

## ТЕОРЕТИКО-МЕТОДИЧНІ АСПЕКТИ ФІЗИЧНОГО ВИХОВАННЯ І СПОРТУ

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### RELIABILITY AND VALIDITY OF A NEW TEST OF CHANGE OF DIRECTION IN PADEL ATHLETES

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Change of direction is often considered as one of the main determinants of successful performance in many field sports. It is routinely measured using field-based tests. Thus, coaches have to use valid and reliable tests to assess the change of direction ability for their athletes. However, controversy regarding test selection still exists based upon the specificity of the tests.

*The purpose of this study* was to analyze the validity and reliability of a specific test of change of direction in padel athletes. Methods: Twenty three male Padel players (mean±SD: 31.6 ans±7.96 year; 81.1 kg±9.95 kg; 181.1 cm±5.26 cm) volunteered for this study. They completed the change of direction modified T-tests and a Padel change of direction specific test on separate days.

*Material and methods.* The study was performed in two stages. The first stage of our study investigated the reliability of the Padel change of direction specific test. After familiarization, the athletes performed the Padel change of direction specific test on two occasions, seven days apart and at the same time of day. Relative reliability of the Padel change of direction specific test performance was assessed using the intraclass correlation coefficient ( $ICC_{3,1}$ ), while absolute reliability was expressed in terms of the standard error of measurement. The sensitivity of Padel change

of direction specific test was revealed by comparing standard error of measurement to the value of the smallest worthwhile change.

In the second stage of our study Pearson product-moment correlation coefficient was used to determine the convergent construct validity between Padel change of direction specific test and the modified T-test.

*Results and discussion.* There were no significant systematic bias between Padel change of direction specific test (7.89±0.47 second) and retest (7.91±0.49 second) performance in the first phase. The Padel change of direction specific test showed good relative ( $ICC = 0.96$ ) and absolute ( $SEM \% = 1.35\%$ ) reliability of the Padel change of direction specific test. The Padel change of direction specific test capacity to detect change was rated as "good". Its standard error of measurement (0.11) was smaller than its smallest worthwhile change (0.26). The results of the second stage of our study, revealed that the Padel change of direction specific test was significantly associated with the the modified T-test ( $r = 0.77$ ;  $R^2 = 60.2\%$ ;  $p < 0.001$ ).

*Conclusion.* Taking into account the Padel change of direction specific test high relative and absolute reliability and the appropriate level of usefulness, Padel change of direction specific test can

be considered as a standard measure and a suitable protocol for quantifying change of direction in Padel players. This information may be considered to be important for trainers aiming to assess change of direction in Padel players.

**Keywords:** agility, physical fitness, reproductibility.

**Introduction.** Since its creation in 1969, Padel has risen to the top-10 most practiced sports in Spain and counts with more than four million regular practitioners [1]. The presence of professional tournaments in Spain, Portugal, Holland, Andorra, Sweden, Belgium, Argentina, USA, Italy, Monaco and United Arab Emirates, is evidence of this impact [2]. This growth of interest can be explained due to some specific characteristics of Padel [3]. Some of these characteristics are the small dimensions of the court and the existence of walls, which facilitate returning the ball, thus motivating recreational players [3].

In Padel match, players are constantly moving from the back (defensive phase) to the net (offensive phase) passing through the middle (transition), and vice versa, and so a variety of specific displacements and behaviors emerged [3, 4]. Priego, et al. (2013) [3] observed a movement predominance in Padel competition, for lateral displacement (16.1 repetitions every 5 minutes), followed by head-on displacement and split-step (13.3 and 7.7 repetitions every 5 minutes respectively). Consequently, the Padel player is required to change directions with a minimum loss of speed, balance, and/or motor control in reply to a stimulus. These requirements are widely reported in the agility literature. Thus, the CoD skills are important and decisive fitness requirements for Padel [3, 5]. Therefore, their improvements and regular monitoring, via physical tests, are crucial, in particular at high levels. However, new tests of CoD are promoted to reproduce similar effort as the game.

In 2009, Sassi et al. [6] validated the modified agility T-test (MATT). The MATT is simple to administer and requires minimal equipment and preparation. The MATT was used to determine speed with directional changes such as forward sprinting, left and right shuffling, and backpedalling. However, the generic cues involved in the MATT did not reproduce exactly the movement pattern of court sports.

However, a more appropriate test based on specific Padel displacements is required for effective field assessment of CoD.

Despite the documented importance of qualities such as explosive strength and speed and direction changes that characterize Padel movement, there appear to be no published Padel-specific tests of CoD [1, 3, 5].

Thus, **the purpose of this study** was to examine the validity of a Padel specific test designed to assess CoD (PCoDST).

**Material and methods.** Twenty three male Padel players (age:  $31,6 \pm 7,96$  years; height:  $181,1 \pm 5,26$  cm; Body mass:  $81,1 \pm 9,95$  kg) were enrolled in the study. They had been playing Padel for more than 3 years. In terms of activity, they participated in four to six training sessions per week. This study was submitted to and approved by the Committee of Ethics in Research. All participants took part voluntarily after being informed about the risks and benefits of the procedures involved and signed an informed consent form that was previously approved by the Ethics Committee.

Data were gathered from two separate sessions. In session one was established the repeatability of the PCoDST. Each player performed the PCoDST twice, on separate days, with a maximum of seven days between the test and retest. The testing procedure and time of day was identical. Subjects involved in session 1 were also used as subjects in session 2, where linear relations between performances from the PCoDST test and performances from the MATT were investigated.

#### Modified T-Test

Based on the protocol outlined by Sassi et al. (2009) [6], the athlete began with both feet behind the starting line **A**. At his own discretion, he sprinted forward to cone **B** and touched the base of it with the right hand. Facing forward and without crossing feet, the athlete shuffled to the left to cone **C** and touches its base with the left hand. Then he shuffled to the right to cone **D** and touches its base with the right hand. The athlete shuffled back to the left to cone **B** and touches its base. Finally, he ran backward as quickly as possible and returns to line **A** (Figure 1).

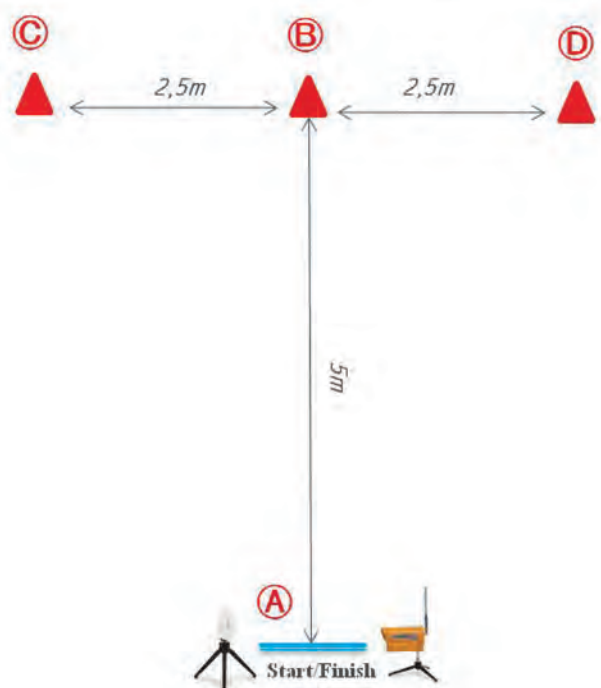
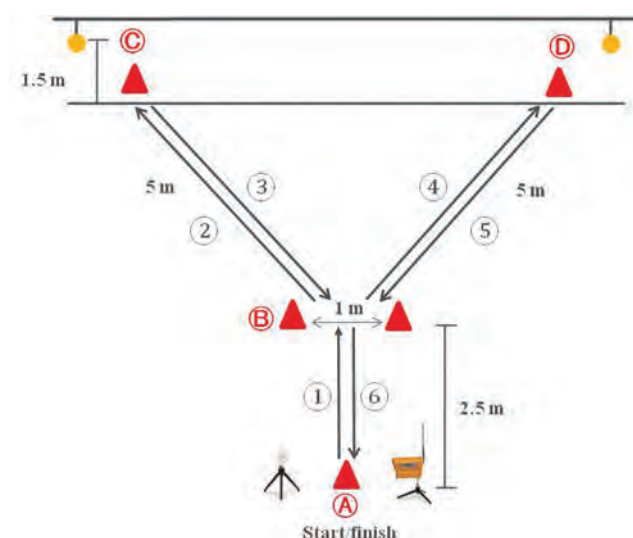


Figure 1. Change of direction speed T-half test

**Padel specific change of direction speed test (PSCDS)**

The dimensions, layout and movement path through the PCoDST are shown in **Figure 2**. PCoDST requires five cones, a double decameter, photocells, two padel balls, a cord and a racket.

The athlete's front foot is placed behind the starting line, which was 0.5 meters before the timing gates. The player carries his racket. At his own discretion, he was required to sprint from the start line (A), to move between cones at B, to reach out to C and hit the attached ball, then, to run backward as quickly as possible to the middle of cones at B and to sprint forward to D. Here he is required to hit the attached ball and immediately run backwards to cones at B and through finish to A. If the player is right-handed, he makes a backhand volley on the first shot and a forehand volley on the second shot. The opposite is done if the player is left-handed. Each athlete mad two trials, and the fastest time is recorded. Participants were simply verbally encouraged to perform maximally during the test.



**Figure 2.** Padel specific change of direction test

**Statistical Analysis**

Statistical analysis of the data was performed by IBM SPSS Statistics software (SPSS Statistics for Windows, Version 20.0.). Relative reliability was determined by calculating intraclass correlation coefficients (ICC). To test absolute reliability the standard error of measurement (SEM) was calculated. The SEM% was also calculated to evaluate PSCDS sensitivity. As a complement to SEM, the smallest worthwhile change (SWC) was also used. The SEM was also used for the calculation of the PSCDS minimal

detectable change ( $MDC_{95}$ ) [7]. The effect size (*d*) was calculated using GPOWER software (Bonn FRG, Bonn University, Department of Psychology) [8]. In the second stage of our study, Pearson product moment correlation was computed between PSCDS and MTCDS performances.

**Results and discussion.** The aims of our study were, firstly, to analyze the reproducibility of a new Padel specific change of direction speed test (PSCDS) and secondly, to study the criterion related validity of this test. The findings of this study showed that PSCDS is a reliable and valid tool for assessing CDS in Padel.

Reliability analysis is commonly used to judge whether a test protocol should be widely used [9]. Relative reliability is commonly evaluated by determining the ICC [10]. In our study, the ICC across the PSCDS test and retest exceeded 0.90 (**Table**). This good relative reliability of PSCDS is comparable to previously reported results on the relative reliability of other CDS tests. In this context, Sassi et al (2009) [6] revealed an ICC of 0.95 in fifty-two male physical education students in the MTCDS test. Same results (ICC of 0.98) were reported by Pauole et al (2000) [11] across three CSD T-test trials in college-aged men and women.

Absolute reliability was analysed from repeated performances of PSCDS test and retest by calculating the SEM. According to Nevill and Atkinson, (1997) [12], any two tests would differ, because of measurement error (SEM % in the current study) by no more than 5%. Retest absolute reliability measurement errors of PSCDS test was good, the SEM % (1.35%) was < 5% (**Table**).

In this study, the likelihood that true values of the estimated difference in PSCDS test and retest (i.e., larger than the SWC) was verified. Results presented in the **Table** revealed that PSCDS test has a good ability to detect real changes in the CDS performance of Padel players. Its SEM (0.11 sec) was smaller than its SWC (0.26 sec).

The SEM is also used to calculate the MDC. The MDC allows the determination of whether a real change has occurred between test and retest and when a change in a test-retest performance is  $\pm MDC$  a true change is indicated [13]. The PSCDS's  $MDC_{95}$  was of 0.29 sec. The  $MDC_{95}$  in this investigation indicates that 95% of the outcomes of the PSCDS will demonstrate a random variation as a result of measurement error of less than 0.29 sec for PSCDS performance. This study is the first to determine the  $MDC_{95}$

**Table –** Descriptive statistics and results of relative and absolute reliabilities of PCoDST for male Padel players (n= 23)

	Test (sec)	Re-test (sec)	p	dz	ICC	SWC (sec)	SEM (sec)	SEM (%)	$MDC_{95}$
PCoDST	7.85±0.47	7.91±0.49	>0.05	0.13	0.961	0.26	0.11	1.35	0.29

of the PSCDS, so future studies are needed to confirm this result to those of the specific literature.

Pearson product moment correlation coefficient was performed between PSCDS and MTCDS tests. The PSCDS test was significantly correlated ( $r = 0.78$ ;  $p < 0.0001$ ;  $R^2 = 60.80\%$ ) to the MTCDS. This result indicates that the PSCDS could be used to evaluate CDS. Even if there is no widely recognised gold-reference agility test, this strong correlation could provide criterion validity to the PSCDS test as the MTCDS has been widely used as a CDS test [6, 14, 15].

**Conclusion.** The PSCDS test showed good relative and absolute reproducibility, as well as a good ability to detect small changes in performance. It also

provided good logical validity estimated by its good correlation with the modified T-test.

**Perspectives:** Investigate the responsiveness of PSCDS test, in other words, investigate if PSCDS test can reveal differences on CDS performance between two levels (regional and national) of Padel competitors.

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**НАДІЙНІСТЬ І ВАЛІДНІСТЬ НОВОГО ТЕСТУ ДЛЯ ОЦІНЮВАННЯ НАВИЧКИ ЗМІНИ НАПРЯМКУ РУХУ У ГРАВЦІВ У ПАДЕЛ-ТЕНІС****Аттія Ахмед, Негра Ясін, Саммуд Сенда, Хемірі Аймен, Фархат Неджиба, Петрова Лілія, Реджаб Неджиб, Халіфа Ріад, Чортане Сабрі Г.**

**Резюме.** Зміна напрямку руху вважається однією з головних рухових навичок, що визначають успішний виступ атлетів у багатьох ігрових видах спорту. Його оцінювання зазвичай здійснюється в умовах, наближених до змагальних. Тому тренер повинен використовувати достовірні і надійні тести для оцінки навичок спортсменів до зміни напрямку руху. Проте як і раніше існують розбіжності щодо вибору того чи іншого тесту через його специфіку.

**Метою цього дослідження** є аналіз достовірності та надійності специфічного тесту для оцінювання навички зміни напрямку руху у спортсменів, які займаються падел-тенісом.

У дослідженні взяли участь двадцять три гравці в падел-теніс (середнє±стандартне відхилення: 31,6±7,96 роки; 81,1 кг±9,95 кг; 181,1±5,26 см). Оцінювання навичок зміни напрямку руху за допомогою модифікованого Т-тесту і специфічного тесту для Настільний теніс здійснювалося в різні дні.

**Матеріал і методи.** Дослідження проводилося в два етапи. На першому етапі дослідження вивчалася надійність специфічного тесту для оцінювання навички зміни напрямку руху в падел-тенісі. Після ознайомлення спортсмени виконали специфічний тест два рази з інтервалом в сім днів і в один і той самий час доби. Відносна надійність результатів тесту для оцінювання навички зміни напрямку руху оцінювалася з використанням коефіцієнта внутрішньокласової кореляції (ICC3,1), а абсолютна надійність виражалася в одиницях стандартної помилки вимірювання. Чутливість тесту для оцінювання зміни напрямку руху в падел-теніс була виявлена шляхом порівняння стандартної похибки вимірювання зі значенням найменшої значущої зміни. На другому етапі дослідження для визначення валідності конвергентної конструкції між тестом зміни напрямку руху в падел-тенісі і модифікованим Т-тестом використовувався лінійний коефіцієнт кореляції Пірсона.

**Результати.** На першому етапі не було виявлено значного систематичного відхилення між результатами специфічного тесту зміни напрямку руху в падел-тенісі (7,89±0,47 секунди) та повторним тестом (7,91±0,49 секунди). Специфічний тест зміни напрямку руху в падел-тенісі показав хорошу відносну (ICC = 0,96) і абсолютну (SEM% = 1,35%) надійність. Можливості специфічного тесту для визначення змін результатів були оцінені як «добре». Його стандартна похибка вимірювання (0,11) була менше його найменшої значущої зміни (0,26). Результати другого етапу дослідження показали, що специфічний тест зміни напрямку руху в падел-тенісі був взаємопов'язаний з модифікованим Т-тестом ( $r = 0,77$ ;  $R^2 = 60,2\%$ ;  $p < 0,001$ ).

**Висновки.** Беручи до уваги високу відносну та абсолютну надійність специфічного тесту і відповідний рівень корисності, його можна розглядати як стандартний засіб контролю та відповідний протокол для кількісної оцінки навички зміни напрямку руху в падел-тенісі. Ця інформація може вважатися важливою для тренерів, які прагнуть оцінити навички зміни напрямку руху у гравців в падел-теніс.

**Ключові слова:** спритність, фізична підготовка, відтворюваність.

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**НАДЕЖНОСТЬ И ВАЛИДНОСТЬ НОВОГО ТЕСТА ДЛЯ ОЦЕНИВАНИЯ НАВЫКА ИЗМЕНЕНИЯ НАПРАВЛЕНИЯ ДВИЖЕНИЯ У ИГРОКОВ В ПАДЕЛ-ТЕННИС****Аттія Ахмед, Негра Ясін, Саммуд Сенда, Хеміри Аймен, Фархат Неджиба, Петрова Лілія, Реджаб Неджиб, Халіфа Ріад, Чортане Сабрі Г.**

**Резюме.** Изменение направления движения считается одним из главных двигательных навыков, определяющих успешное выступление атлетов во многих игровых видах спорта. Его оценивание обычно осуществляется в условиях, приближенных к соревновательным. Поэтому тренер должен использовать достоверные и надежные тесты для оценки навыков спортсменов к изменению направления движения. Однако по-прежнему существуют разногласия относительно выбора того или иного теста из-за его специфики.

**Целью данного исследования** является анализ достоверности и надежности специфического теста для оценивания навыка изменения направления движения у спортсменов, которые занимаются падел-теннисом.

В исследовании приняли участие двадцать три игрока в падел-теннис (среднее±стандартное отклонение: 31,6±7,96 года; 81,1 кг±9,95 кг; 181,1±5,26 см). Оценивание навыков изменения направления движения при помощи модифицированного Т-теста и специфического теста для падел-тенниса осуществлялось в разные дни.

*Матеріал и методи.* Исследование проводилось в два этапа. На первом этапе изучалась надежность специфического теста для оценивания навыка изменения направления движения в падел-теннисе. После ознакомления спортсмены выполнили специфический тест два раза с интервалом в семь дней и в одно и то же время дня. Относительная надежность результатов теста для оценивания навыка изменения направления движения в падел-теннисе оценивалась с использованием коэффициента внутриклассовой корреляции ( $ICC_{3,1}$ ), а абсолютная надежность выражалась в единицах стандартной ошибки измерения. Чувствительность теста для оценивания изменения направления движения в падел-теннисе была выявлена путем сравнения стандартной ошибки измерения со значением наименьшего значимого изменения. На втором этапе исследования для определения валидности конвергентной конструкции между тестом изменения направления в падел-теннисе и модифицированным Т-тестом использовался линейный коэффициент корреляции Пирсона.

*Результаты.* На первом этапе не было выявлено значительного систематического отклонения между результатами специфического теста изменения направления движения в падел-теннисе ( $7,89 \pm 0,47$  секунды) и повторным тестом ( $7,91 \pm 0,49$  секунды). Специфический тест изменения направления движения в падел-теннисе показал хорошую относительную ( $ICC = 0,96$ ) и абсолютную ( $SEM\% = 1,35\%$ ) надежность. Возможности специфического теста для определения изменений результатов были оценены как «хорошо». Его стандартная ошибка измерения ( $0,11$ ) была меньше его наименьшего значимого изменения ( $0,26$ ). Результаты второго этапа исследования показали, что специфический тест изменения направления движения в падел-теннисе был взаимосвязан с модифицированным Т-тестом ( $r = 0,77$ ;  $R^2 = 60,2\%$ ;  $p < 0,001$ ).

*Выводы.* Принимая во внимание высокую относительную и абсолютную надежность специфического теста и соответствующий уровень полезности, его можно рассматривать как стандартное средство контроля и подходящий протокол для количественной оценки навыка изменения направления движения в падел-теннисе. Эта информация может считаться важной для тренеров, стремящихся оценить навыки изменения направления движения у игроков в падел-теннис.

**Ключевые слова:** ловкость, физическая подготовка, воспроизводимость.

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