Title Page

Title: Critical reflection of the advanced rehabilitation of an elite rugby league player sustaining a posterior Bankart lesion.

Author: Andrew McDonough [a, b;]

Affiliation Addresses:

[a]Warrington Wolves Rugby League Football Club
Padgate Training Facility
University of Chester, Padgate Campus
Warrington
WA2 0DB

[b]University of Bath
Claverton Down
Bath
BA2 7AY

Corresponding Author: Andrew McDonough
Postal Address: 3 Olivedale Road, Liverpool, L18 1DD
Phone: 07876614934; Home; 0151 7350213
andrew.mcdonough1@btinternet.com

Abstract:
Objectives: To critically appraise the advanced rehabilitation process of an elite rugby league player undergoing arthroscopic Bankart repair.
Design: Single case study
Setting: Warrington Wolves Rugby League Football Club
Participants: One full time professional rugby league player; first team squad player and international.
Outcomes: Successful return to play and restoration of shoulder isokinetic strength as measured by Biodex system 3.
Results: A successful return to play at 15 weeks post-operatively
Conclusions: This text provides an evidence based rehab program for an accelerated regime following arthroscopic shoulder surgery and successful return to play.

Keywords:

Shoulder, Rehabilitation, Advanced

TITLE

Critical reflection of the advanced rehabilitation of an elite rugby league player sustaining a posterior Bankart lesion.

Summary

The following is a critical description and discussion of the successful assessment and rehabilitation of a right shoulder Bankart repair in an elite rugby league player. The rehabilitation follows accelerated, goal based guidelines, widely adopted in current sports practice but not well documented in the literature (Park, Lin, Yokota & McFarland, 2004; Funk & Snow, 2007). The study serves to be the first critical discussion of such a regime.

INTRODUCTION

Rugby League is an international collision sport with similar rules to rugby union. During the course of a match players are exposed to multiple physical contact and tackles The game requires a high aerobic and anaerobic fitness as well as a large skill component for each player (Gabbett, 2005).

Shoulder injuries are the most common injury in rugby league leading to a significant amount of lost playing time (Edouard, Frize, Calmels, Samozino, Garet & Degache, 2009). In a review specifically of rugby players with shoulder pathology Funk and Snow (2007) found a 35% incidence of labral pathology. In a further study a review of 142 elite rugby player shoulder arthroscopies, 20% had a posterior labral defect (Badge, Tambe & Funk, 2009).

The rehabilitation of such injuries post-surgery is poorly defined in the literature with return to play times varying from 2.6 to 12 months (Park et al., 2004; Badge et al., 2009; Eckenrode Logerstedt & Sennett, 2009). Badge et al., (2009) briefly describe their rehabilitation principles incorporating immobilisation, early closed kinetic chain (CKC) exercise, resistance exercises and functional exercises. However this article lacks detail on the timings and principles used to inform treatment progressions. Mair, Zarzour and Speer, (1998) outline their protocol which is much more conservative with four weeks of immobilisation and limited active range of movement until two months. Contact was only reintroduced at four months whereas Badge et al's., (2009) subjects had returned to playing by this stage.

Eckenrode et al., (2009) describe their rehabilitation regime in good detail and offer some rationale for their progressions based on tissue healing times. Their athletes did not commence formal physiotherapy until seven weeks post-operatively and took six months to return to wrestling. Furthermore all athletes were discharged from physiotherapy before being ready to return to competition. The move from conservative regimes, as listed, to accelerated regimes such as this one mimics that of rehabilitation following anterior cruciate ligament (ACL) reconstruction but without the supporting research as seen in the ACL population.

The player presented with right shoulder pain following a posterior blow to the arm whilst holding a tackle shield. This is not consistent with the literature in rugby where the majority of labral lesions occur when the player makes contact with the ground sustaining a lateral blow to the arm (Funk & Snow 2007; Badge et al., 2009).

There are similar findings for posterior labral lesions in collegiate wrestling and American Football (Mair etal., 1998; Eckenrode et al., 2009). Mair et al; (1998) found posterior labral lesions in a number of American football players where they regularly engaged opponents with their arms raised up in front of them. This mechanism may not have been described in rugby league due to the different nature of the sports and can be considered a rarer occurrence in rugby.

Signs and symptoms experienced by the player were consistent with the literature including pain with bench press activity, inability to perform contact work and inability to return to pre-injury participation (Funk and Snow 2007; Badge et al., 2009)

Assesssment:

Over recent years there has been a growth in the literature surrounding the diagnosis of labral tears in the shoulder. Munro and Healy (2009) conducted a systematic review finding limited research to support biceps test I and II, internal

rotation resistance test (IRRT), Kim, Jerk and Crank tests. Meserve, Cleland and Boucher (2009) performed a meta-analysis looking at SLAP lesions finding active compression test (similar to IRRT), crank and speeds test of value, given in order of superiority. The authors exclude more tests than that of Munro and Healy's (2009) study due to their inclusion / exclusion criteria, therefore explaining the differing results between studies.

The Jerk test or modifications of it have been used in two studies looking specifically at posterior labral tears (Mair et al., 1998; Badge et al., 2009). Mair et al., (1998) found positive crepitus on posterior loading in four out of nine symptomatic athletes and Badge et al., (2009) found similar results in three out of eleven symptomatic athletes, indicating that posteriorly stressing the shoulder alone is not enough for an accurate diagnosis. Overall accuracy of diagnostic tests is improved when a range of tests are utilised (McFarland, Garzon-Muvdi, Jia, Dessai & Petersen; 2010).

The athlete in this case demonstrated a positive IRRT, Crank and Jerk test along with posterior joint line tenderness when. Bicep's Load I and II were negative. Three positive tests with joint line tenderness and subjective signs consistent with the literature led to the hypothesis of a posterior labral lesion in the left shoulder. This was confirmed by an MR arthrogram (MRA) which is current best practice prior to arthroscopy (Tung & Hou, 2003; Holzapfel et al., 2010). It is noted that MRA is not without error and a negative scan in light of appropriate symptoms may lead to arthroscopic investigation.

The decisions for timings of investigations and surgical intervention were multifaceted. The player wished to continue competing initially due to an upcoming final and made an informed choice to be available for selection. Once this fixture had passed it was agreed resulting fixtures were not of significant importance to risk participation and further injury. Consequently a joint decision between the medical staff, coaches and player was made for surgery to take place, ultimately ending the players 2010 season.

Intervention:

early mobilisation:

Current rehabilitation guidelines widely use between three and five weeks of shoulder immobilisation following a Bankart repair (Jackins, 2004). In this case early mobilisation was encouraged as tolerated from day three post operatively as supported by Kim, Ha, Jung, Lim, Kim & Park, 2003.

scapula kinematics:

Scapula kinematics are theorised to play a role in a number of shoulder pathologies (Ludewig & Reynolds, 2009). Methods aimed at restoring normal kinematics involved maintenance of good posture with all exercises, maintenance of thoracic range of motion, global kinetic chain exercises and

treatment of pectoralis minor and posterior cuff tightness (Borstad & Ludewig, 2005).

Strengthening:

isometrics:

In these early stages of rehabilitation, emphasis is placed on muscular coordination, control, and endurance (Hintermeister, Lange, Schultheis, Bey & Hawkins, 1998). Initially isometric exercises are used to promote dynamic stabilisation, proprioception and neuromuscular control (Manske & Prohaska, 2010). No experimental data could be found to justify the use of such exercises but they are widely used in a variety of shoulder rehabilitation guidelines (Wilk, Meister & Andrews, 2002; Jackins 2004; McCarty, Ritchie, Gill & McFarland, 2004).

elastic resistance:

Exercises are rapidly progressed to isotonic exercise using elastic bands. Such bands are commonly used in shoulder rehabilitation and allow early gentle resistance as suited to the post-operative patient (Hintermeister et al., 1998; Jackins, 2004). Elastic band external rotation (ER) and internal rotation (IR), with the arm by the player's side, scaption and low rowing were all performed in the first week of rehabilitation. These exercises have been shown in electromyographic (EMG) studies to accurately target the rotator cuff muscles and supporting musculature of the shoulder girdle (Hintermeister et al., 1998; Reinold et al., 2007).

As the patient progressed in strength and repetitions with elastic band training ER and IR was performed at 90° abduction as well as by the player's side. These exercises utilise the principle of muscle training specificity by strengthening muscles in ranges used in practice to give the greatest carry over to performance (Morrissey, Harman & Johnson 1995). As rugby regularly involves contact above shoulder height it was felt necessary to strengthen the rotator cuff in this way.

weight bearing:

Weight bearing or closed kinetic chain (CKC) exercises are incorporated early in rehabilitation to facilitate rotator cuff co-contraction and shoulder stability (Uhl, Carver, Mattacola, Mair & Nitz, 2003). Rugby league involves both OKC and CKC activities and as such rehabilitation needs to mimic the sport for a successful return to play (Stone, Lueken, Partin, Timm & Ryan, 1993). There is good weight of evidence to support CKC exercises and these are discussed later.

resistance training:

Elastic band resistance was progressed to cable weight resistance as tolerated. Experimental data on IR and ER with elastic bands shows a peak torque reached of approximately 25Nm (Hintermeister et al., 1998) whereas peak torque achieved by healthy rugby players can be in excess of 70Nm (Edouard et al., 2009) showing a need for increased resistance load to return normal strength.

Weight training was incorporated last as a resistance method. This was introduced at week four for pulling activities and from week five for pressing activities as symptoms allowed. Pressing activities place a greater load on the posterior labrum and are therefore introduced later to allow healing and appropriate joint stability (Eckenrode et al; 2009). There is little evidence on the safe reintroduction of weight training so current best practice and discussions with the surgeon guided such decisions. Consequently these guidelines could be seen as current best practice.

return to contact and play:

The decision to allow contact work again was based on isokinetic scores (Figure 1) and free weight load lifted to pre-injury level. With close to normal rotator cuff strength, good shoulder proprioception and improving general upper body strength contact work could begin safely. There is a paucity of research on return to play criteria in all sports with general guidelines rather than experimental data being available (Kovacic & Bergfeld 2005).

Figure 1: Post-operative Intervention Summary

Intervention	Target	Thought Process	Exit Criteria	Reference
Early mobilisation	• Commenced day three • 90 ° by week 1	3 days immobilisation to prevent further acute soft tissue damage	Pain tolerable and good quality movement	Supported Kim, Ha, Lim, Kim Park, 200
Scapula Kinematics	• Ensure "good" movement patterns early in rehab process • Prevent common movement faults such as overuse / poor timing of upper trapezius activation	Maintenance of good posture with all exercises, maintenance of thoracic range of motion, global kinetic chain exercises and treatment of pectoralis minor and posterior cuff tightness	Good quality movement; initially post soft tissue release and with prompts; for addition of load must be independent good movement	Ludewig & Reynolds 2009 Borstad & Ludewig, 2005.
Strengthening *Isometrics* *Elastic* *Weight bearing* *Resistance Training*	• Pain free 30% maximum voluntary contraction (MVC) • Isotonic rotator cuff work in week 1 • Commence in week 1 • Progress partial weight – full weight; stable-unstable; isometric-isotonic-balistic • Successful completion of high repetition and load exercises prior with elastic resistance • Maximal strength development for return to play; equalise strength right to left shoulders	rehabilitation, emphasis is placed on muscular coordination, control, and endurance More functional than isometric contractions and suited to the post-operative patient; successfully target the rotator cuff Facilitate rotator cuff co-contraction and shoulder stability. Rugby league involves OKC and CKC activity therefore rehab should match the sport for successful outcome Elastic resistance cannot attain levels required by healthy rugby players; consequently greater resistance needed	Pain free 50% maximum voluntary contraction (MVC) Pain free completion 3 sets of 10 repetitions each exercise Pain free completion of previous stage and appropriate soft tissue healing time Is on-going with a progression towards players "normal" training as symptoms allow.	Hintermei Lange, Schulthei Bey & Hawkins, 1998. Hintermei et al., 199 Jackins, 2 Reinold e 2007 Morrissey Harman & Johnson Uhl, Carv Mattacola Mair & Ni 2003. Stone, Lueken, Partin, Ti Ryan, 199 Hintermei et al., 199 Edouard 2009
Return to play	• Safe return to play		Less than 10% defecit in rotator cuff strength right to left and with resistance training in all exercises. Successful completion of all previous sections and functional testing.	Kovacic & Bergfeld 2

Results

Results of this rehabilitation program were a successful return to play at 15 weeks post-operatively. Shoulder strength was regained prior to full training resuming. Isokinetic scores at eight weeks post-surgery revealed IR and ER deficits of approximately 15% left to right (Figure 2). A re-test on test at 12 weeks post-surgery showed significantly improved strength to within set criteria for a return to play, and in many areas exceeding such criteria.

Figure 2: Shoulder Isokinetic Testing Data

Angular Velocity (°/sec)	External Rotation Peak Torque (Nm)		Internal Rotation Peak Torque (Nm)	
Test 1	LEFT	RIGHT	LEFT	RIGHT
60°	48.8	42.9	76.5	56.2
120°	39.4	42.6	55.9	58.1
180°	43.5	37.3	63.2	54.6
Test 2				
60°	38.4	50.8	62.8	65.7
% difference to best score	+ 4.1 %	+18.4%	-14%	+16.9%
120°	34.8	43.6	55.2	62.3
% difference to best score	+ 10.7%	+ 2.3 %	+ 11.4%	+ 7.2%
180°	31.3	43.5	51.7	57.3
% difference to best score	0	+ 16.7%	- 10%	+ 4.9%

Discussion

Early immobilisation post operatively was originally recommended in the literature due the widespread use of open procedures and poor fixation with initial arthroscopic repairs (Green & Christensen, 1993). However with improving arthroscopic repairs more aggressive rehabilitation was deemed safe (Kim et al., 2003). Arthroscopic repair meant less inflammation of local tissues and therefore less time required for tissue healing. Kim et al., (2003) allowed early mobilisation up to 90° flexion and abduction from day three as pain allowed. They found that patients undergoing accelerated rehab versus immobilisation had reduced post-operative pain and quicker return to functional activities versus controls. Importantly there was no change in complication rates between the two groups showing that early mobilisation is a safe treatment choice as well as more efficacious in the short term. Whilst early mobilisation is a deviation from the established practice it demonstrates best practice utilising evidence from Kim et al., (2003) for more advanced but ultimately safe rehabilitation. Early mobilisation is made possible and safer in the elite sport setting through collaborative working between the surgeon and physiotherapist. A “safe zone” for range of motion is established intra-operatively that does not stress the repair and this guides initial management.

Stone et al., (1993) recommend reviewing the patient the day after the introduction of each exercise and reducing or removing it in the presence of increased pain. These principles were used for the progression of all exercises during this case. No set backs were experienced in this case meaning exercises

were progressed as deemed appropriate and maintained throughout the rehabilitation period. Regular discussions were held between the surgeon, physiotherapist and player over the player's progress. Timings of advancement were clarified based on the physiotherapists assessment of improvement and functional performance, the player's response and the surgeons opinion on the strength or repair and healing times.

Multiple research papers have failed to agree on a consensus of aberrant movement patterns in the scapula. This is possibly due to a lack of rational theory, paucity of empirical data or the complexity of neuromuscular control; or most likely a combination of all factors. Generally accepted concepts of lack of scapula upward rotation, poor serratus anterior activity and increased upper trapezius activity are prevalent (Ludewig & Reynolds 2009). Specific exercises aimed at scapula kinematics were not used, rather concepts of good posture, whole kinetic chain exercises and shoulder control with all exercises. Exercises such as the push-up plus are used for graded weight bearing but also recruit serratus anterior which is used to produce desired scapula motion as well as inhibit over activity of the upper trapezius (Ludewig, Hoff, Osowski, Meschke & Rundquist, 2004).

Muscle co-contraction is key to good scapula mechanics and whole kinetic chain exercises are used to facilitate this (Gibson, 2004). The use of functional postures and activities combined with a shoulder exercise give greater kinetic

chain input and further improve shoulder proprioception (Riemann & Lephart, 2002; Gibson 2004)

Isometrics are utilised early in rehabilitation to load the rotator cuff without overly stressing the repaired structures. Whilst widely used in rehabilitation there is a lack of clinical trials to justify their inclusion (Wilk et al., 2002). Exercises are performed in varying degrees of elevation and rotation (Appendix 1) to maximise somatosensory feedback and joint proprioception by loading the capsule under differing levels of tension as advocated by Gibson (2004).

There has been a large amount of research into which exercises optimally recruit individual rotator cuff muscles (Bradley & Tibone, 1991; Townsend, Jobe, Pink & Perry, 1991; Moseley, Jobe, Pink, Perry & Tibone, 1992). Whilst these articles found certain exercises did bias individual cuff muscles there was inherently activity in other shoulder girdle musculature (Townsend et al, 1991). As successful rehabilitation and return to play require effective muscle recruitment, co-contraction and co-ordination, individual recruitment of specific muscles is not necessarily desired (Wilk et al., 2002).

As greatest cuff and shoulder girdle recruitment was found with elastic resistance scaption, low row, ER and IR exercise, the early rehabilitation used fits in with current practice and is supported by experimental data.

Weight bearing exercises have been found to improve shoulder proprioception (Ubinger, Prentice & Guskiewicz 1999). Ubinger et al., (1990) looked at shoulder proprioception in healthy subjects over a four week training program of CKC exercises, similar to those in this case, and found significant improvement versus controls. Uhl et al., (2003) went on to examine the EMG response of the shoulder musculature to progressive upper limb weight bearing. They found a suspected linear relationship between load and muscular demand of the rotator cuff. The progressive loading of partial body weight to full body weight along with stable to unstable surfaces used in this study would fit with both clinical data showing improved joint position sense and EMG data targeting the appropriate musculature (Gibson, 2004; Jackins, 2004).

There are some conflicts within the literature and the program used. Uhl et al., (2003) and Eckenrode et al., (2009) state that weight bearing places a greater load on the posterior labrum and could lead to pain and possible injury. However Gibson (2004) states CKC exercises utilise the pre-setting mechanism of the rotator cuff and aid dynamic stability of the shoulder by reducing labral shear forces. Stone et al., (1993) state that such exercises should only be included in functional and return to play phases of rehabilitation. Following a posterior labral repair it could be argued that these exercises were introduced too early. The exercises were included following discussion with the surgeon who deemed the repair strong enough to take such load. Clinical experience of collaborative working with Mr Funk on previously successful cases led to a joint decision being made to pursue an advanced regime.

Multidisciplinary work with the strength and conditioning coach helped to set a weights regime for the upper body (Appendix 1). Lower body work was performed throughout rehabilitation to minimise de-training and maintain fitness where possible. Weight on each exercise was increased as tolerated and a guideline of 90% strength to pre-injury levels was one criterion for a return to contact work and training. Strength scores of 90% to the uninjured side are widely used in sport for safe rehabilitation progression and discharge (Eckenrode et al., 2009).

Strength was assessed by comparison of weight lifted to previous levels as well as isokinetic dynamometry. Isokinetics give an objective measure of shoulder ER and IR strength and were compared with the unaffected limb. As well as strength normalisation a ratio of ER:IR of 65-75% was deemed desirable as set out in the literature (Ellenbecker, 1995). Testing protocols used were that regularly employed by the player's club (Figure 2).

return to play:

For return to contact work a similar approach to that used by Eckenrode et al., (2009) was utilised. Graduated falls and contact in a controlled environment were progressed from slow to fast, padding / bags to pitch based contact and finally full contact with live tackling drills under supervision. No standardised return to play tests are used in rugby league or universally across any sport (Park et al., 2004). A return to play "test" was not used in this process rather a

continuum of logical progressions, with successful pain free completion of each section criterion for advancement.

Injuries in rugby league are associated with fatigue as is shoulder joint position sense (Gabbett, King & Jenkins 2008; Herrington, Horsley, Whitaker & Rolf 2008). Consequently the player completed numerous fitness drills based on the physiology of rugby league and on current first team drills to allow successful reintegration with the squad. Rugby league requires aerobic power, speed, repeat sprint ability, strength, and multiple skill elements (Gabbett et al., 2008). End stage rehabilitation consisted of drills incorporating all these factors plus shoulder proprioception drills.

The inclusion of such drills under fatigue is an example of innovative practice. There is evidence from soccer that balance training under fatigue gives greater benefits to balance than training beforehand (Gioftsidou, Malliou, Pafis, Beneka, Godolias & Maganaris 2006). This is in contrast to results found in tennis (Malliou et al., 2008). Whilst there is no definitive answer on the inclusion of proprioception work under fatigue it was felt this method warranted merit and could be of benefit to the athlete. Further investigation into upper limb training and fatigue is needed.

The majority of literature lists return to play for multiple sports following shoulder surgery at greater than six months (Wilk et al; 2002; Park et al., 2004; Kovacic & Bergfeld, 2005; Eckenrode et al., 2009). There are some exceptions with Badge

et al; (2009) and Funk and Snow (2007) reporting return to play of 4.3 and 2.6 months. Interestingly apart from Eckenrode etal; (2009) these are more recent studies, possibly indicating a general trend towards more advanced rehabilitation.

A quicker return to play could be interpreted as a move from best / current practice. However clinical guidelines as set out by Park et al., (2004), McCarty et al., (2004) and Kovacic and Bergfeld (2005) were incorporated in the return to play decision as well as a thought model advocated by Creighton, Shrier, Shultz, Meeuwisse, and Matheson (2010). By using these guidelines with an advanced rehabilitation protocol a successful return to play was made without delaying the player's participation unnecessarily.

Future Practice:

Eckenrode et al., (2009) theorise that infraspinatus strengthening will reinforce the posterior capsule and aid posterior shoulder stability. As such in future more bias could be place on shoulder external rotation exercises to improve posterior stability, especially early in rehabilitation when newly repaired structures are weakest.

Conclusion

This case describes the successful advanced rehabilitation of an elite rugby player following posterior stabilisation of the glenohumeral joint. In contact

athletes accurate diagnosis, appropriate management, collaborative MDT work and individually tailored, goal based rehabilitation are essential for an optimal outcome. Rehabilitation is based on the best available evidence, collaborative feedback, and expert opinion to advance physiotherapy practice in contact sports. Future research should focus on a number of areas including strength profiling of elite rugby league players for comparative normal scores. The optimal timing and volume of rehabilitation exercises is not known and there is no standardised, reliable and valid return to play test. Research could also look at a link between shoulder strength and injury and with isokinetics in more detail look at rate of force development and overall work performed and its link to injury and successful return to play.

Appendix 1 – Rehabilitation Protocol

Week	Activity Description	Frequency	Week	Activity Description	Frequency
1	**Limitations** In sling approx 3 days post injury Use sling out in public and whilst asleep **Rehab** Static contractions abd/flex/ext/int rot/ext rot Passive flex with broom handle DA weight bearing with scap pinch in safe zone Theraband: early abd/flex/low row/SA row Scap pinch clockface with swiss ball	 10 second hold 3 x10 3 x 10 5 x 30 secs 3 x 6 each 3 x 20 secs	3	**Limitations** No contact / running **Rehab:** Cable LR, MR, AB, F, SA row GB press in standing Press up turn out R LL step up with R GHJF with TB GB squat with TB loop and GHJF Reverse Flye Prone on GB **Conditioning:** Bike x 4" between 2-3 exercises Pool running – kick sessions X trainer – no arms	 3 x 10 all increase weight as able 4 x 5 4 x 5 3 x 10 3 x 10 3 x 12
2	**Limitations** Use sling out in public and whilst asleep if not confident, remove other times **Rehab** Static contractions – Abduction at 30°, 60° & 90° Flexion at 30°, 60° & 90° Lat Rot 45° of med rot & 90°(neutral) Med Rot at 45° & 90° (neutral) SA weight bearing with scap pinch in safe zone Theraband: pain free abd/flex/low row/SA row Cable – abduction, flexion, med & lat rot, single arm row, reverse fly Scap pinch clock face/alphabet with swiss ball Scap pinch wall wash Supine – balance swiss ball 10 secs with 5 ball press x 3 Press up position balance on airex cushions 10 x 10 sec holds Step-ups with R GHF with TB **Conditioning** Static bike Leg work – Step ups/downs/throughs/SLS's/Box Squats	 10 second hold 3 x10 3 x10 3 x 10 3 x10 5 x 30 secs 3 x10	4	**Limitations** No contact Running as comfortable **Rehab:** Cable LR, MR, AB, F, SA row – increase weight GB press-up – against wall if control an issue Press up turn out GB squat with TB loop and GHJF Reverse Flye Prone on GB – increase DB weight Bent Over Row with bar bell – 20kg Seated Row machine – weight as tolerated **Conditioning:** Bike x 4" between 2-3 exercises – start spinning sessions Pool running – kick sessions X trainer – no arms	 3 x 10 3 x 10 3 x 10 3 x 12 3 x 10 3 x 10 3 x 10
Week	**Activity Description**	**Frequency**	**Week**	**Activity Description**	**Frequency**

5	**Limitations** No contact Running as comfortable **Rehab:** Cable LR, MR, AB, F, SA row – increase weight LR and MR at 90 degrees Abd GB press-up Press up turn out GB squat with TB loop and GHJF Reverse Flye Prone on GB – increase DB weight Bent Over Row with bar bell – weight as able Seated Row machine – weight as tolerated Seated shoulder press 8kg DB **Conditioning:** Bike x 4" between 2-3 exercises Pool running – kick sessions X trainer	 3 x 10 3 x 10 3 x 10 3 x 10 3 x 12 3 x 10 3 x 10 3 x 10 3 x 10 3 x 10	7	**Limitations** Light to moderate contact **Rehab** SA weight bearing swiss ball Prone row with bar bell + 20kg Dumb bell press Shoulder retraction: prone with dumbells on swiss ball Rotator cuff variations: cables as above Rebound board with med ball **Conditioning** Static bike/X-trainer (no arms) Pool running/leg kick session L & R passing distance as tolerated Running as tolerated Leg work – Step ups/downs/throughs/SLS's/Box Squats Shrugs Trap bar dead lift & RDL's High Pulls	 20 positions 3 x 12 3 x 10 4 x 12 3 x 8 each ex 3 x 20 40-60mins
6	**Limitations** No contact Running as comfortable **Rehab:** Cable LR, MR, AB, F, SA row – increase weight LR and MR at 90 degrees Abd GB press-up Press up turn out GB squat with TB loop and GHJF Reverse Flye Prone on GB – increase DB weight Bent Over Row with bar bell – weight as able Seated Row machine – weight as tolerated Seated shoulder press increase weight as tolerated Re-bounder 2-3kg MB R+L ball passing **Conditioning:** Static bike/X-trainer (no arms) Pool running/leg kick session L & R passing distance as tolerated Running as tolerated; Step ups/downs/throughs/SLS's/Box Squats	 3 x 10 3 x 10 3 x 10 3 x 10 3 x 12 3 x 10 3 x 10 3 x 10 3 x 10 3 x 10 40-60"	8 +	**Limitations** Moderate contact **Rehab** SA weight bearing swiss ball Prone row with bar bell + 20kg Dumb bell press Shoulder retraction: prone with dumbells on swiss ball Rotator cuff variations: cables as above Rebound board with med ball Graded fall work **Conditioning** Static bike/X-trainer Pool running/leg kick session L & R passing distance as tolerated Running as tolerated Leg work – Step ups/downs/throughs/SLS's/Box Squats Shrugs Trap bar dead lift & RDL's High Pulls	 20 positions 3 x 12 3 x 10 4 x 12 3 x 8 each ex 3 x 20 20 mins 20 mins 40-60mins

STATEMENTS

Ethical Approval: No ethical approval was required as this is a retrospective descriptive case study. Anonymity has been protected throughout

Funding: No funding was required for this study

Conflicts of Interest: None forseen

Reference List

Badge, R., Tambe, A. and Funk, L. (2009) Arthroscopic isolated posterior labral repair in rugby players, *International Journal of Shoulder Surgery*, 3, 1, 4-7.

Bradley, J.P. and Tibone, .JE. (1991) Electromyographic analysis of muscle action about the shoulder. Clinics in Sports Medicine 10, 789–805.

Eckenrode, B.J., Logerstedt, D.S. and Sennett, B.J. (2009) Rehabilitation and Functional outcomes in Collegiate Wrestlers Following a Posterior Shoulder Stabilization Procedure, *Journal of Orthopaedic and Sports Physical Therapy*, 39, 7, 550-559.

Edouard, P., Frize, N., Calmels, P., Samozino, P., Garet, M. and Degache, F. (2009) Influence of Rugby Practice on Shoulder Internal and External Rotation Strength, International Journal of Sports Medicine, 30, 863-867.

Ellenbecker, T.S. (1995) Rehabilitation of shoulder and elbow injuries in tennis players. *Clinics in Sports* Medicine, 14, 87-109.

Funk, L. and Snow, M. (2007) SLAP Tears of the Glenoid Labrum in Contact Athletes, *Clinical Journal of Sports Medicine*, 17, 1-4.

Gabbett, T. (2005) Science of rugby league football: a review, *Journal of Sports Science*, 23, 961–976.

Gabbett, T., King., T. and Jenkins, D. (2008) Applied Physiology of Rugby league, *Sports Medicine*, 38, 2, 118-138.

Green, M.R. and Christensen, J.P. (1993) Arthroscopic versus open Bankart procedures: a comparison of early morbidity and complications, *Arthroscopy*, 9, 371-374.

Herrington, L., Horsley. I., Whitaker, L. and Rolf, C. (2008) Does a tackling task effect shoulder joint position sense in rugby players? *Physical therapy in Sport*, 9 67-71.

Hintermeister, R.A., Lange, G.W., Schultheis, J.M., Bey, M.J. and Hawkins, R.J. (1998) Electromyographic Activity and Applied Load During Shoulder Rehabilitation Exercises Using Elastic Resistance, *The American Journal of Sports Medicine*, 26, 2, 210-220.

Holzapfel, K., Waldt, S., Bruegel, M., Paul, J., Heinrich, P., Imhoff, A.B., Rummeny, E.J., Woertler, K. (2010) Inter- and intraobserver variability of MR arthrography in the detection and classification of superior labral anterior posterior (SLAP) lesions: evaluation in 78 cases with arthroscopic correlation, *European Radiology*, 20, 3, 666-673.

Jackins, S. (2004) Postoperative Shoulder Rehabilitation, *Physical medicine and rehabilitation clinics of North America*, 15, 643-682.

Kim, S., Ha, K., Jung, M., Lim, M., Kim, Y. and Park, J. (2003) Accelerated rehabilitation after Arthroscopic Bankart Repair for Selected Cases: A Prospective Randomised Clinical Study, *Arthroscopy*, 19, 7, 722-731.

Kovacic, J., and Bergfeld, J. (2005) Return to Play Issues in upper Extremity Injuries, *Clinical Journal of Sports Medicine*, 15, 6, 448-452.

Ludewig, P.M., Hoff, M.S., Osowski, E.E., Meschke, S.A. and Rundquist, P.J. (2004) Relative balance of serratus anterior and upper trapezius muscle activity during push-up exercises, *The American Journal of Sports Medicine,* 32, 484-493.

Ludewig, P.M. and Reynolds, J.F. (2009) The Association of Scapular Kinematics and Glenohumeral Joint Pathologies, *Journal of Orthopaedic & Sports Physical Therapy*, 39, 2, 90-104.

Mair, S.D., Zarzour, R. and Speer, K.P. (1998) Posterior labral injury in contact athletes, *The American Journal of Sports Medicine*, 26, 6, 753-758.

Malliou, V.J., Malliou, P., Gioftsidou, A., Pafis, G., Katsikas, C., Beneka, A., Tsiganos, G. and Godolias, G. (2008) *Journal of Back and Musculoskeletal Rehabilitation*, 21, 87–90.

Manske, R. and Prohaska, R. (2010) Superior labrum anterior to posterior (SLAP) rehabilitation in the overhead athlete, *Physical Therapy in Sport*, 11, 110-121.

McFarland, E.G., Garzon-Muvdi, J., Jia, X.F, Dessai, P., and Petersen, S.A. (2010) Clinical and diagnostic tests for shoulder disorders: a critical review, *British Journal of Sports Medicine*, 44, 5, 328-332.

McCarty, E.C., Ritchie, P., Gill, H.S. and McFarland, E.G. (2004) Shoulder Instability: return to play, *Clinics in Sports Medicine*, 23, 335-351.

Meserve, B.B., Cleland, J.A. and Boucher, T.R. (2009) A Meta-analysis Examining Clinical Test Utility for Assessing Superior Labral Anterior Posterior Lesions, *The American Journal of Sports Medicine*, 37, 11, 2252-2258.

Morrissey, M.C., Harman, E.A. and Johnson, M.J. (1995) Resistance Training Modes: specificity and effectiveness, Medicine and Science in Sports and Exercise, 27, 5, 648-660.

Moseley, J.B. Jobe, F.W. Pink, M., Perry, J. and Tibone, J. (1992) EMG analysis of the scapular muscles during a shoulder rehabilitation program, *The American Journal of Sports Medicine*, 20, 128-134.

Munro, W. and Healy, R. (2009) The validity and accuracy of clinical tests used to detect labral pathology of the shoulder, *Manual Therapy*, 14, 119-130.

Park, H.B., Lin, S.K., Yokota, A. and McFarland, E.G. (2004) Return to play for rotator cuff injuries and superior labrum anterior posterior (SLAP) lesions, *Clinics in Sports Medicine*, 23, 3, 321-334.

Reinold, M.M., Macrina, L.C., Wilk, K.E., Fleisig, G.S., Dun, S., Barrentine, S.W., Ellerbusch, M.T. and Andrews, J.R. (2007) Electromyographic Analysis of the Supraspinatus and Deltoid Muscles During 3 Common Rehabilitation Exercises, *Journal of Athletic Training*, 42, 4, 464-469.
Riemann, B.L. and Lephart, S.M. (2002) The sensorimotor system, part II: the role of proprioception in motor control and functional joint stability, *Journal of Athletic Training* , 37,1, 71–9.

Stone, J.A., Lueken, J.S., Partin, N.B., Timm, K.E. and Ryan, E.J. (1993) Closed Kinetic Chain Rehabilitation for the Glenohumeral Joint, *Journal of Athletic Training*, 28, 1, 34-37.

Townsend, H., Jobe, F.W., Pink, M and Perry, J. (1991) Electromyographic analysis of the glenohumeral muscles during a baseball rehabilitation program, , *The American Journal of Sports Medicine*, 19, 3, 264-272.

Tung, G.A. and Hou, D.D. (2003) MR Arthrography of the posterior labrocapsular complex: relationship with glenohumeral joint alignment and clinical posterior instability, *American Journal of Roentology*, 180, 369-375.

Ubinger, M.E., Prentice, W.E. and Guskiewicz, K.M. (1999) Effect of Closed Kinetic Chain Training on Neuromuscular Control in the Upper Extremity, *Journal of Sports rehabilitation*, 8, 184-194.

Uhl, T.L., Carver, T.J., Mattacola, C.D., Mair, S.G. and Nitz, A.J. (2003) Shoulder Musculature Activation During Upper Extremity Weight-Bearing Exercise*, Journal of Orthopaedic & Sports Physical Therapy*, 33, 3, 109-117.

Wilk, K. E., Meister, K. And Andrews, R. (2002) Current Concepts in the Rehabilitation of the Overhead Throwing Athlete, *The American Journal of Sports Medicine*, 30, 1, 136-151.