Online Resource

1. Title

Clinical responses following inspiratory muscle training in exercise-induced laryngeal obstruction

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Online resource 1

Inspiratory muscle training (IMT): A flow-resistive device, Respifit S®, was applied for a six weeks training period. To promote correct breathing pattern, the participants were instructed to inhale using the diaphragm and to minimize cranial shoulder movements. Two modes of IMT was applied in accordance with the manual supplied by the manufacturer, i.e. A) inspiratory muscle strength training (IMST) with the resistance set to produce mouth pressures ≥ 80% of maximal inspiratory mouth pressure ($P_{i\text{max}}$) and B) moderate resistance or inspiratory muscle endurance training (IMET) with the resistance set at 60-80% of $P_{i\text{max}}$. In the IMST sessions, subjects performed five maximal inhalations repeated three times, separated by a one-minute break. In the IMET sessions, subjects were instructed to breathe in and out 12-16 times for one-minute. The frequency and power were guided by an animation program ensuring correct use of the device, and each training session were stored with a memory-card for measurement of compliance. The participants trained every day, in cycles of two days with IMET followed by one day of IMST, for a total of six weeks.
Please answer all questions, and answer as to how you are feeling now.

1. Which treatment did you receive? (Tick as many boxes as appropriate)
   - Information (about the condition) only
   - Inspiratory muscle training
   - Speech therapy
   - Surgery
   - Treatment at another clinic

2. How have your breathing problems changed since your first appointment (Q-A.1-8)?
   - Q-A.1 The breathing problem have got worse
   - Q-A.2 Unchanged, they bother me about as much as before
   - Q-A.3 Unchanged, but I have learnt to live with them
   - Q-A.4 They cause me less problems because I am less active
   - Q-A.5 They cause me less problems because I avoid activities that provoke symptoms
   - Q-A.6 Symptoms are not as severe as before
   - Q-A.7 The breathing problem has improved
   - Q-A.8 I no longer have a breathing problem
3.1 Considering all aspects of life, how much did your breathing problems effect you before you received treatment (Q-B.1)?

- □ Not at all
- □ A little
- □ Quite a lot
- □ A great amount
- □ Crippling

3.2 Considering all aspects of life, how much do your breathing problems effect you now (Q-B.2)?

- □ Not at all
- □ A little
- □ Quite a lot
- □ A great amount
- □ Crippling

4. How would you describe your breathing problems NOW (Q1-18)?

| Q.   | Description                                                                 | Never | Occasionally | Often | Nearly always | Always |
|------|----------------------------------------------------------------------------|-------|--------------|-------|---------------|--------|
| Q.1  | I have trouble breathing in                                               | 1     | 2            | 3     | 4             | 5      |
| Q.2  | I have trouble breathing out                                             | 1     | 2            | 3     | 4             | 5      |
| Q.3  | I feel tightness/pain in my throat                                       | 1     | 2            | 3     | 4             | 5      |
| Q.4  | I feel tightness/pain in my chest                                        | 1     | 2            | 3     | 4             | 5      |
| Q.5  | I get a hoarse voice                                                     | 1     | 2            | 3     | 4             | 5      |
| Q.6  | I frequently have a cough/clear my throat                                | 1     | 2            | 3     | 4             | 5      |
| Q.7  | I feel like I’m being choked                                             | 1     | 2            | 3     | 4             | 5      |
| Q.8  | I become dizzy, nauseous and feel like I’m going to faint                 | 1     | 2            | 3     | 4             | 5      |
| Q.9  | The symptoms come on fast                                               | 1     | 2            | 3     | 4             | 5      |
| Q.10 | The symptoms quickly resolve                                             | 1     | 2            | 3     | 4             | 5      |
| Q.11 | I feel panic                                                             | 1     | 2            | 3     | 4             | 5      |
| Q.12 | I have problems breathing when I am physically active                    | 1     | 2            | 3     | 4             | 5      |

Q.13. I can hear unusual or wheezing sounds when I breathe                  | 1     | 2            | 3     | 4             | 5      |
Q.14. My symptoms prevent me from training/exercising                      | 1     | 2            | 3     | 4             | 5      |
Q.15. I become afraid when I get symptoms                                  | 1     | 2            | 3     | 4             | 5      |
Q.16. My symptoms prevent me pushing myself when exercising                | 1     | 2            | 3     | 4             | 5      |
Q.17. My breathing problems continue even after I have stopped exercise/rested
Q.18. I can control my symptoms when I get them

5. How many hours per week do you play sport/exercise at an intensity that makes you breathless and/or sweaty.
   - None
   - About 30 minutes
   - About 1 hour
   - About 2-3 hours
   - About 4-6 hours
   - 7 hours or more

6.1 What sport do you play?________________________________________________
6.2 At what level?
   - For personal training
   - Local
   - Regional
   - National
   - International

7. Have you experienced any side effects/negative symptoms after treatment for your exercise induced breathing problems?
   - no prolonged side effects/problems
   - Yes
     If yes, please describe:
     ................................................................................................................
     ................................................................................................................
     ................................................................................................................
Thank you for taking the time to answer!
Table 5: Demographic data obtained from eligible subjects with exercise induced laryngeal obstruction (EILO) diagnosed at the outpatient clinic at Haukeland University Hospital, Bergen, Norway. Data are from time of diagnosis and divided in those who answered a follow-up questionnaire 4-6 years after diagnosis (“participants”) and those who did not answer the follow-up questionnaire (“Non-responders”).

|                      | Participants | Non-responders |
|----------------------|--------------|----------------|
|                      | IBA          | IBA+IMT        | P-value<sup>A)</sup> | IBA          | IBA+IMT        | P-value<sup>B)</sup> | P-value<sup>C)</sup> |
| Number               | 23           | 32             |                     | 25           | 18             |                     |                     |
| Male/Female          | 7/16         | 3/29           | 0.019<sup>*</sup>    | 11/14        | 2/16           |                     |                     |
| Age at diagnosis, mean (range) | 15.2 (12-21) | 17.5 (10-30)  |                     | 16.0 (12-27) | 16.6 (11-23)  | 0.248              | 0.269              |
| Age at follow-up, mean (range) | 20.4 (17-26) | 22.7 (15-36)  | 0.036<sup>*</sup>    | 21.4 (18-33) | 21.7 (17-28)  |                     |                     |
| Age symptom debut, mean (range) | 10.5 (5-15)  | 12.6 (1.5-20) | 0.052               | 13.1 (3-26)  | 12.7 (12-14)  | 0.097              | 0.855              |
| Activity hour(s) per week, median | ≥7 hours | ≥7 hours | 0.667<sup>D)</sup> | 4-6 hours | ≥7 hours | 0.181<sup>)</sup> | 0.720<sup>)</sup> |
| Activity times per week, median | 4-6 x/week | 4-6x/week | 0.496<sup>D)</sup> | 4-6 x/week | 4-6 x/week | 0.064<sup>)</sup> | 0.683<sup>)</sup> |
| Level of sports activity, at diagnosis† |                     |                     |                     |                     |                     |                     |                     |
| No organized activity | 3            | 2              |                     | 6            | 2              |                     |                     |
| Local/regional level | 16           | 16             |                     | 11           | 6              |                     |                     |
| National level       | 3            | 10             |                     | 2            | 8              |                     |                     |
| International level  | 0            | 4              |                     | 0            | 2              |                     |                     |
| Effected by breathing problem, mean (95% CI) |                     |                     |                     |                     |                     |                     |                     |
| When physically active | 3.6 (3.2-4.0) | 3.6 (3.3-3.9) | 0.562               | 3.2 (2.7-3.7) | 3.5 (2.9-4.1)  | 0.599              | 0.768              |
| Considering all aspects of life | 2.9 (2.4-3.5) | 2.9 (2.5-3.2) | 0.793               | 2.5 (2.1-3.0) | 2.5 (1.4-3.6)  | 0.688              | 0.932              |
| CLE-score (total) at diagnosis, mean (95% CI) | 2.7 (2.3-3.2) | 3.8 (3.4-4.2) | 0.007<sup>*</sup>   | 2.1 (1.5-2.7) | 3.1 (2.5-3.8)  | 0.196              | 0.227              |

IMT: inspiratory muscle training, IBA: information and breathing advice, CI: confidence interval, CLE: grading of laryngeal obstruction according to Maat et al [1].

<sup>A)</sup> Comparison between responders IBA-group and IBA+IMT group using student t-test and presented as p-value. <sup>B)</sup> Comparison between responders and non-responders in IBA and <sup>C)</sup> IBA+IMT group using Student’s t-test. <sup>D)</sup> Comparison with non-parametric Mann-Whitney-U-test as the data was non-normally distributed.

E) “How much do your breathing problem effect you?” at time of diagnosis, answer scale 1-5: (1: never, 2: occasionally, 3: often, 4: nearly always, 5: always).

† Items where numbers do not add up to the total group n are due to missing answers on questionnaire.
1. Maat, R.C., et al., *Audiovisual assessment of exercise-induced laryngeal obstruction: reliability and validity of observations*. Eur Arch Otorhinolaryngol, 2009. **266**(12): p. 1929-36.

2. Heimdal, J.H., et al., *Continuous laryngoscopy exercise test: a method for visualizing laryngeal dysfunction during exercise*. Laryngoscope, 2006. **116**(1): p. 52-7.
