SPORTS CHIROPRACTIC POST-SURGICAL REHABILITATION FOLLOWING TYPE 3 ACROMIOCLAVICULAR JOINT SEPARATION IN AN AMATEUR RUGBY UNION PLAYER: A CASE REPORT

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ABSTRACT

Sports chiropractors are increasingly being sought by professional and amateur athletes to fulfil their sports medicine needs. This paper describes a case of successful chiropractic clinical management of a post-surgical shoulder rehabilitation program.

Case Presentation

A 25-year-old male suburban-districts level (amateur) rugby union player sought assistance from a AICE titled sports chiropractor who was acting in their capacity as a qualified team sports trainer during the match whilst on-field for right shoulder pain and dysfunction following a tackle where he fell heavily onto the point of his right shoulder. Subsequent radiographic and orthopaedic referral identified an unstable acromioclavicular joint dislocation (type III) and reconstructive surgery was performed. Following the surgical procedure, the post-surgical rehabilitation was completed under the guidance of a sports chiropractor. Over a fifteen week period a multimodal management approach was applied in the post-surgical care that included: physical modalities, soft tissue therapy, functional shoulder and spine exercises, spinal and peripheral joint mobilisations and manipulations. Emphasis during management was given to the sports specific functional exercise progressions. Outcome measures at weeks six, nine, fifteen and 21 weeks 18 months post-surgery, recorded patient change and included: the disabilities of the arm, shoulder, and hand questionnaire (DASH), goniometric measures, visual/verbal analogue scales for pain and shoulder muscle strength by manual muscle testing. This case describes the clinical management after surgical repair of the grade three acromioclavicular ligament tear over a 20-week period with a 12-month follow-up and a full return to pre injury status, function and sporting activity. Management was divided into acute, early recovery, late recovery and functional phases of care. Functional goals and advancement criteria are described for each phase of rehabilitation.

Conclusion

This case documents a sports chiropractor's approach to multimodal rehabilitation of a rugby athlete. This paper describes an example of the integration of the sports chiropractor into the sports medicine team and the skill set in assessment and management required of that role.

Keywords: Shoulder, Arcomioclavicular Joint, Rehabilitation, Chiropractic, Spinal, Extremity, Manipulation

BACKGROUND

Acromioclavicular joint (ACJ) sprain is the most frequently encountered shoulder injury in collision sport. Incidence in professional rugby union has been estimated at 2.86/1000 player hours(1). Comparatively incidence of ACJ sprain in professional rugby league is estimated at 4.5/1000 player hours(2), in elite Australian rules football is estimated at 0.7/1000 player hours(3) and for college American (gridiron) football is estimated at 14/1000 athletic-exposures(4). Other college contact or collision sports such as wrestling(5), lacrosse(6, 7) and ice college hockey(8) as well as non-contact amateur sport like golf(9) have described a high prevalence of ACJ injury. The classification of ACJ dislocation described by Rockwood et al(10) lists 6 sub-class of ACJ injury based on the extent or involvement of acromioclavicular ligaments, coracoclavicular ligaments, the deltoid and trapezial muscles and fascia, and displacement patterns of the clavicle. Type III ACJ injury consist of rupture to the acromioclavicular and coracoclavicular ligaments without significant disruption of the deltoid or trapezial fascia, and superior displacement of the distal clavicle (more than the full width of the clavicle) which results in separation of the articulating ends of the AC joint. The most common mechanism of type III ACJ injury is direct trauma were injury forces make primary contact at some point in the shoulder complex(11). Less frequently indirect trauma occurs were force initiated distal to the shoulder complex (typically the hand) is transmitted along the upper extremity to the shoulder region(11). Headey et al has reported on the epidemiology of shoulder injuries in rugby union(1). The severity of new ACJ injury by time lost from sport was found to average 17-days per player with a recurrence rate of 23%. Recurrent injuries demonstrated a greater severity with an average of 21-days per player lost to recurrent injury. Presumedly this reported severity rate accounts for all classification of ACJ sprain with less extensive tissue injury types predominating as it was not specifically stated. The tackle phase of rugby union accounts for 63% of all ACJ injuries(1). When the higher numbers of tackle situations by backs (particularly the midfield and outside backs) are taken into consideration the incidence of tackle related shoulder injury in backs is far higher. Increased exposure time to rugby union appears to be a risk factor associated with shoulder injury(1).

This case reports the successful rehabilitation of a type III ACJ dislocation following surgical intervention. An integrated functional approach to rehabilitation is applied in this case.

CASE PRESENTATION

A 25-year-old male right hand dominant amateur rugby union player (an inside back playing the "five-eight" position) sought chiropractic assistance from an AICE titled Sports Chiropractor who was acting in their capacity as a qualified team sports trainer whilst on-field for right shoulder pain and dysfunction following a tackle where he fell heavily onto his right shoulder. A palpable step deformity was felt at the ACJ below the players shoulder padding and the athlete was removed from the field of play. Observation revealed a high riding deformity of the ACJ suggesting superior migration of the clavicle in relation to the acromion. He rated the pain intensity at this time as 7/10 on a visual/verbal numerical rating scale. Examination revealed increased pain and limited motion on shoulder flexion, abduction and horizontal adduction. Pronounced shoulder hiking was apparent on initiation of flexion and abduction. Other shoulder ranges were painful towards end range. Assessment of upper limb neurovascular status revealed no abnormal findings. As a result, due to the mechanism of injury, lack of neurovascular findings, distinct symptomatic shoulder ROM changes and the accompanying visual findings an ACJ injury was suspected, with the extent of associated ligament disruption to be between a Type III-VI. The athletes' upper limb was braced to minimise gravity induced upper limb tensile load at the ACJ via the use of ice-wrap™. In addition, ice and compression was applied to the athlete's shoulder. The athlete was immediately referred to the local emergency department for radiographic and orthopaedic evaluation. Radiographic evaluation identified ACJ dislocation.

Surgical procedure and management

Surgical evaluation 48-hours later revealed superior-inferior displacement of the lateral clavicle and marked anterior posterior instability, which with cross body manoeuvres produced "a crossover sign". A "crossover sign" is a painful adduction of the involved arm across the body with reproduction of pain at the ACJ.(12)

Following radiographic and orthopaedic evaluation the athlete was advised to undergo right ACJ repair and coracoclavicular reconstruction. At the time of the surgery a complete disruption of the coracoclavicular ligament in-situ was identified along with complete dislocation of the ACJ with stripping of the ACJ capsule from the lateral clavicle and also of the trapezius. Repair involved a sabre incision into a small area of the anterior deltoid and identifying the bony landmarks of the coracoclavicular ligaments. A drill hole was then sited in coracoid at the coracoclavicular ligament insertion: also, within the clavicle the ACJ was then reduced and held with a K-wire, checked with image intensification. An Arthrex tight rope was then inserted and tensioned. Distal strands were then tension banded laterally to the ACJ capsule. This prevents the scapular from falling away from the lateral clavicle. The ACJ capsule was reattached to the lateral clavicle with trans osseous sutures. The anterior deltoid was reattached. Check radiographs were then obtained and the position found to be satisfactory. Post operatively the patient was immobilised in a sling for six-weeks to allow healing of the coracoclavicular ligament and capsule. Post-operative analgesics included non-steroidal anti-inflammatories, and only gentle passive forward flexion and external rotation were undertaken to avoid the

development of frozen shoulder and to minimise any overuse of the effected joint causing surgical interventions to become loosened and ineffective. The patient was viewed two-weeks post-operatively to assess his wound and the patient was then viewed at six-weeks where his sling was removed.

Post-Surgical Chiropractic Management

Six-weeks following surgery, the athlete commenced rehabilitative management with the chiropractor working with the rugby club (first author). Surgeons' instruction indicated the athlete was ready to start passive shoulder forward flexion movements as well as gentle resistance-band external rotation and deltoid forward flexion in the supine position with light weight. Passive shoulder abduction was instructed to be avoided for three-months. The patient management plan and progress were reported to the referring surgeon at monthly intervals until the patient was discharged from chiropractic rehabilitation care. Patient progression was predicated on the patient being able to complete the required range of motion exercises without pain or restriction.

It was stipulated that the orthopaedic surgeon's recommendations were to be followed and that at any time the referring surgeon could modify the rehabilitation program as he saw fit.

Outcome measures recorded at the six, nine, fifteen and 21 week mark as well as eighteen month mark, to monitor patient progress throughout the rehabilitative management include the disabilities of the arm, shoulder, and hand questionnaire (DASH)(13), glenohumeral joint motion(14), pain intensity by way of visual/verbal numerical rating scales and shoulder muscle strength according to Kendal et al(15).

At the initial post-surgical chiropractic assessment, the athlete recorded an initial score of 57 on the general DASH questionnaire and 90.75 on the work/sport/performing module (Table 1).

The athlete demonstrated a mildly kyphotic posture with slight forward head carriage. Atrophy of the right deltoid, right peri-scapular muscles, rotator cuff, right arm and forearm was present. A vertical surgical scar roughly 4cm long was noted about anterior-superior shoulder with diffuse low-grade paraesthesia surrounding the scar. Reduced skin mobility was noted in this region. Cervical spine active range of motion(12) was limited at end range on left lateral flexion and left side bend but was otherwise full and pain free. Cervical compression and Spurling's manoeuvre(12) were negative for localised or referred pain. Right active shoulder flexion was limited to 80 degrees (Table 2) with pain rated at 6/10 NRS in the supine position, active external rotation in the neutral position supine was limited to 55 degrees with pain 6/10 NRS. Active behind back reach(12) (combined extension, adduction and internal rotation) in the standing position was limited to the L3 spinous level with pain 6/10 NRS.

Resisted glenohumeral external rotation(12) in the neutral position was rated at 3+/5 with pain 6/10 NRS. Upper limb sensation to superficial pain was unremarkable except for a

small region about the surgical scar. At week-7, right-sided glenohumeral accessory joint play of posterior glide was accessed(12) in 30° of abduction, 30° of flexion and 10° of internal rotation. A hard and abrupt end-feel was noted comparatively to the contralateral side(16). Further physical assessment was excluded until nine weeks post-surgery as to not have a negative effect on healing tissues.

Chiropractic Intervention

Acute Phase: Weeks 6-9 post surgery (Figures 1-2)

The athlete attended six chiropractic consultations in the initial three weeks of care and one consultation in the fourth week. Multiple modalities were utilised in consultations to clear soft tissue restrictions including the application of moist heat for 15 minutes and myofascial release techniques (involving longitudinal muscle stripping with active or passive muscle lengthening) to the right infra-spinous fossa, sub-scapular fossa and scalene regions. Glenohumeral passive range of motion (PROM) was performed to tolerance (≤4/10 numeric rating scale) in the directions of forward flexion, external rotation at 0° abduction and internal rotation at 0° abduction was performed with the patient positioned in the supine position. From week 7 onwards passive joint mobilisation (Maitland grade 3)(17) was directed to the posterior glenohumeral joint capsule. No manipulation (Maitland grade 5 HVLA)(18) was performed to the spine or peripheries in the first 3 weeks of chiropractic care. A large emphasis was placed on active care with exercise technique being reviewed at each chiropractic consultation (approximately 30minutes duration). Initially exercises were performed in the supine position to allow for upper limb support during the acute phase of rehabilitation (see Table 3).

The exercise routine for this period (Table 3) consisted of muscle re-education and range of motion (ROM) activity.

This exercise protocol was instructed to be performed twice daily. Emphasise was placed on neutral spine posture in all exercise activity. Exercises were to be performed in a relatively pain free manner. Sparing strategies (i.e. advice on sitting posture and ergonomic workstation setup) to minimise office work stress were implemented(19). The athlete was advised to continue non-exertive activities of daily living and instructed to avoid heavy lifting and vigorous activity until further notice.

Figure 1: Shoulder ROM Acute Recovery Phase

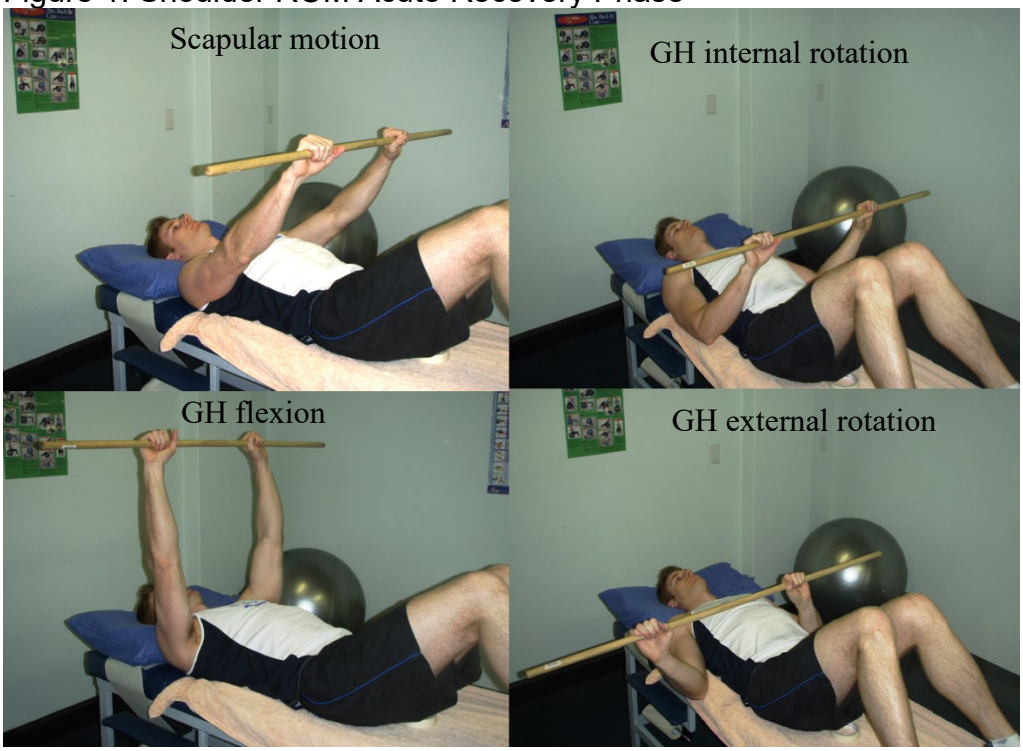
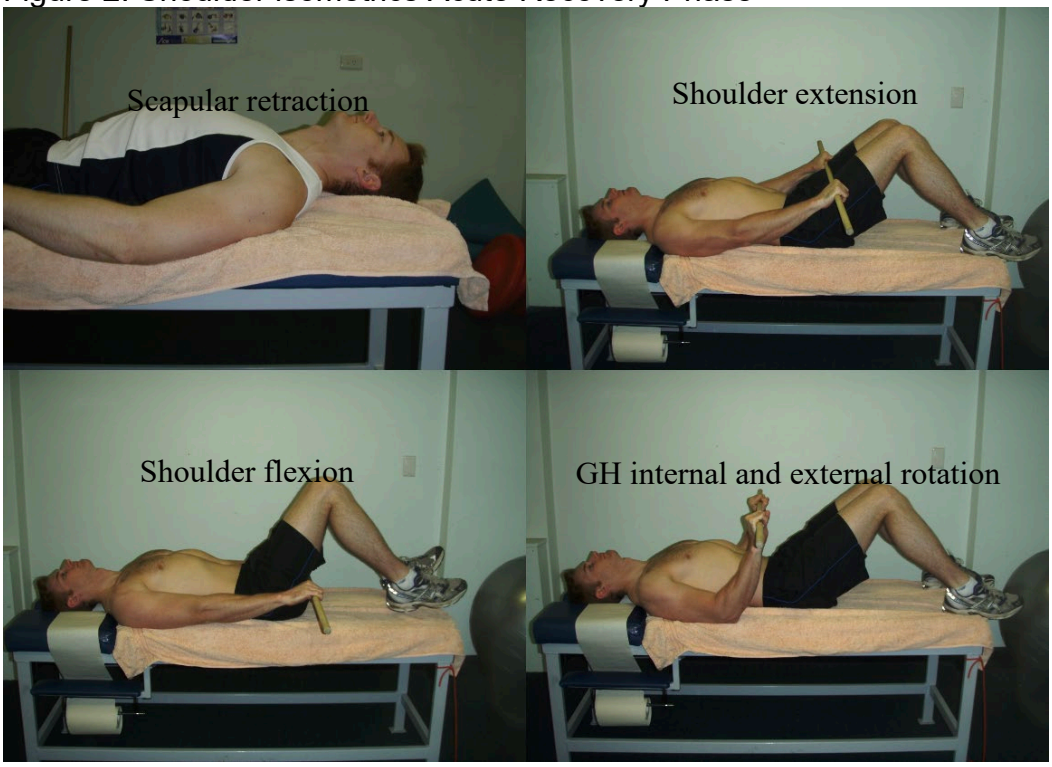


Figure 2: Shoulder isometrics Acute Recovery Phase



Early Recovery Phase: Weeks 10-13 post surgery (Figures 3-8)
The athlete achieved adequate functional progress in the aforementioned goals including supine positioned near full range passive/active assisted glenohumeral motions in flexion and external rotation at 0° abduction at the week 9 chiropractic post-surgical evaluation.

Table 2 indicates objective AROM and strength changes at this time. Additionally, the athlete reported mild diffuse lower cervical (right anterior/supraclavicular and right posterior superior scapular) ache and right posterior shoulder ache 3/10 NRS which was intermittent and cyclical in nature being more predominant in the mornings and post activity. Additional diffuse low grade 2/10 NRS non-radiating mechanical low back pain was reported by the athlete during this phase of management. The athlete reported a past history of multiple episodes of non-radiating mechanical low back pain.

Assessment of lumbo-pelvic function revealed an aberrant trunk flexion movement pattern(20) with early heel raise (i.e. feet lifting off the table) and excessive lumbo-pelvic rotation on active SLR(20) bilaterally. Assessment of accessory joint motion of the spine and pelvis revealed motion fixation at the mid and upper thoracic regions, lower and upper cervical regions and the right sacroiliac joint.

The athlete attended four chiropractic consultations between week ten and week thirteen post-surgery. Multiple modalities were utilised in this period similarly to the last.

During this phase of rehabilitation neutral spine posturing with an abdominal brace(21, 22) was instructed and emphasised with exercises. One set of 20 repetitions of abdominal bracing in the supine hook lying position was performed as a facilitating activity.

Shoulder exercises were performed without table support (Table 4). Glenohumeral motion and flexibility exercise consisted of AAROM with cane and AROM in planes of flexion, external and internal rotation up to week-11 and then all to planes at week-12 post surgery. AAROM and AROM exercises were performed at a quantity of one set with twenty repetitions. Closed chain co-contraction exercises included scapular clock, upper extremity support and push-up plus exercises. Scapular clock exercises were performed in the 12, 9, 3, and 6 o'clock positions. One set of ten repetitions in all directions (protraction/retraction, elevation/depression) were instructed. Upper extremity support exercises initially began at low levels of forward flexion on a table with progressions to the wall at 90°-100° and then support on a exercise ball on the wall. Two sets of sixty-second hold were performed for upper extremity support. Push-up plus exercises were performed on a wall progressing to kneeling on the floor. Two sets of ten repetitions were instructed. Closed kinetic chain activities help to reproduce or provide proprioceptive stimulation to joint mechanoreceptors to assist in the reorganisation and re-establishment of normal muscle firing patterns. In addition, these activities are protective in that they help to decrease muscular shear force on injured joints or healing tissues by promoting

muscular co-contraction. Integrated open chain exercises followed which involve scaption and push/pull exercises(23) using Ausband™ red (medium resistance) therapy bands.

Home exercise was instructed to be performed twice daily. Again, exercise was instructed to be performed in a relatively pain free manner, with quality of motion not quantity of repetition rate being advised. The athlete was advised to progressively return to all activities of daily living that do not involve heavy lifting or vigorous activity, using caution above the shoulder and across the chest. Functional progression from this stage was set at full pain-free range of motion, improved scapular kinematics, and adequate strength and control of lumbopelvic, scapulothoracic and glenohumeral dynamic stabilisers.

Figure 3: ROM with Stick Early Recovery Phase

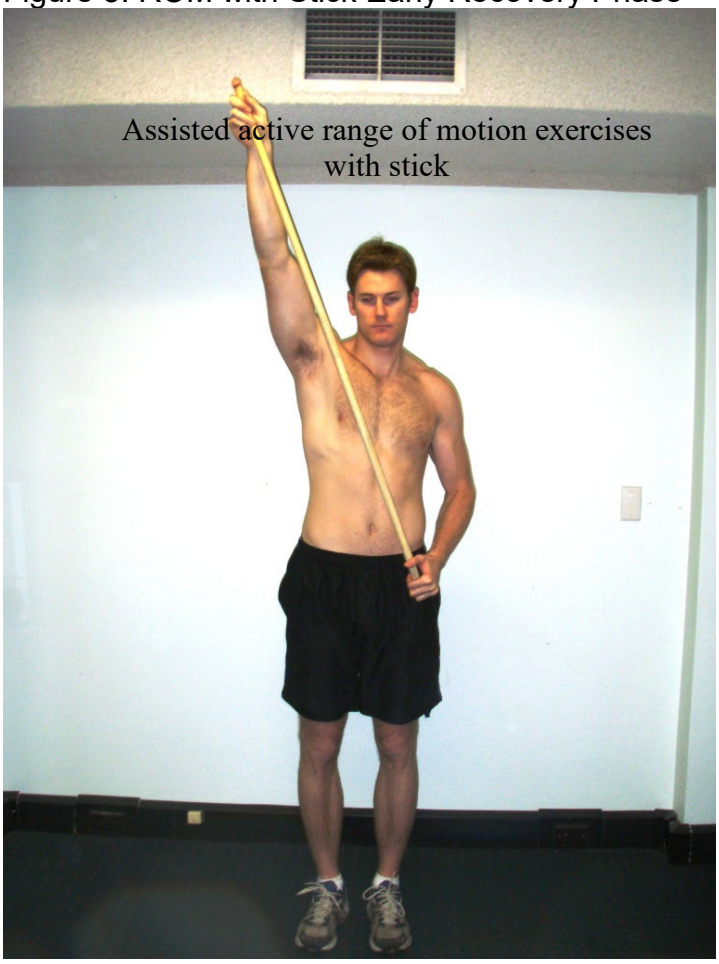


Figure 4: Scapula clocks Early Recovery Phase

Figure 5: Upper extremity Support

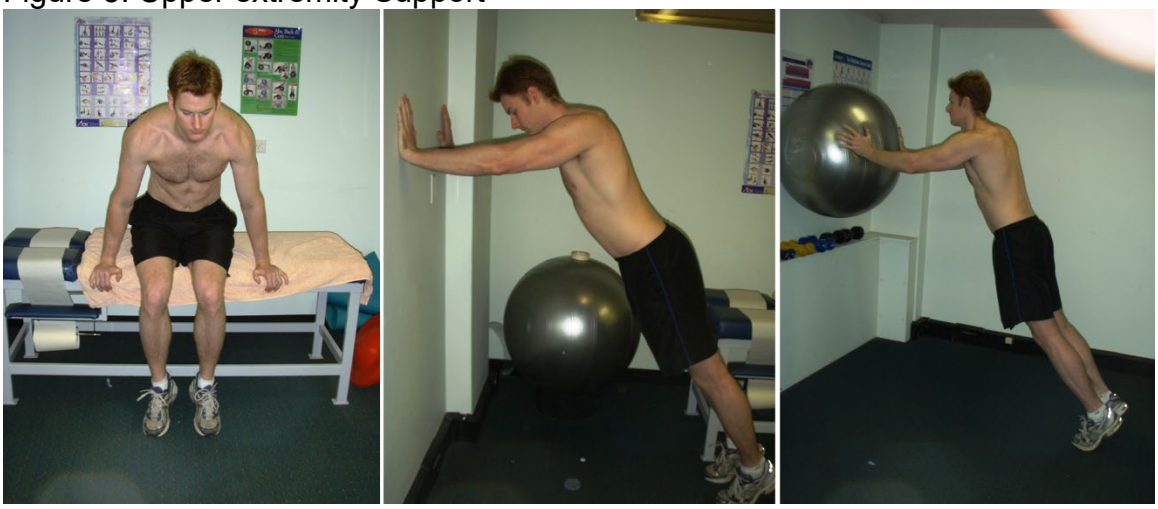


Figure 6: Push Up Plus

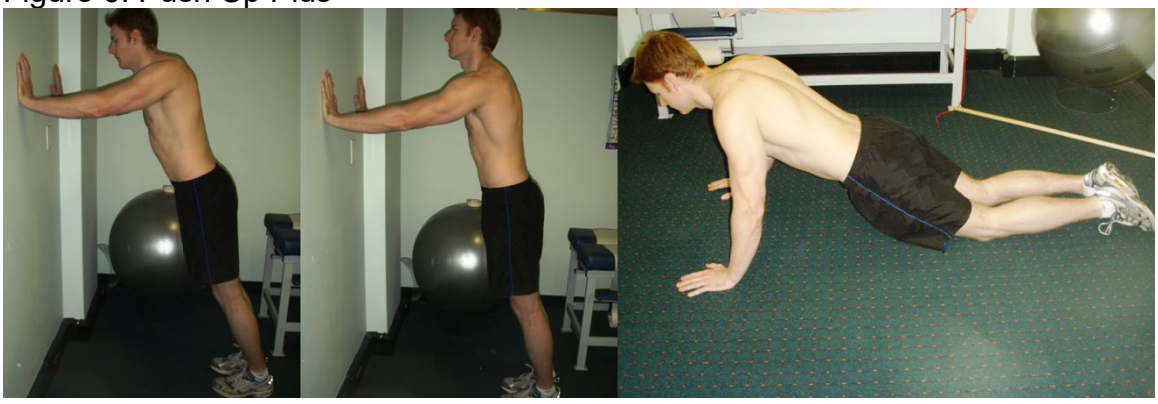
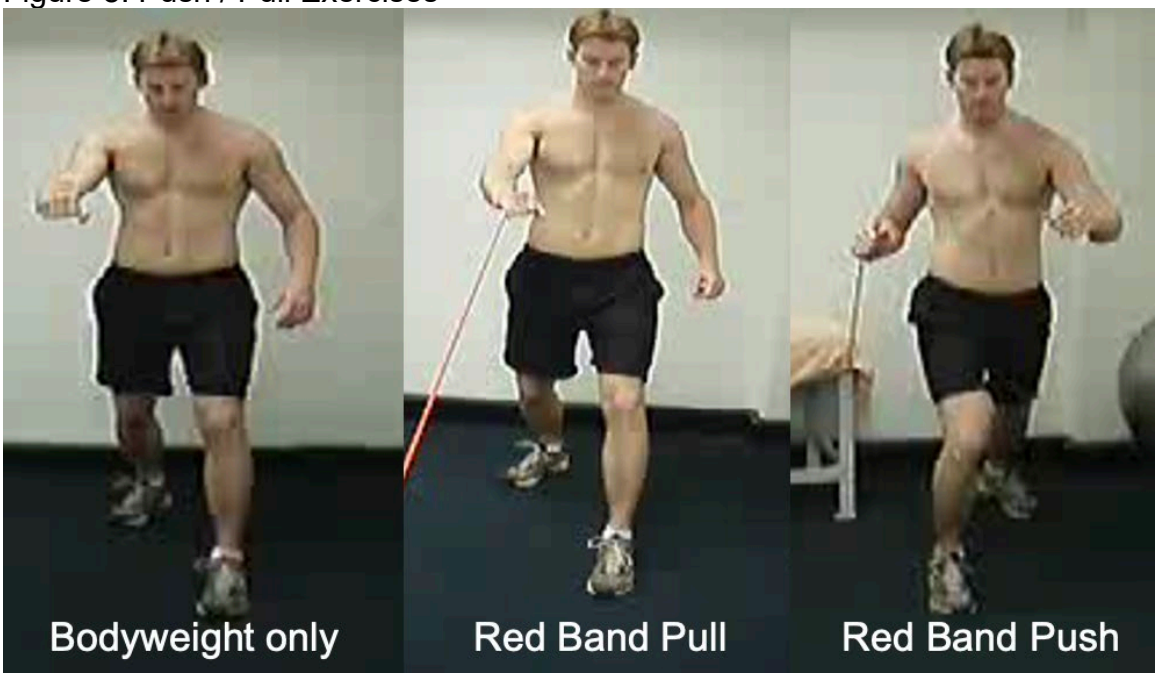


Figure 7: Scaption

Figure 8: Push / Pull Exercises



Late Recovery Phase: Weeks 14-19 post surgery (Figures 9-14)

The athlete achieved the aforementioned functional goals at 14-weeks post-surgery. At 15-weeks post-surgery a score of 10.29 was recorded on the general DASH and a score of 53.12 on the work/sports/performing module of the DASH (Table 1). Table 2 indicates objective AROM and strength changes. The athlete reports only mild stiffness/tension 1/10 NRS of the right lower cervical region and right superior clavicular region which lasts for less than 30-minutes upon waking in the morning. Functional shoulder assessment at this time reveals normalisation of scapulohumeral rhythm during arm abduction and arm flexion movement patterns, however push-up movement pattern on the wall and floor (on the knees) reveals prominence of the right inferior angle of the scapular, or inferior angle (type I) patterning(24), as did resisted assessment of the mid/lower trapezius and rhomboid muscles. The athlete attended three chiropractic consultations in the period of weeks 14 and 19 post surgery. Multiple modalities were again utilised during this phase of management to address joint and soft tissue restrictions.

Spinal HVLA manipulative therapy to the lower cervical and upper thoracic regions continued. Post isometric relaxation techniques were applied to the right pectoralis minor muscle, pectoralis major muscle (sternal head) and right upper trapezius muscle following aberrant muscle length and tone findings when compared bilaterally. Additional peripheral HVLA manipulative techniques (Maitland grade V) were applied to the right sternoclavicular joint and right elbow joint following accessory joint motion assessment of aberrant sternoclavicular A-P glide and right elbow end range extension restriction.

Core strengthening exercises of the early recovery phase were advanced to the dying bug(22) position with three sets of fifteen repetitions. The quadruped track(25) was initiated during this phase of the rehabilitation program. Initially in this phase single leg reaches were instructed with progression to opposite arm and leg reaches. This exercise was functionally applicable to this athlete as it allowed for graded exposure, incorporated upper limb axial loading, lumbo-pelvic and scapulothoracic stability, and integrates cross crawl motor patterns. Three sets of fifteen repetitions were instructed for quadruped exercises. Shoulder motion and flexibility exercises were modified to address passive end range limitations in flexion and abduction. Axially loaded AROM exercise utilised a swiss ball on wall in the standing position. Passive over pressure at end range was achieved via athlete-controlled body weight loading. Closed kinetic chain co-contraction exercises of the early recovery phase were advanced. Upper extremity support was now performed on the floor with progression to the labile surface of a wobble board. Push-up plus' were advance to the floor followed by the piked position. Push-up's were commenced in the kneeling position and advanced to the full length position. Integrated open chain exercises were advanced. Scaption exercises were modified to incorporate clockwise and counterclockwise circular motions, and horizontal abduction and adduction for dynamic scapular patterning. A two-kilogram dumbbell was used for resistance and three sets of twelve repetitions were instructed for each. Functional training was initiated with sword(23, 26) and punch(23, 26) exercises which incorporates transverse plane motions(23, 26, 27). This was achieved initially with stationary feet and progressed to include steps and lunges without a reach. Three sets of twenty repetitions were instructed for each. Dumbbells were utilised for resistance with progressions from no weight to one then three kilograms were instructed. Again abdominal bracing(21) and neutral spine(21) was emphasised. Isolated glenohumeral, elbow and wrist isokinetic strengthening continued and was advanced via increased resistance. Late recovery exercises (Table 5) were instructed to be performed once to twice daily. Exercises were instructed to be performed in a relatively pain free manner, with quality of motion not quantity of resistance or repetition rate being emphasised. Return to more vigorous activity such as running, controlled golf swings, swimming and light free weight training which included low rows, lat pull-downs, cable bicep curls/triceps pushdowns and flat dumbbell bench-press was progressively allowed and encouraged towards the end of this period. Heavy lifting and contact sport were still prohibited. Advancement criteria from this phase of management was met when the patient could reach full range of motion, demonstrate normal scapular kinematics in both open and closed chain positions under load, and demonstrate at least 75% of normal, strength power and endurance when compared to the contralateral side.

Figure 9: Axially Loaded AROM

Figure 10: Upper extremity Support Late Recovery Phase

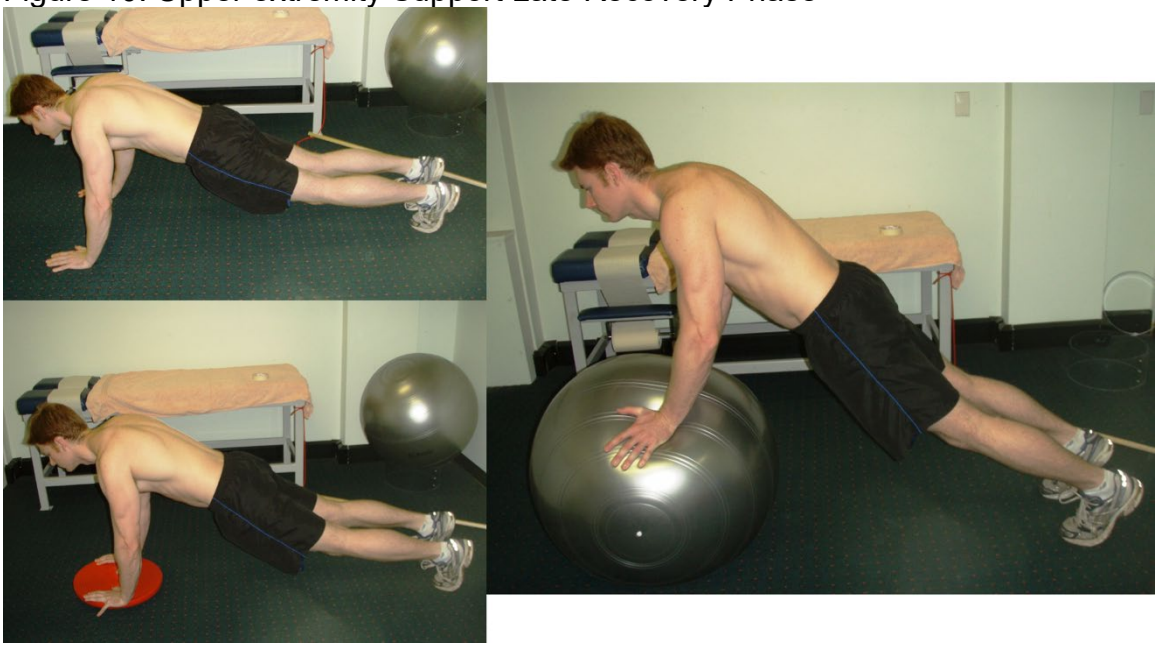


Figure 11: Push Up Plus

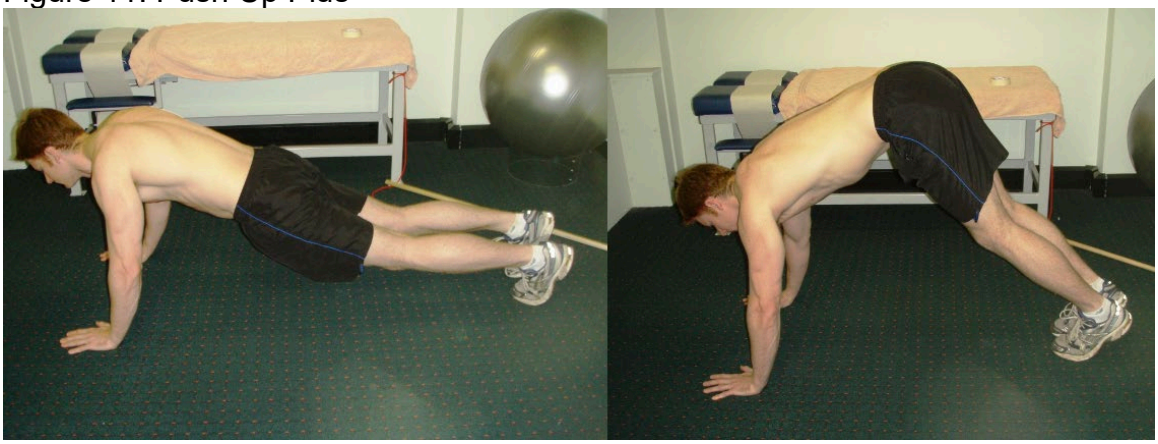


Figure 12: Scaption Circles

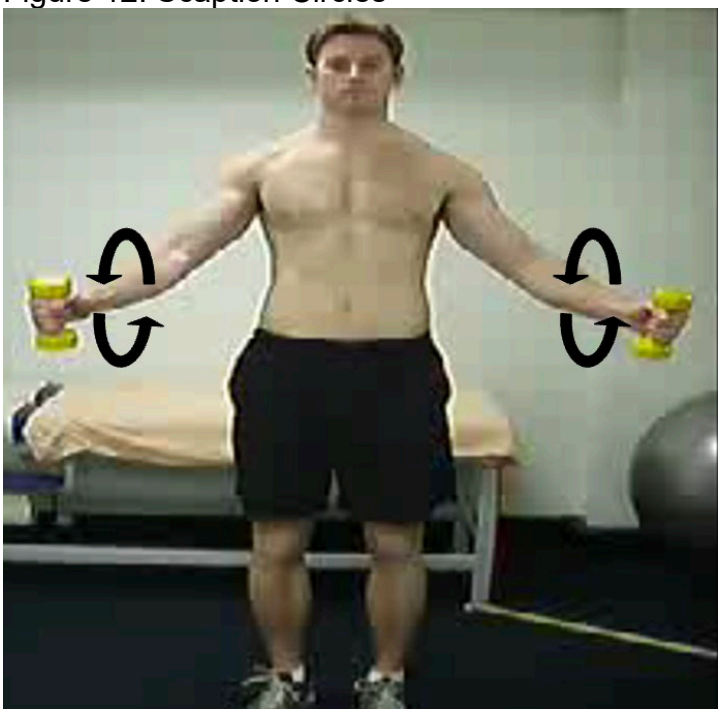


Figure 12: Scaption Horizontal Abduction/ Adduction

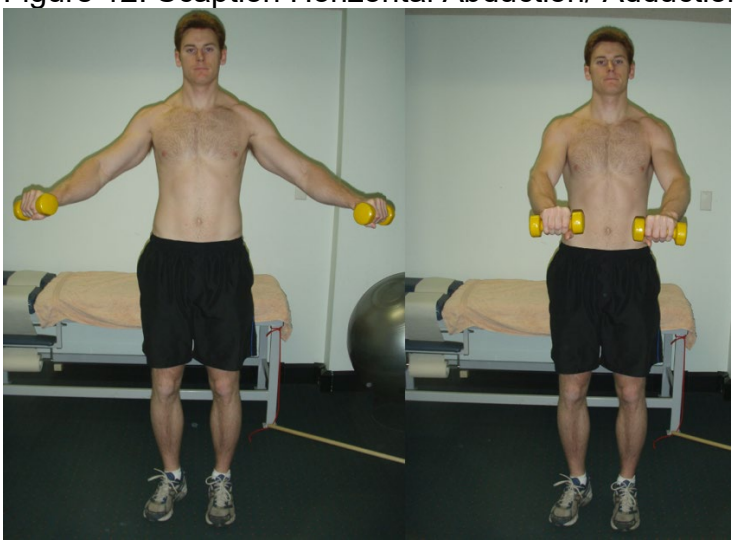
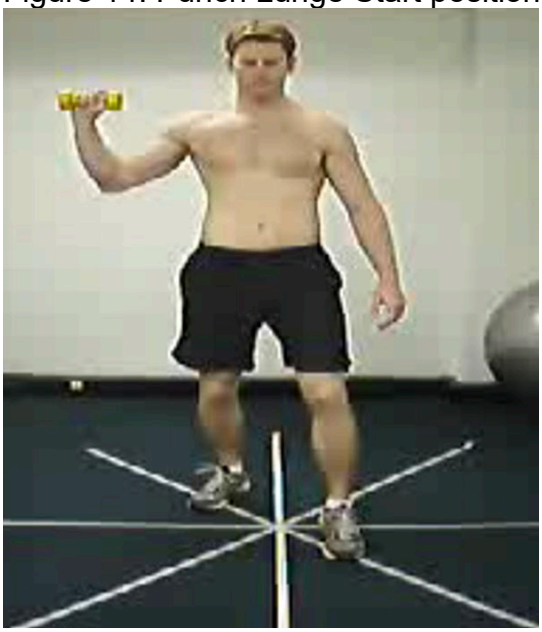


Figure 13: Sword Lunge Start Position

Figure 14: Punch Lunge Start position



Functional Phase: Week 20+ post-surgery) Figures 15-19)

The athlete achieved the aforementioned functional goals at 20-weeks post-surgery. At 21-weeks post-surgery a score of 4.16 was recorded on the general DASH and a score of 3.13 on the work/sports/performing module of the DASH (Table 1). Table 2 indicates objective AROM and strength changes. The athlete reported no stiffness or pain 0/10 NRS in the right shoulder or upper quarter over the previous 4-week period. Functional shoulder assessment at this time revealed normal scapulohumeral rhythm during arm abduction, arm flexion/lowering movement patterns, push-up movement pattern.

The athlete attended two further chiropractic consultations in the 20+ week period post-surgery. Passive intervention included the application of moist heat, myofascial release to the cervical and right shoulder regions, and spinal HVLA manipulative therapy to the cervical and thoracic regions.

Functional integrated training was advanced on the 20-week post-surgery stage (Table 6). Closed kinetic chain exercises included windmill exercise on wobble board which incorporates transverse plane motions with unilateral upper extremity support, and push-ups on the wobble board which were advanced to plyometric push ups and lateral plyometric body weight shifts. Integrated open chain exercises continued to include sword and punch lunges. Advancement of these exercises came via the addition of a plyomertic lunge, leg and arm reach, and increased resistance to a five-kilogram dumbbell. Plyometric sports specific activity was achieved with ball catch and throw exercises against the wall. Three sets of fifteen repetitions bilaterally were instructed. This exercise was progressed from two hand throw-catch to one arm and progressive wall weight was recommended. Free weight training was allowed and encouraged with weight as

tolerated. The athlete was briefed on the expected outcome being a low rate of surgical breakdown, low rate of deformity, low rate of ongoing pain, to expect near normal (90%) ROM and strength(28). Risk of re-injury for this type of surgical intervention is yet to be evaluated in a rugby population. It has previously been reported that the incidence of post traumatic osteoarthritis in a surgically treated ACJ dislocation population to be at 25%(28). The athlete was discharged from care roughly 4 months post initial chiropractic consultation unsure if he would return to contact/collision sports.

Figure 15:Upper extremity Support: Windmill

Figure 16: Push Ups Functional Phase

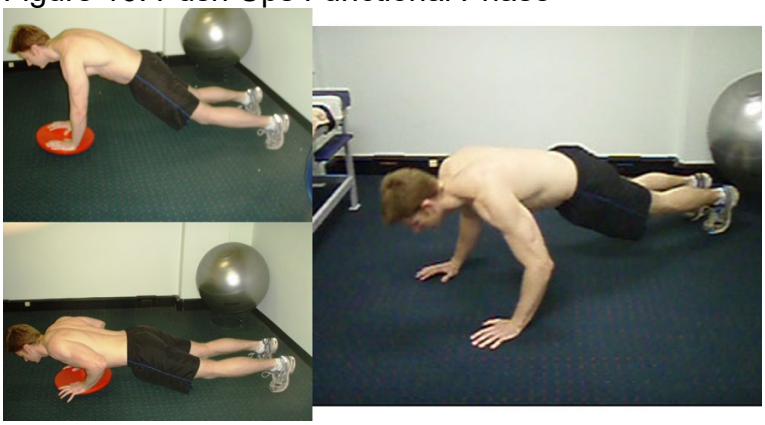


Figure 17: Weight Shifts (feet)

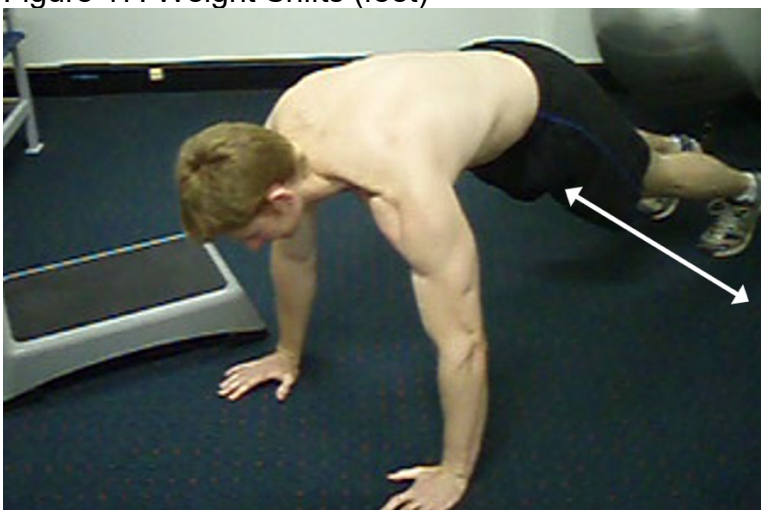


Figure 18: Sword Lunge Reach

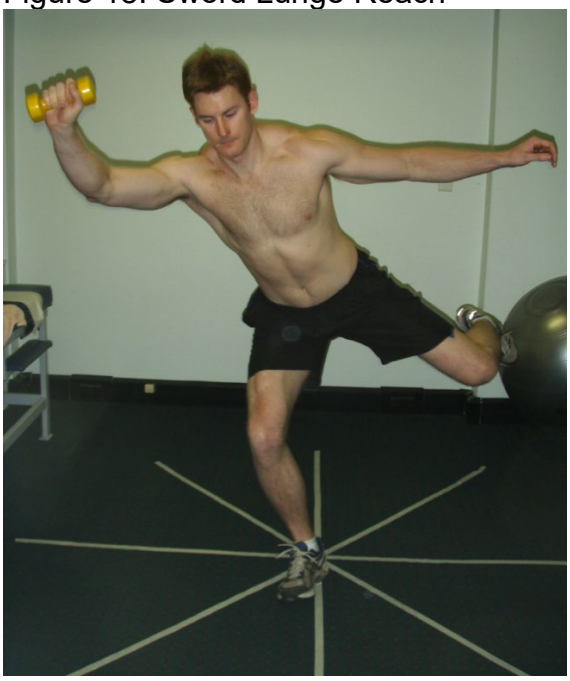
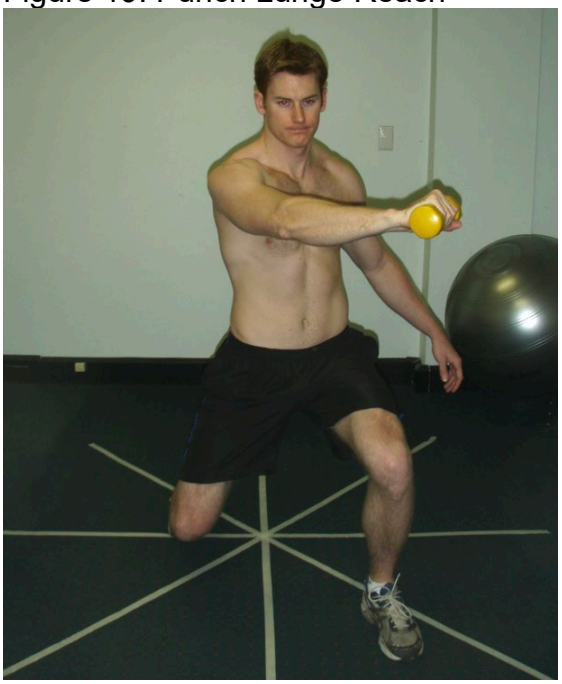


Figure 19: Punch Lunge Reach



Follow-up at 18 Months Post Surgery

The athlete was interviewed at 18-months post-surgery in follow-up. A score of 1.66 was recorded on the general DASH and a score of 0 on the work/sports/performing module of the DASH. Subjective questioning sought to identify any ongoing pain, strength or mobility deficits or reduction in activities of daily living. No pain (0 out of 10 on a numerical rating) was recalled during daily living. Medial right clavicle discomfort was noticed sporadically during times of prolonged sleeping on the right shoulder. The athlete had modified his sleeping position in response. No mobility deficit or ongoing sensations of stiffness were recalled. Mild strength deficit was noticed in activities that require powerful external rotation when compared bilaterally. A 5% reduction in bench press capacity was verbally noted. Additionally, the athlete felt that his right posterior glenohumeral muscle bulk was slightly less than preinjury status.

The athlete returned to all preinjury sporting activities which include golf, gym, running, surfing, swimming and rugby union at preinjury levels. The athlete returned to rugby union mid-season six-months after discharge from chiropractic care. He recalled early apprehension (fear in tackle situations) in his shoulders ability to perform on field, which caused him to leave the field for the initial four games without physical deficit. Following this initial period of adjustment, the athlete participated fully in different positions for the remaining 14 rounds of the season, which included a grand final win. When asked if he was unsatisfied with any part of his care, he felt that the 6-week sling immobilisation period impacted on him in social and psychological terms. He conceded the surgeons advice to initially rest as necessity to allow tissue healing, however felt the length of time

significantly decreased his upper limb function and added to recovery time. At this time overall patient satisfaction was assessed in accordance to Chen et al(29). A patient questionnaire was developed that asked, “How satisfied are you with your current outcome?” This question was scored on a discrete ordinal scale from 1 to 10, in which 1 indicated very unsatisfied and 10 indicated very satisfied. A score of 9 was given at follow-up.

DISCUSSION

Debate exists in the literature over the most appropriate management to type III ACJ injury. No perfect study exists which demonstrates clear superiority of surgical or nonsurgical treatment(30). A systematic review(31) supports non-operative treatment compared to traditional operative treatment in the management of grade III ACJ separation. In that study meta-analysis was not possible as outcome measures, procedures and populations varied between reviewed studies. Additionally psychosocial parameters were not measured.

Debate exists with regards to populations which may benefit from an operative approach. Hootman(32) suggests occupation, activity level, and physical demands of daily functioning play an enormous role in global patient satisfaction. As in this case report, athletes involved in contact sports are sometimes considered special cases(33). Persistent symptoms of conservative management include increased instability, impingement due to scapular dyskinesia, decreased strength, inability to get the arm into a cocking position in throwing, and pain, especially posterior instability with the clavicle abutting the anterior portion of the spine of the scapula(33). In such cases revision surgery may be indicated(33).

Comparisons can be made between this case report and data available from the literature. Historically post-surgical immobilisation time has ranged from no immobilisation time(34) up to 8 weeks(35) with full recovery expected by 6 months (36). As in this case, Culp and Romani(37) reported similar upper limb ROM and strength deficits after 6 weeks of immobilization. They suggest the 6-week immobilisation period was necessary to ensure long term integrity of the transected ligament. Mazzocca et al(33) recommends commencement of supported range of motion exercises between 4 to 6 weeks post-surgery, strengthening to begin 6 to 12-weeks post-surgery and weight training to commence at 3 to 4.5 months post-surgery. They suggest demands required for power athletes and heavy labor require 9 to 12-months to achieve required peak strength. In this case limited range of motion exercises with support and isometric shoulder strengthening exercises began at 6-weeks post-surgery, with table support being removed at 10-weeks post-surgery. The athlete returned to running, swimming and controlled golf swings at three months post-surgery and began light weight training at four months post-surgery. The athlete returned to contact sport at 12-months post-surgery. Cardone et al(38) report on the return to participation times in Australian Rules Football players following conservative or operative management of type III ACJ injuries. They found a faster return to non-contact training in the conservatively managed athletes at 2-6 weeks, however

return to competition was seen to be faster for players treated operatively with a return to play time being 18 to 26-weeks. In contrast to this case report Hauser(39) describes a limited chiropractic protocol in the conservative management of type III ACJ injury. After the initial 48-hours he reports using the Heron method of ACJ mobilisation on nine occasions in conjunction with other modalities, ROM exercises and strengthening exercise to release the patient from care in less than 21-days.

Six chiropractic management cases of ACJ sprain are cited in the index to chiropractic literature since 1996 (11, 39-41) (Table 7). These reports outline chiropractic conservative management of type II(11, 40, 41) and type III(39) ACJ injury. Described are multimodal management approaches phasic in nature which initially address pain and inflammation through the use of electophysical modalities, and immobilisation. Once acute symptoms abate the use of local soft tissue therapies, mobilisation/manipulation, and initial range of motion exercises and progressive strengthening exercises are performed. The chiropractic approach is similar to conservative recommendations in this case report and elsewhere(42). Furthermore, chiropractic papers report the incorporation of spinal manipulative therapy to one or multiple regions of the spine as an important adjunct to management. This phenomenon appears to be under reported in the literature.

Spinal joint manipulation, particularly of the cervicothoracic and mid thoracic regions was included to address functional regional interdependence. (43) From a mechanical perspective, these regions share biomechanical function with involved muscles spanning both shoulder and spinal articulations, in addition these muscles and joints share neurological supply. co management of these structures was incorporated into management. (44) The management approaches are common in chiropractic (see table 7) and have been described in earlier research that has demonstrated improved outcomes in surgical and non surgical cases of shoulder pain and dysfunction that received thoracic and or cervical manipulation.

Functional rehabilitation considers the coordinated muscle activation sequences result in movement patterns that create joint motions to efficiently accomplish specific tasks. Diagonal activation patterns create a “serape” effect from the knee or lumbopelvic region to the shoulder act locally on one joint or harmonize several joints, provide co-contraction / force couples that control joint perturbations and provide stability, and generate and transmit force(45).

Traditional approaches to glenohumeral and scapulothoracic stabilisation detail principles of regaining flexibility to full and appropriate motions, integrating complementary hip and trunk musculature exercises, and utlilising closed chain strengthening activity before open chain exercises are introduced (45). Such exercises approaches should be relatively pain free, with emphasis on quality of exercise opposed to quantity being performed, with function rather than time determined progressions(45).

Conclusion

This paper describes the management offered by a sports chiropractor operating successfully and harmoniously in a multidisciplinary team for the benefit of the athlete. It highlights a successful and detailed multimodal management that required communication between the sports chiropractor and other healthcare practitioners in the rehabilitation / surgical team to maximise the benefit to all concerned. Communication was provided in the form of industry standard outcome assessments, as well as personal communication with the athlete and the rehabilitation / surgical team.

Consent

Written informed consent was obtained from the patient prior to publication.
Written informed consent was obtained for the use of exercise images prior to publication.

TABLES AND CAPTIONS

Table 1

Case subjects score for pain (NRS), the Disabilities of the Arm, Shoulder, and Hand outcome questionnaire (DASH)(44) with the additional work/sport/performing module recorded at weeks six, nine, fifteen and twenty-one post-surgery.

	Week 6	**Week 9**	**Week 15**	**Week 21**	**18 Months**
Pain (NRS)	7	4	3	1	0
DASH	57	29.75	10.29	4.16	1.66
Work/Sport/Performing	90.75	40.75	53.12	3.13	0

Table 2
Case subjects score for glenohumeral and elbow active range of motion, and strength assessment outcome measures recorded at weeks six, nine, fifteen and twenty-one post-surgery.

Right Upper Limb		**Week 6**	**Week 9**	**Week 15**	**Week 21**	**Normal(15)**
G/H Joint AROM	Flexion	80	168	170	173	160-180
	Abduction			170	180	170-180
	ER (90 Ab)		58	104	110	-
	ER (0 Ab)	55	70	80	85	80-90
	IR (90 Ab)		60	85	85	60-100
	Apley's: Over head reach		T2	T2	T2	-
	Apley's: Behind Back reach	L3	T8	T7	T6	-
Elbow Joint AROM	Extension – Flexion	5 – 140	3 – 140	5-140	2-140	0 to 140-150
Strength	External Rot		5/5	5/5	5/5	-
	Lat Dorsi		4/5	4/5	4/5	-
	Lower Trap		4/5	3/5	4/5	-
	Mid Trap		4/5	4/5	5/5	-
	Rhomboid		4/5	4/5	5/5	-
	Serratus Ant		4/5	5/5	5/5	-

Table 3

Active care routine for the acute phase of rehabilitation: weeks 6-9 post surgery. Exercises were performed in the supine positions during this period. This exercise routine was instructed to be performed twice daily.

Exercise	Sets x Repetitions
Scapular Motion and Facilitation	
Elevation/Depression	1 x 20
Protraction/Retraction	1 x 20
G/H Motion and Flexibility	
Flexion	1 x 20
External rotation	1 x 20
Internal rotation	1 x 20
Shoulder Isometric Strength	
Scapular retraction	2 x 10 x 5 sec
G/H Flexion	2 x 10 x 5 sec
G/H Extension	2 x 10 x 5 sec
G/H Internal rotation	2 x 10 x 5 sec
G/H External rotation	2 x 10 x 5 sec
Elbow Motion and Strength	
Flexion	3 x 12 - red Aus-tubing
Extension	(medium resistance)
Wrist Motion and Strength	3 x 12 - green Aus-tubing
Flexion	(medium resistance + 30%)
Extension	2 x 20 - red Aus-tubing
Pronation	2 x 20 - red Aus-tubing
Supination	2 x 20 - red Aus-tubing
Ulnar deviation	2 x 20 - red Aus-tubing
Radial deviation	2 x 20 - red Aus-tubing
	2 x 20 - red Aus-tubing

Table 4

Active care routine for the early recovery phase of rehabilitation: weeks 10-13 post surgery. Exercises were performed without table support during this period. This exercise routine was instructed to be performed twice daily.

Exercise	Sets x Repetitions
Closed Kinetic Chain Co-contraction	
Scapular Clock (12, 9, 3 and 6 o'clock positions)	1 x 20
Upper Extremity Support (Progress table to wall)	2 x 60 sec hold
Push-up Plus on Wall	2 x 10 - body weight
Integrated Open Chain Exercises	
Scaption	1 x 10 x 2kg
Push-pull	1 x 10 - red Aus-tubing (push and pull)
G/H Motion and Flexibility	
Flexion	1 x 20
External rotation	1 x 20
Internal rotation	1 x 20
G/H Isokinetic Strength	
Internal rotation	2 x 15 - red Aus-tubing
External rotation	2 x 15 - red Aus-tubing
Forward flexion	2 x 15 - 2 kg dumbbell
Extension	2 x 15 - red Aus-tubing
Elbow Isokinetic Strength	
Flexion	3 x 15 - 5 kg dumbbell
Extension	3 x 15 - 5 kg dumbbell
Wrist Isokinetic Strength	
Flexion	3 x 15 - green Aus-tubing
Extension	3 x 15 - green Aus-tubing
Pronation	3 x 15 - green Aus-tubing
Supination	3 x 15 - green Aus-tubing
Ulnar deviation	3 x 15 - green Aus-tubing
Radial Deviation	3 x 15 - green Aus-tubing

Table 5

Active care routine for the late recovery phase of rehabilitation: Weeks 14-19 post surgery. These exercises were instructed to be performed twice daily

Exercise	Sets x Repetitions
Closed Kinetic Chain Co-contraction	
Upper Extremity Support on floor	2 x 60 sec hold
Push-up Plus on Floor	2 x 10 - body weight
(progress to pike position)	
Push-up on knees	2 x 10 - body weight
(progress to full length)	
Integrated Open Chain Exercises	
Scaption to 30° with circles	3 x 10 x 2kg
Scaption to 30° with horizontal Abduction-Adduction	3 x 10 x 2kg
Sword with lunge	3 x 10 progress 1kg to 3kg Bilateral
Punch with lunge	3 x 10 progress 1kg to 3kg Bilateral
Axially Loaded AROM Exercise	
Flexion	1 x 20
Abduction	1 x 20
G/H Isokinetic Strength	
Internal rotation	2 x 15 – green Aus-tubing
External rotation	2 x 15 – green Aus-tubing
Forward flexion	2 x 15 – green Aus-tubing
Extension	2 x 15 – green Aus-tubing
Elbow Isokinetic Strength	
Flexion	3 x 15 - 5 kg dumbbell
Extension	3 x 15 - 5 kg dumbbell
Wrist Isokinetic Strength	
Flexion	3 x 15 - green Aus-tubing
Extension	3 x 15 - green Aus-tubing
Pronation	3 x 15 - green Aus-tubing
Supination	3 x 15 - green Aus-tubing
Ulnar deviation	3 x 15 - green Aus-tubing
Radial Deviation	3 x 15 - green Aus-tubing

Table 6
Active care routine for the late recovery phase of rehabilitation: Weeks 20+ post-surgery. These exercises were instructed to be performed twice daily

Exercise	Sets x Repetitions
Closed Kinetic Chain Co-contraction	
Windmill on wobble board	2 x 20
Push-up on wobble board	2 x Failure
Integrated Open Chain Exercises	
Sword with lung	2 x 10 x 5kg Bilateral
Punch with lung	2 x 10 x 5kg Bilateral
Plyometric Sports Specific Exercises	
Medicine ball catch and throw (progressing to single arm)	2 x 15 Progressive medicine ball weight

Table 7
Comparison of chiropractic articles describing ACJ sprain as cited in the ICL from 1996 to 2021.

Year Author	ACJ Injury Classification & Management type	Outcome measures	Co-management	Treatment modalities
2017. Emary P, Watkins KM, Taylor JA.(48)	Grade V Conservatively managed	Verbal patient report	Medical radiological and orthopaedic evaluation preceding	Ultrasound, ultrasound therapy home-based rotator cuff isometric and TheraBand™ isotonic strengthening exercises, cryotherapy, splint,
2011. Robb AJ, Howitt S.(49)	Grade III Conservatively managed	Verbal patient report	Chiropractic radiology: shoulder x-ray with 10 year follow up	acupuncture, joint mobilizations, palliative adhesive taping of the AC joint, Active Release Technique, and progressive resisted exercises.
2004. Kiner A.(41)	Grade II Conservatively managed	Verbal patient report	Medical radiological and orthopaedic evaluation preceding	Shoulder proprioceptive taping, PNF, soft tissue work (friction massage, trigger point release) and Shoulder exercise
2002. Pollard H, Quodling N. McHardy A.(11)	Type II Conservatively managed	None reported	Preceding medical observation for concussion	Initially ice and rest. Soft tissue therapy, ACJ mobilisation. Cervical soft tissue therapy and manipulation. Shoulder exercise
2000. Stoddard J. Johnson C.(40)	Type II Conservatively managed	Verbal pain scale, ROM, functional patient report	Medical physician: Pain medication and sling. Medical Radiology: shoulder x-ray	Cervical, thoracic and lumbar manipulation. Shoulder ice, and strapping. Shoulder exercise

1996. Hauser R.(39)	Grade III Conservatively managed	Verbal patient report	Chiropractic radiology: shoulder x-ray	Shoulder ice and immobilisation. ACJ manipulation /mobilisation. Shoulder phonophoresis, taping, and friction massage. Shoulder exercise

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