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Conservative Outpatient Physical Therapy Management of Patient with Atraumatic Anterior Sternoclavicular Joint Subluxation: A Case Report

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CONSERVATIVE OUTPATIENT PHYSICAL THERAPY MANAGEMENT OF PATIENT WITH ATRAUMATIC ANTERIOR STERNOCLAVICULAR JOINT SUBLUXATION: A CASE REPORT

by

Fallon Nicole Hill

Bachelor of University Studies, North Dakota State University, 2020

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

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TABLE OF CONTENTS

DocuSign Envelope ID: 98E36A57-8651-4A51-B9CA-78B6AFC01DBA

LIST OF FIGURES

DocuSign Envelope ID: 98E36A57-8651-4A51-B9CA-78B6AFC01DBA

LIST OF TABLES

DocuSign Envelope ID: 98E36A57-8651-4A51-B9CA-78B6AFC01DBA

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ABSTRACT

Introduction: Atraumatic Anterior Subluxations of the Sternoclavicular Joint (SCJ) are a rare upper extremity injury that may cause range of motion (ROM) and strength deficits to the shoulder joint due to pain and feelings of instability. There are a variety of approaches for management as with SCJ subluxations, but atraumatic anterior displacements respond mostly to conservative management or masterly neglect. **Case Description:** The patient was a 63-year-old female with an atraumatic anterior subluxation of her right side. The patient did not qualify for surgical or physician intervention and was referred to physical therapy for conservative treatment and pain management. **Interventions:** The therapy provided emphasized general strengthening of the shoulder complex and passive treatments utilizing hot pack and Kinesiotape. The interventions were performed to improve upper extremity strength, ROM, and pain. **Outcomes:** Over the course of treatment, the patient was able to decrease best and worst pain, increase strength of the upper extremity, and functional mobility. **Discussion:** The patient responded well to treatment allowing her to return to work without limitations. There was only one goal that was not met by discharge that was caused by various reasons. More research is needed to further distinguish the best treatment for managing atraumatic anterior subluxations of the SCJ.

KEYWORDS

Atraumatic, sternoclavicular joint, anterior, subluxation, conservative, management, interventions, instability

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CHAPTER 1

INTRODUCTION

The shoulder is comprised of three very important joints that regulate functional movement.[1] Those three joints are the scapulothoracic joint, acromioclavicular (AC) joint, and sternoclavicular joint (SCJ). While the first two joints are frequently studied and treated in the physical therapy setting, there isn't much on injuries (traumatic and more uncommon, atraumatic) to the sternoclavicular joint. This is mostly attributed to the fact that the sternoclavicular joint makes up 1-3% of all upper extremity orthopedic injuries, making it very rare.[2] The SCJ is a synovial joint that connects the clavicle to the sternum, and more specifically, the manubrium.[3] Due to its important involvement in connecting the shoulder girdle to the axial skeleton, having a deeper understanding into the anatomy and the role of the SCJ with biomechanics can allow health professionals a greater opportunity for treating patients with injuries involving the SCJ.

The anatomy of the SCJ involves ossification which occurs by the fifth week of gestation.[3] While the clavicle ossifies early, the physis of the medial portion of the clavicle does not close until approximately 25 years of age. The medial clavicular head and manubrium have many variations in size and shape across populations of genders, and even individual patients.[4] With this knowledge, the asymmetry found within the SCJ should be expected to avoid misdiagnosing patients. The joint is covered by hyaline cartilage and eventually fibrocartilage as a person ages.[5] Between the clavicle and sternum is a dense fibrocartilaginous disc that divides the joints into two separate synovial compartments. (See Figure 1.) It is also a joint that is highly

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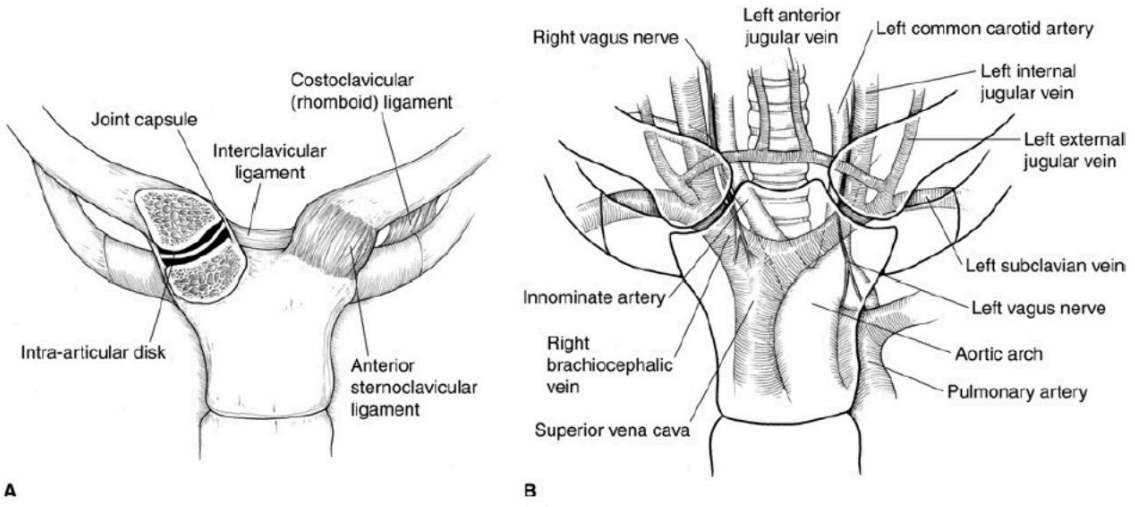
stabilized by several ligaments like, the anterior and posterior capsular ligaments, interclavicular ligament, costoclavicular ligament, and intra-articular disc ligament.[3] The intra-articular ligament's primary role for stability is preventing medial displacement of the clavicle. The anterior and posterior ligaments restrict anterior and posterior movement of the medial clavicle. Directly posterior, as close as 6.6 mm deep from the connection spot between the clavicle and sternum, lies the mediastinal vessels. The vessels involved are the left and right brachiocephalic veins, brachiocephalic artery, and the left carotid artery that runs along the subclavian vessels.

Figure 1. The Sternoclavicular Joint Anatomy.



This image identifies bony structures, joint capsules, ligaments, and vasculature surrounding the sternoclavicular joint.[5] Image obtained from: doi: 10.5435/00124635-200503000-00007.

The biomechanics across the sternoclavicular joint provide many degrees of range of motion (ROM) into many different planes.[6] The joint can rotate up to 50º posteriorly in combination with 35º of shoulder elevation, flexion, and extension, if the humerus is below 90º

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of elevation. The sternoclavicular joint has been found to contribute 4º of movement for every 10º with humeral elevation.[7] The primary movements of the sternoclavicular joint are protraction, retraction, elevation, and depression of the clavicle.[8]

Diagnosing SCJ involvement with three clinical signs have been described in literature. First is tenderness by palpation, second is localized swelling, and third is pain during active elevation.[9] The most sensitive test for SC arthropathy of 93% was local tenderness. Another test that had an 84% sensitivity was pain in the SCJ during shoulder elevation above 100º, except for in patients with other glenohumeral (GH) pathologies as it is not a valid test because shoulder elevation involves many other UE joints. With scapular protraction and retraction, this motion has been found to mostly isolate the SCJ. Scapular protraction adds a compressive force into the joint, so it has a 91% sensitivity in determining SC arthropathy. Scapular retraction only has a 39% sensitivity for its distractive motion on the SCJ. Imaging methods include anteroposterior (AP) view and serendipity view radiographs to compare bilateral joints and view direction of displacement or fracture.[10] The recommended imaging method is computed tomography (CT) scans as it can help identify injury to mediastinal structures along with displacements and/or fractures.

With sternoclavicular injuries being so rare, the likelihood of sternoclavicular dislocation is even lower. The most common of dislocations can take place in an anterior or posterior fashion, either traumatic or atraumatic.[11] In the event of a traumatic SCJ injury, patients will typically present with pain and swelling. If there's a mild sprain or subluxation, complaints of instability in the joint will be noted. With dislocations, palpable and visible step-off deformity of the SCJ may be displayed. An atraumatic cause for dislocations can be through disease processes that occur similarly in other joints like degenerative, rheumatoid, and septic arthritis, condensing

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osteitis, and aseptic osteonecrosis (Friedrich's disease).[5] For patients mostly in their teens and twenties with ligamentous laxity that have been performing movements in overhead elevation, a spontaneous anterior subluxation may present itself as a sudden "pop" with anterior movement of the medial clavicle on the sternum. In older adults, it's highly likely to find osteoarthritis in the SCJ if CT imaging is performed, especially for post-menopausal women. Other atraumatic SCJ disorders can be due to congenital malformations, hypermobility syndromes, and abnormal patterning and movements within the scapulothoracic joint.[12]

An anterior displacement is much more common and less life-threatening than a posterior displacement. As noted earlier, there are many crucial vessels lying directly posterior to the SCJ which can cause a potentially fatal event if a dislocation were to happen in a posterior direction.[13] For those with anterior SCJ injuries, pain is experienced with posteriorly directed forces onto the medial end of the clavicle, shoulder horizontal adduction, and resisted overhead shoulder movements with flexion and/or abduction.[14] These motions cause pain primarily because it compresses the articulation between the sternum and clavicle as well as places the SCJ in a vulnerable position for subluxation or dislocation.[15] By having these motions limited by pain, a patient may be negatively affected with performing work activities, activities of daily living (ADLs), and have high amounts of pain with actions like opening doors, dressing, and bathing. The physical presentation with an anterior displacement injury is a swollen and painful gross deformity consisting of a protruding lump at the joint between the sternum and clavicle.[16] The most common complications after SCJ injury in traumatic and atraumatic cases are sternoclavicular joint arthritis and a visible cosmetic deformity.[17]

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Figure 2. Illustration of the Figure-of-Eight Reconstruction Technique

This image is an illustration showing an example of a common SCJ surgical intervention utilizing the figure-of-eight reconstruction technique, typically performed with a tendon autograft.[14] Image obtained from doi: 10.1177/0363546513498990

A patient with SCJ instability, subluxations, and even dislocations can be managed in a few different ways. The deciding factors usually depend on the severity of the instability, frequency and direction of the displacement, and the limitations in lifestyle the injury is causing the patient. There isn't a determined method that is better than another due to the infrequency of the injury and the lack of studies that observe long-term results. Dislocations seen by a physician

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within 7-10 days of the injury can be treated with surgical methods before utilizing physical therapy interventions.[16] Surgical methods include open or closed reductions as well as anterior SC ligament reconstruction using figure-of-eight reconstruction techniques with a variety of autograft tendon options[18-20] (See Figure 2.), fixation of the sternoclavicular (SC) and costoclavicular (CC) ligaments with K-wires[21,22], CC ligament reconstruction with autografts[23-25], and medial end resection arthroplasty[26,27]. With patients who received surgical interventions, the rehabilitation protocol has more detail. After surgical intervention, patients may go through a period of immobilization in a sling.[6,28] Once able to begin therapy after surgery, the primary goal is to maintain ROM within its available range. Gentle pendulums are given as an exercise with caution of avoiding active flexion and abduction over 90º.[27] No abduction or significant motions affecting the SCJ is allowed for 6 weeks.[29] Once the surgical patient is cleared according to surgeon requirements, the strengthening program focuses on the surrounding shoulder musculature, like deltoids and trapezius due to its role in dynamic stabilization.[30] A return to full activities and/or sports are allowed around 12 to 16 weeks post-surgery.

Unfortunately, there is a gap in the research on interventions for approaching SCJ injuries in a conservative, non-operative route. With the nature of a SCJ injury and the supporting ligaments having potential of having been injured, the chances of re-subluxation occurring frequently are possible. Patient should avoid any activities that cause symptoms of pain or discomfort in the sternoclavicular joint region. They are also recommended to apply moist heat, perform gentle strengthening exercises for the shoulder, and were encouraged to return to unrestricted activity as tolerated.[6] Another conservative, non-operative method

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approach that has been tested out is the “wait-and-see” policy that is based off masterly neglect to see how the injury heals without any intervention.[27]

Most research articles that approached SCJ injuries with non-operative, physical therapy management had positive outcomes with minimal activity and lifestyle restrictions post-intervention.[6,10,15,31] Some patients did report intermittent episodes of SCJ subluxations, but with decreased overall pain of the subluxations.[6] It was also found that patients who had non-operative management of SCJ injury were overall happier with the results in comparison to patients with surgical interventions due to the post-operative complications. Surgical SCJ intervention complications may include, infection, like osteomyelitis, development of frozen shoulder, increased pain, persistent instability, visible scar, limitations in activity, migrating hardware, arthritis, recurring dislocations, and muscle weakness.[2,12]

The focus for this case study is on atraumatic anterior subluxations of the SCJ. The goal is to find conservative treatment methods that maintain ROM, progress strength, and improve overall performance of activities of daily living with a decreased chance of re-injury. This will lead to greater depth of knowledge into the treatment of SCJ and better clinical outcomes.

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CHAPTER II

CASE DESCRIPTION

The patient was a 63-year-old female presenting to an outpatient hospital physical therapy clinic in the rural Midwest. The patient worked as a gas station attendant in the same town as the clinic. She lived 13 miles out of town in a smaller rural community with her husband and two dogs. The patient had their own personal transportation and was able to attend therapy sessions biweekly, weather permitting. This case involves an injury that occurred while at work, resulting in the patient not working during the episode of care and receiving worker's compensation insurance coverage.

The patient was re-stocking the refrigerator when the injury occurred. The mechanism of injury (MOI) involved lifting a case of beverages with an outstretched and elevated arm. The patient felt a "pop" at the junction between the medial clavicle and sternum with immediate pain and a visible deformity in comparison to the contralateral sternoclavicular joint. The physician declared the patient did not need any operative interventions for the injury and did not place the patient on an immobilization protocol due to the increased risk for negative effects to the shoulder. A study looking into the effects of shoulder immobilization on participants and their daily physical activity determined that the overall activity of healthy individuals is negatively impacted, and sedentary behavior is increased.[32] The use of immobilization may also cause shoulder stiffness, which in turn may cause a decrease in shoulder ROM, thus causing increased difficulty with ADLs and functional mobility.[33] The patient was prescribed diclofenac (Voltaren) 1% topical gel as needed for pain.

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At the initial evaluation, the patient reported crepitus at the SCJ with movement. Using the Visual Analogue Scale (VAS) to rate pain, 0 = no pain and 10 = worst imaginable pain, the patient shared she had been experiencing 10/10 pain, causing headaches and nausea. The pain was waking her up three to four times a night. Moments of increased pain occurred with dressing and work activities. The patient complained of the most pain with specific movements into horizontal adduction and horizontal abduction. The patient reported difficulty with sleeping and completing ADLs such as: walking her dogs, typing on a computer, cleaning the house, getting dressed, and showering. She also had more difficulty with any pushing and pulling actions including opening and closing doors.

Figure 3. AP View Radiograph of Right Clavicle

This image is an AP view radiograph of the patient's right clavicle. Image obtained via patient consent for release of EMR imaging.

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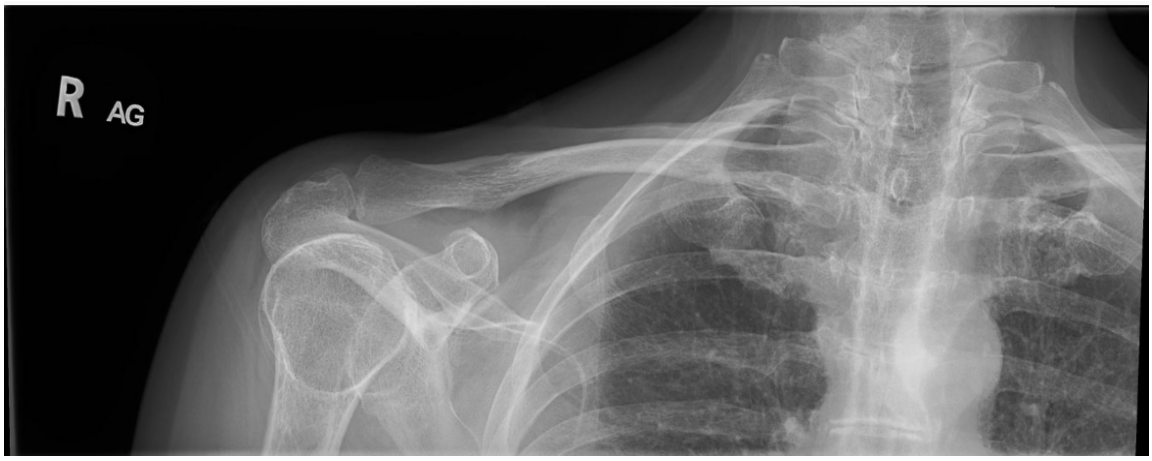
Figure 4. PA View Radiograph of Right Clavicle



This image is a PA view radiograph of the patient's right clavicle. Image obtained via patient consent for release of EMR imaging.

Imaging in the form of radiographs was obtained before the initial examination and evaluation. The images were reviewed by the SPT and PT prior to the first visit via patient electronic medical record (EMR). (See Figure 3 and 4.) The radiologist findings stated, "no acute fracture or dislocation, with no significant soft tissue swelling. There was minimal acromioclavicular osteoarthritic changes and mild osteophyte formation within the GH joint." The overall impression of the two radiograph views was that there was no acute abnormality in the SCJ.

The patient was a 5'5", 129-pound, right-hand dominant female with a past medical history including scoliosis, chronic neck pain, cervical radiculopathy, controlled hypertension, and ongoing vertigo. The past medical history was important due to scoliosis causing a deformity within the skeletal system, causing a potential increase in risk for asymmetrical instability. This was important to note as dislocations of the SCJ may occur with congenital abnormalities of the

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bony anatomy due to the disruption of connecting joint surfaces.[34] The patient was an active smoker prior to and throughout the episode of care. In a systematic review[35] looking at the effects of smoking on the musculoskeletal system, there was evidence of adverse effects on all muscles, tendons, cartilage, and ligaments. There was also clear evidence of smokers being associated with an increased risk of lower bone mineral density, increased risk for fracture, increased joint disease, poor functional outcomes, and poor therapeutic responses.

Examination

The patient attended the physical therapy initial evaluation 10 days after the physician appointment. Upon arrival to the clinic, the patient completed the Shoulder Pain and Disability Index (SPADI) as a functional outcome measure. The SPADI has been shown to be acceptable for research and clinical use. A systematic review has shown the relative reliability of the SPADI is excellent with an ICC of > 0.85.[36] The absolute measurement errors, Standard Error of Measurement (SEM) and Minimal Detectable Change (MDC), are higher for the SPADI in comparison to other commonly used shoulder disability questionnaires, like the American Shoulder and Elbow Surgeons Standardized Shoulder Assessment (ASES) and the Disabilities of the Arm, Shoulder, and Hand (DASH). Average SEM for the SPADI is 6.8 and the average MDC 95% CI for the SPADI is 18.[37] The Minimal Clinically Important Difference (MCID) range for the SPADI is 8-13.2.[38] It has been concluded the SPADI is reliable, valid, and responsive across several pathologies involving the shoulder, including nonsurgical pathologies.[36] The patient scored a 44/50 or 84% on the pain portion and 41/80 or 51% on the disability portion. Total SPADI score was 85/130 or 64% for pain and disability combined.

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Table 1. Manual Muscle Testing of the Right and Left Shoulder.

Shoulder Motion	Right	Left
Flexion	3+/5, painful	4+/5
Abduction	3+/5, painful	5/5
External Rotation	3+/5	5/5
Internal Rotation	4+/5	5/5

Figure 5. Patient Clavicle Deformity on the Right

This image is a photo of the patient's right clavicle on the day of injury, which was taken prior to physical therapy evaluation. Image Obtained by patient with consent for use.

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The evaluation of the patient discovered active range of motion (AROM) to be within functional limits (WFL), but painful on the right side with shoulder flexion and abduction. The patient also had pain with passive range of motion (PROM) into the same shoulder motions. Manual muscle testing (MMT) presented with asymmetrical strength within the shoulders and with pain. (See Table 1.) Other clinical tests that were performed include joint play, which was painful and noted to be more mobile than the contralateral SCJ during mobilizations of the joint posteriorly, anteriorly, superiorly, and inferiorly. Palpation was tender on the right SCJ and along the medial half of the clavicle. Observation of the joint displayed a visible deformity comparing medial collarbones and localized swelling on the right. (See Figure 5.) The deformity was more noticeable in sitting and standing and less in supine.

Evaluation, Diagnosis, and Prognosis

The examination of the patient displayed weakness in the right upper extremity (UE) and painful ROM. She also had a grossly apparent deformity of the SCJ that appeared stable. The patient's primary goal for physical therapy was to decrease the visible deformity. To address this patient goal, the physical therapist recommended the patient see a chiropractor for a consultation to assess the joint and investigate reducing the displaced joint, if deemed fit. The patient returned to physical therapy without success and in increased pain from the chiropractor's attempt.

The patient was medically diagnosed with a right sternoclavicular joint ligament sprain. The physical therapy ICD-10 diagnosis codes used were S23.420D - Sprain of sternoclavicular (joint) (ligament), subsequent encounter, M25.511 – Pain in right shoulder, M62.81 – Muscle weakness (generalized), and R29.3 – Abnormal posture. Due to the nature of this injury and

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being cleared by a physician and radiologist, the physical therapy examination results deemed her an appropriate candidate.

The goals for therapy were to decrease pain, swelling, and allow the patient to return to work and perform ADLs without pain or limitation. Short term goals were for the patient to be independent with her home exercise program (HEP) within one to two weeks. Long term goals were for the patient to have decreased pain at worst a 5/10 for improved sleeping capability, improved MMT of right shoulder flexion and abduction to be 4/5 or better to have less difficulty with dressing, and for the patient to be able to complete right shoulder AROM in all directions with no pain to have less difficulty with ADLs, like typing on the computer. All goals were to be met in four to six weeks. To achieve these goals, the patient was educated on the suspected injury and the plan of care. The plan of care set in place was for the patient to be seen one to two times per week for four to six weeks for therapeutic exercise, neuromuscular re-education, therapeutic activities, patient education, and modality use, as needed. The prognosis for this patient was expected to be "good" based on examination findings. The factors that helped determine the good prognosis was the patient not having a prior history of this type of injury, her relatively young age, the consideration that she was working full-time prior to the injury and was previously an active individual. Even though prognosis was expected to be good, there were some factors considered that could have potentially limited her progress. The limitations included her current history of cigarette smoking, personal life stress, and possible issues that arose with worker's compensation insurance coverage.

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CHAPTER III

INTERVENTION

The interventions chosen were based on the problem list of the patient during the initial evaluation. Goals of the intervention methods were to address pain, maintain ROM, and strengthen the posterior trunk muscles and the musculature that support the shoulder complex. Due to the lack of research on effective conservative treatments for spontaneous anterior SCJ subluxations, there are no specific protocols for therapeutic interventions when treating this type of injury. The sternoclavicular joint is unique, so there are no strengthening exercises directly at the joint, thus the attention on the surrounding joint, especially the shoulder. As found, abnormal patterning and movements within the scapulothoracic joint can cause atraumatic SCJ disorders.[12] Due to the patient having frequent bouts of vertigo that required benign paroxysmal positional vertigo (BPPV) treatment, interventions were modified. The patient was uncomfortable with laying down on the bed as she was fearful of triggering her vertigo. Modifications that were made were altering exercises that are typically performed in supine, prone, and side lying and having the patient in an upright position of standing or sitting. Exercises that were modified into an upright position were prone “I”s which are shoulder extension, “Y”’s which are shoulder flexion, and “T”’s which are scapular rows that use gravity and free weights to challenge the posterior musculature, side lying external rotation that target the rotator cuff muscles, and supine passive and active-assisted ROM.

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Interventions were performed twice a week during a 30-minute appointment time unless external factors affected frequency or duration of appointments. Outside of the intervention sessions, the patient was provided with a home exercise program (HEP) and was to perform it one to two times per day, seven days a week. For each exercise in the HEP, the patient was to perform one to three sets of 10 repetitions. (See Appendix 1.) The adherence to the assigned HEP was minimal to poor with the patient admitting low compliance. Throughout therapy sessions, exercises were modified according to current symptoms and the patient's personal reporting of their physical response to the previous session. At the initial evaluation, the patient was provided with non-weighted AROM exercises and Codman's exercises to assist with pain management. The patient was educated to perform the exercises twice per day, seven days a week. At the follow-up visit, the patient had a severe case of BPPV that intervened with treatment for this episode of care. The patient was treated for her vertigo and therapeutic exercises for the episode were rescheduled to the next visit. By the third visit, the patient was feeling better as the pain had settled more, allowing for introduction of gentle moist heat prior to the session, a warmup with pulleys, and light resistance exercises with a TheraBand. By visit six, the patient received a new HEP of performing standing shoulder internal and external rotations using a TheraBand, to be performed one time per day with three sets of 10. The use of Kinesiotape was introduced at visit six after the patient emphasized continued difficulty with pain during overhead movements and ADLs. Dumbbells were incorporated into therapy sessions during visit seven to continue increasing resistance during exercises. At visit 14, the patient had expressed her lack of compliance with her HEP due to the way her house was designed, so she was provided with alternate options of performing isometric contractions or using dumbbells at home instead of her TheraBand. Upon the 18th visit in which the patient was discharged,

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exercises were being performed proficiently with an increase in dumbbell weight and number of sets and reps. The patient had become competent with Kinesiotape application as well.

Figure 6. Standing "I"'s with TheraBand

This image is an example of a patient performing standing "I"'s with a TheraBand.

Image obtained from: hep2go.com

Therapeutic exercises were performed in an upright position, either sitting or standing and utilized TheraBand resistance bands and dumbbells, approximately one to four pounds. All therapeutic exercises were documented and detailed by each visit with progressions of HEP, resistance, as well as sets and reps. (See Appendix 1.) Some of the resisted exercises performed with TheraBand and dumbbells were scapular rows, standing "I"'s, unilateral and bilateral external rotations, internal rotations, shoulder flexion, shoulder abduction, biceps curls, overhead presses, and triceps kickbacks. (See Figure 6 for Standing "I"'s with TheraBand.) The stretches utilized in this episode of care were 90/90 corner pectoralis stretches, upper trapezius stretches,

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sternocleidomastoid stretches, and scalene stretches. The exercises during sessions were mostly consistent, but each session would either focus on maintenance of current progress, or progressing the patient by increasing resistance/weight or sets/reps.

The first passive intervention method that was used starting at visit three was gentle moist heat via hot pack which was applied at the beginning of each session. The second passive intervention method that was used started at visit six was Kinesiotape (KT) which was initially applied at the end of each session before the patient left, but around visit 12 the KT was being applied at the beginning before exercises. The patient became skilled in applying the KT herself, so by visit 15, she did not need assistance with application during therapy sessions. The use of cryotherapy via cold packs were utilized at the initial evaluation to assist with pain management as it is an appropriate passive modality for acute injuries.[39] Cold packs provide an analgesic effect on acute soft tissue injuries, but after the immediate injury phase, prolonged application of cold therapy has been found to delay the start of healing, thus lengthening the recovery process. In replacement of cold pack, gentle heat via hot pack was utilized before each session as it was recommended in conjunction with shoulder strengthening exercises for patients with a SCJ injury.[15]

The incorporation of KT was chosen to provide extra assistance with support and pain management to the patient while not at the clinic. In a systematic review looking at the efficacy of Kinesio taping in treatment of shoulder pain and disability,[40] the combination of KT plus exercise versus exercise alone resulted in a significant reduction of pain at rest with the following results: standardized mean difference (SMD) of -0.50, a 95% confidence interval (CI) of -0.95 to -0.06, and a P-value of 0.03.[41-43] Other studies within the systematic review looked at the functional outcome measure, the SPADI. For shoulder disability, two studies used the

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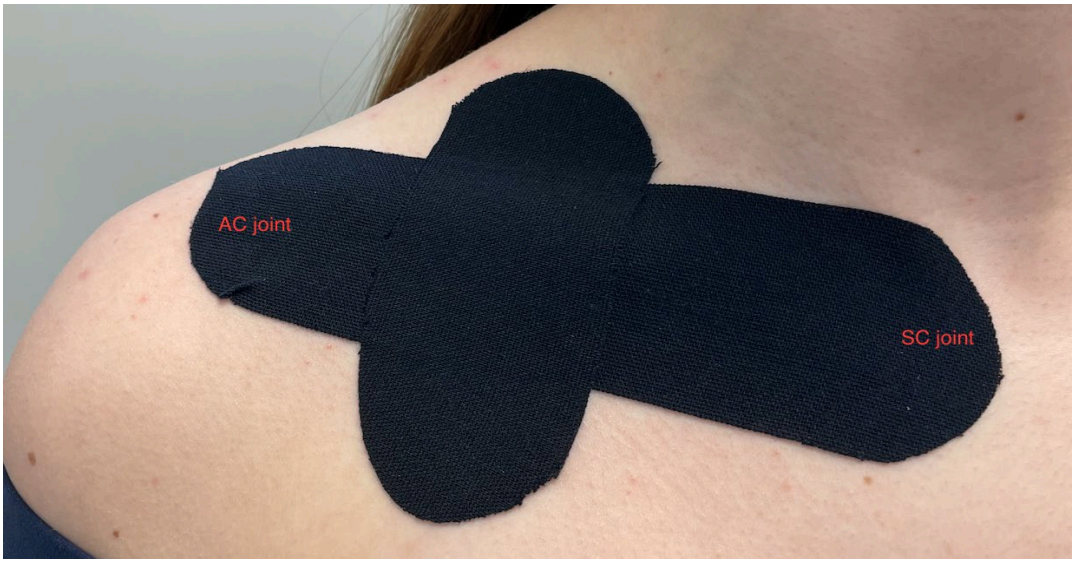
SPADI.[41,43] It was found that pain and disability decreased significantly in patients who had kinesio taping plus exercise. For shoulder pain, SMD was 1.32, 95% CI was 0.63 to 2.01, and P-value was < 0.01. For disability, SMD was 0.77, 95% CI was 0.13 to 1.42, and P-value was 0.02. But there was no significant difference seen in the total SPADI score. With a combination of the Egypt[41] and Korea[42] studies of participants involved in kinesio taping plus exercise versus exercise alone, the SMD was -0.50 and the 95% CI was [-0.95 to -0.06]. Heterogeneity found I^2 = 0% and p = 0.73. The test for overall effect was z = -2.20 (p = 0.03). Overall, the study findings encouraged the combination of utilizing KT alongside therapeutic exercise for treating shoulder pain and disability for patients.

Figure 7. KinesioTape Application Method



Application method applied to patient to support SCJ. Image obtained from personal record.

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The patient responded well after the first application of KT, reporting decreased pain and greater ease with ADLs. The method of taping that was used addressed the mechanics of the SCJ and the fascia and ligaments surrounding the joint. The concept behind this directional decision was based off the patient having most pain with overhead and horizontal adduction movements. The taping method was done by applying a strip approximately the length of the patient's clavicle from the SCJ moving laterally towards the AC joint with a 50% stretch. This provided a horizontal abduction pull and provided some resistance into horizontal adduction as most patients with anterior subluxations have increased pain with motions into horizontal adduction. The second strip was applied in the mid-point between the SC and AC joint with a pull going superiorly towards the upper trapezius to assist with the rotational component with overhead motions with a 50% stretch. (See Figure 7.) The patient purchased her own KT for use at home and was educated on the application techniques and the signs and symptoms of any negative side effects, like skin irritation due to an allergy from the adhesive.

Re-examination was performed at the 10th visit and at discharge to assess patient progress and determine if more sessions were to be requested. Re-examination focused on pain with ROM and MMT strength as well as pain associated with resisted movements. At this visit, goals that were created on the day of evaluation were assessed and revised. By the 10th visit, the patient had expressed sincere enjoyment with the use of KT for her pain management and better ease with ADLs. The patient began to plateau in strength progress from the 10th to the 18th visit. Re-examination at the 18th visit in which she was discharged, focused primarily on strength in the form of MMT as this was one of her last goals to be met. The patient also completed a final SPADI functional outcome measure to see the patient's progress during this episode of care.

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CHAPTER IV

OUTCOMES

The outcomes for this patient were positive but left room for more progress due to the difficulty with patient HEP compliance. She had reported her house layout was difficult to use the TheraBand on doors. To address this issue, the patient was provided with alternate methods for performing the HEP exercises to target the same musculature, while still considering her preference of staying upright. Alternate methods for performing the exercises were to use dumbbells instead of the TheraBand or performing isometric contractions with her arm on the wall and a towel providing cushioning between the two. The patient continued to share at sessions that she could be doing a better job at home doing her HEP more often as well. The objective and subjective measures used throughout the episode of care helped determine the effectiveness of the physical therapy intervention. Objective measures that were frequently re-assessed were strength via MMT. Subjective measures that were consistently re-assessed were patient rating of pain and personal report on the functional outcome measure used for this patient, the SPADI.

Comparing the objective measure of strength testing in the form of MMT was completed on initial evaluation day, the 10th visit, and upon discharge. (See Table 2.) While strength had not significantly improved throughout the episode of care, the patient's pain associated with resisted movement dissipated. Comparing the subjective measure of patient rating of pain was assessed each session, whether it was scored using the VAS or verbally described as "better", the "same",

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or "worse". The VAS was scored specifically on the initial evaluation, 10th visit, and upon discharge. (See Table 3.)

Table 2. MMT Scores of Initial Eval, 10th Visit, and Discharge.

Shoulder Motion	**R UE (Initial Eval)**	**R UE (10th Visit)**	**R UE (Discharge)**
Flexion	3+/5, painful	3+/5	4-/5
Abduction	3+/5, painful	3+/5	4-/5
External Rotation	3+/5	3+/5	4-/5
Internal Rotation	4+/5	4+/5	5/5

Table 3. VAS Pain Ratings at Initial Eval, 10th Visit, and Discharge.

Pain Rating	**Initial Eval**	**10th Visit**	**Discharge**
VAS RANKING (0-10)	7/10 (Best) 10/10 (Worst)	4-5/10 (Best) 8/10 (Worst)	0/10 (Best) 4/10 (Worst)

The patient also completed the SPADI functional outcome measure at the initial evaluation and upon discharge. (See Table 4.) Comparison of the patient's functional outcome measure from initial evaluation to discharge, the patient had a final SPADI pain scale improvement of 22 points, or 30% and a 19 point, or 23.5% improvement in the disability scale. Overall total SPADI score improvement was 36 points or 26%. From the scored improvement,

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pain and disability of the patient's shoulder decreased. The MCID is 8-13.2 points and the patient surpassed that by almost double in each category.[44]

Table 4. Functional Outcome Measure Score at Initial Eval and Discharge.

SPADI Outcome Measure	Initial Eval	Discharge
Pain Scale	44/50 (84%)	22/50 (54%)
Disability Scale	41/80 (51%)	22/80 (27.5%)
Total Score	85/130 (64%)	49/130 (38%)

The goals that were to be met by discharge in four to six weeks included independence with HEP, worst pain to 5/10, MMT of the R shoulder to 4/5 or better, and for the patient to be able to perform AROM in all directions with no pain. Almost all goals were met, except the MMT scoring 4-/5 on the day of discharge from outpatient therapy services. Reasons for not meeting goals could be due to the patient's questionable compliance with her HEP, the patient's strength prior to the injury, and any pain that was limiting the ability to increase resistance during earlier intervention appointments.

The patient tolerated all sessions very well. The patient was able to finish each session with no increase in pain at the end, even if some exercises were somewhat irritating. The patient also did not have any instances of instability within the clinic and in her daily life throughout the episode of care. The patient returned to work towards the end of the episode of care at a new job. She made the decision to find a new job due to personal choice and personal difficulties with the management of her previous job. The position she had was less physically demanding pertaining

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to overhead actions. The patient had reported that she did not feel limited by the injury with beginning her new job. The patient reported she felt successful with independent application of Kinesiotape on her own, thus helping her be more independent at work and at home as this decreased her pain significantly. The patient was encouraged to remember precautions associated with her injury and was instructed to maintain the shoulder strengthening dumbbell resistance exercises. By the date of discharge, the patient expressed her personal feelings of having been successful with physical therapy and having greater ease with performing ADLs without pain. Discharge was decided by therapist-patient discussion and the plateau of progress. She felt as though she received the most out of what physical therapy could offer her and agreed with the plan to discharge. Upon discharge, the patient was encouraged to continue performing the exercises that were in her HEP to build upon her progress and decrease her chances of re-injury. She was instructed to perform the HEP exercises three times per week with four-to-five-pound dumbbells emphasizing strengthening.

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CHAPTER V

DISCUSSION

This patient's case was challenging due to the uniqueness of the diagnosis and the limited amount of research for conservative treatment. With the base knowledge of the anatomy and biomechanics of the SCJ and the generalized treatment of strengthening and pain management, interventions used were based off patient response during each session. The episode of care utilized interventions like therapeutic exercise to strengthen the scapular stabilizers and muscles surrounding the shoulder joint as cited in other research articles.[15] Specific exercises were decided by the therapist as most research articles did not have clear instructions for exercise performance and repetitions for said exercises. Other interventions used were modalities, like hot pack and Kinesiotape to provide pain management for the patient. A HEP was assigned to the patient throughout the plan of care and was expected to be performed once a day. (See Appendix 1.) The patient responded well to the interventions chosen and was able to meet all but one goal, which was to score 4/5 or greater in MMT of the shoulder.

The biggest improvements were the patient's subjective reports of pain perception, ability to perform ADLs, and the SPADI functional outcome measure score surpassing the MCID of 8-13.2 points. The patient came to the PT initial evaluation rating 7/10 best pain and 10/10 worst pain and was able to achieve 0/10 best pain and 4/10 worst pain by discharge. (See Table 3.) The patient was having difficulty with ADLs upon initial evaluation day, specifically with typing on her iPad, working, and walking her dogs. By discharge, the patient was able to perform all ADLs without pain or restriction. Lastly, the patient completed a functional outcome measure, the

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SPADI, and at the initial evaluation scored an 85/130 (64%) limitation with pain and disability. By discharge, the patient scored a 49/130 (38%) limitation with pain and disability. (See Table 4.)

While some research articles encourage conservative treatment involving exercise and strengthening,[2,6] another research article encouraged patient education and a "wait-and-see" policy.[15] The only modification of the "wait-and-see" policy was if a patient began to lose passive ROM, they were provided with stretching exercises. Between research that encouraged a wait-and-see policy as well as generalized "shoulder strengthening", it was found that patients with atraumatic anterior SCJ subluxation reported mild to no pain and little to no disability with ADLs at the end of the episode of care.[15] Most patients with SCJ injuries that were treated conservatively concluded their intervention with physical therapy reporting good ROM and strength, but still experienced a significant difference on the affected side with ROM and strength in comparison to the unaffected side. There were instances of patients with negative conservative treatment outcomes, but that was more likely to occur for patients with strenuous working conditions that demanded continuous manual labor. As stated in previous chapters, patients with operative treatments typically report more unsatisfying results due to complications of surgery like scarring, persistent pain, and instability, as well as limitations with ADLs.

Since SCJ pathologies are rare, there are no standardized tests or questionnaires for correctly evaluating and measuring aspects of atraumatic SCJ injuries. One study did find that utilizing the Nottingham Clavicle Score (NCS) was most appropriate for accurately measuring and reflecting upon atraumatic SCJ pathology.[15] Future studies could focus on more in-depth research or development for functional outcome measures specifically sensitive to SCJ injuries as well as other intervention methods in the means of exercises, modalities, immobilization, and

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whether the "wait-and-see" policy is better than another protocol, like the generalized shoulder strengthening and pain management techniques that were used for this case. Limitations regarding this specific case include patient PMH involving bouts of vertigo, which affected the intervention methods chosen, the frequency of therapy visits, personal life stressors, instances of worker's compensation insurance coverage, and lack of patient HEP compliance. Other limitations outside of this case is the lack of research and specific protocol for SCJ injuries, so there is no list of exercises patients must perform to guide them through physical therapy intervention. Due to the variety of limitations within this case study, future research is needed.

REFLECTIVE PRACTICE

For future cases involving pathology of the SCJ, additional examination procedures to be considered are, questions pertaining to past experiences with localized or generalized hypermobility of the patient, MMT of the remaining UE movements, especially the horizontal abduction and horizontal adduction of the shoulders, and mobility of the scapulothoracic joint for a more in-depth understanding of the other joints that may be involved. Adjustments to the plan of care that could be made are interventions pertaining to strengthening the core as it has been found to provide a stable base and assist with the development of force between the scapula and arm. Scapular positioning and motion deficits are associated with shoulder injuries, so addressing these weaknesses outside of the GH joint and SCJ will allow for patients to be treated as a whole, versus treating the specific area of injury.[45] Having the ability to utilize training against gravity would also be a new avenue for exercise interventions if patients do not have a preference of being horizontal over being vertical for an increased challenge of training in multiple planes of movement.

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The physical therapist encouraged the patient to visit a chiropractor for the visible deformity, but after the unsuccessful and painful experience the patient had, this would most likely be avoided in future cases. As the patient's injury was non-reducible and having a visible deformity is part of the diagnosis, the chiropractor may not have been a useful tool in assisting with this specific case. Utilizing or referring to a physician and/or orthopedic specialist within 7-10 days of the injury, if not sooner, is encouraged in the case of an injury that could benefit from reduction. (See Appendix 2.)

Since there is no current evidence for what protocol may be best for treatment of atraumatic SCJ injuries, it's important to consider the cost and benefit for receiving skilled physical therapy treatment for this diagnosis. In this article, the patient received 19 visits, including the initial evaluation. The average cost per patient visit included two units charged for therapeutic exercise, which was approximately $220 per visit at the specific outpatient hospital clinic the patient was attending. Total cost for the entire episode of care was $4,365 including the initial evaluation. As some clinics are transitioning to cash pay, patients sometimes receive discounts for paying with cash as they do not have to go through insurance companies. This hospital utilized insurance and for this specific episode, the patient was being covered by worker's compensation insurance due to this injury happening at her place of work. Workers' compensation covers 100% of 10 visits or 60 days of treatment, whichever comes first. Since an additional 10 visits were requested at the 10th visit progress note and worker's compensation insurance confirmed the additional 10, the patient continued to be 100% covered for the extra visits. Final cost for the patient was $0 and the third-party payer of worker's compensation insurance paid the full amount listed above. Now, considering the total cost of the episode of care and if the patient had to hypothetically pay that amount, it's important to consider the

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benefits for the patient receiving skilled PT intervention. Benefits that are found with skilled PT intervention for atraumatic SCJ injury is decreasing pain, educating the patient about the specific pathology and how to prevent re-injury, improving quality of life (QOL), maintaining independence with ADLs, as well as assisting the patient to return to work without limitations.

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Appendix 1. Episode of Care Therapy Sessions

Visit #1 Initial Evaluation	- Codman's with a cane x 10 - Seated Scapular Retractions x 10 - R elbow AROM flexion/extension x 10 - Seated cervical side bends x 10 - Corner pectoralis stretch x 3 x 10 second holds - Cold pack x 5 minutes to R clavicle HEP of the above exercises were assigned with a handout to be done twice daily.
Visit #2 Follow-up Visit	The patient had complaints of severe vertigo this session interfering with SCJ treatment. Benign Paroxysmal Positional Vertigo (BPPV) treatment was provided. She was unable to tolerate this causing nausea. This treatment session did not have any exercises for this episode of care.
Visit #3	- Hot pack x 10 minutes to R clavicle - Pulleys x 5 minutes into shoulder flexion, scaption, and abduction - Reviewed HEP exercises given at the initial evaluation - Standing shoulder strengthening of resisted flexion (FLEX), abduction (ABD), extension (EXT), adduction (ADD), external rotation (ER), and internal rotation (IR) with red TheraBand (TB) x 10 each
Visit #4	- Hot pack x 10 minutes to R clavicle - Pulleys x 5 minutes into shoulder flexion, scaption, and abduction - Green TB 2 x 10: standing scapular rows, standing I's**, R elbow extension - R elbow flexion with 5#* dumbbell (DB) 2 x 10 - Green TB x 10 each: Standing shoulder resisted FLEX, EXT, ADD, ABD, ER, IR
Visit #5	- Hot pack x 10 minutes to R clavicle - Pulleys x 5 minutes into shoulder flexion, scaption, and abduction - Green TB x 10: standing scapular rows, elbow extension pull downs, ER, IR - Corner 90/90 pectoralis stretch x 4 x 15 seconds each - Wall push-plus for serratus anterior x 10 - Seated shoulder FLEX, ABD, and scaption with 1# DB x 15 each
Visit #6	- Hot pack x 10 minutes to R clavicle - Pulleys x 5 minutes into shoulder flexion, abduction, and scaption - Seated scapular retractions x 10 - Green TB x 10: standing scapular rows, elbow extension pull downs, ER, IR - Corner 90/90 pectoralis stretch x 30 seconds

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	- Seated bilateral ER pull apart*** with green TB x 10 Introduced KinesioTape (KT) at the end of this session^ New HEP assigned with standing ER/IR using green TB 3 x 10. To be completed one time daily.
Visit #7	- Hot pack x 10 minutes to R clavicle - Seated scapular retractions x 10 - Corner 90/90 pectoralis stretch x 2 x 30 seconds - Green TB x 10: standing scapular rows, elbow extension pull downs, ER, IR, seated bilateral ER pull apart - 2# DB x 10: Seated shoulder FLEX and ABD - KT applied
Visit #8	- Hot pack x 10 minutes to R clavicle - Seated scapular retractions x 10 - Corner 90/90 pectoralis stretch x 2 x 30 seconds - Green TB x 10: standing scapular rows, elbow extension pull downs, ER, IR, seated bilateral ER pull apart - 2# DB x 10: Seated shoulder FLEX and ABD - KT applied
Visit #9	Patient took a week off therapy and returned for this session to check-in. Increased pain at this visit. - Hot pack x 10 minutes to R clavicle - Cane active-assisted range of motion (AAROM) into shoulder FLEX, ABD, scaption, and ER x 10 each - 2# DB x 10: Seated shoulder FLEX and ABD - Green TB x 10: standing scapular rows, elbow extension pull downs, ER, IR - Passive seated scapular retraction for pectoralis stretch x 2 x 30 seconds - Seated bilateral ER pull apart with green TB x 10 - Upper trapezius (UT), scalene, and sternocleidomastoid (SCM) stretches x 30 seconds each - KT applied
Visit #10 10th Visit Re-Assessment	Reassessed areas of limitations in MMT and ROM of patient during session. - Cane active-assisted range of motion (AAROM) into shoulder FLEX, ABD, scaption, and ER x 10 each - Green TB x 10: ER, IR, scapular rows, and bilateral ER pull apart - 1# DB x 10: shoulder FLEX and ABD - KT applied

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	Requested 10 more visits from worker's compensation insurance to further strengthening.
Visit #11	- Hot pack x 10 minutes to R clavicle - Pulleys x 5 minutes into shoulder flexion, scaption, and abduction - Green TB x 2 x 15: scapular rows, standing I's, ER - 3# DB x 2 x 10: shoulder FLEX and ABD - KT applied
Visit #12	- Hot pack x 10 minutes to R clavicle - KT applied - Green TB x 2 x 10: ER, IR, scapular rows, standing I's - 3# DB x 2 x 10: shoulder FLEX and ABD with bent elbow to 90º, bicep curls, bent over row
Visit #13	- Hot pack x 10 minutes to R clavicle - KT applied - Green TB x 2 x 10: ER, IR, scapular rows, standing I's - 3# DB x 2 x 10: shoulder FLEX, ABD with elbow bent to 90º, bicep curls, and bent over rows
Visit #14	- Hot pack x 10 minutes to R clavicle - Standing isometrics x 10 x 5 second hold: IR, ER - KT applied - 2# DB x 2 x 10: bicep curls, shoulder FLEX, ABD, overhead press, and bent over rows Patient reported she was no longer working at the job where the injury occurred and was looking for a new job. Patient reported having difficulty with performing door TB exercises and was educated on alternate methods while maintaining in an upright position to avoid aggravation of BPPV.
Visit #15	- Hot pack x 10 minutes to R clavicle - Pulleys x 5 minutes into shoulder FLEX and ABD - 2# DB x 10 + 3# DB x 10: shoulder FLEX, ABD, bicep curls, bend over rows, triceps kickback - Green TB x 10: standing I's, scapular rows, ER, IR Patient began new job with less overhead strenuous movements.
Visit #16	- 2# DB x 2 x 10: overhead press, bicep curls, shoulder FLEX and ABD, - 4# DB x 2 x 10: triceps kickback, bent over row

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	- Green TB x 10: bilateral ER pull apart
Visit #17	- Pulleys x 5 minutes into shoulder FLEX and ABD - 2# DB x 2 x 10: shoulder FLEX and ABD, overhead press, bent over row, triceps kickback - Green TB x 10: ER, IR, scapular rows - Corner 90/90 pectoralis stretch x 2 x 30 seconds
Visit #18 Discharge from PT	Reassessed areas of limitations in MMT of patient during session. Patient completed final SPADI functional outcome measure. - Pulleys x 5 minutes into shoulder FLEX and ABD - Corner 90/90 pectoralis stretch x 2 x 30 seconds - 3# DB x 2 x 10: shoulder FLEX and ABD, bicep curls, overhead press, bent over rows, triceps kickback - Green TB x 2 x 10: ER, IR, scapular rows

*(#) – pounds, **(See Figure 5), ***(See Figure 6), ^(See Figure 7)

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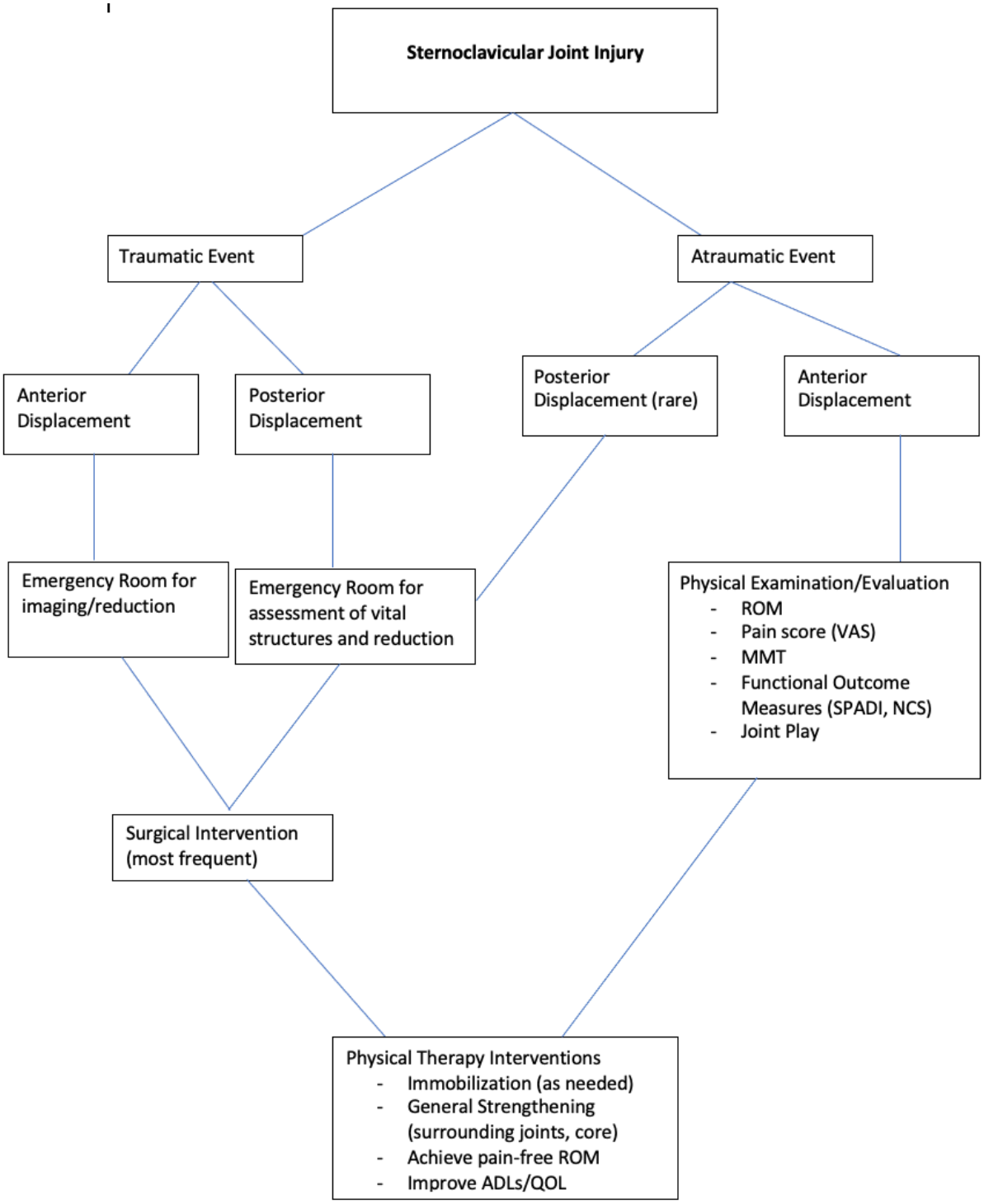
Appendix 2. Physical Therapy Intervention Decision Tree for SCJ Injuries



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