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Characterization of the technique "backhandling" in underwater rugby and relation between the speed of execution and goal effectiveness in competitions

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Abstract

Objective: to identify correlations between the speed of execution and effectiveness of the goal in competitions of the technique of backhandling in underwater rugby players. **Method**: 59 elite underwater rugby players (20 = Women, 39 = Men) first performed a warm-up, both general and specific, to subsequently make 2 gestures on their more skilful side. The assessment of the execution times was made by photogrammetry. The data of the scorer's table were consulted on the website of the Federation of Underwater Activities. **Results**: on average, men develop the gesture with greater speed than Women. In addition, for men, there is a high correlation with the shorter execution time and the annotation index in national competitions and that differs with the women sex.

Keywords: underwater sports, underwater rugby, temporal analysis, annotation.

Introduction

The backhandling gesture (BH) is well known in the underwater rugby community as one of the most used gestures to make an entry and score goals. However, until now there is no description or theoretical model to describe the process of action, coordination and movement control.

Underwater rugby is a relatively new team sport that was had its origin in German diving clubs as a training methodology to improve performance in dives. Except for its name, it is very similar to English rugby. According to Scheufler et al. (2013), in 1961 Ludwig von Bersuda, a member of an underwater club in Cologne, Germany, developed the idea of an underwater game with a ball. Underwater rugby is a team sport which has a characteristic that makes it unique and is played in a three-dimensional field in a pool. Two baskets of stainless steel 39-40 cm in diameter and 45 cm high lie on the floor of the pool that has a depth between 3.5 and 5.0 m. The plastic ball has a diameter of 49-51 cm for women and 52-54 cm

for men. The ball is filled with a saline solution so that it reaches the bottom of the pool at a speed of 1.25 m / s. Two teams composed of twelve players, six of them always in the water with their respective active relay have as objective to score goals with the ball putting it inside the basket of the opposing team. The ball must be completely inside the basket to be an annotation. The player in possession of the ball can be taken and take other players which implies that the ball must be passed quickly to avoid the struggle. As in other team sports, the players in the water have a specific position, forwards, goalkeepers and defences (six in the water, two per position). The forwards are in charge of taking care of the area above the basket, avoiding that opponents contact their goalkeeper who covers the basket with his back. The goalkeeper will have his legs in the direction of the surface, a position known as suction cup, which from the movement of the legs generates a force that will propel him onto the basket. Finally, the defender is in charge of protecting the area under the basket. No player can use the basket as a means of restraint to take advantage of the opponent in both defensive and offensive positions.

Normally the scores are very close due to the volume of players around the basket. Therefore, the score will depend on the speed and technique of the athletes to score. There are several techniques to make an annotation: diagonalhandling, headhandling and backhandling which it is the most used to score (reference taken from a survey which was developed for this study). The following description was made by a national coach of underwater rugby team since until now no definition was known about the aforementioned gesture. The posture and recommended technical execution of the backhandling gesture (BH) in underwater rugby is as follows:

> From a static body position, the ball should be supported on the ground with both hands at a distance between 15 and 25 cm from the basket, the wrists should be extended with the fingers towards the floor, the fingers should be comfortably separated to achieve greater coverage of the ball and therefore more control of it. The elbows must be flexed between 45 and 90 degrees, this variation will depend on the strength of the player or the length of the arms, the shoulder proximal to the wall must be completely attached to it. Body upside down with a slight tilt of the top up. Legs separated almost shoulder-width apart and knees slightly bent to drive the jerk. It is advisable to keep the joints involved linearly with the basket (ankle, knee, hip, shoulder, elbow and epicondylar on both sides). It is necessary to maintain this alignment during the execution of the movement to avoid loss of energy generated by some deviation of the body. From this position the gesture will be made. Starting with the extension and flexion of the legs (kick), continuing with the turn of the head towards the side of the wall and finally with the extension of elbows. This movement must be synchronized to allow the transfer of force that is generated from the lower limbs to the posterior shoulder area distal to the wall. It is essential to dissociate correctly the movement of the legs that cause a forward impulse and the extension of elbows that cause an upward impulse. Once the shoulder proximal to the wall makes contact with the

basket, begins the extension of elbows which combined with the impulse generated by the kick will displace the goalkeeper no more than enough to introduce the ball.

Table 1. Initial position gesture backhandling gesture

Body segment	Description of the position of the body segment
Hand	The ball supported and held with both palms perpendicular
Elbow	Must be flexed between 45º and 90º degrees
Legs	Kick crawl continues
Joints involved	Flexion of the elbow joint, extension and flexion of the hip, knee, ankle

Figure 1. Initial position backhandling gesture.

Table 2. Backhandling gesture Central position

Body segment	Description of the position of the body segment
Head	Broken Head next to the wall once the shoulder proximal to this makes contact with the basket.
Arms	Performs a continuous movement of extension to contact the goalkeeper with the posterior deltoid area (App. 160º) down.
Legs	Kick crawl continues
Joints involved	Extension of the elbow joint, hip extension and flexion, knee, ankle, rotation of the head.

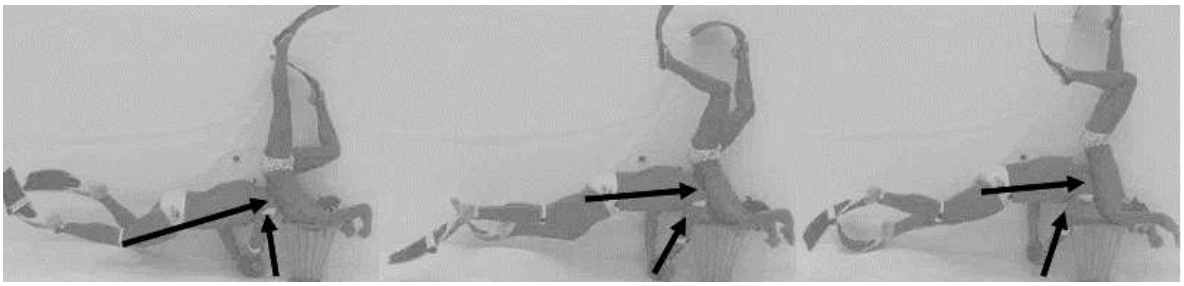

Figure 2. Backhandling gesture central position.

Table 3. Backhandling gesture final position

Body segment	Description of the position of the body segment
Hands	Accompany the ball until it passes through the goalkeeper and the basket
Arms	Performs a continuous movement of flexion up to 90º App upwards.
Legs	Kick crawl continues
Joints involved	Extension and flexion of the joint elbow, hip, knee, ankle.

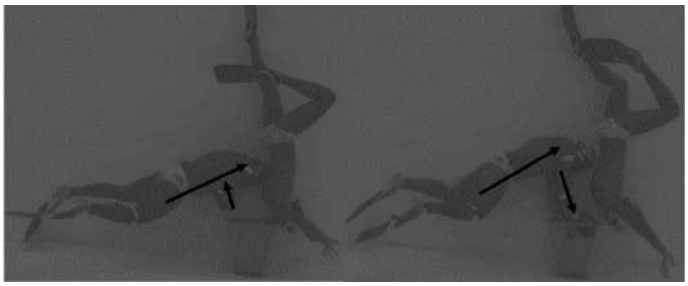

Figure 3. Backhandling gesture final position

Research on underwater rugby is limited to studies regarding injuries (Scheufler et al., 2013; Hüls, 2006.), effects of the practice of underwater rugby (Cavas, 2005; Richardson et al., 2005.), and implementation of training procedures with underwater rugby players to see the effect on maximum oxygen consumption (Ospina & Trujillo, 2014.). However, there is a lack of studies on the description of scoring technique and no analytical research of the temporal effects and its relationship with the effectiveness of scoring in underwater rugby with elite players has been developed. Therefore, the objective of this study was to report and identify time - effectiveness correlations of the score of players of underwater rugby using the gesture of BH and to identify temporary differences by sex.

Method

Transversal quantitative descriptive study and no experimental design was carry out. The sample was intentionally non-probabilistic where an open invitation was made to two community underwater rugby clubs in Medellin, Colombia. Fifty-nine participants, thirty-nine men and twenty women elite underwater rugby players participated in the study (Table 4). All the participants signed an informed consent based on the declaration of Helsinki. As a condition to be part of the sample, the subjects have had no history of injury at the time of measurement that could compromise their safety, have a minimum of two years of practice in underwater rugby, have participated in at least two official tournaments in the last six months.

Measurement Tools: The execution time of the action, which corresponded to the time taken since the subject held the ball with both hands until the ball passed the goal ring, was collected by a GO PRO HERO 4 camera at 120 FPS in the sagittal plane at 5 metres from the player and 0.50 m high. The videos were processed in the free version of MPEG STREAM CLICK software.

Process: The tests were taken during one day. For the data collection, the subject was asked to execute two repetitions of the backhanding gesture to the maximum of his possibilities. The gesture was made, in a pool at a regular practice, from the initial position defined above to a depth of five meters (Figure 1). A pass was made to the player where the execution time of the action was taken. The goalkeeper was asked to develop his defence to the maximum of his ability.

Statistical analysis: Statistical analysis was carried out using SPSS v. 18 software. Means, minimums, maximums and standard deviations of the execution time of the action were calculated for women and men. Normality test were applied to the data and Pearson correlation was used to analyse the relationship between top scorer and time of execution in women and Spearman correlation for men. The alpha level of significance was set at p, 0,05 for all statistical test.

Results

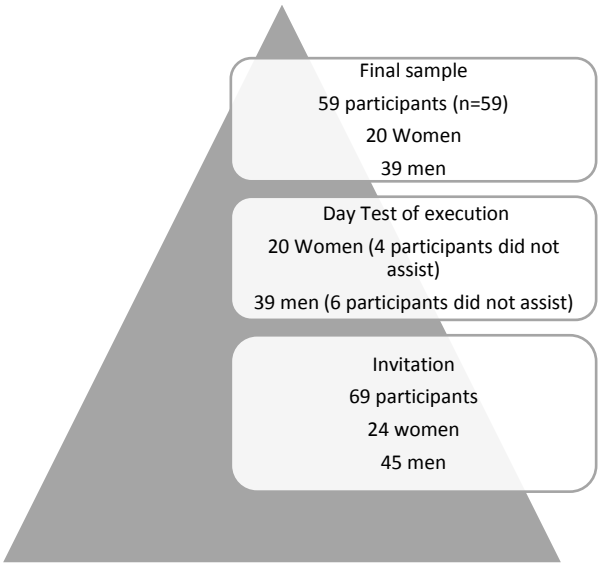

Figure 4. Flow diagram of the participants.

Figure 4, shows the flow diagram of the participants were initially an open invitation was made to two clubs from Medellin, Colombia. Sixty-nine participants attended the invitation; however, only fifty-nine participants (20 women and and 39 men) appeared the day of the evaluation.

Univariate analysis

The temporal measures obtained from the technical gesture had few differences for both men and women (Table 4) with coefficients of variation lower than 25% (CVMen: 22,07 %, CVWomen: 21,70 %). On average, the execution time of the technical gesture in the men was lower than in the women group (TimeMen: 1,41 ± 0,31 s, TimeWomen: 1,89 ± 0,41s).

Table 4. Mean execution times of BH, standard deviation (SD), maximum (Max) and minimum (Min) range in Men and Women in seconds (s).

Sample	Average	N	SD	Range	Minimum	Maximus
Men	1,41	39	0,31	1,44	0,96	2,40
Women	1,89	20	0,41	1,64	1,28	2,92
General	1,57	59	0,45	1,96	0,96	2,92

Regarding to top scores in women and men, men recorded a lower time of execution compared with the non-top scores (Table 5). However, for women the time of execution in non-top scorer was lower than in the top scorer group (TimeMenTop: 1,27 ± 0,30 s, TimeMen-NonTop: 1,52 ± 0,28 s TimeWomenTop: 1,91 ± 0,30s, TimeWomenNonTop: 1,88 ± 0,47 s).

Table 5. Mean execution times of BH, standard deviation (SD), maximum (Max) and minimum (Min) range in top score and non-top score in Men and Women(s).

Sample	N	Average	SD	Range	Minimum	Maximus
Top score Women	8	1,91	0,30	0,88	1,48	2,36
Non top score Women	12	1,88	0,47	1,64	1,28	2,92
Top score Men	16	1,27	0,30	1,12	0,96	2,08
Non top score Men	23	1,52	0,28	1,28	1,12	2,40

Table 6 shows the correlation between the time of execution of the gesture of BH, men and women, and the position in the scorer's table of the League in the season 2014-2015. The analyses developed were carried out only with athletes who had figured in the top scorer's table according to official records, in total 16 men and 8 women from the total sample (N=59) were present for this analysis. In men, there was a significant relationship between the time of execution and the state of being top scorer r_s=0,75, *p* (one-tailed) < 0,05. On the contrary, the women group did not report a significant correlation between the execution time and the state of being top score r=0,89, *p* (one-tailed) > 0,05.

Table 6. Correlation between the time of execution of the gesture of Backhandling gesture, Men (M) and Women(F), and the position in the scorer's table of the underwater rugby league in the season 2014-2015.

Correlation in time of Men (M) and Women(F) with position in the scorer's table season 2014-15		Position according to table of scorers F	Position according to table of scorers M
Rho from Pearson	execution time Women		
	Correlation coefficient	- 0.089	
	Sig. (Bilateral)	0.71	
	N	8	
Rho from Spearman	execution time Men		
	Correlation coefficient		0.758
	Sig. (Bilateral)		0.001
	N		16

Discussion

The objective of this research was to identify time - effectiveness correlations of the technical backhandling gesture in underwater rugby in both men and women that would reveal the incidence of execution speed in the annotation success.

Contemplating a theoretical characterization of the gesture of backhandling (BH) in underwater rugby provides a tool, supporting the work of the coach in teaching-learning processes.

The temporary conditions for men and women when developing the BH gesture suggest that there are no substantial differences between them. However, men, on average, have less time in the execution of the BH gesture compared to women. The time in the execution of the gesture of BH in men, presumes to be a determining factor in the effectiveness to score in national tournaments. However, this condition does not seem to apply to women. It is relevant to point out that, the lack of temporal analysis for each phase described in the BH gesture and the small population, could account for this condition in women.

The above becomes a first approach of the characterization of a gesture in a contemporary sport and allows coaches to have objective assessments when selecting and emphasizing their training methodology.

The exposed results show a high incidence of the speed of execution of the gesture of backhanding in the efficiency of annotations in federated competitions. This information, together with the conceptual characterization of the gesture, could be very useful for assessing and guiding the development of the BH gesture by the trainer. The authors state the need to implement future studies where the population can be expanded and the development of kinematic analysis of the gesture that would allow to contrast the results obtained.

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Conflict of interest statement

There are not any potential conflicts of interest in this study and permission has been obtained from the Club Orcas to be named in the acknowledgments.

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