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ORIGINAL ARTICLE

Oculomotricity in childhood: is the normal range the same as in adults?

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Summary

The study of oculomotricity is done by the evaluation of three systems: saccade eye movements (MOS), optokinetic nystagmus (NO) and smooth pursuit eye movement (MORL). The joint action of these three systems allows the visual field's establishment in different movement situations. **Aim**: To compare the value of oculomotricity in normal adults and children to confirm, or not if it is viable to use the same parameters of adults normality to children's exams interpretation. **Study design:** clinical with transversal cohort. **Material and Method:** We studied MOS, NO and MORL in 50 normal children and in 35 adults and the results were compared by the t Student test. **Results**: The data analysis showed significant difference between children and adults (significance at level ± = 0.05) **Discussion**: In the literature we have found evidence that myelinization of the vestibular pathways happen at about 16 weeks and the pyramidal tracts, at 24 months. Oculomotricity is finished at this time. Other papers describe the importance of these tests in the diagnostic of neurological diseases, visual alterations and as predictors of the risk of schizophrenia development but they do not report the normal range in children. In our study we found increased latency of MOS, increase in gain of NO, reduction in gain and increase in the distortion of MORL in children if compared to adults, which is in accordance with the literature. These alterations can be explained by the low attention during the tests and the immaturity of ocular movements' control in children. **Conclusion**: Therefore, the establishment of a parameter of normality to the oculomotricity in childhood is necessary for the correct analysis of the oculography to avoid misinterpretation of the exam.

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INTRODUCTION

The look is resultant from head and ocular movements directed to centralizing the image of an object over the fovea. Phasic and tonic movements of the head search for the visual target and stabilize the image over the fovea.

The study of oculomotricity is defined through the assessment of three movements: saccadic eye movement (MOS), optokinetic nystagmus (NO) and smooth pursuit eye movement (MORL). The joint action of these three systems enables stabilization of the visual field in different situations of movement to which the subjects are submitted.

The term saccadic is defined as quick eye movement of high speed in hundreds of degrees/seconds and its purpose is to position the image of a visual field over the fovea [1,2]. There is still some controversy about the neural mechanisms involved in the execution of MOS, but recent studies indicated that the generator of horizontal movement is at the medullar point of the reticular formation, close to the abducens nucleus, whereas the generator of vertical movement is in the medium rostral reticular formation for the oculomotor nuclei [3,4].

The movement of a visual scene through the visual field evokes involuntary and conjugated ocular movement, named optokinetic nystagmus. The optokinetic system operates with visual signals of the whole retina, not over the fovea [1]. Such system is closely related with the vestibular system, given that the real objective of the optokinetic system does not follow the movement of the visual scene whereas the observer remains stationary, but rather, supports the vestibular system during the movement of rotation, producing ocular movements that are appropriate to maintaining the image on the retina [1]. Both systems share the same objective to try to maintain the same speed in both eyes and against the speed of the head. This objective is achieved by the modification of the oculomotor response induced by vestibular-ocular reflexes and by optokinetic nystagmus, continuously and according to the speed of the visual and head fields [2].Smooth pursuit eye movement is the mechanism, of oculomotor control that moves the eyes to stabilize the target image on the retina. Neural pathways involved in this movement go through the occipital cortex, temporal cortex, parietal cortex, corpus callosum, pons, bulb and cerebellum [5].

The study of oculomotricity is important in the assessment of patients with dizziness, given that body balance is maintained by the interaction of the three systems: visual, labyrinth and proprioceptive. MOS, NO and MORL analysis is widely used to investigate the visual system and its contribution to the maintenance of balance. The study, therefore, is based on the otoneurological assessment of both adults and children.

As to adults, there are normal range values well determined in the literature for each test [6]. Thus, for saccadic eye movement, normal latency is between 180-250mseg and precision over 80%. For optokinetic nystagmus, gain in speed of 30º/sec is of about 0.740,17 and for speed of 60º/sec it is about 0.890.12. The normal range for gain in pendular tracking of 0.95º and degree of distortion is up to 10%. However, concerning children, there are studies commenting about the affections to oculomotricity as a result of growing [7-10], and others show that oculomotricity may help in diagnosing abnormalities [11, 12] and diseases [13-15], but there are no reference test values to be used as baseline.

We know that there is influence of age on visual mechanisms of balance control [16], such as for example, reduction in gain of optokinetic nystagmus in speed over 60º /sec in elderly subjects [6]. For this reason, the values of normal range in adults may be used to interpret exams in children.

OBJECTIVE

Given that we did not find any studies correlating normal results in adults and children, the present study intended to investigate saccadic eye pursuit movement, optokinetic nystagmus and smooth pursuit eye movements in normal children through measurements obtained with oculography and to compare the results with value found in normal adults (control group) and to confirm or not the feasibility of using the same normal range parameters in adults to interpret tests in children.

MATERIAL AND METHOD

We selected 50 children aged 5 to 10 years and 35 adults aged 22 to 50 years who had normal clinical history and physical examination, without data that suggested ocular pattern abnormalities.

The inclusion criteria were:

- Visual acuity and collaboration compatible with the requirements of the exam;
- Absence of dizziness complaints or signs or symptoms that could indicate abnormal vestibular function;
- Absence of history of neurological disease;
- Absence of extrinsic ocular motricity deficit or other abnormal ocular movements.

To perform the vestibular test we used a Belgium program ENG 290 MUMEDIA of computed vestibulometry, installed in a 386 PC, given that it is slow and could better show the tracing, with direct connection with a high-definition 20" TV monitor. The program enabled the examiner to control the presentation of stimulus in all tests and to make