

### AGE-RELATED CORRELATION BETWEEN ERECTILE DYSFUNCTION AND PREMATURE EJACULATION

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#### ABSTRACT

##### Background and objective

To evaluate the relationship between erectile dysfunction (ED) and premature ejaculation (PE) among men aged 40–79 years and to compare age-related differences between men aged 40–59 years and 60–79 years.

##### Materials and methods

From January 2014 to January 2019, records of 892 men aged 40–79 years were analyzed. We performed correlation analysis using the self-reported intravaginal ejaculation latency time (IELT), premature ejaculatory diagnostic tool (PEDT), Male Sexual Health Questionnaire-ejaculation (MSHQ-EjD), and International Index of Erectile Function5 (IIEF5) questionnaires.

##### Results

The mean age of the 892 males was  $52.8 \pm 7.3$  years (40–76). All subjects were divided into group 1 (40–59 years old) and group 2 (60–79 years old). The IIEF5 score of group 1 was significantly higher than that of group 2 ( $18.7 \pm 5.5$  vs.  $17.7 \pm 5.7$ ,  $p = 0.049$ ). Of the total subjects, 71 (8%) had IELT value of less than 1 min. A total of 51 (6.9%) and 20 (13.5%) were in groups 1 and 2, respectively ( $p = 0.02$ ). The PEDT total score was higher and more subjects were identified as suffering from PE (PEDT  $\geq 9$ ) from amongst the ED subjects (IIEF-5  $\leq 21$ ). In both groups 1 and 2, more PE subjects were identified in ED subjects (IIEF-5  $\leq 21$ ) than normal subjects (IIEF-5  $> 21$ ) (all  $p < 0.01$ ). In the total subjects, group 1 and 2, the IIEF-5 and PEDT score showed a weak negative correlation ( $r = -0.302$ ,  $r = -0.361$ ,  $r = -0.248$ , all  $p < 0.01$ ). In group 2,

the IELT and MSHQ-EjD score also showed a weak positive correlation between the IIEF-5 score ( $r = 0.166$ ,  $p = 0.044$  and  $r = 0.164$ ,  $p = 0.047$ , respectively).

### Conclusion

More subjects defined PE value as less than 1 min on the self-reported IELT in the elderly group  $\geq 60$  years than those among the 40–59 years age group; moreover, the lower the IIEF5 total score among subjects  $\geq 60$  years, the higher the PEDT score and the lower the IELT and MSHQ-EjD scores.

**Keywords:** *erectile dysfunction; International Index of Erectile Function; premature ejaculation; premature ejaculatory diagnostic tool*

## INTRODUCTION

Premature ejaculation (PE) is one of the most common among ejaculation disorders.<sup>1</sup> The prevalence of PE is reported to vary from 3 to 30%.<sup>2–5</sup> This is attributed to inconsistencies in definition of PE.<sup>3</sup> The International Society for Sexual Medicine (ISSM) has defined PE as follows: (1) inability to delay ejaculation on all or nearly all vaginal penetrations; (2) negative personal consequences, such as distress, distraction, frustration, or avoidance of sexual intimacy; and (3) ejaculation that always or nearly always occurs before or within about 1 min of vaginal penetration from the first sexual experience (life-long PE), or a clinically significant and bother-some reduction in latency time, often up to about  $\leq 3$  min (acquired PE). This type of PE is known to have a great influence on the quality of life. When studying the organic factors of PE, it has been observed that lifelong PE is mainly attributed to genetic factors, while acquired PE may be caused by hormonal imbalance, prostatitis, metabolic syndrome, and erectile dysfunction (ED).<sup>6–12</sup>

ED is the most common male sexual disorder, and has a significant impact on the quality of life. Risk factors for ED are chronic diseases, such as hypertension, diabetes, and renal failure.<sup>13–18</sup> Other risk factors for ED include age, testosterone deficiency, and urinary symptoms.<sup>19,20</sup> Recent studies have reported that PE is also associated with ED.<sup>21,22</sup> Although specific factors or linkages between ED and PE are not known, ED may be a result of PE.<sup>8</sup> If ED causes the duration of intercourse to be shortened, PE could occur. Further, people with ED

have a higher prevalence of PE than those without ED.<sup>22,23</sup> While the incidence of ED increases with age,<sup>1,14</sup> it is known that there is no difference in the prevalence of PE according to age based on several previous studies.<sup>24,25</sup> However, recent studies have reported that the prevalence of PE increased with age.<sup>26–28</sup> These conflicting results are thought to result from a different definition of PE. Premature ejaculatory diagnostic tool (PEDT) questionnaires, intravaginal ejaculation latency time (IELT), and male sexual health questionnaire for ejaculatory dysfunction (MSHQ-EjD) are currently used to diagnose and evaluate PE. In previous studies, PEDT or self-reported PE was used for the diagnosis of PE in the study of the relationship between ED and PE.<sup>27</sup> However, the current PEDT questionnaire is tailored according to the DSM definition, before publishing of the ISSM definition. Therefore, it may not fit the current PE definition of ISSM.<sup>28,29</sup>

We hypothesized that ED is associated with PE and this disease is more pronounced in older people. We aimed to evaluate the relationship between ED and PE using several methods. In addition, we compared men before and after 60 years of age to analyze and identify if there were any differences according to age.

## METHODS

### Study Population

We retrospectively reviewed data from 1121 men who visited our health-care center for a general

health check-up between January 2014 and January 2019. The exclusion criteria were as follows: (1) Those who are younger than 40 years and older than 80 years; (2) participants who did not have sex within the previous 6 months; (3) those who had been diagnosed with PE, ED, benign prostatic hyperplasia, urologic malignancies, and neurogenic bladder disease; (4) participants who had been diagnosed and received ongoing medications for hyperthyroidism or psychological disorders; and (5) those who were taking medications including SSRIs, testosterone,  $\alpha$  blockers, 5- $\alpha$  reductase inhibitors, or phosphodiesterase-5 inhibitors were also excluded. A total of 892 subjects (324 patients in the 40–49 age group, 420 in the 50–59 age group, 126 in the 60–69 age group, and 22 in the 70–79 age group) were enrolled.

#### **ED and PE Assessment**

All participants completed the PEDT questionnaire, self-reported IELT, MSHQ-EjD questionnaire, and International Index of Erectile Function-5 (IIEF-5) questionnaire. The subjects were asked to fill in the questionnaires after providing sufficient explanation about each item. Participants were asked to report their IELT as less than 1 min, 1–5 min, and 5 min or more. The collected questionnaires were analyzed, and IELT less than 1 min or PEDT scores  $\geq 9$  were classified as having PE. Additionally, we classified erectile function as normal (IIEF-5  $> 21$ ), mild ED ( $16 < \text{IIEF-5} \leq 21$ ), mild to moderate ED ( $11 < \text{IIEF-5} \leq 16$ ), moderate ED ( $7 < \text{IIEF-5} \leq 11$ ), and severe ED ( $\text{IIEF-5} \leq 7$ ). In conclusion, men with IIEF-5 scores  $\leq 21$  were classified as having ED.

#### **Statistical Analysis**

Data collected were processed and analyzed using routine statistical methods, and  $p < 0.05$  was taken as an indication of significant difference. Comparison of intergroup was performed using Chi-test or one-way analysis of variance (ANOVA) test. The odds ratios (ORs) and 95% confidence intervals were determined to evaluate

the relationships between PE and ED. All analyses were conducted using IBM SPSS ver. 24 (IBM Co., Armonk, NY, USA).

#### **Ethics Statement**

The present study was approved by the Institutional Review Board (IRB) (No. 2019-06-016). The requirement for informed consent was waived based on the study's retrospective design.

## **RESULTS**

Table 1 shows the baseline characteristics of the total participants. The mean age of the 892 patients was  $52.8 \pm 7.3$  years (40–76). When divided based on the age of 60 years, 744 (83.4%) were aged from 40 to 59 (Group 1) and 148 (16.6%) were aged from 60 to 79 (Group 2). There were no significant differences in number of ED subjects (IIEF-5  $\leq 21$ ) between the groups ( $p = 0.162$ ). PEDT score and number of PE subjects (PEDT  $\geq 9$ ) showed no significant differences ( $p = 0.461$  and  $p = 0.830$ , respectively). However, the IIEF5 score of group 1 was significantly higher than that of group 2 ( $18.7 \pm 5.5$  vs.  $17.7 \pm 5.7$ ,  $p = 0.049$ ). A total of 71 (8%) subjects were identified as suffering from PE (IELT  $< 1$  min) among all subjects and there were more PE-affected subjects in group 2 than group 1 (51(6.9%) vs. 20(13.5%),  $p = 0.02$ ). Also, the mean total score of MSHQ-EjD was significantly higher in group 1 than group 2 ( $27.3 \pm 5.6$  vs.  $22.5 \pm 6.6$ ,  $p < 0.01$ ).

Table 2 shows that more subjects were identified as suffering from PE (PEDT  $\geq 9$ ) from amongst the ED subjects than normal subjects (221[44%] vs. 69[17.7%],  $p < 0.01$ ). Meanwhile, there were no significant differences in MSHQ-EjD scores and IELT ( $p = 0.233$  and  $p = 0.557$ , respectively).

Table 3 shows that in both groups 1 and 2, more PE subjects (PEDT  $\geq 9$ ) were identified in ED subjects (IIEF-5  $\leq 21$ ) than normal subjects (IIEF-5  $> 21$ ) (all  $p < 0.01$ ). Although ED subjects had higher PE values (IELT  $< 1$  min) and a lower MSHQ-EjD

**TABLE 1** Baseline Characteristics of the Total Participants.

	Total	Group 1 40–59 years old	Group 2 60–79 years old	p-value
No (%)	892 (100)	744 (83.4)	148 (16.6)	—
Mean age±SD (years)	52.8 ± 7.3	50.5 ± 5.4	64.2 ± 4.1	< 0.01
IIEF-5 total (Mean±SD)	18.5 ± 5.6	18.7 ± 5.5	17.7 ± 5.7	0.049
No. ED (%) (≤ 21)	502 (56.3)	411 (55.2)	91 (61.5)	0.162
PEDT total (Mean±SD)	6.7 ± 4.3	6.7 ± 4.3	6.9 ± 4.3	0.461
No. PE (%) (≥ 9)	290 (32.5)	243 (32.7)	47 (31.8)	0.830
IELT (N %)	—	—	—	—
< 1 min (PE)	71 (8)	51 (6.9)	20 (13.5)	0.02
1–5 min	389 (43.6)	325 (43.7)	64 (43.2)	S/A
> 5 min	432 (48.4)	368 (49.5)	64 (43.2)	S/A
MSHQ-EjD total (Mean±SD)	26.5 ± 6.1	27.3 ± 5.6	22.5 ± 6.6	< 0.01

*SD, standard deviation; IIEF-5, International Index of Erectile Function-5; PEDT, Premature Ejaculation Diagnostic Tool; ED, Erectile dysfunction; IELT, Intravaginal ejaculatory latency time; MSHQ-EjD, Male Sexual Health-Ejaculatory Dysfunction Questionnaire-Ejaculatory Dysfunction; PE, Premature ejaculation.*

**TABLE 2** The Comparisons of the Self-Reported Questionnaires According to the IIEF-5 Score in Total Participants.

Variable (Mean ± SD)	ED (N = 502) IIEF-5 ≤ 21	Normal (N = 390) IIEF-5 > 21	p-value
PEDT total score	8.0 ± 4.0	5.0 ± 4.2	< 0.01
No. PE (%) (≥ 9)	221 (44)	69 (17.7)	—
MSHQ-EjD total	26.3 ± 6.6	26.7 ± 5.3	0.233
IELT (N(%))	—	—	—
< 1 min (PE)	43 (8.6)	28 (7.2)	0.557
1–5 min	212 (42.2)	177 (45.4)	—
> 5 min	247 (49.2)	185 (47.4)	—

*SD, standard deviation; IIEF-5, International Index of Erectile Function-5; PEDT, Premature Ejaculation Diagnostic Tool; ED, Erectile dysfunction; IELT, Intravaginal ejaculatory latency time; MSHQ-EjD, Male Sexual Health-Ejaculatory Dysfunction Questionnaire-Ejaculatory Dysfunction; PE, Premature ejaculation.*

score in group 2, no statistically significant differences were noted (all  $p > 0.05$ ). Table 4 shows the correlation between PEDT score, IELT, MSHQ-EjD score, and IIEF-5 score. In total subjects, from amongst group 1 and 2, the IIEF-5 and PEDT score showed a weak negative correlation ( $r = -0.302$ ,  $r = -0.361$ ,  $r = -0.248$ , all  $p < 0.01$ ). In group 2, the IELT

and MSHQ-EjD scores also showed a weak positive correlation between the IIEF-5 score ( $r = 0.166$ ,  $p = 0.044$  and  $r = 0.164$ ,  $p = 0.047$ , respectively). Briefly, more significant correlations between ED and PE were found in elderly males.

Table 5 shows the results of correlation with same variables in non ED (IIEF-5  $\geq 21$ ) subjects.

**TABLE 3** The Comparisons of the Self-Reported Questionnaires by the IIEF-5 Score According to the Age.

Variable (Mean±SD)	Group 1 (N=744) 40–59 years old		p-value	Group 2 (N=148) 60–79 years old		p-value
	ED (N=411) IIEF-5 ≤ 21	Normal (N=333) IIEF-5 > 21		ED (N=91) IIEF-5 ≤ 21	Normal (N=57) IIEF-5 > 21	
PEDT total score	8.0 ± 4.0	5.0 ± 4.2	< 0.01	8.0 ± 4.3	5.3 ± 4.0	< 0.01
No. PE (%) (≥ 9)	183 (44.5)	60 (18.0)	—	38 (41.8)	9 (15.8)	—
MSHQ-EjD total	27.3 ± 6.0	27.3 ± 5.1	0.968	21.8 ± 7.1	23.6 ± 5.6	0.101
IELT (N (%))	411 (55.2)	333 (44.8)	0.418	91 (61.5)	57 (38.5)	0.226
< 1 min (PE)	28 (6.8)	23 (6.9)	—	15 (16.5)	5 (8.8)	—
1–5 min	171 (41.6)	154 (46.2)	—	41 (45.1)	23 (40.4)	—
> 5 min	212 (51.6)	156 (46.8)	—	35 (38.5)	29 (50.9)	—

SD, standard deviation; IIEF-5, International Index of Erectile Function-5; PEDT, Premature Ejaculation Diagnostic Tool; ED, Erectile dysfunction; IELT, Intravaginal ejaculatory latency time; MSHQ-EjD, Male Sexual Health-Ejaculatory Dysfunction Questionnaire-Ejaculatory Dysfunction; PE, Premature ejaculation.

**TABLE 4** Coefficient of correlation between IIEF-5 score and premature ejaculatory related questionnaires.

	Total (N=892)		Group 1 (N=744) 40–59 years old		Group 2 (N=148) 60–79 years old	
	r	p-value	r	p-value	r	p-value
IIEF-5 total	—	—	—	—	—	—
& PEDT total	−0.342	< 0.01	−0.361	< 0.01	−0.248	< 0.01
& IELT	0.055	0.101	0.024	0.518	0.166	0.044
& MSHQ-EjD total	0.079	0.019	0.038	0.305	0.164	0.047

IIEF-5, International Index of Erectile Function-5; PEDT, Premature Ejaculation Diagnostic Tool; IELT, Intravaginal ejaculatory latency time; MSHQ-EjD, Male Sexual Health-Ejaculatory Dysfunction Questionnaire-Ejaculatory Dysfunction.

For a total of 390 non ED subjects, the IIEF5 score showed a negative correlation between the PEDT score ( $r = -0.287$ ,  $p < 0.01$ ), and a positive correlation between the IELT ( $r = 0.224$ ,  $p < 0.01$ ) and MSHQ-EjD scores ( $r = 0.272$ ,  $p < 0.01$ ). The results of group 1 were similar to total subjects. Meanwhile, in group 2, it showed only a positive correlation with the IIEF5 score and the MSHQ-EjD score ( $r = 0.300$ ,  $p = 0.024$ ).

## DISCUSSION

To our knowledge, this study was the first to examine the relationship between ED and PE using PEDT, self-reported IELT, and MSHQ-EjD.

Lee studied the relationship between ED and PE in 2591 men in their 40s and 50s using IIEF5 and PEDT.<sup>27</sup> The study showed that ED and PE were related to each other ( $r = -0.413$ ,  $p < 0.001$ ).

**TABLE 5** Coefficient of correlation between IIEF-5 and premature ejaculatory related questionnaires in IIEF5 > 21 participants.

	Total (N = 390)		Group 1 (N = 333) 40–59 years old		Group 2 (N = 57) 60–79 years old	
	r	p-value	r	p-value	r	p-value
IIEF-5 total	—	—	—	—	—	—
& PEDT total	-0.287	< 0.01	-0.344	< 0.01	0.040	0.766
& IELT	0.224	< 0.01	0.221	< 0.01	0.253	0.058
& MSHQ-EjD total	0.272	< 0.01	0.251	< 0.01	0.300	0.024

*IIEF-5, International Index of Erectile Function-5; PEDT, Premature Ejaculation Diagnostic Tool; IELT, Intravaginal ejaculatory latency time; MSHQ-EjD, Male Sexual Health-Ejaculatory Dysfunction Questionnaire-Ejaculatory Dysfunction.*

In addition, the severity of ED was associated with a PE positive ratio. There was a significant increase in the PE ratio as the severity of ED increased. Our study also revealed a relation between PE and ED. In other words, there was a negative correlation between IIEF5 and PEDT. However, in this study, the self-reported IELT and MSHQ-EjD values were not correlated with IIEF5 scores in the whole subject group. In addition, there was a difference in the prevalence of PE (32.5%) diagnosed with PEDT and the prevalence of PE (8%) in less than 1 min of self-reported IELT. These results may be related to the PEDT questionnaire. PEDT is a questionnaire designed to diagnose PE based on DSM-IV-TR diagnostic criteria for control, frequency, minimal sexual stimulation, pain, and interpersonal difficulties. There is no study related to whether PEDT reflects the severity of PE or whether PEDT is suitable for diagnosis of life long PE.<sup>28,29</sup>

Laumann et al. conducted a questionnaire survey on the prevalence of sexual dysfunction in 1410 men aged 18–59 years.<sup>24</sup> There was no difference in the prevalence of Climax Too Early diagnosed as PE. However, the results of this study suggest that the diagnostic criteria for PE are self-reported PE. In addition, there is no study on elderly patients over 60 years of age. In this study, we divided the subjects into two groups based on the 60s. In other words, the middle-aged (40–50s) and the elderly

(60–70s) formed the two groups. In the present study, there was no difference in PDET between the two groups; however, there was a significant difference between the self-reported IELT of less than 1 min and MSHQ-EjD in the 60–79 years age group. In addition, when self-reported IELT was diagnosed with less than 1 min of PE, the prevalence rate was high in the 60–79 years age group (13.5%). In the 60–79 years age group, IIEF5 correlated with PEDT, self-reported IELT, and MSHQ-EjD. These results suggest that PE and ED are more related in the older age group. This result is considered to be related to the deterioration of sexual function, such as ejaculatory ability or erectile function according to age. However, the correlation between PE and ED in men without ED was different. For men with normal erection function, it was noted that the higher was the IIEF5 score, the lower was the PEDT score and the higher the IELT and MSHQ-EjD scores. That is, the better the erection function, the better the ejaculation function. The results of this study suggest that even if there is no secondary PE due to ED, there is a correlation between ED and PE. In particular, the same result was found in the middle-aged people (40–59 years). However, the result of the elderly 60–70s group showed only a weak correlation with the IIEF5 score and the MSHQ-EjD score. This is presumed to be the result of weakening of the correlation between erectile function

and ejaculatory function in elderly men with normal erectile function.

In literature, some studies have found age to be a predisposing factor for PE.<sup>26–28</sup> In particular, when ISSM definition is applied, previous studies examined the prevalence of PE in 2081 men with PEDT, self-reported PE, and stopwatch IELT.<sup>27</sup> PE increased with age in all diagnostic criteria. Age and IELT showed a negative correlation (correlation coefficient  $r = -0.166$ ,  $p < 0.001$ ), whereas IIEF-5 score and stopwatch IELT had a positive correlation that more severe ED was associated with shorter IELT (correlation coefficient  $r = 0.111$ ,  $p < 0.001$ ). The results of the present study are in accordance with those of the above study. The correlation between PE and ED is more prominent in the elderly. This is thought to be related to PE due to ED. In other words, if the duration of sexual intercourse is shortened because of ED, it can be explained that PE occurs during intercourse.

The results of PE-related studies differ according to the definition of PE. However, many studies on PE have been conducted before the definition of PE by ISSM. Corona et al. examined the correlation between ED and PE in their meta-analysis.<sup>22</sup> Analysis of 474 subjects in 18 studies showed that the presence of PE was associated with a significant increase in ED risk (OR: 3.68[2.61–5.18];  $P < 0.0001$ ). In this study, PEDT, self-reported IELT, and MSHQ-EjD showed statistically significant correlations with IIEF in the 60–79 years age group.

This study had some limitations. First, the cross-sectional nature of the dataset made causal inferences problematic. Second, we did not investigate the marital status and information of the partner. Third, as this study comprised data from a single institution and was conducted using a single occupational cluster, there may have been a selection bias. In addition, we initially tried to identify the relationship between ED and PE according to four age groups. However, retrospective design made significant discrepancy of subject number in each age groups. So, we finally present the results

according to only two age groups. This weakens the range of our study. To identify both precise relationships and tendency of changing between age and SD, we tried to conduct a prospective multicenter design study in the near future. The last limitation was the survey methodology. Our survey was based on self-reported data by the subjects. Self-reported IELT tends to be more inaccurate than stopwatch-recorded IELT. We also did not measure IELT less than 3 min while measuring the self-reported IELT. This study did not include data on acquired PE. This study divided the self-reported IELT into less than 5 min based on a previous study, where Korean urologists were questioned about IELTS criteria for PE; 80% of the participants defined PE as less than 5 min.<sup>30</sup>

## CONCLUSIONS

More subjects were defined as suffering from PE based on self-reported IELT (<1 min) in the 60–79 years age group as compared to the 40–59 years age group. The lower the IIEF5 total score in the elderly, the higher the PEDT score and the lower the IELT and MSHQ-EjD scores. This suggests that the correlation between PE and ED in the 60s and 70s is owing to PE caused by ED. The effects of ED should be considered in the diagnosis and treatment of patients with PE over 60 years of age. Further, it is necessary to carry out research to support this through prospective multicenter design study.

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## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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