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REHABILITATION AFTER LATERAL ANKLE STABILISATION SURGERY AS GUIDED BY A SPORTS CHIROPRACTOR – A CASE REPORT

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Abstract

Objective: The purpose of this case study was to report the Chiropractic management of a patient by a sports chiropractor following a Bröstrom-Gould surgical intervention for chronic ankle instability.

Clinical Features: A 41-year-old woman presented with lateral ankle instability and pain following a number of inversion sprains over a 3-year period. Following specialist review, a reconstructive surgical procedure, a Bröstrom-Gould procedure, was recommended.

Intervention and Outcome: A three phase approach was applied to rehabilitation aiming at ankle range of motion, rebuilding strength through the calf and lower limb musculature and return to sport with plyometric and strength endurance training. The athlete returned to unencumbered athletic participation with significant changes in Foot and Ankle Outcome Score (FOAS) questionnaires, from 63% function pre-operation to 100% post-operation. Follow up evaluation revealed no pain or functional complaints.

Conclusion: Graded rehabilitation focusing on range of motion, strength and plyometric qualities can return athletes to full function athletic participation in the ankle within a number of months post-operatively, and can be adequately applied and guided by Sports Chiropractors.

Key words – Case Report, Surgical, ankle, rehabilitation, sports chiropractor, Brostrom procedure

Introduction

Ankle sprains are one of the most prevalent musculoskeletal injuries, usually resulting from a sudden twisting or ‘rolling’ of the ankle joint. Whilst many individuals fully recover with conservative treatment, a significant proportion of those injuries go on to develop recurrent sprains and chronic impairment, or chronic ankle instability (CAI).

Acute ankle sprains are one of the most common sporting injuries presenting to musculoskeletal medicine, with an estimated 2 million occurring each year in the US [24]. In an athletic population, a cohort of sub-elite Australian football athletes showed an incidence of 3.1 ankle sprains per 1000 athlete exposures during their 2016 season [54].

Here it is important to briefly define chronic ankle instability and how lateral ankle sprains may link to the development of this diagnosis.
The International Ankle Consortium characterises chronic ankle instability as a condition in which an individual has a significant ankle sprain, and/or experienced recurrent ankle

sprain on the same ankle, and/or ankle instability, and/or giving way at least twice in the past 6 months [19].
Thus, through the definition from the International Ankle Consortium, we can draw a link between recurrence of ankle sprains and the onset of chronic ankle instability (CAI).

The estimations of recurrence rates in lateral ankle sprains are highly varied, with some estimates sitting around 20 – 30% [15, 24, 50]. Though in another survey of elite, competition and recreational athletes in China found that 73.5% of participants had at least 2 ankle sprains to the same ankle, and 22% had 5 or more prior sprains [25, 56].

The incidence of CAI also has a wide range, with some estimations between 10 – 40% of acute lateral ankle sprains progressing to develop chronic ankle instability [40, 42], and another paper by Gribble et al describing that 70% of acute ankle sprains go on to develop CAI within a short time period after initial injury [21].
However, a systematic review in 2021 by Lin et al found that the prevalence of CAI in active populations was 25%, and ranged from 7 – 53% for other populations [36].
Despite the ranges in the estimations, it can be inferred that chronic ankle instability is a common condition for both athletic and general populations.

CAI is widely described as either mechanical or functional instability, though this has now been further expanded by Hiller et al to describe 7 subsets of CAI. [26].
Mechanical instability refers to the abnormal laxity of ligamentous restraints and is based on the physical and radiological examination [39].
Functional instability is caused by muscle weakness, neuromuscular or proprioceptive deficits and is normal ligamentous restraint with recurrent episodes of giving way [13, 39].

Previously there was much debate around whether the two instability types existed in isolation or not [4, 28]. However, with the new model proposed by Hiller et al, the majority of cases have been identified to have multiple features of mechanical instability, recurrent sprains and functional or perceived instability. This new model much less binary, and highlights the likelihood that each case sits somewhere on a continuum of instability [26].
Thus, it is important and useful for the practical clinician to assess for signs and symptoms of both mechanical and functional deficits within each case, and ensure the rehabilitation is aimed for the patient rather than the diagnosis.

In terms of risk and causation, the primary risk factor that predisposes to ankle injury is a history of previous injury in the ankle, as identified by Delahunt & Remus [12]. This further supports the development of CAI, as a recurrent giving way of the ankle joint, or recurrent lateral ankle sprains.

This paper also described other internal key risk factors that included body composition and BMI, ankle and hip joint musculature strength and postural balance [1, 12, 13].

For practical clinicians, it would be prudent to also discuss and educate the patient around these risk factors and collaborate together to implement strategies to control these variables as much as possible to provide best possible outcomes.
Delahunt & Remus also described associated extrinsic risk factors, though the majority of these were related to participation rates in certain sports, specifically men and women's basketball, women's volleyball and women's lacrosse [12].

Throughout this case study the focus of rehabilitation was twofold. Firstly, the restoration of normal joint function post surgically, and secondarily to reduce the impact of these internal risk factors. In this case, there was specific attention on ankle and hip joint musculature strength, and postural balance [12].

The surgical intervention performed was a modified Broström-Gould procedure. The Broström procedure, and in particular the modified Broström-Gould procedure continue to be the gold standard of surgical intervention for chronic lateral ankle ligament instability [29].

The procedure involves a tightening of the anterior talofibular ligament (ATFL) and sometimes the calcaneofibular ligament, by cutting and repairing the ligament with strong non-absorbable sutures. The Gould modification of the original Broström procedure involves incorporating the extensor retinaculum to this, in order to provide further stability and strength [8, 14].

Post-operatively for Broström-Gould procedures the outcomes are largely positive [49]. One study found that within elite athlete populations the majority of post-surgical cases of CAI return to play 4 months after repair, and 100% of players returning to play after 8 months post-operatively [34]. Though there are constraints in extrapolating these results to a general population, these timeframes are useful to provide a point of reference in the creation and guidance of rehabilitation programs for patients.

Finally, this leads us to the purpose and intent of this case report, which is to document the journey of a patient through their rehabilitation under the guidance of two Sports Chiropractors specialising in sports injuries, as well as to add to the growing body of literature supporting the utilisation of Sports Chiropractors in the management of non-spinal musculoskeletal conditions.

With the implementation of a number of educational bodies and policies within Australia there have been large improvements in the training and education for Chiropractors, and formalised learning pathways in to Sports Chiropractic. Namely the introduction of the Australian Institute of Chiropractic Education (AICE) and the Sports and Exercise Chiropractor titling framework [3].
Through these educational initiatives, more and more Chiropractors are engaging within sports and musculoskeletal medicine, and have a greater understanding and ability to manage cases of musculoskeletal rehabilitation [9, 48].

Case Report

Within this case report, we present a 41-year-old woman whom was suffering from left chronic ankle pain and instability following multiple inversion sprains over a 3-year period. With an initial incidence occurring in 2019 whilst walking across an oval, two occurring in 2020 during CrossFit gym sessions, and one in 2021 during CrossFit also.
The final incident of inversion sprain occurred whilst walking down the stairs at home, where the ankle gave way, without a loss in footing or contact from an external force, and an audible click was noted at the time. There was immediate swelling through the ankle.

Pre-operative management of these included dry needling, soft tissue release and exercise prescription aimed at loading ligamentous structures, strengthening ankle musculature and retraining postural balance.

The medical history included insulin resistance symptoms, hypertension and previous diagnoses of depression and anxiety that were not requiring medication.

On clinical examination on the 5th October 2021, there was tenderness noted around the anterolateral talofibular ligament (ATFL) on palpation, with swelling noted around the anterior and inferior lateral malleolus.
There was no restriction to the ankle range of motion and no pain noted on any active or passive movements. There was weakness noted in all ankle ranges on resisted isometric testing, with all ranges rated at 3/5 on manual muscle grading, being movement against gravity over full range of motion but not resistance.

The patient described feelings of instability or weakness whilst ambulating, and significant clicking during ankle range of motions. She also reported swelling worsening when being on her feet for any extended lengths of time. There was no locking, catching or seizing noted through the joint.

Anterior and posterior talar shift tests were negative for laxity with some tenderness noted through the anterior talofibular ligament (ATFL) region on both tests.
Eversion stress tests were negative and pain-free, as well as high ankle sprain testing.
The inversion stress test was positive for apprehension but did not elicit any pain response.

On a visual analogue scale, the pain was rated at a 3 out of 10, with 10 being the worst pain possible and 0 being no pain at all.

The patient's main concerns were two-fold, with the primary concern being future quality of life being impacted with further deterioration of ankle joint function and stability with age, and secondarily being the inability to perform within the sport of CrossFit due to pain and instability.

Her goals were to be able to return to CrossFit, and to be able to run the City 2 Surf, a 15 kilometre 'fun-run' race in Sydney.

The patient sought a surgical repair and engaged an orthopaedic surgeon, who recommended a Broström-Gould procedure.
Pre-operatively her ankle measured 60% on the Foot and Ankle Outcome Score (FAOS) [43], and supported the need for the modified Broström-Gould procedure, supported by post-surgical recovery and rehabilitation.
Below is a table documenting her pre-operative Foot and Ankle Outcome Score.

Symptoms and Stiffness subtotal	82%
Pain subtotal	53%
Function daily living subtotal	75%
Function, sports and recreational activities subtotal	20%
Quality of Life subtotal	50%
FAOS Score	63%

Fig 1. Preoperative Foot and Ankle Outcome Score

Post-surgery
Following the surgery, the patient was immobilised in a Controlled Ankle Motion (CAM) boot for 6 weeks to allow gait without unnecessary loading through the surgical site. The boot was allowed to be removed periodically during unloaded activities and for rehabilitation. However, the patient was instructed to avoid inversion for 6 weeks following the surgery to avoid compromises to the surgical intervention.

The rehabilitation protocol was divided in to three phases, which was heavily informed by the protocol developed by The Wexner Medical Center at The Ohio State University [53]. This protocol was provided by the surgeon to the patient, and has very strong similarities to another common protocol used by NYU Langone Health [30, 53]. The compatibility of major protocols from leading bodies of evidence is very helpful to the practical clinician, in order to use and tailor towards their patient.

Phase I was aimed at improving ankle range of motion with basic sagittal plane strength.
Phase II was predominantly focused on rebuilding strength through the calf and surrounding lower limb musculature.
Phase III was return to sport with a significant focus on plyometric ability and strength endurance.

The generally accepted phases of healing, of haemostasis and inflammation, proliferative and maturation are 0-4 days, up to 4 weeks, and up to 1 year [31]. These three phases can sometimes be occurring concurrently and are extremely dependant on the tissue in question. However, the concept for each rehabilitation phase roughly aligned with the

phases of healing and were strongly influenced by the strength and conditioning principles of progression, overload, specificity and individualisation.

Throughout the phases there was a combined multi-modal approach of manual therapy, including the use of soft tissue work in the form of effleurage massage, Active Release Techniques and trigger point therapy, as well as dry needling and instrumental assisted soft tissue mobilisation [5, 52]. These techniques were directed at the calf musculature complex, gastrocnemius and soleus, as well as the peroneals, tibialis posterior, tibialis anterior, hamstring, gluteus group, lumbar erector spinae, and quadratus lumborum.

Phase I lasted for around 4 weeks and was focused on regaining ankle range of motion with calf raises. During this phase, inversion was avoided as per the surgeon's instructions. This time frame was consistent with the healing phase of haematosis and inflammation and extended in to the proliferative phase [31].
Initially the patient was prescribed simple range of motion exercises including ankle alphabets, and gentle plantarflexion and dorsiflexion. Following on from this, banded plantarflexion and dorsiflexion in both 90° knee flexion and full knee extension positions, and foot intrinsic strength drills.
Low grade calf strength drills were prescribed such as banded calf eccentrics, seated unweighted calf raises, seated tibialis anterior raises to begin to build awareness and strength.

Phase II continued on from this for the next 6 weeks with the first two weeks of this period still avoiding inversion positions. Here the focus was building strength of the tissue through both the proliferative and maturation-remodelling phases of healing [31].
The exercises here focused on building calf strength through seated, standing and single leg (SL) calf raise variations, as well as single leg compound movements like SL Romanian Deadlifts. Thigh and hip musculature were targeted to build further stability and minimise the impact of these intrinsic risk factors [12], through lunge, squatting and deadlift variations. During this period, there was low level straight line jogging introduced also and core strengthening also.

Phase III was planned out and begun with the patient but ceased in the fourth week through due to financial constraints and schedule availability with changing work conditions. This phase focus on remodelling and ensuring that the tissue capacity improved to be able to handle the increased loading conditions associated with CrossFit [14].
The plan for phase III involved;

- Plyometric ability – progressions of depth drops, depth and rebound jumps, broad and long jumps, skipping and running
- Metabolic conditioning – workouts involving cycling or rowing fatigue and strength based workout circuits including calf raises, plyometric drills and unilateral lower limb strength movements

- Long distance endurance – return to running protocols that facilitate towards running the 15 kilometres required for City 2 Surf

The rehabilitation protocol can be found below in Fig 2.

Phase	Exercises
1	Ankle alphabets Banded calf eccentrics Gentle plantarflexion and dorsiflexion ROM Towel scrunches Toe curls Banded dorsiflexion and plantarflexion, knee flexed Banded dorsiflexion and plantarflexion, knee extended Seated calf raise (unweighted) Tibialis anterior raises Half kneeling calf raise with 3 second eccentric 3 way heel raise
2	Seated calf raises – Single leg Standing calf raises – Double leg to single leg Single leg Romanian Deadlifts (reduced height) Single leg balance (varying surfaces) Single leg star excursions Seated banded hamstring curls Seated banded knee extensions Glute bridge calf raise with toe taps Farmers carry (on tip toes) Curtsey lunge Lateral lunge Step ups Barbell box squats Barbell Romanian Deadlifts Trap bar deadlifts Straight line jogging
3 (Planned but not completed)	Lateral hops Running – acceleration and deceleration

	Walking lunges High knees Broad jumps Lateral jumps Reactive single leg stability – distraction and awareness drills Cycle/rower in to plyometric drills Change of direction drills Cone drills Speed ladder drills

Fig. 2 – Rehabilitation Protocol

At the cessation of care, outcome measures were collected and the patient was interviewed to ascertain the level of progress and their satisfaction levels.

The Foot and Ankle Outcome Score was 100% in all areas [43], and the strength testing was found to be mostly within 90% of the contralateral leg except for dynamometer measured plantarflexion, as seen in Figure 3. The patient's standing SL calf raise improved from 3 repetitions to 21 repetitions [23].

	Initial Presentation	**Cessation of Care**
Strength		
R DF	8 kg	11 kg
L DF	12 kg	12 kg
R PF	6 kg	11 kg
L PF	11 kg	14 kg
Single Leg Calf raise	3 reps	21 reps
Foot and Ankle Outcome Score		
Symptoms and Stiffness subtotal	82%	100%
Pain subtotal	53%	100%
Function daily living subtotal	75%	100%
Function, sports and recreational activities subtotal	20%	100%
Quality of Life subtotal	50%	100%
FAOS Score	63%	100%

DF = Dorsiflexion
PF = Plantarflexion

Fig. 3 – Outcome Measures

The qualitative assessment of the patient's Star Excursion Test [20] improved from 20 cm reach in all directions, to 80 cm reach in all directions with a subjective visual improvement in midfoot and ankle control.

The patient was also interviewed and reported having achieved the following goals that were initially set out at the beginning of treatment;

- Having no pain through the foot and ankle
- Having complete trust that the foot and ankle will not give way unexpectedly
- Be able to train and exercise in her sport of CrossFit

At 6 months follow up, the patient continues to have no reported symptoms or limitations in her activities of daily living or within her ability to exercise within the sport of CrossFit.

Discussion

Ankle sprains are common sporting injuries, and many inversion sprains are either significant enough to result in instability or they become that way secondary to repeated sprain. Management of instability maybe addressed with conservative rehabilitation methods but frequently this subset of conditions is managed surgically. When managed surgically, the Broström-Gould procedure is considered the gold standard surgical intervention for chronic lateral ankle ligament instability [29]. Chronic ankle instability can significantly impact an individual's quality of life and hinder sports performance [27].
Current approaches to ankle instability vary dependant on the practitioner, though most protocols discuss the prevention of instability through the control of the previously mentioned intrinsic risk factors of body composition and BMI, ankle and hip joint musculature strength and postural balance [12].

In clinical practice, calf strengthening is a mainstay of rehabilitation for acute ankle injuries and post surgical cases. In this case report, the patient achieved an improvement from in calf raise repetitions of 3 reps to 21 reps at cessation of care. This is still below the normative data of 45 repetitions for women in the patient's age category [23, 41]. The rehabilitation process should have continued to aim for higher strength endurance of the calf musculature, though was ended prematurely due to financial constraints on the patient.

In the literature, Chiropractic manipulative therapy has been described to aid in the short term recovery of lateral ankle inversion sprains [6, 10, 17, 18, 46] and for chronic recurrent lateral ankle sprains [5, 17].
There are multiple hypotheses of the effects of joint manipulation acting upon the central nervous system through proprioception [32, 37, 38, 47], changes in muscle tone and neurological gain [47], and changes in sensorimotor integration [22]. However, all of these studies point to the utilisation of joint manipulative therapy for the neurological effects, rather than the mechanical changes.
Thus, combining joint manipulative therapy in a multi-modal approach with soft tissue work and rehabilitation exercise therapy, appears to have a positive cumulative effect. This worked especially well in this case, with the patient reporting full return to function.

Managing post-surgical rehabilitation requires aligning rehabilitation phases with the healing timeframes of the injury. In this case, the three rehabilitation phases corresponded to the phases of haemostasis and inflammation, proliferation, and maturation [31]. Additionally, the strength and conditioning principles of progression, overload, specificity, and individualization played a crucial role in optimizing the patient's recovery.

It is here that the importance of understanding the surgical procedure is highlighted, as it informs the patient's recovery and the clinician's development of the rehabilitation program.

The procedure aims to restore the bone-ligament interface, which is a transitional zone of the body that follows Wollf's law [45]. The mechanical properties of bone and ligament decrease without the appropriate loading or stress placed upon them, and thus mechanical stimulus is required to achieve optimal repair [55]. In the creation of rehabilitation programs for post-surgical CAI repair, it is important for the practical clinician to ensure the mechanical stimulus is great enough to develop a robust transitional zone, rather than the development of scar tissue [2, 16, 45, 55].

Through applying a personalised rehabilitation program with concurrent manual therapy techniques, the practitioners were able to return the patient to pre-surgical function with minimal to no pain. Through a variety of conversational and rapport building techniques, the patient was able to manage their injury and rehabilitation program through both face to face and take home exercise programs [7, 50].

With the limitation to the case report with an early ending of the rehabilitation program, the patient was able to return to their sport of CrossFit within 4 months. This timeframe was in line with the research done by Lee et al [34], and may be a useful indication for further research in to return to play timeframes for general populations.

Overall Sports Chiropractors are well-positioned to perform these tasks and can play a significant role in the management of post-surgical rehabilitation [48]. Their training encompasses a comprehensive understanding of musculoskeletal injuries, manual therapy techniques, exercise rehabilitation, and patient-centered care [3]. As the field of Chiropractic continues to evolve, Chiropractors who are typically known for spinal and osseous joint procedures are gaining advanced skills in joint and soft tissue rehabilitation techniques and are expanding their scope of practice to effectively manage complex musculoskeletal cases including post-surgical cases [11, 32, 33, 35, 44, 51].

More case reports of chiropractors managing both axial and appendicular musculoskeletal injuries should be published to support the growing trend within the healthcare industry.

Limitations, Funding and Conflicts of Interest

The limitations of this paper are that the rehabilitation protocol was not completed due to financial and time constraints of the patient, and thus the results of this study should be replicated to confirm reliability.

The results are also based on a singular individual, and cannot be inferred to the population of all post-surgical patients.
There were no external sources of funding or conflicts of interest in the conduct of this study.

Conclusion

This case report describes the successful post-surgical rehabilitation of ankle instability using a Sports Chiropractic approach to the post-surgical rehabilitation. The rehabilitation protocol guided by both the surgeon and Sports Chiropractors emphasised a multi-modal approach combining manual therapy modalities with structured exercise programs. The three-phase program aligned with healing timeframes and incorporated principles of progression, progressive overload, specificity and individualisation from strength and conditioning. By providing comprehensive and tailored rehabilitation programs, Sports Chiropractors can contribute to the successful recovery and return to sport of patients undergoing ankle surgery.

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