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Does the evidence for spinal manipulation translate into better outcomes in routine clinical care for patients with occupational low back pain? A case-control study

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Abstract

BACKGROUND CONTEXT: Previous research has identified clinical characteristics of patients who are likely to respond favorably to thrust manipulation. The application of this evidence and its effect on clinical outcomes among patients with occupational low back pain has not been examined.
PURPOSE: Examine patients treated in physical therapy with occupational low back pain who fit a subgroup likely to respond to thrust manipulation.
STUDY DESIGN/SETTING: Retrospective review of clinical database.
PATIENT SAMPLE: Patients with low back pain of less than 16 days duration with no symptoms distal to the knee or signs of nerve root compression receiving workers' compensation and referred to physical therapy were included.
OUTCOME MEASURES: Self-report measures: numeric pain rating and Oswestry disability questionnaire.
FUNCTIONAL MEASURES: Number of visits, duration, and costs of physical therapy.
METHODS: Physical therapy notes for the first two sessions were examined. Patients were categorized as having received thrust manipulation, nonthrust manipulation, or no manipulation. Pain intensity and disability were recorded at initial and final sessions. The number of sessions, length of stay, and costs of physical therapy were recorded. Comparisons were made between patients receiving manipulation versus no manipulation, and between those receiving thrust versus nonthrust manipulation.
RESULTS: Two hundred fifteen patients were included (mean age 35.9 [±10.1] years, 67.9% male). Thrust manipulation was received by 107 (49.8%) patients; 36 (16.7%) received nonthrust manipulation and 72 (33.5%) received no manipulation. Patients receiving manipulation (thrust or nonthrust) experienced greater reductions in pain and disability with treatment. Patients receiving thrust manipulation had fewer sessions, a shorter length of stay, and lower costs in physical therapy than patients receiving nonthrust manipulation.
CONCLUSIONS: The evidence supporting superior clinical outcomes with the use of manipulation for a subgroup of patients was corroborated by this retrospective review of patients with occupational low back pain. The use of thrust manipulation appeared to be more efficient than the use of nonthrust manipulation for these patients.

Keywords: Low back pain; Work-related; Physical therapy; Subgrouping; Manipulation

Introduction

Several randomized controlled trials [1–3] and many clinical practice guidelines [4] recommend the use of thrust manipulation as a treatment for at least some patients with low back pain (LBP). Despite the evidence, utilization of thrust manipulation for patients with LBP appears to be

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low in many settings [5,6]. The translation of findings from randomized trials into routine clinical care is often a surprisingly slow and incomplete process [7]. Common reasons cited for the gap between research evidence and clinical practice are concerns about the effectiveness and cost-effectiveness of applying research findings derived from highly controlled and standardized trials in the more heterogeneous realm of everyday clinical practice [8,9].

A recent randomized trial by Childs et al. [2] reported a substantial benefit from thrust manipulation when used in a subgroup of patients with LBP whose clinical presentation suggested a high likelihood of responding to the treatment. The subgroup was defined as those between the ages of 18 to 60 with non-neurogenic LBP and no history of surgery to the lumbar spine. The subgroup was further defined by the presence of four out of five clinical factors: 1) duration of symptoms <16 days; 2) no symptoms distal to the knee; 3) Fear Avoidance Beliefs Questionnaire Work subscale score <19; 4) hip internal rotation >35°; and 5) lumbar stiffness with manual assessment [10]. Patients with at least four of these five factors at the initial examination experienced significantly greater and more rapid reductions in pain and disability when a specific thrust manipulation technique was applied during the first two physical therapy sessions when compared with patients with at least four variables present who did not receive thrust manipulation during the first two treatments [2].

The applicability of this evidence to clinical practice, particularly among patients with occupational LBP, has not been investigated. The utilization of thrust manipulation in patients with occupational LBP and its relationship to clinical outcomes has not been examined. The outcomes of patients receiving thrust manipulation have not been compared with those receiving other forms of manipulation (ie, nonthrust) or those receiving no manipulation. The purpose of this retrospective case-control study was to examine patients with occupational LBP fitting the subgroup identified as likely to respond favorably to thrust manipulation. Clinical outcomes and physical therapy costs were compared between patients who received or did not receive any manipulation, and between those receiving thrust or nonthrust manipulation, during the first two physical therapy treatment sessions.

Materials and methods

Subjects

A retrospective review of patients with occupational LBP receiving treatment at 10 outpatient physical therapy clinics of Intermountain Health Care (IHC) in the Salt Lake City region between January 1, 2004 and December 31, 2004 was performed using the IHC Rehabilitation Division Rehab Outcomes Management Systems (ROMS). ROMS is an electronic database that stores baseline and follow-up data collected from IHC outpatient physical therapy clinics using an intranet Java web application. Two clinics included in the review were specifically designated for the treatment of work-related injuries; the other eight were general outpatient clinics. All patients receiving at least two visits of outpatient physical therapy are entered into ROMS. Demographic data are input including age, sex, date of injury, and date of surgery (if applicable). The ROMS database is linked with the clinic billing database, which permits the identification of patients with LBP receiving workers' compensation, and computation of physical therapy costs for each patient. The protocol for this study qualified for exempt review from the Institutional Review Board at IHC.

Routine procedures at each physical therapy clinic were to administer and record in the ROMS database a measure of pain and disability taken at the beginning of each treatment session. A numeric pain rating on a 0–10 scale with 0 representing ''no pain'' and 10 ''worst imaginable pain'' was used to assess current pain intensity [11]. A modified version of the Oswestry (OSW) [12] low back disability questionnaire was used to quantify disability. The OSW contains 10 items related to daily activities, and the final score is expressed as a percentage with higher numbers indicating greater disability. The version of the OSW used in this study has been validated in a sample of patients with acute (<3 weeks duration), occupational LBP [12]. A Spanish translation of the OSW was used for individuals who were unable to complete the form in English. During the 1-year period of this review, a total of 578 patients (mean age 38.5±12.2 years, 68.2% male, median symptom duration 11 days) with LBP receiving workers' compensation were included in the ROMS database and considered for inclusion in this study.

Patients included in this study were those with a high likelihood of benefiting from thrust manipulation based on previous evidence. We excluded patients over age 60, with a history of surgery to the lumbar spine, with signs of nerve root compression on examination (ie, positive tension signs, or deficits in strength, sensation, or reflex response), who had a baseline OSW score <20%, or who were currently pregnant, because these patients were excluded from the studies identifying the criteria for predicting success with thrust manipulation [2,10]. Inclusion criteria were duration of symptoms <16 days, and no symptoms distal to the knee. These are two of the original five criteria for predicting success with thrust manipulation. Our previous research has found that the presence of these two factors accurately predicts status on the five criteria rule (positive likelihood ratio=8.9) [13].

Methods

The 578 patients with occupational LBP receiving physical therapy in 2004 were reviewed for the inclusion/exclusion criteria. Symptom duration, age, postoperative status, and baseline OSW were determined from the ROMS database. The charts of all patients not excluded on one of these

factors were reviewed to determine if any other exclusion criteria (symptoms distal to the knee, signs of nerve root compression, or pregnancy) were present. Patients not excluded for any factor who met both inclusion criteria (symptom duration <16 days and no symptoms distal to the knee) were considered likely to respond to manipulation and were included in the analysis.

The physical therapy treatment notes of all included patients were reviewed to determine if a manipulation technique was received during at least one of the first two physical therapy sessions. If the treatment note indicated that a high-velocity thrust procedure was performed, the patient was categorized as having received thrust manipulation. If manipulation was used but the treatment note did not indicate that a high-velocity thrust procedure was used, the patient was categorized as having received nonthrust manipulation. Patients receiving either thrust or nonthrust manipulation during the first two treatment sessions were categorized as having received manipulation; all other patients were categorized as not having received manipulation.

The OSW and pain scores at the initial and final physical therapy session were recorded for each patient. Also recorded were the age, work status (regular, modified, or off work) at the time of the initial session, and the patient's report of a previous episode of LBP (yes/no). The number of physical therapy visits was recorded, and the length of stay in physical therapy was calculated as the number of days between the initial and final visits. The total cost of the physical therapy episode of care was recorded from the billing database as the amount of physical therapy charges billed to the workers' compensation provider.

Statistical analysis

The first set of comparisons was performed between patients receiving manipulation (thrust or nonthrust) versus those not receiving manipulation. Baseline characteristics were compared using *t* tests and chi-square tests of independence for continuous or categorical variables respectively. Change scores for the OSW and pain were computed by subtracting the final visit score from the initial score. Analysis of covariance was used to compare the mean change in the OSW between the groups using the baseline score as the covariate. A similar analysis of covariance was used to compare mean change in pain. The number of visits was compared using a *t* test. Length of stay and costs were compared using Mann-Whitney *U* tests due to skewed distributions. The second set of comparisons was performed in a similar manner between patients who received thrust manipulation and those who received nonthrust manipulation. A significance level of .05 was used for all tests.

Results

From the 578 patients with LBP, 215 (37.2%) fit the inclusion/exclusion criteria and were considered likely to benefit from thrust manipulation. The most common reason for exclusion was duration of symptoms ≥16 days (53.4%). Other reasons for exclusion are outlined in Figure 1. The mean age of included patients was 35.9 (±10.1 years), and 67.9% were male. Further baseline characteristics are provided in Table 1. Sixteen different physical therapists at eight clinical sites provided treatment for included patients.

Of the 215 included patients, 143 (66.5%) received manipulation (thrust or nonthrust) during the first two physical therapy sessions. There were no statistically significant baseline differences between patients who did or did not receive manipulation during the first two sessions (Table 2); however, there were trends towards greater proportions of male patients (p=.07), a greater proportion of patients completing the OSW in Spanish (p=.08), and lower baseline OSW scores (p=.06) among patients receiving manipulation. After adjusting for baseline scores, patients receiving manipulation experienced greater improvements in pain (mean difference 0.87, 95% confidence interval [CI]: 0.21, 1.5, p=.01) and disability measured by the OSW (mean difference 6.4 points, 95% CI: 1.7, 11.1, p=.008). Patients who received manipulation also had a shorter stay in physical therapy (median length of stay 12 days vs. 17 days, p=.02). There were no differences between groups for the number of visits or cost of physical therapy.

Among the 143 patients receiving manipulation, 107 (74.8%) received at least one thrust manipulation, and 36 received only nonthrust manipulation during the first two physical therapy sessions. Patients receiving thrust manipulation were younger (mean difference 4.0 years, 95% CI: 0.30, 7.7, p=.03), and had lower baseline OSW scores (mean difference 7.1 points, 95% CI: 1.4, 12.9, p=.02). No differences were found in the clinical outcomes between the thrust and nonthrust manipulation groups (Table 3); however, patients receiving thrust manipulation had significantly fewer therapy sessions (median number of sessions 4 vs. 5, p=.04), a shorter stay in physical therapy (median length of stay 10 days vs. 15 days, p=.02), and lower costs (median physical therapy cost $586.63 vs. $753.99, p=.03).

A post hoc power analysis was performed to examine the potential for type II errors in the data analysis. Using the standard deviations calculated from the study data and assuming an alpha level of 0.05 with a two-sided alternative hypothesis, both the comparison between patients receiving or not receiving manipulation, and the comparison between patients receiving thrust and nonthrust manipulation had at least 80% power to detect the minimum clinically important differences for the clinical outcome measures used (6 points for the OSW and 2 points for the pain rating). The study therefore appeared to be adequately powered to detect clinically meaningful differences between groups if such differences did exist.

Discussion

The gap between research evidence and clinical practice has been described as a ''Quality Chasm'' [14]. The gap is

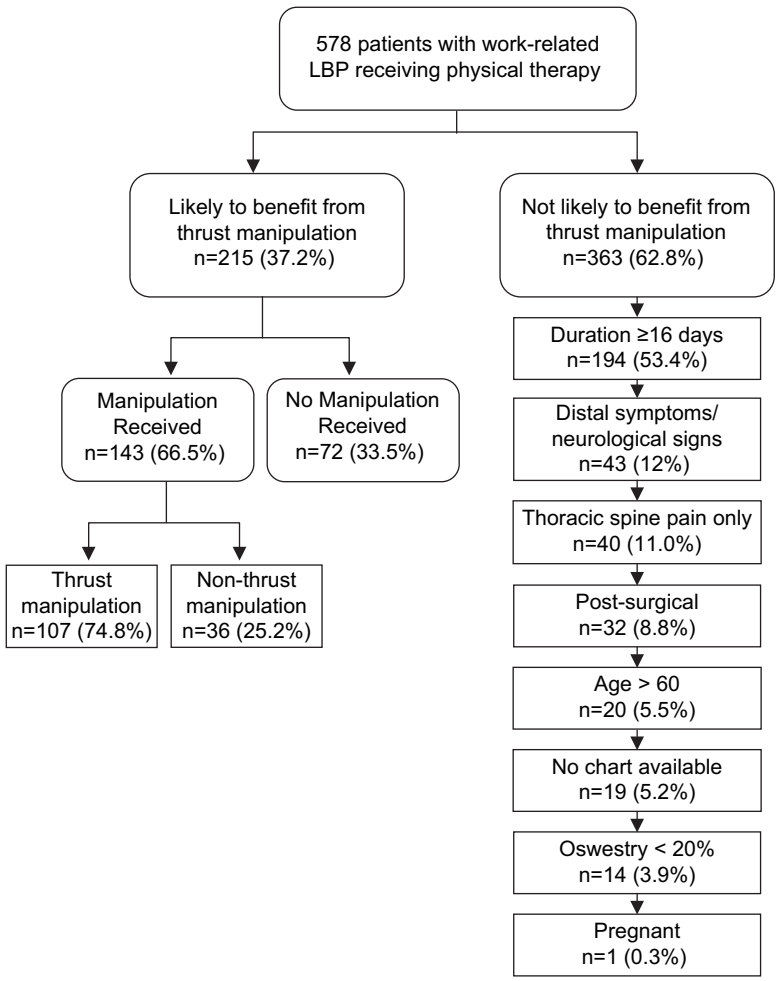

Fig. 1. Patient flow diagram.

not unique to the care of patients with LBP, or to occupational health-care settings [15]. Numerous factors contribute to the gap between evidence and practice, but concern about the applicability of research findings to everyday clinical care is prominent among the reasons [16]. Clinical care involves more heterogeneous patients who may not be as compliant as participants in a trial, and less standardized treatment protocols that may be delivered by clinicians with less training [17]. We undertook this retrospective review of patients with occupational LBP to examine the applicability of evidence supporting thrust manipulation for a subgroup of patients with LBP [2] receiving workers' compensation to determine the rate of utilization of thrust manipulation in an occupational medicine setting among patients who appeared likely to benefit from it. We also wanted to examine clinical outcomes related to receiving manipulation (thrust or nonthrust) versus receiving no manipulation to determine if the evidence from randomized controlled trials appeared to carry over into routine clinical care of patients with occupational LBP. Finally, we compared the clinical outcomes of receiving thrust versus nonthrust manipulation to examine if the evidence for thrust manipulation carried over to other manipulation procedures.

Like many evidence-based interventions, it appears that thrust manipulation may be underutilized by physical therapists [5,6,18,19]. Although data are sparse, there is some prior evidence suggesting a low rate of utilization of thrust manipulation for patients with occupational LBP as well [20–22]. Interpretation of the rates of utilization reported in previous studies is difficult because no attempts were made to determine if a patient's clinical presentation suggested a need for thrust manipulation. In this review, we included only patients whose clinical characteristics placed them in a subgroup with an increased likelihood of responding to thrust manipulation based on previous research. Among these patients, the rate of utilization of some form of manipulation was 66.5%, and utilization of thrust manipulation was 49.8%. Therapists in this review appeared somewhat more likely to use some type of manipulation for male patients and for those with lower levels of baseline disability. The choice to use thrust versus nonthrust manipulation appeared to be influenced by the baseline level of disability and the patient's age, with younger, less disabled patients more likely to receive thrust manipulation. Our previous research has found no relationship between response to thrust manipulation and factors such as

Table 1
Baseline characteristics of the patients included in the analysis

	Patients included in the analysis (n=215)
Age (years)	35.9 (10.1)
Prior LBP history (% yes)	38.5%
Sex (% male)	67.9%
Work status	
Regular	19.0%
Modified	40.5%
Off work	40.5%
Duration of symptoms (days)	5.3 (4.7) median=4 days
Baseline Oswestry	45.6 (15.6)
Baseline pain rating	6.6 (2.1)

LBP=low back pain.
Values represent means and standard deviation unless otherwise indicated.

age, sex, or baseline disability [10,23]. Educating therapists regarding the relative insignificance of these factors may help to alleviate apparent misperceptions and improve utilization of thrust manipulation for appropriate patients.

Recent research and clinical perceptions indicate that the characteristics and outcomes of patients with occupational LBP may differ from those with LBP in the general population [24], raising questions about the applicability of research generated in cohorts of patients with nonoccupational LBP. The research evidence [2] showing greater and more rapid reductions in pain and disability when thrust manipulation is used in the first two physical therapy sessions was generally supported by the results of this retrospective review among patients with occupational LBP. Childs et al. [2] reported 82.9% improvement in OSW scores over 4 weeks and five physical therapy sessions among patients fitting the subgroup of likely responders who received thrust manipulation during the first two physical therapy sessions. In this study, patients receiving thrust manipulation during the first two therapy sessions experienced a 66.6% reduction in OSW scores over approximately 2½ weeks and a median of four sessions. The magnitude of improvement in both pain and disability were better, and the duration of care shorter among patients receiving manipulation as compared with those who did not receive manipulation (Table 2). The design of this study was retrospective, and therefore we cannot exclude the influence of other factors in creating the observed differences between groups. The design of the study and the lack of a true control group preclude conclusions about the efficacy of manipulation among patients with occupational LBP;

Table 2
Comparison of patients designated as likely responders to manipulation who either did or did not receive manipulation (either thrust or nonthrust) during the first two physical therapy sessions

	Received manipulation (n=143)	Did not receive manipulation (n=72)	*p* Value
Age	36.2 (9.9)	35.4 (10.6)	.62
Prior LBP history (% yes)	35.7%	40.3%	.51
Sex (% male)	72.0%	59.7%	.07
Work Status			
Regular	16.8%	15.3%	
Modified	45.5%	37.5%	.58
Off work	37.8%	47.2%	
ODI completed in Spanish (% yes)	21.0%	11.1%	.08
Duration of symptoms (days)	5.1 (4.6) med=4	5.8 (4.9) med=5	.27†
Baseline ODI	44.2 (15.4)	48.4 (15.8)	.06
Baseline pain	6.4 (2.2)	6.9 (2.0)	.17
Change in ODI	28.9 (16.7)	24.1 (18.6)	.01*
Change in pain	4.4 (2.6)	3.8 (2.5)	.008*
Number of therapy sessions	5.7 (3.9) med=4	6.2 (4.0) med=5	.35†
Length of stay (days)	15.5 (12.9) med=12	20.2 (15.6) med=17	.02†
Physical therapy cost	$774.72 ($471.68) med=$606.49	$781.12 ($474.89) med=$648.80	.94†

ANCOVA=analysis of covariance; LBP=low back pain; ODI=Oswestry Disability Index; med=median.
* ANCOVA was used to obtain significance controlling for baseline scores.
† Mann-Whitney test was used to obtain significance.

Table 3
Comparison of patients designated as likely responders to thrust manipulation who received thrust manipulation with those who received nonthrust manipulation during the first two physical therapy sessions

	Received thrust manipulation (n=107)	Received nonthrust manipulation (n=36)	*p* Value
Age (years)	35.2 (10.0)	39.2 (9.0)	.03
Prior LBP history (% yes)	40.7%	27.8%	.15
Sex (% male)	71.0%	75.0%	.65
Work status			
Regular	36.4%	38.8%	
Modified	42.1%	55.6%	.08
Off work	21.5%	5.6%	
ODI completed in Spanish (% yes)	20.6%	22.2%	.83
Duration of symptoms (days)	5.0 (4.6) med=4	5.4 (5.0) med=5	.76†
Baseline ODI	42.4 (15.8)	49.5 (12.8)	.02
Baseline pain	6.3 (2.3)	6.9 (1.9)	.11
Change in ODI	28.2 (15.6)	30.9 (19.7)	.76*
Change in pain	4.3 (2.6)	4.6 (2.8)	.74*
Number of therapy sessions	5.4 (3.8) med=4	6.8 (4.4) med=5	.04†
Length of stay (days)	14.2 (11.5) med=10	19.6 (15.7) med=15	.02†
Physical therapy cost	$727.80 ($445.70) med=$586.63	$914.18 ($523.74) med=$753.99	.03†

ANCOVA=analysis of covariance; LBP=low back pain; ODI=Oswestry Disability Index; med=median.
* ANCOVA was used to obtain significance controlling for baseline scores.
† Mann-Whitney test was used to obtain significance.

however, the results suggest that further investigation among this group of patients is warranted.

The study by Childs et al. [2] provided evidence for the efficacy of one thrust manipulation technique applied in a standardized manner by therapists who had undergone training in the technique. In clinical practice, the selection of a manipulation technique varies widely among clinicians [25]. Some techniques involve high-velocity, low-amplitude thrust procedures similar to those used in the study by Childs. Other clinicians tend to select nonthrust procedures. Some studies suggest that thrust manipulation may provide superior results when compared with nonthrust manipulation, but the studies are few and of poor methodological quality [26]. We found comparable clinical outcomes between patients receiving thrust or nonthrust manipulation; however, the number of therapy sessions and length of stay were greater in the group receiving nonthrust techniques (Table 3). The cost of physical therapy treatment was also greater in the group receiving nonthrust techniques by an average of $186 per patient. We did not consider indirect costs such as lost work productivity, which may have increased the cost difference between thrust and nonthrust procedures even further. Our results therefore suggest that while the effectiveness of thrust and nonthrust manipulation procedures may be similar, an analysis of cost-effectiveness may favor thrust manipulation. Further research using prospective designs is needed to examine this hypothesis.

The retrospective nature of this research precludes any causal conclusions, and several factors that may have influenced outcomes could not be recorded, including the patient's employer, psychological status, coping skills, and co-interventions. Within these limitations, the results of this study suggest that using manipulation for patients fitting this subgroup may result in more pronounced and rapid reductions in pain and disability. The subgroup includes those patients less than age 60 with a symptom duration of <16 days, with no symptoms distal to the knee or signs of nerve root compression. Furthermore, the use of thrust manipulation instead of nonthrust procedures improved the efficiency of care and reduced costs.

It is almost certain that a variety of different techniques were used within the groups of patients receiving thrust or nonthrust procedures; however, we were unable to ascertain from the chart the specific technique that was used for most patients. We therefore cannot compare outcomes for patients receiving different types of thrust manipulation, or determine if there was any benefit to receiving the specific thrust manipulation technique used in the study by Childs et al., or if all thrust techniques resulted in similar outcomes. Our results do suggest that manipulation may be a better choice then no manipulation, and that thrust manipulation may also be a more efficient choice than nonthrust manipulation for patients in the subgroup examined in this study.

This review examined only patients referred to physical therapy. Slightly more than a third of these patients (37.2%) fit two criteria identifying them as likely to benefit from manipulation (symptom duration <16 days and no symptoms distal to the knee), and did not have any exclusion criteria (eg, signs of nerve root compression, prior surgery, age >60 years). Over half of the patients not included in the review were disqualified on the basis of a symptom duration that was ≥ 16 days, indicating that the proportion of patients likely to benefit from manipulation would have been higher if all patients with occupational LBP visiting a physician were considered. Some previous research has suggested that earlier referral to physical therapy is associated with better outcomes [20,27], whereas other studies have associated the use of physical therapy with worse outcomes among patients with acute, occupational LBP [28]. The results of this study cannot address the question of whether or not patients fitting the subgroup of likely responders to manipulation will experience better outcomes if they are referred to physical therapy. The results of the study do support the evidence recommending that when patients with a short duration of symptoms and no symptoms distal to the knee, who do not have signs of nerve root compression, or any other exclusion criteria are referred to physical therapy, thrust manipulation may improve outcomes and efficiency of care.

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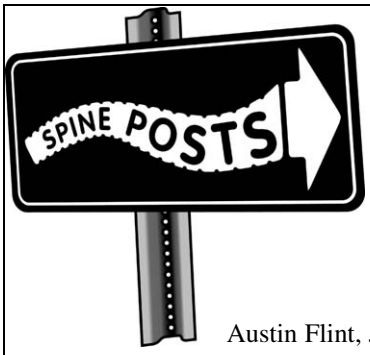

135 Years Ago in Spine

Austin Flint, Jr., son of a distinguished Massachusetts physician, was an eminent physiologist. In 1871, he published a frequently referenced paper on the physiologic effects of prolonged exercise [1]. His subject attempted to walk 400 miles in 5 days.

Reference

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