

# Correlation of Ocular Motor Reading Strategies to the Status of Adaptation in Patients with Hemianopic Visual Field Defects

DIETER SCHOEPP AND WOLFGANG H. ZANGEMEISTER<sup>a</sup>

*Department of Neurology  
University of Hamburg  
Martinistrasse 52  
D-2000 Hamburg 20  
Germany*

## INTRODUCTION

To compensate for hemianopia it is necessary to have appropriate ocular motor strategies for efficient use of the remaining half of the visual field.<sup>1</sup> In reference 2 we demonstrated that patients with pure hemianopia and foveal sparing optimally learn to compensate their visual handicap in reading by active and motivated visual training. The purpose of the present study is to analyze in detail the different ocular motor reading strategies that hemianopic patients develop to compensate their visual handicap corresponding to their "relative" status of ocular motor adaptation in reading. Therefore, the eye and head reading path of ten well-selected patients with hemianopic visual field defects due to different aetiology was completely analyzed under this aspect. The "relative" status of ocular motor adaptation was marked according to the *mean reading rate*, the *frequency of acoustical reading errors*, and the most frequently applied *ocular motor reading strategies*. The apparatus and methods used were the same as previously described.<sup>2</sup> All patients had to read two groups of four different texts with distinct content. In a low-letter density mode the texts had 28 letters per line, and in high-letter density mode each text had 46 letters per line. The task was performed under two varying conditions: a head-fixed condition and a head-free-to-move condition. The patients were asked to read the texts as accurately and as quickly as possible.

## RESULTS

The aetiology of the hemianopia, the visual field defect, and the reading efficiency of eight hemianopic patients of the experimental group are represented in TABLE 1, and the different reading strategies are shown in FIGURE 1. The upper two strategies were demonstrated by left hemianopic patients, the lower four by right hemianopic patients.

Patients with additional signs of visual hemi-inattention did not develop any adaptive ocular motor reading strategies. A normal "stop and go" reading pattern was

<sup>a</sup>To whom correspondence should be addressed.

**TABLE 1.** Description of Visual Field Defects, Aetiology, and Reading Efficiency of Eight Patients with Homonymous Hemianopia

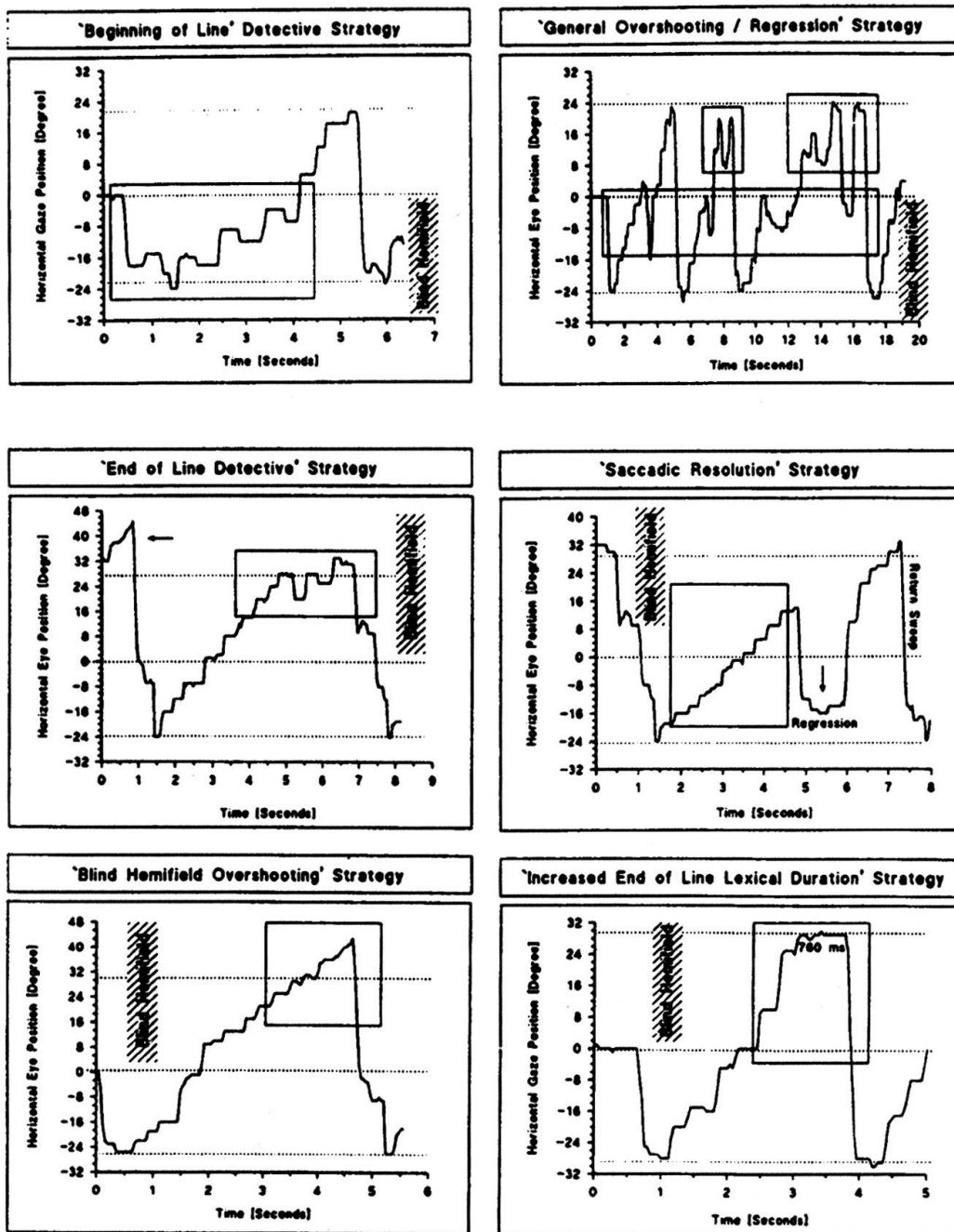
RHH Patients	Age	Visual Field Defect	Aetiology	Male			Relative Status of Adaptation
				Neuro-psychological Testing	Reading Rate in Eye and Head Reading Path	Frequency of Acoustical Reading Error	
D.H.	24	—Complete <i>right</i> hemifield loss without macular sparing —Slowly developing over 4 years	—Stenosis of Basilar At. —No CCT/MRI correlation —Psychogenic aetiology in question —Infarction left lower ocular lobe —CCT correlation —Acute event [3 months]	No signs of visual hemi-inattention	11.5 L/S	—No acoustical reading error	+ 9
E.S.	56	—Complete dense <i>right</i> lower hemifield loss reaching far over the horizontal meridian into the right upper quadrant	—Isolated neuritis of the optic nerve (R.E.) —No other neurological diseases	No signs of visual hemi-inattention	7.1 L/S	—No acoustical reading error	+ 5
A.S.	36	— <i>Right</i> wedged shaped defect reaching from the papilla into the periphery —Additional right paracentral sco. — <i>Left eye patched</i>	—Infarction left P.C.A. —Temporal contusion —CCT correlation —Acute event [11 months]	No signs of visual hemi-inattention	7.5 L/S	—<1 error/text	+ 4
Z.Z.	46	—Incomplete <i>right</i> hemifield loss with de-termination of the upper quadrant —Macular sparing [3–5°] (left quadrant)	—Recurrent cerebral embolism with transient dysphasia and hemiparesis	No signs of visual hemi-inattention	6.6 L/S	—>1 error/text	– 2
R.K.	48	—Incomplete <i>right</i> hemifield loss with de-termination of the upper quadrant —Macular sparing [3–5°] CCT (+)		— <i>Poor test</i> with additional signs of visual neglect	< 4 L/S	—>4 error/text	– 8

(continued)

TABLE 1. (Continued)

LHH Patients	Age	Visual Field Defect	Aetiology	Neuro-psychological Testing	Male Reading Rate in Eye and Head Reading Path	Frequency of Acoustical Reading Error	Mostly Used Reading Strategies	Relative Status of Adaptation
G.S.	56	—Irregular <i>left</i> hemifield loss reaching into the right upper quadrant —Macular sparing [2°]	—Vascular embolism —Infarction P.C.A. —CCT correlation —Acute event [22 days]	No signs of visual hemi-inattention	8.3 L/S	—<1 error/text	—General oversh./reg. strategy	+ 5
K.U.	73	—Incomplete <i>left</i> hemifield loss —Macular sparing [5°]	—Vascular embolism —Infarction P.C.A. —CCT correlation —Acute event [31 days]	No signs of visual hemi-inattention	7.9 L/S	—No acoustical reading error	—Beginning of line detection strategy	+ 4
J.S.	59	—Complete dense <i>left</i> upper quadrant loss —Visus right eye 0.1 —Visus left eye 1.0	—Cerebral embolism —CCT correlation —Acute event [12 days]	No signs of visual hemi-inattention	6.7 L/S	—>2 error/text	—Beginning of line detection strategy	— 5

Note: Left [LHH] and right hemianopic patients [RHH] are ordered according to their "relative" status of ocular motor adaptation. The highest status of ocular motor adaptation in reading is reflected by plus ten; minus ten reflects the lowest status of adaptation.



**FIGURE 1.** Ocular motor reading strategies that hemianopic patients demonstrated in the "eye and head reading path." *Often applied strategies* were the "beginning of line detective" strategy, the "end of line detective" strategy, and the "saccadic resolution" strategy. *Rarely used strategies* were the "general overshooting/regression" strategy, the "blind hemifield overshooting" strategy, and the "increased end of line lexical duration" strategy.

diminished, and the reading saccades appeared as strongly "disorganized." The mean reading rate was greatly decreased. Because of the disturbed ocular motor reading behavior, an increased number of acoustical reading errors resulted.

Simple adaptive reading strategies used by "poorly adapted" patients were as follows: the "beginning of line detective" strategy, the "end of line detective" strategy, and the "saccadic resolution" strategy. Higher adaptive reading strategies used by "better adapted" patients included the "general overshooting/regression" strategy, the "blind hemifield overshooting" strategy, and the "increased end of line lexical duration" strategy.

### *Delimitation of the Term "Subcortical Reading Ability"*

In our experimental setup, with special respect to the patient D.H., who demonstrated clinically a maximal statokinetic dissociation,<sup>3</sup> a mean reading rate faster than nine letters per second, in combination with the "increased end of line lexical duration" strategy, was directed either to a "simulated," that is, hysterically, hemianopia, or to subcortical reading abilities.

## CONCLUSION

The mean reading rate and the number of acoustical reading errors of the hemianopic patients were directly correlated with the "relative" status of ocular motor adaptation and to the aetiology of the visual field defect.

## REFERENCES

1. ZANGEMEISTER, W. H., O. MEIENBERG, L. STARK & W. F. HOYT. 1982. Eye head coordination in homonymous hemianopia. *J. Neurol.* **226**: 243-254.
2. SCHOEPP, D. & W. H. ZANGEMEISTER. 1992. Eye and head reading path in hemianopic patients. *In Studies in Visual Information Processing*, R. Groner, Ed.: 267-290. North-Holland/Elsevier. Amsterdam.
3. RIDDOCH, G. 1917. Dissociation in visual perception due to occipital injuries, with special reference to appreciation of movement. *Brain* **40**: 15-57.