

BACKGROUND

Concussions can result from various mechanisms, including direct blows to the head, rotational forces, & impacts to the body that transmit force to the head. They can have short-term & long-term consequences on athletes' health & well-being, including cognitive impairments, emotional changes, & increased risk of future concussions and other musculoskeletal injuries.¹

In an NCAA study of injury epidemiology Chandran et al indicated concussion was one of the most commonly reported injuries and accounted for 7.3% of all injuries in women's volleyball. Additionally, it was stated the majority of those concussions were caused by contact with the equipment (the ball).² Vaandering et al investigated injury rate during a 7-day tournament in Canada where there were 1,876[466 males, 1391 females, with a mean age of 16.2 years (± 1.26)] participants.³ It was found that there were 101 injuries: 6.78 injuries/1000 in females and 4.30 injuries/1000 in males. Of those, joint sprain ($n = 29, 28.71\%$) and concussion ($n = 26, 25.74\%$) were the most common and most concussions were associated with ball-to-head contact (61.5%).³ In data collected comparing indoor and beach volleyball in women, the injury rate amongst indoor volleyball players was significantly higher at a rate of 5.3 per 1000 compared to just 1.8 per 1000 for beach volleyball. Indoor players had a 1% higher rate of concussion.⁴ When determining risk for concussion it is not surprising that being hit in the face with the ball would create a concussion as the mean speed of the ball is 71.2 ± 5.1 km/h for the jump spike and 70.7 ± 6.2 km/h for the standing spike.⁵

Given the incidence rate and velocity of the ball, it might be possible to prevent concussion if hits to the face are prevented. The purpose of this study was to investigate readiness hand position in defensive women's volleyball players.

METHODS

EXPERIMENTAL DESIGN

- The number of hits to the face or near misses of hits to the face during volleyball games was assessed and coded for 6 top NCAA Women's Volleyball Teams 2022 Season. When recording a hit or near miss to the face, the hand position of the athlete was coded.

PROCEDURES

- 6 NCAA teams were selected for the use of this research, and these teams were selected due to their top rankings in the 2022 volleyball season.
- For each game, the date and the number of total attacks for the game were recorded.
- Each attack was watched to determine if the ball hit the defensive player in the face or if it would have hit the face if the player's hands were not able to get there fast enough (near miss). The number of hits to the face or near misses to the face were indicated by recording the score and set in which it occurred.

- If the play resulted in a clear hit to the face or a near miss, the hand position of the athlete who experienced the hit or near miss was coded.
- The data of the hand placement was coded by using a number system, where each number correlated to a different hand position. Number 1 indicated a low hand position, a number 2 indicated a medium hand position, a number 3 indicated a high hand position, a number 4 indicated off balance positioning, and number 5 indicated that the athlete moved out of the way.
- The final data set included near misses or hits to the face with a correlated date of the game, number of attacks during that game, the specific score and set of that near miss or hit, and a hand positioning number.
- If a specific game did not experience any near misses or hits to the face, the specific game date and the number of attacks was recorded.

Data Analysis:

- The data was analyzed by using the number of attacks to calculate an incidence rate for near misses and hits to the face per 1000 exposures.
- A percentage of each hand position was then calculated for near misses and hits to the face.



Figure 1: Low hand position



Figure 2: Medium hand position



Figure 3: High hand position

RESULTS

A total of 176 games from 6 top ranked Division I Women's volleyball teams were coded for hand positioning of defensive players. During these games there were 42,533 attack plays. There were 294 near misses or 6.9 per 1000 exposures and 61 total hits to the face resulting in a per 1000 exposure rate of 1.43.

Hand Positioning		% of total
Low (1)	63	21.42
Medium (2)	16	5.44
High (3)	136	46.25
Off Balance (4)	3	1.02
Moved out of the way Low (5,1)	47	15.98
Moved out of the way Medium (5,2)	9	3.06
Moved out of the way High (5,3)	20	6.80

Table 1: Hand positioning prior to a near miss to the face with the ball.

Hand Positioning		% of total
Low (1)	40	65.57
Medium (2)	8	13.11
High (3)	11	18.03
Off Balance (4)	2	3.27
Total Hits	61	

Table 2: Hand positioning prior to being hit in the face with the ball.

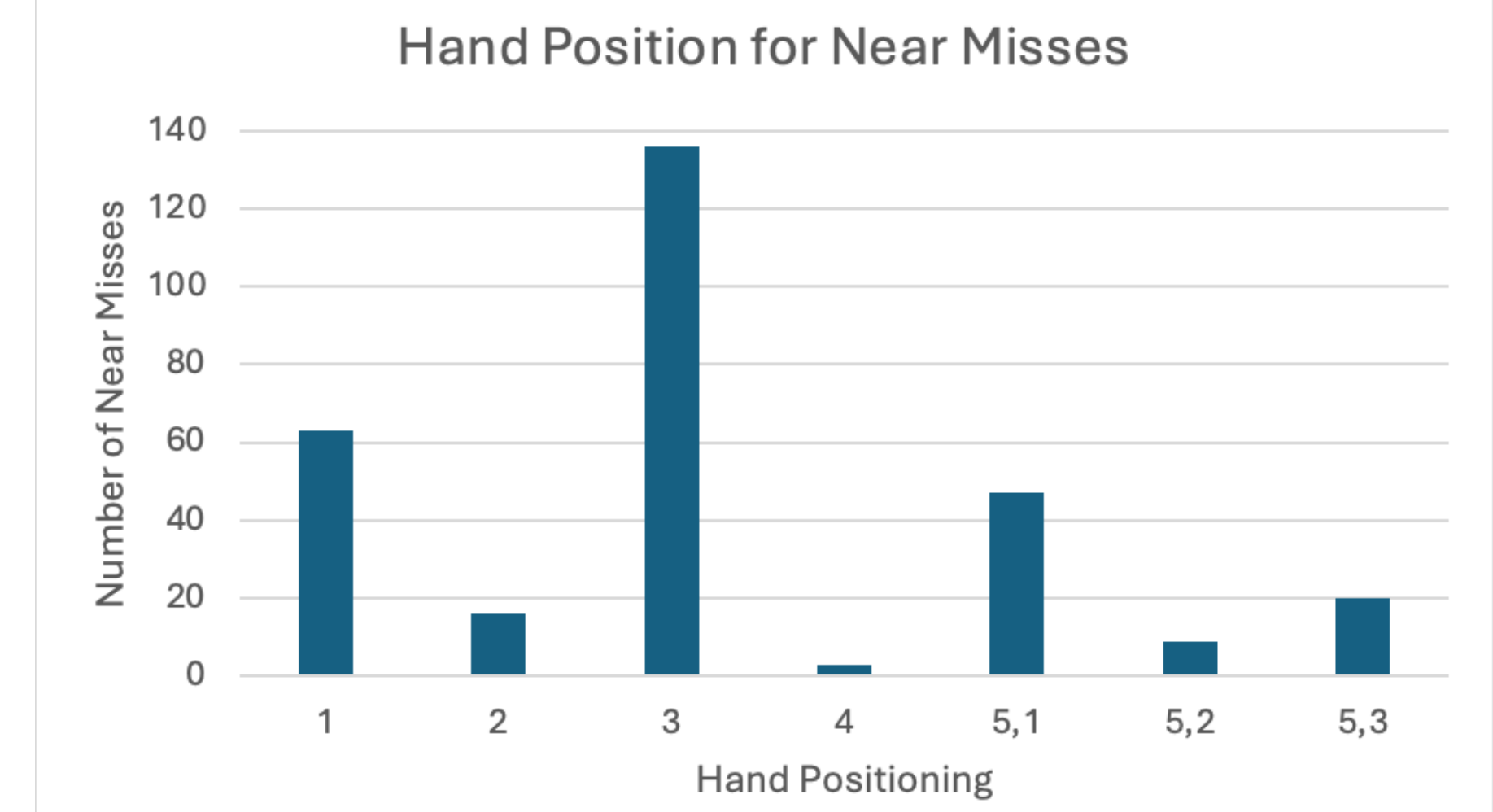


Figure 4: Number of Near misses vs Defensive hand positioning. Position 3 allows for the hand to get up to the face to protect it. Near misses avoided by moving occurred most often in the low hand position.

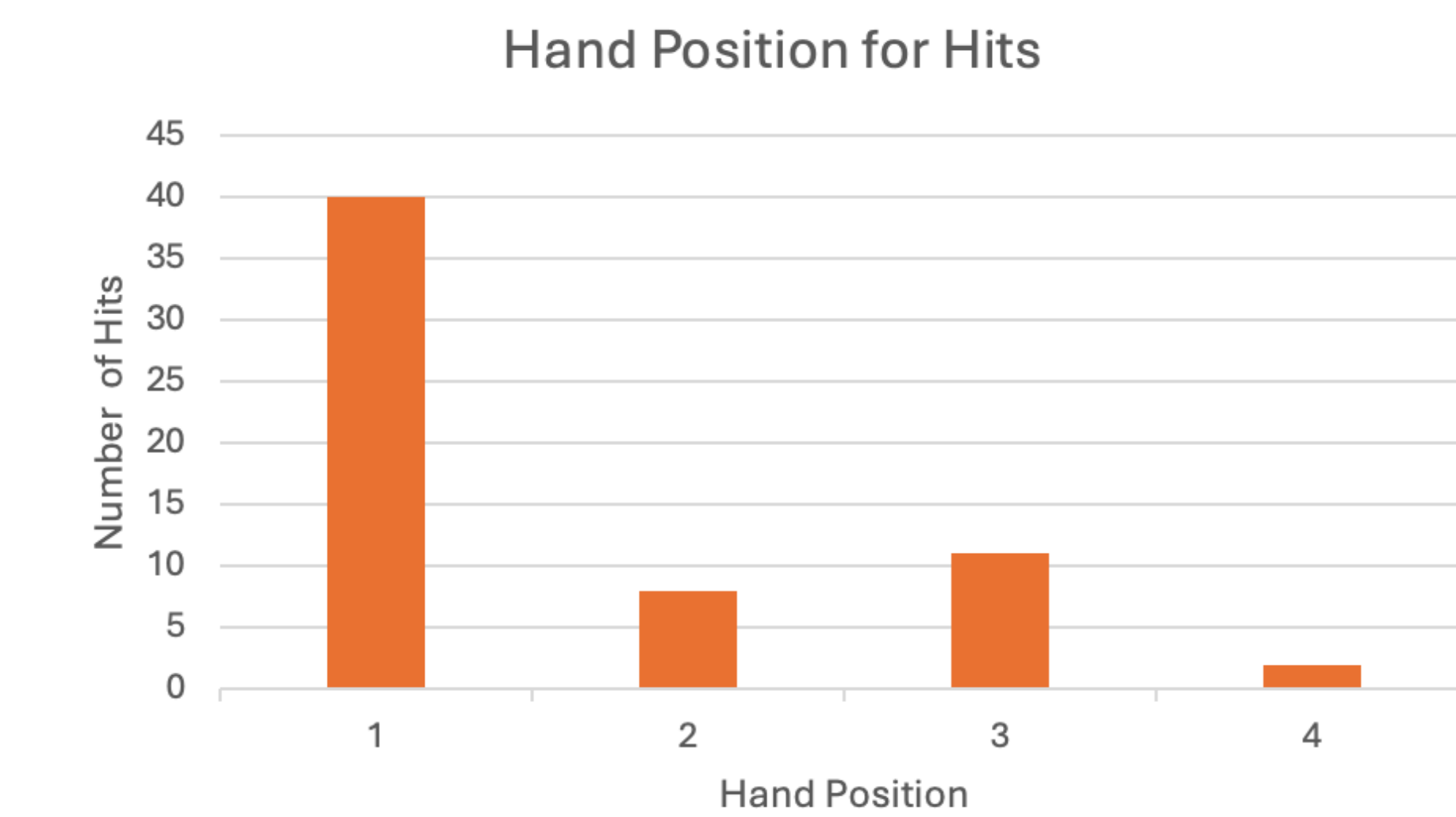


Figure 5: Number of hits to the face vs Hand position. 65.57% of hits to the face were with the athlete in hand the low hand position.

CONCLUSIONS

- After analyzing the results, we can conclude that the hand positioning that led to the most near misses was hand position 3, a high hand position (Table 1). Thus, we can conclude that hand position 3 is the position that allows players to move quickly enough to protect themselves from getting hit in the face suggesting that positioning the hands higher reduces the likelihood of being hit in the face with the ball.
- We also can conclude the hand positioning that correlated with the most hits to the face with the ball was hand position 1, a low hand position (Table 2). This indicates that lower hand positioning increases the risk of direct hits to the face. From this, we can thoroughly say that proper hand positioning is crucial in reducing direct hits to the face.
- Low incidence rates of the other hand positions highlight the importance of proper technique for hand positioning and player safety.
- While we do not know if any of the hits to the face resulted in concussion, we do know that we can prevent concussion if we prevent players from being hit in the face with the ball.

REFERENCES

- Pierpoint, Lauren a., PhD and Collins, Christy, PhD. Epidemiology of Sport Related Concussion Clinics in Sports Medicine, 2021-01-01, Volume 40, Issue 1, Pages 1-18, Copyright © 2020 Elsevier Inc.
- Chandran A, Morris SN, Lempke LB, Boltz AJ, Robison HJ, Collins CL. Epidemiology of Injuries in National Collegiate Athletic Association Women's Volleyball: 2014-2015 Through 2018-2019. J Athl Train. 2021 Jul 1;56(7):666-673. doi: 10.4085/1062-6050-679-20. PMID: 34280268; PMCID: PMC8293869.
- Vaandering K, Meeuwisse D, MacDonald K, Eliason PH, Graham RF, Chadler MK, Lebrun CM, Emery CA, Schneider KJ. Injuries in Youth Volleyball Players at a National Championship: Incidence, Risk Factors, and Mechanisms of Injury. Clin J Sport Med. 2022 Nov 22. doi: 10.1097/JSM.0000000000001098. Epub ahead of print. PMID: 36730298.
- Juhan T, Bolia IK, Kang HP, Homere A, Romano R, Tibone JE, Gamradt SC, Weber AE. Injury Epidemiology and Time Lost From Participation in Women's NCAA Division I Indoor Versus Beach Volleyball Players. Orthop J Sports Med. 2021 Apr 27;9(4):23259671211004546. doi: 10.1177/23259671211004546. PMID: 33997071; PMCID: PMC8085369.
- Valades, D., & Palao, J. M. (2015). MONITORING BALL SPEED OF THE VOLLEYBALL SPIKE THROUGHOUT THE SEASON FOR ELITE WOMEN'S VOLLEYBALL PLAYERS. Journal of Sport and Human Performance, 3(2). https://doi.org/10.12922/jshp.v3i2.53