Global flash multifocal electroretinogram in the early detection of the local functional changes of diabetic retinopathy lesions

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Purpose:
To investigate the functional changes of different types of common diabetic retinopathy lesions by global flash multifocal electroretinogram (mfERG).

Method:
Detailed eye examinations (including fundus photodocumentation) were carried on thirty-eight diabetic patients. The diabetic patients were divided into two groups: Sixteen of them (aged 49.7± 6.4 years) were grouped as free from diabetic retinopathy while twenty-two of them (aged 49.8 ± 6.4 years) were grouped as non-proliferative diabetic retinopathy (NPDR). Fourteen age-matched healthy control subjects (49.4 ± 7.0 years) were recruited for comparison. One eye of each patient would be selected for the global flash mfERG assessment with 103-hexagon stimuli under high and low contrast conditions (98% and 46%). The 103 mfERG locations were grouped into 9 regions (central hexagon, 4 inner quadrants and 4 outer quadrants) to match with the retinopathy locations found in the fundus photos for the NPDR group. Z-scores of the amplitude and implicit time of the direct component (DC) and induced component (IC) would be studied according to their severity of retinopathy: free from NPDR, existence of hard exudates only, existence of dot haemorrhages, existence of the flame haemorrhages and soft exudates, and then compared with the control group.

Results:
Three hundred and fifty-three samples were collected from the patients and they were grouped into 5 groups: a) control (35.7%), b) no NPDR (40.8%), c) hard exudates only (2.8%), d) dot/blot haemorrhages (16.1%) and e) flame haemorrhages with soft exudates (4.5%). Under both high and low contrast levels (98% and 46%), the z-score of the DC amplitude for the “no NPDR” and haemorrhage groups were significantly smaller than the control group (p<0.005 and p<0.02 respectively). For the IC amplitudes, the z-score of all the diabetic patients were markedly reduced (p≤0.005).

For the implicit time of DC, all NPDR groups had significantly delayed in the z-score of implicit time comparing with the control (p≤0.001) and the “no NPDR” groups (p<0.001) at high contrast level. At the low contrast level, significant difference existed mainly for the haemorrhage groups against the control group (p≤0.001) and the “no NPDR” group (p<0.001). For the implicit time of IC, all NPDR groups had a significant delay when compared with the control (p<0.01) and “no NPDR” groups (p<0.01) at high contrast level only. Significant difference found neither in the DC nor IC implicit times between the control and the “no NPDR” groups at both contrast.
**Conclusion:**
Periodic focal and global flash can trigger both outer and inner retinal responses. The reductions in the z-scores of the DC (predominantly from the outer retina) and IC (predominantly from the inner retina) amplitude indicate that the adaptive function may deteriorate early before the vascular changes among the diabetic patients. The global flash mfERG paradigm may provide a way for early detection in the changes of retinal functional changes in diabetic patients.

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