

BUMP, SET, SPIKE: DEVELOPMENT OF AN INTERVAL HITTING PROGRAM FOR A COLLEGIATE VOLLEYBALL PLAYER

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LEARNING OBJECTIVES

- Identify need for updated systematic return to volleyball hitting program following injury with inclusion of sports specific work volume in practices and competition
- Develop stepwise progression back to pre-injury volleyball hitting with consideration of volume and intensity
- Assess functional and objective outcomes of volleyball athlete throughout rehabilitation

INTRODUCTION

Volleyball is a popular sport with statistics showing a steady increase in participation of adolescents. Due to high volume and repetitive motions, players are at increased risk for shoulder injuries such as biceps or rotator cuff tendinopathy and labral injuries. Shoulder injury incidence rates in VB range from 8-15%, with a recent study in 2023 noting 12.4% in high school athletes.

An IHP is designed to gradually progress a volleyball player back to pre-injury hitting volume and intensity. Hurd et al developed the only data driven IHP in literature in 2009 using data collected over 7 seasons for different types of overhead motions and for different positions. There have been no updates to this research regarding progression of volume of hits and overhead contacts in an IHP; however, Wolfe et al collected data in both games and practices to determine work volume (serves, overhead hits, and total swings (serves + hits)) in 2019.

PURPOSE

To date, there has been only one study using a data driven IHP for volleyball; however, no updates regarding progression of volume have been done. The purpose of this case study was to integrate the previous IHP with data on sports-specific work volumes to individualize a program for gradual return to high level volleyball activities.

CASE

A 20-year-old, female, collegiate volleyball player was evaluated in clinic 8.5 weeks following right labral repair. She was seen following surgery for post-operative care with the athletic trainer at her college for 6 weeks prior to returning home for the summer.

10 weeks of progressive strengthening and manual therapy promoted increased range of motion (ROM). QuickDASH, ROM, strength, Closed Kinetic Chain Upper Extremity Stability Test (CKCUEST), and UQ Y-Balance Test (UQ-YBT) were measured at baseline and throughout the plan of care. QuickDASH was used to measure subjective report of function with upper extremity (UE) based activities, while CKCUEST and UQ-YBT were used to assess UE stability, power, and closed chain strength.

An IHP was developed and adapted from current literature but individualized to this patient as an outside hitter, the lead front row attacker with high hitting volume. The published IHP was used as a framework for this case study and updates on workload came from the published data of Wolfe et al in 2019. Soreness rules were used for individualized progression through each stage and phase of IHP.

INTERVAL HITTING PROGRAM

Phase 1: Form Hitting

Stage 1 10 tips off box 10 roll shots off box	Stage 2 12 tips off box 12 roll shots off box	Stage 3 15 tips off box 15 roll shots off box	Stage 4 17 tips off box 17 roll shots off box	Stage 5 15 tips off box 15 roll shots off box 10 float serves @ 10ft line
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Phase 2: Down Balls

Stage 1 10 (2 sets of 5) roll shots from back row with approach 10 (2 sets of 5) down balls from back row (50%) 15 (3 sets of 5) serves @ 10ft	Stage 2 10 (2 sets of 5) roll shots from back row with approach 10 (2 sets of 5) down balls from back row (50%) 10 (2 sets of 5) serves @ 15ft	Stage 3 10 (2 sets of 5) roll shots from back row with approach 10 (2 sets of 5) down balls from back row (50%) 15 (3 sets of 5) serves @ 15ft
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Phase 3: Back Row Attacks

Stage 1 10 (2 sets of 5) down balls from back row (75%) 10 (2 sets of 5) back row attacks (50%) 15 (3 sets of 5) serves @ 15ft	Stage 2 12 (2 sets of 6) down balls from back row (75%) 12 (2 sets of 6) back row attacks (50%) 15 (3 sets of 5) serves @ 15ft
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Phase 4: Full Serving + Full Swings from Box

Stage 1 12 (2 sets of 6) back row attacks (75%) 12 (2 sets of 6) full swing on box @ net (50%) 15 (3 sets of 5) full court float serves (50%)	Stage 2 15 (3 sets of 5) back row attacks (75%) 12 (2 sets of 6) full swing on box @ net (50%) 15 (3 sets of 5) full court float serves (50%)	Stage 3 15 (3 sets of 5) back row attacks (75%) 15 (3 sets of 5) full swing on box @ net (50%) 15 (3 sets of 5) full court float serves (50%)	Stage 4 10 (2 sets of 5) back row attacks (100%) 15 (3 sets of 5) full swing on box @ net (75%) 15 (3 sets of 5) full court float serves (75%)	Stage 5 12 (2 sets of 6) back row attacks (100%) 16 (2 sets of 8) full swing on box @ net (75%) 16 (2 sets of 8) full court float serves (75%)
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Phase 5: Full Approach

Stage 1 15 (3 sets of 5) back row attacks (100%) 10 (2 sets of 5) full swing on box @ net (100%) 10 (2 sets of 5) full court float serves (100%)	Stage 2 15 (3 sets of 5) back row attacks (100%) 12 (2 sets of 6) full swing on box @ net (100%) 12 (2 sets of 6) full court float serves (100%)	Stage 3 15 (3 sets of 5) full swing on box @ net (100%) 10 (2 sets of 5) full approach at net (50%) 15 (3 sets of 5) full court float serves (100%)	Stage 4 20 (4 sets of 5) full swing on box @ net (100%) 10 (2 sets of 5) full approach at net (50%) 15 (3 sets of 5) full court float serves (100%)	Stage 5 20 (4 sets of 5) full swing on box @ net (100%) 12 (2 sets of 6) full approach at net (50%) 20 (4 sets of 5) full court float serves (100%)
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Phase 6: Continuation of Full Approach

Stage 1 20 (4 sets of 5) full swing on box @ net (100%) 15 (3 sets of 5) full approach at net (50%)	Stage 2 20 (4 sets of 5) full swing on box @ net (100%) 15 (3 sets of 5) full approach at net (75%)	Stage 3 24 (4 sets of 6) full swing on box @ net (100%) 15 (3 sets of 5) full approach at net (75%)
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Phase 7: Continuation of Full Approach

Stage 1 20 (4 sets of 5) full approach at net (100%)	Stage 2 24 (4 sets of 6) full approach at net (100%)	Stage 3 28 (4 sets of 7) full approach at net (100%)	Stage 4 30 (5 sets of 6) full approach at net (100%)	Stage 5 35 (7 sets of 5) full approach at net (100%)
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Phase 8: Full Return to Practice and Games

OUTCOMES

- Patient transitioned to primary supervision of IHP with ATC at 18.5 weeks post-op as she was returning to school
- QuickDASH score had decreased from 22 to 0 (MCID 8)
- CKCUEST score had increased from 21 touches to 25
- Limb symmetry index on UQ-YBT average had improved from 95.3% to 104.3%
- Surgeon cleared her at 20 weeks post-op with directions to finish the IHP for full clearance and return to VB
- Patient finished the IHP at 21.5 weeks post-op with a few delays in progression due to soreness. She was able to start in game 1 and played the whole season.

DISCUSSION

There is currently limited evidence regarding return to play for volleyball athletes, especially with the use of interval hitting programs and tests to assist with decision making for proper time to return to play. To the author's knowledge, there has been no update to the IHP researched by Hurd et al. This case serves to provide an investigation into application of an updated IHP specific to this patient's position and demands. The IHP developed dives deeper into different types of hits, including back row attacks, that have not previously been included. This patient received specific care directed at volleyball specific motions and return to play considerations while addressing her specific impairments following labral repair. Additional research is needed to better objectify a percentage of attack effort, especially considering a high portion of athletes working through an IHP may be recovering from surgery and not played in several months

CONCLUSION

- Range of motion limitations have several factors that can play a part into the limitation including joint mobility, capsule restrictions, and muscle hypertonicity. It is important to assess all to help improve ROM, especially post-operatively, to ensure limitations are properly addressed.
- Communication with MD is key, especially for a post operative case. It was even more key throughout the care of this patient as her surgeon was in a different state and she did not have any follow-up appointments during her time at home while on break from school.
- Different positions have different demands and average load as far as total contacts in the game, so this needs to be considered when individualizing interval hitting programs for return to volleyball.

REFERENCES

- Briner WW, Kacmar L. Common injuries in volleyball. *Sports Medicine*. 1997;24(1):65-71. doi:10.2165/00007256-199724010-00006
- Ellenbecker TS, Aoki R. Step by step guide to understanding the kinetic chain concept in the overhead athlete. *Current Reviews in Musculoskeletal Medicine*. 2020;13(2):155-163. doi:10.1007/s12178-020-09615-1
- Hall K, Borstad JD. Posterior shoulder tightness: To treat or not to treat? *Journal of Orthopaedic & Sports Physical Therapy*. 2018;48(3):133-136. doi:10.2519/jospt.2018.0605
- Hurd W, Hunter-Giordano A, Axe M, Snyder-Mackler L. Data-based interval hitting program for Female College Volleyball Players. *Sports Health: A Multidisciplinary Approach*. 2009;1(6):522-530. doi:10.1177/1941738109351171
- McGuine TA, Post EG, Biese KM, et al. Incidence and risk factors for injuries in girls' high school volleyball: A study of 2072 players. *Journal of Athletic Training*. 2023;58(2):177-184. doi:10.4085/182-20
- Michener LA, Abrams JS, Bliven KC, et al. National Athletic Trainers' Association position statement: Evaluation, management, and outcomes of and return-to-play criteria for overhead athletes with superior labral anterior-posterior injuries. *Journal of Athletic Training*. 2018;53(3):209-229. doi:10.4085/1062-6050-59-16
- Shih Y-F, Wang Y-C. Spiking kinematics in volleyball players with shoulder pain. *Journal of Athletic Training*. 2019;54(1):90-98. doi:10.4085/1062-6050-216-17
- Wolfe H, Poole K, Tezanos AG, English R, Uhl TL. Volleyball overhead swing volume and injury frequency over the course of a season. *International Journal of Sports Physical Therapy*. 2019;14(1):88-96. doi:10.26603/ijsp20190088

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