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Interval return to play for a wrist fracture in a hockey player: a case report

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Distal radius fractures are a common sports injury, often managed with reduction, immobilization, and rehabilitation. However, structured sport specific return to play protocols have yet to be developed, specifically within hockey. This case report reviews the various factors to consider when managing an athlete's recovery from a radius fracture, and objective measures to aid with return to play decision making when managing a hockey player.

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KEY WORDS: radius, fracture, return to play, hockey, athlete, chiropractic, rehabilitation

Retour au jeu dans l'intervalle pour une fracture du poignet chez un joueur de hockey: un cas concret

Les fractures du radius distal sont des blessures sportives courantes, souvent traitées par réduction, immobilisation et rééducation. Cependant, des protocoles de retour au jeu structurés et spécifiques au sport n'ont pas encore été mis au point, en particulier pour le hockey. Ce rapport de cas examine les différents facteurs à considérer lors de la gestion de la récupération d'un athlète après une fracture du radius, et les mesures objectives visant à faciliter la prise de décision concernant le retour au jeu lors de la gestion d'un joueur de hockey.

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MOTS CLÉS : radius, fracture, retour au jeu, hockey, athlète, chiropratique, rééducation

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Introduction

Injuries are common amongst athletes, most notably within contact sports such as hockey, due to the nature of play. In the United States, it is estimated that the emergency department sees 18,000 hockey related injuries per year with over 90% of these patients being males, and 50% between the ages of 9-18 years old.[1] Elbow, wrist, and hand injuries account for 14.1% of all hockey related visits to the emergency department.[1] The most common upper extremity mechanism of injuries in hockey players are falls, collisions with other players, or contact with another stick or the boards. Defensemen are susceptible to these mechanisms of injury through their sport-specific demands and have been shown to comprise 40.1% of all wrist and forearm hockey related injuries.[2] To the authors' knowledge, a formal return to play protocol for hockey players following a distal radius fracture has yet to be developed. General principles of fracture management include reduction, immobilization, and rehabilitation.[3] Athletes' sport, position, and timing of injury within season all need to be considered for optimal fracture management.[3] For example, the demands placed through a wrist will vary between sports and sport specific roles, as well the frequency and intensity of practice and game play throughout a season. This case report reviews the various factors to consider for a return to play following a wrist fracture, and objective measures that a clinician can use to aid in their decision making.

Case presentation

A left-handed, 18-year-old male Junior A hockey defenseman, was playing in an exhibition game on August 30, 2019. Holding his stick with both hands, he pushed an opposing player across their back and felt a snap sensation in his left wrist. A "fork deformity" was observed by the team therapist as the player used his right arm to help hold his hand stationary. The player was removed from the ice and brought directly to the dressing room. The arm was stabilized in a splint by the team therapist, and they were transported to the hospital by ambulance.

At the hospital, radiographs confirmed a displaced left distal radius fracture (Figures 1a and 1b). External reduction was completed, and further radiographic imaging confirmed appropriate bone alignment (Figure 2). The player was released with a referral to follow up with an orthopaedic surgeon who recommended surgery. Open reduction with internal fixation surgery with follow-up radiographs took place a week and half later (Figure 3).

The player's left wrist was splinted in a hard plaster cast following their surgery. The plaster cast was removed

a) Left PA wrist radiograph.

b) Left lateral wrist radiograph.

Figure 1.
Initial left PA wrist (a) and lateral wrist (b) radiographs taken at the emergency department.

Figure 2.
Follow up left PA wrist radiograph taken post-external reduction to confirm proper bone alignment.

Figure 3.
Follow up left PA wrist radiograph taken after open reduction with internal fixation surgery, one and a half weeks post-injury.

three weeks post-surgery and replaced with a removable splint to be worn 24-hours a day, except while doing rehabilitation. With guidance from the orthopaedic surgeon, a goal was set with the team therapist and player to prepare for a full return to play (RTP) thirteen weeks after the initial injury.

A full rehabilitation schedule with pre-established outcome measures including wrist range of motion, shot speed, and hockey specific wrist strength, was developed based on the proposed RTP plan (see Table 1). Measured wrist ranges of motion included wrist flexion (flex), extension (ext), ulnar deviation (ulnar dev) and radial deviation (rad dev). Range of motion was measured to the nearest degree using a goniometer. Shot speed was assessed using a radar gun (km/hour) while shooting on ice with different variations of a shot including wrist shot, snap-shot, and slap shot (See Figure 4a and 4b, and Table 2). Lastly, hockey specific wrist strength was assessed using a weight scale objective measurement by determining the maximum weighted force (lbs.) a player could flex through their stick onto a weight scale off ice (See Figure 5). Two measurements were taken per player and the average was used. To determine if the player's outcome measures of shot speed (km/hour) and hockey specific wrist strength (lbs) were an accurate representation of a Junior A hockey player of similar weight (within 10lbs) and height, data was collected from three teammates (see Table 1).

Table 1.

Rehabilitation Weekly Plan and Measured Outcomes Pre/Post Treatment. Following the rehabilitation plan, prescribed exercises were progressed using load management concepts to gradually increase repetitions, sets, and resistance, in accordance with the player's symptoms, objective measures, and daily load.

WEEK	Rehabilitation Plan	Outcome Measures
Week 1 Sept. 25 to Oct. 3	• Finger Movements/ROM • Pinch grip • Resisted finger extension with elastic band • On ice skating, no stick/puck	Oct 3 (Day 1 cast off) ***Range of Motion*** / **Pre Treatment** / **Post Treatment** *Flex* 10° 13° *Ext* 25° 25° *Radial Dev* 15° 15° *Ulnar Dev* 15° 18°
Week 2 Oct. 3 to Oct. 9	• **Cast removed Oct. 3, 2019 (5 weeks post injury, 3 weeks post-surgery)** • Active wrist and finger ROM • Full hand grip squeezes with ball • Soft tissue therapy of associated muscles APCF • Mobilization of carpal joints • Acupuncture of associated muscles	Oct 8 ***Range of Motion*** / **Pre Treatment** / **Post Treatment** *Flex* 45° 60° *Ext* 30° 43° *Radial Dev* 15° 15° *Ulnar Dev* 20° 20°
Week 3 Oct. 10 to Oct. 16	• Resisted wrist ROM (isometric) • Resisted wrist flexion/extension with TheraBand's • Wrist ROM with stick • Soft tissue therapy of associated muscles APCF • Mobilization of carpal joints • Acupuncture of associated muscles	Oct 10 ***Motion*** / **Treatment** / **Treatment** *Flex* 46° 60° *Ext* 20° 30° *Radial Dev* 20° 20° *Ulnar Dev* 20° 20° Oct 15 ***Motion*** / **Treatment** / **Treatment** *Flex* 30° 35° *Ext* 65° 73° *Radial Dev* 25° 30° *Ulnar Dev* 25° 25°
Week 4 Oct. 17 to Oct. 23	• Active wrist ROM • Stick work (No ball/ puck) • Strength Training of wrist/hand/elbow with added resistance • Soft tissue therapy of associated muscles APCF • Mobilization of carpal joints • Acupuncture of associated muscles	Oct 19 ***Motion*** / **Treatment** / **Treatment** *Flex* 73° NA* *Ext* 35° NA* *Radial Dev* NA* NA* *Ulnar Dev* NA* NA* Oct 22 ***Motion*** / **Treatment** / **Treatment** *Flex* 75° NA* *Ext* 40° NA* *Radial Dev* 30° NA* *Ulnar Dev* 25° NA* Weight Scale of stick flex was 25lbs

WEEK	Rehabilitation Plan	Outcome Measures
Week 5 Oct. 24 to Oct. 30	• Stick work with ball off ice • Continue with Strength Training of upper extremity • Soft tissue therapy of associated muscles APCF • Mobilization of carpal joints • Acupuncture of associated muscles	No data collected
Week 6 Oct. 31 to Nov. 6	• On ice individual stick handling drills • Individual shooting off ice with ball • Begin single player passing drills • Continue with Strength Training of upper extremity • Soft tissue therapy of associated muscles APCF • Mobilization of carpal joints • Acupuncture of associated muscles	Nov 4 Weight Scale comparison to teammates • Player 1, R handed forward: 50lbs • Player 2, L handed Defence: 50.5lbs • Player 3, L handed Defence: 66.5lbs • Injured Player: 35 lbs
Week 7 Nov. 7 to Nov. 13	• Non-contact practice focusing on multi-athlete drills • Shooting drills with other players and goalie • Full body strength training • Soft tissue therapy of associated muscles APCF • Mobilization of carpal joints • Acupuncture of associated muscles	No data collection
Week 8 & 9 Nov. 14 to Nov. 28	• Return to Full practice with battling drills • Continue Off ice cross training • Soft tissue therapy of associated muscles APCF • Mobilization of carpal joints • Acupuncture of associated muscles	Nov 16 Weight Scale of injured player 41lbs

* ROM was measured using a goniometer during the days the player received treatment
** A weight scale was placed on the floor with players putting their strength through their flexed stick, 2 measurements were taken per player and the numbers averaged. Players compared were the closest in weight and height of the injured player.
***APCF – As per clinical findings
**** N/A – Data was not collected at this time

a) Slap Shot

b) Wrist Shot

Figure 4.
Demonstration of speed of shot Measurements (km/hour). Used to determine hockey player's shot speed on ice using a radar gun. The radar gun is placed behind the net and the player is asked to shoot either a slap shot, or wrist shot from the hashmarks, approximately 22 feet away from the goal line.

Table 2.
Speed of shot measurements for teammates (km/hour)

Player Handedness and Position	Wrist Shot	Slap Shot	Snap Shot
Left-handed Defenseman	71.17	80	70
Right-Handed Defenseman	71	79.33	70
Left-Handed Forward	70.56	77.98	71.94
Right-Handed Forward	69	76.25	69.3
Injured Player Nov 19	61.67	Unable due to pain	64
Injured Player Dec 13	65.5	55	66

*Teammates were measured taking the shots in a stationary position from the hash marks in front of the goal. Players who took multiple shots were averaged to get their speed. Players were grouped into their shot handedness and position for comparison

The player followed the structured RTP plan with weekly treatments. Updates to the team therapist were incorporated into the rehabilitation program (see Table 1). The player returned for a seven-week follow-up appointment with the orthopaedic surgeon, where wrist strength was tested and found to be 5/5 with no pain, and the incision was determined to be healing appropriately. The surgeon recommended discontinuous use of the splint and cleared him to begin sport specific conditioning. However, it was advised that the player not return to game play for the remainder of the season due to the extent of the initial injury. Following this appointment, the player began sport specific rehabilitation on-ice in non-contact conditions only.

The player requested a second opinion and scheduled an appointment with a sports medicine physician with

Figure 5.
Hockey Specific Wrist Strength - Weight Scale Objective Measure (lbs.). Intended to measure wrist strength for hockey players. With a weight scale placed on the floor, the player was instructed to put as much force through the stick as possible to flex their stick.

hockey specific knowledge to consult on his RTP plan. Upon evaluation, the sports physician was satisfied with the completed rehabilitation, along with the player's strength and capabilities to perform sport specific tasks. Due to the extent of the initial injury and the full contact nature of hockey, the player was not cleared for a full RTP by the proposed deadline and was advised to wait four additional weeks before returning to games to ensure adequate bone healing.

During the additional four weeks, the player continued to follow the rehabilitation plan set forth to enhance strength, while participating in full contact practices with no pain or reinjury. Objective measures continued to be collected, which showed ongoing improvement in each variation of shooting. He returned to play a full game without incident eighteen weeks from the date of injury.

Discussion

This case study highlights the various factors associated with return to play decisions following a distal radius fracture in a hockey player including bone healing, range of motion, strength, ability to meet position-specific demands of their sport, and timing within a sport season. The main goal when managing an acute intra-articular fracture is to restore the articular surfaces.[4] Internal fixation (the surgical approach used with this case) generally provides an earlier return to sport at six to twelve weeks compared to a pin fixation or wrist spanning procedure, with fewer complications.[4] Management of fractures in athletes varies significantly from the general population as their course of action may be chosen for a specific return to sport outcome.[3] In this case, the surgeon decided to remove the splint and advise rehabilitation three weeks after surgery. Open reduction and internal fixation are common for the management of distal radial fractures as it allows for early mobilization and strengthening, supporting positive outcomes with athletes returning to play.[5] Quadlbauer *et al*.[6] compared the functional results between early mobilization immediately following surgery and five weeks of immobilization after surgery. The early mobilization group was placed in a removable splint and were encouraged to start rehabilitation in the first week post-operatively. They concluded that the early mobilization group had increased ROM and grip strength as well as better outcome scores compared to the immobilization group.[6] Additionally, Brehmer *et al*.[5] compared an accelerated rehabilitation program with a standard protocol after surgical fixation. The accelerated program began passive ROM and strengthening at two weeks compared to six weeks in the standard program. At zero to eight weeks the accelerated program showed better mobility, strength, and outcome scores with earlier return to function com-

pared to the standard group.[5] This data supports the decision to begin passive range of motion and strengthening exercises in week one and two.

For athletes who require a full functioning wrist for their sport and cannot continue to play with a cast, it is recommended that they only consider returning to play after the fracture has fully healed.[1] In preparation for sport, gradual progressions are recommended to ensure the wrist is capable of functioning comfortably for daily activities, followed by sport specific drills, practice and the final step of game play.[1] Henn and Wolfe recommend at least 80% of baseline ROM and strength should be demonstrated, as well as radiographic healing of the bone prior to returning to play.[4] These principles were foundational for this athlete's structured RTP plan and the sports medicine physician's decision to allow game play eighteen weeks following the initial injury. The timing of the injury also influenced the athlete's decision to seek out a second opinion for RTP clearance. As an influential player on the team's success, along with significant scouting opportunities to impact his future hockey career, he was eager to return for playoffs. Although athletes may disagree with the timeline and would prefer a quicker return to play process, it may not always be the appropriate decision for that case. The athlete's health and injury recovery should always be the main priority regardless of level of competition.

To the best of the authors' knowledge, there currently is not a collection of pre-established objective measures to help with clinical decisions when guiding an athlete, specifically a defenseman, back to hockey following a wrist injury. Wrist range of motion, shot speed, and hockey specific wrist strength were selected as objective measures for this case as range of motion is a standard measurement with fracture recovery,[2] and shot speed and wrist strength (measured through a player's ability to flex their stick) are skills required for role-specific success as a defenseman. Although further investigation is required to validate the objective measured used here, this case study can act as a foundation for developing hockey sport specific objective measures to help guide clinical decisions with distal radial fractures.

Limitations

The authors acknowledge the limitations of this case study including a small amount of data collected, lack of generalizability, lack of a control group, and a small sample size when comparing the athlete to his teammates. The athlete was also provided with specific exercises, where other exercises could have been more effective. Lastly, our suggested outcome measures of using a weighted scale and speed of shot are unvalidated and need to be further investigated.

Summary

This case report described the occurrence and management of a distal radius fracture in a defensive hockey player. It highlights the unique clinical considerations as an athlete progresses through this injury, while demonstrating the importance of objective measures within a structured, sport-specific return to play.

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