

Comparison of the retinal modulation transfer function between amblyopes successfully corrected and normal subjects

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Abstract

- **AIM:** To analyze the retinal modulation transfer function between amblyopes whose visual acuity was corrected to 5.0 and normal subjects at the same age.

- **METHODS:** RM-800 used to detect contrast sensitivity was adopted to measure MTF of 96 amblyopes (96 eyes) whose visual acuity was corrected to 5.0 and 80 normal controls (80 eyes) at the same age under six interference fringes (IVA=0.06, 0.1, 0.2, 0.4, 0.6, 0.8).

- **RESULTS:** The functional values of amblyopes were significantly lower than those of normal subjects in every fringe ($P<0.01$), especially in medium and high frequency.

- **CONCLUSION:** For amblyopes, MTF was still abnormal after stopping the treatments.

- **KEYWORDS:** modulation transfer function; amblyope; Interference Fringe Visual Acuity

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INTRODUCTION

Nowadays, evaluation criteria of treated amblyopes mainly rely on examinations of visual testing charts. But the examinations only indicate the abilities of distinguishing the charts in different space frequency under

high contrast. Modulation transfer function (MTF) can fully evaluate visual quality. This study compared the visual performance between amblyopes whose visual acuity was corrected to 5.0 and normal subjects using MTF.

MATERIALS AND METHODS

Materials From June, 2009 to June, 2010, 96 subjects (96 eyes, 52 males and 44 females, 6-12 years old, average age is 8.6 ± 2.9) were randomly selected in amblyopes whose visual acuity was corrected to 5.0 and remained stable for half a year, and 80 normal subjects (80 eyes, 44 male and 36 female, 6-12 years old, average age is 8.3 ± 2.8) were also randomly selected as control subjects.

Methods MTF named RM-800 (Reman Guangdian Corporation, Wenzhou, China) was used to measure the values of MTF in six interference fringes (IVA=0.06, 0.1, 0.2, 0.4, 0.6 and 0.8). We can measure retina-brain visual performance directly, excluding influences of dioptric media^[1]. The steps were as follows: (1) start the apparatus under natural lights; (2) ask the patient to put his jaw on the base; (3) make sure the tested eye is right to the peer-hole when interference fringes turn up; (4) light the six different fringes and contrast gradually until the patient can see it; (5) press acknowledge key and the last acknowledge value is the functional value of MTF in the interference fringe which can be seen.

Statistical Analysis SPSS 13.0 was adopted. Independent sample *t*-test was used to analyze the functional values of two groups in different space frequencies.

RESULTS

The functional values of amblyopes in every space frequency were significantly lower than those of the control group ($P<0.01$), especially in medium and high frequency (Table 1). The curve of MTF showed the pattern of parabola (Figure 1). The values of MTF of amblyopes were lower than those of normal subjects. There was a left shift in medium and high frequency.

Table 1 IVA of the successfully treated amblyopes

Group	n	0.06	0.1	0.2	0.4	0.6	0.8
Normal	96	62.0±24.3	68.2±24.3	75.8±29.4	35.7±23.7	16.4±17.8	9.0±14.0
Amblyope	80	46.6±20.0 ^b	60.0±20.3 ^a	50.0±20.4 ^b	13.6±19.6 ^b	7.2±7.4 ^b	2.7±4.6 ^b

^aP<0.05, ^bP<0.01, vs Normal

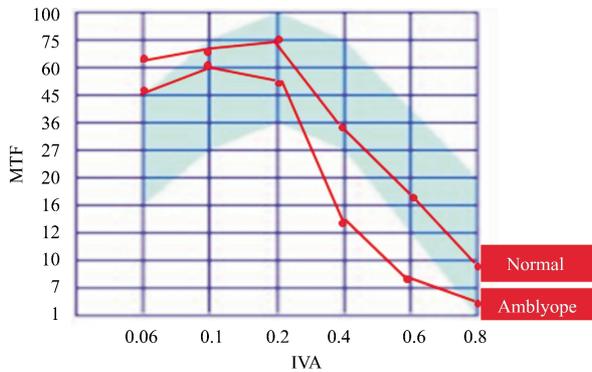


Figure 1 Comparison of contrast sensitivity of the successfully treated amblyopes and normal eyes

DISCUSSION

The curve of MTF takes on parabola shape. The study of retinal MTF indicates compared to normal subjects, the results of amblyopes were significantly lower. There are two changes: (1)The values are declined significantly in medium and high frequency. Left shift can be seen in high frequency; (2)The values in six space frequencies are lower than those of normal subjects. The off frequency has a left shift [2,3]. Reduction of the values in low frequency shows serious visual loss in amblyopes. Some investigators believe the noticeable declines in medium and high frequency may be related to the damage of visual perception in macula lutea [4]. The results manifest that the functional values of amblyopes are lower than that of normal subjects, especially in medium and high frequency. Left shifts can be seen in high and off frequency. But compared to untreated amblyopes, successfully treated amblyopes have remarkable improvements in low frequency.

In amblyopia therapies, the keys are to deal with the potent formative factors, increase amblyopic visual stimulus and inhibit the abnormal visual input delivered to the brain. The earlier the treatments of amblyopia, the more quickly the

vision recovers. Plenty of researches show if amblyopes are treated reasonably, they can get a good visual improvement. But the visual acuity usually returns back when the treatments have been completed. Holmes *et al* [5] found vision decreased in about one-fourth of amblyopes after stopping treatments for one year when detecting and tracking on them.

Recently, the evaluation criteria of treatment effect usually rely on visual examination. In most cases, the values of MTF rise parallel with vision during treatments. But they can also potentially increase without improvement of vision. As a result, we can consider MTF as a diagnostic criterion of early slight changes of visual quality on amblyopes [6]. The results show the values of MTF of successfully treated amblyopes are lower than those of normal subjects, especially in medium and high frequency, which may point out that visual acuity of successfully treated amblyopes returns back may due to using the vision as the successful criterion.

In conclusion, after treatments when visual acuity of amblyopes rises to 5.0 or higher, further criteria should be needed. MTF can be considered as one of them.

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