Effect of contextual interference on motor asymmetry of hand and bilateral transfer in basketball dribble

Elham Daneshyar\textsuperscript{a}, Afkham Daneshfar\textsuperscript{b}, Masoumeh Doosti\textsuperscript{c}

\textsuperscript{a}Master of Motor Behavior, Alzahra University, Tehran, Iran
\textsuperscript{b}Assistant Professor of Motor Behavior, Alzahra University, Tehran, Iran
\textsuperscript{c}Master of Motor Behavior, Alzahra University, Tehran, Iran

Abstract
The purpose of this study was to evaluate the effect of contextual interference on the motor asymmetry of hand and bilateral transfer of young girls in basketball dribbling. For this purpose, 50 female students with an average age of 20.4±1.4 (5 left-handed and the other right-handed) were randomly selected and assigned into 5 sets of training groups of blocked dominant-non-dominant hand, a set of blocked non-dominant-dominant hand, serial, increasing contextual interference, and control groups. In order to determine handedness, Annet questionnaire of handedness was used and to assess proficiency in dribbling skill, Slalom-Dribble Test was used in 4 stages of pre-test, acquisition, retention and transfer. The analysis of covariance indicated that there is a significant difference between the motor asymmetry of hand in retention and transfer stage between blocked dominant-non-dominant hand and serial, however, no significant differences was found between the other groups. The statistical calculation of transfer rate in retention and transfer stages indicated that transfer was from the dominant hand to the non-dominant hand. Finally, according to the findings, the trainers are suggested take advantage of the incentive effects of blocked dominant-non-dominant hand in basketball dribbling.

Key words: motor asymmetry, bilateral transfer, basketball dribble

Introduction
The basic assumption in motor behavior studies is that the dominant brain hemisphere exists to control movement and brain dominance means that a brain hemisphere, usually the left one, has a greater capacity to control the opposite side of the body, faster production, more precise and harmonious movements in contrast to the non-dominant hemisphere (Teixeira, Silva, Carvalho, 2003). The most famous behavioral detection is resulted from brain lateralization, motor or functional asymmetry (Watson, Pusakulich, Ward, & Hermann, 1998). Motor asymmetry, is the internal preference of the individual to use a side the body (Gabbard, 2012). Many factors are involved in performing sports skills that one of these factors can be motor asymmetry. There are different theories about the motor asymmetry, some of which investigate the source of asymmetry in the environment (the theory of birth time stress and the longer growth of the left brain hemisphere) and some investigate in genetics (the theory of shift to right by Annet, 1996, 1985 and Corballis and Morgan, 1978). From the environmental perspective, reducing motor asymmetry in sports and skills that are applicable with both sides, most probably, it has strategic benefits for the athletes who can successfully perform the movement with leg, arm or hand during the competition; because performing their motor skills such as attacking and
RESEARCH ARTICLE

dribbling angles or the direction of shooting is unpredictable (Gabbard, 2012). The results of the researches conducted by Sommer (2006), Stockel et al. (2012) in basketball, as well as a part of the results of the researches conducted by Teixeira (2003) and Daneshyar (2013) in soccer, indicated reduced motor asymmetry due to practice. Stockel and Weigelt (2012) indicated that emphasize and the importance of the dominant hand has decreased by increasing the level of skills in basketball players. In addition, most of the time the professional players use their non-dominant hand are more successful than the semi-professional and amateur players. Bilateral transfer is a concept that is related to the effect of exercising a skill with an organ on learning it with the opposite organ (Magil, 2011). In this regard, the results of Xiaobo indicate that the direction of bilateral transfer in learning basketball dribble, is from the non-dominant hand to the dominant hand and the exercise pattern of the non-dominant hand and the dominant hand is useful to learn to basketball dribbling. Daneshyar (2013) also indicated that the bilateral transfer from the non-dominant leg to the dominant leg is more than the dominant-non-dominant leg. One of the problems that the trainers face during the training, is the limited time for training. However, due to lack of time many teachers and trainers have to teach or practice a few different skills in a session. Therefore, one of the challenges that they face is the interference that is resulted through the implementation of a few skills. Organizing variable exercises by taking into account the different levels of contextual interference, is possible through using blocked exercises, serial exercises and random exercises. Contextual interference(CI) is an interference that is resulted from the changes in regulatory or non-regulatory conditions of one or more skills and the contextual interference effect is a phenomenon in which the resulted interference during the acquisition phase, undermines the widespread practice; but increases his learning in retention and transfer tests (Magil, 2011). This dichotomy in implementation and learning led to the introduction of various assumptions, including assumptions such as elaboration hypothesis, action plan reconstruction hypothesis, retroactive inhibition hypothesis and cognitive effort hypothesis. Most research that have been done on the contextual interference indicate that serial exercise causes learning in contrast to other exercise methods. Vieira et al (2008) concluded that the serial exercise is better than the blocked and random exercise. Feqhi et al. (2011) stated that the increase in the contextual interference is even better than a specific exercises to learn a single task. Daneshyar (2013) also indicated that a regular increase in contextual interference reduces motor asymmetry of children in soccer shots. Due to the limited researches on the effects of contextual interference on the motor asymmetry and the lack of research on the contextual interference on motor asymmetry of continuous skills, was the aim of evaluate the effect of contextual interference on motor asymmetry and bilateral transfer of young girls in continuous basketball dribbling skill.

Methodology
Participants
The participants of this experimental and applied research were 50 non-PE volunteer students with an average age of (20.4±1.4) who were randomly assigned into 5 groups of 10 subjects of blocked dominant-non-dominant hand, blocked non-dominant-dominant hand, serial, increasing contextual interference and control groups. The participants’ consent to participate in the research was taken.
Tasks and instruments
The research task was basketball dribbling which was carried out with number 6 Molten leather ball for women. To assess dribbling skills, Slalom-Dribble Test was used (Stockel et al., 2011). In this test, the participants must dribble in a spiral from through 6 obstacles which were placed in a distance of 1.5 meters away from each other, and after passing the last obstacle, they return the 9-meter distance in a direct way. The time calculated from the beginning to the end was considered as the dribbling skills performance. In addition, a cardboard barrier was used in the transfer test. This barrier was limiting the subjects’ eyesight to the ball during dribbling (lower half of the purview), but did have any effect on seeing the direction (the upper half of the purview).

In order to determine the handedness of the subjects, Annet handedness questionnaire (1970) was used which contains 12 questions and also contains questions about the hand used for writing, throwing, catching the rocket, igniting matches, using scissors, using a trowel, using the needle, using a hammer, put the cards on the table, using a brush, opening the lid and using a broom. Each question of the questionnaire has five choices of always right, usually right, no difference, usually left and always left. Validity and reliability of the Persian version of the questionnaire has been approved by Rezaei (2011).

Procedure
First the handedness questionnaire was distributed to determine the handedness of the participants. Right-handed and left-handed subjects were separately randomized into 5 groups. During the skill training stage, a general view of dribbling as well as instructions on lack of ball contact with the palm curve and complete stretch of elbows were given to the subjects. Then, in order to get familiar with the task, the subjects dribbled in a straight distance up to 9 meters along with changing the hands in a reciprocal manner. In the pretest, the Slalom Test was separately performed for each hand with a minute distance. For the exercise period, 4 sessions of 25-minutes were considered that were held once in a week. The scheduling of each session includes 8 minutes of warm-up and moves with the ball (which were generally carried out with two hands and without any dribbling) and 15 minutes of dribbling and 2 minutes was for cooling. The process and the type of practices in all experimental groups was the same and included the increase in speed and the emphasis on gradual reduction of direct looking at the ball. The difference of the groups during the trial period was in the dribbling hand during the practice; so that the blocked dominant – non-dominant group, practiced the first two sessions with the dominant hand and the third and fourth sessions they practiced with the non-dominant hand. This order changed for the blocked non-dominant – dominant group. Also in the serial group, the subjects periodically conducted the exercises with the dominant and non-dominant hand in each session. In the group with increasing contextual interference, the exercise of the first session were performed with the dominant hand and the exercises of the second session were conducted with the non-dominant hand. In the third session, the practice time for each half was divided and half of the devoted time was allocated to each hand. The fourth session, changing hands happened accidentally. The control group attended the tests without any exercise and only along with other groups. At the end of the acquisition period and the end of the fourth session, the acquisition test was conducted similar to the pre-test and the retention test was performed 3 days later and with a distance of 5 minutes the
transfer test was taken. In the transfer test, the subjects performed a 9-meter straight round with a cardboard barrier and along with changing the hands in order to learn the task and controlling the effect of warming loss. Then both dominant and non-dominant hands were separately exposed to the transfer test with one-minute intervals. It should be noted that in all the tests and exercises, the effect of dribbling hand order was controlled using the mutual alignment. Test execution time was recorded by the chronometer in the whole process. The performance asymmetry index was calculated using the following formula (Rodrigues et al., 2009):

\[
\frac{(\text{dominant hand} - \text{non-dominant hand})}{\text{(dominant hand + non-dominant hand)}} \times 100
\]

Statistical analysis

Regarding the normality of the data distribution at different levels, group and test factors were obtained using Kolmogorov Smirnov test (p>0.05) and the homogeneity of variances was obtained using Leven’e Test (p>0.05). To analyze the handedness data, the variance analysis of 5 groups in 4 tests with a repeated measure of test factor and with the significant difference of the pretest groups in non-dominant hand (F(4, 42) = 2.62, p = 0.048) and the two-handed asymmetry index of (F(4, 42) = 2.73, p = 0.041) to analyze the relevant data from the covariance analysis of 5 groups in 3 tests with repeated measure of test factor and the Bonferroni post hoc test was used in significant effects. The significance level in all tests was considered to be p<0.05.

Results

Figure 1 indicates the linear diagram of the average dribbling time for different groups in the dominant hand. Analysis of covariance of the 5 groups in 4 tests for the dribbling time of the dominant hand indicated that the main effect of the group (F(4, 42) = 3.01, p = 0.028, \(\eta^2 = 0.22\)) and the main effect of the test was significant (F(3, 40) = 71.81, p = 0.001, \(\eta^2 = 0.84\)) but the interaction between the group and the test was not significant (F(12, 106.12) = 1.38, p = 0.185, \(\eta^2 = 0.12\)). Paired comparisons using Bonferroni test for the main effect of the group indicated that the average time of dribbling of the the control group (14.44 seconds) is significantly higher than those of the blocked non-dominant-dominant hands (12.49 seconds), and (p<0.05) and there was no significant difference between the other groups. Paired comparisons using Bonferroni test indicated that the average time of dribbling in the pretest (14.23) and transfer test (14.87), was significantly higher than the acquisition test (11.88) and retention (11.7), (p<0.001); but there was no significant difference between the pretest and the transfer test acquisition as well as the difference between acquisition and retention tests (p>0.05).
Figure 1: Average dribbling time of different groups with the dominant hand.

Figure 2 indicates the linear diagram of the average dribbling time for different groups in the non-dominant hand. Analysis of covariance of the 5 groups in 3 tests for the dribbling time of the non-dominant hand indicated that the main effect of the group ($F_{(4, 41)} = 1.91, p = 0.126, \eta^2 = 0.16$) the main effect of the test ($F_{(2, 40)} = 0.83, p = 0.445, \eta^2 = 0.04$) and the interaction between the group and the test was not significant ($F_{(8, 80)} = 1.19, p = 0.318, \eta^2 = 0.11$).

Figure 2: Average dribbling time of different groups with the non-dominant hand.

Figure 3 indicates the linear diagram of the average asymmetry index for the performance of both hands. Analysis of covariance for 5 groups in 3 tests for the asymmetry index indicated that the main effect of the group ($F_{(4, 41)} = 3.05, p = 0.027, \eta^2 = 0.23$) was significant; but the main effect of the test ($F_{(2, 40)} = 0.37, p = 0.695, \eta^2 = 0.02$) and the interaction between group and test was not significant ($F_{(8, 80)} = 0.65, p = 0.731, \eta^2 = 0.06$) Paired comparisons using Bonferroni test for main effects indicated that the asymmetry index of blocked dominant-non-dominant hand performance (2.94) was significantly lower than the serial group (6.46), ($p = 0.048$) and there was no significant difference between other groups ($p>0.05$).

www.saussurea.org
RESEARCH ARTICLE

Figure 3: Average performance asymmetry index of both hands in different groups.

Discussion and Conclusion

The purpose of the present study is to investigate the effect of contextual interference on motor asymmetry of hand and the bilateral transfer of the young girls in continuous basketball dribbling skills. The results indicated that there is significant relationship between the motor asymmetry of hand in retention and transfer stages between the blocked dominant-non-dominant hand and serial groups which is inconsistent with the findings of Daneshyar (2013). In the study conducted by Daneshyar which was conducted on the single kicking skill, no significant difference was found between the blocked dominant-non-dominant hand and serial groups; perhaps the reason of this inconsistency is related to performing organ and the nature of the task. First, the degree of this motor asymmetry in the lower extremities is less than the upper extremities (Gabbard, 2012) and perhaps the degree of the primary motor asymmetry of the upper extremities, may have created a different effect from the exercises.

Secondly, kicking is a single soccer skills and benefits from increased interference; while for a continuous skills such as basketball dribbling, learning with the dominant hand has well transferred to the non-dominant hand in the blocked dominant-non-dominant hand group and this effective bilateral transfer reduces asymmetry. In other words, the proper hand practice for a higher bilateral transfer has a similar beneficial effect with the contextual interference in generated serial group. The results of the calculation of transfer rate in the retention and transfer stages indicated that the transfer rate from the dominant hand to the non-dominant hand was more than that from the non-dominant to the dominant which is inconsistent with the results of Xiaobo (2013) and Stockel et al. (2013) in basketball and Daneshyar (2013) in soccer. Xiaobo (2013) found that the bilateral transfer in learning basketball dribbling is from the non-dominant hand to the dominant hand, and the practice pattern of the non-dominant hand and then the dominant hand is useful to learn basketball dribbling.

Stoeckel et al. (2013) also aimed to investigate the effect of practice order to learn the complex skill of basketball in a bilateral transfer model in the retention and transfer test indicated that the non-dominant - dominant group have spent a shorter time for the movement in contrast to the dominant – non-dominant group. And stated that these results can be justified by the brain hemispheres which are specified for different assignments, probably one of the reasons that cause this contradiction is related to the experience and the

www.saussurea.org
RESEARCH ARTICLE

participants being novice; since the participants of the research have not been athletes and did not have any experience in sports fields and especially in basketball dribbling skills, therefore starting to practice with the dominant hand was easier for them and consequently caused the increase in transfer from the dominant hand to the non-dominant hand.

The results of Daneshyar (2013) indicated that the percentage of bilateral transfer from the non-dominant leg to the dominant leg is more than the transfer from the dominant leg to the non-dominant leg that the resulted inconsistency from this research is related to the nature of the involved tasks and the performing organ in both studies. Results of the study conducted by Stockel and Weigelt (2011) on the acquisition of throwing skills (throwing basketball and handball) indicated that tasks which require spatial precision, basic exercises with the non-dominant hand leads to a higher learning, while primary practice with the dominant hand in tasks which require maximum power, are useful. These effects are justified by the lateral dominancy of the brain and bilateral exercise plans. Therefore, regarding that the dribbling skill itself and Slalom-dribble Test require accuracy and scheduling to go through the obstacles, according to results of Stockel and Weigelt, we can say that the primary exercises with the dominant hand lead to higher learning and transfer.

Results of the retention stage of the study indicated less motor asymmetry of other groups than the control group which is consistent with the results of the studies conducted by Sommer (2006) and Stockel et al. (2012) in basketball and it was consistent with a part of the results in a study conducted by Teixeira et al. (2003) in football which indicates the reduction in motor asymmetry due to practice that although it was not statistically significant, but the averages indicated the result. On the other hand, although no significant difference was observed between the increasing contextual interference group with other groups at the stage of transfer, but the average time in this group was lower than the other groups which reflects the effect of increasing contextual interference on the reduction of motor asymmetry which is consistent with the overall results of the research conducted by Daneshyar (2013). It seems that the lower number of practice sessions are is effective in non-significance.. Regarding the importance of asymmetry in the performance of different skills in comparison to the bilateral transfer, the trainers are suggested take advantage of the incentive effects of blocked dominant-non-dominant hand in basketball dribbling.

References


