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Jason Brumitt

George Fox University, jbrumitt@georgefox.edu

Alma Sproul

Philip Lentz

Linda McIntosh

Richard Rutt

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Case study

In-season rehabilitation of a division III female wrestler after a glenohumeral dislocation

Jason Brumitt^{a,*}, Alma Sproul^b, Philip Lentz^b, Linda McIntosh^b, Richard Rutt^{a,b}

^aSchool of Physical Therapy, Pacific University Oregon, 222 SE 8th Ave., Hillsboro, OR 97123, USA

^bAthletic Training Department, Pacific University Oregon, 2043 College Way, Forest Grove, OR 97116, USA

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ABSTRACT

Objective: Wrestling is a popular sport in the United States at both the high school and collegiate levels. Traditionally a men's sport, participation by female athletes in wrestling is increasing. There exists a paucity of literature regarding injury incidence in women's wrestling. This lack of information challenges the ability of sports medicine and strength training professionals to design optimal injury prevention programs, training routines, and rehabilitation strategies. The objective of this report is to detail the successful conservative rehabilitation of a female wrestler after an initial glenohumeral dislocation.

Design: Case report

Case description: A 20-year-old female wrestling student-athlete presented to the university's sports medicine team after sustaining an anteriorly dislocated right shoulder. The patient had the goal to return back to competition in time for the National Championships. An evidenced-supported, non-traumatic glenohumeral instability rehabilitation protocol combined with weight-bearing exercises simulating functional sport positions was implemented with the goal of returning the injured collegiate female wrestler back to sport.

Results: At the end of the rehabilitation program the athlete demonstrated full active range of motion, good strength in the right shoulder, and reported her pain rating at a 1/10. The conservative rehabilitation strategy utilized in this case enabled the patient to return to wrestling and successfully compete at the National Championships.

1. Introduction

Wrestling is a popular sport in the United States at both the high school and collegiate levels (National Collegiate Athletic Association, 2008; National Federation of State High School Associations, 2008). Due to the nature of the sport, wrestlers are at risk of sustaining a spectrum of injuries ranging from sprains and strains to catastrophic injuries such as head trauma and fractures (Halloran, 2008; Ogawa & Ui, 1997; Pasque & Hewett, 2000; Powell & Dompier, 2004; Yard, Collins, Dick, & Comstock, 2008). A recent epidemiological investigation of sports injuries at the collegiate level demonstrated that wrestlers are among the most frequently injured and their injuries resulted in longer time-loss from competition than most other sports (Powell & Dompier, 2004).

Powell and Dompier (2004) found that injury rates for wrestlers (34.3 per 1000 athletic exposures) ranked 4th behind football players, tennis players, and indoor track and field athletes at the division I level. In addition, wrestlers at the division I level experienced the greatest number of injuries that resulted in time lost from sport (10.7 per 1000 athletic exposures) (Powell & Dompier, 2004). At the division III level, Powell and Dompier (2004) found wrestlers sustained more injuries than any other sport (44.7 per 1000 athletic exposures) and ranked 3rd behind football players and soccer players for the greatest number of injuries resulting in time lost from sport (7.8 per 1000 athletic exposures).

Wrestling has been primarily a men's sport at the high school and collegiate levels. However, there are a growing number of female athletes who compete on co-ed or all female wrestling teams. During the 2005–2006 high school academic year, almost 5000 female wrestlers competed for 1081 high school teams (National Federation of State High School Associations, 2008). It is unclear however as to how many female wrestlers competed at the collegiate level. The NCAA publishes the Sports Sponsorship and

Participation Rates Report which presents participation statistics for men's and women's collegiate sports (National Collegiate Athletic Association, 2008). The current report provides sports participation rates for the 2005–2006 sports season (National Collegiate Athletic Association, 2008). Including all athletes from division I, II, and III schools, a total of 228 men's wrestling teams boasted 6139 athletes (National Collegiate Athletic Association, 2008). Participation rates for women's wrestling were not available in this report (National Collegiate Athletic Association, 2008).

With a paucity of epidemiological investigations, one is left to speculate as to injury incidence and specific injury diagnoses that may be experienced by female wrestling athletes (Agel, Ransone, Dick, Oppliger, & Marshall, 2007; Yard et al., 2008). A recent review of the literature (MEDLINE and CINAHL) revealed only one article reporting injury to female wrestlers. Ogawa and Ui (1997) retrospectively reviewed 30 cases of wrestlers who had sustained a humeral shaft fracture. Of the 30 cases, 2 of the fractures were sustained by female wrestlers (Ogawa & Ui, 1997). Lacking adequate epidemiological studies, strength coaches and sports medicine professionals are thus limited in their ability to prescribe optimal training or rehabilitation programs.

The purpose of this report is to highlight a unique case of a collegiate female wrestling athlete who experienced an anterior glenohumeral dislocation at the start of the season and the rehabilitation strategy that was implemented allowing the athlete to successfully return to sport.

2. Case description

A 20-year-old female wrestling student–athlete presented to the university's sports medicine team approximately 3 weeks after sustaining an anteriorly dislocated right shoulder. She sustained the injury to her dominant extremity during a practice prior to the first match of the season.

2.1. Immediate medical management

The athlete sustained the shoulder dislocation upon impact with the ground after a takedown. She was immediately transferred from the university via ambulance to the local hospital's emergency room. The athlete's medical record revealed that her pre-manipulation pain rating ranged from 7 to 9/10. Prior to the manipulation, light touch sensation testing found decreased sensation in the right hand and fingers when compared with her left side. The athlete noted that her right hand and fingers were "tingling". The athlete's shoulder was reduced by a board-certified emergency medicine physician. Post-reduction X-rays revealed a successful manipulation without obvious fracture. Her sensation was also restored post-manipulation. She was discharged from the hospital wearing a shoulder sling (with her right shoulder positioned in internal rotation), provided a prescription for pain medication, and was instructed to follow up with the university's team physician. The university's team physician, an orthopedic surgeon, re-evaluated the athlete (5 days post injury) and referred her to the university's sports medicine team to begin the rehabilitation program. The team physician placed her on the injured list for at least a minimum of 4 weeks.

2.2. Initial musculoskeletal assessment

The patient attended her first rehabilitation session 18 days after dislocating her shoulder. She was continuing to support her right upper extremity with the shoulder sling, although she had been allowed by the team physician to discontinue its use when tolerated. She reported her average pain level score as 6 out of 10 (visual

analog scale). Once her sling had been removed for the initial evaluation, she initially supported her right upper extremity with her left. When questioned as to why she did this, she reported that it was out of "fear of pain". Observation of her upper quadrant revealed bilateral winging of the scapula consistent with a Kibler type II presentation (medial border winging of the scapula) (Kibler, Uhl, Maddux, Brooks, Zeller, & McMullen, 2002). Her scapular and core muscles appeared generally deconditioned. Due to the severe pain she was experiencing, the evaluator was unable to conduct manual muscle tests at this time that would reliably quantify strength or endurance capacity. Baseline passive range of motion (PROM) measures of the right glenohumeral joint revealed shoulder flexion limited by pain to 130°, shoulder abduction limited by pain to 90°, and shoulder external rotation (at 0° abduction) limited by pain to 25°. When manually assessing the athlete's available passive range of motion in the right shoulder, she presented with a muscular spasm end-feel in each of the measured directions. Her left glenohumeral PROM measures were as follows: flexion 165°, abduction 165°, and external rotation 90°. A neurologic screen of both upper extremities revealed 2+ C5 and C6 reflexes bilaterally and intact dermatomes (C4–T1) bilaterally. Additional testing of the right shoulder, including active range of motion (AROM) and manual muscle tests (MMT) was deferred.

2.3. Rehabilitation

The conservative rehabilitation strategy implemented for this patient was based on published clinical guidelines (Davies, Manske, Schulte, DiLorenzo, Jennings, & Matheson, 2006; Kirkley, Werstine, Ratjek, & Griffin, 2005; Wilk, Macrina, & Reinold, 2006). We primarily utilized a 4-phase protocol advocated by Wilk et al. (2006). Each phase of this protocol is defined by specific rehabilitation goals, treatment recommendations, and minimum functional outcomes an athlete must achieve prior to progressing to the next phase (Wilk et al., 2006). As necessary, we modified this program to prescribe exercises that functionally reproduced the unique forces experienced during wrestling.

2.4. "Phase I – acute phase" (Wilk et al., 2006)

Wilk et al. (2006) proposed the goals for this initial phase are to decrease pain, increase "non-painful" motion, initiate gentle therapeutic exercises, and avoid undue stress to the healing joint capsule. Patients with anterior glenohumeral instability should be restricted from performing excessive ROM exercises into horizontal abduction or external rotation (Wilk et al., 2006)

During this phase of therapy, the patient was treated with modalities in order to decrease pain and inflammation, was prescribed gentle ROM activities to restore her PROM, and was prescribed isometric exercises to initiate gentle strengthening (Table 1). Ice packs and interferential electric stimulation (80–150 Hz, 100% scan, 15-second scan period, 20-minute treatment) were utilized to help reduce the patient's pain (Jorge, Parada, Ferreira, & Tambeli, 2006; Shapiro, 2009). The patient was also encouraged to use ice frequently at home. To address her ROM limitations, active assisted cane exercises (in lieu of an L-Bar) were performed in the sagittal plane to restore flexion and in the scapular plane to restore external rotation (with the shoulder slightly abducted approximately 25° from the side of the body).

The patient was scheduled to attend therapy 2 times per week with at least one day between therapy sessions. She was instructed to perform her prescribed ROM exercises at home daily in between her scheduled therapy appointments. The patient's right shoulder PROM improved to 140° of flexion and 45° of external rotation by

Table 1
Exercises prescribed per rehabilitation phase.

Phase I	Range of Motion Exercise	<ul style="list-style-type: none"> • Cane Exercises: shoulder flexion and ER • Physioball: Active Assisted Range of Motion in the horizontal plane to facilitate flexion Isometrics (in neutral) • Shoulder flexion, extension, ER, and IR
Phase II	Upper Body Ergometry Shoulder and Scapular Strengthening	<ul style="list-style-type: none"> • Prone Extension • Prone Row • Side-lying ER • Theraband ER-IR • Prone Horizontal Abduction with Shoulder in ER • Bicep Curls • Scaptions with Shoulder in ER • Seated Rows Shoulder Stabilization Drills • Wall Push Ups (with Physioball) • Manual Rhythmic Stabilization (performed in neutral) • Body Blade (2 positions)
Phase III	Continued previously prescribed exercises from phase II Shoulder Stabilization Drills	<ul style="list-style-type: none"> • Manual Rhythmic Stabilization drills • Proprioceptive Neuromuscular Facilitation: D2 pattern • Body Blade (multiple positions) • Push Up with a Plus (Plus position only) Plyometrics • 2 hand plyometric drills <ul style="list-style-type: none"> ○ Chest pass ○ Side to Side Throws • 1 hand plyometric drills <ul style="list-style-type: none"> ○ 90/90 throws to a rebounder ○ Wall dribbles
Phase IV	Continued previously prescribed exercises from phase II-III Shoulder Stabilization Drills	<ul style="list-style-type: none"> • Axial compression drills over various surfaces (“up and downs”)

the 3rd visit (4 weeks post injury). The patient was prescribed gentle shoulder isometrics during the 3rd visit (Table 1).

By the 3rd visit the patient no longer wore the shoulder sling, she demonstrated an increase in shoulder PROM, and reported no pain or discomfort when performing her rehabilitation exercises. The patient did however require counseling regarding non-therapy activity levels. She experienced two days of shoulder pain prior to the 3rd rehab appointment after she participated in a school assignment consisting of manual labor (lifting objects during an outdoor science lab).

The patient attended only 3 therapy sessions during the “acute phase”. Her injury occurred near the end of the fall academic semester. She missed a couple of scheduled appointments due to the time constraints and pressures associated with final exams. After the completion of her final exams, she returned home for the winter break.

2.5. “Phase II – intermediate phase” (Wilk et al., 2006)

The patient returned to the university by the start of the spring academic semester. She was now approximately 11-weeks post injury, with 6 weeks remaining until the national tournament. During the winter break the patient reported continuing her established home exercise rehab program. Her right shoulder PROM had been restored (flexion 165°, abd 165°, and ER 90°).

However, due to the aforementioned scheduling challenges, we were limited in our ability to safely advance the therapeutic exercises designed to increase muscular strength. Despite missing approximately 3 months of practices and competitions already, and only participating in a few supervised treatment sessions, the patient still expressed the goal of returning to competition in time for the National Collegiate Wrestling Association’s (NCWA) National Championships (to be held 6 weeks later).

The recommended goals for the 2nd phase include increasing strength, restoring AROM/PROM/joint mobility, and initiating proprioception and stabilization training (Wilk et al., 2006). Wilk et al. (2006) recommend that a patient must demonstrate “good” MMT of the shoulder, especially for rotation and elevation positions prior to advancing to the next stage. It was apparent at this point the patient presented with functional weakness of her right upper extremity. Specific MMT was not performed; rather qualitative assessment of the patient’s muscular strength was appreciated by observing her ability to perform rotator cuff and scapular strengthening exercises initiated during this phase (II) of the rehabilitation protocol.

Table 1 presents the exercises initiated during this phase of the rehabilitation program. Rotator cuff and scapular stabilization exercises were prescribed to address weakness and poor neuromuscular control (Moseley, Jobe, Pink, Perry, & Tibone, 1992; Townsend, Jobe, Pink, & Perry, 1991). During this stage, the patient was instructed to perform a single set of each exercise with high-repetitions (20–25 reps) in order to increase muscular endurance (Davies et al., 2006; Wolfe, LeMura, & Cole, 2004). Initially the patient was unable to complete one set for the desired number of repetitions for several of the open chain shoulder exercises (prone extension, prone row, side-lying external rotation (Fig. 1), and scaptions) due to muscular fatigue. It took approximately a week and a half of performing these exercises daily before she had the strength and endurance capacity to successfully complete one set each exercise for the desired number of reps. Once she was able to successfully perform an exercise for the desired number of repetitions, resistance was added using light dumbbells (beginning with 1 lbs weights, increasing by 1 lbs increments). Later in the phase stabilization exercises were included in order to improve neuromuscular control and her ability to stabilize the shoulder (Kirkley et al., 2005; Wilk et al., 2006). These included rhythmic stabilization drills utilizing the Body Blade (Fig. 2) and manual resistance with the shoulder flexed to 90° (Fig. 3). After two

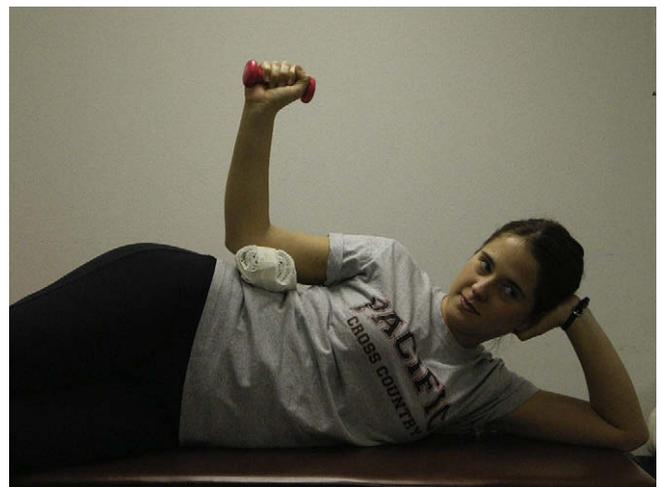


Fig. 1. Side-lying external rotation.



Fig. 2. Rhythmic stabilization drill using the Body Blade (shoulder flexed to 90°).

weeks of daily rehabilitation (5 sessions per week), the patient's shoulder strength improved allowing her program to be advanced to the 3rd phase.

2.6. "Phase III – advanced strengthening" (Wilk et al., 2006)

The goals of this phase are to increase shoulder strength, increase power, and advance stabilization and proprioception training (Wilk et al., 2006). All exercises prescribed during the 2nd phase of the program were continued into the 3rd phase (Table 1). The patient was instructed to now perform 2–3 sets of each exercise for 15–20 repetitions. The team physician allowed the patient to return back to practice to begin conditioning with the team, although she was not yet allowed to begin contact drills.

Shoulder stabilization exercises were progressed from the basic positions utilized during phase II to activities incorporating the entire shoulder's range of motion. A wrestling athlete must be able to stabilize the shoulder in response to the rapid positional changes and violent forces experienced during sparring, take-downs, and escapes (Halloran, 2008; Labriola, Lee, Debski, & McMahon, 2005). Manual (submaximal) isometric rhythmic



Fig. 3. Rhythmic stabilization in supine.

stabilization drills were conducted at various angles (60°, 90°, 120°, and 150°) of flexion (sagittal plane) and abduction (scapular plane). Manual resistance was also applied to the right upper extremity throughout the D2 proprioceptive neuromuscular facilitation (PNF) pattern (Fig. 4). Rhythmic stabilization drills with the Body Blade were performed at 4 angles: shoulder in neutral with elbow by the side for ER-IR, shoulder flexed to 90°, shoulder abducted and ER to the 90°–90° position (Fig. 5), and with the shoulder abducted to 110°–120° with the shoulder ER to 90°. The patient performed 2 reps of each body blade exercise for 20–30 s. The push up with a plus exercise (emphasizing only scapular protraction – "the plus") was introduced at this point in order to initiate controlled weight bearing through the upper extremities.

Plyometric drills were also introduced during this phase to enhance dynamic stability and develop power. Low weight, two-handed drills were performed first, later progressing to single arm plyometric drills.

2.7. "Phase IV – return to activity phase" (Wilk et al., 2006)

The athlete was transitioned to the final rehab phase during the two weeks prior to the national championships. The team physician allowed her now to participate in almost all practice drills except for wrestling match simulations. The patient had also been allowed to compete in the forthcoming wrestling tournament.

The goals of the final rehab phase are to maximize strength and power and to progress functional training to return an athlete to sport (Wilk et al., 2006). Phase II and III exercises were continued during this final phase. "Up and downs" were added during this phase and were performed over various surfaces (blocks, BOSU) and at various speeds in order to simulate potential upper extremity weight-bearing positions. The patient was first instructed to perform slow hand walks back and forth over a 4" to 6" step, progressed to fast hand walks back and forth over a BOSU (Fig. 6).

3. Results

At the completion of her supervised rehabilitation program, the patient was able to demonstrate equal active range of motion bilaterally (flexion 165°, abduction 165°, external rotation 90°). She reported that her pain level was "at most" a 1/10 after



Fig. 4. Manual resistance applied during proprioceptive neuromuscular facilitation pattern D2.



Fig. 5. Rhythmic stabilization drill using the Body Blade at the 90°-90° position.

wrestling practice. She reported 0/10 pain when exercising and at rest. Traditional manual muscle tests for the shoulder and scapula were also conducted and graded on the 1–5 scale (Ekstrom & Osborn, 2004). She presented with 4/5 strength at the right anterior deltoid, 4–/5 strength at the right middle deltoid, 5/5 strength at the right posterior deltoid, 4/5 strength for the right middle trapezius, 4/5 strength of the right shoulder external rotators, and 5/5 strength of the right shoulder internal rotators. Despite the fact that her right shoulder did not present with 5/5 (or “excellent”) strength in all of her shoulder muscles, her strength presentation was similar to her contralateral shoulder. Her left shoulder scores were: anterior deltoid 4+/5, middle deltoid 4+/5, posterior deltoid 5/5, middle deltoid 4/5, external rotators 4/5, and 5/5 for the internal rotators.

She was able to compete at the 2008 NCWA’s Women’s National Championship earning an All-American status. She pinned her first two opponents, both under 30 s. Overall she went 3–1 at the tournament, losing only her last match to the weight class (59 kg) champion.

4. Discussion

This case highlights the rehabilitation management of a female wrestling athlete who sustained a right glenohumeral dislocation



Fig. 6. Up and downs.

during the initial part of the wrestling season. The conservative rehabilitation strategy that was utilized and implemented helped the patient achieve her primary goal to return to competition (Wilk et al., 2006).

There exists a paucity in the literature regarding injuries sustained in women’s wrestling. This lack of information challenges the ability of sports medicine and strength training professionals to design optimal injury prevention programs, training routines, and rehabilitation strategies for the female wrestling athlete. Case reports, clinical commentaries, and epidemiological investigations are needed at this time in order to improve our awareness of injury incidence and diagnoses associated with this population. The rehabilitation protocol adopted in this case report assisted the athlete to return to sport preparing her for success at the national championships.

Conflict of Interest

None.

Ethical Approval

None.

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