Low-Contrast Character Recognition in Patients with Cerebral Visual Field Defects

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Introduction:

At present cerebral visual field defects following brain injuries (hemianopia, quadrant anopia, scotomata) are usually diagnosed using standard automatic perimetry. For these procedures the detection of stimuli – at low or high contrast – is the main criterion. Only a few studies[1] investigated stimulus recognition at lower contrast and its modulation by cerebral visual field defects, most of them with a small number of subjects only. The goal of our study was to compare the contrast thresholds for the recognition of characters (digits) and the detection of gabor patterns in the intact and injured visual field.

Methods:

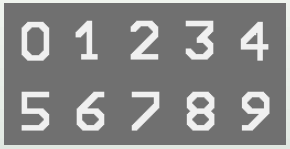
Eleven hemianopic patients und 10 age-matched healthy volunteers were examined. We determined the contrast thresholds for the detection of gabor patterns (1 cyc/°, sigma 1.5°) and recognition of digits (size 2.4°) at 32 positions in the visual field presented on a 21" monitor. Foveal testing was done for three stimulus sizes (1°, 2°, 4°). The results were compared with the visual field obtained on a Tübingen Automatic Perimeter and with qualitative high-resolution perimetry.

ID	Hemianopia	Etiology	
OS	Left	Infarction	right posterior
WF	Left	Ischemia	right tempero-occipital
WB	Left	Infarction	right posterior
FJ	Left	Angioma	right parieto-occipital
WV	Left	Ischemia	right parieto-occipital
FS	Left	Infarction	right posterior
MO	Left	Intracerebral bleeding after AV malformation	right occipital
MR	Right	Infarction	left posterior
ER	Right	Infarction	left posterior
JD	Right	Infarction	left posterior
WP	Right	Infarction	left posterior

The perimetric measurements, MRI images, and psychophysical results are shown in more detail for the example of patient OS. Patient OS also has a history of migraine.

***Fig.1**: MRT of patient OS*

***Fig.2:** Automatic perimetry (Tübinger Perimeter): left and right eye*



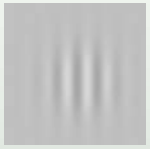


Fig 3: Stimulus examples: digits (left) and gabor patterns (right)

Results:

Foveally we revealed a significant loss of recognition sensitivity but not of detection sensitivity in the patient group. In the zone of transition from the intact to the injured visual field, as defined by qualitative perimetry, there was a gradual sensitivity decrease in both recognition and gabor detection. Most interestingly, in some patients recognition sensitivity was impaired within the intact visual field itself. There is a significant difference between the detection of gabor patterns and the recognition of digits for all measurements (healthy volunteers and patients).

***Fig.4:** Contrast sensitivity for the detection of gabor patterns (left) and recognition of digits (right) in healthy volunteers*

***Fig.5:** Contrast sensitivity for the detection of gabor patterns (left) and recognition of digits (right) in patient OS*

Conclusion:

The results indicate that visual field defects following cortex lesions lead to decreased performance in recognition tasks not only along the border of the field defect but in some patients also in the intact parts of the visual field. Interestingly, patients show foveally a loss of character recognition but inconspicuous gabor detection. The intraindividual differences within the results show the need for a detailed characterization of the visual field defect with additional diagnostical tests. Future studies should focus on aspects also in the perimetrically intact areas of vision.

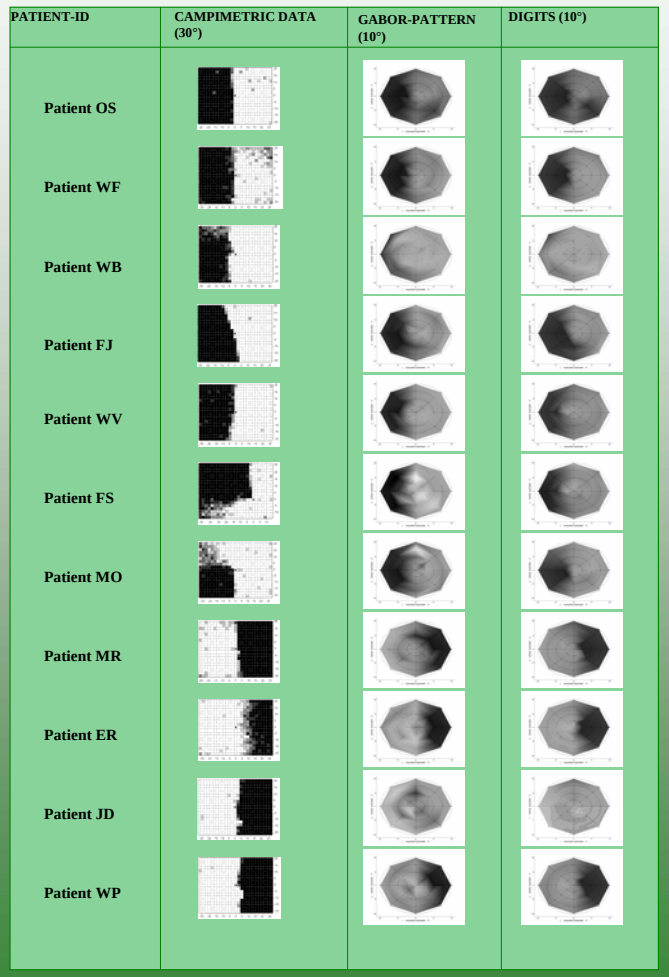


***Fig. 6:** Results of the 11 patients: campimetry (left), gabor patterns (middle) and digits (right). The values for gabor patterns and digits are shown as differences relative to the normal data, i.e. averaged contrast sensitivity in healthy subjects.*

References:

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[3]Kasten-E, Strasburger-H & Sabel-BA (1997) Spatial Vision, 10, 449-503