Analysis of Patient Outcomes Using the MyoKinesthetic System for the Treatment of Low Back Pain:

A CASE SERIES

Kari Brody, DAT,[a] Alan M. Nasypany, EdD, [b] Russell T. Baker, DAT,[b] and James M. May, DAT[b]

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ABSTRACT

Objective: The purpose of this case series was to test the feasibility of using the MyoKinesthetic (MYK) System as a treatment-based classification system and intervention for a sample of patients with low back pain.

Methods: This within-subject intervention was completed in a university athletic training clinic. Nine participants (mean age: 31 years) with a primary complaint of LBP were evaluated and included. An athletic trainer performed the initial assessment, which contained the following components: patient history, palpation, range of motion testing, lower quarter neurologic screening, MYK System posture screen, orthopedic special tests, and baseline data for pain intensity, disability, and function. All participants were treated with the MYK System. The primary outcomes were pain, disability, function, active range of motion, posture, and global efficacy of treatment.

Results: The mean number of MYK treatments administered was 12.11 (SD = 6.25), and the mean number of days until discharge was 28.67 (SD = 9.38). A repeated-measures analysis of variance revealed statistically significant and clinically meaningful improvements in pain, disability, function, and posture from the initial evaluation to discharge and from the initial evaluation to a 1-month follow-up (P b .01).

Conclusion: This study determined the feasibility of further evaluation of the MYK System as a treatment-based classification system and intervention for patients with low back pain. (J Chiropr Med 2017;16:111-121)

Key Indexing Terms: *Low Back Pain; Therapeutics; Spinal Nerves*

INTRODUCTION

Low back pain (LBP) is a widespread and costly health care epidemic. More than 1000 randomized controlled trials of various interventions used for the management of LBP have been conducted, but the evidence from these trials is contradictory and inconclusive.[1-3] The lack of a gold standard for LBP diagnosis further complicates the problem. Advanced imaging detects many abnormalities in both asymptomatic and symptomatic individuals, which indicates that pathoanatomic structures may not always be responsible for symptoms.[4] Radiographic imaging also cannot account for the psychogenic causes that may be the source of chronic LBP in many individuals.[5] Because of a complicated etiology, approximately 85% of LBP patients receive the vague diagnosis of nonspecific LBP.[2,3,6-9]

Many LBP studies lack favorable outcomes because of a heterogeneous population of nonspecific LBP patients and the focus on 1 intervention benefiting everyone.[2] In an effort to rectify this problem, classification systems were developed to match patients to an appropriate treatment based on criteria discovered during a triage process of clinical evaluation.[10] The primary purpose of treatment based classification (TBC) systems is to optimize the effects of treatment.[11] Because patient outcomes have improved when patients are provided a subgroup-matched treatment,[1,12-14] research on TBC systems for LBP has become a priority.[11,15]

One TBC system, which has not been included in the 4 primary LBP classification systems,[11] is the MyoKinesthetic (MYK) System. The MYK System is used for a variety of musculoskeletal conditions, including LBP. Developed and introduced by Dr. Michael Uriarte in 1998, the MYK System is a relatively new paradigm focused on balancing the nervous system by correcting posture

[a] Sports Medicine, McNeese State University, Lake Charles, LA.

[b] Department of Movement Sciences, University of Idaho, Moscow, ID.

Corresponding author: Kari Brody, DAT, Sports Medicine, McNeese State University, 700 E McNeese St, Lake Charles, LA 70609. Tel.: +1 337 475 5206. (e-mail: kbrody@mcneese.edu).

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abnormalities.[16] Researchers have hypothesized that posture imbalances are the result of changes in the central nervous system (CNS) as it responds to afferent feedback from the body.[17] The developed posture asymmetries are considered to be compensations that the CNS established in an effort to achieve pain-free, yet dysfunctional, movement.[18] In this compensatory state, posture imbalances would result in restricted joint motion and decreased mechanoreceptor firing.[16]

In the MYK System, a clinician classifies a patient based on postural abnormalities, the presence of peripheral neuropathy, and muscle weakness. The MYK System includes a comprehensive global evaluation process, with the primary component being a full-body posture screen (Fig 1). The posture screen is used to determine the nerve root level with the greatest number of dysfunctions. The patient is then classified into 1 of 16 subgroups, or nerve root levels, based on the results of the posture assessment.[16] Each of the 16 subgroups, which correspond to the 16 nerve root levels from C1 to T1 and L1 to S2, contains a matching treatment within the MYK System.[16]

HEAD				**LUMBAR SPINE**	
Extension	____(C1-C3)	(L1-L5)	____	Flexed	
Flexion	____ (C1-T1)	(L1-L2)	____	Extended	
Rotation	____ (C1-T1)	(L1,L2)	____	Lateral Flexion	
Lateral flexion	____ (C1-T1)	(L1-L5)	____	Rotation	
SCAPULA				**HIP**	
Elevated	____ (C3,C4)	(L5,S1)	____	Ant Rot (flex)	
Depressed	____ (C3-C5)	(L1,2,3,4,5)	____	Post Rot (Ext)	
Protracted(AB)	____ (C3-C5)	(L2,L3)	____	Downslip (AB)	
Retracted (ADD)	____ (C5-C8)	(L4,L5)	____	Upslip (ADD)	
Upward rotated	____ (C3-C8)	(L2,3,4,5,S1)	____	Lateral Rotated	
Downward rotated	____ (C3-C7)	(L5,S1)	____	Medial Rotated	
SHOULDER				**KNEE**	
Flexed	____ (C5-C8)	(L3,L4)	____	Flexed	
Extended	____ (C5-C8)	(S1)	____	Extended	
Depressed(AB)	____ (C5-C8)	(L2,L3,S1)	____	Externally Rot	
Elevated (ADD)	____ (C5-C6)	(S1)	____	Internally Rot	
Medial rotated	____ (C5-C6)				
Lateral rotated	____ (C5-C8)				
ELBOW				**ANKLE**	
Flexed	____ (C7-C8)	(L4)	____	Plantar Flexed	
Extended	____(C5-C7)	(S1,S2)	____	Dorsiflexed	
		(L4)	____	Everted	
FOREARM		(L4)	____	Pronated	
Supinated	____ (C6-T1)	(L5,S1)	____	Inverted	
Pronated	____ (C5-C6)	(L5,S1)	____	Supinated	
WRIST				**BIG TOE**	
Flexed	____ (C6-C8)	(L5)	____	Flexion	
Extended	____ (C6-T1)	(S1,S2)	____	Extension	
Radial deviated	____ (C7-C8)	(S1,S2)	____	Hal Varus/AB	
Ulnar deviated	____ (C6-C7)	(L5,S1)	____	Hal Valgus/ADD	
THUMB				**TOES**	
Flexed	____ (C7-T1)	(L5)	____	Flexed	
Extended	____ (C6-T1)	(S1,S2)	____	Extended	
Abducted	____ (C8-T1)				
Adducted	____ (C6-T1)				
FINGER					
Flexed	____ (C6-T1)				
Extended	____ (C7-T1)				
Abducted	____ (C8-T1)				
Adducted	____ (C8-T1)				

Fig 1. MyoKinesthetic System posture chart. AB, abduction; ADD, adduction.

The MYK System treatment is focused on stimulating the CNS through bilateral movements and muscle sensory stimulation. Bilateral treatment is essential because it mirrors the function of the CNS and allows for the cross-education of strength and motor skills.[19-22] The combination of tactile stimulation and movement stimulates mechanoreceptors of the selected nerve root pathway, resulting in decreased nociceptor firing and muscle relaxation.[23,24] Because pain and dysfunction can alter signal transmission from the CNS, MYK treatment is used to improve communication between the CNS and muscles.[16] MyoKinesthetic treatment is theorized to increase afferent stimulation along a specific nerve root pathway, resulting in the generation of efferent feedback, which causes normalization of neural input and output, allowing muscles to function properly.[16]

Although it was introduced in 1998, the MYK System lacks independent rigorous evaluation. In 1 case study, use of the MYK System on a patient with several posture imbalances and multiple disk herniations (confirmed through magnetic resonance imaging) resulted in improvements in pain, disability, and function.[25] Although studies have been conducted to assess the effectiveness of a variety of manual therapy interventions for LBP, no other has targeted the MYK System. Therefore, the purpose of this case series was to test the feasibility of using the MYK System as a TBC system and intervention for a sample of patients with LBP.

METHODS

Design

The study design was a within-subject repeated-measures case series, with participants representing their own controls. Baseline data did not include data collected at the weekly appointments, discharge, and 1-month follow-up visits. Written informed consent was obtained from all participants prior to the initial evaluation. Patients were provided a waiver, which described the study, and asked to sign if they agreed to participate. The University of Idaho institutional review board approved the research protocol.

Participants

Patients were classified into subgroups within the 2007 model of the Delitto et al[10] TBC system to determine the effects of MYK treatment on the different subgroups. Delitto et al's TBC system was chosen because it has been researched more than any other TBC system in physical therapy.[11] A certified athletic trainer screened a convenience sample of patients who reported to a university athletic training clinic for evaluation and treatment for inclusion in the study. Inclusion criteria were defined as (1) age N18 years and (2) chief complaint of LBP, with or without radiating leg pain. Patients were excluded if they were in their third trimester of pregnancy, exhibited signs of serious infection, or received steroid injections up to 1 month prior to the initial evaluation. Additionally, patients were to be removed from this study and offered an alternate treatment if a 50% reduction in pain on the Numeric Rating Scale (NRS) was not reported after 4 for evaluation and treatment for inclusion in the study. Inclusion criteria were defined as (1) age N18 years and (2) chief complaint of LBP, with or without radiating leg pain. Patients were excluded if they were in their third trimester of pregnancy, exhibited signs of serious infection, or received steroid injections up to 1 month prior to the initial evaluation. Additionally, patients were to be removed from this study and offered an alternate treatment if a 50% reduction in pain on the Numeric Rating Scale (NRS) was not reported after 4 successive MYK treatments. The MYK System is recommended if improvements are obtained in the first 3 to 5 consecutive treatments.16 Because all participants were patients reporting to a clinic for care, the researchers selected 4 treatments as the cutoff point for determining whether the MYK treatment should be continued or deemed unsuccessful.

Outcome Measures

Outcome measurements were obtained at the initial evaluation, weekly appointments, discharge, and 1-month follow-up visits. The primary outcomes were pain (NRS), disability (Disablement in the Physically Active [DPA] Scale and Modified Oswestry Low Back Pain Disability Questionnaire [OSW]), function (Patient-Specific Functional Scale [PSFS]), active range of motion (fingertip-to-floor distance [FFD] and fingertip-to-thigh distance [FTD]), posture (MYK System), and global efficacy of treatment (Global Rating of Change [GRC] Scale). Each outcome measure is described in Table 1.

The MYK System posture assessment was used to identify imbalances in the neck, thorax, shoulders, scapula, lumbar spine, hips, and extremities (Fig 1). Each posture imbalance was correlated with 1 or more nerve root levels, and on completion, the levels were totaled to determine the nerve pathway (eg, L4, C5, S1) with the most imbalances for treatment.[16] Prior to the study, the researcher performed inter- and intrarater reliability testing (κcoefficient, percentage agreement, and coefficient of determination) on the MYK System posture screen. Interrater reliability was conducted between a certified MYK practitioner and an expert practitioner (developer of the technique). A certified MYK practitioner is defined as a clinician who has completed the MYK System upper body workshop, lower body workshop, and certification seminar and who has demonstrated proficient use of the technique.[37] The primary researcher, a certified MYK practitioner, demonstrated almost perfect agreement with an expert practitioner on both the upper body (.90 [$P < .001$], 93.3%, 81%) and lower body (.88 [$P < .001$], 93.3%, 77%) posture assessment. Substantial intrarater reliability on both the upper body (.79 [$P < .001$], 93.3%, 62%) and lower body (.77 [$P < .001$], 86.7%, 59%) posture screen was also demonstrated by the primary researcher.

Procedures

All initial examinations, follow-up visits, and treatments were completed by the primary researcher, who was a certified MYK practitioner and certified athletic trainer. The initial evaluation included patient history, palpation, range-of-motion testing, lower-quarter neurologic screening, MYK System posture screen, orthopedic special tests, and baseline data for the NRS, DPA Scale, OSW, and PSFS. Additionally, all participants were evaluated and placed into subgroups using the 2007 TBC system algorithm (Fig 2).[38] All NRS scores were recorded pre and post treatment; all other measures were recorded weekly, at discharge, and at the 1-month follow-up visit. Discharge criteria were set as follows: NRS scores (current pain levels) ≤1, DPA Scale <23, OSW <20%, and balanced MYK postures maintained between visits.

The MYK treatment was performed daily (if patient availability allowed), and all movements were pain free. All muscles associated with the selected nerve root were treated bilaterally with active and passive movement and sensory stimulation through massage. Treatment time varied from 5 to 20 minutes, depending on the nerve root level. For example, treatment of the L4 nerve root involved 10 different movements and took less time than the L5 nerve root treatment, which required 17 different movements. The combination of muscles being treated was dependent on the nerve root level selected in the assessment. Once the nerve root level was established, each patient was treated with bilateral active movements initiated by the antagonist muscles and bilateral passive movements of the agonist muscles. During each movement, the clinician performed a brief soft tissue massage of the targeted muscle. The technique is illustrated in Figures 3 and 4.

Statistical Analysis

All data was analyzed using SPSS Version 22.0 (IBM, Armonk, NY). Pilot data previously collected using the MYK System to treat LBP patients produced effect sizes ranging from $f = .5$ to $f = .7$, depending on the outcome measure being analyzed. A power calculation was conducted using G*Power (Department of Psychology, Dusseldorf, Germany).[39] Given the previously calculated effect sizes, along with 80% power and an level of $P = .05$, a sample size of 7 to 10 participants was indicated as being sufficient for this study. One-way repeated-measures analysis of variance (ANOVA) tests were conducted to evaluate the effect of MYK treatment on the NRS, DPA Scale, PSFS, OSW, MYK posture, FFD, and FTD across time. Mean differences from the initial visit scores and 95% confidence intervals were calculated for the NRS, DPA Scale, PSFS, OSW, and MYK posture for discharge and a 1-month follow-up. Significant changes were further analyzed with Bonferroni post hoc testing. Prior to data analysis, normality of distribution was assessed and theκlevel was set at $P < .05$. Effect size differences were computed with $\kappa\eta^2$, which is the more commonly reported effect size measure for an ANOVA.[40] A small effect size was $\kappa\eta^2 = .01$; a medium effect size was κη2 = .06; and a large effect size was $\kappa\eta^2 = .15$.[41]

Table 1. *Description of Outcome Measures*

Outcome Measure	Construct	Description
Numeric Rating Scale (NRS)[26–28]	Pain intensity	The NRS is an 11-point scale used to rate pain intensity. Each patient rated pain on a scale of 0 (no pain) to 10 (extreme pain). The NRS scores were recorded before and after each treatment. The NRS total (an average of the current, best, and worst scores) was used for reporting. The MCID was a decrease of 2 points or 30%. When compared with other pain rating scales, the NRS was valid, reliable, and more sensitive than the verbal rating scale.
Disablement in the Physically Active (DPA) Scale[29]	Disability	The DPA Scale is a 16-item questionnaire related to the following items: impairment, functional limitation, disability, and quality of life. Each statement was rated by the patient on a scale of 1 (no problem) to 5 (severe), with a maximum score of 64 and minimum score of 0. The MCID was a decrease of 9 points for acute injuries and 6 points for chronic injuries. The DPA Scale has been found to be valid, reliable, and responsive.
Modified Oswestry Low Back Pain Disability Questionnaire (OSW)[30,31]	Disability	The OSW is a 10-item questionnaire related to normal activities of daily living. Each question was scored from 0 (no disability) to 5 (severe disability). The MCID was a decrease of 6 points or 12%. The OSW has been found to be valid and reliable and had higher levels of test-retest reliability when compared with the Quebec Back Pain Disability Scale.
Patient-Specific Functional Scale (PSFS)[32–34]	Function	The PSFS is related to functional activities. Participants selected 3 to 5 activities that they could not perform at a normal level. Each activity was rated on a scale of 0 (could not perform) to 10 (could perform normally at pre-injury levels). The scores were then averaged to determine the final score, with an MCID represented by a decrease in 2 points. The PSFS has been found to be reliable, valid, and responsive in various patient populations.
Fingertip-to-floor distance (FFD)[35]	Thoracolumbar AROM	The FFD was measured with the patient standing on a 20-cm-high step with the feet together. The patient was instructed to bend forward, and the distance from the third fingertip to the floor was measured in centimeters. An average of 3 readings was recorded. Normal values for the FFD have been identified as 0.1 to 2.2 cm, with participants standing on the floor.
Fingertip-to-thigh distance (FTD)[35]	Thoracolumbar AROM	The FTD was measured with the patient standing with his or her back against a wall with feet shoulder width apart. An initial mark was made where the patient's third fingertip rested on the lateral thigh. The patient was instructed to laterally flex as far as possible while keeping his or her back and shoulders against the wall. A final mark was made where the third fingertip moved down the thigh. The distance was measured between both marks and recorded in centimeters. An average of 3 readings were recorded. Normal values for the FTD have been identified as 19.1 to 21.6 cm.
MYK System posture screen[16]	Posture	Each participant's posture was assessed using the MYK posture screen, which correlated each imbalance with a specific nerve root. The number of posture asymmetries was totaled to determine the nerve root level for treatment.
Global Rating of Change (GRC) Scale[36]	Global efficacy of treatment	The GRC Scale is an 11-point scale, with end ranges at –5 (very much worse) and 5 (completely recovered). Participants assessed their improvement over time to determine the effects of MYK treatment on their chief complaint. The GRC Scale had high reliability and validity scores, and the MCID was an increase in 2 points.

AROM, active range of motion; *DPA*, Disablement in the Physically Active scale; *FFD*, fingertip-to-floor distance; *FTD*, fingertip-to-thigh distance; *GRC*, Global Rating of Change Scale; *MCID*, minimally clinical important decrease; *MYK* System, MyoKinesthetic System; *NRS*, numeric rating scale; *OSW*, Oswestry Low Back Pain Disability Questionnaire; *PSFS*, Patient-Specific Functional Scale.

RESULTS

In September and October 2014, 9 consecutive patients (4 females and 5males) were evaluated in the clinic, and all met the inclusion criteria for the study (Table 2).All 9 patients were treated with only the MYK System, and no patient had to be removed from participation. Additionally, none of the patients completed any rehabilitation exercises while participating in this study. The participants' mean age was 31.11 years (SD = 16.04). The majority of patients reported chronic LBP (n = 6), with an average symptom duration of 6 years (*SD* = 4.52). The remaining patients reported subacute or acute LBP (n = 3),with an average symptom duration of 8.67 days (*SD* = 10.79). The mean number of MYK treatments administered was 12.11 (*SD* = 6.25), and themean number of days until discharge was 28.67 (*SD* = 9.38). At the discharge visit, 100% of the participants reported complete resolution of their pain. At the 1-month follow-up visit, 89%of the participants remained pain free. Table 3 presents the mean values, standard deviations, minimal clinically important difference (MCID) values, effect sizes, and *P* values for each outcome measure from the initial examination to the discharge visit and 1-month follow-up.

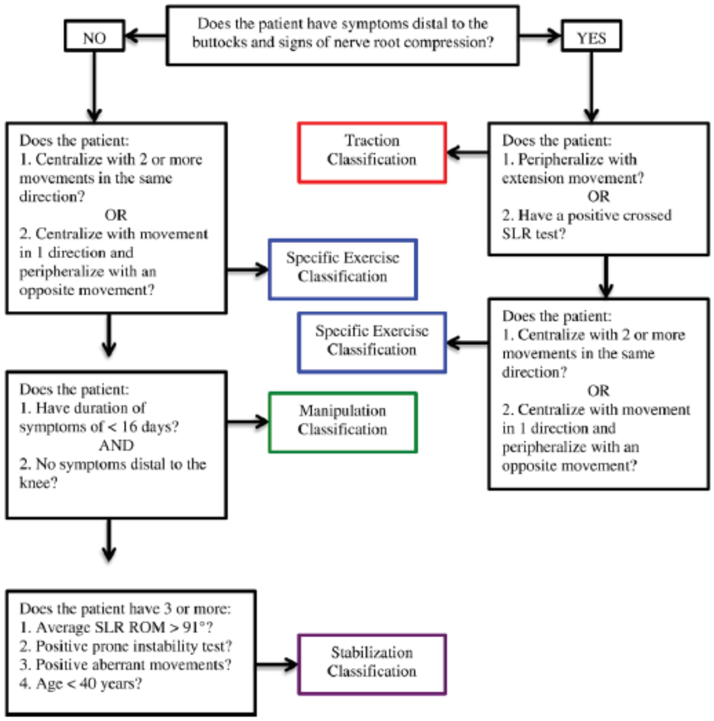

Fig 2. *Treatment-based classification system algorithm. SLR, straight leg raise; ROM, range of motion.*

Numeric Rating Scale

The MYK System resulted in statistically significant improvements in pain over time [$F(1.101, 8.804) = 29.659$, $P < .001$, $\eta^2 = .788$, power = .999] (Table 3). Following 1 week of treatment, 100% of patients reported an NRS score that exceeded the MCID value.26 Additionally, 89% of the patients achieved an MCID on the NRS (current pain) following the first treatment.

Fig 3. *Starting (left) and ending (right) positions for MyoKinesthetic System passive treatment of the psoas major and psoas minor muscles. The clinician applies tactile stimulation medial to the anterior superior iliac spine while passively moving the hip into extension.*

Fig 4. *Starting (left) and ending (right) positions for MyoKinesthetic System active treatment of the psoas major and psoas minor muscles. The clinician applies tactile stimulation medial to the anterior superior iliac spine while the patient actively contracts the gluteus maximus, resulting in hip extension.*

Table 2. *Participants' Demographic Details (n = 9)*

Patient	Age/Sex	Symptom Location	Symptom Duration	Injury Mechanism	TBC	MYK Tx	Txs
1	30/F	Right lumbar, hip	9 y	Gradual onset	Traction	L4	9
2	30/M	Bilateral lumbar	12 y	Weight lifting/sudden	None	S1	15
3	24/M	Central lumbar	9 y	Fall/trauma	None	L4 and C8	24
4	50/F	Bilateral lumbar, right hip	3 wk	Running/sudden	None	L5	8
5	19/M	Left lumbar	1 d	Weight lifting/sudden	Manipulation	L4	7
6	19/F	Right lumbar, posterior thigh	4 d	Running/sudden	Specific exercise	L5	5
7	65/M	Bilateral lumbar	2 y	Gradual onset	None	L3	8
8	20/F	Right lumbar, SIJ	2 y	Weight lifting/sudden	Specific exercise	L5 and S1	18
9	22/M	Central lumbar	2 y	MVA/trauma	Specific exercise	L5 and C5	15

MVA, motor vehicle accident; *MYK Tx*, nerve root level used for MyoKinesthetic System treatment; *SIJ*, sacroiliac joint; *TBC*, treatment-based classification subgroup; *Txs*, number of treatments.

Disablement in the Physically Active Scale

Statistically significant improvements were recorded for DPA Scale scores over time [F(2, 14) = 87.763, P b .001, $\kappa\eta^2$ = .926, power = 1.00] (Table 3). Additionally, 89% of patients reported a DPA Scale score that exceeded the MCID value after 1 week of treatment.[29]

Patient-Specific Functional Scale

The MYK treatment also produced statistically significant improvements in PSFS scores over time [F(2, 16) = 46.660, $p < .001$, $\kappa\eta^2$ = .854, power = 1.00] (Table 3). After 1 week of treatment, 44% of patients reported a PSFS score that exceeded the MCID value.[32,33] At discharge, 89% of patients reported a score of 9 or higher, with 10 representing the highest score possible. At the 1-month follow-up, 78% of patients reported a score of 9 or higher.

Modified Oswestry LBP Disability Questionnaire

Statistically significant improvements were recorded for OSW scores over time [F(1.147, 9.173) = 15.128, P = .003, $\kappa\eta^2$ = .654, power = .969] (Table 3). Additionally, 44% of patients reported an OSW score that exceeded the MCID value after 1 week of treatment.30 The mean OSW score at initial exam indicated moderate disability, which was later reduced to minimal to no disability at both discharge visit and 1-month follow-up for 100% of the patients.

MyoKinesthetic Posture Assessment

The MYK treatment also produced statistically significant improvements in posture over time [F(1.191, 9.524) = 39.626, $P < .001$, η^2 = .832, power = 1.00] (Table 3).

Active Range of Motion

The MYK treatment also produced statistically significant improvements in posture over time [F(1.191, 9.524) = 39.626, $P < .001$, η^2 = .832, power = 1.00] (Table 3). The MYK treatment also did not produce statistically significant changes in thoracolumbar right lateral flexion over time [F(2, 16) = 0.412, P = .669, $\kappa 2$ = .049, power = .105] (Table 3) or in thoracolumbar left lateral flexion over time [F(1.215, 9.717) = 1.148, P = .324, $\kappa\eta^2$ = .125, power = .171] (Table 3).

Active Range of Motion

Table 3. *Overall Mean ± SD, MCID, and Effect Size Differences at Discharge and 1-Month Follow-up (n = 9)*

Outcome Measure	Initial Examination	At Discharge	At 1-mo F/U	MCID (points)	η^2	*P* Value
NRS (total)	3.43 ± 1.78	0.23 ± 0.25 [a]	0.36 ± 0.43 [b]	2 (30%)	.79	.000
DPA Scale	33.25 ± 8.21	5.88 ± 5.72 [a]	6.75 ± 6.67 [b]	6-9	.93	.000
PSFS	5.53 ± 1.50	9.41 ± 0.48 [a]	9.31 ± 0.99 [b]	2	.85	.000
OSW	22.44 ± 12.99	4.89 ± 6.09 [a]	4.84 ± 4.96 [b]	12%	.65	.003
MYK [c]	7.44 ± 1.42	3.11 ± 0.78	4.00 ± 1.22	N/A	.83	.000
FFD (cm)	14.22 ± 9.23	13.33 ± 8.60	15.17 ± 7.22	N/A	.08	.504
FTD (cm)						
Left	20.44 ± 3.80	18.72 ± 6.12	18.72 ± 4.93	N/A	.13	.324
Right	20.33 ± 3.19	19.28 ± 5.57	19.00 ± 5.00	N/A	.05	.669

DPA Scale, Disablement in the Physically Active Scale; *FFD*, fingertip-to-floor distance (normal range: 0.1-2.2 cm from the floor without a step); *FTD*, fingertip-to-thigh distance (normal range: 19.1-21.6 cm; *F/U*, follow-up; *MCID*, minimally clinically important decrease (6 points for chronic, 9 points for acute); *MYK*, MyoKinesthetic System; *N/A*, no MCID value available; *NRS*, Numeric Rating Scale; *OSW*, Modified Oswestry Low Back Pain Disability Questionnaire; *PSFS*, Patient-Specific Functional Scale.

[a] MCID, day 1 to discharge.
[b] MCID, day 1 to F/U.
[c] Number of posture imbalances.

Treatment-Based Classification System

Because of the small sample size of subgroups within the TBC system, inferential statistics were not conducted to compare the effects of MYK treatment on each TBC subgroup. However, the mean changes in scores across all outcome measures were similar across the TBC subgroups (Table 4).

Table 4. *Mean Change in Outcome Measures Comparing TBC Subgroups (n = 9)*

TBC Subgroup	Initial	Discharge (*M*Δ)	1 mo (*M*Δ)
	Numeric Rating Scale		
Traction (n = 1)	2.2	0 (2.2)	0 (2.2)
No subgroup (n = 4)	4.0	0.2 (3.8)	0.6 (3.4)
Manipulation (n = 1)	1.7	0.3 (1.4)	0 (1.7)
Specific exercise (n = 3)	3.7	0.4 (3.3)	0.3 (3.4)
	Disablement in the Physically Active Scale		
Traction	32	10 (22)	17 (15)
No subgroup	31	4.3 (26.7)	6.5 (24.5)
Manipulation	27	0 (27)	0 (27)
Specific exercise	29	7 (22)	3.7 (25.3)
	Patient-Specific Functional Scale		
Traction	4.7	9.3 (4.6)	9.8 (5.1)
No subgroup	6.2	9.6 (3.4)	9 (2.8)
Manipulation	4	9.3 (5.3)	10 (6)
Specific exercise	5.4	9.3 (3.9)	9.4 (4)
	Modified Oswestry Low Back Pain Disability Questionnaire		
Traction	16%	6% (10%)	2% (14%)
No subgroup	26%	4.5% (21.5%)	4.5% (21.5%)
Manipulation	16%	2% (14%)	0% (16%)
Specific exercise	22%	6% (16%)	6% (16%)

*M*Δ, mean change from initial visit; *TBC*, treatment-based classification.

DISCUSSION

In this small sample of patients with LBP, we measured meaningful improvements in pain, disability, and function at discharge and at a 1-month follow-up. Changes in the mean values of the scores on the NRS, DPA Scale, PSFS, OSW, and MYK posture screen over time may be an indication of the effects of the MYK System treatment, and the P values reflect the significance of these effects (Table 3). Additionally, the initial DPA Scale score in this study (^{M}= 33.25) was higher than reported normal baseline values for this outcomes measure (*M* = 27.27); however, the patients in this study achieved much lower scores at discharge (*M* = 5.88) than the reported normal values for persistent injuries at 6 weeks (*M*= 18.91).[29]

Although the MYK System did not produce significant changes in active range of motion (AROM), it should be noted that FTD measurements were within normal ranges prior to treatment.35 Additionally, the mean value for FFD at the initial exam exceeded the normal range by 14.33 cm, indicating hypermobility in thoracolumbar flexion in this patient population.35 Despite minimal changes in AROM, the MYK System did result in statistically significant improvements in posture, as measured by the MYK posture screen. In this study, a broad scope of outcomes were included, because in the assessment of LBP treatments, no one, fixed outcome is considered ideal; rather, the use of a battery of outcome measures is suggested.[42] The consistent improvement in all outcome measures in this study provides evidence of the impact of the MYK System on multiple dimensions of LBP.

Despite the heterogeneous nature of the patient population included in this study, classification and treatment within the MYK System produced decreases in NRS scores similar to those documented in other larger TBC studies.15,43,44 Apeldoorn et al44 reported a mean baseline score of 6.06 on the NRS, which was lowered to 4.04 following 8 weeks of treatment with Delitto et al's TBC system. Our mean NRS scores were 3.43 at baseline and 0.23 at discharge, and were achieved within 1 month for most patients. Additionally, 100% of the participants in our study reported NRS scores less than 1 at discharge and 1-month follow-up.

The improvements on the PSFS in our participants were similar to those experienced in other randomized clinical trials45-48; however, our participants reported higher PSFS scores 1 month post-treatment. In a study examining the effects of motor control exercises on LBP, Aasa et al49 reported a mean PSFS baseline score of 3.8 and a 2-month follow-up score of 7.8. Similarly, Macedo et al47 reported a baseline PSFS score of 3.7 and a 2-month follow-up score of 5.9 in patients treated with motor control exercises. In our study, patients reported a higher baseline PSFS score (M = 5.5) and a higher score at the 1-month follow-up (M = 9.3). More importantly, our patients' scores were also close to the maximum score of 10, which indicated that the patients had returned to almost normal, pre-injury function at discharge and 1-month follow-up exams.

With the variety of interventions available for patients with LBP, consistent selection of effective treatment is difficult.2 The value of any TBC system is predicated on its ability to produce more consistent outcomes by placing patients into homogenous subgroups and matching their classification to a specific treatment.[11] The results of this preliminary study provide evidence that the MYK System may be effective as a TBC system in reducing pain and disability and in improving function and posture in patients with LBP. Like Delitto et al's TBC system, the MYK system contains mutually exclusive subgroups, but patients may fit the criteria of more than 1 subgroup. Both TBC systems require prioritization and allow for patients to be reclassified into another treatment option as their clinical status changes.[11] Although the updated 2015 TBC system allows for more precise patient classification,[11] the 2007 model was less exact, with only 50% of patients able to be placed into 1 subgroup for treatment.38 The remaining 50% either did not fit into any subgroup or could be placed into several subgroups.[38] Our findings are similar, as 44% of our patients could not be placed into any of the subgroups within Delitto et al's 2007 TBC system. These patients would be less likely to receive a classification-based treatment in the 2007 TBC model; however, within the MYK System, all patients appeared to receive a properly matched treatment.

Additional research is necessary to determine the strengths and limitations of TBC systems, including the MYK System. As with any classification system, the MYK System may not be comprehensive enough to manage the variety of clinical presentations in patients with LBP. For example, the MYK System does not address the psychosocial factors that may play a role in a patient's pain and disability. Delitto et al's 2015 TBC system has attempted to correct this flaw by triaging patients into a medical management group if they require a multidisciplinary approach to manage LBP.[11] As more research is conducted, TBC systems will continue to evolve and incorporate a wealth of evidence-based data to advance the way in which patients are treated for complex conditions such as LBP.

Limitations

Several limitations were present in this study. Although the sample size was appropriate to power the study from a statistical lens, the sample population is not representative of all LBP patients. Thus, the results may not be generalizable to all cases of LBP. Another limitation of the sample size was limited ability to compare the effects of the MYK treatment between Delitto et al's TBC subgroups. Additionally, bias may have been introduced, because the patient and primary researcher were not blinded to the procedure or outcomes. The lack of a control or comparison group also limited the researcher's ability to verify that all changes were the result of MYK treatment.

Further studies are needed, with independent researchers, to confirm the benefits experienced in this case series compared with the benefits experienced with other interventions. Although there were positive findings with MYK treatment at 1-month follow-up, subsequent studies should be conducted to investigate the long-term benefits of this treatment.

CONCLUSIONS

The sample of patients with LBP in this case series had improved pain, disability, function, and posture in patients with LBP. The patients did not require additional treatment following discharge, and all improvements were maintained at a 1-month follow-up. Based on these findings, we suggest that the MYK System may be an appropriate TBC system for patients with LBP, who can be classified within the system, but further research is required to substantiate these findings. This study indicated the feasibility of further evaluation of the MYK System as a TBC system and intervention for patients with LBP.

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CONTRIBUTORSHIP INFORMATION

Concept development (provided idea for the research): K.B.

Design (planned the methods to generate the results): K.B.

Supervision (provided oversight, responsible for organization and implementation, writing of the manuscript):

K.B., R.T.B., A.M.N., J.M.M.

Data collection/processing (responsible for experiments, patient management, organization, or reporting data): K.B.

Analysis/interpretation (responsible for statistical analysis, evaluation, and presentation of the results): K.B.

Literature search (performed the literature search): K.B.

Writing (responsible for writing a substantive part of the manuscript): K.B.

Critical review (revised manuscript for intellectual content, this does not relate to spelling and checking): K.B., R.T.B., A.M.N., J.M.M.

Practical Applications

The findings of this study may be useful to clinicians seeking additional treatment options for LBP.

- The MyoKinesthetic System includes a thorough evaluation component, which is then used to select an appropriate treatment method.
- Although a significant amount of research has been conducted on LBP treatment, evidence does not favorably support any one specific treatment.
- The results of this study, however, indicated significant improvements in pain and disability in a heterogeneous population of LBP patients.

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