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## Low Back Pain: A Case Study

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**Low Back Pain: A Case Study**

by

Samir Maleki  
Bachelor of Science in Psychology  
Doctorate in Physical Therapy

A Scholarly Project Submitted to the Graduate Faculty of the

Department of Physical Therapy  
School of Medicine and Health Sciences

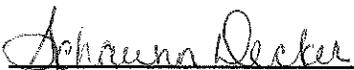
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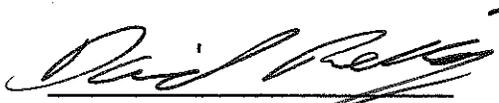
in partial fulfillment of the requirements for the degree of

Doctor of Physical Therapy

Grand Forks, North Dakota  
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This Scholarly Project, submitted by Samir Maleki in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

  
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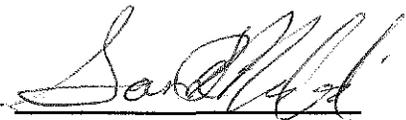
PERMISSION

**Title**                      **Low Back Pain: A Case Study**

**Department**              Physical Therapy

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## ABSTRACT

**Background and Purpose:** Low back pain (LBP) is a common complaint in the U.S., and has many possible causes. Multiple physical therapy interventions, including electrotherapy, traction, and lumbar stabilization exercises such as bridging and planking variations, have been shown to be very effective in reducing LBP. The purpose of this case study is to examine the effects of lumbar stabilization exercise and electrotherapy on LBP.

**Case Description:** The patient was a 43 year-old male, who had been experiencing LBP for the past year. He reported falling off of a truck and landing with his hand tucked into the small of his back. The patient was very limited in activities of daily living, and was reliant on pain medication to function day-to-day. Initial physical therapy examination showed significant limitations in trunk and hip strength and range of motion (ROM). During the first few visits, the patient was unable to perform strengthening or ROM exercises effectively due to extreme levels of pain. Following application of H-wave, an electrotherapeutic modality, the patient was able to actively participate in therapy sessions, which included lumbar stabilization exercises. By the end of the patient's therapy sessions, he demonstrated normal strength in the majority of hip/trunk muscles, as well as full ROM in all formerly tested motions.

**Discussion:** It is likely that the patient's recovery was not due to H-wave application alone, but was multifactorial in nature. This case study has demonstrated that regardless of electrotherapy's impact on actual patient recovery, it is an effective means of reducing pain to help lead to better participation in therapeutic exercise.

## CHAPTER 1

### BACKGROUND AND PURPOSE

Low back pain (LBP) is a very common complaint in the country, as it is the second most common reason people see a physician. According to Mayo Clinic, LBP may present itself in many different ways, such as muscle aching, radiating pain from the back to the legs, and decreased range of motion (ROM).<sup>1</sup> LBP has a variety of causes, such as improper posture, improper biomechanics, falls, and overuse—such as lifting too much weight. Low back pain can happen to anybody, but those that are obese and/or sedentary tend to be at a higher risk. Possible treatments for LBP include medications, steroid injections, education, physical therapy, or surgery. Surgery is typically used as a last resort, since it can be very expensive, and may lead to greater complications.

Physical therapy is an often-used conservative treatment option to treat various low back diagnoses. Various interventions include traction, electrotherapy, and therapeutic exercise, which may include lumbar stabilization exercises. It is very important to be aware of the research behind these various interventions, as well as whether they are cost-effective relative to surgical intervention.

Yoon, Lee and Kim set out to examine the effects of Swiss ball lumbar stabilization exercises on pain levels of their subjects' lower backs. The study took place over a course of 16 weeks, and they had a total of 36 patients, all of which had a diagnosis of chronic low back pain. They were split into three groups: conservative treatment, floor exercise, and Swiss ball exercise groups. Pain was measured regularly

using the visual analog scale (VAS). Three times per week, the conservative group received different modalities such as electrical stimulation or heat. The floor group performed lumbar stabilization exercises on the floor, and the Swiss ball group performed lumbar stabilization exercises on a Swiss ball. Results came to show that stabilization exercises on a Swiss ball led to significantly lower pain on the VAS.<sup>2</sup>

Schellenberg et al performed a study to determine the mean prone and supine bridging times in patients with and without low back pain, as well as determine the muscles that activated the most during these maneuvers. They were interested in determining whether these mean bridging times were a valuable diagnostic and progression tool. Results came to show that the primary muscles involved in supine bridging were the rectus abdominis and the external oblique. The primary muscles involved in prone bridging were the erector spinae and hamstrings. Mean bridging times were significantly different between the symptomatic and asymptomatic groups.<sup>3</sup> It can be concluded from this research article that bridging times are a valuable diagnostic tool. They are also potential stabilization exercises that can be incorporated into therapeutic exercise regimens for low back patients.

There are many electrotherapeutic modalities available for pain relief. The one of particular interest in this study is the H-wave Instrument, which is manufactured by Electronic Waveform Labs (EWL). The company explains that TENS utilizes a squared-off waveform to exert its effects, and IFC uses a sinusoidal waveform. The difference between these modalities and H-wave, is that H-wave emulates Hoffman's Reflex, also known as the finger flexor reflex. EWL claims that emulating Hoffman's Reflex allows the H-wave device to penetrate deeper into tissues.

Representatives from EWL explained that there are two functional uses for H-wave. Using low-frequency stimulation is beneficial for causing muscle contractions, which in turn leads to fluid shifts, and can reduce edema/swelling. In contrast, high-frequency stimulation is beneficial for pain control.

A meta-analysis was performed by Blum et al to determine the safety and efficacy of H-wave use on patients with chronic pain conditions. They found that the use of H-wave significantly reduced pain levels, reduced the usage of pain medications, and led to increased functionality in patients with various chronic pain conditions. There were no indications that H-wave could lead to unwanted side effects. It was also suggested that the use of H-wave can lead to a faster return to work and other activities.<sup>4</sup>

Another study performed by Blum et al set out to determine whether repeated H-wave stimulation could have a positive effect on shoulder range of motion, following rotator cuff reconstruction. Patients received 1 hour of H-wave stimulation, 2 times per day for 90 days. Measures taken at 45 and 90 showed a significant improvement in shoulder ROM when compared to stimulation with a placebo device.<sup>5</sup> These findings suggest that the H-wave would have use in improving the range of motion in a variety of conditions not related to the shoulder.

The purpose of this case study is to examine the effectiveness of lumbar stabilization exercise and electrotherapy, specifically H-wave stimulation, in improving functional outcomes in a low back pain patient.

## CHAPTER 2

### CASE DESCRIPTION

#### **History/Mechanism of Injury, and Subjective Findings:**

A 43 year-old African American male, came to therapy for the first time with a physician's referral to evaluate and treat his complaint of chronic low back pain. The patient was experiencing pain in his low back that began about a year ago, and had been gradually worsening. He had fallen off a semi-truck, which he was working on, landing on his back with his hand tucked into the small of his back, which broke his hand and initiated his back pain. X-rays did not reveal any unusual findings

The patient lived alone in a single bedroom apartment, on the ground level. He was unable to work due to his back pain, and reported feeling so hopeless that he didn't feel like going out to socialize with his friends. The only thing that he was able to do was lie in bed for the majority of the day, and even that did not make it better.

The patient reported having no other significant orthopedic issues, but had a history of hypertension, anxiety, and depression. He did not drink alcohol regularly, and had never smoked. The only surgical procedure was removal of wisdom teeth.

Prior to his injury, he reports that he was independent in all ADLs, and was very active in work and exercise-related activities. He was limited in his tolerance to being in an upright position. He had extreme difficulty with the following tasks: moving sit to/from stand, getting in/out of a car, moving around in his bed, and cleaning his apartment. He also had difficulty with ascending/descending stairs, driving his car for any

longer than 30 minutes, bending over to pick up objects, and walking for any longer than 10-12 minutes. He had been using hydrocodone to reduce his pain-related symptoms.

At best, his pain level was a 4/10 on the Visual Analogue Scale (VAS). He was experiencing a 6/10 at the time of evaluation, and 10/10 when the pain was at its worst. Everything made his pain worse, and could not think of anything that could relieve his symptoms, other than the pain medication that he had recently started. He denied any radiating symptoms.

### **Observation, Examination, and Evaluation**

In the seated position, the patient presented with a posterior sway. In standing, posture showed increased lumbar lordosis, and a slight forward head. There was a moderate loss of cadence, and very limited motion at the hips during ambulation. Facial grimacing occurred every couple steps

With palpation, there was increased tightness in the bilateral lumbar paraspinals, gluteals, and latissimus dorsi. Patient was tender to the touch-with moderate pressure, from approximately T10-S1, bilateral lumbar paraspinals, posterior-superior iliac spines (PSISs), gluteals, and latissimus dorsi.

*Table 1:*

**MMT:** All tested in seated position

|                   | Right | Left |
|-------------------|-------|------|
| Hip Flexion       | 3/5   | 3/5  |
| Hip Abduction     | 4/5   | 4/5  |
| Hip Adduction     | 5/5   | 5/5  |
| Trunk Sidebending | 3/5   | 3/5  |
| Trunk Rotation    | 3/5   | 3/5  |
| Trunk Flexion     | 3/5   |      |
| Trunk Extension   | 4/5   |      |

Table 2:

**ROM:**

|                      |                     |
|----------------------|---------------------|
| Trunk Extension: 20° | Trunk Flexion: 30°  |
| Left Sidebend: 12°   | Right Sidebend: 17° |
| Left Rotation: 15°   | Right Rotation: 20° |

*All of these motions caused the patient a great deal of pain, and took him a long time to perform, with the exception of trunk extension.*

The following special tests were negative: straight leg raise (SLR), slump, all provocative tests of the sacroiliac (SI) joint, prone instability, and Faber's. A positive special test was manual lumbar distraction, during which the patient stated that it made it feel like a pressure was being let off.

The subjective and objective information obtained from this patient, show that he had significant limitations in functional strength, mobility, and endurance. These functional limitations could be addressed conservatively with physical therapy intervention.

**Diagnosis, Prognosis and Plan of Care**

Multiple visits were needed to assign an actual diagnosis to the patient's condition, due to inconsistent patterns of movement and inconsistent complaints. The eventual diagnosis was lumbar arthropathy. This diagnosis fit the Guide to PT Practice's Preferred Practice Pattern 4F: Impaired joint mobility, motor function, muscle performance, range of motion and reflex integrity associated with Spinal Disorders. ICD-9 Code: 716.9.

There was not a specific regimen designed to treat lumbar arthropathy, so generalized physical therapy intervention was considered an appropriate treatment option.

Kamali et al found that physical therapy intervention could successfully improve range of motion in women with nonspecific chronic LBP.<sup>6</sup>

According to the *Guide to PT Practice*: “Over the course of 8-24 weeks, patient/client will demonstrate optimal joint mobility, motor function, muscle performance, and range of motion and the highest level of functioning in home, work, community, and leisure environments.”

The patient’s plan of care included the following: therapeutic exercise, therapeutic activity, gait training, posture training, and modalities as needed.

*Table 3:*  
**Physical Therapy Goals**

| <b>Short-Term Goals (Within 2 weeks)</b>  | <b>Long-Term Goals (Within 6 weeks)</b>  |
|---|--|
| <ol style="list-style-type: none"> <li>1. The patient will be aware of aggravating factors and proper posturing to avoid further exacerbation of symptoms</li> <li>2. The patient will be independent with a home exercise program to improve overall physical condition</li> </ol> | <ol style="list-style-type: none"> <li>1. The patient will have improved trunk ROM, all planes, to aid in activities such as getting in/out of a car, and getting in/out of a bed</li> <li>2. The patient will have 5/5 strength in trunk and bilateral lower extremities to aid in daily activities such as ascending/descending stairs, and bending down to pick up heavy objects</li> <li>3. The patient will be able to ambulate 1 mile on even/uneven surfaces with normal gait mechanics, to improve overall endurance, health, and able to function within the community</li> </ol> |

**Interventions:**

Each therapy session lasted from 45-75 minutes, the patient was made aware of any associated risks, and gave his consent at the beginning of each therapy session.

The first session began with patient warming up on the NuStep for 10 minutes at a low resistance setting. Patient began complaining of back pain immediately after

warming up and it was difficult for him to stand up. Next, core/low back stabilization exercises were attempted, such as bridging, lower trunk rotation, and straight leg raises, which the patient was hardly able to perform due to LBP. The session ended with soft-tissue massage to the bilateral gluteals and lumbar paraspinals, which helped to alleviate some symptoms.

In the second session, the patient started with warming up on the NuStep, which again caused him to have pain. More simple exercises were attempted, to avoid overstress of tissue. Examples of these exercises include mini squats and clams (side-lying hip abduction with the feet touching). A systematic review found limited evidence to support the use of manual therapy in improvement of LBP.<sup>7</sup> Despite this; the session again ended with soft-tissue massage to the bilateral gluteals and lumbar paraspinals, as there had been positive feelings towards manual therapy at the end of the previous session.

The process was repeated for several visits with no signs of real progress. The patient would report high pain levels during every visit, have a great deal of difficulty fully participating in exercises/activities, and seemingly was becoming more dependent on pain medication to get by on a daily basis. It was finally suggested to try the H-wave, an electrotherapy device. Representatives from EWL had suggested that utilizing H-wave was not a solution to a problem, but a means to increase compliance in completing therapeutic exercise. Therefore, it was seen as a perfect fit for this patient.

Each of the remaining therapy sessions started with 20 to 30 minutes of H-wave application, on the highest-frequency setting. High-frequency settings were best-suited to manage pain. The patient immediately reported that it felt better than his pain medications. Even on the first day, the patient was able to successfully complete all

prescribed exercises without any report of symptom aggravation. Over the next few weeks, the patient made significant progress. Following application of H-wave, he was able to complete advanced exercises such as squatting with dumbbells, Theraband hip abduction while bridging, planking, and advanced lumbar stabilization exercises with a Swiss ball (see Appendix for pictures).

Patient was not seen through completion of therapy; however, several findings during reevaluation demonstrated that the patient had significantly improved in many areas. Initially the patient had displayed weakness through manual muscle testing of the hip and trunk musculature. At reevaluation, the patient was able to demonstrate a 5/5 in the majority of hip and trunk movements, and a 4/5 with trunk flexion. The patient's ROM also drastically improved from the initial visit. At reevaluation, he displayed WNL for all trunk and hip motions. During the first several visits, the patient reported very high levels of pain typically. His subjective pain ratings gradually decreased, and were considered to be at a manageable level for him during reevaluation.

## CHAPTER 3

### DISCUSSION

There were many factors that led to the improvement in this patient's strength, range of motion, and subjective pain levels. During the early phase of his rehabilitation, motivation seemed to play a very large role in the success of therapy sessions. The patient was just in too much pain to be able to participate enough to gain benefits. With the initiation of H-wave therapy, patient took a turn for the better. The H-wave therapy led to a reduced perception of pain, and made the patient much more willing to participate in exercises. Following the very first application of H-wave, the patient was able to successfully complete basic core stabilization exercises that he was initially unable to perform. After just a few visits, the patient was able to regularly incorporate advanced lumbar stabilization exercises into the daily routine.

One measure that may have been useful during the initial examination of this patient, was assessing his hip internal and external rotation. A case report performed by Reinhardt was able to attribute limited hip internal rotation to the development and exacerbation of a golfer with low back pain.<sup>8</sup> Having this knowledge could have provided more direction for designing therapeutic exercise regimens, which may have led to even better outcomes.

The patient indicated that he was experiencing some psychological distress due to a recent divorce, and showed signs of depression several times throughout his time at the clinic. Findings from a study by Björnsdóttir et al showed that patients with chronic pain

are at a higher risk for mental health conditions, such as depression.<sup>9</sup> Retrospectively, it may have been helpful to refer this man to a support group, or to a psychotherapist to help address his underlying issues.

The question in need of further investigation is whether or not the application of H-wave or other electrotherapeutic modalities, can lead to improved therapeutic outcomes. The H-wave website provides several claims stating that using the device alone can lead to improved physical functioning. For as many claims that are providing evidence for the H-wave and other electrotherapeutic modalities, there are just as many, if not more, that illustrate very little effectiveness. One study carried out by Bilgin et al found that the use of electrical stimulation did not alter the activity of the multifidus muscle in patients without LBP.<sup>10</sup> Whether it is different for those with LBP is to be determined.

If something as simple as the H-wave is able to improve a patient's perception of pain, and increase their willingness to participate in exercise, then it definitely has a place in a plan of care. Although, the evidence is very mixed, sometimes all it takes is symptom management to increase a patient's participation.

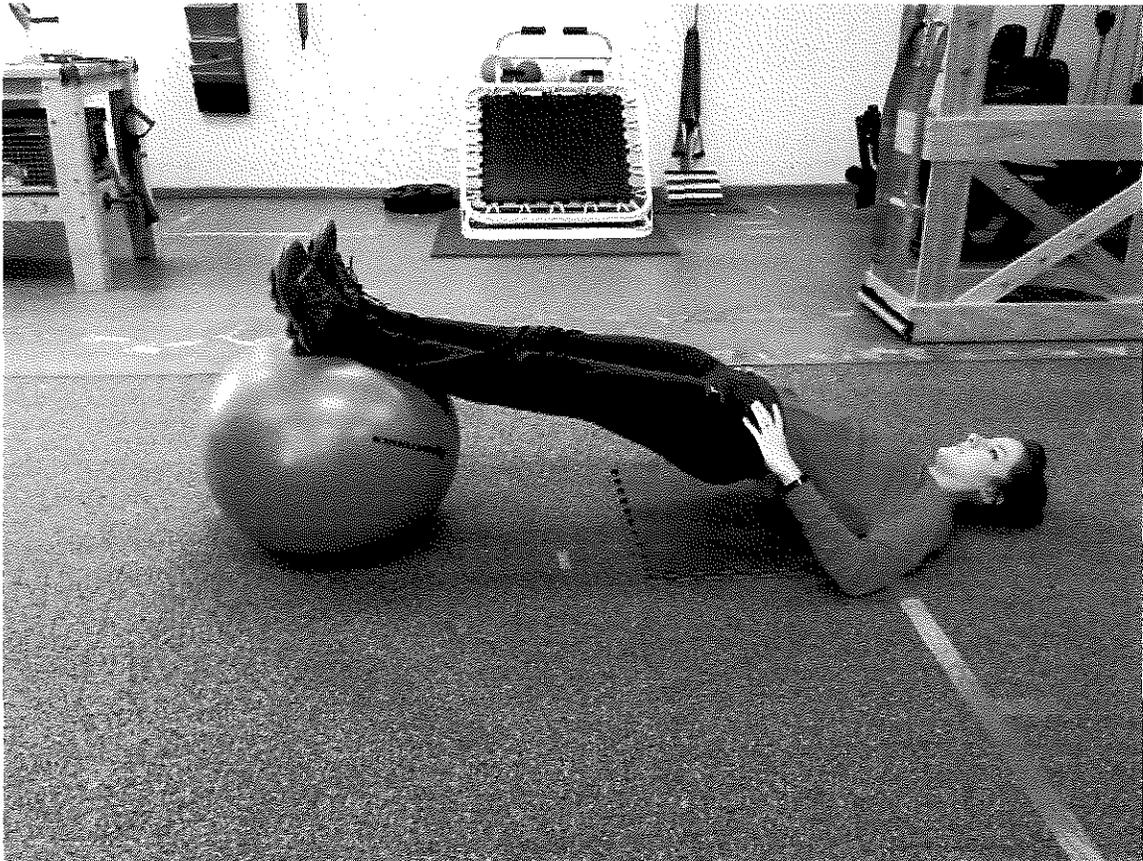
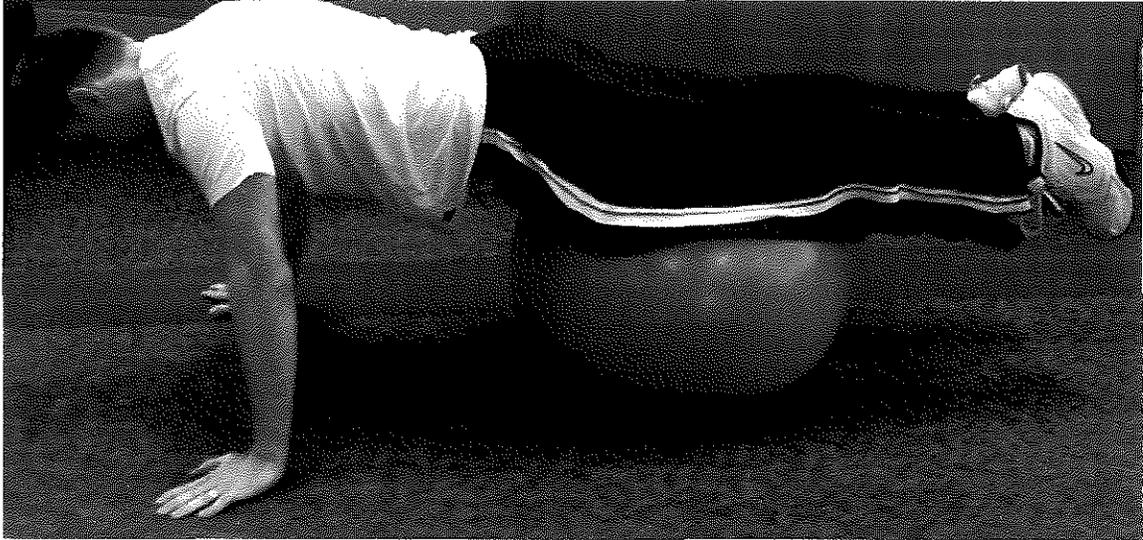
**Reflective Practice:**

This case study was an excellent learning opportunity. There are things that went very well, and things that could be improved upon. The therapeutic outcomes of this study could not have gone any better. The patient became significantly more functional in a relatively short amount of time. In addition, there were also no ethical issues that arose throughout the duration of the patient's physical therapy treatments.

One drawback of this study was not having the information obtained on the

patient at actual discharge. This would have been useful to illustrate the complete picture of this patient's situation, and could further strengthen the argument for H-wave and lumbar stabilization exercises. Another possible drawback, is that my actual experience level during the initial examination was at a beginners level. Had there been a different therapist performing the examination, there may have been different findings in the evaluation.

## APPENDIX



Examples of Advanced Swiss Ball Stability Exercises:

Swiss Ball Plank and Swiss Ball Bridge

Images taken from [www.hep2go.com](http://www.hep2go.com)

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