

**Preparation step**

Lectures

1. Description of significance and benefit
2. Illustration of GPB Mechanism
3. Watching demonstration video provided by patients who had already mastered GPB
4. Watching real-time demonstration by the therapist

**Practice step**

**Conventional Strategies**

Each step consists of up to 5 trials, and if the subject or the examiner judges that it is difficult to learn, proceed to the next step

Step 1

Imitation method

Imitate GPB shown by the video and therapist

Step 2

Simple instruction method

Repeat "swallowing the air" or "imagining dropping air toward the lungs"

**Alternative Strategies**

10 - 15 min = 1 session, up to 4 - 6 sessions = up to 60 min  
Up to 3 sessions for each step, and shift to the next step

Step 3

Induction of Sucking Motion

Training 1

Sucking motion

Training 2

Sucking motion with a straw connected with a plastic bag + Swallowing

Practice 1

Swallowing followed by sucking + with a nose clip

Practice 2

Swallowing followed by sucking + without a nose clip

Step 4

Induction of Phonation with Inhalation

Training 1

Phonation with inhalation

Training 2

MIC → stepwise MIC → stepwise MIC + Phonation with inhalation

Training 3

"Breath-holding following Phonation with inhalation" (single to repeat)

Practice 1

Phonation with inhalation + Breath-holding with a nose clip

Practice 2

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)

Abbreviation: MIC, maximum insufflation capacity

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.