BINOCULAR VISION AND BALANCE MEASUREMENT AND ANALYSIS

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Introduction:

An individual's ability to see and function visually is determined largely by the relative contributions of a number underlying components of vision designated as visual abilities (Corn & Koenig, 1996; Lueck, 2004). These visual abilities are: acuity, visual field, motility, brain functions and light and colour reception (Corn & Koenig, 1996) others consider also contrast, accommodation and binocular vision (Lueck, 2004; American Academy of Optometry & American Optometric Association, 1999).

It is through the conjugated movement of the two eyes that we can fix and pursue one object. The ocular movements and the binocular vision are linking and they are influence mutually.

The measurement device most often used for measuring eye movements is commonly known as an eye tracker.

Objective:

To characterize the signal having in account the type of ocular movement that means saccadics and fixation movements. Habitually, the objective of the analysis is to locate regions where the signal brusquely changes position, indicating the end of the fixation and the beginning of saccade. Later the signal assumes a stationary position, indicating the beginning of a new fixation (Duchowski, 2002).

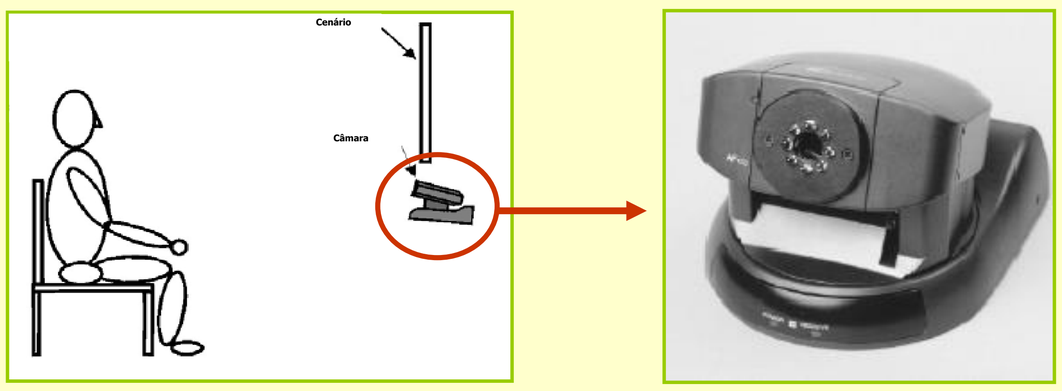
Methodology:

In order to characterize through fixation and pursuit we opted to study a group of 24 individuals with normal binocular vision (NBV), in conditions of binocularity (NBV1) and monocularity (NBV2), as well as another group also formed for 24 individuals with convergence insufficiency (IC) that is the alteration most frequent of the binocular vision.

Our sample was composed by individuals, men and women, with ages between 18 and 23.

To achieve those objectives we had used the following variables: mean duration of the fixation in seconds (left-right LRMD; right-left RLMD; up-down UDMD; down-up DUMD), mean saccadic amplitudes in visual angle degrees (left-right LRMA; right-left RLMA; up-down UDMA; down-up DUMA).

In order to characterize the mechanisms of fixation and persecution and the way how binocular vision influences them, we use in our study the Eye Tracking System-ASL 504, because allows an evaluation next to the natural conditions and in real time.



The Eye Tracking ASL - 504 are a complex device that allows to register two parameters of the eye: the movement of this on the visual field (what it corresponds to the line of vision of an individual) and the size of the pupil. This device allows us, in an objective way (without verbalize), to get the necessary parameters that make possible to identify the individual look point, with a great precision. These registers are based on the size of the pupil and the principle of the corneal reflexion.

We used a white circle with 5mm of diameter as a target in a LCD monitor. The target was shown in the horizontal line (in both senses) in nine sequential positions and in vertical line (in both senses) in seven sequential positions, in each second between each position in both situations.

Results:

In this table we can observe the study of normality (level of significance p<0,1). The variables are organized by the carried segments.

	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
Variables	Statistic	df	Sig.	Statistic	df	Sig.
LRMDNBV1	,117	24	,200(*)	,973	24	**,746**
LRMDNBV2	,100	24	,200(*)	,960	24	**,431**
LRMDCI	,091	24	,200(*)	,981	24	**,906**
LRMANBV1	,125	24	,200(*)	,939	24	**,152**
LRMANBV2	,096	24	,200(*)	,967	24	**,606**
LRMACI	,174	24	,057	,939	24	**,156**
RLMDNBV1	,129	24	,200(*)	,943	24	**,187**
RLMDNBV2	,158	24	,124	,909	24	,033
RLMDCI	,123	24	,200(*)	,978	24	**,852**
RLMANBV1	,146	24	,200(*)	,929	24	,095
RLMANBV2	,114	24	,200(*)	,936	24	**,135**
RLMACI	,191	24	,023	,910	24	,036
UDMDNBV1	,105	24	,200(*)	,960	24	**,439**
UDMDNBV2	,122	24	,200(*)	,956	24	**,361**
UDMDCI	,076	24	,200(*)	,983	24	**,950**
UDMANBV1	,108	24	,200(*)	,980	24	**,895**
UDMANBV2	,168	24	,077	,916	24	,048
UDMACI	,098	24	,200(*)	,984	24	**,955**
DUMDNBV1	,093	24	,200(*)	,967	24	**,588**
DUMDNBV2	,131	24	,200(*)	,924	24	,072
DUMDCI	,148	24	,188	,892	24	,015
DUMANBV1	,105	24	,200(*)	,942	24	**,181**
DUMANBV2	,147	24	,196	,904	24	,026
DUMACI	,183	24	,037	,866	24	,004

* This is a lower bound of the true significance.
a Lilliefors Significance Correction

We verified that in the segments most usual LR and UD the variables present a normal distribution with exception of the variable MA in the monocularity condition. As for the segments less usual, we verified normality of the data in all variables in conditions of binocularity with exception of MA in the RL, being although, very next to the value of significance (0,095).

Discussion/Conclusions:

The eye tracking system that we use showed a good discrimination for the selected variables.

The existence of normality in the segments most usual even in situations where the binocular vision is not present or is modified seems to indicate that the Eye Tracker is an efficient system for the study of the ocular movements (fixation and pursuit). The trainings due to the execution of habitual tasks, it will could to favour the existence of normality even in the presence of changes of the binocular vision.

Relatively to the segments less usual where the training factor does not play a determinative paper, the existence of normality in the group of normal binocular vision was only verified, in binocularity conditions, such fact seems to be, mainly, related with the loss of binocularity or with alterations of the binocular vision as it is the case of the convergence insufficiency.

We think that this study show the important contribution that eye tracking can give in the analysis, of the functional alterations of the binocular vision, because allows to evaluate them in conditions very next to the reality. In the context of vision and eye movements, knowledge of the physiological organization of the optic tract as well as of cognitive and behavioural aspects of vision is indispensable in obtaining a complete understanding of human vision (Duchowski, 2003).

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