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Case Report

Changes in gait kinematics and lower back muscle activity post-radiofrequency denervation of the zygapophysial joint: a case study

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Abstract

BACKGROUND CONTEXT: Using diagnostic anesthetic blocks, the lumbar zygapophysial (facet) joint has been shown to be the primary cause of pain in approximately 15% of patients with chronic low back pain. Radiofrequency neurotomy (RFN) of the lumbar medial branch innervating the zygapophysial joint has been shown to provide a significant decrease in pain in patients selected by dual comparative anesthetic blocks, but quantitative improvements in mobility have not been fully elucidated. A theoretical concern with RFN is that the multifidus muscle, a stabilizing paraspinal muscle, is also denervated during this procedure, which may have adverse effects on mobility and spine stability.

PURPOSE: The purpose of this study was to examine gait kinematics and muscle activity of the low back during treadmill walking both before and after RFN.

STUDY DESIGN: Case study.

PATIENT SAMPLE: One 33-year-old female, with 15 years of chronic left low back pain and a diagnosis of L4/L5 lumbar zygapophysial joint pain by dual comparative anesthetic blocks was studied.

OUTCOME MEASURES: Self-reported measures of perceived pain and effort; in addition to physiologic measures of heart rate, gait kinematics and surface electromyography (EMG) activity of the multifidus and erector spinae muscles were collected before and after the procedure.

METHODS: The participant walked for 15 consecutive minutes on a treadmill. The first and last 5-minute intervals were at a self-selected pace, and the middle 5-minute interval was at a 50% increase of the self-selected pace. Gait kinematics and lumbar paraspinal surface EMG activity were recorded during the last minute of each walking interval. Heart rate, perceived effort, and perceived pain were also collected at the end of each walking interval. Data were collected both 7 and 1 days before RFN, and on the following days post-RFN: 0, 8, 14, 28, and 58.

RESULTS: Perceived effort did not change despite an increase in treadmill speed and heart rate. Pain decreased by 60% in the first two weeks and by 92% by 4 weeks post-RFN. There were also gradual positive changes in gait kinematics across all post-sessions and an immediate and sustained decrease in surface EMG activity over the left multifidus and erector spinae muscles following RFN.

CONCLUSIONS: The results of this pilot study are the first to show quantitative positive changes in gait and muscle activity post-RFN, suggesting that the relationship between this procedure and mobility warrant further investigation. © 2015 Elsevier Inc. All rights reserved.

Keywords: Radiofrequency denervation; Lumber zygapophysial pain; Gait; EMG

Introduction

A World Health Organization study in the primary care setting reported an overall prevalence of persistent pain in 20% of primary care patients, with approximately 48% of those patients reporting low back pain [1]. Using diagnostic

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anesthetic blocks, the lumbar zygapophysial joint (aka facet or z-joint) has been shown to be the primary pain generator in 15% of patients with chronic low back pain [2]. Current treatment options for lumbar zygapophysial joint pain include medical management, physical therapy, interventional procedures, and surgery [2]. Conservative therapy with medical management has been shown to be effective at reducing pain [3–8], yet no studies to date have shown the ability of oral or topical medications to completely eliminate lumbar zygapophysial joint pain. There is also little evidence to support the use of one medication over another [9–11]. Procedural interventions for zygapophysial joint pain are the second most common type of procedure performed in pain management centers throughout the United States [2]. Yet, the effect of these procedures on mobility and pain has not been fully elicited.

Radiofrequency neurotomy (RFN) is a procedure where a controlled burn is generated via radiofrequency energy through a small diameter probe. This procedure can apply a thermal burn to the lumbar medial branch nerves, which innervate the lumbar zygapophysial joint, thus hopefully diminishing its afferent pain signals. When used with correct technique on patients selected via dual comparative medial branch blocks, this procedure has been shown to provide a significant decrease in lumbar zygapophysial joint pain [2]. The literature does however have mixed results because of differences in patient selection criteria and technique used [12–16], with reports of sustained relief of back pain in 50% to 80% of subjects without previous back surgery and 35% to 50% of patients with failed back surgery syndrome [17–20].

Rotational movements of the trunk that require stabilization of the spine occur normally during walking [21]. Muscular co-contraction of anterior and posterior trunk muscles, including the multifidus, is felt to be the major stabilizing mechanism of the spine [22–24]. However, during RFN, the multifidus is denervated. Previous research has shown that a loss of reflexive activity of the multifidus muscle may result in instability and injury of the spine [25]. Taken together, this would suggest that while RFN may reduce zygapophysial joint generated pain in those selected via dual comparative medical branch blocks, there may also be significant changes in mobility and stabilization of the spine. Yet, to date, no study has examined changes in mobility and associated muscle activity pre- and post-RFN in patients with block confirmed lumbar zygapophysial joint pain. The purpose of this case study was to examine the effects of RFN on gait and muscle activity in the low back. Self-reported measures and physiological measures including gait kinematics and surface electromyography (EMG) activity over the multifidus muscle were collected during treadmill walking pre- and post-RFN. We hypothesized that low back pain and surface EMG activity over the low back would decrease, but there would be no changes in gait kinematics from pre- to post-RFN.

Methods

This case study included one 33-year-old female ex-collegiate volleyball player with 15 years of chronic left low back pain without radiation, which was worse with extension. She reported difficulties with walking for more than 15 minutes without pain and limitations in her normal activities of daily living. She had a normal neurologic examination with a negative seated slump test. She had no pain with multiple sacroiliac joint provocative tests including hip flexion abduction and external rotation, thigh thrust, sacral distraction, sacral thrust, and gaenslen's tests. She also had no pain with hip internal or external rotation or flexion adduction and internal rotation (FAIR test). Her only positive physical examination findings were pain with lumbar spine extension and tenderness to palpation over the left lower paraspinals at the L4–L5 spinal level (which was confirmed by palpation under fluoroscopic guidance). Her magnetic resonance imaging showed lumbar spondylosis affecting left L4–L5 zygapophysial joint (Fig. 1), with no evidence of spondylolisthesis or spondylolysis. Her symptoms lead to the presumptive diagnosis of lumbar zygapophysial joint pain. She failed multiple conservative therapies including non-steroidal anti-inflammatory medications, extensive physical therapy, and even an intra-articular injection of corticosteroid in the left L4/L5 zygapophysial joint. She underwent dual, comparative, medial branch blocks targeted at the left L3 and L4 medial branches that innervate the left L4/L5 zygapophysial joint. The first block was done with 0.3 cc of 0.5% marcaine and the second block with 0.3 cc of 2% lidocaine. She had 100% short-term pain relief with each block that corresponded to the length of the respective anesthetic. She therefore underwent RFN of the left L4–L5

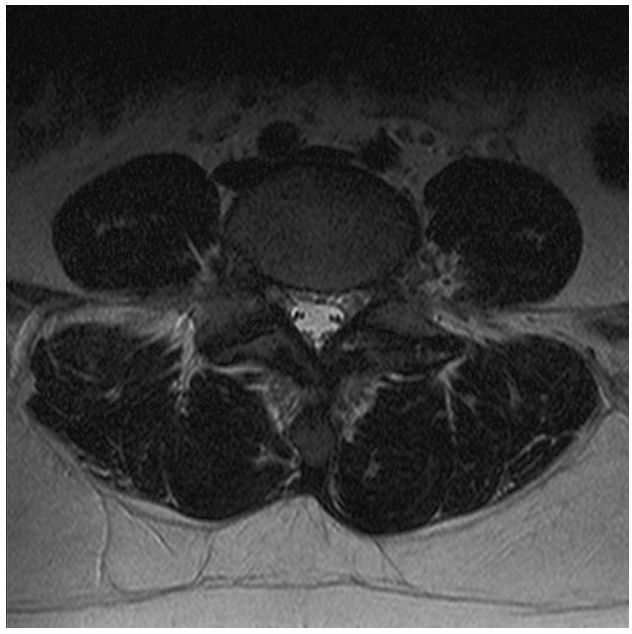

Fig. 1. Magnetic resonance imaging showing lumbar spondylosis affecting left L4–L5 zygapophysial joint.

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