Eye gaze in individuals with and without convergence insufficiency

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Introduction

- Repeated requests from the visual system tends to create problems in susceptible individuals. An inefficient vision can lead to a lesser capability of accomplishing some tasks correctly or have these same tasks performed with an added effort. One of the most common situations where this occurs is the <u>convergence insufficiency</u>.

Introduction

- The convergence insufficiency is one of the main causes of ocular discomfort. In fact, it's the most common cause of muscular asthenopia, being therefore of a great clinic relevance (Von Noorden, 1996).

Introduction

- **Convergence insufficiency**

  - ◆ Incidence

  - ◆ Symptoms

  - ◆ Diagnosis

  - ◆ Impact

Introduction

- **Convergence insufficiency**

  - **Incidence**

  - Symptoms

  - Diagnosis

  - Impact

  Several authors present quite different incidence values that range between 1,75% a 25% (Cooper & Duckman, 1978).

Introduction

- **Convergence insufficiency**

  - ◆ Incidence

  - ◆ **Symptoms**

  - ◆ Diagnosis

  - ◆ Impact

Blurry vision, diplopia, ocular discomfort during or immediately after near vision work, frontal headaches, nausea, dizziness, loss of concentration, heaviness feeling over the eyelids, fatigue in general and a feeling that the eyes are being "pushed outwards" (Ciuffreda, 2002).

Introduction

- **Convergence insufficiency**

  - ◆ Incidence

  - ◆ Symptoms

  - ◆ **Diagnosis**

  - ◆ Impact

The diagnosis of convergence insufficiency is based on a remote NPC and a reduced near convergence amplitudes (Hugonnier & Hugonnier, 1981; Von Noorden, 1996).

Introduction

- **Convergence insufficiency**

  - ◆ Incidence

  - ◆ Symptoms

  - ◆ Diagnosis

  - ◆ **Impact**

This type of situation have an impact in the quality of life, with particular incidence in the scholastic and professional performances (Ciuffreda, 2002). Not knowing exactly what level of impact (Scheiman et al., 2002, 2005).

Introduction

- The ocular movements' measurement in individuals with convergence insufficiency can provide a useful information for the establishment of more efficient criteria in the diagnose of convergence insufficiency (van Leeuwen, Westen, van der Steen, de Faber & Collewijn, 1999).

Objective

- Characterization of the eye gaze, through the analysis of eye movements during fixation and pursuit of a target in young adults with convergence insufficiency and young adults with normal binocular vision.

In the horizontal from left-right in the vertical from up-down, for the most used direction, in the horizontal from right-left and in the vertical from down-up for the less used direction.
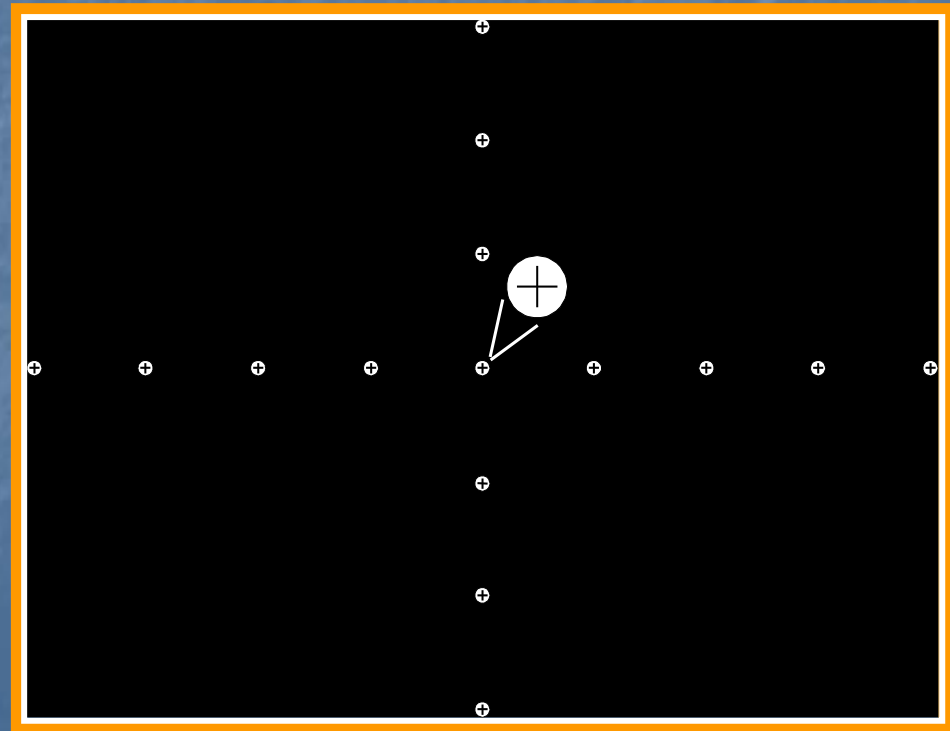
Methodology
Instruments

- Eye tracking system, model ASL 504
- The stimulus, a white circle with a black cross in the interior, was presented on a computer monitor.

Methodology
Instruments

- The target was displayed on a black background and presented at a distance of 50cm horizontally and vertically. From left to right (L-R), from right to left (R-L), from up (D-U) and up down (U-D).

Methodology
Variables

- Number of fixations

- Duration of the fixations (in seconds)

- Inter-fixation amplitudes (in visual angle degrees)

- Number of inversions

Results

Subjects

	n	%	Age		
			Mean	**SD**	**Range**
NBV Group					
Men	4	15,4%	21,8	1,0	18 - 23
Women	22	84,6%	20,2	1,4	18 - 23
CI Group					
Men	3	11,5%	18,7	0,6	18 - 19
Women	23	88,5%	20,2	1,5	18 - 23
Total	52	100%	20,2	1,5	18 - 23

Results

Comparative Study

	Number of fixations			
Segment	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig.(2-tailed)
L-R	175,000	526,000	-3,023	**0,003**
R-L	147,500	498,500	-3,520	**0,000**
U-D	170,000	521,000	-3,124	**0,002**
D-U	227,500	578,500	-2,046	**0,041**

Results

Comparative Study

Duration of the fixations

Segment	t-test for Equality of Means				
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
L-R	2,757	50	**0,008**	0,090653	0,032886
R-L	4,235	50	**0,000**	0,128542	0,030354
U-D	2,961	50	**0,005**	0,095622	0,032289

Segment	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig.(2-tailed)
D-U	231,000	582,000	-1,958	**0,050**

Results

Comparative Study

Inter-fixation amplitudes

Segment	t-test for Equality of Means				
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
U-D	3,110	50	**0,003**	0,439473	0,141300

Segment	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig.(2-tailed)
L-R	192,000	543,000	-2,672	**0,008**
R-L	282,000	633,000	-1,025	**0,305**
D-U	240,000	591,000	-1,794	**0,073**

Results

Comparative Study

Number of inversions

Segment	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig.(2-tailed)
L-R	295,000	646,000	-0,951	0,341
R-L	237,000	588,000	-2,054	0,040
U-D	298,500	649,500	-0,769	0,442
D-U	317,000	668,000	-0,440	0,660

Conclusions

- In a generic form, the analysis of the variables shows that, in our study, convergence insufficiency leads to loss of quality relatively to the fixation and visual pursuit.

Conclusions

- The number of fixations and the number of inversions were always lower in NBV group than in the CI group.

- Similar values were reported by Biscaldi, Fischer & Aiple (1994), in a comparative study between dyslexic children and children without reading and writing difficulties.

Conclusions

- In a similar study performed in adults, the results are equivalent (Fischer, Biscaldi e Otto, 1993).

- However, the number
of regressive saccades (number of inversions) was not discriminative between the two groups.

Conclusions

- This convergence of results seems to suggests a relationship between changes in dyslexic individuals and the problems of convergence and binocular vision.

- Further studies are needed to relate the binocularity alterations with learning problems, including difficulties in reading and writing.

Conclusions

- The values of the number of fixations and the mean duration of fixations, seems to indicate a more stable fixation and also to a more precise saccade in NBV group compared with the CI group.

- The fixation and saccadic movements are more stable in the presence of a normal binocular vision (Pigassou-Albouy, 1995).

Conclusions

- The reestablishment of the normal binocular vision, in the individuals with convergence insufficiency is fundamental for the existence of an adequate visual comfort so it allows a normal performance in the different daily activities.

- More studies that fallow-up the binocular vision alterations are needed were the eye tracking systems can provide an important contribute.

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