Case Report

The addition of manipulation to an extension-oriented intervention for a patient with chronic LBP

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Objective and importance: There is a paucity of research investigating the combined interventions of direction-specific lumbar exercise and manipulation for individuals with low back pain (LBP) who exhibit centralization or a directional preference. The purpose of this report was to describe the management and outcomes of a patient with chronic LBP who met two categories of the revised treatment based classification (TBC) approach initially described by Delitto and colleagues.

Clinical presentation: A 55-year-old female with a 15-year history of right LBP/leg pain demonstrated centralization of symptoms with repeated extension and met four out of five criteria on the clinical prediction rule for thrust manipulation.

Interventions: The patient was treated for seven physical therapy sessions, once a week for seven weeks. Lumbar thrust manipulation and extension-oriented interventions were combined throughout the course of care. The patient experienced a decrease on the modified Oswestry disability index score from 26 to 8%, an increase in the patient-specific functional scale score from 5.6 to 9.4, and patient-report of full return to pain-free activity at discharge.

Conclusion: A patient with chronic LBP reported a clinically meaningful improvement after seven visits of manipulation and extension-oriented interventions. Further research should compare the effectiveness of combining interventions for individuals who meet the two TBC groups of manipulation and extension-specific exercise compared with performing either intervention alone.

Keywords: Thrust manipulation, Extension specific exercise, Directional preference, Chronic low back pain, Treatment based classification, Motor control, Clinical decision making

Background

More than one-fourth of US adults report having low back pain (LBP) within the previous three months,¹ and 15% report frequent back pain, making chronic LBP one of the most common patient complaints.² Systematic reviews of common conservative interventions for LBP, such as manipulation and specific back exercises, have concluded that these interventions are marginally effective.³⁻⁶ However, patients with LBP are likely a heterogeneous group and therefore do not respond similarly to all interventions. Classification schemes which categorize patients into more homogenous sub-groups may allow for more tailored interventions, resulting in a greater clinical effect.

One LBP classification system is the treatment based classification (TBC) approach initially described by Delitto *et al.*,⁷ and later updated by Fritz and

colleagues.⁸ This approach classifies patients with LBP into four subgroups based on signs and symptoms, and attempts to identify a priori who will benefit from specific interventions. The four subgroups are manipulation,^{9,10} specific exercise,^{11,12} stabilization/motor control exercises,¹³ and traction,¹⁴ the criteria for these subgroups have been previously described.⁸ Randomized controlled trials of patients with acute and/or subacute LBP have reported significantly improved outcomes for patients in physical therapy utilizing TBC, as compared to either usual care¹⁵ or randomly selected interventions.¹⁶ Most recently, Apeldoorn *et al.*¹⁷ randomized patients with subacute/chronic LBP to physical therapy according to the TBC compared with physical therapy based on Dutch Clinical Practice Guidelines. They reported no significant differences in outcomes between the two groups over time. However a sub-group of patients in the TBC group who had a 'clear classification' into one TBC category (74% of the patient sample) had

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Figure 1 Patient's body chart. P_c=Cervical pain, P_b=Buttock pain, P_L=Leg pain, N/T=numbness and tingling, C/V=constant varying, I/M=intermittent, check marks indicate no pain reported in region.

significantly improved outcomes compared to the usual physical therapy group. The authors reported that the lack of a clear classification for a significant portion of the patients may have been one reason why there was no significant overall difference in study outcomes.

As reported by Apeldoorn *et al.*,¹⁷ a common clinical finding when utilizing the LBP TBC is that patients often do not clearly fit into a single treatment category.¹⁸ Stanton *et al.*¹⁸ reported the prevalence of patients meeting the criteria for each treatment subgroup. In a sample of 250 patients with LBP, 50% could not be classified into a single sub-group and 25% met the criteria for two or more subgroups (dual classification). Stanton and colleagues¹⁸ suggested that patients who meet a dual classification could receive both matched interventions.

There is little published research documenting use of the LBP TBC for patients meeting dual classification. Three case reports^{19–21} have discussed the decision-making and outcomes of patients who have met the criteria for more than one subgroup of the TBC.⁷ Thus, the purpose of this report is to describe the evaluation, management, and outcomes of a patient with LBP who met both the manipulation and specific exercise subgroups of the TBC. Given that LBP is the reason for seeking physical therapy care in nearly 50% of patients presenting to outpatient orthopedic clinics,²² decision-making described in this case report might assist clinicians in practice. Furthermore, outcomes of the report may spur future

high quality research on use of TBC for patients meeting more than one classification.

Patient Characteristics

The patient was a 55-year-old female homemaker with chronic right low back, buttock, and intermittent right posterior thigh pain referring to the knee. This patient was seen at the physical therapy outpatient faculty clinic through Temple University, Department of Physical Therapy, and informed consent was obtained. Figure 1 depicts the patient's body chart, generated from the patient's history information. The patient's LBP episodes began insidiously 15 years prior to evaluation. Two years prior, the patient reported that she experienced severe low back and posterior thigh pain and a lateral shift after a bout of prolonged sitting in the car. Since this episode two years ago, she reported having constant buttock pain and intermittent posterior thigh pain. Other than a history of cervical pain which was determined to be unrelated to the LBP complaint, the patient was in reportedly good health at the time of evaluation with no medical red flags noted.

Previous care for her LBP included multiple chiropractic and physical therapy treatments. She reported that intermittent chiropractic care (high velocity thrust manipulation, non-specific exercise) for the past 10 years helped resolve her referred leg pain during acute episodic exacerbations but did not change her constant local back and buttock pain. Her last chiropractic visit was two years prior to the current evaluation, partially due to her frustration that the symptoms exacerbated with the exercises. She also reported minimal improvement with two months of physical therapy that she received about one year prior to our evaluation at a nearby clinic. Treatment consisted of non-thrust and thrust manipulation to the thoracic and lumbar spine, soft tissue mobilization, hip strengthening, lumbar stabilization exercises, hip stretches and home exercises per the clinic's chart documentation.

Examination

A comprehensive history and physical examination was performed and standardized outcome measures were administered at baseline and throughout the course of care. The patient initially scored 28% on the modified Oswestry Disability Index (ODI)^{23,24} and 5.6 out of a maximum score of 10 on the Patient Specific Functional Scale (PSFS).²³ The patient was given the Fear Avoidance Belief Questionnaire (FABQ),^{25,26} and scored 0 on the work subscale (the patient was not employed), and 14 on the physical activity subscale. The treating therapist also asked for the patient's global rating of improvement

Table 1 The patient's report of symptoms, global rating of improvement scores, and details of the intervention implemented each visit

Visit (1 ×/week)	Subjective (% global rating of improvement)	Intervention
Eval	Constant right LBP Constant right buttock pain	To promote lumbar extension Prone extension press ups × 10 (HEP) Walking until onset of pain To promote hip flexion (minimize lumbar flexion) (HEP) Education to sit on wedge to increase anterior tilt (see Appendix) Sidelying LP rotational thrust manipulation
F/u 1	Right LBP Right buttock pain (Intermittent) 30% Improved	To promote lumbar extension Gr IV unilateral PA Right L5-S1 in extension 30" × 3 (HEP) Prone extension to end range × 10, 3 ×/day To promote hip flexion (minimize lumbar flexion) Taping applied (see Appendix), only performed one session Double leg hip hinge with dowel, 6" away from wall × 10 Sidelying LP rotational thrust manipulation
F/u 2	Right LBP No buttock pain 50% Improved	To promote lumbar extension Gr IV + unilateral PA Right L5-S1 in increased extension 30" × 2 (HEP) Standing Extension × 10, 3 ×/day (HEP) Progress walking to 20 minutes daily To promote hip flexion (minimize lumbar flexion) Single leg hip hinge, 6" away from wall × 10 Sidelying LP rotational thrust manipulation
F/u 3	No LBP No buttock pain Only reports a.m. stiffness and pain with bending to put on stockings and sitting >30 minutes 80% Improved	To promote lumbar extension Gr IV + + unilateral PA Right L5-S1 in increased extension 30" × 2 (HEP) standing extension × 10, 5 ×/day (HEP) Progress walking to 1 hour, run 5–10 minutes daily To promote hip flexion (minimize lumbar flexion) Single leg hip hinge, 10" away from wall × 10 Sitting hip hinge × 10 Sidelying LP rotational thrust manipulation Lumbopelvic endurance program initiated (Prone/side plank)
F/u 4	No pain Less morning stiffness Only pain sitting >1 hour 90% Improved	To promote lumbar extension Gr IV + + unilateral PA Right L5-S1 in full end-range extension 30" × 2 (HEP) Standing Extension × 10, 5 ×/day (HEP) Run 10 minutes daily To promote hip flexion (minimize lumbar flexion) Triplanar single leg hip hinge 10 inches away from wall × 10 Sitting hip hinge with increased hip flexion Sidelying LP rotational thrust manipulation Lumbopelvic endurance program progressed
F/u 5	No pain except for 1 day 'flare up' Only two mornings felt stiff low back 85% Improved	To promote lumbar extension Gr IV + + unilateral PA Right L5-S1 in full end-range extension 30" × 2 (HEP) Standing Extension × 10, 5 ×/day (HEP) Run 15–20 minutes To promote hip flexion (minimize lumbar flexion) Triplanar hip hinge 12 inches away from wall × 10 Sitting hip hinge with knee in more extension (lengthens hamstring) Sidelying LP rotational thrust manipulation Lumbopelvic endurance program progressed
D/C	No pain Can sit 1–2 hours and put on stockings now without pain Rarely has morning stiffness 95% Improved	To promote lumbar extension Gr IV + + unilateral PA Right L5-S1 in full end-range extension 30" × 2 (HEP) Run 30 minutes To promote hip flexion (minimize lumbar flexion) Triplanar hip hinge 12 inches away from wall × 10 Sitting hip hinge with further increased hip flexion Sidelying LP rotational thrust manipulation Lumbopelvic program HEP reviewed to ensure independence

Note: Interventions were performed in the order listed each visit: specific exercise extension-oriented program [organized by goals: (1) promote lumbar extension, and (2) minimize lumbar flexion], thrust manipulation, and finally, on follow up visit 3 and later, Stage II lumbopelvic endurance exercises. % Improved=patient asked, 'If 0% was your status at initial evaluation and 100% is full recovery to your pre-injury status, what would you rate yourself today?' D/C= discharge. F/u= follow up. Gr=grade. LP=lumbopelvic. " =seconds. L/S=lumbar spine. ×/week=times per week referring to treatment frequency.

at the beginning of each visit, 'If 0% was your status at initial evaluation and 100% is full recovery to your pre-injury status, what would you rate yourself today?' The global rating of improvement scores reported by the patient for each visit are listed in Table 1.

Aggravating factors included putting on nylons, dressing in the morning, making her bed, sitting longer than five minutes, driving (which immediately increased pain), prolonged periods of walking and occasionally moving from supine to sidelying. She reported LBP and stiffness every morning and experienced increased pain with sneezing and coughing, especially during an acute episode of leg pain. The patient had discontinued all gym exercise for the past two years but continued walking 30–60 minutes two times per week despite pain with this activity. Her goal was to be able to walk pain-free and return to regular gym exercise, such as running. She was not taking any medication at the time of evaluation.

The patient was a female, five foot nine inches tall, and observation revealed a decreased lumbar lordosis. As part of functional observation, the patient was asked to pick up a pen off the floor. The therapist qualitatively observed that the patient accomplished the task with excessive lumbar flexion and decreased hip/knee flexion. The patient also reported increased right LBP with this activity. She was unable to maintain neutral lumbar lordosis when asked to use a hip/knee flexion strategy with verbal/manual cues. Lumbar range of motion (ROM) was measured with a bubble inclinometer. Reliability of lumbar flexion and extension ROM has been previously documented²⁷ with intraclass correlation coefficient (ICC) and 95% confidence intervals of flexion 0.60 (0.33, 0.79), extension 0.61 (0.37, 0.78). Another study²⁸ examined lumbar lateral flexion with a similar single inclinometer ranging from 0.78 to 0.95 depending on tester (confidence intervals not available). Spinal flexion active ROM was 50° and extension was 20°; both motions producing right low back/buttock pain. Right lateral flexion was 30° and pain-free while left lateral flexion was 25° with right LBP. Passive sideglide ROM was equal and pain-free bilaterally.

Repeated flexion in standing for two repetitions caused increased buttock pain. Additional repetitions were deferred due to an increase and peripheralization of symptoms. Active standing lumbar extension for 10 repetitions resulted in elimination of her buttock pain and decreased local lumbar pain both during and after the repetitions. A serial increase in extension ROM with repetitions was additionally observed. Based on these findings, it was determined that her symptoms centralized with repeated extension and she would likely respond to extension-oriented interventions.^{11,12}

The lower quarter neurological examination revealed normal strength, sensation, and reflexes. The passive straight leg raise test was negative bilaterally for symptom reproduction. Central and right unilateral posterior to anterior accessory glides were hypomobile from L1 to L5 and reproduced varying degrees of local lumbar pain; however, a right L5-S1 posterior to anterior glide was the only level that reproduced both the low back and buttock pain. Hip internal/external rotation in supine/prone was approximately equal bilaterally (prone, right 35 degrees, left 40 degrees). Muscle strength tests measured with manual muscle testing, identified decreased right gluteus maximus (4/5 right, 4+/5 left) and posterior gluteus medius (3–/5 right, 5/5 left) strength. She was able to hold a full side plank within normative ranges on the left side (78 seconds), but not on the right side (55 seconds).²⁹

Clinical Impression

It was determined that the patient presented with chronic mechanical LBP based on reproduction of the patient's buttock pain with a right L5-S1 posterior to anterior glide, absence of red flags, and an unremarkable neurological examination. To guide intervention, the patient was classified using the TBC criteria.⁸ The more recent algorithm for the TBC¹⁷ first establishes whether the patient has a DP, and only considers other categories when a DP has been excluded. However, the TBC algorithm is often used differently in clinical practice compared with research studies; in clinical practice, clinicians frequently combine multiple treatment if the patient meets more

Table 2 Updated classification criteria as per Fritz et al.¹⁴

Thrust manipulation	Specific exercise: extension
Criteria met: • No symptoms distal to the knee • Low FABQW score (<19) • Hypomobility of the lumbar spine • Hip internal rotation ROM (>35° for at least 1 hip) Criteria not met: • Recent onset of symptoms (<16 d)	Criteria met: • Symptoms distal to the buttock • Directional preference for extension • Symptoms centralize with lumbar extension or symptoms peripheralize with lumbar flexion

Note: The patient met all but one criterion for the thrust manipulation clinical prediction rule developed by Flynn and colleagues,³⁷ and later validated by Childs et al.⁹ and she met all the criteria for the specific exercise extension classification.⁸

Figure 2 : ODI=Modified Oswestry Disability Index, Eval=initial physical therapy evaluation, DC=discharge from physical therapy. Graph on the left shows improved function over time, graph on the right shows decreased disability over time.

than one category. The patient in this report matched the criteria for the specific exercise, extension subgroup, based on centralization of symptoms with repeated lumbar extension, as well as the thrust manipulation subgroup since she met four out of five criteria on the clinical prediction rule for thrust manipulation as outlined in Table 2. Since the patient met criteria for two subgroups, the treating author (HO) decided to implement both interventions throughout the course of care.

In addition to utilizing the TBC,¹⁷ it was the authors' opinion that identifying and treating specific impairments would further tailor the intervention plan to the patient's presentation. Impairments identified in the examination included decreased right hip extensor/abductor strength, impaired lumbopelvic motor control/endurance, and low fear avoidance of physical activity according to previously cited scores.^{30,31}

Interventions Implemented

The patient was treated once a week for seven weeks. The prescription and progression of the matched dual interventions of lumbo-pelvic thrust manipulation and extension-oriented intervention are outlined in detail in Table 1 and illustrated in Appendix. The first intervention, lumbo-pelvic thrust manipulation, was performed sidelying with the left side up, due to clinician preference and patient comfort. Customarily, thrust manipulation is performed for only the first few visits.³² However, the treating author chose to continue performance of thrust manipulation throughout the course of care immediately prior to exercise with the goal of enhancing voluntary trunk muscle activation during therapeutic exercises following the manipulation.^{21,33,34}

The second intervention prescribed was the lumbar extension-oriented program. In addition to active lumbar extension exercises and manual posterior to anterior lumbar joint mobilization,^{11,12} the extension oriented program was augmented with postural and body mechanics education, proprioceptive lumbar taping, and motor reeducation exercises, designed to enhance control of lumbar flexion (refer to Table 1 and Appendix). Most of the activities that aggravated the patient's LBP included flexion-oriented motions (i.e. bending, sitting). Accordingly, it was of the treating author's opinion that in addition to performing extension-oriented interventions, outcomes might be optimized if the patient learned to control lumbar flexion during functional activities.

At the time when Delitto and colleagues⁷ initially described use of the TBC, they suggested that staging could guide the intervention plan. When using the lumbar TBC, patients are categorized into Stage I if they have moderate to high disability, with primary goals of pain modulation and improvement in the ability to carry out basic activities of daily living. Patients presenting with or progressing to lower pain or disability scores are categorized into stage II of the TBC. Stage II interventions focus on patient-specific impairments including strength, flexibility, and endurance. Although the patient did not meet the criteria for the stabilization TBC, the patient reported no pain since the previous visit and the PSFS showed considerable functional improvement (increased from 5.4 to 8.7) on follow-up visit three. It was therefore determined that a progressive lumbopelvic stabilization/endurance program should be incorporated to target her impairments and potentially reduce recurrent future episodes of LBP.³⁵ At discharge, the

patient was instructed to perform the trunk stabilization exercises at least one time per week.

Outcomes

Outcomes are outlined both in Table 1 and Fig. 2. Disability measured with the modified ODI decreased from 26 to 8% and function assessed with the PSFS increased from 5.6 to 9.4, surpassing the minimal clinically important differences for the modified ODI (6–8 points)^{23,24} and the PSFS (2 points) for the total score.²³ The patient reported 95% global improvement at the end of follow-up visit six, and when questioned, the patient reported that the remaining 5% was due to the presence of intermittent central back stiffness after two hours of sitting or driving. At discharge, lumbar flexion active ROM was 100° flexion, extension was 40°, and lateral flexion was 40° bilateral, all motions pain-free with overpressure. Muscle strength/endurance (gluteus medius, maximus, side plank) impairments were similar bilaterally and within normal acceptable ranges. The patient reported on the last visit that she had progressed to running 20–30 minutes without pain.

Discussion

The purpose of this case report was to present the outcomes of a combined intervention of specific extension-oriented treatment and lumbopelvic thrust manipulation utilized with an individual with chronic LBP who met two subgroups of the TBC. In this case report, the patient experienced a positive short-term outcome. The decrease in the ODI score of 18 points and 3.8 point increase in PSFS surpassed the minimal clinically important differences previously reported in literature^{23,24} for these measures.

Following multiple bouts of chiropractic care over 10 years and a previous trial of physical therapy for months without reported improvement, it is interesting to consider why the patient reported an immediate short-term improvement with the treatment described in this report. Among other non-specific interventions, the patient received lumbopelvic thrust manipulation in previous bouts of physical therapy and chiropractic care without resolution of her local low back and buttock pain. However, she had not received manipulation combined with a specific extension-oriented program previously, and perhaps these two interventions combined were associated with the positive outcome. Alternatively, the patient may have improved with the extension-oriented program alone

without the addition of the lumbar thrust manipulation. She had not previously been prescribed this intervention and had a favorable prognosis given that her symptoms centralized after repeated extension in standing during the initial evaluation.³⁶ Finally, the addition of the motor reeducation exercises (refer to Appendix, standing and sitting hip hinge, and tape) to the traditional extension-oriented program, could have theoretically affected outcomes. Due to the multiple interventions prescribed in this intervention, it is difficult to make judgments about which components were effective. In retrospect, the authors could have trialed extension-oriented procedures alone and assessed effects before combining with the thrust manipulation from the start of care. Additional research and refinement of the TBC is required to determine the best course of action for patients who meet more than one category or for patients who do not clearly fit into one category.

There are various limitations which should be recognized in interpreting the outcomes of this report. Although spontaneous recovery is an unlikely explanation for outcomes in this case due to the patient's chronic history, the inherent limitations of a case report preclude the ability to make a causal connection between the intervention and outcome. Furthermore, an augmented placebo effect may have occurred since the patient was previously known to the treating therapist (family friend). Lastly, outcome measure forms were handed to the patient each session by the primary author, and percentage improvement was reported directly to the treating therapist, potentially introducing bias with the patient reporting results.

Conclusion

The purpose of this report was to describe the management and outcomes of a patient with chronic LBP who met two categories of the revised TBC approach. Although a case report has limitations, it affords the opportunity to describe the clinical decision-making and details of the intervention protocol associated with utilization of the lumbar TBC in clinical practice. Clinicians often use clinical prediction rules or classification approaches as guides to combine or administer multiple interventions if a patient meets criteria for more than one subgroup. Future research is warranted to determine the most effective interventions for patients with LBP who meet the dual TBC categories of extension specific exercise and manipulation.

Appendix

Stage I, TBC Manipulative Therapy Lumbar Thrust Manipulation

Stage I, TBC Specific Exercise, Extension-oriented Intervention (select interventions illustrated).

Education, to sit on wedge

Right L5-S1 unilateral PA in extension

Told to avoid tape* stretch during bending to cue for more hip/knee bend

Exercises to promote hip versus lumbar flexion (dowel ensures no loss of lordosis):
Standing Hip-hinge progression
(double leg, single leg, standing progressively further from wall)

Sitting Hip-hinge

Stage II: Lumbopelvic Endurance Exercises Prone Plank Progression (static hold, rock forward/backward)

Sidelying Progression (static, repetitions of abduction)

Combined prone/side plank with hip abduction

Note: BSN Jobst Leukotape® P Sports Tape, used with BSN Jobst medical Cover-Roll® stretch tape.

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