

Cengiz YAKINCI<sup>1</sup>  
Hamdi ER<sup>2</sup>  
Bülent MÜNGEN<sup>3</sup>  
Yaşar DURMAZ<sup>1</sup>  
Hamza KARABİBER<sup>1</sup>

## Pupil Cycle Time in Children With Nocturnal Enuresis

Departments of <sup>1</sup>Pediatrics, <sup>2</sup>Ophthalmology,  
Inönü University Medical School,  
Malatya-Turkey  
<sup>3</sup>Department of Neurology, Firat University  
Medical School, Elazığ-Turkey

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Enuresis is the occurrence of involuntary voiding at an age when volitional control of micturition is expected. Nocturnal Enuresis (NE) without overt daytime voiding symptoms affects up to 20% of children at the age of five. With a spontaneous resolution rate of about 15 per cent per year, 99 per cent of children have got over it by the age of 15. The precise cause of NE is not known. There have been various theories such as developmental delay, genetic factors, stress and psychological factors, and sleep abnormalities, as well as organic urinary tract disease (1,2). Urodynamic studies have confirmed the presence of bladder hyperactivity in a number of enuretics (1,3-7). The cause of bladder hyperactivity is not clear. Our previous study was about autonomic nervous system (ANS) function in NE and ANS dysfunction was determined in enuretic children. We suggested that ANS dysfunction might be the cause of bladder hyperactivity in NE (8). In this study we planned to investigate ocular ANS function in enuretic children. Pupil cycle time (PCT) is an objective criterion in determining ocular ANS function (9). For this reason, we used PCT to investigate ocular ANS function in children with NE.

The study group (SG) consisted of 28 children randomly selected (13 girls and 15 boys; aged between 7-14 years, mean age  $9.2 \pm 1.6$  years) with NE (no concomitant disease) There were 25 healthy children (13 girls and 12 boys; aged between 7-14 years; mean age:  $10.0 \pm 1.9$  years) in the control group (CG). On every child in each group; a detailed history was obtained, and physical and eye examination, urinary analysis, urinary culture and urosonography were carried out. All tests were within the normal limits in both SG and CG. No

child was receiving treatment for enuresis at the time of testing. After explaining the procedure to the parents, PCT the right and left eyes were measured in both groups. PCT measurements were made according to the method defined by Miller SD and Thomson HS (10). Student's t-test and Mann-Whitney U test were used for the statistical analysis.

The mean PCTs of SG were  $786.0 \pm 172.8$  msec. (range 528-1164 msec.) and  $813.8 \pm 163.8$  msec. (range 504-1128 msec.) in the right and left eyes, respectively. The difference between the right and left eyes of SG were not significant ( $p=0.4592$ ). The mean PCTs of CG were  $628.8 \pm 126.7$  msec. (range 432-888 msec.) in the right eyes and  $580.8 \pm 113.2$  msec. (range 432-912 msec.) in left eyes. No significant difference was obtained between both eyes of CG ( $p=0.1096$ ).

On the other hand, the mean PCTs were  $799.9 \pm 167.4$  msec. (range 504-1164 msec.) and  $604.8 \pm 121.4$  msec. (range 432-912 msec.) in 56 eyes of SG and 50 eyes of CG, respectively. The mean PCT of SG was significantly different (longer) from the mean PCT of CG ( $p<0.0005$ ).

PCT evaluates especially the parasympathetic efferent section of the pupillary reflex arc (9). PCT of children with enuresis was found to be significantly longer than CG ( $p<0.0005$ ). These results demonstrate ocular parasympathetic nervous system dysfunction characterized by hypoactivity in children with enuresis. Recently, we had studied ANS functions by using the 'Orthostatic test, Valsalva ratio, 30/15 ratio and Heart rate responses to deep breathing' in enuretic children. Parasympathetic hyperactivity was determined and we suggested that bladder hyperactivity might be related to

this abnormality (8). These two findings (parasympathetic hyperactivity detected in our previous study and ocular parasympathetic hypoactivity in this study) seem to be controversial but actually these results showed parasympathetic dysfunction, supporting both findings. For this reason, our suggestion of ANS dysfunction in enuretics is reinforced by these two

studies. We could not find any similar study in the literature. Further studies will shed light on this subject. Measurement of PCT is a noninvasive, simple, confident and objective method for evaluating ocular ANS, especially the efferent parasympathetic section of the pupilla reflex arc (9).

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