PRACTICAL STRATEGIES FOR TEACHING YOUR CLIENTS TO BREATHE

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What is healthy breathing and why should we teach it?
Breathing assessment
Teaching and practicing healthy breathing
Practice tips and Client resources
Breathing in Neurofeedback
Healthy breathing

- maintains an optimal level of CO2 in the blood
- releases oxygen to body tissues for gas exchange
- promotes nitric oxide (NO) release to blood vessels for vasodilation and glucose release for energy
Healthy Breathing

Oxygen from pulmonary alveolus

Red blood cell

Hemoglobin molecules (one hemoglobin molecule can bind up to four oxygen molecules)

Oxygen released to cells
Healthy Breathing

↑ blood CO2 and ↓ pH

↑ hemoglobin release of oxygen and NO

↑ vasodilation
↑ oxygen and glucose
HEALTHY BREATHING
Overbreathing is the behavioral mismatch of the rate and depth of breathing

- resulting in ventilating out too much carbon dioxide
- lowering blood levels of CO₂
- and leading to a condition called hypocapnia, or lack of CO₂.
**Why do we care?**

- Hypocapnia disrupts:
  - Body acid-base chemistry (pH balance)
  - Electrolyte balance
  - Blood flow
  - Delivery of oxygen

- Hypocapnia can trigger, cause, or exacerbate psychological and physiological issues:
  - anxiety, panic, anger, chronic pain, headaches, asthma, GI distress, etc.
This is your brain on normal breathing.

This is your brain on overbreathing.

Image by Scott Wood, MD
OVERBREATHING AND OXYGEN DELIVERY

- Moderate overbreathing can reduce oxygen delivery to the brain by 30%-40%
- Severe overbreathing can reduce oxygen delivery by 60%
SYMPTOMS OF ACUTE OVERBREATHING

- shortness of breath
- bronchial constriction, airway resistance, other asthma symptoms
- chest tightness, pressure, and pain
- trembling, tingling, and numbness in the arms and legs
- sweatiness or shivering
- increased heart rate and/or heart palpitations
- muscle tension
- blurred vision
- dry mouth
- dizziness
- difficulty concentrating
- “foggy” mind, difficulty thinking straight
- nausea
- feeling of dissociation or unreality
**Physiological Changes**

- Reduction in O\(_2\) and glucose reaching organs and tissues

- Electrolyte imbalances, affecting muscle and brain function

- Kidneys expelling bicarbonates to compensate for chronic overbreathing
Breathing Assessment
Breathing Assessment

The Waiting Room
1. The waiting room is an ideal place to observe breathing behaviors without reactivity.
2. Your staff should covertly observe respiration rate, shoulder movement, gasping, sighing, yawning, and apnea (breath holding).
Breathing Assessment

The Clinic
Look for restrictive clothing that could interfere with abdominal movement.
Look for posture that could interfere with abdominal movement.
Check for reverse breathing, where the abdomen contracts during inhalation.
This pattern often accompanies thoracic breathing and results in incomplete ventilation of the lungs.
Reverse Breathing

Stomach contracts during inhalation
Check for clavicular breathing.
In clavicular breathing, the shoulders rise and fall during breathing.

Clavicular breathing may accompany thoracic breathing. Patients breathe through their mouths to increase air intake. This pattern provides minimal pulmonary ventilation.
The accessory muscles (sternocleidomastoid, pectoralis minor, scalene, and trapezius) use more oxygen than clavicular breathing provides (deficit spending) over time.
CLAVICULAR BREATHING
THORACIC BREATHING

Check whether breathing is primarily *thoracic* or *abdominal* using covert observation and a respirometer.
In thoracic breathing, the external intercostals lift the rib cage up and out. Upward and outward movement of the ribs enlarges the thoracic cavity producing a partial vacuum. Negative pressure expands the lungs, but is too weak to ventilate their lower lobes.
THORACIC BREATHING
This reduces oxygen delivery since the lower lobes receive a disproportionate share of the blood supply due to gravity.

Thoracic breathing, with or without reverse breathing, expends excessive energy and incompletely ventilates the lungs.
THORACIC BREATHING
Check for **apnea**, which is suspension of breathing, often for 30 seconds or longer.
APNEA

Don’t confuse apnea with a post-expiratory pause.
While awake, a patient may present with this symptom when engaged in ordinary activities like opening a jar, speaking, or writing a check.

Episodes of apnea decrease ventilation and may increase blood pressure.
APNEA
Check respiration rate (breaths per minute) and amplitude (amount of abdominal respirometer movement).

Thoracic breathing at rates at or above 16 bpm may be associated with hyperventilation syndrome (HVS).
Check for **effortful breathing** by monitoring the abdominal tracing for loss of a smooth sinusoidal pattern.
EFFORTFUL BREATHING

Respiration

B: BVP heart rate: 66.86
HR Max - HR Min: 5.49
G: Respiration Rate: 4.35

Loss of smooth sinusoidal waveform
Also, check *breathing effort* by monitoring accessory (trapezius and scalene) and frontal SEMG.
Effortful Breathing
Check oxygen saturation (PO2) using a pulse oximeter. A range of 95%-98% is ideal. Hyperventilation may increase it to 100%. Values outside of this range signal reduced oxygen delivery to tissues (Gilbert, 2012).
Check end-tidal CO2 using a capnometer.

A value of 36 torr (5%) is normal, while values below 33 torr are seen in HVS.
A healthy range is 35-45 torr.
**Overbreathing**

<table>
<thead>
<tr>
<th>End-tidal CO2 Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy breathing</td>
</tr>
<tr>
<td>Overbreathing</td>
</tr>
<tr>
<td>Mild-to-moderate</td>
</tr>
<tr>
<td>Moderate-to-severe</td>
</tr>
<tr>
<td>Severe</td>
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</tbody>
</table>
## Normal Values

<table>
<thead>
<tr>
<th>Physiological Metrics</th>
<th>Normal Adult Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breathing</td>
<td></td>
</tr>
<tr>
<td>Respiration Rate</td>
<td>12-14 bpm</td>
</tr>
<tr>
<td>End-tidal CO2</td>
<td>35-45 mmHg</td>
</tr>
<tr>
<td>Oxygen Saturation</td>
<td>95-98%</td>
</tr>
</tbody>
</table>
## Breathing Assessment

<table>
<thead>
<tr>
<th>Breathing Pattern</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>apnea</td>
<td>brief suspension of breathing, which decreases ventilation and may raise blood pressure</td>
</tr>
<tr>
<td>clavicular breathing</td>
<td>The chest rises and the collarbones elevate to draw the abdomen in and raise the diaphragm, but over time the accessory muscles (sternocleidomastoid, pectoralis minor, scalene, and trapezius) consume more oxygen than they provide</td>
</tr>
<tr>
<td>hyperventilation</td>
<td>rapid breathing and breathlessness reduce end-tidal CO\textsubscript{2} below 5%, exceeding the body's need to eliminate CO\textsubscript{2}</td>
</tr>
<tr>
<td>overbreathing</td>
<td>subtle breathing behavior like gaps, sighs, and yawns, and excessive breathing effort reduce end-tidal CO\textsubscript{2} below 5%, exceeding the body's need to eliminate CO\textsubscript{2}</td>
</tr>
<tr>
<td>reverse breathing</td>
<td>the abdomen expands during expiration and contracts during inspiration, and expends excessive energy to incompletely ventilate the lungs</td>
</tr>
<tr>
<td>thoracic breathing</td>
<td>The upward and outward movement of the ribs due to the contraction of the external intercostals produces a partial vacuum, but expends excessive energy to incompletely ventilate the lungs</td>
</tr>
</tbody>
</table>
SKILLS FOR TEACHING AND PRACTICING HEALTHY BREATHING
COMMON MISCONCEPTION ABOUT BREATHING

- At rest, we do not need more oxygen!
- At (or close to) sea level, with healthy lungs and healthy hearts, the air we breathe in contains ~21% oxygen, and the air we breathe out contains ~15% oxygen
- We only use about ¼ of the oxygen we take in
- No need for more oxygen
- Have to conserve CO₂
  - retain 85-88%
Healthy Breathing Basics

- Match between metabolic needs, CO₂ production, and size and rate of breath
- Need to maintain proper breathing chemistry with any level of activity and any rate of breathing
- Fast breathing rate does not mean there is overbreathing, but there is a correlation
- Slow breathing does not mean breathing is healthy, but there is a correlation
HEALTHY BREATHING TRAINING

- Education about breathing and overbreathing
- Mindful breathing awareness
- Mindful Low and Slow breathing
- “Finding” the breathing reflex
How to explain healthy breathing

- Depends on the sophistication and interest of the client

- Minimal: At or close to sea level, with healthy lungs and healthy heart, you have plenty of oxygen. You do not need any more. You do, however, need to conserve your carbon dioxide in order for the oxygen to get to where it needs to go. The breathing skills I am going to teach you will help you conserve carbon dioxide and help your body to use the oxygen most efficiently.
HOW TO EXPLAIN HEALTHY BREATHING - “MEDIUM”

- What is the first thing that comes to mind when you think about healthy breathing? (possible response: getting enough oxygen). That’s true.

- What do you think we need to do with our carbon dioxide? (possible response – get rid of it).

- You might be surprised to hear that you actually need to conserve about 85% of your CO2. The reason for it is because CO2 is responsible for distribution of oxygen.

- At or close to sea level, with healthy lungs and healthy heart, you have plenty of oxygen. You do not need any more. You do, however, need to conserve your carbon dioxide in order for the oxygen to get to where it needs to go.

- The breathing skills I am going to teach you will help you conserve carbon dioxide and help your body to use the oxygen most efficiently.
Use the script from “medium” explanation

Describe respiratory physiology using 2 charts in the next 2 slides
Normal respiration chemistry

Higher metabolism and ↑CO₂ production

- Drop in pH level (↑ acidity)
- Hemoglobin releases NO
- Local vasodilation, resulting in delivery of O₂ and glucose to tissues with higher needs
- Hemoglobin releases O₂
- Delivery of O₂ to tissues with higher needs
Overbreathing Chemistry

↑ ventilation of CO\textsubscript{2} without ↑ metabolism

↓ CO\textsubscript{2} level in blood

↑ in pH level
(↑ alkalinity)

H\textsubscript{b} does not release sufficient NO

Vasoconstriction, resulting in decreased supply of O\textsubscript{2} and glucose

H\textsubscript{b} does not release sufficient O\textsubscript{2}

Decreased supply of oxygen to organs and tissues
YOU DON’T NEED TO BREATHE **THAT** DEEPLY!

DEEP BREATHING
Do NOT take deep breaths

- Deep breathing for the purpose of calming down is often associated with unintentional overbreathing

- A deep breath has greater tidal volume than a typical breath

- Taking several deep, but fast, breaths is the best way to overbreathe!

- Breathe in more = breathe out more, with no increase in O₂ demand or in CO₂ production = breathe out too much CO₂
Calm breathing

In order for breathing to be calming, the size and rate of the breath have to correspond to the metabolic needs of a resting state.
Mindful breathing awareness

- Focus on the breath as it is without struggling
  - Option: Listen to the breath using earplugs (or plug ears with fingers)

- Attend to the sensations of inhalation and exhalation

- Allow natural transition from exhalation into inhalation

- Become aware of difficult emotions, thoughts, physiological sensations associated with breathing
“Low and Slow” Breathing
(Adapted from Robert Fried)

- Shift the breath to the abdomen
- Slow down the rate of breathing
- Take a normal size inhale
- Exhale slowly (through nose or pursed lips)
- **Do not emphasize the depth (and size) of the breath**
- Promotes calming without overbreathing
TEACHING LOW AND SLOW BREATHING

- Ask the client to loosen clothing, belts, buckles, zippers, or anything else that might obstruct free movement of the diaphragm, and get into a comfortable position (e.g., recline)

- Ask the client to place one hand on the abdomen and one hand on the chest

- Optional - Introduce balloon imagery to facilitate shifting the breath from the chest to the abdomen and to help the client remember when the stomach is supposed to expand and when to contract

INHALE – stomach EXPANDS (inflating the balloon)

EXHALE – stomach CONTRACTS (deflating the balloon)
Encourage mindful effortless breathing. This is a very important step. Many people put a lot of effort into breathing practice. Effort in breathing is not only not helpful but counterproductive. Effortful breathing is likely to include larger tidal volume on inhale and faster exhales, leading to overbreathing.

- Use words like “allow”, “let”, “permit”
- Do not use words and phrases containing “try”, “work”, “effort”, “correct”, etc.
- Demonstrate
- Allow to practice for a few minutes in your office
SAMPLE INSTRUCTIONS FOR MINDFUL LOW AND SLOW BREATHING

- “Let’s practice Low and Slow breathing

- Allow your breath to shift lower towards your abdomen and to gently slow down

- Optional To help guide your breath lower, imagine that there is a balloon in your belly. What color is it? .... Now, with every inhalation, imagine that you are gently inflating the balloon and with every exhalation, you are allowing the balloon to deflate.
Do not push your stomach out, do not pull it back in. In fact, do not apply any effort at all

Provide your body with some guidance, and then let your body breathe for you

This is all about letting your breathing happen as opposed to making it happen
Keep in mind that your body knows exactly how to breathe low and slow. When you were a baby and a young child, you were breathing this way all the time. You have a few years of practice. This is kind of like riding a bike, you don’t forget how to do it. You just need to let your body do what it knows how to do. Watch me doing this first, and then join in whenever you are ready.”
Let’s shift the breath down from the chest to the belly, take a normal sized comfortable breath in, and exhale slowly, perhaps blowing air out through pursed lips, as if you are blowing out a candle.

- Allow yourself to exhale fully, do not rush the next inhalation
- Again, take a normal sized comfortable breath in, exhale slowly and fully
- Repeat 5 or 6 breaths
THE BREATHING REFLEX

- The natural drive to breathe
- Triggered by the medulla oblongata in response to rising levels of CO$_2$
- Chemical receptors sensitive to pH level of the blood
- As CO$_2$ levels rise, pH becomes more acidic
- Medulla sends the signal to breathe
“Losing” the Breathing Reflex

- Often overridden during overbreathing

- Person breathes in too early, before CO$_2$ levels rise sufficiently. This brings blood CO$_2$ levels down

- Can be taken over by
  - attempts to “catch” one’s breath due to fear of having difficulty breathing
  - over-regulation of breathing in an attempt to reduce anxiety
“Finding” the Breathing Reflex

- Take a normal sized comfortable breath in and slow down the exhalation
- Pause your breath for a few seconds between the end of the exhalation and the beginning of the next inhalation
- Observe mindfully
- Notice and allow fear, anxiety, temptation to rush to the next breath, etc.
- Inhale again only when the physiological, not emotional, need to do so arises
- Repeat for 4 or 5 breaths. Follow with low and slow breathing (do not return to overbreathing breaths)
Troubleshooting

- Client reports dizziness, shortness of breath, or feelings of anxiety
  - s/he may be overbreathing. Ask the client to slow down the breath, extend the exhalation and slow down the very beginning of the exhalation
  - s/he may be trying to breathe, creating sympathetic activation. Ask him/her to let go of trying and allow the breath to happen

- Client reports breathing is not relaxing
  - Remind him/her that relaxation is not the purpose, but restoring proper breathing chemistry is
HOW TO HANDLE ACUTE OVERBREATHING

- Bring mindful attention to the breath
- Listen to the breath using earplugs (or plug ears with fingers)
- Take smaller breaths
- Low and Slow breathing
  - Slow breathing down
  - Shift the breath from the chest to the belly
- Breathe out through pursed lips, extending the exhalation
- Extend the transition time between breaths
- Find the breathing reflex
When overbreathing is severe (panic)

- The client may have a hard time catching his/her breath and feel panicked

  - Ask the client to hold his/her breath for 5-20 seconds until sensations of overbreathing begin to subside

  - Be sure the client then continues with low and slow breathing with extended exhale, in order not to return to overbreathing
Paper bag
**Paper Bag**

- Offered to people who are severely overbreathing to breathe into

- Breathing back in exhaled CO$_2$ helps restore CO$_2$ levels in the blood, balance pH, and stop the overbreathing cycle

- Often not advisable as it may exacerbate oxygen deprivation during an asthma attack or another pulmonary or cardiac issue

- Use skills from previous slide instead
MEDICAL CONDITIONS AND OVERBREATHING

- Overbreathing can be compensatory for increased acidity caused by certain disorders of the heart and kidneys, such as diabetes

- Overbreathing reduces acidity, stabilizing the pH

- In cases like these, stopping overbreathing without addressing the physiological illness can be dangerous
PRACTICE TIPS AND CLIENT RESOURCES
1. Clients can place their hands on their abdomen/chest to increase respiratory feedback
2. Breathe with a weight on the abdomen while lying on the floor with knees bent (don’t use *Biofeedback: A Practitioner’s Guide* 3rd edition or a 20-pound sack of rice)
3. Use sound with or without an animated pacer.

The following selection is one of Wayne Martin’s free HRV biofeedback recordings (waynemartinlcsw.com/biofeedback).
4. Breathe with a RESPeRate for auditory and visual respiration rate feedback to slow breathing and increase the post-expiratory pause (don’t let it slow breathing below your clients’ RF).
5. Guide breathing using computer and smartphone pacing displays.

http://www.heartmathstore.com/
Mac OSX or Windows $19.95
Practice Tips

EZ-Air Plus bfe.org $19.95
Practice Tips

Breathe
Breathe2Relax
Breathe Sync
Breathing Zone
PRACTICE TIPS

MyBreath

MyCalmBeat
6. Encourage clients to practice RF breathing during commonplace activities in diverse settings (commuting, at work, and at home).