

Introduction

DEM test is a clinical and screening test used to evaluate the ocular motility skill and naming in developmental age using a visuo – verbal format. Different from other visuo - verbal saccade test the DEM test was designed to attempt to control for the automaticity factor (Garzia et al., 1990).

In the manual was specified the absence of horizontal movement in the vertical subtest of DEM (Richman, 2009) and this condition was taken as naming baseline. This condition is not a pure naming condition because there are 76 little vertical movements and two large diagonal movements. On the other hand the test can be viewed as a comparison between small vertical ocular movements in the first part and large horizontal ocular movements in second part.

Hypothesis

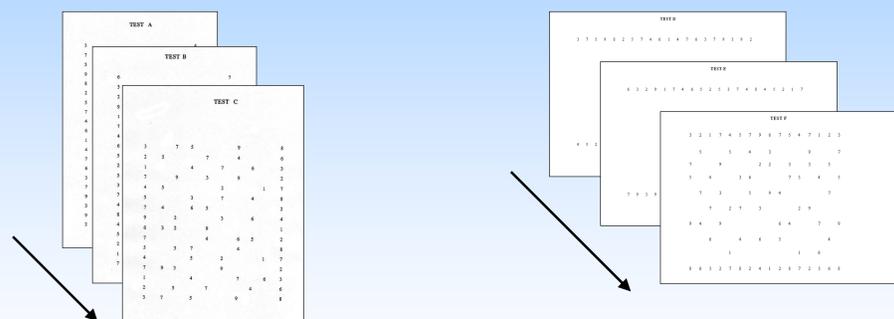
The purpose of this study is to assess if the horizontal naming was faster than vertical and more generally if there are difference, in evaluation of ocular movement, between the different directions of ocular movement: only horizontal, only vertical, or vertical and horizontal such in DEM test.

Subjects

157 children from 6 to 14 years old participated to the study with no history of neurological disorder, refractive correct and without binocular anomalies. The data was acquired during a school screening program

Materials and methods

The standard cards of DEM (A, B, C) were used, together with a modified version in which all characteristics of the test were the same but the direction was rotated by 90°. This other new cards presents a horizontal short condition, like A and B, but horizontally, called D and E. The other new card is with a vertical large - spaced condition, like C card but vertically, called F. All horizontal and vertical cards present the same psychophysical properties. The only difference is direction.



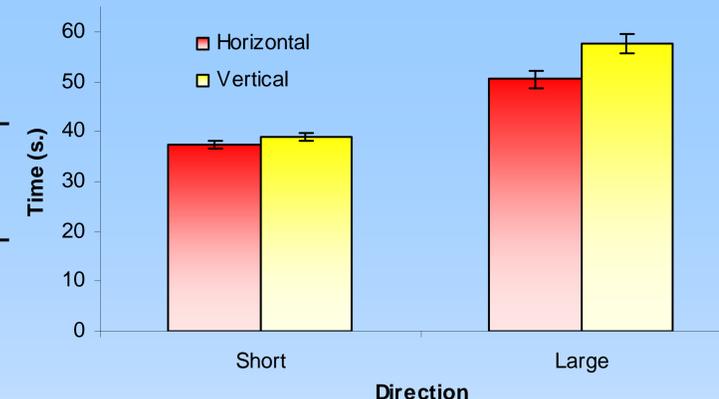
These two blocks of conditions were presented counterbalanced at the subjects: ABC – DEF and DEF – ABC. One series of 3 card was presented in the initial part of visual screening and the second series in the final part of screening.

Results

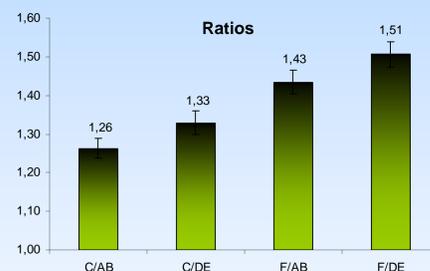
To evaluate at better the all condition an MANOVA was performed with 1 between factor (sequence of presentation with 2 level) and 2 within factors (direction with 2 level and spacing with 2 level).

The results show no difference for sequence of presentation, a significant difference for direction ($F_{(1,155)}=49.27$ $p<0.0001$), spacing ($F_{(1,155)}=154.59$ $p<0.0001$) e their interaction ($F_{(1,155)}=18.86$ $p<0.0001$). A t-test show significant difference between all condition (all <0.0001).

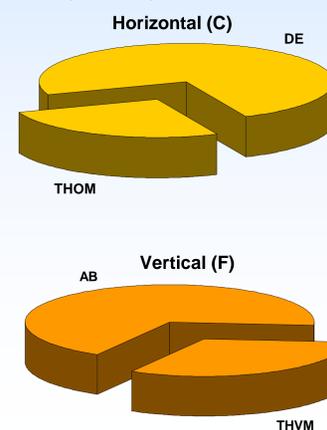
Subtest	Results
AB	39.08 (9.47) sec.
C	50.53 (22.29) sec.
DE	37.39 (9.75) sec.
F	57.50 (25.10) sec.



The DE time was significantly shorter than AB time. Also the F time was significantly longer than C time. This results confirm the role of ocular movement in naming time: naming number horizontally is faster than vertical.

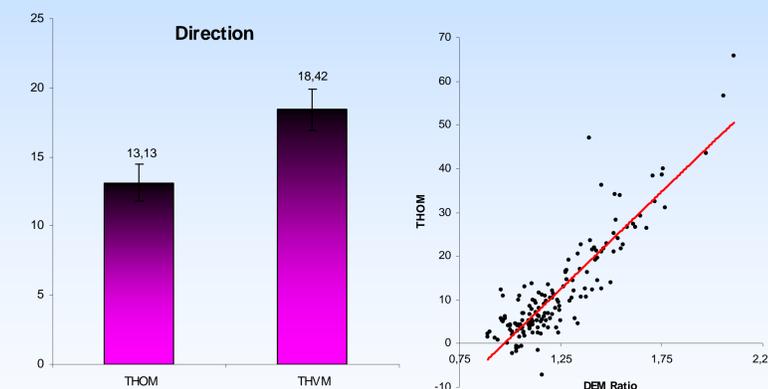


Using the same direction of ocular movement, a subtractive method permits at better to evaluate the Time spent to execute the Horizontal Ocular Movements (THOM) and Time for Vertical Ocular Movement (TVOM).



To test the difference between ratio, an ANOVA was performed. Results are significant ($F_{(3,468)}=41,576$ $p<0.001$). A direct comparison between single ratio show the difference between all condition (all <0.0001).

The comparison between the same direction permits to obtain a more uniform results than the two directions are mixed.



A comparison between THOM and THVM show a significant difference ($t(156)=4,25$ $p<0.0001$) and the correlation between the two direction is medium ($r=0,61$ $p<0.0001$). Finally, if we compare THOM and classical DEM evaluation, with a partial correlation, corrected for age, we found a very high correlation ($r=0.93$ $p<0.0001$).

Procedure

At subjects was required to read as fast as possible the numbers. The time spent to read each table was recorded. The time was recorded with a chronograph using a two decimal digits. Different from manual, to obtain better precision, all times was corrected for errors of addition and omission using the formula reported in DEM manual. The time for naming card A and B were summed. Also the D and E. The final number of condition was 4 subdivided by direction (horizontal and vertical) and spacing (short and large): AB, C, DE, F

References

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 RICHMAN, J. E. (2009) Developmental Eye Movement Test, Examiner's manual, version 2.0, South Bend, IN, Bernell Corp.
 RICHMAN, J. E. & GARZIA, R. P. (1987) Developmental Eye Movement Test, Examiners booklet, version 1, South Bend, IN, Bernell Corp.

Conclusion

Globally the horizontal eye movements are faster than vertical. The two conditions used in DEM test are called "naming" and "reading like condition". Based on our results the two conditions differ for spacing and direction, so the proper name was "short vertical" and "large horizontal" conditions because the time spent for the two directions and two spacing was always different. Superior face validity and better results are predicted if the test is performed by using the same direction and subtractive method. Compared to this more precise evaluation, DEM remains a valid test because it shows a precise normative data for a specific condition, so the psychometrics properties for a clinical and a screening use are maintained.

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