THE IMPACT OF CHIROPRACTIC MANIPULATIVE THERAPY ON CHRONIC RECURRENT LATERAL ANKLE SPRAIN SYNDROME IN TWO YOUNG ATHLETES

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ABSTRACT

Objective: To describe two cases of abrupt resolution of chronic, recurrent, inversion sprain to ankles in young recreational athletes.

Clinical Features: A 13-year-old, female, avid recreational soccer player with ankles that would spontaneously invert during various inconsistent points in the weight bearing gait cycle, sometimes with acute pain or sprain to the ankle. No intervention was attempted prior to her entry to the chiropractic office. A 17-year-old male avid skateboarder and snowboarder whose left ankle routinely "gave out" into inversion upon mundane weight bearing activity, usually with pain and with dependence on wearing an ankle support when skateboarding to lessen ankle pain. The patient had used an ankle support prior to seeking chiropractic care.

Intervention and Outcome: High velocity, low amplitude chiropractic manipulative therapy applied to the spine, pelvis and extremity joints was the primary intervention in both cases, with particular focus on the ankle. Other procedures used included taping and orthotics, but not before the manipulation effect was noted.

Conclusion: High velocity, low amplitude chiropractic manipulative therapy to the spine, pelvis, and extremities, particularly at the ankle, should be considered when managing young recreational athletes with functional chronic, recurrent, ankle inversion sprains. (*J Chiropr Med* 2004;3:153–159)

Key Indexing Terms: Ankle Injuries; Sprains and Strains; Joint Instability; Chiropractic Manipulation; Lower Extremity

INTRODUCTION

Lateral ankle sprain (LAS) is one of the most common athletic injuries in weight bearing sports.^{1–3} It can affect a broad age-range, with one study identifying an age range of 4 to 85 years of age.⁴ A common observation about this injury is the seeming predisposition for the previously injured ankle to re-injure in a plantarflexion and inversion fashion.⁵ In patients with previous ankle injury, there is a higher incidence of complaints of "giving way," residual pain, and decreased range of motion (ROM) associated.^{6,7} In fact, long after the acute injury subsides, there are patients who often describe a "giving way" of their ankle with little provocation, or a sense of weakness and vulnerability to the affected ankle.^{7–9} Literature supports this typical, persistent dysfunction.^{10,11} Despite extensive clinical research, the recurrence rate remains high.⁷

There is the potential for more serious morbidity including fractures of different sites in the foot and ankle; chondral and osteochondral fragments;^{6,9,12} common peroneal nerve sheath damage; development of tarsal tunnel syndrome; or neuritis.^{1,4} While treatment options focus more on managing the aftermath of the injury, the prevention of LAS also has clinical value.^{13,14}

Following LAS, ligament injury may result in laxity,^{4,12,15} with mechanical instability being a possible consequence.¹⁶ The lateral ankle ligament complex is the most affected, with the anterior talofibular ligament (ATFL) being the most frequently damaged.^{17,18} The medial ligament complex, interosseous talocalcaneal, cervical and deltoid ligaments can also be affected with inversion sprains.¹⁹ While functional instability patients may present with mechanical instability, it is most common that the previously sprained ankle or the functionally unstable ankle has no ligament laxity.^{20,21} In these cases, the instability is considered to be a functional instability,

a term first coined by Freeman in 1965.²⁰ Functional instability is very common, and it is estimated that 30%-40% of LAS leads to functional instability.⁴

In palpating the previously sprained ankle, a common finding is loss of joint play at the ankle mortise, or at the subtalar joint, or a loss of talar anterior-to-posterior motion.^{22,23} Even several weeks post injury, the sprained ankle often demonstrates a loss of range of motion.^{24,25} Figure 1 demonstrates a typical presentation of a loss of active dorsiflexion in an ankle previously sprained in the distant past. When manually pressing the ankles passively into maximum dorsiflexion, the ankle with the malfunctioning or “subluxated” talus often shows a loss of full range of dorsiflexion.²⁶ This author also finds a loss

of maximum, passive dorsiflexion range in ankles previously sprained, even years prior, and with the patient having no ankle symptoms at the time of evaluation. Challenging the ankles with the patient supine, by pressing both at the same time, forcefully, with the pressure to bring the ankles into maximum dorsiflexion are found to reveal this alteration (Fig 2). Etiologies may include soft tissue problems secondary to injury, a poor healing environment from a previous injury, or a subluxation/dysfunction of the talocrural or subtalar joint that was never corrected. It may be a soft tissue disruption and subluxation/dysfunction, or a summation of multiple factors.

Manual joint mobilization and manipulation can improve dorsiflexion in an acute and post acute sprained ankle.^{27,28,29} This author finds that high velocity, low amplitude chiropractic manipulative therapy (HVLA-CMT) to the affected ankle joint, targeting the talocrural and subtalar articulations, may restore the full, passive motion in an affected ankle (Fig 2). This finding is contrary to the findings of other authors whereby a single talocrural joint manipulation did not affect ankle joint range of motion.^{30,31} But these findings were in asymptomatic subjects with no history of significant lower extremity injury, recurrent inversion sprains, or sprains within 6 months of selection. Also, they may not have tested the true end range of passive dorsiflexion motion.

While chiropractic offers viable treatment and rehabilitation avenues for the acute sprained ankle,^{22,26,32,33} finding ways to prevent LAS and any resulting functional or mechanical instability would have notable implications in healthcare cost

Figure 1. The “talus sign” observed before and after high velocity joint manipulation. A) With forceful pressure by the practitioner, the left ankle demonstrates a full range of passive dorsiflexion and a soft end-feel, while the right ankle has a limited passive dorsiflexion and a hard end-feel. This barrier may be created by loss of anterior-to-posterior talar motion at the talocrural joint. B) Following a high velocity joint manipulation to the ankle, the “talus sign” is absent. The reduction of this joint dysfunction gives the right ankle a soft end-feel and seemingly full passive range of motion.

Figure 2. The loss of active dorsiflexion typically seen as a residual impairment following ankle sprains. This patient could not fully dorsiflex the left ankle as far as the right.

savings with reduced frequency of hospital visits and less dependence on use of voluminous athletic taping.¹³ This paper describes the abrupt resolution of chronic, recurrent, ankle inversion sprains in 2 young recreational athletes.

CASE REPORT

Case 1

A 13-year-old female, was brought to the office by her father. She was an avid, highly competitive soccer player whose ankles “gave out” easily while running or walking. She and her father confirmed that both of her ankles would randomly give out, implying a sudden, uncontrollable, inversion “giving way” or “rolling out” of the ankle. The frequency of this event was about twice per day and did not always occur during soccer or other sports, but always during weight bearing ambulation. The patient reported that the sudden “roll-out” was painful, and that the pain lasted for about 2 minutes as a sharp pain. Occasionally an event would be worse such that mild swelling would occur, without ecchymosis. She did not wear ankle braces or supports of any kind.

She was a 62-inch, 135 pound, muscular female, with no loss of active range of the spine, hips, knees, or ankles. Postural observation showed a level pelvis and a slightly low right shoulder with a slight list of the neck to the right. Ankles were observed to be mildly pronated, bilaterally. Observation of gait showed moderate, bilateral deformation of the transverse arches during the forefoot-loaded, “foot-flat” stage of gait, with observable dropping of the metatarsal heads and splaying of the second through fourth digits. The left forefoot was slightly adducted. Primary lower motor exam was normal (nerve roots L3 to S1). Additional isometric testing demonstrated grade 4/5 weakness to the right iliopsoas and piriformis, and left rectus femoris and hip abductors. The left knee went into full extension, but demonstrated a loss of anatomical locking upon valgus stress.³² While active dorsiflexion, plantarflexion, inversion and eversion appeared to be symmetric bilaterally, the observed maximum passive dorsiflexion was reduced on the right side. The right ankle did not seem to traverse the full arc of dorsiflexion and had a hard end-feel.

Treatment on day 1 consisted of specific HVLA-CMT to the sacroiliac joints, L3, T3-T5 and T5-T7 seg-

ments. HVLA-CMT to the feet and ankles was performed with particular focus on the talus. Follow up on day 3 showed a reduction in the number of sudden ankle inversions, with the patient reporting about 2 minor inversions over the 3-day period. HVLA-CMT was performed as before. She was taped to add support to the longitudinal arch with a combination of strapping tape (Biersdorf) and Elastikon tape (Johnson & Johnson) applied to each ankle with a 2-day maximum wear time for the tape. She was instructed to remove the tape at the end of the second day. Strips of strapping tape were applied to the lateral calf to provide proprioceptive input in case of sudden ankle inversion.

The patient returned on day 7 and reported that she had no inversion episodes of her ankles. Treatment was provided, including the taping. On days 10, 14, and 21, she again reported no inversions of her ankles. Between 21 days and 7 weeks, she reported about 4 inversions without sprain. Taping was stopped after day 10. Over the course of about a year with periodic treatment (16 total visits, some visits addressed other sports injury issues), she reported only a few inversions of her ankle. On visit 17 she reported not rolling her ankles at all. Over periodic evaluations, she reported no problems with her ankles while she continued to play soccer, basketball, and lacrosse.

Case 2

A 17-year-old male experienced lower back pain caused by a heavy lifting task 4 weeks prior. His back condition was acute, uncomplicated, and reported never having a back problem in the past. Further history revealed a fracture to the right ankle about 2 years prior that occurred while running. He could not recall which bones were broken. When questioned about his ankles, he disclosed how his left ankle always “gives out” (in inversion) and how he must rely on wearing an ankle brace when skateboarding. He did not play team sports but was an avid skateboarder and snowboarder, riding snowboards at an expert level. He stated that his left ankle hurt during and after skateboarding and snowboarding, even though he wore the ankle brace. He stated that his left ankle “gives out” with the slightest provocation during his routine day, such as stepping on a sharply uneven surface or the edge of a small object, or debris on the floor of his work place. He stated that his ankle gives out be-

tween 2 and 4 times per week, and about 10 times per month over the 3 months before his initial office visit. He reported that going up and down stairs was usually painful to the left ankle. He described a sudden, uncontrollable, inversion with a giving way of the left ankle, often times followed by acute pain and mild swelling, but without ecchymosis.

The patient was 69 inches tall and 138 pounds. He had full range of motion of his neck and trunk, with trunk extension provoking moderate lower back pain. A slight rib hump was noted in the left middle thoracic spine upon full flexion. There was no gait imbalance or antalgia. Neck compression and standing Kemp's facet compression caused axial pain without radiation. There were no other painful or positive orthopedic tests or maneuvers. There was minimal lumbar muscle spasm. Myofascial lesions were few and located in the neck and upper back paraspinal musculature. Motor strength examination was essentially normal with no apparent weakness to muscles corresponding to C5-T1 and L3-S1 nerve roots except for isometric testing revealed grade 4/5 weakness to the hip abductors bilaterally, and a grade 4/5 weak left iliopsoas. Ankle active dorsiflexion was reduced bilaterally, with greater reduction on the left. His knees went into full extension, but demonstrated a loss of anatomical locking upon valgus and varus stress in the right knee and loss of locking to valgus stress in the left knee.²⁷

For treatment, HVLA-CMT was performed to the left lumbosacral spine, thoracic segments approximately T3-T5 and T8/T9, and at the talus (primarily) and cuboid (secondarily) of the ankles. A "Zindler (Double-Thumb) Thrust"²⁷ was performed at the knees. Follow up was done 2 days later and he reported that he went "up and down stairs all day with no ankle pain," no giving out, and he even "tripped over things at work and (his) left ankle still remained stable, whereas prior it would have most likely given out and been painful." He still complained of lower back pain. Lower extremity testing revealed grade 5+/5 return of strength. Treatment was again provided, with HVLA-CMT and also included L3-L5 and sacrum.

One week later, he reported improved lower back pain. He also reported skateboarding without the need for the ankle brace. He stated that his left ankle was "perfect" and caused him no trouble. There was no pain or soreness after skateboarding.

On exam, knees remained stable during the valgus and varus stress, and muscle strength remained 5+/5 strong. There was minimal lower back hyper-tonicity. Treatment again was provided, without performing a Zindler Thrust maneuver. Another week later, he stated that he had been skating hard and without any reservation, and challenging his ankle at home and at work. He also reported his lower back to be "70%" better. Treatment was provided to the spine and left talus and cuboid of the ankle. On follow up 10 weeks later, he reported feeling good, with no lower back pain, and more notably, no ankle problems when snowboarding.

DISCUSSION

Functional instability following LAS may predispose individuals to re-injury because of neuromuscular deficits that result from the injury.²⁰ Articular afferent input from the dense type-II and type-III mechanoreceptor innervation to the lateral ankle can elicit efferent responses, also called arthrogenic muscle inhibition, causing muscles surrounding that joint to be inhibited.^{34,35} There is conflicting evidence of alterations in muscular responsiveness in both weight bearing and non-weight bearing proprioception, regardless of joint capsule involvement. One study suggests that proprioception was not affected by direct anesthesia blockade to the ankle joint ligaments.³⁶ However, not all of the significant ankle ligaments were anesthetized; only 1 or 2 of the lateral ankle ligaments, the ATFL and/or calcaneofibular ligament, were anesthetized. Also, ankle position sense was assessed passively, unloaded, while non-weight bearing. A previous study found that ATFL anesthetization improved balancing ability.³⁷ There seems to be a relationship between functional instability and associated weakness in either invertor and evertor muscle groups, with different authors demonstrating different results depending on their study parameters.³⁸ In general, the concept of altered sensory/motor control and proprioceptive deficit being factors associated with functional instability and in the treatment of LAS are well accepted.³⁹

Treatment for recurring LAS and functional instability commonly include ankle taping and bracing with a variety of supports, including lace-up and plastic-fastened supports.^{40,41} The reason for the reduced re-injury may be increased afferent feedback from cutaneous receptors from the supports or tape against the skin, thus fostering a better joint position

sense.⁴² Possibly the reduction in LAS is from the combination of increased mechanical stability as well as from cutaneous proprioceptive increase.⁴³

Resistive muscle strength testing is part of chiropractic and orthopedic physical examination. In an intact, healthy muscular system, strength of muscles will vary if underlying mechanical faults are present, as seen, for example, in quadriceps in people with patellofemoral syndromes.⁴⁴ This is understood to be an eliciting of inhibitory reflexes to muscles that are related to the joint.^{45,46} Inhibitory reflexes are seen in the quadriceps following knee injuries.⁴⁷ Increased intra-articular pressure has been shown to strongly excite capsular joint afferents and to evoke reflexes with inhibitory effects on [alpha]-motoneurons projecting to surrounding joint muscles.^{34,48}

It is appreciated that nervous distribution to a joint also distributes to the primary movers of a joint, as explained by "Hilton's Law" of physiology.⁴⁹ Electromyography studies confirm that sacroiliac joint manipulation alters muscle inhibition and improves quadriceps muscle strength in patients with anterior knee pain.⁴⁵ Back and limb muscles demonstrate global electromyographic responses following HVLA spinal manipulation, with some of the responses occurring in linked muscles distant to the site of the treatment.⁴⁶ In the clinic setting, isometric manual muscle testing of various hip muscles is reported to be related to malfunction of ankle joints.^{22,32}

There does not seem to be a single etiology for functional instability. Research focuses on isolated muscular, pathological, and proprioceptive parameters. Recreational athletes with functional instability may have deficits such as increased talar tilt,⁵⁰ decreased motion sense and peroneal muscle weakness, but not all have been consistently demonstrated or correlated in research studies. Lentell et al⁵⁰ found that of the three deficits tested in his study (increased talar tilt, reduced passive motion sense, and peroneal muscle weakness), it was not likely for those with functional instability to have more than one deficit. Refshauge et al⁴⁰ showed that in subjects with taped and un-taped ankles, both perceived passive changes to plantarflexion motion the same in sprained and un-sprained ankles.

Like many studies involving perception of motion changes, subjects are not fully weight bearing. LAS only occurs when weight bearing. Athletes who

sprain their ankles do so in challenging weight bearing activities that often involve running and jumping, and not in cycling, for example.^{4,34} The population with forefoot-valgus, the most frequently seen foot deformity, has weight bearing gait pathomechanics that foster inversion sprain. In this group, during the stage of gait with heel lift-off and early propulsion, a subtalar supination occurs to stabilize the ankle by bringing the calcaneocuboid joint into its close-packed position. This can be damaging and create a lateral instability and subsequent inversion to the joint.³⁴

The hypothesis of muscular weakness causing functional instability is still under debate, and the role of leg muscles as dynamic stabilizers preventing LAS comes under question. The idea is that proprioceptive reflexes are elicited when soft tissue structures are stretched, notably ligament capsule structures, and the challenged tissues provoke a disturbance to these reflexes. Ebig et al² showed that in subjects with unilateral chronic LAS, but with no complaints of functional instability or evidence of tissue pathology, there was no statistical difference on EMG between injured and non-injured ankles to a sudden weight-bearing inversion stress. Reflex response time to peroneal and tibialis anterior muscles did not differ between chronic functionally unstable ankles and normal ankles. Other studies highlight this conflict.

Capsular ligaments being the sole controller of proprioception for leg stabilization remains unsupported. In a study of proprioception of the ankle, the effect of anesthetic blockade of ligaments did not affect postural sway during single-leg stance or peroneal reaction time to sudden ankle inversion. It only affected passive joint position sense. This was after a regional anesthetic block of the ankle and foot with local anesthetic, and not simply local block of two select ankle ligaments.⁵¹ In another study of ballet dancers with grade 2 and 3 sprains at ten weeks post injury, even with range of motion deficit, joint position sense was not different between injured and non-injured ankles, but there was a difference in postural sway when weight bearing on the injured verses the non-injured ankle. This postural sway deficit reduced following rehabilitation and return to regular professional dancing.²⁴ Beckman et al⁵² reasoned that increased joint laxity decreases activation of stretch-sensitive receptors, and that this causes an increased latency of muscular response to an inversion challenge. In this study,

peroneus and gluteus medius muscles were monitored with electromyography in full weight-bearing subjects as the subjects underwent a rapid 30 degree ankle inversion. Mean peroneal muscle latencies were not significantly different between normal and hypermobile ankles when challenged to the rapid inversion challenge, but there was a significant difference between the gluteus medius in the normal verses hypermobile group. It is generally understood that ligaments provide proprioceptive afferent input. But, it may be that their role in modulating functional stability may have to do with more than the simple stretch of the tissue itself. It could be the overall constraint caused by the joint capsule, the joint geometry, the friction between the cartilage surfaces, and the compression force caused by the body weight and the muscle activity around the joint.⁵³

HVLA-CMT to the pelvic and extremity joints in the functional instability patient may improve the lower extremity's ability to respond to mechanical challenges that would otherwise cause it to fail. The accompanying case studies cause this author to hypothesize that aberrant intra-articular pressure at the subtalar and/or talocrural joints sends an abrupt volley of afferent input and reflexive inhibitory signals that lead to kinematic failure, or the subsequent "giving out," to the lateral ankle upon a weight bearing challenge. Observations during clinical practice in patients that are randomly assessed seem to indicate that in those with a loss of the full range of passive dorsiflexion motion but with no problems with functional instability, there either is a lack of response to HVLA-CMT in improving the motion, or the improved motion has no bearing on their perceived ankle function. There does seem to be a consistent pattern of previous inversion sprain, even very mild and with minimal symptoms, and the finding of loss of full, passive dorsiflexion motion.

Based on the volume of research available, the precise mechanisms behind functional instability following LAS remain elusive.⁵⁴ While proprioceptive mechanisms are associated with it, or contribute both to LAS and functional instability, there is no one, specific, identifiable cause. With the effects of HVLA-CMT becoming more understood, using it as a treatment option may prove valuable in the reduction and prevention of LAS and functional instability.

CONCLUSION

This article discusses concepts behind the functional instability phenomenon, with a study of 2 cases where the results of treatment were notable. Each patient experienced the cessation of frequent LAS and resolution of a feeling of the ankle "giving out." Though exact mechanisms involved remain speculative, these cases serve to promote further investigation of the effect of chiropractic adjustments to the ankle or multiple regions, alone or with taping, on the correction of LAS. Changes in joint function and neuromuscular responsiveness of extremities by chiropractic joint manipulation deserves further study.

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