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RESEARCH ARTICLE

Evaluation of Time Perception in Individuals with Lifelong Premature Ejaculation

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Abstract

Objective: Premature Ejaculation (PE) is a common sexual disorder that considerably affects sexual satisfaction, subjective well-being, and quality of life. A clear picture of the pathophysiology of PE has still not been determined. Current research has revealed the involvement of the central nervous system. Alterations in frontal cerebral structures and a discrepancy between the reported and objectively measured intravaginal ejaculatory latency times both point to a possible alteration of time perception. The present study aimed to assess the time perception between individuals with lifelong PE and healthy individuals.

Material and Methods: 24 individuals with lifelong PE and 24 healthy volunteers were recruited. Participants were administered both clinical measures and a time perception test battery including time interval estimation tests and time interval production tests for 4,7,32 and 58-second time intervals.

Results: Lower predictions for 4-second time intervals were found in individuals with lifelong PE than in healthy controls. No differences were found for 7,32 and 58-second time intervals. The Premature Ejaculation Diagnostic Tool scores correlated negatively with the 4-second and 32-second time interval predictions.

Conclusion: The present results indicate a time perception deficit for short intervals in individuals with lifelong PE for the first time. This might be due to a working memory/executive function deficit or disruption of frontal functions on account of impulsivity. A specific deficit in time perception deficit might also occur. Further studies assessing other frontal functions concomitantly are required to draw firm conclusions.

Keywords: Cognitive functions, premature ejaculation, sexual disorders, time perception

INTRODUCTION

Premature Ejaculation (PE) is one of the most common sexual disorders in men that has been characterized by a loss of ejaculatory control and premature ejaculation before expected sexual satisfaction (1). The prevalence of PE has been estimated to be about 20-30% in Türkiye (2). PE results

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in a considerable loss of sexual satisfaction and thereby self-esteem, subjective well-being, and quality of life (1). Since its first definition in 1887, substantial improvement regarding its understanding and more satisfactory treatment outcomes have been reported recently (1,3). While various typologies have been defined, lifelong PE has the best-documented intrinsic pathophysiology. Nevertheless, the exact course and the clear picture of the pathophysiology have not been sketched out thus far (3). A plethora of pathophysiological mechanisms including penile hypersensitivity, 5-HT receptor dysfunction, and anxiety have been identified while numerous others like obesity, sedentary lifestyle, diabetes, and traumatic sexual or emotional experiences have also been depicted to have a possible role (4,5). However, novel insights regarding the contribution of the central nervous system have been gained in the last decade. In animals, various central regions like the medial preoptic area, paraventricular nucleus, periaqueductal grey matter, and lateral paragigantocellular nucleus have been associated with ejaculation (6,7). In these regions, multiple neurotransmitters, especially serotonin, are involved in the processes of ejaculation. In humans, the involvement of the central nervous system in PE is also considered in light of the recent findings. During ejaculation, cranial activity has been indicated to decrease in the medial prefrontal cortex and inferior frontal cortex (8,9). Individuals with PE have also been shown to have functional connectivity alterations in the bilateral medial orbitofrontal cortices, right inferior frontal gyrus, and other cranial brain regions (10–12).

Time perception is a broad term for distinct relevant skills including the ability to measure the time passed between two events, the ability to discriminate the difference between time intervals, etc. which are involved in maintaining numerous daily activities (13). Bearing the wide daily usage in mind, it is not surprising that deficits in some or all aspects of time perception have been revealed in a wide spectrum of neuropsychiatric disorders (14). However, no studies have previously assessed time perception in individuals with lifelong PE. Two main arguments may point to a possible alteration of time perception in individuals with lifelong PE. First, a significant discrepancy between the reported and actual intravaginal ejaculatory latency times has been observed in some of the studies (15,16), but not all of them (17,18). Second, some disruptions have been observed in frontal structures (10,11) which are essentially involved in time perception (19).

The present study aimed to assess the differences in time perception between individuals with PE and healthy individuals. We postulated that specific or generalized alterations in time perception might occur in individuals with PE.

MATERIAL AND METHODS

Design

The present cross-sectional study was conducted in the Department of Urology and the Department of Physiology of the Faculty of Medicine. The study was approved by the local ethical committee (dated 25th December 2022, decision number 91). All participants provided written informed consent. The study procedures complied with the Declaration of Helsinki. Experienced urologists medically examined all participants. No compensation was provided for the participants. The routine medical treatment of the individuals with PE was initiated after completing the study procedures. General mental health status was evaluated with the Patient Health Questionnaire-9 (PHQ-9) (20). The severity of PE was determined with the Premature Ejaculation Diagnostic Tool (PEDT) (21). The International Index of Erectile Function- Erectile Function subscale (IIEF-EF) was utilized to exclude erectile dysfunction (22). Time perception was evaluated with the Time Interval Estimation Tests (TIET) and the Time Interval Production Tests (TIPT).

Participants

Twenty-four treatment-naive individuals with lifelong PE and twenty-four volunteering healthy control subjects were recruited from the urology outpatient clinic. Healthy volunteers were recruited from the hospital attendants. Lifelong PE diagnosis was performed by the International Society of Sexual Medicine-2014 criteria (23). Exclusion criteria were being aged below 18 or above 60, the lack of a heterosexual monogamic partner, less than four sexual intercourses in the last month as at least four sexual intercourses have been suggested to calculate Intravaginal Ejaculatory Latency Time, serious neurologic, psychiatric, or other medical illness, had a history of major pelvic/penile surgery, had retrograde/painful ejaculation or anejaculation, had a sexual partner with sexual dysfunction, or a serious medical illness (24). Participants with a Body Mass Index above 40 and with a PHQ-9 score of above 10 were also excluded. Participants in the lifelong PE group were treatment-naïve, had a mean Intravaginal Ejaculatory Latency Time of less than one minute in the last month, a PEDT score of more than 11, and an IIEF-EF score of more

than 21 to exclude erectile dysfunction. Participants in the healthy volunteer group had a mean Intravaginal Ejaculatory Latency Time of more than one minute in the last month, a PEDT score of less than 11, and an IIEF-EF score of more than 21 to exclude erectile dysfunction.

Instruments

Premature Ejaculation Diagnostic Tool (PEDT): PEDT is a Likert-type self-report diagnostic tool that consists of five practical items to overall determine the presence and degree of PE in males (21). The approximate application duration is 2 minutes. Total scores above 11 correspond to definite PE while total scores of 10 and 11 correspond to probable PE.

International Index of Erectile Function- Erectile Function subscale (IIEF-EF): The International Index of Erectile Function is a comprehensive 6-point Likert-type scale that involves five main sections as follows: Erectile function, orgasmic function, sexual desire, intercourse satisfaction, and overall satisfaction. The IIEF-EF is the subscale that chiefly assesses erectile function status (22). The total score of IIEF-EF was calculated with the sum of the first five items and the fifteenth item. Studies indicated its similar validity to the laboratory tests of EF (25). An IIEF-EF score above 21 is probably adequate to exclude EF.

Patient Health Questionnaire-9 (PHQ-9): PHQ-9 is a common diagnostic screening tool to assess general mental status and to screen major depressive disorder. It is a nine-item self-report Likert-type scale that was mainly based on the Diagnostic and Statistical Manual of Mental Disorders-IV criteria. Turkish reliability and validity of the scale were performed in the general population (20). In PHQ-9; total scores between 0-4 correspond to minimal/no depression, total scores between 5-9 correspond to mild depression, total scores between 10-14 correspond to moderate depression, and total scores between 15-21 correspond to severe depression. Individuals with total scores above 10 have 7-13.6 times higher risk of having clinical major depressive disorder (26).

Time Interval Estimation Tests (TIET): In Time Interval Estimation Tests, participants were asked to estimate the duration between two beep sounds that corresponded to "start" and "stop" commands and then tell the duration of the sound verbally. Participants were previously informed that they would be asked to estimate the duration of the time interval. However, counting verbally or using rhythmic body movements was not allowed. Four distinct time intervals (4,7,32 and 58 seconds) were each performed thrice (27,28). Therefore, a total of twelve distinct time intervals were estimated. Interval trials were performed in a randomized order. The averages for each four distinct time intervals were calculated. Then, the average of the reported duration for each interval was divided by the exact duration of the time intervals to calculate the Ratios for each interval.

Time Interval Production Tests (TIPT): In Time Interval Production Tests, participants were asked to produce a previously determined time interval. To this end, participants were asked to give the "stop" command verbally when the previously determined time interval had passed after the "start" command. However, counting verbally or using rhythmic body movements was not allowed. Four distinct time intervals (4,7,32 and 58 seconds) were each performed thrice (27,28). Therefore, a total of twelve distinct time intervals were estimated. Interval trials were performed in a randomized order. The averages for each four distinct time intervals were calculated. Then, the average of the reported duration for each interval was divided by the exact duration of the time intervals to calculate the Ratios for each interval.

Statistical Analyses

Statistical analyses were performed using Statistical Package for Social Sciences (SPSS) 25.0 (IBM Corporation, Armonk, NY, USA). Shapiro-Wilk tests were conducted to determine the normality status. All variables except the Ratio of TIPT 4 Seconds were non-normally distributed. Independent Samples T-tests were conducted to compare the normally distributed variables between the lifelong PE and healthy control groups. Mann-Whitney *U* tests were conducted to compare the non-normally distributed variables between the lifelong PE and healthy control groups. A *p*-value below 0.05 was considered significant.

RESULTS

The comparison of the demographic and clinical properties between lifelong PE and healthy control groups is depicted in Table 1. The mean age of the study sample was 32.0 and a significant age difference was found between lifelong PE and healthy control groups ($Z = -4.077$; $p < 0.001$). There were also significant differences in the number of educated years ($Z = -2.661$; $p = 0.008$) and the PEDT scores ($Z = -5.957$; $p < 0.001$), but IIEF-EF scores and the PHQ-9 total scores were similar.

The comparison of the time perception test results is depicted

in Table 2. TIET 4 Seconds Ratios were lower in the lifelong PE group than the healthy control group (t = 2.268; p = 0.029) (Figure 1). There were no significant differences in the TIET Ratios for 7,32 and 52 Seconds.

The PEDT score correlated with the TIET Ratios for 4 Seconds (r = -0.287; p = 0.048) and 32 Seconds (r = -0.303; p = 0.036). There were also correlation trends towards significance between the PEDT score and TIET Ratios for 7 Seconds (r = -0.273; p = 0.060) and 58 Seconds (r = -0.284; p = 0.051).

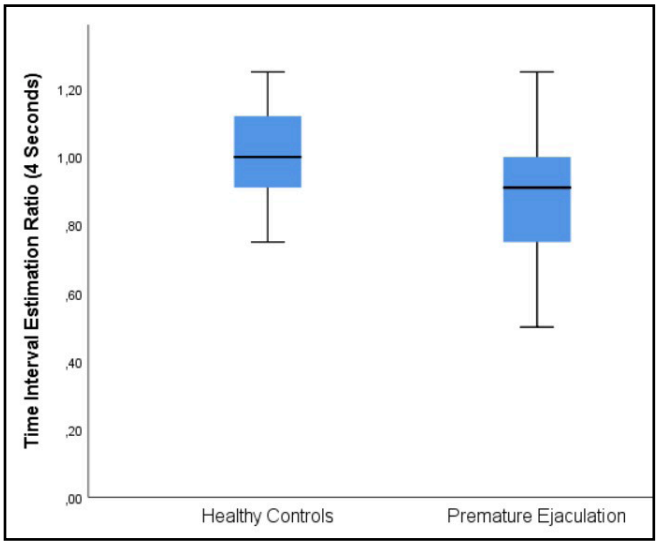

Figure 1. Differences in 4 second (short) time interval between individuals with premature ejaculation and healthy controls. Bars represent standard error.

Table 1. Comparison of Demographic and Clinical Variables Between Individuals with Premature Ejaculation and Healthy Controls

	Variables			
	PE (n=24)	**Healthy (n=24)**	**Z**	**P-values**
Demographic/Clinical Measure				
Age	24.00 (12.50)	36.50 (13.25)	-4.077	**<0.001**
Education (years)	13.50 (4.00)	16.00 (2.00)	-2.661	**0.008**
PEDT	17.00 (7.25)	7.00 (6.75)	-5.957	**<0.001**
IIEF-EF	25.50 (8.00)	24.00 (4.00)	-0.907	0.365
PHQ-9	5.50 (4.50)	6.00 (7.75)	-0.062	0.950

PE: Premature Ejaculation; PEDT: Premature Ejaculation Diagnostic Tool; IIEF-EF: International Index of Erectile Function-Erectile Function; PHQ-9: Patient Health Questionnaire-9. Medians (interquartile ranges) and Z values are shown. Significant p-values are bold.

Table 2. Time Perception Parameters in Individuals with Premature Ejaculation and Healthy Controls

Measures	**PE (n=24)**	**Healthy (n=24)**	**Total (n=48)**	**Z/t**	**p-values**
TIET 4 seconds Ratio	0.885 (0.206)	1.000 (0.230)	0.942 (0.181)	2.268	**0.029**
TIET 7 seconds Ratio	0.900 (0.150)	0.925 (0.130)	0.900 (0.110)	-1.484	0.138
TIET 32 seconds Ratio	0.860 (0.250)	0.900 (0.100)	0.880 (0.120)	-1.566	0.117
TIET 58 seconds Ratio	0.905 (0.160)	0.930 (0.130)	0.910 (0.170)	-1.710	0.087
TIPT 4 seconds Ratio	1.080 (0.120)	1.000 (0.080)	1.040 (0.080)	-1.098	0.272
TIPT 7 seconds Ratio	1.110 (0.410)	1.040 (0.120)	-1.070 (0.250)	-1.061	0.289
TIPT 32 seconds Ratio	1.135 (0.300)	1.075 (0.200)	1.110 (0.290)	-0.827	0.408
TIPT 58 seconds Ratio	1.270 (0.520)	1.150 (0.260)	1.160 (0.430)	-1.469	0.142

PE: Premature Ejaculation; TIET: Time Interval Estimation Test. Mean (standard deviation) and t value for TIET 4 seconds ratio are shown. Medians (interquartile ranges) and Z values for other outcome variables are shown. Significant p-values are bold.

DISCUSSION

The present study intended to assess time perception differences between individuals with lifelong PE and healthy individuals for the first time. Partially consistent with the hypotheses, lower accuracy of the 4-second time estimation was found in individuals with lifelong PE than in healthy controls. Moreover, disease severity as assessed by the PEDT score correlated negatively with the accuracy of the 4-second time estimation. On the other hand, no differences were observed in other time intervals.

The crucial finding of the present study was the alteration of 4-second time interval predictions. Since individuals with PE had lower age than healthy controls, this alteration was not attributable to high age. A variety of reasons might explain this finding. First, this might be due to a slight deficit in working memory/executive functions as there is a significant relationship between time perception and frontal functions (29), and frontal alterations to some extent have been observed in individuals with PE (10,11). Time perception is a multifaceted cognitive function that involves the contribution of numerous cognitive and perceptual processes. Among them, attention and working memory come to the fore which are chiefly maintained by the frontal structures of the brain (29). Auditory and visual inputs are compared with the speed of the internal time clock and integrated with the internal time clock by the prefrontal cortex. This process considerably requires a proper attention/working memory system. However, we did not assess working memory/executive functions and no studies have directly identified a working memory/executive function deficit in individuals with lifelong PE thus far. Nevertheless, previously identified alterations of the frontal structures in individuals with PE might point to a possible attention/working memory deficit (10,11).

Another possible explanation for the lower ratios of the TIET 4 Second test might be impulsivity which might also be associated with the frontal alterations or working memory/executive function deficits. The relationship between short-time-interval estimation and impulsivity supports this notion (30). Even though the neural bases of this assumption have not been exactly identified yet, a theoretical neural model has been suggested that integrates the neural circuits of time perception and impulsivity through the common structures and pathways (30).

Finally, the alteration of time perception in individuals with PE might be also a specific cognitive deficit. Nevertheless, time perception is a complex phenomenon with multiple sub-aspects (13). Thus, further studies are required to draw firm conclusions. It should also be mentioned that we could not determine the order of emergence or the causal link between the PE and the alteration of short-interval time perception since the present study was a cross-sectional study.

A few limitations of the present study should be mentioned. The relatively small sample size, lack of a general cognitive status assessment, and lack of an age-matched control group are the outstanding limitations of the present study.

CONCLUSIONS

To conclude, the present study indicates a significant difference in time perception of a short time interval between lifelong PE and healthy control groups that may point to a specific time deficit or a possible deficit in working memory. However, the present results were not able to confirm these assumptions, and further studies with larger samples are required to draw firm conclusions.

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Ethics Committee: Muğla Sitki Koçman University / Faculty of Medicine (25.12.2022 Decision No: 91).

Author Contributions:

Serkan Aksu: Concept and design, data collection, data analysis and evaluation, writing of the manuscript draft, review of the manuscript draft, statistical analysis, and final approval. Harun Bal, Hüseyin Tarhan, Hasan Deliktaş, Hayrettin Şahin: Concept and design, data collection, data analysis, and evaluation, review of the manuscript draft, statistical analysis, final approval.

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