Detection of functional changes in retina before diabetic retinopathy using double mfERG stimulation

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INTRODUCTION: The current clinical assessment of diabetic retinopathy is based on the fundus observation by ophthalmoscopy and fundus photography. However, the detection of functional changes in retina in diabetic patient is not well developed. The detection of functional changes in diabetic retina may provide more information about the condition as well as the progression of diabetic retinopathy. This pilot study aims to introduce a new mfERG paradigm to assess retinal function before diabetic retinopathy happened.

METHOD: Thirty-two diabetic patients without retinopathy and twenty-eight age-matched normal subjects were recruited for mfERG measurement with double stimulation paradigm. The stimulus pattern was 94% in contrast with mean luminance of 80cd/m². The mfERG paradigm composed of 2 m-sequence frames followed by 3 dark frames. The responses were processed separately at two time slices for the m-sequence frames. The peak-to-peak amplitudes of the two m-sequence frames (m1 and m2) and the amplitude ratio of m1 to m2 (m1/m2 ratio) from two groups were compared.

RESULTS: In the control group, the response amplitudes at m1 were significantly larger than those at m2 and in the diabetic group, the response amplitudes at m1 were also larger than those at m2 (p<0.01). In the sequence of m1, the response amplitude at central retina of the diabetic group was significant weaker than that of the control group (p<0.001), but not in paracentral and peripheral retinal regions. The m1/m2 ratios at paracentral and peripheral regions of diabetic retina showed larger values as compared to those of control group (p<0.05).

CONCLUSIONS: The double stimulation mfERG paradigm provides a platform to measure the temporal visual characteristics. The m1/m2 ratio acts as an indirect functional indicator on retinal adaptation which is believed to be abnormal in a diseased retina. The significant difference of m1/m2 ratios between normal and diabetic conditions suggested that this modified mfERG paradigm can measure the pathological changes in diabetic retina before retinopathy happened. Further advancement of this method may help to monitor the functional variation in diabetic retina and to predict the occurrence of diabetic retinopathy.

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