

A simple and effective method for measuring brain asymmetry in children with autism

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For the last two decades a number of publications have shown that the pattern of brain asymmetry in people with mental handicap, including autism, depression and schizophrenia, differs from that of normal subjects [1]. Results of the studies are in accordance with the Crow theory that supposed the causes of mental disorders to be disorders of the mechanisms responsible for the development of lateral asymmetries [2]. It has been confirmed that lateralized training of brain hemispheres can influence behavioural and sensory asymmetries and stimulate one of the hemispheres selectively [3]. These facts strengthen importance to investigate asymmetries in people with mental handicap. It can broaden our understanding of the underlying mechanisms of mental disorders in order to develop better diagnostic and therapeutic methods. Therefore it seems necessary to develop technological instruments fulfilling the following requirements: relative simplicity of use, high effectiveness, interest and motivation for the subjects, ability to scale the effect, ability to record the reactions of the patients.

A device for measuring signal transfer within and between hemispheres, so called Sensopress, has been developed at the Centre for Neuropsychological Research at the University of Trier, Germany [4]. It contains two identical panels allowing both, tactile stimulation and motor response with buttons for the fingers of each hand. The buttons have two functions. They can exert a slight tactile stimulation to a finger, and they can be pressed down by the finger to provide a motor response to the tactile stimulation allowing measuring the response time. This device is controlled by a computer. Among the methods implemented in the software the following were used for the purposes of the present experiment:

Finger tapping test. The subject is asked to repeatedly press a button on the panel as quickly as possible by the index finger of one hand for 10 sec. After a break of 5 sec. the same procedure is performed by the index finger of the other hand. This procedure is repeated 12 times. The device records the mean number of finger taps for each hand as a measure for manual motor speed, and the average time for one finger print is calculated.

Unilateral processing of tactile stimulation. The subject is asked to concentrate attention on the fingers and keep them on the buttons. As soon as a slight tactile stimulation is applied to a finger the subject must respond by pressing the button with the same finger. In this case the tactile stimulation and response are performed on the same side, and this allows measuring the rate of tactile processing within one hemisphere. The response time for the left-sided condition (L/L) indicates the rate of right hemispheric processing whereas response time for the right-sided condition (R/R) indicates the rate of left hemispheric processing.

Bilateral processing of tactile stimulation. As soon as the subject detects tactile stimulation of a finger of one hand he must respond with the same finger of the other hand (R/L and

L/R). In this case the tactile stimulation is performed on one side whereas response is performed on the other side, and it means that the stimulus transfers from one brain hemisphere to the other. This procedure allows measuring the rate of interhemisphere transfer by calculating the difference in response time between the bilateral condition and unilateral condition mentioned above.

The experiments were performed on 28 boys with autism spectrum disorders (age: 13.90 ± 0.58 years) and 20 normal boys (age: 12.56 ± 0.65). Only index fingers of both hands were used in these experiments. The experimental procedure started with finger tapping followed by the procedures with unilateral and bilateral processing of tactile stimulation.

Both autistic and normal children responded positively to the test procedure and liked to participate in the experiments. They accepted it as a kind of game.

The results of the finger tapping test have shown that manual motor speed of both right and left index finger did not differ in autistic children compared to the controls, but they differed significantly in the response time to tactile stimulation. Thus L/L time was shorter than R/R in 86.2% of the autistic boys and 33.3% controls ($p < 0.01$). The difference L/L – R/R was significant in the autistic subjects, (-25.8 msec. and $+5.40$ msec. in the children with autism and normal subjects correspondingly, $p < 0.05$). R/R time in autistic children was longer than R/R in the controls (299.41 ± 36.50 msec. compared to 205.16 ± 24.36 msec. correspondingly, $p < 0.05$).

The results indicate that the left hemisphere processing was slower than that of the right hemisphere in autistic children. Their brains were more asymmetrical, and the left hemisphere conducted the signals slower compared to the normal subjects. It corroborates with the results in the literature and conceptions of other authors [5].

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