Lateral differentiation in results of global movement coordination level in selected combat sports and sport team games of high advances athletes

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Amidst numerous technical elements present in some sports disciplines (e.g. rhythmic gymnastics, acrobatics, karate, ice figure skating) exercises requiring rotation assume paramount importance. They can be performed on the right-hand side or left-hand side and symmetrically in exceptional cases i.e. in both directions by rotation.
Such a mastery of exercises proves the high level of movement coordination and adaptation capabilities of an individual [1-3, 20]. Analyzing literary output showed that few authors [3-14, 19, 21-23, 25-26] were interested in this problem. According to, F. Stein’s [6] hypothesis based on observation of ice figure and roller skaters, every man has „a natural direction of rotation”.

![Ice skater](image1)

![Roller skater](image2)
However, this was not confirmed by numerous tests conducted by W. Starosta [7-9,14]. Since a smaller degree of domination of younger competitors and potentiality to perform miscellaneous exercises symmetrically was found. **Thus genetic conditioning of predominant direction of rotation was brought in question.** Engaging in numerous scientific research [15,16] casted farther doubts on the supremacy of on side of body over the other during the performance of rotation in exercises. Hither the problem of side differentiation occupied little number of papers but not in relation to the direction of rotation [5,17-19,27-29].
THE AIMS:

1. Define the dominant direction of rotation in the highest degree of competitors of various sports.
2. Appreciating the level of global movement coordination by the means of scores in “T” scale.
3. Appointing correlation between the level of movement coordination and its side differentiation.
4. Assigning the predominant direction of rotation in chosen trial.
5. Set the degree of intensity of the lateral differentiation when performing the testing task with a rotation in two directions – symmetrically.
6. Define the value of the lateral differentiation of the results scored after the execution of the maximum rotation by athletes practicing various sports.
MATERIAL AND METHODS

The research was carried out among 183 high advanced competitors (including 106 from Polish National Team) of 9 sports disciplines: basketball, water polo, hockey, ringo, judo, karate kyokushinkai, traditional karate, wrestling-free and classical style.
MATERIAL AND METHODS

The average age of an interviewed person was 25 and training practice 14 years. The results were measured by means with one tasks of **global movement coordination W. Starosta test and his measurement apparatus - coordination-meter** \((r=0.93-0.99)\). [13]. It was a jump from both legs with maximum rotation to the right and left direction. From three repetition of both tasks the best results was including in statistical operations [10,13].

To appreciate the level of global movement coordination the score „\(T\)” scale compiled and verified by W. Starosta [11,13] was used. It is used to estimate the level of movement abilities. Chosen results in different units are changed into scores and than classified in points.
1. Precision the size of side differentiation of rotation in the highest degree of competitors of various sports

The results of the research showed by participants in movement coordination test reveal a left-side predomination in 60.7% of the interviewed group and right-side predomination in case of 37.2% respectively. Therefore, side differentiation was stated and it amounted 9.02% for all the individuals. It was slightly higher in case of persons practicing team sports games (9.92%) than competitors participating in martial arts (8.45%). This can be corroborated by the average results of side differentiation demonstrated by all the interviewed (Fig. 1).
The highest side differentiation was typical for water polo players (12.87%) and basketball players women cadets (12.29%), the least for wrestlers of classical style (juniors 3.47%). It can betoken that martial arts competitors’ training focuses on developing higher movement versatility which encompasses symmetry of movements i.e. performing elements of rotation in both directions. Thus, it is not a coincidence that this group contains those competitors of Poland who belong to world’s elite in traditional karate, wrestling or judo.
FIG. 1. THE AVERAGE VALUE OF SIDE DIFFERENTIATION IN MOTOR COORDINATION TEST BY CONTESTANTS OF VARIOUS SPORTS BRANCHES (n=183)

1 - Basketball (cadetts women) (n=16)
2 - Basketball (seniors women) (n=10)
3 - Wrestling (classical style juniors) (n=16)
4 - Wrestling (free style seniors) (n=11)
5 - Wrestling (classical style seniors) (n=11)
6 - Ringo (n=21)
7 - Water polo (n=14)
8 - Judo - juniors (n=27)
9 - Judo - seniors (n=11)
10 - Karate - traditional (n=13)
11 - Karate Kyokushinkai (n=24)
12 - Hockey (n=9)
The analysis of results achieved by individuals points to their considerable differentiation. The broadest range was demonstrated by senior judokas (0.87% - 42.12%), basketball cadets’ women (0.79% - 39.81%), water polo players (0.8% - 43.06%). It was the narrowest at ice hockey players (2.35% - 9.08%). Among these figures one could notice extreme qualities for away from average. They overestimated the value of differentiation and crucially influenced the average results. **This can be exemplified by the results achieved by wrestlers in classical style (juniors).** Within this group the results ranged from 1.26% to 27.74%. For example the size of side differentiation demonstrated by one athletes was a few times higher than the average result of the whole group. A similar inclination characterized other sports. Comparing the average and individual results we arrived at conclusion that the former flatten the latter. **Hence a serious right or left side differentiation at neither competitors practicing various sports nor all persons under research was found.**
On estimating the level of movement coordination it was noted that the highest results in test assignment (i.e. the sum of highest degree of rotation to right and left) were achieved by traditional karate competitors (842.6°), the lowest by water polo players (628.0°). In „T” scale score karate competitors got 63 points and their level was estimated as very good. Senior judokas got a bit less i.e. 60 points (good level of coordination). The worst in this classification were water polo players who got 40 points which was a mark of a low level of coordination ability (table 1).
Table 1. The average results achieved in global movement coordination test by competitors of various sports  

<table>
<thead>
<tr>
<th>SPORT DISCIPLINE</th>
<th>N</th>
<th>Turning Rotation right</th>
<th>Turning rotation left</th>
<th>Sum of highest degree of turning right and left</th>
<th>Difference between sides (°)</th>
<th>Sum of highest degree of turning right and left in score „T“ scale</th>
<th>Level of movement coordination</th>
<th>Predominant direction of rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basketball (cadets women)</td>
<td>16</td>
<td>347.3</td>
<td>342.1</td>
<td>689.4</td>
<td>46.12</td>
<td>12.29</td>
<td>47</td>
<td>Sufficient</td>
</tr>
<tr>
<td>Basketball (seniors women)</td>
<td>10</td>
<td>342.4</td>
<td>336.0</td>
<td>678.4</td>
<td>20.80</td>
<td>5.96</td>
<td>45</td>
<td>Sufficient</td>
</tr>
<tr>
<td>Wrestling (classical style juniors)</td>
<td>16</td>
<td>399.0</td>
<td>390.0</td>
<td>789.0</td>
<td>14.63</td>
<td>3.47</td>
<td>57</td>
<td>Average</td>
</tr>
<tr>
<td>Wrestling (free style seniors)</td>
<td>11</td>
<td>353.8</td>
<td>365.4</td>
<td>719.2</td>
<td>42.82</td>
<td>10.54</td>
<td>50</td>
<td>Average</td>
</tr>
<tr>
<td>Wrestling (classical style seniors)</td>
<td>11</td>
<td>347.9</td>
<td>359.5</td>
<td>707.4</td>
<td>40.27</td>
<td>9.76</td>
<td>48</td>
<td>Average</td>
</tr>
<tr>
<td>Ringo</td>
<td>21</td>
<td>360.5</td>
<td>342.5</td>
<td>703.0</td>
<td>36.43</td>
<td>9.91</td>
<td>48</td>
<td>Average</td>
</tr>
<tr>
<td>Water polo</td>
<td>14</td>
<td>307.4</td>
<td>320.6</td>
<td>628.0</td>
<td>43.57</td>
<td>12.87</td>
<td>40</td>
<td>Low</td>
</tr>
<tr>
<td>Judo</td>
<td>27</td>
<td>387.8</td>
<td>362.3</td>
<td>750.1</td>
<td>33.59</td>
<td>8.06</td>
<td>53</td>
<td>Medium</td>
</tr>
<tr>
<td>Judo</td>
<td>11</td>
<td>428.4</td>
<td>390.0</td>
<td>818.4</td>
<td>63.45</td>
<td>10.64</td>
<td>60</td>
<td>Good</td>
</tr>
<tr>
<td>Karate – traditional</td>
<td>13</td>
<td>435.8</td>
<td>406.9</td>
<td>842.6</td>
<td>35.38</td>
<td>7.79</td>
<td>63</td>
<td>very good</td>
</tr>
<tr>
<td>Karate Kyokushinkai</td>
<td>24</td>
<td>339.7</td>
<td>332.7</td>
<td>672.4</td>
<td>29.92</td>
<td>8.61</td>
<td>45</td>
<td>Sufficient</td>
</tr>
<tr>
<td>Ice hockey</td>
<td>9</td>
<td>344.9</td>
<td>345.7</td>
<td>690.6</td>
<td>19.67</td>
<td>5.52</td>
<td>47</td>
<td>Sufficient</td>
</tr>
</tbody>
</table>
The majority of competitors demonstrated the average level of coordination (21.9%). Among all the 183 members of the research group only 7 person showed an outstanding level in this respect (Fig. 2). They practiced judo (seniors and juniors), traditional karate, wrestling in classical style (juniors). The results of the latter embodied the characteristics of lack of side differentiation. It can attest to their versatile and in-born predispositions to doing exercises with rotation symmetrically.
Fig. 2. The level of movement coordination in score „T” scale for the whole research group (n=183)
3. Appointing correlation between the level of movement coordination and its side differentiation

The analysis of results achieved by individuals practicing various sports made us look for a relationship between little side differentiation and high level of movement coordination. It was found that small side differentiation characterized only 2.2% of all the persons of the research group who had outstanding level of the ability under research. In relation to 183 competitors it was a relatively not large group. Thus, this predisposes to assumption that high level is irrelevant to the degree of side differentiation in the research group. The highest percentage of the research group (13.1%) who has small differentiation demonstrated the average level of coordination.
4. Predominant direction of rotation in selected sport exercises

On the basis of the average results in movement coordination test the predominant direction of rotation for particular sports was stated (see Table 1). The predominant direction of rotation on the right was typical for hockey, water polo players, wrestlers in free and classical style. In other sports rotation on the left was predominant. The majority of research group (60.7%) preferred performing the exercises left side whereas 37.2% right side. Only 2.1% of individuals were equally successful in performing rotation both sides.
CONCLUSIONS

1. Intermediate competitors practicing 9 sports demonstrated slight (9%) differentiation in performing right and left-side rotation.
2. Competitors of the Polish national team of traditional karate and judo (seniors) featured the highest level of global movement coordination, whereas the lowest was featured by ice hockey players.
3. The biggest side differentiation was observed in water polo players (12.9%) and basketball cadet’s women players (12.3%), the least in wrestlers (classical style juniors - 3.5%).
4. Comparing to all investigated persons of research group the greatest number (21.9\%) showed the average level of global movement coordination (their appreciation was according to „T” scale score).
5. A correlation between outstanding level of global movement coordination and side differentiation of the exercises performed could be followed merely in 2.2% of the research group.
6. The majority of participants (60.7%) demonstrated a left-side predomination of rotation whereas 37.2% a right-side predomination in exercises.
7. The **biggest lateral differentiation** of the average results of the test with right and left rotation was observed among juniors and seniors of judo and traditional karate (seniors), and the smallest was observed among ice hockey players.
8. The analysis of the individual results of those practicing particular disciplines demonstrated their considerable lateral differentiation. The widest span of results was registered among senior judo competitors (0.9 – 42.1%) and juniors (0.3 – 22.7%), as well as karate competitors (0.3-25.5%). A smaller span was noted among ice hockey athletes (2.3 – 8.8%). The comparison between the average and individual results demonstrated that the first ones „flatter” the individual lateral differentiation.
MANY THANKS FOR YOUR KIND ATTENTION