Supplementary material to article by K. Haruyama et al. “Strategies for learning glossopharyngeal breathing in boys with Duchenne muscular dystrophy: A feasibility case series”

Preparation step
- Lectures

Practice step
- Conventional Strategies
  - Step 1: Description of significance and benefit
  - Step 2: Illustration of GPB Mechanism
  - Step 3: Watching demonstration video provided by patients who had already mastered GPB
  - Step 4: Watching real-time demonstration by the therapist

  - Simple instruction method
    - Imitate GPB shown by the video and therapist
    - Repeat “swallowing the air” or “imagining dropping air toward the lungs”

  - Alternative Strategies
    - Step 3: Induction of Sucking Motion
      - Sucking motion
      - Sucking motion with a straw connected with a plastic bag + Swallowing
      - Swallowing followed by sucking + with a nose clip
      - Swallowing followed by sucking + without a nose clip
    - Step 4: Induction of Phonation with Inhalation
      - Phonation with inhalation
      - MIC → stepwise MIC → stepwise MIC + Phonation with inhalation
      - "Breath-holding following Phonation with inhalation“ (single to repeat)
      - Phonation with inhalation + Breath-holding with a nose clip
      - Phonation with inhalation + Breath-holding without a nose clip

- Final evaluation
  - If the patient misses all the steps above, he or she may finish the protocol as failing to acquire the GPB

Through all the steps:
- If any of the trainings or practices in each step subjectively or objectively show that it is difficult to learn, you may proceed to the next step.
- Subject may receive thorax and thyroid cartilage mobilization or stretch as warming up.
- If achievement of mastery criteria is confirmed by spirometry, you may finish the protocol at that point (The therapist can perform measurements at items marked by •)
- Stepwise MIC: Repeat the air stacking followed by a small amount of insufflation with a bag valve mask as the patient repeatedly inspires (repeat to MIC)

The following options are available for air leaks during training

**Countermeasures against mouth leak**

- In the case of sucking motion:
  - A) Promotion of tongue movement
  - B) Assistance with neck extension
  - C) Feedback of laryngeal movement

- In the case of phonation with inhalation:
  - A) Repetition of quick change between inhalation and exhalation
  - B) Feedback of laryngeal movement
  - C) Change in pronunciation of phonation with inhalation (e.g. /ka/, /ku/, /gu/, or /go/)
  - D) Performance of neck extension during inspiration and neck flexion during breath holding
  - E) Voluntary repetition of root of tongue descent and elevation and intake synchronized with its movement

**Countermeasures against nasal leak**

- In both induction methods:
  - (Use nasal mirror as feedback if necessary)
  - A) Supraglottic swallow
  - B) Blowing training
  - C) Sucking training (reverse blowing)
  - D) Tongue movement with bulged cheeks
  - E) Inhibition of nasal respiration using smells

Fig. S2. Learning protocol for glossopharyngeal breathing (GPB). MIC: maximum insufflation capacity.