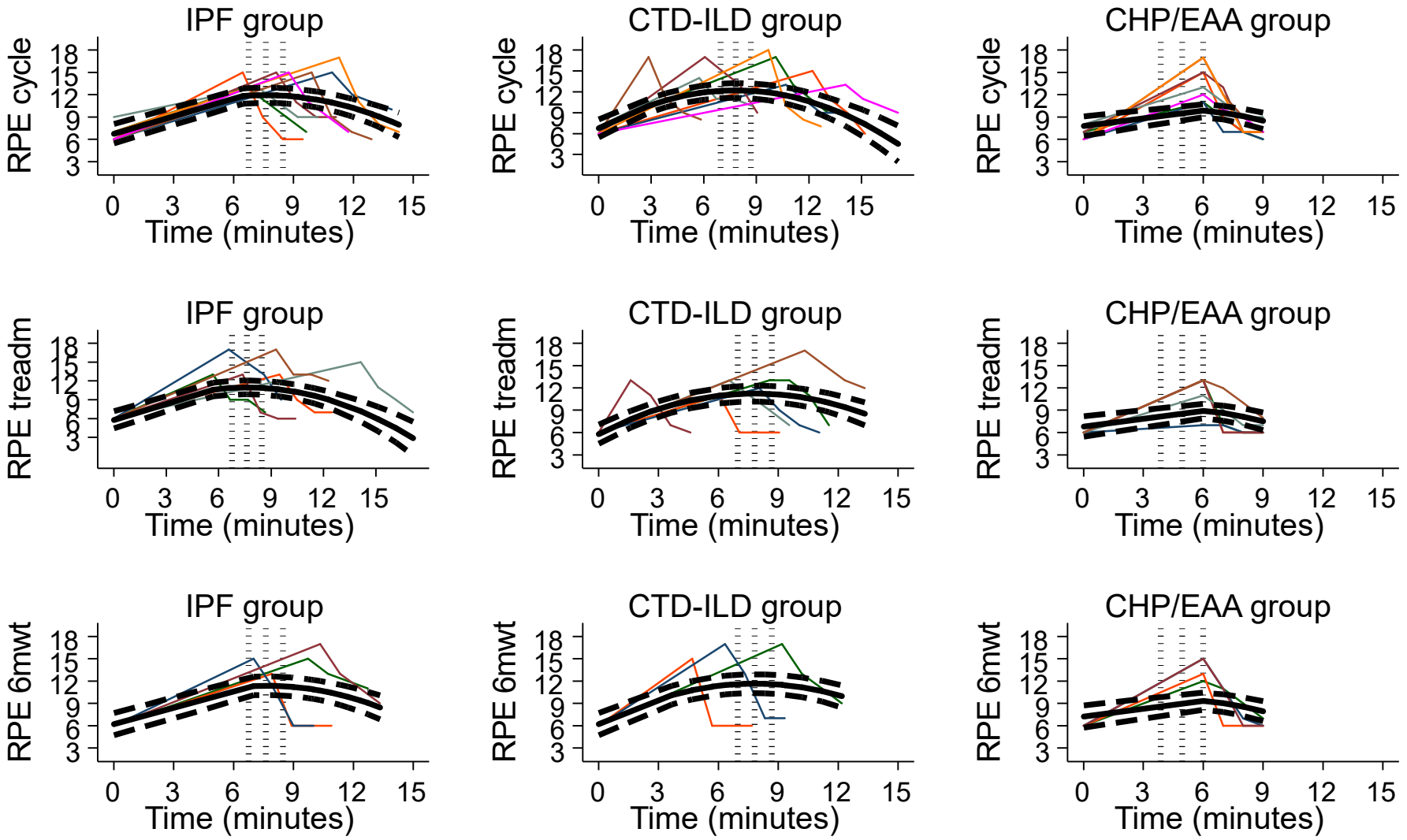


Results


SPO2 by mode
SPO2
110
100
90
80
70
0
3
6
9
12
Time (minutes)
cycle
treadm
6mwt


IPF
CTD-ILD
CHP
SPO2 - IPF
SPO2 - CTD-IDL
SPO2 - CHP/EAA
110
100
90
80
70
0
3
6
9
12
15
Time (minutes)
cycle
treadm
6mwt

Perceived Exertion-Results



Similar results for perception of breathlessness

Reasons for stopping

- There was no clear distinction in type of symptoms (breathlessness or leg fatigue/exertion) between Cycle and Treadmill CPET
- The CTD-ILD group had a preference for Treadmill than Cycle CPET

- The CHP group had the lowest duration in both Treadmill and Cycle CPET regardless of reason for terminating the tests

Conclusions

- Cardiopulmonary parameters can be derived accurately from both types of CPET
- No clear distinction in perception of breathlessness or leg fatigue based on CPET mode
- No clear distinction in HR and SpO_2 responses based on CPET mode or clinical groups

- The SpO_2 desaturation at the end of the 6MWT reflected that of the Treadmill CPET but underestimated the delay in recovery

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