Diaphragmatic Breathing as an Intervention for Chronic Low Pain

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Objectives

1. Demographics of chronic low back pain
2. Basic understanding of the sources of pain perception
3. Efficacy of diaphragmatic breathing as an intervention for anxiety and depression
4. Efficacy of diaphragmatic breathing as an intervention for low back pain
5. Correct sequence and recruitment muscles for diaphragmatic breathing
6. Basic ability to assess and treat breathing patterns

Why is this important?

- Approximately ¼ of adults in the US experience low back pain yearly [1]
- According to the National Institutes of Health, 80% of adults in the US will experience low back pain in their lifetime [2]
- The incident rate of low back pain in the US in 1.39 per 1,000 person-years and accounted for 3.16% of the ED visits between the years 2004-2008 [3]
- $87.6 billion total healthcare expenditures on LBP [4]
- Opioid prescriptions increased from 164 million to 234+ million between the years 2000-2010 [5]
- Opioid related trips to the ED increased from 150% to 200% [5]
- In 2014, 18,893 patients died due to prescription drug overdose [5]
- October 26, 2017, opioid crisis declared Public Health Emergency [6]

Demographics

- Peak age groups affected are 25-29 years old with an incident rate of 2.58 per 1,000 person-years and 95-99 year old with an incident rate of 1.47 per 1,000 person-years [3]
- Males > Females between the ages 10-49 years old, Females > males between the ages 65-99 years old [3]
- African Americans and Caucasians have a higher incidence rate of LBP than Asians [3]
- Geriatric population overall has the highest incidence of LBP [3]

Sources of Pain Perception [7]

1. Peripheral
2. Central
3. Biobehavioral

Psychosocial Behaviors:
Effect on Pain Perception

Central [7]

- Adaptations made in the brain and spinal cord in response to pain

Biobehavioral [7]

- Catastrophizing
- Poor coping
- Fear
- Anxiety*
- Depression*

Psychosocial Behaviors:
Effect on Pain Perception

Depression

- Sagheer et al (2013) [8]
- Kinney et al (1993) [9]

Anxiety

- Nahman-Averbuch et al 2016 [10]
- Sagheer et al (2013) [8]
- Kinney et al (1993) [9]

Diaphragmatic Breathing:
Intervention for Anxiety and Depression

Chen et al (2016) [11]

- **N**= 46: 24 =DBR, 22 = control
  - DBR; mean age = 23.8 +/- 6.1, 24 participants (9 F*), 1 participant dx with depression.
  - Control group; mean age = 25.27 +/- 7.49, 22 participants (11 F*), 1 participant dx with depression
  - *High dropout
- **Eligibility criteria**:
  - anxiety ≳ 1 month, BAI score >8.
  - Not eligible if dx with respiratory disorder or 7-finger defect.
- **Baseline variables:** Baseline BAI scores were not statistically different between groups.

Chen et al: Results [11]

	Experimental group ($N = 15$) Mean ± *SD*	Control group ($N = 15$) Mean ± *SD*	p^a
BAI (scores)			
Week			.033*
0	19.13 ± 7.52	19.87 ± 10.75	
4	12.67 ± 7.09	15.93 ± 9.57	
8	5.33 ± 4.52	18.20 ± 9.87	
$p^b < .001$			$p^c = .001$***
Skin conduct (μmhos)			
Week			.58
0	1.77 ± 2.51	0.87 ± 0.55	
4	1.05 ± 1.49	1.10 ± 1.19	
8	0.49 ± 0.42	0.69 ± 0.46	
Peripheral temperature (°C)			
Week			.026*
0	33.26 ± 1.49	31.45 ± 4.22	
4	34.53 ± 1.10	32.70 ± 2.89	
8	34.77 ± 1.01	32.21 ± 4.15	
$p^b = .018$*			$p^c = .653$
Heart rate (number/min)			
Week			.005**
0	85.52 ± 8.02	82.82 ± 5.50	
4	76.97 ± 7.14	85.69 ± 10.19	
8	72.45 ± 5.57	83.63 ± 6.17	
$p^b = .004$**			$p^c = .001$***

Chen et al: Results [11]

Breath rate (number/min)			
Week			.004**
0	16.24 ± 2.27	16.04 ± 1.43	
4	14.06 ± 2.20	16.56 ± 2.23	
8	12.59 ± 2.40	16.16 ± 1..81	
$p^{b} < .001$			$p^{c} < .001$***

Diaphragmatic Breathing:
Intervention for Anxiety and Depression

Ma et al (2017) [12]

- **N**= 40, 20 = BIG, 20 = control
  - BIG; mean age = 30.16 ± 5.11, 10 F, mean education = 16.21 ± 1.03 years, mean work = 7.24 ± 5.34 years.
  - Control; mean age = 28.25 ± 3.91, 10 F, mean education = 15.85 ± 0.37 years, mean work = 5.75 ± 3.31 years
- **Eligibility criteria**:
  - excluded if PMH of cardiovascular diseases, cerebrovascular diseases, respiratory diseases, autoimmune diseases, diabetes, neuropathy, drug or alcohol abuse, prior training in yoga, Quigong, and mind-body training
- **Baseline variables:** Baseline respiratory rate and salivary cortisol levels not statistically different between groups

Ma et al Results [12]

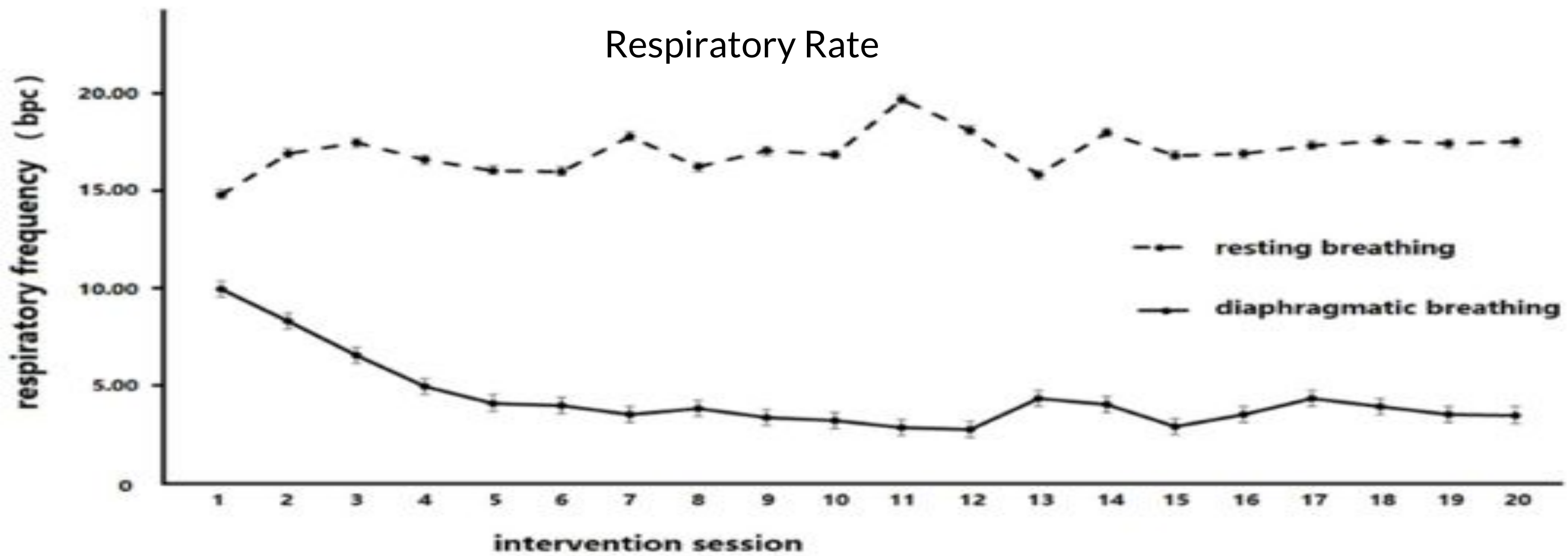


FIGURE 2 | Respiratory frequency changes in breathing intervention group (BIG) under different breathing conditions. Diaphragmatic breathing frequency was significantly lower than that in the resting breathing condition in BIG.

Ma et al Results [12]

- Salivary Cortisol
  - Experimental group: significant decrease
  - Control group: no change

Diaphragmatic Breathing:
Intervention for LBP

Mehling et al [13]

- **N**= 36, PT = 18, Breath therapy = 18
  - PT; mean age = 48.7 +/- 12.5, 58.3% F, median education = college degree, 83.3% on pain med, 91.7% previous PT tx, median pain duration = 13.7 +/-5.9 months
  - BT; mean age = 49.7 +/- 12.1, 68.7% F, median education =college degree, 87.5% on pain meds, 75% previous PT tx, median pain duration = 11.6 +/-5.9 months.
- **Eligibility criteria**:
  - 20-70 years old
  - 3-24 months of symptomatic LBP
  - previous tx from PCP for LBP
  - fluent in English.
  - Excluded if: spinal sp, compensation for LBP, abuse alcohol or drugs, mental or psychological impairments, or other diseases related to pain.
- **Baseline variables:**
  - 3/5 postural sway tests worse in PT
  - All other variables did not demonstrate significant differences between groups at baseline.

Mehling et al Results [13]

Results

	Breath Therapy	Physical Therapy	P value within groups	P value between groups
Mean VAS score at Baseline (cm)*	5.15 (±2.04)	4.37 (±2.36)		0.36
Mean changes from Baseline to Post intervention*	-2.71 (± 2.23)	-2.43 (± 2.05)	<0.005	0.74
Mean changes from Baseline to 6 months post intervention*	-1.71 (±2.12)	-2.45(±2.55)	<0.006	0.56
*scores reported as mean ± SD in cm				

Mehling et al Results [13]

Results

	Breath Therapy	Physical Therapy	P value between groups
Mean SF-36 bodily pain score at Baseline	50.1 (±16.6)	42.3 (± 16.0)	0.23
Mean changes from Baseline to Post intervention	+14.9 (±1.5) ¶	+21.0 (± 2.48)**	0.45¥
Mean changes from Baseline to 6 months post intervention	+14.6 (± 19.5)§	+27.0 (± 22.6) ¶	0.27£
*scores reported as mean ± SD, ¥ by t-test, £ by repeated measures ANOVA for the 3 time points, p value within groups ** $p < 0.05$, § $p < 0.01$, ¶ $p < 0.005$			

Mehling et al Results [13]

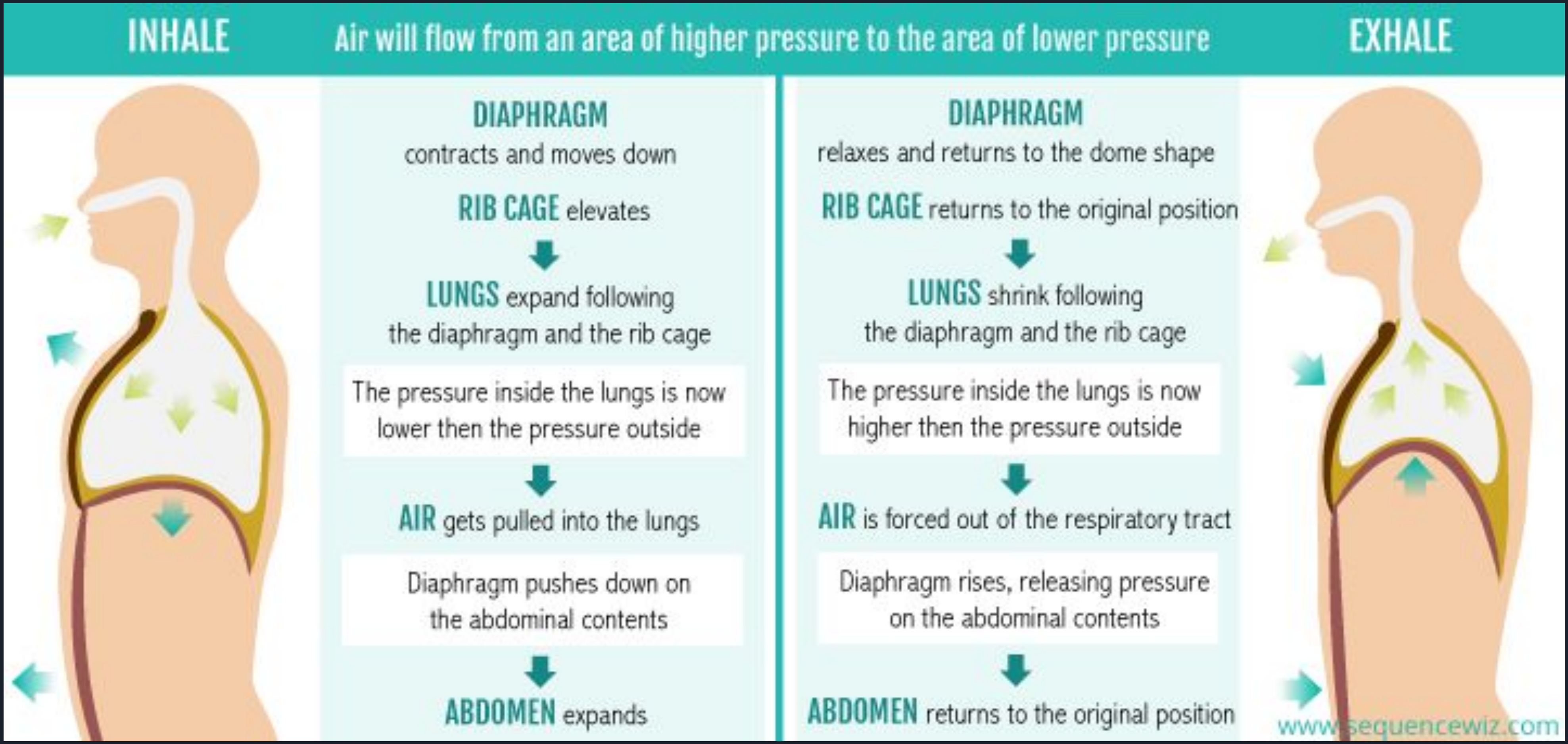
Results

	Breath Therapy	Physical Therapy	P value between groups
Mean mRMQ score at Baseline	6.7 (± 3.3)	6.6 (± 4.0)	0.94
Mean changes from Baseline to Post intervention	-4.28 (± 5.92) §	-3.13 (± 6.90)	0.51¥
Mean changes from Baseline to 6 months post intervention	-3.72 (± 6.03)**	5.18 (± 5.90)**	0.53£
*scores reported as mean ± SD, ¥ by t-test, £ by repeated measures ANOVA for the 3 time points, p value within groups ** $p < 0.05$, § $p < 0.01$, ¶ $p < 0.005$			

Respiratory Diseases and Low Back Pain [14]

- Evidence demonstrates association between respiratory disorders and LBP [14-17]
- Dyspnea
  - 64% higher prevalence of pain
  - Relative risk for LBP 1.76 (CI 1.71 - 1.82) → 3.26 (CI 3.06 - 3.46)
- Non-Specified Respiratory Disorder
  - Developing LBP : Young F = 1.43 - 1.38 OR, middle-aged F 1.13 - 1.63 OR, older women 1.09 - 2.11 OR
  - Developing RD: 1.3 OR (CI 1.0 - 1.6)
- Asthma
  - 30% > prevalence of LBP in ages 20-39 years old
- Allergy
  - 50% more likely to develop LBP
- COPD
  - 58% - 69% reported LBP
- Respiratory Infections
  - Positive relationship found b/w those suffering from RI and LBP

Diaphragmatic Breathing



http://sequencewiz.org/2014/03/04/yogic-breathing-chest-belly-belly-chest-care/

Muscles of Inhalation and Exhalation

- Chapman et al (2016)

	Muscles of Inhalation	Muscles of Exhalation
Primary	Diaphragm Parasternal internal intercostals Upper and lateral external intercostals Levatores costarum Scalenes (less active during normal breathing)	Elastic recoil* Diaphragm Pleura and costal cartilage*
Accessory	Sternocleidomastoid Upper trapexius Serratus anterior Latissimus dorsi Iliocostalis thoracis Subclavius Omohyoid	Interosseous internal intercostals Abdominal muscles Transversus thoracis Subcostales Iliocostalis lumborum Quadratus lumborum Serratus posterior inferior Latissimus dorsi

Assessment [16,17]

- Posture
- Expansion during inhalation

Let’s Practice!

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