

Analysis of Biomechanics Slap Hit and Push in The Field Hockey

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Abstract— In the study will describe about the variables that provide support in the implementation of the slap hit and push to be used as a curriculum in the basic techniques of coaching at an early age in schools and clubs. Data retrieval is done by using two Sony Handycam HDX 450 on six athletes PELATNAS as an experienced athlete and six athletes PUSLATCAB of Surabaya as inexperienced athletes in conducting each trial five basic techniques of the slap hit and push. In this study the results of the recordings analyzed at a distance away, the angle of the right arm, right leg, left leg, and added speed and distance of drag on a technical analysis of the push to gain speed and accuracy results. The analysis of the results obtained using significant level p (0.05) showed that there was no difference in the ability of the slap hit in significant among both groups of either accuracy or speed but there is a difference the ability significant at the time push. In this study recommend the coach to pay attention to the angle of the arm and a leg at the time of the slap hit, as well as increase the distance and speed of drag on the technique of push to get maximum speed and high accuracy. And reduce the risk of injury during practice and on.

Keywords—field hockey, slap hit, push, biomechanics

I. INTRODUCTION

Hockey is a sport game played by two teams who are aiming to get a goal as much as possible. In the sport of hockey is known, there are three categories of games that are popular in doing that is field hockey, indoor hockey, and ice hockey. As the name field hockey is played on the field 47 m x 94 m by using a special synthetic grass (water based system). Played by 11 people, consisting of 1 person as a goalkeeper and 10 field players. In this game are known to some of the basic techniques used during the game. The basic technique consists of push, slap hit, hit, reverse hit, scope, flick, drag flick, and the dribble. The results of preliminary research conducted by the researchers with a means of observing a hockey match in video download through youtube.com. Observations made on match of Hockey World Cup Download 2014 between Australia against India and the final match between Australia against the Netherlands. The next game of the Sultan Azlan Shah Cup 2017 between Australia against India, Australia against Malaysia, and Malaysia against Japan. From the results of the match observations obtained 5 a technique often done with result push with an average of 357 times each game, slap hit with an average of 140 times per match, a reverse hit with an average of 50 times a game, scope with an average of 35 times a game, and hit with an average of 23 times a game. As for the technique of flick and drag flick is only done when doing

pinalty corner. From these observations showed basic techniques push and slap hit has a large average to do every game. The push technique is the ability to feed the players conducted by means of pushing the ball toward the target using the power of the hand and waist rotation to move the time of the body such as in Figure 1. below.



Fig. 1. Push technique a). the prefix b). release the ball c). advanced motion.

This technique tends to be done while doing the three nearby and quickly push therefore became the first choice players while doing passing to a friend. The slap hit technique is the ability of players to do so in a way the bait hit the ball with a swing arm is parallel with the ground of the results of the ball along the ground towards the target as shown in Figure 2. The technique of slap hit into the second choice players at the moment or wanted to do far and fast to friends or also at the time of the shot in the pinalty corner.



Fig. 2. Slap hit technique a). the prefix b). release the ball c). advanced motion.

From previous research including [5] examines the basic technique of slap hit in a game of hockey, [6] examines the importance of tests to know the basic techniques of field hockey at the beginner, teenager, and professional, Fathurozi examines the basic technique of push and flick on the game of hockey, [15] in a research review on the evaluation of the basic techniques of flat backhand hits or also called the Tomahawk in the game of hockey, Rebecca Kerr & Kevin Ness that review about the ability of doing push-in at the time of pinalty corner.

On the implementation of the push has similarities with the implementation of the drag flick and push in IE needs a lighter ball from the starting position until the ball hit by the stick position release the ball but on the implementation of the initial position of push the ball lets do the time Ball State running while in drag flick and push-in the ball in a position to stop. On analysis of the push in Rebecca Kerr & Kevin Ness showed wide support spacing right and left foot, using the help of the rotation of the hips, the maximum distance the maximum speed and the Flint Flint ball before the release (drag) affect the speed and accuracy his ball. Whereas, in the implementation of the slap technique has similarities to the hit implementation techniques hit in field hockey and slap Shoot on ice hockey that is in need of power assisted swing arm with the rotation of the hips slap hit but in the position of the body tend to lower as shown in Figure 2. The results of the analysis of slap shoot [5] shows that the role of a more consistent arm angle than the angle of the knee is more fickle results and success punch slap shoot.

The purpose of this study was to describe the variables support in the execution of basic techniques push and slap hit on sports field hockey which will be used as a curriculum in the basic techniques of coaching at an early age in schools and clubs. Given the difference in quality between the ability of players who are experienced with inexperienced then experienced players will show better results than a inexperienced in the perspective of the ball's speed, accuracy, and kinematic variable at the time of the basic techniques of push and slap hit between them. However, from two basic research analysis of push-in by Rebecca Kerr & Kevin Ness and slap analysis shoot by [5] have the same correlation on all players.

II. METHOD

In this research was conducted on 6 athletes son PELATNAS hockey Indonesia as experienced players and 6 athletes son hockey city of Surabaya as inexperienced players. The entire player making an experiment as much as 5 times on each basic technique. The average player's personal information is contained in table 1 and table 2. The data retrieval experiment. Tests were conducted on a synthetic pitch which uses water based system i.e. Field Hockey Dharmawangsa Surabaya and field hockey Senayan Jakarta.

TABLE I. THE DATA CAST EXPERIENCED AND INEXPERIENCED ON THE PUSH TECHNIQUE

Group	Age (years)	Weight (Kg)	Height (cm)	Experience (years)
Experienced (6)	20-30	57-70	164-175	6-12
Inexperienced (6)	16-20	55-70	158-175	1-5

TABLE II. THE DATA CAST EXPERIENCED AND INEXPERIENCED ON THE SLAP HIT

Group	Age	Weight	Height	Experience
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	(years)	(Kg)	(cm)	(years)
Experienced (6)	20-30	57-70	164-175	6-12
Inexperienced (6)	16-20	55-70	158-175	1-5

Research on data obtained from the tests the ability push and slap hit [7] taken using two handycam SONY HDR-CX450 laid on camera 1 (C1) serves to record the angle of the front of the subject at a distance of 3 meters straight line with the placement of the ball with a height of 55 cm cameras, camera 2 (C2) function to record the ball when passing through the target line to help figure out the target accuracy and speed ball camera is placed straight with the target line as far as 3 meters from the end of the target line with the camera's height 55 cm. Format the placement of cameras and objectives as in Figure 3. And the point was made that observation recommendations shown in Figure 4.

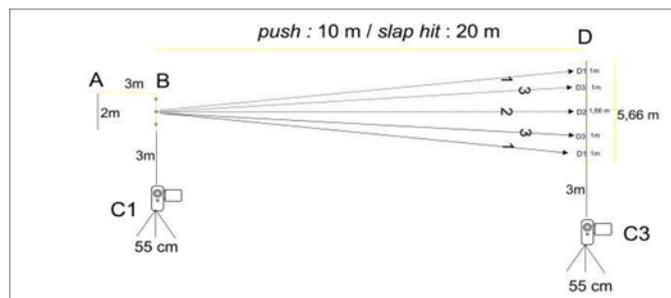


Fig. 3. Research area push and slap hit.

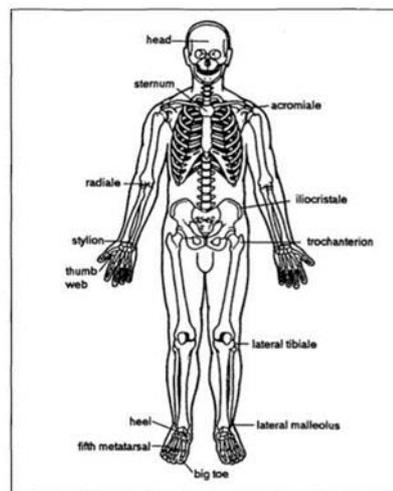


Fig. 4. Anatomical point of reference retrieval corner.

In this study the variables described has 3 characters i.e. first performance analysis (results) that saw the speed and accuracy of the ball. A second analysis of the width and the distance that is the width of the foot, a distance of drag, drag and speed. The third analysis of angle joints IE right arm angle, the angle of the right foot, and the left leg. With the following explanation:

Performance analysis: Accuracy (%): average total value of target accuracy of whole experiments conducted by athletes
 Ball speed (m/s): the value of the speed of the ball is first off of the stick (release) up to the target.

Analysis of the width and distance: Wide leg (m): the value of the distance between the lateral maleolus right foot with your left foot. Drag the distance (m): the value of the distance between the impact of the first ball with a stick up to release the ball or off with stick. Drag speed (m/s): the value of the speed of the ball when first impact with the stick up to release the ball or off of the stick. Analysis of angle joints: Right arm angle (°): the value of a right angle right arm which was formed from the point of acromiale, stylium, and radiale. The angle of the right foot (°): the value of the angle of the knee right leg formed by trochanterion, lateral to the lateral maleolus tibiale, and right leg.

Left leg angle (°): left leg knee angular values formed by trochanterion, lateral to the lateral maleolus tibiale, and left leg. The experience of the play in question is the old player is playing hockey. The entire cast perform accurate shots on target 5 as wide as 5.66 meters with 1-3 points as shown in Figure 3. Each experiment with the best accuracy and the highest speed will do more in-depth analysis to find the best punch results overall. Before doing the video cuts into pieces using punch software corel video studio which was then placed into the dartfish teampro software 5.5. to do analysis of biomechanics.

The results of analysis of biomechanics in the form of average variable data that supports push and slap hit techniques from experienced players and inexperienced players in the form of the mean, standard deviation, range, and then conducted a comparison test using independent t-test. As for the significant level (alpha) that is used in the overall statistical analysis on the research is exploratory research because it is 0.05. Then push and slap the experiment taken hits from the best overall athlete to have been described in the materials and made recommendations to the coach.

III. RESULTS

Summary of the value of the mean, range, standard deviation and the ρ value derived from the calculation of the second variable groups. With ρ value for explaining the difference both group. While the significant correlations of variables.

Analysis on the value of performance variables mean and presentation of accuracy do not indicate any significant difference between the inexperienced players (2.43/65,7%) and experienced players (2.60/70,2%) with ρ value = 0.259. The same thing also happened in the value of the mean and standard deviation of speed ball difference does not indicate significant results between experienced players (15,82/2.29) and (15,57/2.18) for inexperienced players with a ρ value = 0.667 despite both showed the results of the experienced players is better than inexperienced players.

Then in the analysis of angle joints when the prefix value of the mean and standard deviation indicates a significant difference of a third variable is observed among them at an

angle right arm experienced players showed the formation of a smaller corner significantly (150,64/7.77) rather than the inexperienced player (162,61/11,29) with ρ value = 0.0004. Applies also on the establishment of the corner leg curly experienced players showed a smaller leg angles (116,84/15,86) rather than the inexperienced players (134,95/14,37) with ρ value = 0.0004 and right foot (144,68/159,02/vs 25,74 16,90) with ρ value = even on the corner legs 0.013 indicates a greater standard deviation on the experienced players.

When the impact value is the mean and standard deviation are not showed significant differences from the third variable is observed among them at an angle right arm experienced players showed the formation of a slightly larger angle (151,91/14.45) than inexperienced players (151,52/10,59) with ρ value = 0.906. Applies also on the establishment of the angle of the right foot experienced players showed a corner away slightly larger (97,02/31,41) rather than the inexperienced player (94,60/26,96) with ρ value = 0.750 but at the corner of the left leg angle formed of players experienced smaller (99,29/15.38 vs. 100,96/15,24) with ρ value = 0.675.

Advanced motion when the value of the mean and standard deviation indicates a significant difference only variable angle right arm that is experienced players showed the formation of a greater angle significantly (166,10/8.53) than players who are inexperienced (160,49/6.54) with ρ value = 0.006. Unlike with variable angle of right and left feet that do not indicate significant differences. On the formation of experienced players left leg angle indicates angle smaller feet (107,35/17,64) rather than the inexperienced player (109,75/24,97) with ρ value = 0.669 and angle of the right foot (97,93/40,77 vs. 79,74/40,52) with ρ value = 0.088.

The third analysis of variable distance which is about the distance of the right foot and left leg formed by athletes at a time when the prefix does not indicate significant differences although experienced players showed mean wider. Experienced players showed the mean distance is wider with ρ value = 0.648. But when impact and advanced motion showed significant difference experienced players showed mean wider. Experienced players showed the mean distance is wider (0.45/0.14) on impact and (0.42/0.15) on advanced motion compared to inexperienced players (0.36/0.10) on impact and (0.30/0.12) on advanced motion with ρ value = 0.010 and ρ value = 0.001.

The variable analysis on the performance of the value of the mean accuracy of the presentation showed a significant difference between the inexperienced players (78,9%) and 2.63/experienced players (86,1%) with 2.87/ ρ value = 0.037. The same thing also happened in the value of the mean and standard deviation of speed ball difference showed significant results between experienced players (25.03/6,82) and (20.75/4.05) for inexperienced players with a ρ value = 0.005. A significant difference is also shown on the mean and standard deviation of speed drag IE experienced players showed more speed than with the inexperienced (5.11/1.73 vs. 4.35/1.08) with ρ value = 0.047.

Then in the analysis of angle joints when the prefix value of the mean and standard deviation indicates a significant

difference at the angle of the left foot only. Experienced players showed a greater angle (159,01/13,08) compared with players inexperienced (142,49/21,38) with ρ value = 0.001. Whereas, in the right arm and right leg experienced players showed the formation of smaller angle but not significantly (169,16/7,63 vs 170,64/7,46) and (160,30/12,12 vs 164,87/9,35) rather than the inexperienced players with ρ value = 0.391 and 0.107.

When release the value of the mean and standard deviation do not indicate a significant difference only at the right hand joints. Experienced players showed a smaller angle (134,17/13,07) compared to inexperienced players (138,12/17,65) with ρ value = 0.329. Whereas, in the joint of the right foot and left foot experienced players showed the difference of formation angles significantly on right foot showed a greater angle (111,82/22,70 vs. 99,25/23,20) and on the left foot showed a smaller angle (112,28/128,63/11,70 vs. 10,07) rather than the inexperienced players with a ρ value = 0.041 and 0.001.

Advanced motion when the value of the mean and standard deviation indicates a significant difference only at the right joints. experienced players showed a greater angle (148,07/26,68) compared to inexperienced players (112,39/39,23) with ρ value = 0.000. Whereas on the right foot showed a greater angle (112,46/29, 61 vs. 112,20/39,23) and experienced players left leg showed the formation of smaller angle (119,44/131,75/vs 15,03 22,35) but not significantly than players who inexperienced with the ρ value = 0.975 and 0.975.

The third analysis of variable distance which is about the distance of the right foot and left leg formed by athletes at a time when the prefix does not indicate significant differences although experienced players showed mean wider. Experienced players showed the mean distance is wider (0.49/0.17) compared to inexperienced players (0.43/0.18) with ρ value = 0.221. However, the distance of the leg which was formed when the release and advanced motion showed significant differences. Experienced players showed greater distance (0.67/0.08 vs. 0.43/0.18) and (0.57/0,16 vs. 0,41/0,13) than inexperienced players with a ρ value = 0.000 and 0.000. Likewise with the creation of a distance of drag experienced players showed a wider drag distance compared to the inexperienced players (1.80/0.32 vs. 1.40/0.32) with ρ value = 0.000 and 0.000.

IV. RESULTS

Looking at the analysis of performance in this speed and accuracy in basic techniques of slap hit the ability of experienced players showed better results even though it does not show the difference between a group of athletes significantly experienced and inexperienced. However does not significance results from the two groups there must be many factors that affected it. But in a data which is served experienced athlete showed an average level and a better consistency.

Looking at the analysis of performance in this speed and accuracy in basic techniques of push shows the difference between the groups is significantly experienced and

inexperienced athletes. A group of experienced athlete showed better results both speed as well as accuracy. Similarly, with the results of drag speed, time and distance experienced players showed better results.

Looking at the analysis of motion in this joint of the angle of the arm, right leg, left leg angle, and the distance of the leg on the basic techniques of the slap hit shows differences between groups significantly experienced and inexperienced athletes at the angle of the arm when the prefix the angle of the arm when advanced motion, angle right foot when a prefix, the prefix when the left leg angle, distance away at the time of impact and advanced motion. The group experienced showed results with bigger numbers at the angle of the arm when advanced motion, distance away when impact and advanced motion but for some of the other inexperienced athletes showed bigger numbers. Thus it can be concluded in order to obtain better results and consistently takes the angle of the arm, right leg, left leg and when a prefix is small, and the distance of the leg width when impact and advanced motion as well as the wide arm angle when the motion Advanced.

Looking at the analysis of motion in this joint of the angle of the arm, right leg, left leg angle, and the distance of the leg on the basic techniques of push shows the difference between the groups is significantly experienced and inexperienced athletes at the angle of the arm when the motion further, the angle of the right foot while impact, the angle of the left leg while the prefix, release, and advanced motion, distance away at the time of the release of advanced motion, time and drag and drag speed. The group experienced showed results with greater numbers at an angle the arm when advanced motion, angle right leg while the left leg angle release, when the prefix, distance away when the release of advanced motion, time and drag, drag and speed. Exception at the angle of the left leg when the release of advanced motion and inexperienced athletes showed bigger numbers. Thus it can be concluded in order to obtain better results and consistent arm angle required prefix, right foot and left foot release, when the prefix is great, wide foot distance while impact and advanced motion, drag a distance away, and the high drag speed as well as the angle of the left leg which is small at the moment of the release and a advanced motion.

V. CONCLUSION

Experienced players showed better push capabilities significantly in balls speed, accuracy, and speed the drag compared to inexperienced players. But on the ability of the slap hit both groups showed no significant difference but experienced players have values mean better and more consistent results. With the overall results then in train is recommended to improve the quality of the basic techniques of the slap hit then, coaches should pay more attention to the angle of the arm, right leg, left leg athletes when the prefix, as well as the distance of the leg made by athletes when impact with the ball and advanced motion. And to improve the quality of basic techniques push then, the coach must pay more attention to the angle of the arm when the motion continued, right foot when release, left foot athlete when the prefix, the release, and continued motion. also distance made by the

athlete when the release with the ball and advanced motion, distance and speed that is created when the athletes do drag.

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