SPINE Volume 32, Number 26, pp E793–E800

Is There a Subgroup of Patients With Low Back Pain Likely to Benefit From Mechanical Traction?

Results of a Randomized Clinical Trial and Subgrouping Analysis

Julie M. Fritz, PhD, PT, ATC,*† Weston Lindsay, MS, PT, ATC,*
James W. Matheson, DPT, MS, SCS, CSCS,‡ Gerard P. Brennan, PhD, PT,*
Stephen J. Hunter, MS, PT, OCS,* Steve D. Moffit, DPT,* Aaron Swalberg, MPT,*
and Brian Rodriquez, PT, OCS*

Study Design. Randomized Clinical Trial.

Objective. To identify a subgroup of patients with low back pain who are likely to respond favorably to an intervention including mechanical traction.

Summary of Background Data. Previous research has failed to find evidence supporting traction for patients with low back pain. Previous studies have used heterogeneous samples, although clinical experts tend to recommend traction for a more limited subgroup of patients with low back pain.

Methods. Sixty-four subjects (mean age 41.1 year, 56.3% female) with low back and leg pain and signs of nerve root compression were randomized to receive a 6-week extension-oriented intervention with or without mechanical traction during the first 2 weeks. Between-group comparisons were conducted for changes in pain, disability, and fear-avoidance beliefs. Baseline variables were explored for potential as subgrouping criteria defining a subgroup of subjects likely to benefit from traction.

Results. The group receiving traction showed greater improvements in disability (adjusted mean difference in Oswestry change 7.2 points) and fear-avoidance beliefs (adjusted mean difference in FABQPA change 2.6 points) after 2 weeks. There were no between-group differences after 6 weeks. Two baseline variables were associated with greater improvements with traction treatment; peripheralization with extension movements and a crossed straight leg raise.

Conclusion. A subgroup of patients likely to benefit from mechanical traction may exist. The results of this study suggest this subgroup is characterized by the presence of leg symptoms, signs of nerve root compression, and either peripheralization with extension movements or a crossed straight leg raise. Further research is needed to validate this finding.

Key words: low back pain, sciatica, traction, subgroups, classification. **Spine 2007;32:E793–E800**

From the *Intermountain Healthcare, and †University of Utah, Salt Lake City, UT; and ‡Therapy Partners, Inc., Burnsville, MN.
Acknowledgment date: April 2, 2007. Revision date: July 9, 2007. Acceptance date: August 27, 2007.
Financial support for this study was received from The Saunders Company, Inc, Chaska, MN.
The manuscript submitted does not contain information about medical device(s)/drug(s).
Corporate/Industry funds were received in support of this work. No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this manuscript.
Address correspondence and reprint requests to Julie M. Fritz, PhD, PT, ATC, 520 Wakara Way, Salt Lake City, UT 84106; E-mail: Julie.fritz@hsc.utah.edu

The use of mechanical traction in the management of patients with acute or chronic low back pain (LBP) has generally not been endorsed by evidence-based practice guidelines.[1–4] This lack of support is based on the results of randomized clinical trials that have examined heterogeneous samples of patients with LBP and failed to find any benefit for traction when compared with sham, placebo, or other treatments.[5–9] It seems, however, that clinicians who use or recommend traction believe the intervention is likely to benefit a more specific subgroup of patients with LBP.[10] Recent evidence supports the contention that the power of clinical research can be enhanced when more homogeneous subgroups of subjects are studied,[11–13] but most research on traction has not taken this into account.

Expert opinion[14,15] and surveys of clinicians[10,16–18] indicate that the presence of sciatica is the primary factor believed to define the subgroup of patients with LBP for whom traction is most beneficial. Others have further specified the subgroup as those with sciatica who also have signs of nerve root compression, a positive straight leg raise test, or who fail to show centralization of symptoms during examination.[19–22] Recent systematic reviews have reported that few studies have attempted examine the effectiveness of traction in more homogeneous subgroups of subjects with sciatica, and studies that have been done are of low methodologic quality.[23–25]

The purpose of this study was to examine whether a subgroup of patients with LBP could be identified that may be likely to respond favorably to an intervention that included mechanical traction. We first compared short-term outcomes of subjects randomized to treatment with or without traction in a relatively homogenous cohort of subjects with LBP, sciatica, and signs of nerve root compression. We selected these criteria because they have been identified by clinicians as defining patients who may respond to a traction intervention. Second, we explored the value of additional baseline examination findings for defining a subgroup of patients with LBP who may preferentially respond to an intervention that includes mechanical traction.

Methods

Study Design. This study was a single-blind randomized clinical trial comparing interventions for patients with LBP with signs of radiculopathy. Subjects were recruited from 4 outpa-

tient physical therapy clinics in Minneapolis, MN and Salt Lake City, UT. All subjects provided written informed consent. The study protocol was approved by the Institutional Review Boards at the University of Utah and Intermountain Healthcare.

Subjects. Inclusion criteria for participation were; age between 18 and 60 years, symptoms of pain and/or numbness extending distal to the buttock in the past 24 hours, Oswestry score ≥30%, signs of nerve root compression [positive straight leg raise (reproduction of symptoms at <45°), or reflex, sensory, or muscle strength deficit]. Potential subjects were excluded based on any of the following; medical red flags indicative of nonmechanical LBP, previous spinal fusion or spine surgery in the past 6 months, current pregnancy, or the absence of any symptoms while sitting.

Randomization Procedures and Treatment Protocols. All baseline information was obtained before randomization by a research assistant. Randomization envelopes were prepared before the study using a computer-generated random number list. After completion of the baseline assessments procedures the randomization assignment was revealed. Follow-up assessments were performed by an examiner who did not participate in the subject's treatment and was blind to the subject's treatment allocation. For 15 subjects (20%) blinding of the examiner at the 6-week reassessment was lost because of procedural error or subject disclosure. The majority of the 6-week reassessment consisted of self-report questionnaires that were completed by the subject without any input or influence from the examiner.

Treatments were provided by 6 physical therapists (mean years of experience 11.5 years, range 3–25 years) trained to deliver the study-related interventions. The treatment period for both groups was 6 weeks. Treatment sessions lasted between 30 and 45 minutes.

Extension-oriented Treatment Approach Group. Subjects in the extension-oriented treatment approach (EOTA) group received exercise, mobilization, and education to promote extension of the lumbar spine with the goal of producing centralization of symptoms. Subjects were instructed in a series of extension-oriented exercises, including sustained and repeated lumbar extension in prone and standing positions. Exercises were progressed by the treating physical therapist as tolerated by the patient with an emphasis on achieving as much extension range of motion (ROM) as possible without peripheralizing symptoms. Subjects were progressed to perform 3 sets of 10 repetitions of extension exercises to be performed throughout the day every 4 to 5 hours. During treatment sessions subjects in the EOTA group also received a series of 10 to 20 grade 3 or 4 oscillations of posterior to anterior mobilization.[26] The therapist selected the grade and lumbar spinal level for mobilization during each treatment session based on the goals of promoting centralization, reducing stiffness, and decreasing symptoms. Subjects were also educated to maintain the lumbar lordosis while sitting, and were instructed to discontinue any activities that caused peripheralization of their symptoms. Subjects in the EOTA group could receive a maximum of 9 sessions during the 6-week treatment period (2 sessions per week for weeks 1–3, 1 session per week for weeks 4–6). The actual number of sessions was determined based on the therapist's judgment and the subject's response to treatment.

Traction Plus EOTA Group. Subjects in the traction plus EOTA (TRACT) group received exactly the same EOTA intervention previously described with the addition of mechanical traction during the first 2 weeks of treatment. Mechanical traction was provided using an adjustable table allowing for modifications of a subject's position in flexion/extension, rotation or side-bending (3-dimensional ActiveTrac table, The Saunders Group, Inc.). Traction was performed with the patient prone. The table was adjusted as needed to maximize centralization of the subject's symptoms before beginning traction. Static traction was applied for a maximum of 12 minutes (10 minutes at the desired intensity with 1-minute ramp up and ramp down time). Intensity of the traction force was 40% to 60% of the subject's body weight, adjusted based on the subject's tolerance and symptom response. After 3 minutes of traction, if the table was initially positioned in flexion or side bending/rotation, the table was repositioned as tolerated, with the goal of achieving a neutral or extended spinal position. After completing the traction subjects remained in prone lying for at least 2 minutes, and then performed a set of active extension exercises (prone-press-ups) before resuming a weight-bearing position. The TRACT protocol was chosen based on expert opinion and recommendations from the manufacturer.[27] Subjects in the TRACT group could receive a maximum of 12 sessions during the 6-week treatment period (4 sessions per week for weeks 1–2, 1 session per week for weeks 3–6 during which only the EOTA intervention was received).

Outcomes Measures and Follow-up Procedures. At the baseline assessment subjects provided demographic and historical information on past medical history and prior experiences of LBP. A pain body diagram was used to assess the anatomic distribution of symptoms.[28] Pain intensity (current, at worst and at best in the past 24 hours) was assessed using 11-point numerical pain rating scales. The mean of the 3 ratings was used to represent the subject's pain intensity.[29] A modified Oswestry Questionnaire (OSW) was used to assess disability because of LBP,[30] and the Fear-Avoidance Beliefs Questionnaire (FABQ) was used to assess the subject's degree of fear and avoidance beliefs related to physical and work activities.[31]

A physical examination was completed at baseline. This included an assessment of centralization or peripheralization with active lumbar movements including flexion, extension and side-gliding movements in standing, repeated extension in standing, sustained extension in prone, and repeated flexion in sitting. Centralization was defined as occurring when a movement abolished symptoms, or caused symptoms to move proximally towards the midline of the spine. Peripheralization was defined as occurring when a movement caused symptoms to move distally away from the midline of the spine.[32] A lateral shift was judged to be present if there was a visible offset of the shoulders relative to the pelvis observed with the patient standing.[33] ROM measurements were taken for total lumbar flexion and extension with the subject standing. Straight leg raise ROM was measured with the subject supine. All ROM measurements were taken using single inclinometer techniques.[34] Mobility of the lumbar spinal segments was assessed using posterior-to-anterior testing as previously described.[35]

Follow-up assessments were performed 2 and 6 weeks (post-treatment) after baseline. At each follow-up subjects completed the self-report questionnaires described above. In addition, subjects completed a 15-point global rating of change questionnaire.[36] This questionnaire asked subjects to rate their

perceived level of improvement because the beginning of treatment on a likert-type scale ranging from "a very great deal worse" (−7) to "about the same" (0) to "a very great deal better" (+7). Patients with ratings between −2 ("a little bit worse") to +2 ("a little bit better") were categorized as unchanged. Rating below −2 or greater than +2 were categorized as worsened or improved, respectively.

Sample Size and Statistical Analysis. Sample size was based on detecting minimally important change of 10 points on the OSW.[37] A sample size of 31 subjects per group provided 90% power to detect this difference assuming a common standard deviation of 12.0 and a 2-sided hypothesis with $\alpha = 0.05$. All subjects were included in all analyses according to intention-to-treat principles (last available score forward method). Alternative "completers analyses" were also performed including only subjects who did not drop-out or receive other medical cointerventions during treatment. Baseline status of the groups was compared using 2-tailed independent t tests or appropriate nonparametric alternatives. Between-group differences on the OSW and average numerical pain rating were examined using separate analysis of covariance (ANCOVA) procedures. The baseline score of the outcome measure served as the covariate and any baseline variables found to differ between groups. Differences between groups on the global rating of change were examined using χ^2 tests.

To examine the potential clinical impact of the treatments, the percentage change in the OSW score ([initial OSW score − 6-week OSW score]/initial OSW score × 100%) was calculated for each subject. Consistent with other studies of nonoperative interventions for individuals with LBP, subjects with a percentage change of 50% or greater were categorized as having a successful treatment outcome.[38,39] Subjects with less than 50% improvements were categorized as a nonsuccessful outcome. We examined the proportion of subjects achieving a successful outcome using χ^2 tests of association. Alpha level was 0.05 for all analyses.

To examine the value of baseline findings for defining a subgroup of subjects with LBP likely to benefit from traction, a series of preplanned comparisons were performed using 2-way ANCOVA procedures with subjects in the completers analysis. For each ANCOVA the dependent variable was 6-week change in OSW, with baseline OSW as the covariate. Independent variables were treatment group and the baseline variable being examined. The hypothesis of interest was the 2-way interaction between the variable and treatment group. A significant interaction indicated that the clinical outcome depended on the combination of the subject's status on the variable and the treatment received. Baseline findings examined as potential subgrouping factors included; centralization or peripheralization with flexion, extension and side-gliding movements, the presence of a lateral shift, ROM measures, straight leg raise test, lumbar spine mobility judgments, sex, age, body mass index, duration of symptoms, belief traction would help symptoms, baseline FABQ, OSW, and pain rating scores. Continuous baseline variables were dichotomized using a median split to create "high" and "low" groups for the purpose of this analysis.

■ Results

Sixty-four subjects were recruited, 31 randomized to TRACT and 33 to the EOTA treatment group. Mean age was 41.1 year (SD = 9.8) with a median symptom duration of 47.5 days (range 2–761 days). Thirty-six subjects (56.3%) were female and 49 (76.6%) had a history of LBP. Further baseline information is found in Tables 1 and 2. The only statistically significant between-group difference was a higher percentage of subjects in the TRACT group taking prescription medication for pain ($P = 0.044$). Eight subjects (12.5%) (5 from TRACT group, 3 from EOTA) dropped out during the treatment period

Table 1. Demographic Variables and Results of Self-report Measures at Baseline Examination

	Extension (n = 33)	Traction + Extension (n = 31)
Age	40.7 (7.6)	41.5 (11.7)
Body mass index	30.6 (7.0)	29.6 (6.9)
Sex (% female)	57.6	54.8
Prior history of low back pain (%)	78.8	74.2
Prior surgery for low back pain (%)	9.1	6.5
Symptoms distal to the knee (%)	75.8	77.4
Missed work during this episode due to low back pain (%)	57.1	56.0
Currently not working due to low back pain (%)	7.4	12.0
Currently taking medication for low back pain (%)	71.9	93.3
Patient expectation that traction is likely to provide benefit (%)	36.7	48.1
Numeric pain rating	5.3 (1.5)	5.0 (1.8)
Oswestry disability score	41.3 (10.8)	46.1 (14.9)
FABQ—physical activity subscale	14.9 (5.2)	15.2 (4.8)
FABQ—work subscale	10.6 (10.3)	13.3 (10.7)

Table 2. Physical Examination Findings at Baseline Examination

	Extension (n = 33)	Traction + Extension (n = 31)
Visible lateral shift present (%)	48.5	32.3
Total flexion ROM	59.9° (24.6)	63.9° (23.1)
Total extension ROM	21.0° (9.1)	18.8° (8.1)
Centralizes with extension movement (%)	57.6	38.7
Peripheralizes with extension movement (%)	33.3	41.9
Centralizes with flexion movement (%)	9.1	3.2
Peripheralizes with flexion movement (%)	81.8	83.9
Centralizes with side-glide movement (%)	18.2	6.5
Peripheralizes with side-glide movement (%)	21.2	25.8
Positive ipsilateral straight leg raise test (%)	81.8	83.9
Straight leg raise ROM (involved side)	45.7° (20.4)	43.3° (16.4)
Hypomobility present with lumbar mobility assessment (%)	81.3	77.4
Hypermobility present with lumbar mobility assessment (%)	15.6	6.5

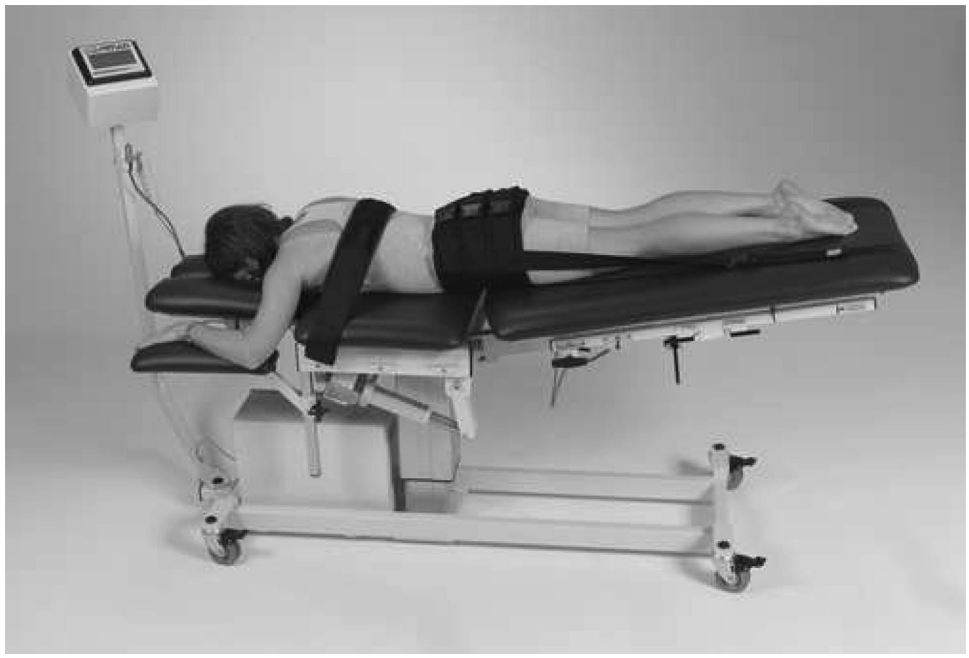

Figure 1. Table used for subjects in the traction group.

and did not complete the 6-week follow-up. Reasons for drop-outs are provided in Figure 1. Seven subjects (3 from TRACT group, 4 from EOTA) received medical cointerventions during the treatment period (Figure 2). The median number of treatment sessions was significantly greater for the TRACT group (8.0, range 1–13) than the EOTA group (4.0, range 1–8), $P = 0.01$.

Results of the intention-to-treat analysis revealed no between-group differences at the 6-week follow-up (Table 3). The TRACT group had greater change in OSW and FABQPA scores at the 2-week follow-up. There were also no differences in the patient global rating or rate of successful outcome at 6-weeks (Table 3). Completers analysis included 49 patients (23 TRACT, 26 EOTA) who did not drop-out or receive a medical cointervention. The groups differed at baseline with respect to the percentage of patients taking prescription medication (TRACT = 91.3%, EOTA = 65.4%, $P = 0.030$) and baseline OSW score (TRACT = 45.7, EOTA = 39.0, $P = 0.04$). Results of the completers analysis showed a similar pattern as the intention-to-treat analysis. At the 2-week follow-up the TRACT showed greater improvement on the OSW (mean difference 8.7 points, 95% CI: 0.32–17.1) and FABQPA (mean difference 2.6, 95% CI: 0.21–5.0). No differences existed between groups at the 6-week follow-up. After 6 weeks 82.6% of subjects in the TRACT group rated themselves as improved, compared with 73.1% in the EOTA group. Rates of successful outcome based on 50% improvement on the OSW were 60.9% and 61.5% for the TRACT and EOTA groups, respectively.

ANCOVA results for baseline findings identified 2 variables with a significant interaction with treatment group. Subjects who peripheralized with extension movement

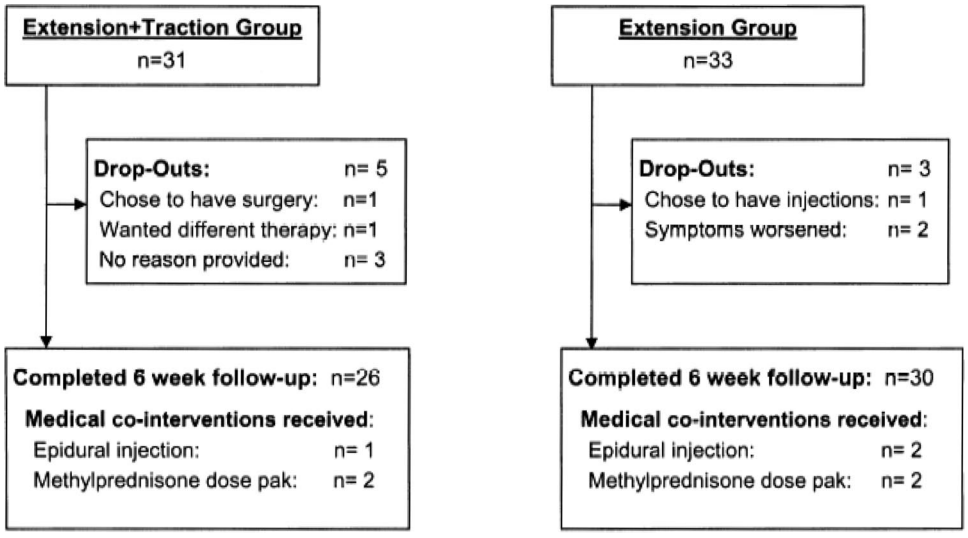

Figure 2. Subject flow through the study.

Table 3. Results of the Intention-to-Treat Analysis Comparing Outcomes Between Treatment Groups

	Mean (SD) for Each Group		Adjusted Mean Difference (95% CI) Between Groups*
	Extension (n = 33)	Traction + Extension (n = 31)	
Oswestry Score			
Baseline	41.5 (10.7)	46.1 (14.9)	—
2 wk	32.4 (19.2)	30.0 (19.3)	7.2 (0.13, 14.3)
6 wk	25.6 (19.9)	28.3 (19.3)	1.8 (−6.4, 10.1)
Pain rating			
Baseline	5.3 (1.5)	5.0 (1.8)	—
2 wk	4.1 (2.5)	3.6 (2.1)	0.23 (−1.4, 1.9)
6 wk	3.0 (2.4)	3.2 (2.5)	−0.17 (−1.4, 1.1)
FABQ—physical activity subscale			
Baseline	14.9 (5.2)	15.2 (4.8)	—
2 wk	15.7 (4.7)	13.1 (5.0)	2.7 (0.66, 4.6)
6 wk	12.9 (6.4)	12.0 (7.1)	0.50 (−2.4, 3.4)
FABQ—work subscale			
Baseline	10.6 (10.3)	13.3 (10.7)	—
2 wk	10.6 (10.4)	14.3 (10.4)	−1.1 (−4.2, 1.9)
6 wk	9.2 (10.2)	13.7 (11.0)	−3.1 (−6.5, 0.36)
Patient global rating at 6 wk			
Worsened	3 (9.7%)	2 (6.1%)	—
Unchanged	7 (22.6%)	10 (30.3%)	—
Improved	21 (67.7%)	21 (63.6%)	NS
Successful outcome (>50% Oswestry change)	14 (45.2%)	17 (51.5%)	NS

*Scores were adjusted for baseline values on the outcome measure and for taking prescription pain medication.
NS indicates not significant.

or had a positive crossed SLR test at baseline achieved greater reductions in 6-week OSW when randomized to TRACT instead of EOTA. Among subjects who peripheralized with extension movement at baseline, the mean adjusted difference in 6-week OSW change between groups was 15.5 points (95% CI: 2.7–28.3) favoring the TRACT group (Figure 3). For subjects with a positive crossed SLR test, those randomized to the TRACT group experienced an average 18.9 points more change (95% CI: 1.5–36.4) (Figure 4). Twenty-four subjects had either a positive crossed SLR test or peripheralized with extension at baseline. Among these subjects the rate of a successful outcome was 84.6% for subjects in the TRACT group, and 45.5% for subjects in the EOTA group ($P = 0.04$). One baseline finding, centralization with extension movements, had a significant main effect, indicating that centralization with extension was a favorable prognostic finding regardless of treatment. Subjects demonstrating centralization with extension improved an average of 8.8 points more than subjects without centralization (95% CI: 0.61–17.0, $P = 0.04$).

Discussion

This study explored whether a subgroup of patients with LBP exists who may preferentially benefit from an intervention that included mechanical traction along with an extension-oriented approach. Clinicians suggest that patients with LBP and sciatica are more likely to benefit from traction than more heterogeneous groups with LBP.[10,21] A recent study[40] compared an EOTA with a spinal strengthening approach in this subgroup and found superior results for the EOTA. We recruited a sample of subjects from this same subgroup (LBP with sciatica) and compared an EOTA with or without the

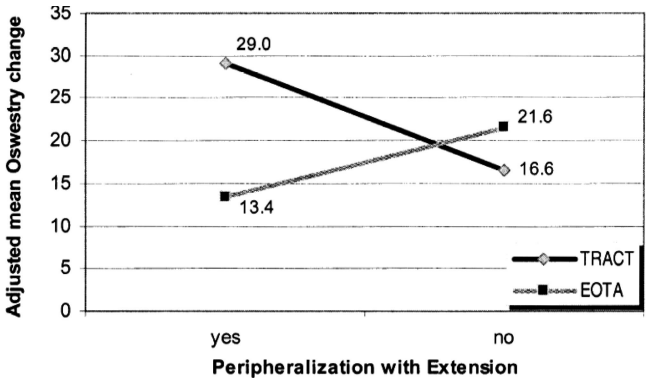

Figure 3. Interaction effect between treatment group and the baseline variable peripheralization with extension. The interaction effect was statistically significant ($P < 0.05$).

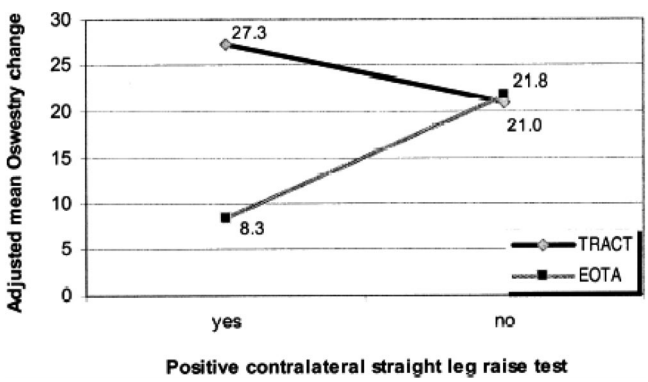

Figure 4. Interaction effect between treatment group and the baseline variable crossed straight leg raise test. The interaction effect was statistically significant ($P < 0.05$).

addition of mechanical traction during the first 2 weeks of treatment. Overall results of the study found greater reductions in disability and fear-avoidance beliefs for patients receiving traction after 2 weeks, with no differences after 6 weeks. These results may suggest that the addition of a traction intervention does not provide any lasting benefit to this subgroup of patients. Alternatively, because traction was provided only during the first 2 weeks, the results may suggest the traction intervention should have been extended beyond 2 weeks. Further research is needed to clarify this issue.

We were able to identify additional examination findings that may help refine the criteria defining a subgroup of patients likely to benefit from an intervention that includes traction along with an extension-oriented approach. The presence of peripheralization of symptoms with extension movement at baseline seems to be an important criterion for defining a subgroup likely to respond to traction. Centralization of symptoms on examination has been associated with a good prognosis,[41,42] and when exercise is prescribed to match the direction of centralization outcomes are generally good.[43] Our results were consistent with these findings. Centralization with extension was associated with greater improvement in disability regardless of the treatment received, likely because both groups performed extension exercises. Peripheralization, however, has been associated with more severe intervertebral disc pathology and a worse prognosis.[44,45] Peripheralization has recently been found to be associated with an increased likelihood of having surgery in a cohort of patients with LBP and sciatica.[46] Delitto *et al*[19] proposed that traction may have a role in patients who demonstrate peripheralization instead of centralization with movement because these patients would not be able to be treated with exercise in the direction of centralization. The results of this study support this contention. Subjects receiving traction whose symptoms peripheralized with extension experienced a 29 point reduction in OSW score on average, compared with 13 points for those receiving the EOTA approach (Figure 3). Ten of the 11 subjects in the traction group whose symptoms peripheralized had a successful outcome based on at least 50% reduction in OSW over 6 weeks. This could represent an important finding, as patients whose symptoms peripheralize are generally believed to have a poor prognosis, with few viable nonoperative treatment options.

The other baseline finding associated with greater improvement with traction was a positive crossed SLR test. The crossed SLR test has been shown to be highly specific for diagnosing lumbar disc herniation,[47,48] and has been associated with more severe disc pathology.[49] This result may corroborate the finding in subjects with peripheralization, and indicate that traction may be most beneficial for patients with more severe disc pathology.

The effectiveness of traction is likely affected by parameters of frequency, duration, and mode (*i.e.*, static or intermittent) of treatment, and the magnitude of the traction force applied.[21] There is substantial diversity in these parameters in the published literature and among clinicians who use traction.[10] This study employed a standardized protocol of static traction performed with the patient prone and a high magnitude of force (40%–60% body weight) and high frequency (up to 4 times per week) for a relatively short duration (2 weeks). The protocol was based on expert opinion,[27] as little evidence exists to support any particular protocol. The mechanism of action of mechanical traction is not well-understood; however, the benefit to patients with signs of nerve root compression is presumed to result from vertebral separation.[21] Experts have proposed that achieving separation requires a traction force of up to 40% to 50% body weight,[50,51] and may be best achieved with a static force.[52,53] Proponents further recommend using traction frequently at the beginning of treatment, with the goal of progressing the patient to an exercise approach as quickly as possible.[27] Our results suggest that extending the duration of traction treatment beyond 2 weeks may be beneficial. Future research should examine additional parameters to optimize the effectiveness of traction.

Conclusions from this article are limited by a short-term follow-up and a relatively small sample. There was a lack of blinding at the follow-up examination for 20% of subjects, but all outcome measures reported were patient self-reports completed without input from the examiner, which should limit the potential for bias. Considering these limitations, the results do suggest that a subgroup of patients with LBP may exist for whom traction, along with an extension-oriented approach is the preferred intervention. Based on our results, criteria for membership in this subgroup would be the presence of sciatica, signs of nerve root compression, and either peripheralization with extension movements or a positive crossed SLR test. These criteria are generally consistent with the opinions of clinicians.[10,19] Although this subgroup likely represents a small proportion of all patients with LBP, it is also a subgroup that seems to have few other noninvasive treatment options. Further research is needed to validate this subgroup and examine long-term efficacy of a traction intervention.

■ Key Points

- Systematic reviews and clinical practice guidelines do not recommend the use of mechanical traction for patients with low back pain based largely on research conducted using heterogeneous subjects with nonspecific low back pain.
- Clinical experts advocate the use of mechanical traction for more specific subgroups of patients with low back pain, particularly those with sciatica and signs of nerve root compression.

• When compared with an evidence-based intervention for patients with low back and leg pain, this study found superior short-term results when traction was included in the treatment, with no differences present after 6 weeks of treatment.
• Although there were no overall differences between groups after 6 weeks, 2 baseline variables were associated with better outcomes for subjects receiving traction; peripheralization with extension movements and a positive crossed straight leg raise test.
• A subgroup of patients with low back pain may exist for whom mechanical traction is an effective treatment.

References

1. Airaksinen O, Brox JI, Cedraschi C, et al. European guidelines for the management of chronic nonspecific low back pain. *Eur Spine J* 2006;15(suppl): S192–S300.
2. Koes BW, van Tulder MW, Ostelo R, et al. Clinical guidelines for the management of low back pain in primary care: an international comparison. *Spine* 2001;26:2504–13.
3. Staal JB, Hlobil H, van Tulder MW, et al. Occupational health guidelines for the management of low back pain: an international comparison. *J Occup Environ Med* 2003;60:618–26.
4. Van Tulder MW, Becker A, Bekkering T, et al. European guidelines for the management of acute nonspecific low back pain in primary care. *Eur Spine J* 2006;15(suppl):S169–S191.
5. Beurskens AJ, de Vet HC, Koke AJ, et al. Efficacy of traction for non-specific low back pain: a randomised clinical trial. *Lancet* 1995;346:1596–600.
6. Beurskens AJ, De Vet HC, Koke AJ, et al. Efficacy of traction for nonspecific low back pain. 12-week and 6-month results of a randomized clinical trial. *Spine* 1997;22:2756–62.
7. Borman P, Keskin D, Bodur H. The efficacy of lumbar traction in the management of patients with low back pain. *Rheumatol Int* 2003;23 82–6.
8. van der Heijden GJ, Beurskens AJ, Dirx MJ, et al. Efficacy of lumbar traction: a randomised clinical trial. *Physiotherapy* 1995;81:29–35.
9. Werners R, Pynsent PB, Bulstrode CJK. Randomized trial comparing interferential therapy with motorized lumbar traction and massage in the management of low back pain in a primary care setting. *Spine* 1999;24 1579–84.
10. Harte AA, Gracey JH, Baxter GD. Current use of lumbar traction in the management of low back pain: results of a survey of physiotherapists in the United Kingdom. *Arch Phys Med Rehabil* 2005;86:1164–9.
11. Brennan GP, Fritz JM, Hunter SJ, et al. Identifying sub-groups of patients with "non-specific" low back pain: results of a randomized clinical trial. *Spine* 2006;31:623–31.
12. Childs JD, Fritz JM, Flynn TW, et al. Validation of a clinical prediction rule to identify patients with low back pain likely to benefit from spinal manipulation. *Ann Intern Med* 2004;141:920–8.
13. Fritz JM, Delitto A, Erhard RE. Comparison of a classification-based approach to physical therapy and therapy based on clinical practice guidelines for patients with acute low back pain: a randomized clinical trial. *Spine* 2003;28:1363–72.
14. Cyriax JH. Diagnosis of soft tissue lesions. In: Cyriax JH, ed. *Textbook of Orthopaedic Medicine*. 6th ed. Baltimore: Williams & Wilkins; 1976:389.
15. Maitland GD. *Vertebral Manipulation*. 5th ed. Oxford, England: Butterworth Heinemann; 1986.
16. Li LC, Bombardier C. Physical therapy management of low back pain: an exploratory survey of therapist approaches. *Phys Ther* 2001;81:1018–28.
17. Poitras S, Blais R, Swaine B, et al. Management of work-related low back pain: a population-based survey of physical therapists. *Phys Ther* 2005;85: 1168–81.
18. Webster BS, Courtney TK, Huang YH, et al. Survey of acute low back pain management by specialty group and practice experience. *J Occup Environ Med* 2006;48:723–32.
19. Delitto A, Erhard RE, Bowling RW. A treatment-based classification approach to low back syndrome: identifying and staging patients for conservative management. *Phys Ther* 1995;75:470–89.
20. Fritz JM. A classification approach to the treatment of 3 patients with low back syndrome. *Phys Ther* 1998;78:766–77.
21. Krause M, Refshauge KM, Dessen M, et al. Lumbar spine traction: evaluation of effects and recommended application for treatment. *Man Ther* 2000; 5:72–81.
22. Meszaros TF, Olson R, Kulig K, et al. Effect of 10%, 30%, and 60% body weight traction on the straight leg raise test of symptomatic patients with low back pain. *J Orthop Sports Phys Ther* 2000;30:595–601.
23. Clarke J, van Tulder M, Blomberg S, et al. Traction for low back pain with or without sciatica: an updated systematic review within the framework of the Cochrane collaboration. *Spine* 2006;31:1591–9.
24. Harte AA, Baxter GD, Gracey JH. The efficacy of traction for back pain: a systematic review of randomized controlled trials. *Arch Phys Med Rehabil* 2003;84:1542–53.
25. Macario A, Pergolizzi JV. Systematic literature review of spinal decompression via motorized traction for chronic discogenic low back pain. *Pain Pract* 2006;6:171–8.
26. Powers CM, Kulig K, Harrison J, et al. Segmental mobility of the lumbar spine during a posterior to anterior mobilization: assessment using dynamic MRI. *Clin Biomech* 2003;18:80–3.
27. Saunders HD. *Evaluation, Treatment and Prevention of Musculoskeletal Disorders*. Vol. 1. 4th ed. Chaska, MN: The Saunders Group; 2004.
28. Werneke M, Hart DL, Cook D. A descriptive study of the centralization phenomenon. A prospective analysis. *Spine* 1999;24:676–83.
29. Childs JD, Piva SR, Fritz JM. Responsiveness of the numeric pain rating scale in patients with low back pain. *Spine* 2005;30:1331–5.
30. Fritz JM, Irrgang JJ. A comparison of a modified Oswestry disability questionnaire and the Quebec back pain disability scale. *Phys Ther* 2001;81: 776–88.
31. Waddell G, Newton M, Henderson I, et al. A Fear-Avoidance Beliefs Questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability. *Pain* 1993;52:157–68.
32. Fritz JM, Delitto A, Vignovic M, et al. Inter-rater reliability of judgments of the centralization phenomenon and status change during movement testing in patients with low back pain. *Arch Phys Med Rehabil* 2000;81:57–61.
33. Tenhula JA, Rose SJ, Delitto A. Association between direction of lateral lumbar shift, movement tests, and side of symptoms in patients with low back pain syndrome. 1990;70:480–6.
34. Fritz JM, Piva SR. Physical impairment index: reliability, validity, and responsiveness in patients with acute low back pain. *Spine* 2003;28:1189–94.
35. Fritz JM, Piva SR, Childs JD. Accuracy of the clinical examination to predict radiographic instability of the lumbar spine. *Eur Spine J* 2005;14:743–50.
36. Jaeschke R, Singer J, Guyatt GH. Measurement of health status: ascertaining the minimal clinically important difference. *Control Clin Trials* 1989;10: 407–15.
37. Ostelo RW, de Vet HC. Clinically important outcomes in low back pain. *Best Pract Res Clin Rheumatol* 2005;19:593–607.
38. Flynn T, Fritz J, Whitman J, et al. A clinical prediction rule for classifying patients with low back pain who demonstrate short term improvement with spinal manipulation. *Spine* 2002;27:2835–43.
39. Hicks GE, Fritz JM, Delitto A, et al. Preliminary development of a clinical prediction rule for determining which patients with low back pain will respond to a stabilization exercise program. *Arch Phys Med Rehabil* 2005;86: 1753–62.
40. Browder DA, Childs JD, Cleland JA, et al. Effectiveness of an extension oriented treatment approach in a subgroup of patients with low back pain: a randomized clinical trial. *Phys Ther* 2007;87:e-published ahead of print, September 27, 2007.
41. Donelson R, Silva G, Murphy K. Centralization phenomenon: its usefulness in evaluating and treating referred pain. *Spine* 1990;15:211–13.
42. Long AL. The centralization phenomenon: its usefulness as a predictor of outcome in conservative treatment of low back pain (a pilot study). *Spine* 1995;20:2513–21.
43. Long AL, Donelson R. Does it matter which exercise? A randomized trial of exercise for low back pain. *Spine* 2004;29:2593–602.
44. Donelson R, Aprill C, Medcalf R, et al. A prospective study of centralization of lumbar and referred pain. A predictor of symptomatic discs and anular competence. *Spine* 1997;22:1115–22.
45. Donelson R, Grant W, Kamp C, et al. Pain response to sagittal end-range spinal motion. *Spine* 1991;16(suppl):s206–s212.
46. Skytte L, May S, Petersen P. Centralization: its prognostic value in patients with referred symptoms and sciatica. *Spine* 2005;30:E293–E299.
47. Kosteljanetz M, Bang F, Schmidt-Olsen S. The clinical significance of straight-leg raising (Lasegue's sign) in the diagnosis of prolapsed lumbar disc. Interobserver variation and correlation with surgical finding. *Spine* 1988;13: 393–5.
48. Vroomen PCAJ, de Krom MC, Knottnerus JA. Diagnostic value of history

and physical examination in patients suspected of sciatica due to disc herniation: a systematic review. *J Neurosurg* 1999;246:899–906.
49. Jonsson B, Stromqvist B. Clinical appearance of contained and noncontained lumbar disc herniation. *J Spinal Dis* 1996;9:32–8.
50. Judovich B. Lumbar traction therapy. *JAMA* 1955;159:549–50.
51. Mathews JA. The effects of spinal traction. *Physiotherapy* 1972;58:64–66.
52. Mathews JA. Dynamic discography: a study of lumbar traction. *Ann Phys Med* 1968;9:275–9.
53. Skillern FM. The treatment of lumbar disk lesions by sustained traction. *Physiotherapy* 1953;39:335–8.