Making an Impact on Posture with Manual Therapy and Exercise

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Objectives

- Examine causes and multisystem health implications of agerelated hyperkyphosis using the ICF model
- Discuss and perform evidence based and clinically relevant examination techniques for hyperkyphosis and forward head posture
- Discuss and perform evidence based manual therapy techniques and postural exercises for hyperkyphosis and forward head posture
- Discuss the impact of manual therapy and exercise on multiple systems including posture, gait, functional mobility, and quality of life through case presentation and research results

Content Outline

Lesson 1: Introduction: Hyperkyphosis

- What is hyperkyphosis?
- What are the contributing factors and health implications?
- Lesson 2: Examination of Hyperkyphosis and Forward Head Posture
 - Review of evidence
 - Lab: Perform clinically relevant postural measures
- Lesson 3: Intervention for Hyperkyphosis and Forward Head Posture
 - Evidence for manual therapy and therapeutic exercise
 - Lab: Practice techniques
- Lesson 4: Impact of Manual Therapy and Exercise on Posture, Gait, and Functional Mobility
 - Application of ICF model
 - Results and Qualitative impact

Patient Case

- 89 y/o male
- Forward head, thoracic kyphosis, increased hip flexion, knee flexion, DF
- Poor functional balance





Definitions

Posture



Normal Kyphosis 20-40 degrees Cobb angle



Definitions



Age-related hyperkyphosis

Prevalence & incidence in both genders: 20-40%

- Childhood to 3rd decade = 20-29 degrees (Cobb angle)
- Age 40+ = Cobb angle increases in females > males
 - Age 55-60 = 43 degrees
 - Age 76-80 = 52 degrees
- Block test = 1 to 5 blocks



Contributing Factors to Hyperkyphosis

Fixed	 Vertebral compression fractures Degenerative disc disease Decreased body density Spondylosis Aging Genetic predisposition
Modifiable	 Muscular weakness Decreased muscle mass Decreased postural (sagittal) alignment Increased connective tissue fragility Decreased balance, postural instability and risk of falls Decreased physical function /outdoor activity
Fixed and/or Modifiable	 Occupation and functional activities that require spinal flexion > extension Psychotropic medications Emotional state Impaired pulmonary function

Multisystem Health Implications

ICF Domain	Problem
Health conditions	Vertebral compression fractures Pneumonia, COPD Gastrointestinal problems Falls, Fear of falling
Impaired body structure/ function	Back pain, neck pain Spinal muscle weakness ↓ balance ↓ gait speed, chair stands ↓ Pulmonary function (difficulty breathing, ↓ vital capacity)
Activity limitation	Impaired functional mobility & ADL: difficulty - reaching, housework, community activities)
Participation	Sleep problems due to pain Quality of life (↓ social interaction, dependence on others) Mortality (2° vertebral fracture, pneumonia, COPD)

Postural Measures

- Height
- Observation/Plumb line
- Tragus to Wall
- Block test
- Flexicurve
- Debrunner kyphometer
- Spinal mouse

Reliability & Validity

Test	Inter-rater	Intrarater	Validity	Source
Cobb Angle (Gold Standard)	.97 NR	.97 NR	NR .97 (Convex) & .98 (Concave)	Wu et al. (2014) Ricart et al. (2011)
Debrunner Kyphometer	.9798 .85	.98 .92	NR NR	Greendale et al. (2011) Korovessis et al. (2001)
Flexicurve Index	.9394 .87 .96 .94	NR .94 .96 .86	NR .528906 .656 – 758 0.4	Hinman (2004) Teixeira & Carvalho (2007) Greendale et al. (2011) Barrett et al. (2013)
Tragus or Occiput to Wall	.9395 .86 (relax)/ .89 (cued) .96 .84	NR NR NR .90	NR NR NR NR	Heuft-Dorenbosch et al. (2004) Nair et al. 2017 Calvo-Gutierrez et al. 2016 Shipe et al. 2012
Block method	.85 – 1	NR	NR	Katzman et al. 2015

Review of the Evidence

Gold Standard Comparison			
Tool	R ²		
Debrunner Kyphyometer	.5865		
Flexicurve Index	.5768		
Tragus to wall	Not available		
Block method	.63		

Postural Measures

Height







Posture





Kypholordosis variations:



Kyphotic index norms?

Milne (1974) Age Effects in Kyphosis and Lordosis

- Age Female Male
- \sim 20-24 7.0 \pm 2.0 8.5 \pm 2.0
- ► 25-29 8.5 ± 2.5 8.0 ± 2.5
- **•** 30-34 7.0 ± 1.0 8.0 ± 2.5
- 35-39 7.5 ± 2.0 8.2 ± 1.5
- **•** 40-44 7.0 \pm 1.5 8.5 \pm 2.5
- ► 45-49 7.0 ± 2.0 8.5 ± 2.5
- **•** 50-54 9.0 \pm 3.0 7.5 \pm 2.0
- **•** 55-59 9.5 ± 2.5 8.5 ± 3.0
- \bullet 60-64 11.0 \pm 2.0 10.0 \pm 3.0
- **•** 65-69 $12.0 \pm 2.5 11.0 \pm 3.0$
- **•** 70-74 $12.5 \pm 3.011.5 \pm 2.5$
- **•** 75-79 $13.5 \pm 4.012.0 \pm 4.0$
- \sim 80 + 15.0 ± 6.0 12.0 ± 4.0

Tragus to Wall





Tragus to Wall



Blocks Method

Hyperkyphosis = 1 to 5 blocks



Blocks Method – Normal posture



Blocks Method – Kyphotic Posture



Blocks Method



Acromion to table





Practice Lab

Flexicurve
Tragus to Wall
Block method
Acromion to table

Refer to your handouts for procedure

Other Measures

- 2 Minute Walk Test (2MWT)
- Timed Up & Go (TUG)
- Functional Reach
- Gaitrite

Timed Up & Go (TUG) test



Functional Reach Test



Gaitrite and Tekscan



Evidence on flexed posture and function

- Those with more blocks associated with poor physical function or slower walking speeds or slowest chair to stand
- No association between kyphosis and chair stands or walking speeds or self-reported impairments

Gait Speed and Survival in Older Adults



Patient Case

- 89 y/o male
- Forward head, thoracic kyphosis, increased hip flexion, knee flexion, PF
- Poor functional balance

What subjective interview questions would you ask?

Hyperkyphosis



World Health Organization. Towards a Common Language for Functioning, Disability and Health: ICF http://www.who.int/classifications/icf/icfbeginnersquide.pdf?ua=1. 2002; Accessed September 18, 2017.

Treatment/Goals

What are the modifiable aspects of posture?

What would you do to treat this person?

Exercise to improve range of motion

Exercise to improve strength

Manual therapy to improve joint mobility and soft tissue mobility

Functional activities to improve functional mobility and balance

Case Results

	Pre-test	Post-test	Difference
Height (cm)	166.1	168.4	2.3
TUG (sec)	13.2	9.5	-3.7
Block test (cm)	7	4.5	-2.5

TUG Normative Data for Community-Dwelling Adults:					
Age	Gender	n	Mean	SD	95% CI
60-69	Male	15	8	2	7-9
	Female	22	8	2	7-9
70-79	Male	14	9	3	7-11
	Female	22	9	2	8-10
80-89	Male	8	10	1	9-11
	Female	15	11	3	9-12

Cut-Off Scores indicating risk of falls by population

Population	Cut-Off score	Author
Community dwelling	> 13.5*	Shumway-Cook et al,
adults		2000
		Rehabmeasures.org

Height







Posture





Pre-treatment



Post-treatment



Flexicurve

	Pre-test	Post-test	Difference	-
TW	4.05	3.4	0.7	
TL	33.3	39.7	6.4	
LW	0.3	0.6	0.3	
LL	8.6	7.6	1.0	-
L	41.9	47.3	4.4	
KI=100*TW/T				
L	12.16	8.56	3.6	U



Block Method

Pre-treatment





Block Method

Pre-treatment



Post-treatment



Treatment delivered

3x/week x 4 weeks

Manual therapy

- Joint mobilizations (cervical, thoracic, rib, shoulder/pelvic girdle)
- Myofascial release (pecs, scalenes, suboccipitals, erector spinae, hip flexors)
- Therapeutic exercise
 - Scapular and hip strengthening with the use of theraband as resistance
 - Stretching of the spine and shoulder/pelvic girdles

Exercise



Inclusion criteria

- Participants were at least 50 years old
- community-dwelling
- with hyperkyphosis or forward-head posture
- able to walk at least 15 feet x 5

Results Demographics

- 14 women and 8 men participated in this study
- Mean age was 66.5 (± 9 SD, range 52-90 years)
- Ethnicity: Not Hispanic
- Race: White

Posture and Function

Outcome	Change	Change	Total Change
Measure	Initial to Middle	Middle to Final	Initial to Final
Height	+0.83 cm*	-0.08 cm	+0.75 cm*
KI	-1.58*	-0.83	-2.41*
Block Test	-0.57 cm	-0.60 cm*	-1.17 cm*
ATT	-0.93 cm*	-0.91 cm*	-1.85 cm*
TUG	-0.60 sec	-0.51 sec*	-1.11 sec*
2MWT	+31.08 ft*	+16.30 ft*	+47.38 ft*
5xSTS	-0.93 sec	-0.66 sec	-1.58 sec*
FR	+2.05 cm	-0.12 cm	+1.93 cm

* Indicates significance (p < 0.05)

Graphs of Postural Change Over 4 weeks









Graphs of Functional Change Over 4 weeks











Visual of Postural Change



Insert video



Visual of Postural Change





Pre- (red) & Post- (green) intervention Flexicurve tracing and photos of same participant

Gait

Statistically significant changes

- Gait velocity increased by .09 m/sec (SD±0.21); MDC = +0.1 m/sec
- Stride length increase by 4.53 cm (SD±18); MDC = +5 cm
- Double limb support time decreased by 0.032 sec; MDC = -0.022 sec

Clinically significant change

Stride width decreased by 0.3 cm (clinically significant change 0.05 cm)

Gait Speed and Survival in Older Adults



Patient Specific Functional Scale (PSFS)

- Participants identified 3 activities affected by posture
- Each activity was rated for level of difficulty on a scale of 0 to 10 (higher is less difficult) at initial and final visits
- Ratings across the 3 items were averaged for a composite PSFS score



Qualitative Results

PSFS

Outcome Measure	Pre- treatment Mean (SD)	Post- treatment Mean (SD)	Difference
PSFS	5.7 (1.3)	8.6 (1.1)	2.9*

* *P* < 0.001

Minimum detectable change for average difference = 2.4 to 2.8 points



6 ICF domains accounted for 74.2% of PSFS items

- d415 Maintaining a body position (22.7%)
- d920 Recreation and leisure (13.6%)
- d450 Walking (12.1%)
- d410 Changing basic body position (9.1%)
- d475 Driving (9.1%)
- b134 Sleep functions (7.6%)

Cognitive Mapping How has your posture affected your life?



6 Common Themes

Initial Visit

- 1. posture limits what I can do <_____1. I look better
- 2. posture affects how I look
- 3. poor posture causes me physical discomfort
- 4. posture affects how I feel mentally
- 5. posture affects my wellness
- 6. I desire to correct my posture

Final Visit

- 2. I can do more
 - 3. I feel better mentally
- 4. I feel better physically
 - 5. I can do this able to maintain posture
 - 6. I am more well

3 Most Common Concepts

Initial Visit

- limits my activities (social, recreational, daily, chores)
- 2. causes me physical pain
- 3. limits my endurance

Final Visit

- 1. I am straighter
- 2. I have better function
- 3. I can do more activities

Themes and Concepts move from Negative to Positive Tone

Participants after treatment reported that they felt:

- straighter
- looked better (to self and others)
- younger
- that they were able to do more for longer
- more confident
- had a better attitude
- less pain
- less stiffness
- better sleep
- better health





Conclusions

- A postural intervention of manual therapy and therapeutic exercise may positively influence:
 - Posture (height, block test)
 - Function (TUG, functional reach, 2 MWT, PSFS)
 - Gait (velocity, step/stride length, loading response)
 - Quality of life (PSFS, cognitive mapping)

Conclusions

By maximizing overall alignment of the body through improvements in posture we may improve balance and the ability to control greater gait speed and step length, thereby potentially decreasing fall risk.

Conclusions

This postural intervention of manual therapy and exercise for duration of 4-weeks was found to be effective to elicit changes in posture, function, gait, and quality of life older adults with hyperkyphosis.



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