Are there differences in adherence to home-based, inspiratory muscle training programmes between athletes and non-athletes?

Implications for designing community based rehabilitation programmes for respiratory patients.

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Chronic respiratory conditions and quality of care

- Long term conditions - care of patients absorbs ***70% of hospital and primary care budgets*** in England alone.

- *Domain 2 of NHS England-* Enhancing quality of care for people with long term conditions.
- *Self-management and community based programmes-* Physiotherapist have great input
- *National Service Frameworks (NSF)-* Evidence-based strategies for improving specific areas of care- They set measurable goals within set time-frames

Adherence to community-based exercise programmes

- Evidence from:

  Stroke patients

  Patients with diabetes

  COPD patients etc.

- Adherence varies and has implications for effectiveness of an intervention
- Monitoring- phone calls/ diary cards/visits/ activity monitors/ pedometers etc.

Inspiratory muscle training

- Intervention to improve inspiratory muscle strength
- An ‘adjunct’ of comprehensive pulmonary rehabilitation programmes
- Ideal for home-based programmes

J Physiol 584.3 (2007) pp 1019–1028

Inspiratory muscle training attenuates the human respiratory muscle metaboreflex

Jonathan D. Witt[1], Jordan A. Guenette[1], Jim L. Rupert[1], Donald C. McKenzie[1,2] and A. William Sheel[1]

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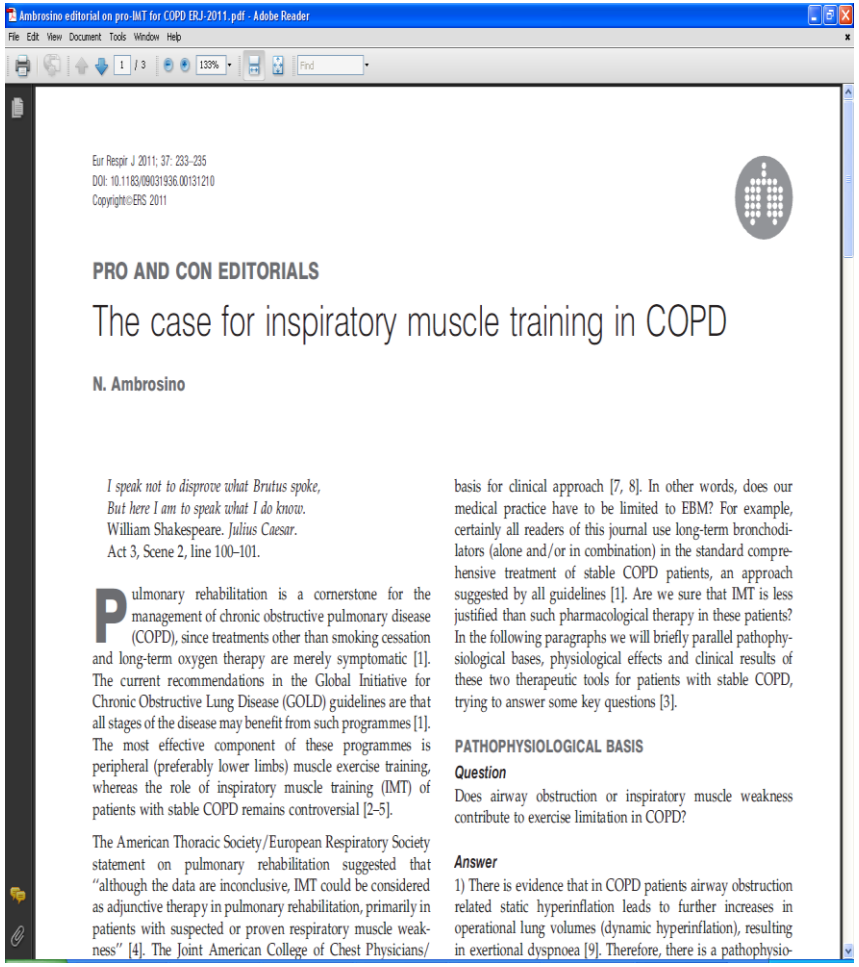
We hypothesized that inspiratory muscle training (IMT) would attenuate the sympathetically mediated heart rate (HR) and mean arterial pressure (MAP) increases normally observed during fatiguing inspiratory muscle work. An experimental group (Exp, $n = 8$) performed IMT 6 days per week for 5 weeks at 50% of maximal inspiratory pressure (MIP), while a control group (Sham, $n = 8$) performed IMT at 10% MIP. Pre- and post-training, subjects underwent a eucapnic resistive breathing task (RBT) (breathing frequency = 15 breaths min^{-1}, duty cycle = 0.70) while HR and MAP were continuously monitored. Following IMT, MIP increased significantly ($P < 0.05$) in the Exp group (-125 ± 10 to -146 ± 12 cmH_2O; mean ± S.E.M.) but not in the Sham group (-141 ± 11 to -148 ± 11 cmH_2O). Prior to IMT, the RBT resulted in significant increases in HR (Sham: 59 ± 2 to 83 ± 4 beats min^{-1}; Exp: 62 ± 3 to 83 ± 4 beats min^{-1}) and MAP (Sham: 88 ± 2 to 106 ± 3 mmHg; Exp: 84 ± 1 to 99 ± 3 mmHg) in both groups relative to rest. Following IMT, the Sham group observed similar HR and MAP responses to the RBT while the Exp group failed to increase HR and MAP to the same extent as before (HR: 59 ± 3 to 74 ± 2 beats min^{-1}; MAP: 84 ± 1 to 89 ± 2 mmHg). This attenuated cardiovascular response

Pro-IMT



Ambrosino editorial on pro-IMT for COPD ERJ-2011.pdf - Adobe Reader

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PRO AND CON EDITORIALS

The case for inspiratory muscle training in COPD

N. Ambrosino

I speak not to disprove what Brutus spoke,
But here I am to speak what I do know.
William Shakespeare. *Julius Caesar.*
Act 3, Scene 2, line 100–101.

Pulmonary rehabilitation is a cornerstone for the management of chronic obstructive pulmonary disease (COPD), since treatments other than smoking cessation and long-term oxygen therapy are merely symptomatic [1]. The current recommendations in the Global Initiative for Chronic Obstructive Lung Disease (GOLD) guidelines are that all stages of the disease may benefit from such programmes [1]. The most effective component of these programmes is peripheral (preferably lower limbs) muscle exercise training, whereas the role of inspiratory muscle training (IMT) of patients with stable COPD remains controversial [2–5].

The American Thoracic Society/European Respiratory Society statement on pulmonary rehabilitation suggested that "although the data are inconclusive, IMT could be considered as adjunctive therapy in pulmonary rehabilitation, primarily in patients with suspected or proven respiratory muscle weakness" [4]. The Joint American College of Chest Physicians/ basis for clinical approach [7, 8]. In other words, does our medical practice have to be limited to EBM? For example, certainly all readers of this journal use long-term bronchodilators (alone and/or in combination) in the standard comprehensive treatment of stable COPD patients, an approach suggested by all guidelines [1]. Are we sure that IMT is less justified than such pharmacological therapy in these patients? In the following paragraphs we will briefly parallel pathophysiological bases, physiological effects and clinical results of these two therapeutic tools for patients with stable COPD, trying to answer some key questions [3].

PATHOPHYSIOLOGICAL BASIS

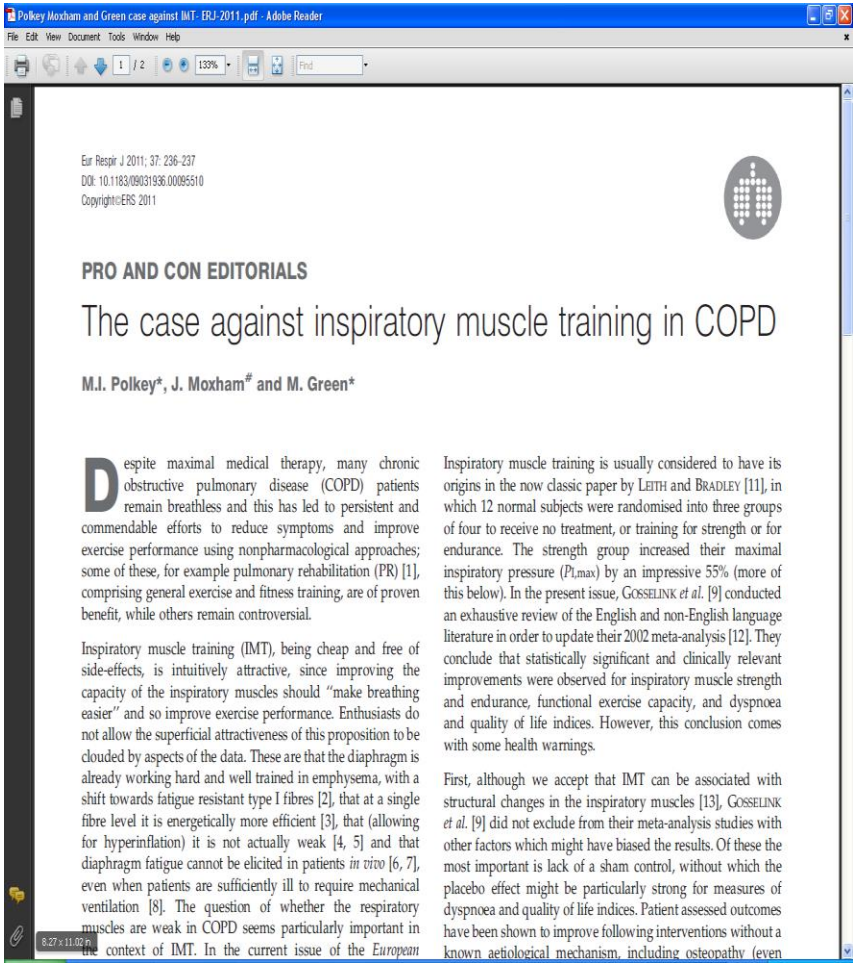
Question

Does airway obstruction or inspiratory muscle weakness contribute to exercise limitation in COPD?

Answer

1) There is evidence that in COPD patients airway obstruction related static hyperinflation leads to further increases in operational lung volumes (dynamic hyperinflation), resulting in exertional dyspnoea [9]. Therefore, there is a pathophysio-

Against-IMT



Polkey Moxham and Green case against IMT- ERJ-2011.pdf - Adobe Reader

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PRO AND CON EDITORIALS

The case against inspiratory muscle training in COPD

M.I. Polkey*, J. Moxham# and M. Green*

Despite maximal medical therapy, many chronic obstructive pulmonary disease (COPD) patients remain breathless and this has led to persistent and commendable efforts to reduce symptoms and improve exercise performance using nonpharmacological approaches; some of these, for example pulmonary rehabilitation (PR) [1], comprising general exercise and fitness training, are of proven benefit, while others remain controversial.

Inspiratory muscle training (IMT), being cheap and free of side-effects, is intuitively attractive, since improving the capacity of the inspiratory muscles should "make breathing easier" and so improve exercise performance. Enthusiasts do not allow the superficial attractiveness of this proposition to be clouded by aspects of the data. These are that the diaphragm is already working hard and well trained in emphysema, with a shift towards fatigue resistant type I fibres [2], that at a single fibre level it is energetically more efficient [3], that (allowing for hyperinflation) it is not actually weak [4, 5] and that diaphragm fatigue cannot be elicited in patients *in vivo* [6, 7], even when patients are sufficiently ill to require mechanical ventilation [8]. The question of whether the respiratory muscles are weak in COPD seems particularly important in the context of IMT. In the current issue of the *European*

Inspiratory muscle training is usually considered to have its origins in the now classic paper by LEITH and BRADLEY [11], in which 12 normal subjects were randomised into three groups of four to receive no treatment, or training for strength or for endurance. The strength group increased their maximal inspiratory pressure ($P_{I,max}$) by an impressive 55% (more of this below). In the present issue, GOSSELINK *et al.* [9] conducted an exhaustive review of the English and non-English language literature in order to update their 2002 meta-analysis [12]. They conclude that statistically significant and clinically relevant improvements were observed for inspiratory muscle strength and endurance, functional exercise capacity, and dyspnoea and quality of life indices. However, this conclusion comes with some health warnings.

First, although we accept that IMT can be associated with structural changes in the inspiratory muscles [13], GOSSELINK *et al.* [9] did not exclude from their meta-analysis studies with other factors which might have biased the results. Of these the most important is lack of a sham control, without which the placebo effect might be particularly strong for measures of dyspnoea and quality of life indices. Patient assessed outcomes have been shown to improve following interventions without a known aetiological mechanism, including osteopathy (even

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RESEARCH PAPER

Evaluation of the effectiveness of a home-based inspiratory muscle training programme in patients with chronic obstructive pulmonary disease using multiple inspiratory muscle tests

Dimitra Nikoletou[1,2], William D.-C. Man[1,3], Naveed Mustfa[1,4], Julie Moore[5], Gerrard Rafferty[1], Robert L. Grant[2], Lorna Johnson[1], and John Moxham[1]

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Abstract

Purpose: To evaluate the effectiveness of a home-based inspiratory muscle training (IMT) programme using multiple inspiratory muscle tests. *Method*: Sixty-eight patients (37 M) with moderate to severe chronic obstructive pulmonary disease (COPD) (Mean [SD], FEV_1 36.1 [13.6]% pred.; FEV_1/FVC 35.7 [11.2]%) were randomised into an experimental or control group

Keywords

COPD, home-based programme, inspiratory muscle training, randomised controlled trial, respiratory muscles

Differences in the literature

- Why is there a difference in results from community-based studies in athletes versus patients with COPD?

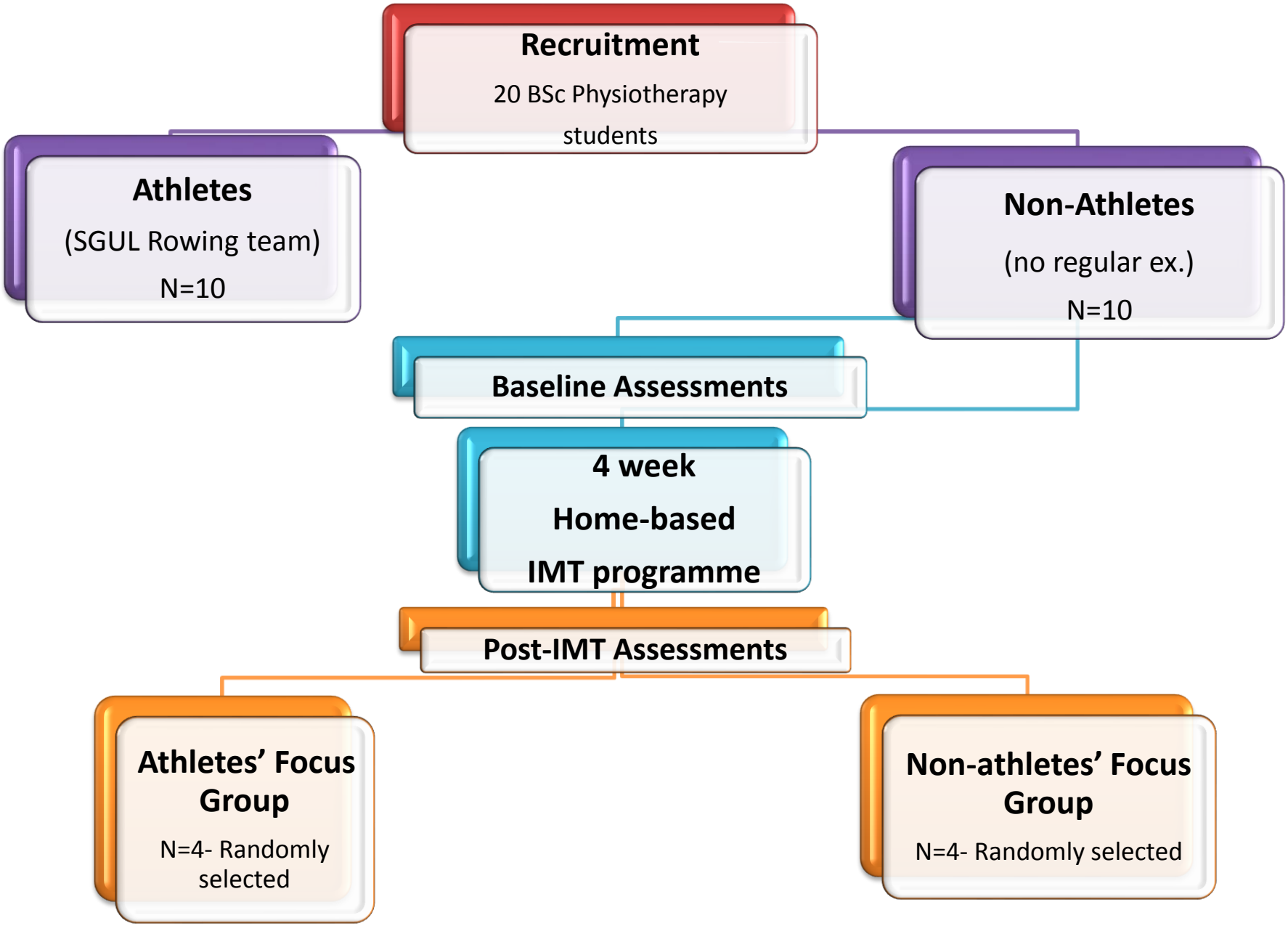
- *Hypothesis:* Athletes more likely to self-manage and adhere to a home-based programme than COPD patients or
- Differences in physiological adaptation to chronic disease

Our study

- ***Mixed methods study***
- ***Aims:***

  a) to explore adherence and other variable differences between athletes and non-athletes

  b) to explore perceptions about the IMT programme in the two groups.


Recruitment
20 BSc Physiotherapy students
Athletes
(SGUL Rowing team)
N=10
Non-Athletes
(no regular ex.)
N=10
Baseline Assessments
4 week
Home-based
IMT programme
Post-IMT Assessments
Athletes' Focus Group
N=4- Randomly selected
Non-athletes' Focus Group
N=4- Randomly selected

The IMT home programme

- 4 weeks duration
- Powerbreathe device

Training Intensity: 60%PImax and increasing by 10% per week
If reached 100%PImax before week 4 then increase number of breaths by 10

Twice daily, 30 breaths per session.

Our assessments:

- Primary Outcome: ***Adherence*** to the IMT programme
- Used self-report Diary cards
- Defined as: High (if > 71% sessions completed)
  Moderate (50%-70%)
  Low (<50%)

- All student-participants were instructed to complete the cards fully.

Our assessments:

- ***Meters rowed-*** 4 min all-out effort on a rowing ergometer
- ***Rate of Perceived Exertion*** (RPE)

Respiratory muscle assessments

- ***Maximal Inspiratory and Expiratory pressures*** (PImax and PEmax)
- Hand-held device

Participants had practice and at least 10 breaths on each occasion

Nikoletou D. *et al.* 'Sniff nasal inspiratory pressure in patients with moderate to severe COPD; Learning effect and short-term between-session repeatability' *Respiration 2014*; 88: 365-370

Qualitative assessment:

- ***Interviews***- 2 Focus groups

- Topic guide
- Recorded and transcribed verbatim
- Thematic analysis
- Themes discussed among research team

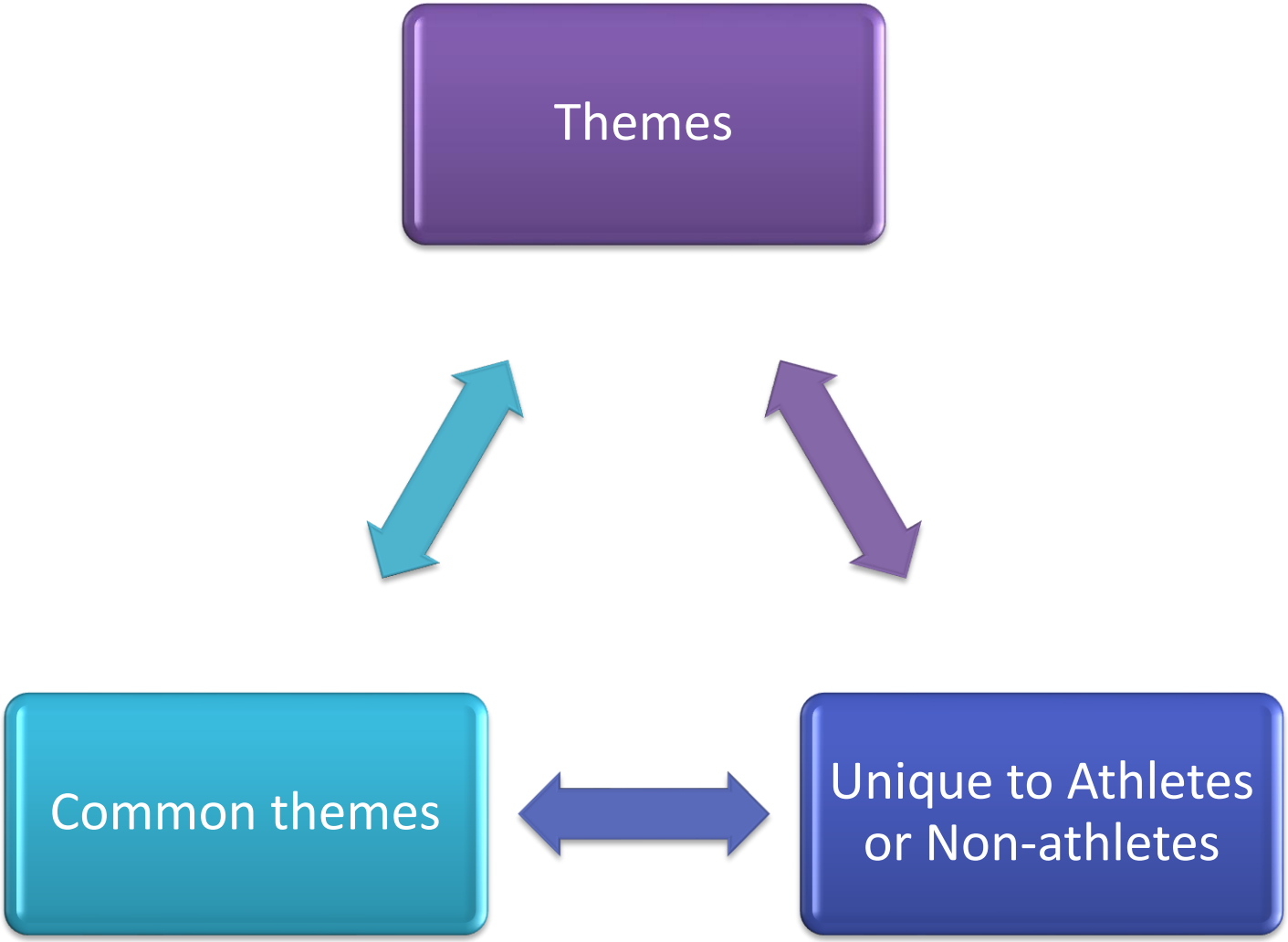
The Focus group topic guide

- What did you find easy about the IMT programme?
- What did you find difficult about the training?
- Is there anything that would make the training programme easier to follow?
- Did you modify or adapt the programme in any way to make it more user friendly for yourself?
- Did anything change in your daily exercise routine or activities change during the 4 weeks?
- Any other general feedback?

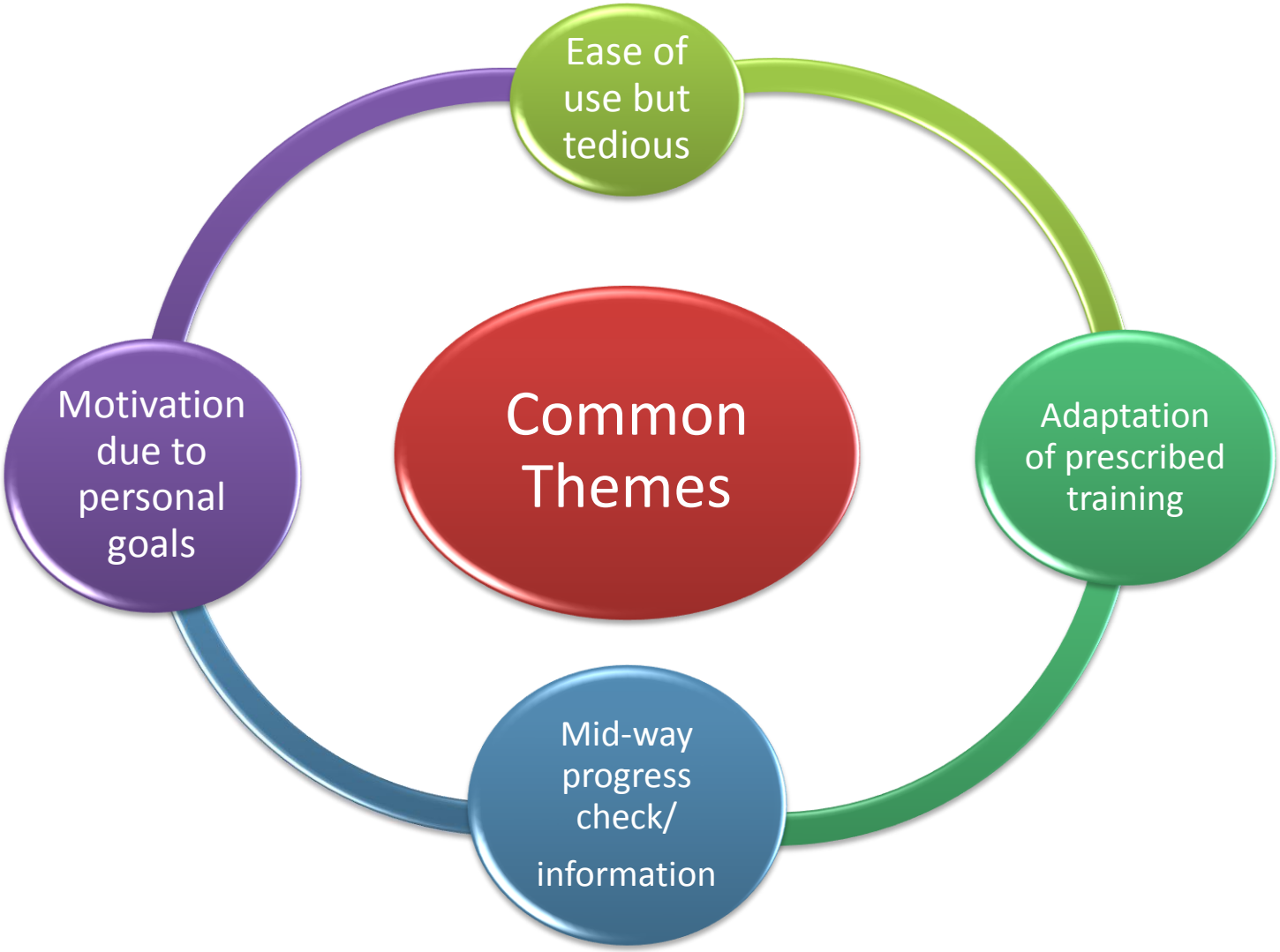
Results

	Pre			Post		Change from baseline		Between-group change
	Non-athletes Mean (SD) **N=10**	**Athletes** Mean (SD) **N=10**	Between group Difference at baseline p value	**Non-Athletes** Mean (SD) **N=9**	**Athletes** Mean (SD) **N=10**	**Non-Athletes** P value	**Athletes** P value	p value (95% CI)
Gender (M:F)	5:5	10:0	0.03*					
Age	29.9 (6.61)	22.2 (3.77)	0.05*					
BMI	24.6 (1.9)	23.43 (1.4)	0.15					
Adherence to the IMT Home-based Programme								
Adherence (%of sessions trained out of possible 40)				51.15 (30.13)	91.67 (11.65)			0.001*
Duration of training (min each session of 30 breaths took)				10.07 (7.6)	4.09 (0.8)			0.037*
Respiratory muscle function								
PImax(cmH_2O)	79.0 (27.39)	114.4 (21.68)	0.05*	89.4 (28.16)	143.7 (28.5)	0.06	0.04*	0.12 (-6.2 to -48.7)
PEmax(cmH_2O)	124.6 (18.77)	157.9 (20.7)	0.01*	123.2 (29.5)	168.1 (28.4)	0.82	0.21	0.18 (-6.3 to 30.8)
Exercise capacity and perceived exertion								
Meters Rowed (m)	867.4 (103.5)	1183.6 (47.8)	0.01*	888.8 (110.6)	1199.3 (53.3)	0.01*	0.01*	0.25
RPE	8.8 (2.2)	12.0 (1.2)	0.01*	9.3 (1.77)	11.59 (1.33)	0.18	0.1	0.04*

Thematic analysis results



Thematic analysis results



I am trying to get fit and lose weight for my wedding. I really felt this helped with my motivation to do the training every day.

I'd heard that IMT can improve your rowing performance, so I did it every day to see if it made a difference.

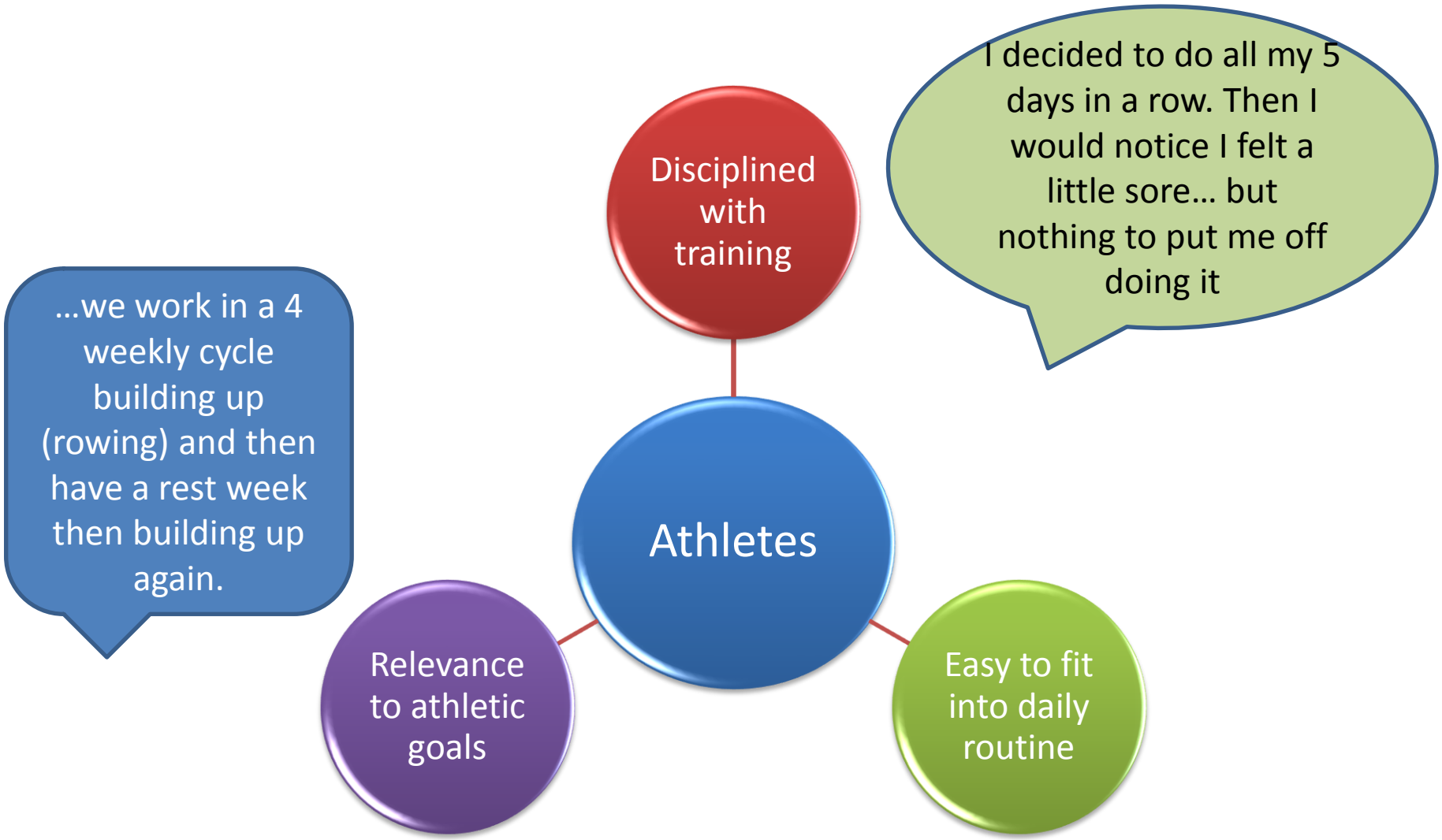
I first started doing it while doing other things at the same time, then realised I couldn't do that.
I started using the nasal clips in week three

I had a go at doing 30 in a row first but this was really difficult. I found three lots of 10 worked best.

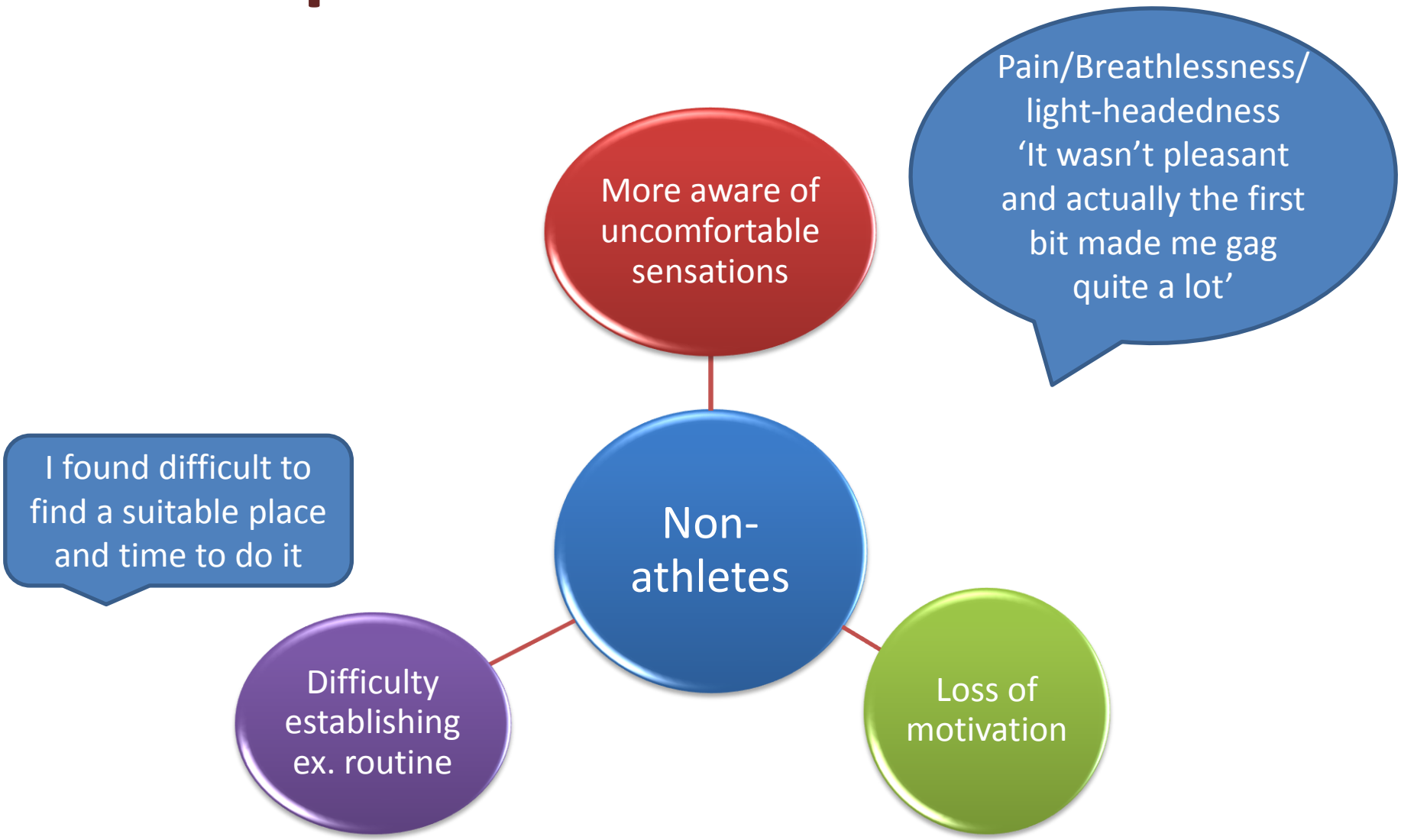
What would have helped is more information about what the training actually does.

Maybe at the week 2 stage…just more information about the benefits of what the training was doing for us

Unique Themes- Athletes



Unique Themes- Non-athletes



Implications for Exercise Prescription in community programmes

- Participants were physiotherapy students
- Very short/intense programme- only 4 weeks
- Volunteered to help their fellow students
- Healthy- no evidence of Breathlessness

- Is knowledge about exercise benefits enough?
- Should we be assessing motivation *before* prescribing exercise?
- How to use behavioural change principles in community programmes.

Implications for Exercise Prescription in community programmes

- Need for visual feedback- numbers etc
- Need for programme to be varied/ more interesting
- More regular monitoring or progress
- Information written and oral

- *CDs?/ Apps?/ Information booklets?*
- *IMT device recent improvements*

Physical Therapy
Journal of the American Physical Therapy Association

Research Reports

Efficacy of a Novel Method for Inspiratory Muscle Training in People With C Obstructive Pulmonary Disease

Daniel Langer, Noppawan Charususin, Cristina Jácome, Mariana Hoffman, Alison McConnell, Marc Decramer, Rik Gosselink

DOI: 10.2522/ptj.20140245 Published September 2015

Abstract

Background Most inspiratory muscle training (IMT) interventions in patients with chronic obstructive pulmonary disease (COPD) have been implemented as fully supervised daily training for 30 minutes with controlled training loads using mechanical threshold loading (MTL) devices.

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- Visual feedback
- ‘Count-down’ of breaths

- But…would it increase/ guarantee adherence?

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- Claire Verrier- Research student
- James McDermott-Research student
- Zac Chandler-Research student
- Peter Fraser- Technical support
- St George's University rowing team
- St George's University Gym for use of their facilities

"What fits your busy schedule better, exercising one hour a day or being dead 24 hours a day?"