Case Study

Resolution of Plantar Fasciitis Following Adjustment of Spinal & Extremity Subluxations

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Abstract

Objective: To describe the chiropractic and multi-modal approach for a patient with bilateral heel pain, medically diagnosed as plantar fasciitis.

Clinical Features: The patient was a 23-year-old female presenting for care with medically diagnosed plantar fasciitis. Previous medical care consisted of orthotics, daily stretching of the feet and daily ingestion of Ibuprofen. These efforts were unsuccessful.

Intervention and Outcome: The patient was managed with high-velocity, low amplitude (HVLA) type adjustments to spinal and lower extremity subluxations along with adjunctive therapies consisting of ultrasound therapy, rock taping of the foot, and neuromuscular re-education. The patient was cared for in this manner over a four month period consisting of 10 visits. Improvements were observed based on subjective outcome measures (i.e., improved activities of daily living), NRS for heel pain and the use of the Lower Extremity Functionality Scale.

Conclusion: This study adds to the evidence on the salutary effects of chiropractic care vis-a-vis HVLA adjustments to spinal and extra-spinal structures along with adjunctive therapies for patients presenting with heel pain.

Key Words: *Chiropractic, plantar fasciitis, subluxation, adjustment, manipulation*

Introduction

Pathognomonic of plantar fasciitis are the first painful steps from bed in the morning or following after rest that worsens as the day progresses. Plantar fasciitis is the most common disorder involving the plantar fascia, a thick fibrous connective tissue with origins at the medial tubercle of the calcaneus and insertions to the plantar surface of the metatarsophalangeal joints.

The problem is so common that it has been estimated that approximately 2 million people in the United States are affected with this disorder and accounts for more than one million visits to foot specialists and primary care physicians.[1] In terms of its pathophysiology, there is continued controversy. Some have suggested an inflammatory etiology[2] and is consistent with the term plantar fasciitis while others point to the observed degenerative changes in connective tissue structures in the region of the calcaneus and should be termed plantar fasciitis.[3-4] Regardless of its poorly understood etiology; at the heart of the development of plantar fasciitis are anatomic and biomechanical factors. The plantar fascia acts as a static and dynamic stabilizer of the longitudinal arch of the foot and as a dynamic shock absorber. Pes planus or flat feet and lower extremity biomechanics leading to lowered medial longitudinal arch are thought to cause plantar fasciitis.[4] Other risk factors identified are improper footwear, obesity and extensive standing, walking, and running.[5]

Chiropractic, with its appreciation of the bi-directional and synergistic relationship between structure and function, has been shown to be effective in addressing a number of musculoskeletal injuries involving the lower extremities.[6] To further contribute to evidence-informed practice, we describe

the chiropractic care of a woman suffering from plantar fasciitis with a history of failed medical intervention.

Case Report

History

A 23-year-old Caucasian female presented to the clinic with complaints of bilateral foot pain. The patient's history revealed she had been medically diagnosed with plantar fasciitis of the right foot prior to presentation. Over the last month and a half, the patient had been experiencing severe bilateral foot pain centralized to the plantar fascia origin. Previous medical treatment for her plantar fasciitis was from a podiatrist that consisted of two visits scheduled at one month apart. The podiatrist prescribed orthotics, recommended stretching her foot every morning and taking ibuprofen daily. Radiographic examinations were also undertaken and according to the patient, were interpreted as unremarkable.

The patient's symptoms included sharp pain, located at the base of her right foot in the absence of radiating pain. The patient expressed that her left foot was beginning to exhibit the same symptoms. The heel pain was described as worse in the morning and exacerbated when attempting to jog. Ice, rest and mild stretching alleviated her pain complaint but only temporarily.

The patient's numerical rating scale (NRS) for heel pain yielded an 8/10 on the right and 7/10 on the left at its worst and a 5/10 on the right and 4/10 on the left on her "good days." Due to pain, her activities of daily living were affected such as jogging in any capacity, despite having been a jogger for many years. She had to intensely modify the way she exercised since any impact to her feet provoked severe pain. The patient was also forced to wear tennis shoes on a daily basis instead of flats or sandals since these shoes facilitated her to walk. She presented for chiropractic care to find the root cause of her feet problem and to alleviate the pain caused by it.

Examination

The patient's vitals, morphometric and other findings from the examination are presented in Table 1. A standardized Lower Extremity Functional Scale (LEFS)[7] was utilized to assess the patient's baseline status and her response to care. On initial use of the LEFS instrument, the patient scored a 20/80, indicative of lower extremity dysfunction. On postural examination, the patient's posture revealed slight anterior head carriage. She had a severely everted right foot and slightly less evertion on the left. There was also a slight valgus stress of her right knee and an elevated right hip.

Digital palpation yielded tenderness and more prominent right posterior superior iliac spine (PSIS) compared to the contralateral side. Tenderness was noted at the patient's right and left plantar fascia origin. Motion palpation revealed restricted motion at the right sacro-iliac (SI) joint and relatively decreased right and left talus bone movement. Upon leg check analysis, the right leg was ¼ inch shorter from neutral to flexed knees at 90^0. These findings were interpreted as a posterior and medial subluxation of the right SI joint and a bilateral anterior subluxation of the talus bone. Orthopedic examinations yielded negative results with the following tests: Cervical compression, cervical distraction, shoulder depression, prone extension test, Kemp's test, Valsalvas's test, Straight- Leg raise, inversion and eversion stress test and Morton's squeeze test. The following neurological tests were performed with negative results: L4-S1 muscle testing, L3-S1 sensory testing, heel to toe walking, heel walking and toe walking and cranial nerve testing.

Based on the history and physical examination findings, the patient was provided a working diagnosis of right and left foot plantar fasciitis, with subluxation at the right S/I joint and bilateral talus bones.

Intervention & Outcomes

On the first visit, the patient received chiropractic adjustments characterized as high velocity, low amplitude (HVLA) thrust type adjustments commonly referred to as Diversified Technique.[8] Chiropractic adjustment were performed to the right S/I joint and to the right and left talus bone. The adjustment at the right S/I joint was performed with the patient lying on their left side while the doctor contacted the patient's right PSIS. With the doctor's right pisiform contact, a posterior to anterior (P-A) and medial to lateral (M-L) HVLA thrust was applied. The right and left talus bones were adjusted using the doctor's right and left distal segment of the third digit superimposed contacting the anterior portion of the patient's talus bone. A P-A thrust with a scooping motion was delivered.

In addition to chiropractic adjustments, adjunctive therapies consisting of ultrasound therapy, rock tape and neuromuscular re-education were utilized. Ultrasound therapy was utilized to provide pain relief at the plantar fascia's origin, rock tape was used to provide stabilization of the foot, neuromuscular re-education was employed to correct gait imbalances (via the fasciculis gracilis nuclei along the dorsal column pathway) and bilateral foot flaring.

Education was provided on properly easing the patient to return to exercise maneuvers (for example, biking for two weeks, elliptical for two weeks, light jogging for two weeks and then eventually running). The patient was also advised to continue stretching her feet each morning as well as performing 20 toe curls per day (bilaterally) to strengthen the foot flexors. These care efforts resulted in the patient experiencing significant pain relief on the first visit. In the patient's own words, "The pain is less and I can walk with significant less pain."

The patient received care in a similar manner over a period of four months consisting of 10 visits. Interestingly, the patient attended care over three courses of treatment due to exacerbations of pain that was relieved with care. At the review and update, the patient stated that she "has not had any exacerbations, her feet feel strong, more stable and great."

In addition to the LEFS as an outcome measure, the patient's activities of daily living were also utilized to measure the patient's progress with care, which began with the patient having significant pain while walking and forcing her to wear

only tennis shoes to the point where the patient was able to lightly jog and wear any form of shoe by the end of her chiropractic care. The LEFS outcome assessment tool was utilized at the end of her trial of care and she scored 5/80. The patient's NRS for pain scale decreased from 8/10 (right foot) and 7/10 (left foot) to a 1/10 for both feet by the end of her care.

Discussion

The diagnosis of plantar fasciitis is based on the history and physical examination along with consideration of its known risk factors. The patient with plantar fasciitis will present with heel pain, described as sharp and stabbing that is worst in the morning (particularly with the first few steps) and may improve with continued walking. However, by the end of the day, the patient may indicate worsening and more intense pain. On physical examination, the sufferer can be observed as antalgic and walk in an equine manner (i.e., on their toes) to avoid placing pressure on the affected heel. Digital palpation of the affected heel will elicit pain at the medial calcaneal region. Dorsiflexion and plantar flexion will also elicit pain at the plantar fascia and possibly at the insertion of the Achilles tendon.

We note for the reader that a myriad of osseous and soft-tissue disorders can lead to heel pain. These disorders are classified based on the involved anatomy and location of pain. Disorders giving rise to heel pain include lesions of the plantar fascia (i.e., fasciitis, rupture, fibromatosis, xanthoma), tendinitis (i.e., tendinitis, tenosynovitis), osseous pathologies (i.e., fractures, bone bruises, osteomyelitis, tumors), bursal lesions (i.e., retrocalcaneal bursitis, retroachilleal bursitis), tarsal tunnel syndrome, and fat pad abnormalities.[9] A summary of the differential diagnosis for heel pain is provided in Table 2.

The use of imaging modalities can augment the differential diagnosis of plantar fasciitis. Radiographic examination can assess the presence of bony lesions such as heel spurs. Note that the presence of heel spurs does not necessarily lead to a diagnosis of plantar fasciitis. Previous studies have shown that subcalcaneal spurs are also found in patients without plantar fasciitis.[24-25] The use of radiography in chiropractic has a rich history to determine positional dyskinesia of osseous structures. Kell[26] utilized a radiographic analysis to determine the subluxation of the calcaneum in relation to the proximal head of the 5th metatarsal in patients presenting with heel pain. Other imaging modalities such as ultrasound imaging is inexpensive and may be useful in ruling out soft tissue pathology of the heel.

Ultrasound findings that support the diagnosis of plantar fasciitis include proximal plantar fascial thickness greater than 4 mm and areas of hypoechogenicity.[24-25] Magnetic resonance imaging (MRI), although expensive, is a valuable tool for assessing the true source of heel pain. Compared to other imaging modalities, MRIs are superior with respect to soft-tissue contrast resolution and the ability to view multiple planes. MR imaging can help determine the cause of heel pain and help assess the extent and severity of a particular disorder/diagnosis in ambiguous or clinically equivocal cases. Diagnostic findings include increased proximal plantar fascia thickening with increased signal intensity on T2-weighted and short tau inversion recovery images.[9,25]

Chiropractors, with a holistic and vitalistic framework to patient care, not only provide care to the individual in the acute or chronic phase to mitigate the consequences of a disorder (i.e., secondary prevention), but they may also incorporate a number of care strategies by preventing the onset of a specific disorder (i.e., primary prevention) or seek to abate the impact caused by the disorder on the patient's function, longevity, and quality of life (i.e., tertiary prevention). No more is this true than for the patient presenting with heel pain. Towards these efforts, the chiropractor must be aware of the risk factors associated with plantar fasciitis (see Table 3). An appreciation of these risk factors not only guide the clinician to formulate an effective care plan but also inform on the best means of prevention. These risk factors can be assessed/identified based on the history and physical examination.

The risk factors are categorized as intrinsic (i.e., anatomical and biomechanical) and extrinsic factors (i.e., environmental) (see Table 3). A number of review articles on plantar fasciitis have identified these risk factors.[1,10] We provide here only a short discussion on the number of studies that have examined these individual risk factors. Yi et al.[23] performed a retrospective analysis of the medical records of 250 patients with plantar heel pain. The authors found that biomechanically, heel cord tightness was the most common problem with limited ankle dorsiflexion. Pes planus was more common than pes cavus in patients with plantar fasciitis or fat pad atrophy.

Explanatory variables were attributed to repetitive pronatory stress that increased the tensile force on the plantar fascia and caused the plantar arch to lower. This pronation was observed with increasing age and was related to limited ankle dorsiflexion due to decreased elasticity of the tendons and decreased range of motion associated with aging. In addition, aging results in loss of buffering tissue such as water and collagen in the fat pad. Fat pad atrophy and decreased shock absorbency has been found to be diminished in individuals than 40 years.

Labovitz et al.[27] prospectively examined 105 patients of which 79 were diagnosed with plantar fasciitis. Body mass index (BMI) and popliteal angle were calculated and correlated with the presence of plantar fasciitis, equinus, and calcaneal spurs. After controlling for covariates, patients with hamstring tightness were about 8.7 times more likely to experience plantar fasciitis.

Frey et al.[28] examined 1,411 adults, and with calculated BMIs, the subjects were divided into two groups: normal and overweight. The investigators found that being overweight or obese significantly increased the chances of having tendinitis in general. If the subjects were overweight or obese, there was an increased likelihood, although not significant, of plantar fasciitis and osteoarthritis.

To determine the relative contributions of work activity (time spent standing, walking, or sitting), floor surface characteristics, weight, BMI, age, foot biomechanics, and other demographic and medical history factors to the

prevalence of plantar fasciitis, Werner et al.[29] found that forefoot pronation on physical examination, high metatarsal pressure on the gait assessment, increasing time spent standing on hard surfaces, increased time spent walking increased the risk of suffering from plantar fasciitis. Rotation or changing shoes during the workweek was found to reduce the risk of plantar fasciitis.

With their comprehensiveness to address a particular topic or disorder, systematic reviews have become an invaluable tool for clinicians to critically appraise (i.e., a careful and systematic examination of the research to judge its trustworthiness, its value and relevance to clinical practice) the literature to augment their clinical expertise to improve the quality of care provided to patients.

On the subject of plantar fasciitis; in a follow-up systematic review of the literature on the use of manipulative therapy for lower extremity conditions[30], Brantingham and colleagues[6] found the evidence as fair (level B based on the Scottish Intercollegiate Guidelines Network (SIGN) ranking system) for the short-term treatment of plantar fasciitis based on their assessment of 48 clinical trials.

In 2006, Stuber & Kristmanson[31] examined only published randomized clinical trials that included at least one conservative care modality (i.e., chiropractic therapy, electric modalities, patient education, soft tissue therapy/massage, acupuncture, taping, night splints, stretching, ice, heat, strengthening, orthotics) in the treatment of plantar fasciitis (or plantar heel pain syndrome, heel spur syndrome, or painful heel syndrome. These authors found one study involving chiropractic care with favorable results. They cited the work of Dimou et al.[32] that evaluated the effectiveness of adjusting the foot with stretching versus orthotics in subjects with chronic plantar fasciitis.

In a prospective, randomized, blinded, controlled clinical trial, 20 subjects between 18 and 60 years old presenting with chronic plantar fasciitis were randomly allocated to 2 groups of 10. Group 1 received chiropractic adjustments of the foot and ankle and stretching exercises twice a week for 4 weeks and at 1-month follow-up. Group 2 received a pair of orthotics and were required to keep them in their shoes for a total of 8 weeks. Outcome measures included the NRS for pain, the first-step pain form, and the effect of heel pain on 3 types of activities form (leisure, work and sport). Objective measurements included algometer readings.

The measurements for all 20 subjects were taken at baseline, after interventions 5 and 9, and at 1 month after initial care. Significant differences were observed on pain scale, first-step pain, heel pain during leisure and algometer readings. Significant differences were observed with the pain scale worst measurement with Group 1 compared to Group 2. Acknowledging the small sample size and the methodological limitations of this trial, the investigators concluded that both treatments appeared useful when used individually for patients with plantar fasciitis.

Brantingham et al.[33] reviewed the outcome of 29 patient files, treated by the authors with manipulation, physiotherapy, and orthotics. The importance of joint dysfunction of the foot and ankle was emphasized as the critical pathway to care. Three patients received little of no relief of pain (less than 50% reduction in symptoms), 4 patients exhibited moderate improvement in symptoms (50-75% reduction in pain), and the remaining 22 patients demonstrated excellent results (greater than 75% reduction in pain) following an average of 8 treatments. Accordingly, the authors concluded that a high degree of success can be achieved with conservative management of plantar fasciitis.

Kell[26] showcased a radiographic method to assess the presence of posterior calcaneus subluxation in unresponsive plantar fasciitis patients. The author described two cases of plantar fasciitis which previously had received comprehensive podiatric treatment. Bilateral radiographs of the lateral feet were compared. The relative position of the calcaneus in relationship to the proximal head of the 5th metatarsal was compared with the less affected or asymptomatic foot. A comparative post-view of the plantar fascial foot was then taken at the conclusion of treatment.

Polkinghorn[34] described 3 cases of patients with plantar fasciitis and the presence of heel spurs. Similar to Brantingham et al.[33] and Kell[26], Polkinghorn[34] emphasized the correction of posterior calcaneal subluxation. Previous unsuccessful care in these 3 patients included oral anti-inflammatories, steroid injections, orthotics, and continued physical therapy. Two of the patients were considered candidates for surgical removal of the spurs but had declined to pursue this option, electing instead to use chiropractic care. All patients were treated with short-lever mechanical force, manually assisted chiropractic adjusting procedures, with special emphasis to the foot, ankle, and calcaneus. Although the specific nature of the relevant subluxations varied with each patient, a common denominator with this particular patient group was the occurrence of a posterior subluxation of the calcaneus. All adjustments were delivered via the use of an Activator Adjusting Instrument and were comfortably tolerated by each patient. Complete resolution of all symptoms was reported without re-occurrence.

Hammer[35] showcased the use of the Graston Technique (GT), an instrument-assisted soft tissue mobilization method in three patients suffering from supraspinatus tendinosis, Achilles tendinosis, and plantar fasciosis. Daniels[36] described the care of a 10-year-old football player with bilateral plantar fasciitis also cared for with the GT along with manipulative therapy and home rehabilitation exercises. The patient attended care for a total of 6 visits over a 6-week period. Daniels reported resolution of foot pain and improvements in activities of daily livings.

Long term follow-up 3 months later revealed the patient as suffering from no complications and the absence of pain. Our case report provides to the literature a prospective reporting of the response of the patient to chiropractic care. Notable in this monitoring is the use of the LEFS and NRS for pain and other subjective outcome measures. The LEFS has been found to be reliable with demonstrated construct validity as supported by its comparison with the SF-36.[7] The minimal detectable change is 9 scale points (90% CI), and the minimal clinically important difference is 9 scale points. The patient's score decreased (towards improvement) a total of 15 points,

exceeding the minimal clinically important difference. With respect to the NRS for pain, the patient's pain rating decreased a range of 6-7 points on the 11-point scale. According to Farrar et al.[37], a reduction of approximately two points represents a clinically important difference in chronic pain intensity.

Case reports are acknowledged as lacking generalizability due to the presence of confounders (i.e., lacking a control group, spontaneous remission, self-limiting course and natural history of the disorder, subjective validation, and expectations for clinical resolution). We therefore caution the reader on this aspect of the salutary effects of chiropractic care in the case reported. Conversely, empirical evidence from case reports provide the basis for generalization as it is epistemologically in-line with our clinical experience and those of our patients. In addition to informing higher-level research designs, case reports further provides for clinicians (and patients) an understanding of their clinical experience that may lead to increasing conviction that chiropractic care can "help."

Conclusion

This case provides supporting evidence that chiropractic adjustments with adjunctive therapies may be an effective care option for patients suffering from plantar fasciitis. We support further research in this field to examine the effectiveness of chiropractic care in similar patients.

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Tables

Height	66 inches or 1.67m
Weight	130 pounds or 58.967 km
BMI	21lb/in^2 or 2.1 kg/m^2
Pulse	50 per minute
Respirations	16 per minute
Blood Pressure	103/66 mm Hg
Temperature	98.1 ^{0}F
Heart Rate	Regular
Table 1. Vitals and morphometric findings from the physical examination.	

Intrinsic Factor		**Extrinsic**
Anatomic	Biomechanical	Environmental
Pes planus	Hyperpronation	Hard surface
Elevated arch	Restricted ankle dorsiflexion	Inadequate footwear
Shortened Achilles tendon	Weak intrinsic muscles of the foot	
Obesity	Weak plantar flexor muscles	
	Excessive Running	
	Subluxation of the tarsal and metatarsal bones	
Table 3. Identified risk factors for plantar fasciitis.[1,10]		

Type or etiology	Diagnosis	Description
Neurologic	Entrapment of the medical calcaneal branch of the tibial nerve.[11]	Burning sensation along with pain in the medial plantar region.
	Neuropathies.[12-13]	Diabetes mellitus, alcohol abuse, vitamin deficiency
	Tarsal tunnel syndrome.[14-15]	Progressively worsening pain in the medial aspect of the right distal Achilles tendon and heel and consistent with a diagnosis of insertional Achilles tendonitis. If the patient does not respond to care, possible involvement of the tarsal tunnel due to, for example, a ganglion cyst.
Skeletal	Calcaneal Fractures[16]	Fracture could be acute due to macro-trauma causing heel pain Fracture could be tress-type due to repetitive exposure to micro-trauma resulting in heel pain of insidious onset
	Severs Disease.[17]	The patient presents with intermittent or continuous heel pain occurring with weight bearing. Findings include a positive squeeze test and tight heel cords.
	Arthritides.[18-19]	The patient presents with heel pain along with pain at multiple joints from systemic arthritides (e.g., rheumatoid arthritis, Reiter syndrome, psoriatic arthritis)
	Neoplasm.[20-	The patient presents with deep intractable heel pain
Soft-tissue	Tendinitis.[9]	Involvement of the Achilles tendon presenting as posterior calcaneal pain Involvement of the posterior tibial tendon results in pain along posterior tibial tendon and at insertion mid foot at the arch and posterior/medial aspect of the foot.
	Heel or fat pad contusion.[0]	Direct fall on the heel with reported bone/fat pad pain
	Retrocalcaneal bursitis.[22]	Pain in the posterosuperior portion of the calcaneus
	Fat pad atrophy.[9,23]	Common in the elderly.
	Plantar fascia rupture[22]	Sudden plantar heel pain and ecchymosis

Table 2. Differential diagnosis for plantar fasciitis or fasciotis.[1,10]