

Multi-dimensional Approach to Breathing Assessment

Proper breathing is essential for optimal health and movement. When breathing becomes dysfunctional it affects overall health and musculoskeletal system performance. Dysfunctional breathing can contribute to many adverse symptoms and functional disturbances, including those affecting the musculoskeletal system. It can contribute to decreased pain thresholds, impaired motor control and balance, and resultant movement dysfunction. Each of these impairments adversely affects performance in movement and rehabilitation. Recent research has concluded that breathing dysfunction is multi-dimensional in nature and includes three (3) primary dimensions of dysfunction: biomechanical, biochemical and the psychophysiological.

Due to the complex nature of dysfunctional breathing, no single test can reliably stand alone to identify the patient with dysfunctional breathing. Proper evaluation of dysfunctional breathing needs to be comprehensive and consider all 3 dimensions, as well as consider causes and contributing factors.

Functional vs Dysfunctional Breathing

The term "dysfunctional breathing" can be ambiguous, as medical professionals have used the term to reference a range of breathing behaviors and symptoms, including the following:

- Hyperventilation and low CO₂
- Mouth breathing
- Upper chest breathing
- Inability to take a deep and satisfying breath
- Frequent yawning
- Snoring
- Unexplained breathing discomfort
- Sleep Apnea

What is functional breathing?

"Functional breathing is breathing that efficiently and appropriately performs primary and secondary functions." - Courtney, R.

EAARS

Functional breathing has the following characteristics:

1. **Efficient**
2. **Adaptive**
3. **Appropriate**
4. **Responsive**
5. **Supportive**

Breathing Assessment

The Nijmegen Questionnaire

The Nijmegen questionnaire gives a broad view of symptoms associated with dysfunctional breathing patterns. It is only a preliminary guide to breathing training.

Please ring the score that best describes the frequency with which you experienced the symptoms listed

Symptom	Never	Seldom	Some-times	Often	Very often
Chest pain	0	1	2	3	4
Blurred vision	0	1	2	3	4
Dizziness	0	1	2	3	4
Confusion or loss of touch with reality	0	1	2	3	4
Fast or deep breathing	0	1	2	3	4
Shortness of breath	0	1	2	3	4
Tightness across chest	0	1	2	3	4
Bloated sensation in stomach	0	1	2	3	4
Tingling in fingers and hands	0	1	2	3	4
Difficulty breathing or taking deep breaths	0	1	2	3	4
Stiffness or cramps in fingers and hands	0	1	2	3	4
Tightness around the mouth	0	1	2	3	4
Cold hands or feet	0	1	2	3	4
Palpitations in the chest	0	1	2	3	4
Anxiety	0	1	2	3	4
Totals					

Grand Total Score



- 20 indicates SEVERE hyperventilation
- 10 to 20 suggests MILD
- Under 10 breathing may not be the cause of health problems
- Any score over 0 indicates breathing assessment is warranted.

Manual Assessment of Respiratory Motion (MARM)

The Manual Assessment of Respiratory Motion (MARM) was originally developed by Dr. Jan van Dixhoorn. It is used to assess and quantify breathing patterns, and in particular, the distribution of breathing motion between the upper and lower parts of the rib cage and abdomen under various conditions. Research has shown that it is a reliable assessment tool in the hands of trained practitioners (Courtney and Dixhoorn 2009).

1. Sit behind your client and place both your hands on the lower lateral rib cage so that your whole hand rests firmly and comfortably and does not restrict breathing motion.
2. Your thumbs should be approximately parallel to the spine, pointing vertically and your hand comfortably open with fingers spread so that the little finger approaches a horizontal orientation.
3. Make sure your 4th and 5th fingers reach below the lower ribs and can feel abdominal expansion.
4. Make an assessment of the extent of how overall vertical motion of your hands feel relative to the overall lateral motion.
5. Decide if the motion is upper rib cage or lower rib cage/abdomen dominant.

Use this information to determine the relative distance from the horizontal line of the upper and lower lines of the MARM diagram. The upper line will be further from the horizontal and closer to the top if there is more vertical and upper ribcage motion. The lower line will be further from the horizontal and closer to the bottom if there is more lateral and lower rib cage/abdomen motion.

6. Document the overall magnitude and freedom of rib cage motion by placing the lines further apart to represent greater overall motion and closer for less motion.

Hi-Lo Test

The Hi-Lo Test is utilized to determine diaphragmatic breathing pattern or if paradoxical breathing is present. It gives the patient biofeedback as to what they should feel during the breathing cycle and, therefore, is often used as a treatment technique. During the test, the PT should not tell the patient what they are looking for as to no bias the test. The Hi-Lo Test is performed in the sitting position or supine.

1. The clinician stands to the side of the patient and places one hand on their sternum and one hand on their upper abdomen to determine whether thoracic or abdominal motion is dominant during breathing.
2. The clinician will demonstrate on themselves first where the palpation points will be. They will also check for paradoxical breathing. This can be observed during inhalation if the abdomen moves toward the spine, and during exhalation, if the abdomen moves in an outward direction. Test will assess for a minimum of five (5) breath cycles.

Sidelying Manual Assessment of Respiratory Motion (SL-MARM)

This test determines ability to expand the posterior mediastinum portion and lateral portion of the thorax. This movement is essential for attaining full diaphragm exhalation position or starting position for contraction for inhalation. Restrictions and limitations can lead to altered respiratory biomechanics.

1. Patient lies in sidelying with knees and hips at 90 degrees.
2. The PT places their hands on the patient's lateral and posterior rib cage.
3. The patient is then asked to take a minimum 5 breaths inhaling in through the nose and out fully through the mouth.
4. The PT senses for both lateral and posterior movement. Differences from side to side are then documented.

Breath Holding at Functional Residual Capacity

FRC refers to the volume of air left in the lungs after a normal, passive exhalation. Breath holding at FRC means holding the breath after a normal relaxed exhalation. Breath holding times help gauge an understanding of all dimensions of breathing because the biomechanical and psychophysiological dimensions can also affect outcome of breath holding times.

1. Have the individual breathe in, breathe out naturally. At the end of the exhale, ask them to hold their breath by plugging their nose.
2. Tell them to hold their breath until they feel a clear desire to breathe or experience involuntary muscle activity from the diaphragm or other breathing muscles.
3. Start a timer as soon as the individual holds their breath and stop when they release their nose, or you see the first sign of muscle activity.

*If time is less than 25 seconds, suspect dysfunctional breathing may be present

Dysfunctional: < 25 Seconds

Sub optimal: 26 - 35 Seconds

Functional: > 35 Seconds

Unilateral Rib Expansion Test

The Unilateral Rib Expansion Test is used to determine the patient's ability to expand or inflate either the right or left rib cage. Clinical observations of patient apprehension, accessory muscle use, and/ or visually noting limitations in expansion are recorded. This is repeated on each side and asymmetries and/ or compensations are noted. While performing this test it is important to note patient response through facial expressions as well as any potential neck muscle activity.

1. The patient lies supine in the hooklying position or with legs elevated on bolster.
2. The therapist instructs the patient to take a breath of air in and then fully exhale.
3. The PT will manually guide the ribs down as the patient exhales.
4. The patient is then asked to inhale while the PT keeps pressure down on the contralateral side being tested (For example, holding down the left side will test the right side ability to expand/ inflate).
5. Have the patient take up to 5 breathes to sense ability to breathing into side being tested
6. PT observes for apprehension, overuse of neck musculature, and or limitations in movement of the rib cage.

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