



## Original Article

# The effect of using entertainment and communication devices before sleep on nocturnal enuresis

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**Abstract** **Background:** Monosymptomatic nocturnal enuresis (MNE) is a common urological problem. The association between the use of entertainment and communication devices (EECDs) at night and enuresis in MNE patients has yet to be reported in the literature. This study aims to determine if an association exists between the use of EECDs before sleep and nocturnal enuresis.

**Methods:** Patients with MNE who presented to the pediatric nephrology department of the center between January 30, 2019 and June 30, 2019 were included in the study. A questionnaire was administered both to the patients and to an age- and sex-matched control group to garner details of sleeping features and duration of exposure to EECDs before sleep. A comparison was then made of the answers provided by the patient and control groups.

**Results:** The study included 138 patients (65 females; 73 males) and 104 controls (44 females; 60 males). The patients who used EECDs for more than 3 h a day before sleep suffered more frequently from bedwetting than those who used EECDs for fewer than 3 h a day ( $P = 0.007$ ). The time of exposure to EECDs before sleep in the patient group was longer than in the control group ( $P < 0.001$ ).

**Conclusions:** The use of EECDs for more than 3 hours before sleep is associated with bedwetting and enuresis frequency in patients with MNE. Patients suffering from MNE should be advised not to use EECDs before sleep.

**Key words** arousal, bedwetting, enuresis, nocturnal, sleep.

Nocturnal enuresis is one of the most common urological problems worldwide. Primary monosymptomatic nocturnal enuresis (MNE) has a high rate of spontaneous resolution, with prevalence decreasing from 16% at that age of 5 years, to 5% at age 10 years, and to 1–2% at age  $\geq 15$  years.<sup>1,2</sup> Despite the high spontaneous resolution rate, the disease can have a devastating effect on children and families.<sup>3</sup> There are a number of etiological factors that can play a role in MNE, including genetic predisposition, sleep arousal dysfunction, altered diurnal antidiuretic hormone secretion, decreased bladder storage capacity, and maturational delay.<sup>4,5</sup> Nocturnal enuresis is also closely related to such lifestyle habits as fluid intake, meal content, and urination before sleep.<sup>6</sup> The therapeutic approach to the underlying reason is important.

The use of entertainment and communication devices (EECDs), including televisions, computers, tablets, video games, and mobile phones, is increasing among children. They can lead to impairment in sleep quality and sleep efficiency when used before sleep.<sup>6</sup> It has been demonstrated that the sleep quality of nocturnal enuretic children is poor,<sup>7,8</sup> and so the use of EECDs before sleep could contribute to the

progress of nocturnal enuresis by impairing sleep quality. Moreover, using EECDs for long periods before sleep can lead to delayed bedtime, increased fluid intake, and neglecting to urinate before going to bed. As a result, the frequency of nocturnal enuresis may increase.

This study aims to identify any association between the use of EECDs before sleep and nocturnal enuresis.

## Methods

Patients with MNE who presented to the Mersin City Education and Research Hospital Pediatric Nephrology Department between January 30, 2019, and June 30, 2019 were included in the study. The Mersin University Ethics Committee approved the study (2019/239). Monosymptomatic nocturnal enuresis was defined as enuresis in children who have never achieved night-time dryness and that had any lower urinary tract symptoms without a history of bladder dysfunction.<sup>9</sup> Patients with secondary nocturnal enuresis, those on medication, those with daytime symptoms, and those with a systemic disease (diabetes mellitus) were excluded from the study. A questionnaire compiled from other published studies was administered to the parents of the patients.<sup>10</sup> This garnered data on the parents' education status, family history of enuresis, frequency of enuresis in a week, sleep duration (calculated by subtracting the child's bedtime and time required to fall

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asleep from wakeup time), time to fall asleep, presence of snoring, waking up during the night after falling asleep, waking up feeling unrefreshed, presence of EECDS (televisions, computers, tablets, video games, and mobile phones) in the bedroom, frequency of exposure to EECDS in a week, and duration of exposure to EECDS before sleep. The same questionnaire, aside from the questions about enuresis, was applied to sex- and age-matched healthy subjects with no MNE or systemic disease. The patients and controls were asked how often they felt like they had not slept when they woke up and evaluated their morning freshness, with the optional answers being never, rarely, and frequently. Time to fall asleep was determined by asking the parents about the time required to fall asleep after going bed, with the answer options being <1 h and  $\geq 1$  h.<sup>6</sup> The duration of the use of EECDS before sleep was categorized as <3 h and  $\geq 3$  h. Because it was demonstrated that using self-luminous Apple iPad for two hours could decrease melatonin production leading to sleep quality impairment,<sup>11</sup> Sleep quality impairment<sup>7,8</sup> and lower peak melatonin levels<sup>12</sup> were identified in MNE patients compared to dry children. We believe that using EECDS for more than 2h before sleep can lead to significantly impaired sleep quality and efficiency, and that this condition could contribute to an increase in the frequency of enuresis. The association between frequency of enuresis in a week and the parents' education status, family history of enuresis, sleep duration, time to fall asleep, presence of snoring, waking up during the night after falling asleep, waking up feeling unrefreshed, presence of EECDS in the bedroom, frequency of exposure to EECDS in a week, and the duration of exposure to EECDS before sleep was evaluated. The same parameters were compared between the patient and control groups.

Descriptive statistics were presented as means and standard deviations, and the dependency between categorical variables was tested using a Pearson's chi-squared test. A *P* value of <0.05 was considered to be statistically significant.

## Results

The study included 138 patients (65 females; 73 males) with MNE and 104 controls (44 females; 60 males). The mean ages in the patient and control groups were  $9.5 \pm 2.7$  (5.5–17) and  $9.5 \pm 2.8$  (5.5–17), respectively. A family history of enuresis was present in 87 patients (63%), and 95 patients (68.8%) suffered from enuresis more than five times a week.

The association between frequency of enuresis and parents' education, enuresis history in the family, sleeping features, and snoring in the patient group is shown in Table 1. No significant differences were observed between frequency of enuresis and gender, parents' education status, enuresis history in the family, sleep duration at night, time to fall asleep, snoring, waking up in the night after falling asleep, waking up feeling unrefreshed, and the presence of EECDS in the bedroom. In the patient group, the patients who used EECDS more than five times a week suffered from bedwetting more frequently than patients who used EECDS fewer than five

times a week ( $P < 0.001$ ) (Table 2). The patients who used EECDS for more than 3 h a day before sleep suffered from bedwetting more frequently than the patients who used EECDS for fewer than 3 h before sleep ( $P = 0.008$ ).

The differences between patient and control groups in terms of the education status of parents, sleeping features, and snoring are shown in Table 3. The sleeping time of enuretic children was shorter than the controls ( $P < 0.001$ ). None of the patients woke up frequently in the night after falling asleep. Waking up in the night and waking feeling unrefreshed was seen more frequently in the control group than in the patient group ( $P = 0.001, 0.010$ ). The duration of exposure to EECDS before sleep in the patient group was longer than that of the control group ( $P < 0.001$ ) (Table 4). No significant differences were observed between the patients and controls in terms of parents' education, sleeping time, snoring, time to fall asleep, and the presence of EECDS in the bedroom.

## Discussion

This study has shown that exposure to EECDS for more than 3 h before sleep can lead to an increased enuresis frequency in

**Table 1** The association between frequency of enuresis and parents' education, enuresis history in the family, sleeping features, and snoring in the patient group

Variables	Frequency of enuresis				<i>P</i>	
	1–4 times a week	%	$\geq 5$ times a week	%		
Gender	Female	20	46.5	45	47.4	0.926
	Male	23	53.5	50	52.6	
Mother's education	Primary school*	30	69.8	80	84.2	0.084
	Secondary school-university**	13	30.2	15	15.8	
Father's education	Primary school	25	58.1	65	68.4	0.326
	Secondary school-university	18	41.9	30	31.6	
Enuresis history in the family	Yes	26	60.5	61	64.2	0.817
	No	17	39.5	34	35.8	
Sleep duration at night	<9 h a day	14	32.6	19	20	0.166
	$\geq 9$ hours a day	29	67.4	76	80	
Time to fall asleep	<1 h	42	97.7	91	95.8	1.000
	$\geq 1$ h	1	2.3	4	4.2	
Snoring	Yes	6	14.0	18	18.9	0.635
	No	37	86.0	77	81.1	
Wake up feeling unrefreshed	Never or rarely	42	97.7	91	95.8	1.000
	Frequently	1	2.3	4	4.2	

\*Graduated from primary school (school for children between five and 11 years old).

\*\*Graduated from secondary school (school for children between the ages of 11 and 18) and university.

**Table 2** The association between enuresis frequency and exposure to EECDs in the patient group

Variables		Frequency of enuresis				P
		1–4 times a week	%	≥5 times a week	%	
Presence of EECD in the bedroom	Yes	23	53.5	41	43.2	0.346
	No	20	46.5	54	56.8	
Frequency of exposure to devices	< 5 times a week	12	27.9	5	5.3	<b>&lt;0.001</b>
	≥ 5 times a week	31	72.1	90	94.7	
Exposure to devices before sleep	< 3 hours a day	23	53.5	27	28.4	<b>&lt;0.008</b>
	≥ 3 hours a day	20	46.5	68	71.6	

**Table 3** The differences between patient and control groups in terms of the education status of parents, sleeping features, and snoring

Variables		Patients (n = 138)		Control (n = 104)		P
		n	%	n	%	
Gender	Female	65	47.1	44	42.3	0.458
	Male	73	52.9	60	57.7	
Mother's education	Primary school*	110	79.7	82	78.8	0.997
	Secondary school-	28	20.3	22	21.2	
	university**					
Father education	Primary school	90	65.2	71	68.3	0.618
	Secondary school-	48	34.8	33	31.7	
Sleep duration at night	< 9 hours	33	23.9	6	5.8	<b>&lt;0.001</b>
	≥ 9 hours	105	76.1	98	94.2	
Time to fall asleep	< 1 hour	133	96.4	96	92.3	0.271
	≥ 1 hour	5	3.6	8	7.7	
Snoring	Yes	24	17.4	12	11.5	0.278
	No	114	82.6	92	88.5	
Waking up at night	Never or rarely	138	100	94	90.4	<b>&lt;0.001</b>
	Frequently	0	0	10	9.6	
Wake up feeling unrefreshed	Never or rarely	133	96.4	90	86.5	<b>0.010</b>
	Frequently	5	3.6	14	13.5	

\*Graduated from primary school (school for children between five and 11 years old).

\*\*Graduated from secondary school (school for children between the ages of 11 and 18) and university.

**Table 4** The differences between patient and control groups in terms of exposure to EECDs

Variables		Patients (n = 138)		Control (n = 104)		P
		n	%	n	%	
Presence of EECD in the bedroom	Yes	64	46.4	46	44.2	0.740
	No	74	53.6	58	55.8	
Frequency of exposure to devices	< 5 times a week	17	12.3	18	17.3	0.364
	≥ 5 times a week	121	87.7	86	82.7	
Exposure to devices before sleep	< 3 hours a day	50	36.2	72	69.2	<b>&lt;0.001</b>
	≥ 3 hours a day	88	63.8	32	30.8	

patients with MNE, and may contribute to the progress of enuresis in children. To the best of our knowledge, the association between the use of EECDs at night and enuresis in MNE patients has yet to be reported in the literature. Since the enuretic children's health-related quality of life is poor and depression is high for both children and their families,<sup>3,13</sup> it is important to identify the reasons for the progression of enuresis. Advising enuretic children and their families to decrease their exposure to EECDs before sleep could contribute to a reduction in enuresis frequency.

It was found that children who used EECDs before sleep experienced shorter sleep duration,<sup>14</sup> poorer sleep quality,<sup>15</sup> and lower sleep efficiency.<sup>16</sup> The mechanism behind the impairment of sleep quality might be related to bright light emitted by many devices.<sup>17</sup> The blue light-rich diodes that are used as a backlight in many EECDs suppress the melatonin hormone, thus delaying sleep onset, shortening sleep duration, and lowering sleep quality.<sup>18,19</sup> It has been shown that exposure to the light emitted by self-luminous Apple iPad tablets for 1 h did not decrease melatonin production but when the time of exposure was increased to 2 h, melatonin production was decreased, delaying sleep onset.<sup>11</sup> In the present study, sleep duration in enuretic children was found to be shorter than in the control group, which could be attributed to higher exposure to EECDs in enuretic children when compared to the control group.

Although the sleep of nocturnal enuretic children may be polysomnographically normal, it has been reported that such children are deep sleepers.<sup>20</sup> The parents of children with nocturnal enuresis often complain that the depth of their child's sleep prevented them from waking up to go to the toilet.<sup>21–23</sup> This can be attributed to a disruption of the autonomic nervous system and pontine reticular activating system in patients with MNE, which under normal circumstances triggers to wake the child when the bladder is full.<sup>20</sup> In the present study none of the patients reported waking up in the night after falling asleep, or only rarely, which is consistent with the literature.

In one study, daytime sleepiness was observed more in children with nocturnal enuresis.<sup>24</sup> This could be related to the

parents of the children often waking the children during the night to cope with enuresis.<sup>25</sup> In the present study, although sleeping time was shorter in the patient group when compared with the control group, the patients never, or only rarely, woke feeling unrefreshed. This finding could be related to the deep sleep of children with MNE.

Although this study demonstrates that using EECDs for long periods before sleep is associated with bedwetting and enuresis frequency, it does not mean that using these devices are etiological factors for nocturnal enuresis. Using these devices before sleep can lead to a decrease in melatonin production, causing impaired sleep quality and shortened sleep duration, as is the case in MNE patients.<sup>6</sup> Melatonin treatment through desmopressin and diet was to be found to be a safe and effective treatment method for nocturnal enuresis.<sup>26</sup> Children who use these devices for long periods before sleep may delay going to bed, may neglect to urinate, and may increase their fluid intake, leading possibly to an increase in enuresis frequency.

The limitations of the study include its small sample size and its single-center design. A larger multicentric sample would provide more detailed information about the association between nocturnal enuresis and the use of EECDs before sleep.

In conclusion, the use of EECDs for more than 3 hours before sleep can be linked to bedwetting and enuresis frequency in patients with MNE. Avoiding the use of EECDs before sleep should be recommended to both children with MNE and their families.

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