Decreased Lung Volume in Cystic Fibrosis Client

Cystic Fibrosis (CF) is an autosomal recessive disease. Most notably, it causes chronic progressive obstructive lung disease, intestinal malabsorption, and decreased sweat glad secretion. Cystic Fibrosis is caused by defects in the cystic fibrosis transmembrane conductance regulator (CFTR) protein. Alteration in the CFTR gene within the lungs causes the mucus that lines the respiratory tract to thicken and build up, increasing inflammatory responses, leading to scaring of the lungs. Overtime this increases dysfunctional breathing patterns and decreases lung function in patients with CF.

Initial Visit

Patient is a 57-year-old female with cystic fibrosis. Her medical complications include moderate chronic obstructive pulmonary disease and exocrine pancreatic insufficiency. She has been exercising for over 30 years, but has not underwent any specific respiratory muscle training throughout her life.

Past Medical History:

Client was diagnosed with Cystic Fibrosis at birth. She was diagnosed with ΔF508 gene mutation. Throughout her life she has had several cases of pneumonia and required hospitalization on multiple occasions for IV antibiotic treatments. She has a history of chest tightness, shortness of breath and lower back pain. She underwent an L-4-5 fusion one year prior to treatment.

Pre Testing:

Client performed spirometry testing before each treatment, as well as post treatment. She used the Microlife PF 100 Peak Flow Meter to collect her peak expiratory flow rate (PEFR) and force expiratory volume in one-second (FEV_1). The client performed four spirometer tests pre and post treatment. The mean PEFR and FEV_1 was calculated between the 2nd, 3rd and 4th test. Prior to treatment her (PEFR) was 360L/min and her FEV_1 was 1.49.

Objective:

Testing	Pre		Post		Post Testing Results
	Left	Right	Left	Right	
Adduction Drop Test	+	+	+	-	
Hruska Adduction Lift Test	0	0	1	0	
Apical Expansion	Limited	Limited	Limited	Increase	
Side Lying Apical Expansion	Limited	Limited	Limited	Limited	
Shoulder Abduction	+	+	Increase	Increase	ROM increase but not significant
GH IR	+	+	Increase	Increase	ROM increase but not significant
PEFR	360 L/min		396 L/min		+ 36 L/min
FEV_1	1.49 L,btps		1.58 L,btps		+ .09 L,btps

Assessment:
The patient presents a PEC pattern and possible superior T4 syndrome. The left and right hemi-pelvis are positioned forward, indicated by a positive left and right adduction drop test. Client presents bilateral rib flare (external rotated). Limited bilateral apical expansion with contralateral opposition and limited side lying apical expansion on both side. After palpations of the left and right subclavius, client presents tenderness and limited distance between the right clavicle and 1st rib compared to the left side. Super T-4 syndrome is hypothesized based on the decrease in bilateral Glenohumeral internal rotation, decrease in bilateral shoulder abduction. During right apical expansion test I observation an over active right scalene. Client is not able to establish an efficient zone of apposition (ZOA) during breathing, more so on the left compared to the right. Initial treatment will focus on inhibiting the right scalene and facilitation of a ZOA.

Treatment:

1. *Superior T4 Manual Technique*
    - Emphasis in inhibiting the right scalene and facilitation and integration of external rotation (inhalation) of the right ribs (3rd-12th) and left ribs internal rotation (exhalation).

2. *Squatting Bar Reach*
    - Promote inhibition of paravertebral muscles and facilitate posterior mediastinum expansion
3. *All 4's Belly Lift*
    - Facilitation of right and left Internal obliques and transverse abdominus to increase bilateral rib internal rotation (exhalation) and establish a ZOA after inhibition of the paravertebral muscles from exercise #2 (squatting bar reach).

<u>Second Visit: (2 days later)</u>

Subjective:
Client reports that they felt as if they could get more in after their initial visit.

Assessment:
Client still presents a PEC pattern, with the left innominate tip a little further forward than the right. Apical expansion is still limited on both sides. The goal is to increase apical expansion with a subclavius release and inhibition of the right scalene and bilateral paravertebral muscles.

Objective:

Testing	Pre		Post		Post Testing Results
	Left	Right	Left	Right	
Adduction Drop Test	+	+	+	-	
Hruska Adduction Lift Test	0	0	1	0	
Apical Expansion	Limited	Limited	Limited	Increase	
Side Lying Apical Expansion	Limited	Limited	Limited	Limited	
Shoulder Abduction	+	+	Decrease	Decrease	Not Significant
GH IR	+	+	Decrease	Decrease	Not Significant
PEFR	385 L/min		410 L/min		+25. L/min
FEV_1	1.57 L,btps		1.74 L,btps		+.17 L,btps

Treatment:

1. *Superior T4 Manual Technique*
    - Emphasis in inhibiting the right scalene and facilitation and integration of right ribs (3^{rd}-12^{th}) external rotation (inhalation) and left ribs internal rotation (exhalation).

2. *All 4's Belly Lift*
    - Facilitation of right and left Internal obliques and transverse abdominus to increase bilateral rib internal rotation (exhalation) and establish a ZOA.

3. *Squatting Bar Reach*
    - Promote inhibition of paravertebral muscles and facilitate posterior mediastinum expansion

Post Treatment Notes:

Client felt as if she was able to get more air into her thoracic cage during inhalation of the spirometry test (post testing). She also coughed profusely after exhalation, which helps aid in the clearing of mucus. This is very important because patients whose lungs are affect by CF, build up mucus in their lungs causing inflammatory responses and eventually scaring of the lung tissue. A goal for people with CF is to cough up as much mucus, so they can clear excess build up reducing the potential of inflammatory responses.

<u>Third Visit: (6 days later)</u>

Subjective:

Client reports that they can't get air into the left side and feels as if the right neck muscles are working during inhalation.

Assessment:

Client still presents a PEC pattern and we believe it is due to the colder weather and exacerbating symptoms over the past week. Emphasis will be placed on inhibiting the right scalene, and increasing ZOA on the left.

Objective:

Testing	Pre		Post		Post Testing Results
	Left	Right	Left	Right	
Adduction Drop Test	+	+	-	-	Able to drop both side posttest (wasn't smooth)
Hruska Adduction Lift Test	0	0	1	1	
Apical Expansion	Limited	Limited	Increase	Increase	Improvement
Side Lying Apical Expansion	Limited	Limited	Increase	Increase	Improvement
Shoulder Abduction	+	+	Decrease	Decrease	Normal
GH IR	+	+	Decrease	Decrease	Normal
PEFR	349 L/min		389 L/min		+40 L/min
FEV_1	1.54 L,btps		1.64 L,btps		+.1 L,btps

Treatment:

1. *Superior T4 Manual Technique*
    - Emphasis in inhibiting the right scalene and facilitation and integration of right ribs (3^{rd}-12^{th}) external rotation (inhalation) and left ribs internal rotation (exhalation).

2. *All 4's Belly Lift*
    - Facilitation of right and left Internal obliques and transverse abdominus to increase bilateral rib internal rotation (exhalation) and establish a ZOA.

3. *Squatting Bar Reach*
    - Promote inhibition of paravertebral muscles and facilitate posterior mediastinum expansion

4. *All Four Left Posterior Mediastinum Expansion in Left AF IR*
    - Promote left posterior mediastinum expansion, left internal obliques and transverse abdominus, facilitate left IC adductor and left semimembranosus and semitendinosus.

Post Treatment Notes:

Client felt as if she had more abdominal activation on the left and air was expanding her upper back during inhalation. She also felt during post spirometer testing, that she was able to get more air in on inhalation and on exhalation, she felt as it was "junkier".

<u>Fourth Visit: (3 days later)</u>

Subjective:

Client reports that she doesn't feel her right neck muscles working when she inhales.

Assessment:

Client still presents limited apical expansion however, she has shown greater improvements than previous treatments. I have also observed less activity in her right scalene

during apical expansion and side lying apical expansion test. Due to this observation, we will focus on improving right intercostal expansion through Standing Right Side Quadratus Lumborum and Intercostal stretch, as well as inhibiting the left latissimus through the Standing Left Side Latissimus stretch. The improvement in apical expansion on the right leads me to hypothesis that inhibiting her left latissimus will aid in an increase in right intercostal expansion and promote rib external rotation on the right side during inhalation.

Objective:

Testing	Pre		Post		Post Testing Results
	Left	Right	Left	Right	
Adduction Drop Test	+	-	-	-	Able to drop on both side posttest (smooth)
Hruska Adduction Lift Test	0	1	2	2	
Apical Expansion	Limited	Limited	Increase	Increase	Improvement
Side Lying Apical Expansion	Limited	Limited	Increase	Increase	Improvement
Shoulder Abduction	-	+	-	-	Normal
GH IR	+	+	-	-	Normal
PEFR	383 L/min		407 L/min		+24 L/min
FEV_1	1.63 L,btps		1.75 L,btps		+.12 L,btps

Treatment:

1. *Standing Right Side Quadratus Lumborum and Intercostal Stretch*
    - Promote right intercostal and quadratus Lumborum inhibition

2. *Standing Left Side Latissimus Stretch*
    - Promote left latissimus inhibition

3. *All 4's Belly Lift*
    - Facilitate right and left Internal obliques and transverse abdominus to increase bilateral rib internal rotation (exhalation) and establish a ZOA.

4. *90/90 Hip lift with Right Arm Reach and Balloon*
    - Emphasis on facilitating right and left IC adductors and semimembranosus and semitendinosus

5. *All Four Left Posterior Mediastinum Expansion in Left AF IR*
    - Promote left posterior mediastinum expansion, left internal obliques and transverse abdominus, facilitate left IC adductor, left semimembranosus and semitendinosus.

6. *Quadruped Passive Left AF IR with Reciprocal TS/ST Integration*
    - Facilitate left IC adductor, left semimembranosus and semitendinosus and right lower trap.

Post Treatment Notes:

Client showed great improvement in apical expansion in the right brachial chain. We integrated lower extremity position exercises to facilitate bilateral hamstring activation to reposition left and right innominate and increase facilitation of the left ZOA with facilitating left IC adductor and left semimembranosus and semitendinosus.

Fifth Visit: (2 days later)

Subjective:

Client reports that her postural repositioning exercises feel as if they have similar effects to her at home respiratory treatments. She feels as if she is able to get more air into the back of her lungs and is coughing up more mucus than she had previously.

Assessment:

Client still presents limited apical expansion however, she is presenting an increase in apical expansion on the right side compared to previous treatments. This leads me to hypothesis that she is developing a higher resistance to a PEC pattern, improvement in respiratory motor control on the right side. Due to the increase in respiratory motor control on her right side, lower extremity exercises geared to improve left and right innominate position will be added to aid and support ZOA on her left side.

Objective:

Testing	Pre		Post		Post Testing Results
	Left	Right	Left	Right	
Adduction Drop Test	+	-	-	-	Able to drop on both side posttest (smooth)
Hruska Adduction Lift Test	1	1	3	3	
Apical Expansion	Limited	Limited	Increase	Increase	Significant Improvement
Side Lying Apical Expansion	Limited	Limited	Increase	Increase	Significant Improvement
Shoulder Abduction	+	+	-	-	Normal
GH IR	+	+	-	-	Normal
PEFR	389 L/min		420 L/min		+31 L/min
FEV_1	1.68 L,btps		1.76 L,btps		+.08 L,btps

Treatment:

1. *Standing Right Side Quadratus Lumborum and Intercostal Stretch*
    - Promote right intercostal and quadratus Lumborum inhibition

2. *Standing Left Side Latissimus Stretch*
    - Promote left latissimus inhibition

3. *All 4's Belly Lift*
    - Facilitate right and left Internal obliques and transverse abdominus to increase bilateral rib internal rotation (exhalation) and establish a ZOA.

4. *90/90 Hip lift with Right Arm Reach and Balloon*
    - Emphasis on facilitating right and left IC adductors and semimembranosus and semitendinosus

5. *All Four Left Posterior Mediastinum Expansion in Left AF IR*
    - Promote left posterior mediastinum expansion, left internal obliques and transverse abdominus, facilitate left IC adductor, left semimembranosus and semitendinosus.

6. *Quadruped Passive Left AF IR with Reciprocal TS/ST Integration*
    - Facilitate left IC adductor, left semimembranosus and semitendinosus and right lower trap.

Post Treatment Notes:

Client felt spirometry testing was her best yet. Client felt as if she could get even more air into her thoracic cage. She coughed more than in previous treatments and overall felt like she had less restrictions in her upper back compared to previous treatments. The goal for her now is to keep up with her exercises and maintain upper extremity apical expansion exercises in her daily exercise routine.

Reference

Hruska, R. (2008). *Postural Restoration Institute*. Retrieved from https://www.posturalrestoration.com/