OUTPATIENT PHYSICAL THERAPY FOR A PATIENT WITH LUMBOSACRAL TRANSITIONAL VERTEBRA AND CHRONIC LOW BACK PAIN

A Doctoral Project
A Comprehensive Case Analysis

Presented to the faculty of the Department of Physical Therapy

California State University, Sacramento

Submitted in partial satisfaction of
the requirements for the degree of

DOCTOR OF PHYSICAL THERAPY

by

Leann Jones

SUMMER
2018

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Abstract

of

OUTPATIENT PHYSICAL THERAPY FOR A PATIENT WITH LUMBOSACRAL TRANSITIONAL VERTEBRA AND CHRONIC LOW BACK PAIN

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A 73-year-old male with chronic low back pain and a diagnosis of lumbosacral transitional vertebrae was seen once a week for twelve weeks at an outpatient physical therapy clinic. Treatment was provided by a student physical therapist under the supervision of a licensed physical therapist. The patient was evaluated with goniometry, the passive knee extension test, manual muscle testing, the numerical pain rating scale, the straight leg raise test, the crossed straight leg raise test, the Oswestry Disability Index, and the Fear-Avoidance Beliefs Questionnaire. A plan of care was established with the main goals of increasing range of motion, strength, functional ability, and sleep quality, as well as for the patient to return to golf, and to reduce pain and fear-avoidance beliefs. Interventions included directional preference and therapeutic exercises, manual therapy, motor control training, a home exercise program, and patient education. The patient increased range of motion, strength, functional ability, and sleep quality, was able to play golf with limitations, and

reported a decrease in pain. He was discharged home with a home exercise program that included information on continuing his graded return to golf.

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ACKNOWLEDGEMENTS

I would like to acknowledge my professors, who have been wonderful role models for me throughout my entire schooling. They taught me a strong foundation for orthopedic physical therapy, allowing me to learn about and treat patients with a variety of orthopedic disorders. Thank you to Dr. MacLeod, Dr. Escamilla, and Dr. Boulgarides for providing me feedback and advising me through the process of creating my doctoral project. Lastly, thank you to my mom for guiding me through not only school, but life as well.

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Chapter 1

General Background

Low back pain (LBP) is a common health problem that roughly 80% of adults experience at some point during their lifetime, with as many as 28% of Americans reporting an episode of LBP within the previous three months.[1] With high prevalence comes increasing costs to individuals, their employers, and healthcare providers. From 1990 to 2010, LBP jumped from the 11th to the 6th contributor to overall global burden of disease, measured in years of life lost due to premature death or years lived in ill health.[2] In 2013, estimated direct and indirect costs associated with LBP were found to be 119-238 billion U.S. dollars.[1] Even a slight decrease in productivity in those experiencing LBP could have an overall greatly magnified effect across the large population producing tens of billions of dollars in lost wages.[1] Conversely, improvements made in these populations can lead to large healthcare cost savings.[1]

Risk factors for experiencing LBP include being female, older age, residing in a country of higher income, being of lower educational status, as well as hereditary factors.[3] Low back pain may arise from multiple pain sensitive anatomical structures including the bones, intervertebral discs, joints, ligaments, muscles, neural structures and blood vessels.[4]

Clinical practice guidelines have been established for LBP to guide clinicians' treatment decisions.[5] The classification system was developed to improve recovery of patients by subgrouping them into specific treatment approaches to which they would be most responsive. Subgroups included traction, specific exercise, manipulation, and

stabilization.[6] Each classification is identified with a unique set of examination criteria. The examination criteria for specific exercise in the direction of extension included symptoms distal to the buttock, symptoms that centralize with lumbar extension, symptoms that peripheralize with lumbar flexion, and demonstration of a directional preference for extension.[6] Centralization occurs when the location of the patient's symptoms are perceived to be in a more proximal location in response to single and repeated motions or sustained positions.[6]

Up to 62% of people with LBP continue to experience symptoms one year later.[4] In addition, the risk of experiencing LBP is doubled for anyone who has a history of LBP.[4] One analysis found centralization to be a stronger predictor of outcome than psychosocial factors such as fear-avoidance beliefs, coping strategy, difficulty sleeping, or somatization.[7] This study found only bothersome leg pain rating and treatment of centralization with the corresponding classification treatment to predict outcome. Specifically, they found subjects with directional preference who received matched therapy treatment to have a 7.8 greater likelihood of a good outcome.[7] The goal of physical therapy intervention is to not only give patients the tools to manage their chronic LBP but to also teach them how to control pain symptoms independently, by helping them to understand a graded return to activity and the nature of chronic pain.

One potential cause of LBP is lumbosacral transitional vertebrae (LSTV). Also known as Bertolotti's syndrome, this anatomical variation is a congenital condition where a fusion occurs between the lumbar and sacral regions.[8] Prevalence ranges from 4% to 35.9%, affecting men more than women, and with unilateral fusion occurring on

the left more often than on the right.[8] Many individuals with LSTV can present without symptoms, and differences in pain or disability amongst those with or without LSTV have not been corroborated by research.[8,9] The proposed mechanisms of pain for symptomatic individuals are similar to those of LBP and include arthritic changes, disc herniation or degeneration, facet joint arthrosis, or spinal canal or foraminal stenosis.[8] At this point, it remains questionable whether or not there is a clear association between LSTV and LBP, and further high-level research is needed to elucidate this relationship.

Chapter 2

Case Background Data

Examination – History

The patient was a 73-year-old male with a BMI of 24.5 referred to the clinic for left-sided LSTV with LBP. The patient presented with chronic (9-year history) non-traumatic gradual onset LBP. The most recent exacerbation had been brought on by a few weeks of coughing when he was sick with a cold 4 months prior. He had visited his primary care physician 2 months prior to his physical therapy appointment.

The patient's chief complaint was central LBP that spread to the left lumbar spine, left posterior leg and lateral calf. His pain was intermittent and variable, ranging from 0-7/10 on the numeric pain rating scale (NPRS). He described the pain as shooting and sharp in the lumbar spine and left buttock, and burning in the left calf. His sleep was being affected as he was waking most nights due to pain once or twice before changing positions to return to sleep immediately.

Aggravating factors included standing up after sitting for more than 3 hours, lifting heavy objects, bending and rotating during a golf swing, and performing yard work. Transitional movements such as rolling in and getting out of bed, and getting up from the floor also caused pain. He described pain with flexion movements and alleviation with extension movements. To ease his symptoms after prolonged sitting the patient would walk for 30 minutes. To alleviate his pain after more vigorous activities like golfing or performing yard work, he would lie down or rest for a day. The patient was of moderate to high severity and minimal irritability.

The patient had a long history of LBP beginning 9 years prior to his evaluation. Radiographs revealed LSTV syndrome on the left side (L5/S1). He originally had LBP that referred down his right leg 9 years prior. After a discectomy at L4/L5 (undisclosed year, more than 5 years prior), he no longer had right radicular symptoms but acquired left radicular symptoms in this most recent exacerbation. He had undergone a cervical fusion 17 years prior and a gall bladder removal in an unspecified year. The patient also reported a history of high blood pressure that was managed with medication. He denied any other medical concerns.

The patient was a retired, yet very active, participant in the community. He was unable to golf, fish, or complete his yard work duties around the house since the most recent exacerbation 4 months prior. He would on occasion complete 1-2 hours of yard work or recreation and spend the following day recuperating from the pain, stiffness, and soreness (7/10). The patient's goals were to ease pain, improve sleep quality, and eventually return to golf. The patient denied any home modifications or using any adaptive equipment.

Systems Review

The patient's musculoskeletal system was impaired. His neurological system was impaired as noted by complaints of radicular symptoms down his left leg. The cardiovascular system was impaired based on patient report, basic vital testing of BP=140/90, and reported medication for hypertension. The pulmonary system was unimpaired based on observation of respiratory rate and breathing pattern as well as per patient report. The integumentary system was unimpaired based on patient report and

observation, however well-healed scars were visible from a prior discectomy and gall bladder removal. The gastrointestinal system was impaired as the patient was taking medication for acid reflux. Language, communication, affect, and learning were all intact and unimpaired based on observation. The patient required reading glasses. The patient denied emotional or psychological problems during the subjective exam. He denied any cauda equina or spinal cord compression symptoms.

Examination - Medications

Table 1

Medications

MEDICATION	DOSAGE	REASON	SIDE EFFECTS
Omeprazole/Prilosec (Proton pump inhibitor)	40 mg daily	GERD, heartburn	Constipation, gas, nausea, vomiting, headache[10]
Benazepril/Lotensin (ACE inhibitor)	10 mg daily	Hypertension	Cough, headache, dizziness, swelling in hands, feet, ankles, or lower legs[11]
Ibuprofen	200 mg; ½ - 1 pill PRN	Pain	Constipation, diarrhea, gas or bloating, dizziness, nervousness, ringing in the ears[12]

Chapter 3

Examination – Tests and Measures

The patient's deficits were classified using the International Classification of Functioning Disability and Health Model.[13] Active range of motion (AROM), passive knee extension (PKE), manual muscle testing (MMT), the NPRS, and the Fear-Avoidance Beliefs Questionnaire (FABQ) were used to measure impairments at the body structure and function level. The straight leg raise (SLR) and the crossed straight leg raise (CSLR) were used as diagnostic tools to rule on involvement of discogenic pathology. The Oswestry Disability Index (ODI) was administered to monitor impairments at the activity level. Self-reported return to golf was used to observe changes made in the patient's participation. Lastly, clinical practice guidelines for directional preference for extension were used once the patient responded well to repeated motions.[6]

Inclinometry is used to measure active range of motion in the lumbar spine. The minimal detectable change at the 90% confidence interval (MDC_{90}) established for inclinometry is 6° to 9° depending on the direction tested.[14] Thus, given a 6° to 9° change, the clinician can be 90% confident that the difference was due to true change and not attributed to error. The minimal clinically important difference (MCID) has not been established, thus the MDC should be used for goal setting. Intrarater reliability for inclinometry is 0.81[14]. When compared to radiographic measurements, inclinometry was valid ($r>0.75$) in all directions (flexion, extension, and lateral flexion) meaning that

the inclinometer measurements were in agreement with radiographic images 75% of the time or more.[14]

Goniometry is used to measure passive range of motion of the hip. The intratester reliability for goniometry s greater than 0.80 and concurrent validity is greater than 0.85.[15] There is no MCID established, however the MDC_{95} has been found to be 5°.[16]

The PKE is used to assess hamstring muscle length. For the PKE, the patient lies supine and the hip and knee on the side being assessed are flexed to 90°. The knee is then passively extended to maximum tolerated stretch. The angle is measured as number of degrees lacking from 0° extension. No MDC or MCID has been established. Test-retest reliability ICCs ranges from 0.84-0.93.[17] Intrarater reliability is ICC = 0.90.[18] An angle of greater than 20° has been found to indicate hamstring muscle tightness in healthy college-aged men and women.[18] Because detectable change values are unknown, the cut-off value of 20° can be used as a goal the PKE.

Manual muscle testing is the most commonly used method for documenting impairments in strength.[19] Performance is ranked on a 5 point scale with 0 indicating no muscle contraction felt and 5 indicating no muscle break against a strong force.[19] A minimum change of one grade is required to indicate true change.[19] Intrarater reliability and test-retest reliability were both found to be excellent for MMTs, 0.96 and 0.98, respectively.[19]

The NPRS is a scale measuring pain experienced by the patient. The patient scores their pain on a 0-10 point scale.[20] A maximum score is 10 and a minimum score

is 0.[20] The MDC_{95} and MCID have been reported as 2 points and 1.5 points, respectively.[21] The MCID is the smallest change that can be determined to be important by the patient or clinician. When the MCID is smaller than the MDC, although the patient may experience a change, the change is not larger than potential error. Thus the larger of the two numbers should be used to avoid a change that could possibly be due to error.

The SLR and CSLR were used as diagnostic tools to determine whether the underlying cause of LBP was discogenic in nature. For the SLR, the patient lies supine and the lower extremity is passively lifted. Various angles of hip flexion have been defined as pathological (30° to 70°).[22] A positive likelihood ratio (LR+) and negative likelihood ratio (LR-) of 1.23 and 0.35 respectively were calculated based on a sensitivity and specificity of 0.91 and 0.26.[22] A LR+ of 1.23 indicates that a positive SLR test causes a negligible shift to the post-test probability that the patient has discogenic involvement. A LR- of 0.35 indicates that a patient with a negative SLR has a small shift in the post-test probability of not having disc pathology. The CSLR is a similar diagnostic test, where the straight leg on the side contralateral to the pain is passively lifted to test for pain provocation. The CSLR has been reported to have a LR+ of 2.8 and a LR- of 0.78.[22] This represents a small shift in the post-test probability in the case of a positive test, and negligible shift with a negative finding.

The ODI is a questionnaire that assesses overall disability and limitation of function in patients experiencing LBP.[23] It consists of 10 questions that are scored from 0 to 5 points. The highest possible score is 50 points with a higher score indicating a

higher level of disability and a score of 0 indicating no disability. The ODI scores can subsequently be interpreted based on percentages. Zero to 20% indicates minimal disability, 21-40% indicates moderate disability, and 41-60% indicates severe disability. Minimal detectable change and MCID were found to be 15.35 points and 9 points, respectively.[24]

The FABQ is a questionnaire used to assess fear-avoidance beliefs in regards to LBP.[25] It is divided into two subscales, a work subscale (FABQ-W) and a physical activity subscale (FABQ-PA). Each question ranges from 0-6 points with higher scores indicating higher levels of fear-avoidance beliefs and lower scores indicating lower levels.[25] The maximum score for the FABQ-PA is 24 points and for the FABQ-W is 43 points. The MDC established for the FABQ-PA is 5.4 points and the MDC established for the FABQ-W is 6.8 points in patients with chronic LBP. The MCID has not been established for chronic LBP.[26] Test-retest reliability for the FABQ-PA and FABQ-W were established at 0.90 and 0.95, respectively.[25] Fear-Avoidance Beliefs Questionnaire Work subscale scores of greater than 25 points out of 43 have the ability to predict poorer outcomes at six months with a LR+ of 2.67 and LR- of 0.65 for patients with acute and subacute LBP seen in an outpatient clinic.[27] A LR+ of 2.67 indicates that a patient scoring higher than 25 points on the FABQ-W has a small shift from pre-test to post-test probability of having poor outcomes at 6 months. Conversely, a score below 25 would cause a negligible shift in the likelihood that they would have a favorable outcome (measured via MCID of ODI) in 6 months. [27]

For patients with chronic LBP who fall into the directional preference classification repeated exercises in the direction determined to improve mobility and reduce symptoms are recommended.[5] At this point in time there are no established diagnostic psychometrics for patients treated with specific exercise interventions. However, the APTA clinical practice guidelines were the highest recommendations for treating LBP and were thus used.[5]

Table 2

Examination Data

BODY FUNCTION OR STRUCTURE		
Measurement Category	Test/Measure Used	Test/Measure Results
Lumbar AROM	AROM (inclinometer) MDC=6-9°[14]	F: 0-40° (no pain-jerky movements with return to standing) Repeated F in lying: increased pain to 3/10 after 5 reps E: 0-5° (pain limited 5/10 eased immediately) Repeated E in prone: decreased pain 3/10 after 10 reps LF R: 0-20° L: 0-15° (pain limited 3-4/10 eased immediately) Rot R:0-45° L: 0-40° (pain limited 3-4/10 in both directions, eased immediately)
Hip PROM	PROM (goniometer) MDC=5°[15]	IR: 0-35° bilaterally
HS muscle length	Passive Knee Extension (goniometer) Cutoff score= 20°	Lacking 45° bilaterally (no pain)
Hip Strength	MMT MDC= 1 grade[19]	F: 5/5 bilaterally E: 3+/5 bilaterally Abd: R: 4/5 L:4-/5 IR: 4/5 bilaterally ER: 4-/5 bilaterally
Pain	NPRS MDC=2 pts[21]	P1 R L5/S1 Worst: 7 Best:0 Average: 3 P2 Buttock Worse: 5 Best: 0 Average: 3 P3 R shin Worse: 2 Best: 0 Average: 0

Discogenic involvement	SLR CSLR	Neg SLR 0-45° bilaterally (no pain) Neg bilaterally (no pain)
Fear-avoidance beliefs	FABQ FABQ-PA MDC=5.4 pts[25] FABQ-W MDC= 6.8 pts[25]	FABQ-PA: 16 pts FABQ-W: 28 pts
FUNCTIONAL ACTIVITY		
Measurement Category	Test/Measure Used	Test/Measure Results
Functional activities	ODI MDC=12.8%[23]	ODI=40% Interpretation: moderate disability
Ability to perform golf swing	Observation	Unable to perform golf swing in clinic without pain (NPRS=4/10)
Sleep quality	Self-report	Waking every night due to pain >2 times.
PARTICIPATION RESTRICTIONS		
Measurement Category	Test/Measure Used	Test/Measure Results
Golf participation	Self-report	Unable to golf
AROM: active range of motion; F: flexion; E: extension; R: right; L: left; Rot: rotation; PROM: passive range of motion; IR: internal rotation; HS: hamstring; MMT: manual muscle test; Abd: abduction; ER: external rotation; NPRS: Numerical Pain Rating Scale; pts: points; SLR: Straight Leg Raise; ODI: Oswestry Disability Index; #: number; FABQ: Fear-Avoidance Behavior Questionnaire.		

Chapter 4

Evaluation

Evaluation Summary

The patient presented with a history of chronic LBP with left-sided buttock pain and left-sided sciatica. His symptoms were minimally irritable, moderately to highly severe, stable in nature, and of neuromusculoskeletal origin. Impairments at the body structure and function level were as follows: pain-limited lumbar AROM in extension, left lateral flexion, left rotation, pain with repeated flexion, easing with repeated extension, restricted hip ROM in internal rotation, decreased hamstring length, decreased strength, increased pain, and increased fear-avoidance beliefs (Table 2). Activity limitations included decreased ability to perform ADLs, inability to perform a golf swing without pain, and inability to sleep through the night without waking due to pain. These impairments and limitations affected the patient's ability to participate in his usual hobbies of golfing and fishing, as well as to perform yard work and chores around the home.

Diagnostic Impression

Signs and symptoms were consistent with chronic LBP, specifically in the directional preference category of the TBC. In addition, he had impaired trunk coordination, aberrant movements, decreased strength, decreased ROM, and increased pain. These impairments all contributed to the patient's inability to perform ADLs such as extended sitting, swinging a golf club, or sleeping through the night. The patient presented with increased fear-avoidance beliefs that added to his reluctance to engage in

normal activities. The summation of these impairments, activity limitations, and fear avoidance beliefs negatively affected the patient's participation ultimately causing him to no longer golf, fish, or perform yard work.

Prognostic Statement

There were positive and negative prognostic factors affecting this patient's outcome. Positive prognostic factors were as follows: Male gender, high self-rated health, low baseline pain intensity, negative depression screen, normal body weight, not having a physically demanding job, and exhibiting centralization with repeated motions.[6,28,29] Negative prognostic factors are as follows: High FABQ score, chronicity of pain, previous LBP, older age, retired status, and functional disability.[27-29] This patient was expected to reach his goals as his positive prognostic factors outweighed his negative factors. In addition, he presented with centralization with repeated motions which is a stronger prognostic factor for a better outcome than fear-avoidance beliefs, coping strategy, or having difficulty sleeping. In addition, the patient lacked bothersome and persistent leg pain which was indicative of poorer outcomes.

G-Codes

Current with modifier: G8981:CJ 40% based on ODI

Goal with modifier: G8982:CI 27% Change of 1 MDC

Discharge Plan

The patient was expected to be discharged to continue living at home with his wife with a home exercise program (HEP) including an extensive return to golf protocol after completion of 12 physical therapy sessions.

Chapter 5

Plan of Care-Goals and Interventions

Table 3

Evaluation and Plan of Care

PROBLEM	PLAN OF CARE		
	Short Term Goals 6 weeks	Long Term Goals 12 weeks	Planned Interventions Interventions are Direct or Procedural unless they are marked: (C) = Coordination of care intervention (E) = Educational intervention
BODY FUNCTION OR STRUCTURE IMPAIRMENTS			
Limited lumbar AROM	Increase lumbar E AROM to 0-10° MDC=6°[14]	Increase lumbar E AROM to 0-20°	Lumbar E: • Prone press up progression- 10 reps, 1-3 sets at 20% full E performed weekly. Progressed to 75% E→CPAs during press up→standing backward bend per pt comfort. • Cat/cow- 10 reps, 1-3 sets to pt comfort, performed weekly. • Foam roller- AP force applied segmentally by PT, 1 sec hold, each segment from thoracic to lumbar performed weekly, 30 reps
	Increase lumbar F to 0-45° MDC=9°[14]	Increase lumbar F to 0-65°	Lumbar F: • Performed/progressed in 1-3 sets of 10 reps: • Pelvic tilts in supine →marching→Double knees to chest performed weekly • Segmental bridging with emphasis on segmental mobility, 1 set weekly • Cat/cow: 1-3 sets of 10 reps, to pt comfort, weekly • Child's pose: 30 secs, 3 reps, weekly.
	Increase lumbar SB to 0-12° bilaterally MDC=6°[14]	Increase lumbar SB to 0-20° bilaterally	Lumbar SB: • Side bending "Teapots"→ on large exercise ball- 10 reps, bilaterally, performed weekly • UPAs bilaterally L1 to L5- Grade II→III-→III/IV, 3 bouts, 30 secs, weekly

	Increase lumbar Rot to 0-45° bilaterally	Increase lumbar Rot to 0-65° bilaterally	Lumbar Rot: • Double knee bent rotations in supine-10 reps, 1-3 sets • Grade II→III-→III/IV rotational mobs- 3 bouts, 30 secs, performed weekly • UPAs bilaterally L1 to L5- Grade II→III-→III/IV, 3 bouts, 30 secs, weekly • Lumbar rotation mobz in sidelying on R: Grade II→III- 3 bouts, 30 secs, weekly
Limited hip PROM	Increase hip IR to 0-35° MDC=5°[16]	Increase hip IR to 0-40°	• Physiologic mobilizations in supine- Grade III, 3 bouts, 30 secs, performed biweekly
Decreased HS length	Increase PKE to (35°) Cut off score=20°	Increase PKE to (20°)	• Contract-relax HS stretch, 30→45 seconds, mod intensity. HEP given including seated HS stretch and supine HS stretch with strap, 3 sets, 45 secs, performed daily
Decreased strength	The patient will increase hip IR from 4/5 to 4+/5 bilaterally MDC= 1 grade[19] Increase hip Abd from 4/5 to 4+/5 bilaterally Increase hip E from 3+/5 to 4+/5 Increase hip ER from 4-/5 to 4/5	The patient will increase hip IR to 5/5 bilaterally Increase hip Abd to 5/5 bilaterally Increase hip E to 5/5 Increase hip ER to 5/5	• Bridges→sit to stands→body weight squats, 1-3 sets of 10, progressed to yellow and red Theraband around knees performed weekly • Catching and throwing 5 lb plyometric ball seated→increased to 10 lb ball, standing, performed weekly for 1-3 min after week 7 • Planks-prone, side lying 10 secs→20 secs→30 secs performed weekly after week 7, performed weekly • Clams- sidelying 10 reps, 3 sets. Performed biweekly

Increased pain	Decrease pain by 1 point P1: 6/10 P2: 4/10 P3: 1/10 MDC=2 points[21]	Decrease pain by 1 points P1: 5/10 P2: 3/10 P3: 0/10	• Grade II rotational mobilizations- 3 bouts, 30 secs, performed as needed. Shown home rotational stretch and press up sequence to control sxs, • (E) Pt educated on graded return to activity, chronic pain, and how to identify an appropriate amount of activity.
ACTIVITY LIMITATIONS			
Decreased ability to perform functional activities	Decrease ODI score to 35% disability MDC=12.8%[23]	Decrease ODI score to 27 % disability	• Improve ROM (see above) • Improve strength (see above) • Decrease pain (see above) • (E) Pt educated on core stabilization, self-pain modulation exercises, stretches, warming up before activity, and graded return to activity. • (E) Pt shown movement adaptations to get out of bed, prolonged sitting, golf swing, and lifting mechanics to reduce pain.
Impaired golf swing	The patient will be able to perform golf swing pain-free with minimal verbal cueing	The patient will be able to perform golf swing pain-free independently	• Golf swing was replicated in clinic with a cane and 3 lb weight. Swings performed as tolerated with verbal cues to contract core. Once able to perform golf swings pain free→10 reps, 1-5 sets, swinging at moderate intensity per pt report, performed weekly. • Plyometric throws- see above • Planks-see above. • Motor control- quadruped arm raising→leg raising→ arm and leg raising, 5-10 reps weekly • E) Pt educated on performing a o thorough warm-up and stretching before doing golf swings at home.
Unable to sleep through night without waking	The patient will be able to sleep through the night 3 nights in a row	The patient will be able to sleep through night 5 nights in a row	• (E) Pt educated on using pillows to maintain a neutral spine and avoiding positions that were known to aggravate sxs. • Pt advised to begin a walking program to maintain his cardiovascular system and improve sleep.

PARTICIPATION RESTRICTIONS			
Unable to golf	The patient will be able to putt, chip, and use low irons at normal intensity for 10 minutes.	The patient will be able to golf 9 holes using putter, chipping wedge, and all irons.	• Graded return to golf protocol including specific exercises, stretches and # of puts, chips, and swings allowed each week. Once one stage was completed pain-free, the pt progressed to the next stage. • Decrease pain (see above) • Increase ROM (see above) • Increase strength (see above) • Improve motor control (see above)
Increased fear-avoidance beliefs	The patient will decrease: FABQ-PA to 13 points MDC=5.4 points[25] FABQ-W to 24 points MDC=6.8 points[25]	The patient will decrease: FABQ-PA to10 points FABQ-W to 21 points	• (E) Pt educated on chronic nature of his pain, normal tissue healing times, and encouraged to find the right amount of activity that did not flare an exacerbation. • (E) Burglar alarm analogy to explain sensitization of the nervous system was used as well as a graded return to golf protocol once golf swing was performed pain-free.
AROM: active range of motion; E: extension; MDC: minimal detectable change; F: flexion; SB: side bend; Rot: rotation; CPAs: central posterior to anterior mobilizations; AP: anterior to posterior mobilizations; UPAs: unilateral posterior to anterior mobilizations; PROM: passive range of motion; IR: internal rotation; HS: hamstring; HEP: home exercise program; Abd: abduction; ER: external rotation; NPRS: Numerical Pain Rating Scale; Sxs: symptoms; E: education; Pt: patient; R: right; ODI: Oswestry Disability Index; FABQ-PA: Fear-Avoidance Beliefs Questionnaire- Physical Activity subscale; FABQ-W: Fear-Avoidance Beliefs Questionnaire-Work subscale.			

Plan of Care – Interventions

See Table 3.

Overall Approach

The TBC approach has been shown to have better clinical outcomes in patients with LBP versus attempting to identify and treat specific pathoanatomical impairments.[6] This patient was treated in accordance with the TBC and CPG for LBP.[5,6] He received a combination of pain modulation, directional preference exercises, stability exercises, motor control training, ROM stretches, strengthening, manual therapy mobilizations,

and neuroscience education on pain. Mobilizations began at gentle intensities initially and increased in vigor as tolerated to address stiffness in the lumbar spine. Tightness, found in the hamstrings was treated both in clinic and addressed with the HEP. Stability and motor control were addressed, specifically in rotation since return to golf was the patient's participation goal. The patient began with simple exercises such as marching while maintaining lumbopelvic control with a biofeedback cuff under his lumbar region. Active SLR and quadruped leg and arm raising were then used to target overall motor control in more challenging positions. These exercises were further progressed to more functional activities such as sitting on a large exercise ball, throwing and catching a medicine ball, and swinging a mock golf club in clinic all while activating the core stabilizers. Lumbar ROM was measured each visit before and after interventions. After treatments, the patient was reassessed for changes in pain. The patient was educated on the chronic nature of pain as well as a graded return to exercise. Lastly, the patient was given a thorough graded return to golf protocol once he was able to perform golf swings in clinic pain-free for five minutes at a moderate intensity.

PICO question

In a 73-year-old male with chronic low back, buttock and leg pain (P), are directionally matched exercises (I) better than non-matched direction of preference exercises (C) at returning function and decreasing pain (O)?

Clinical prediction rules exist for identifying potential responders to manipulation and stabilization exercises.[30,31] However, no such rules exist for classification of patients with LBP most likely to respond to specific exercise. In a

systematic review, Kent et al. compared the effectiveness of targeted versus non-targeted manual therapy and/or exercise on pain and activity limitation in adults with non-specific LBP (Level 1).[32] The authors examined the TBC (including specific exercise, manipulation, and stabilization) to see if matched exercise had better outcomes than non-matched exercises.

Inclusion criteria for the systematic review were RCTs comparing targeted manual therapy and/or exercise interventions to non-targeted interventions in non-specific LBP. Participants were included if they experienced non-specific LBP but were not pregnant. Eighty-five percent of participants needed to be 18 years or older for the study to be included. Studies were included if at least 85% of participants had no neuro-compression signs, and studies with specific LBP were excluded.[32]

Four studies were included that used a total of three clinical prediction rules for targeting treatments. These were the TBC method, the McKenzie directional preference-based exercise approach, and the Flynn manipulation prediction rule.[32] The TBC system used three of the four subgroups: specific exercise, manipulation, and stabilization.[5] The McKenzie directional preference-based exercise classified patients as having an extension, flexion, or lateral directional preference. The Flynn prediction rule did not apply to my case study and will not be discussed further. Outcome measures used included self-reported pain and activity limitation.

Overall, the systematic review found patients who received targeted therapy to the appropriate patient classification to have a statistically significant improvement in short-term outcomes for pain, activity, and reduction of disability. Improvement sizes

ranged from 8.5% to 33.8% of baseline scores in matched groups. Unmatched groups showed insignificant changes. This systematic review was applicable to my patient because he had LBP with a directional preference. His age and chronicity would include him in one study. He fit this systematic review well, and could thus benefit from the TBC, falling into directional preference subgroup.

There are several weaknesses to this systematic review. While they did do a thorough search of the literature, they only included 4 studies. In addition, of the studies included, only one very specifically fit my patient, and only two applied at all. There were also improvements found that trended towards significance but did not reach significance. One study also only found improvements in the short term outcomes and not in long term outcomes. The authors of the study cite that the conclusions made from their study are not strong enough to solely base clinical decisions on. Thus the information gained from the article was used in conjunction with several other factors like clinical expertise and guidelines.

Chapter 6

Outcomes

Table 4

Outcomes

OUTCOMES				
BODY FUNCTION OR STRUCTURE IMPAIRMENTS				
Outcome Measure	Initial	Follow-up (DC)	Change	Goal Met? (Y/N)
Lumbar AROM	F:0-40° E:0-5° LF R:0-20° L:0-15° Rot R:0-45° L:0-40°	F:0-65° E:0-15° LF R:0-35° L:0-35° Rot R:0-60° L:0-55°	F:25° E:10 ° LF R:15° L:20° Rot R:15° L:15°	**Yes**
Hip IR	0-35° bilaterally	0-40° bilaterally	5°	**Yes**
HS length (PKE)	Lacking 45° bilaterally	Lacking 35° bilaterally	10° bilaterally Cut off score=20°	**No**
Strength (MMT)	E: 3+/5 bilaterally Abd: R: 4/5 L:4-/5 IR: 4/5 bilaterally ER: 4-/5 bilaterally	E: 4+/5 bilaterally Abd: R: 4+/5 L:4/5 IR: 4+/5 bilaterally ER: 5/5 bilaterally	E: 1 grade Abd: <1 grade IR: <1 grade ER: >1grade	**Partially**
Pain (NPRS)	P1: 7/10 P2: 5/10 P3: 2/10	P1: 5/10 P2: 3/10 P3: 0/10	P1: 2 points P2: 2 points P3: 2 points	**Yes**
FABQ	FABQ-PA: 16 points FABQ-W: 28 points	FABQ-PA: 14 points FABQ-W: 23 points	FABQ-PA: 2 points FABQ-W: 5 points	**No**
ACTIVITY LIMITATIONS				
Outcome Measure	Initial	Follow-up (DC)	Change	Goal Met? (Y/N)
Functional Disability ODI	ODI=40% Interpretation: moderate disability	ODI=34% Interpretation: moderate disability	6%	**No**
Ability to swing golf club	Unable to swing a golf club without pain.	Able to swing golf club pain-free for 5 minutes with moderate intensity.	From unable to able to swing golf club at moderate intensity.	**Yes**
Sleep Quality	Waking every night due to pain.	Sleeping 6 nights without waking due to pain	Improved # nights without waking to 6.	**Yes**

PARTICIPATION RESTRICTIONS				
Outcome Measure	Initial	Follow-up (DC)	Change	Goal Met? (Y/N)
Golf participation	Unable to play any # of holes pain-free.	Able to play 9 holes using all clubs.	From unable to golf, to able to golf with limitations.	**Yes**
NPRS: Numerical Pain Rating Scale; P1: pain 1, P2: pain 2; P3: pain 3; HS: hamstring; AROM: active range of motion; F: flexion; E: extension; LF: lateral flexion; R: right; L:left; Rot: rotation; IR: internal rotation; MMT: Manual Muscle Testing; Abd: abduction; ER: external rotation; ODI: Oswestry Disability Index; FABQ-PA: Fear-Avoidance Beliefs Questionnaire- Physical Activity subscale; FABQ: Fear-Avoidance Beliefs Questionnaire; FABQ-W: Fear-Avoidance Beliefs Questionnaire-Work subscale.				

Discharge Statement:

The patient was seen for physical therapy treatment for 12 sessions at an outpatient physical therapy clinic over the course of 12 weeks. Main goals for the patient were to increase ROM, increase strength, reduce pain, improve ability to perform functional activities, improve sleep quality, return to golf and reduce fear-avoidance beliefs. The patient received directional preference exercises, manual therapy, motor control training, therapeutic/functional exercise, a home exercise program, and patient education. The patient made clinically meaningful improvements in strength, ROM, sleep quality, pain, golf swing ability and return to golf. The patient was unable to make clinically relevant improvements in the PKE, the ODI, and the FABQ, although slight improvements were noted. The patient was discharged home with a home exercise program including a graded return to golf.

DC G-Code with modifier:

G8981 CJ (34.0% Impaired) based on ODI

Chapter 7

Discussion

If I were to manage a patient with a similar presentation in the future, I would use a comparable multimodal approach following the TBC and CPG for LBP as well as an impairment based approach. Many goals were reached as a result of these direct interventions. Due to the individualized patient case, findings from this case study should only be extrapolated to similar presentations, such as older adults with chronic LBP with or without LSTV.

The patient responded to treatment as expected for many variables. His improvements in pain, ROM, ability to swing a golf club, sleep quality, and golf participation were as expected. Effective interventions included manual therapy, exercise prescription, and making exercises performed in clinic meaningful and functional. Several goals were not met including hamstring length as measured by the PKE, functional disability as measured by the ODI, and fear avoidance beliefs as measured by the FABQ. Since there was no MDC or MCID found for PKE a cutoff score of 20° was used as a goal. For a patient of 73 years old, with a history of back surgery, a more modest goal of 30° may be more realistic since the normal range was determined using a younger population. Increased dosing of stretches also may have helped reach this goal. Improved spine mobility might result from more frequent and prolonged stretching, increased vigor of manual therapy, and inclusion of thoracic spine treatment. The patient did not achieve clinically significant improvements in his ODI score, which improved by only 6%. Per patient report, he was able to perform many

more activities at discharge than he could at initial evaluation. The discrepancy between ODI and self-report measures could be due to interventions targeting specific goals such as swinging a golf club and not components of the ODI which included lifting, sitting, and walking. If this case were to be repeated, there would be more attention spent on addressing these specific items. He did not make significant improvements in his FABQ scores, although they did improve slightly. This may have been due to the fact that the patient needed more education on chronic pain, and further addressing of his fear-avoidance beliefs. In order to address fear avoidance, more time would be spent on education the patient over the course of treatment. In addition, various strategies would be used to ensure patient understanding such analogies and the patient reporting back his understanding. I would increase time spent on showing him how to alleviate symptoms himself making him more in control of his pain. The FABQ-W subscale was used despite the patient being retired and any interpretation of those scores may have decreased reliability and validity.

I expected the patient's diagnosis of LSTV to influence the course of care. However, it had no effect on treatment and he responded well to conservative approaches. The diagnostic tests and outcome measures used on this patient were appropriate. The interventions for this patient can be broadly applied to anyone with similar deficits. The golf swing progression and return to golf should only be used for patients interested in regaining golf function. However, most other interventions followed a direct progression from simple to more functional and challenging exercises.

There is very limited information on physical therapy for individuals with LSTV. While that may not have changed treatment dramatically, it would be beneficial to see higher levels of evidence than case studies. One area of future research could be identifying psychometrics for using the specific exercise classification to predict success with specific exercise classification.

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