DIAGNOSTIC AND PROGNOSTIC ROLE OF OCT AND VEP IN MULTIPLE SCLEROSIS

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Introduction and Objective

Measurement of retinal nerve fiber layer thickness (RNFL) using OCT has been proven useful in detection of optic nerve involvement in Multiple Sclerosis (MS) even without a previous history of optic neuritis (ON), allowing to monitor neurodegeneration along the visual pathways. OCT also correlates with clinical parameters as disease duration (1) , visual acuity (VA) (2), physical and cognitive disability (3), MRI measures of tissue damage (4) and abnormalities of visual evoked potentials (VEPs) (5). The utility of VEPs in evaluating patients with MS is widely recognized and supported by strong clinical and experimental evidences (6). However, little is known about comparative OCT and VEPs sensitivity in patients with MS, also taking into account recent advancements in OCT such as spectral domain technology (7). The aim of this study was to assess the value of OCT and VEP in MS and clinically isolated syndrome (CIS) patients.

Methods

study of 121 consecutive subjects with MS (34 clinically isolated syndrome, 69 relapsing-remitting, 15 secondary progressive, 4 primary progressive; age 36+10 years, disease duration 5.7+4.4 years, females 83, median Expanded Disability Status Scale–EDSS (EDSS1) 2 (range 0.0-7.0). Of 242 eyes, 166 had no previous history of optic neuritis (ON), 22 had a single recent ON episode (<3 months); 54 had chronic ON (at least 1 episode >3 months before). All patients underwent assessment of EDSS, visual acuity (VA), OCT retinal nerve fiber layer (RNFL) thickness and VEP (checkerboard, size 15'). VEP abnormalities were quantified according to a 4-graded conventional score (0 normal, 3 absent). 77 subjects underwent to a second EDSS (EDSS2) evaluation after a mean time of 1, 94 (+0.69) years (median EDSS 2, range 0-7)

Results

In eyes with recent ON, the sensitivity of OCT was 5.6% considering only RNFL thickness increase, 38.9% considering also RNFL reduction, with a higher sensitivity of VEP (77.3%; McNemar p<0.0001 and 0.02) ***(Figure 1)***

In eyes with chronic ON, no significant difference was found between OCT (68.5%) and VEP (81.5%) sensitivity (VEP/OCT 88.9%), as well as in eyes with previous ON within 6 (n=43) and 12 (n=34) months before (OCT 69.8% and 70.6 %; VEP 79.1% and 79.4%). Similar results were found excluding 13 eyes with repeated episodes of ON.

In asymptomatic eyes, VEPs had a higher sensitivity (31.7%) vs OCT (19.9%; p=0.005); VEP/OCT combined detected abnormalities in 39.2%.

All eyes considered, a significant correlation was present between global RNFL thickness and VEPs amplitude (Pearson's r=0.53; p<0.001), VEP latency (r=-0.54; p<0.0001) ***(Figure 2)*** and VEP score (Spearman's ρ = -0.52; p<0.001) ***(Figure 3)***. VA was significantly correlated with RNFL thickness (global RNFL: ρ=0.30, p<0.0001) and with VEP score (ρ=-0.63, p<0.0001)

In eyes without previous ON, VEP score and RNFL thickness were significantly correlated with disease duration (global RNFL: r=-0.33 p<0.0001; VEP score: ρ=0.26 p=0.01) and EDSS (global RNFL: ρ=-0.22, p=0.03; VEP score: ρ=0.29, p<0.001).

In follow up evaluation OCT alterations in 68 asymptomatic patients (= 68 eyes, 1 eye per patient) were associated with development of disability after 2 years. We analyzed 2 groups: Group 1 was composed by 19 patients with basal OCT alteration and Group 2 was composed by 49 patients with normal OCT at basal time.

We assessed non parametric Anova for repetitive measure based on rank (Conover Test) and we found significant effect of main factor group ($F_{0,66}$=4.294 p=0.042) **(Figure 4).**

There were no significant effect of main factor time ($F_{0,66}$=0.193 p=0.662). There was no significant interaction between the 2 main factor time and group ($F_{0,66}$=3.772 p=0.056).

Non significant difference of EDSS values were found between the 2 groups at basal time, while significant difference were found after 2 years (Mann-Whitney p=0.013).

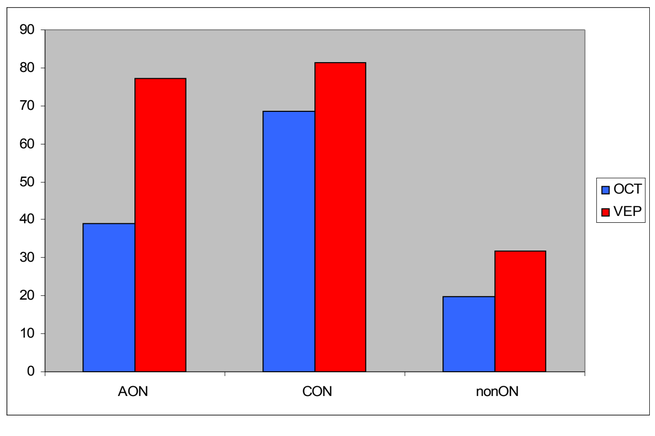

Figure 1 - Abnormal tests (%) in eyes with acute/subacute ON (AON), chronic optic neuritis (CON) and without optic neuritis (non ON)

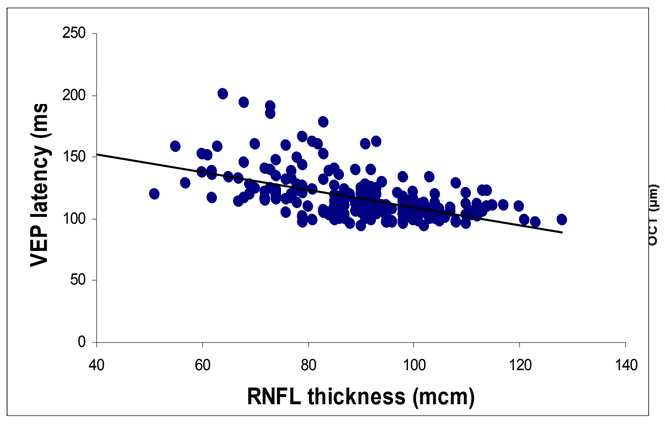

Figure 2 - Correlation between Global RNFL thickness and VEPs latency (r=-0.54; p<0.0001)

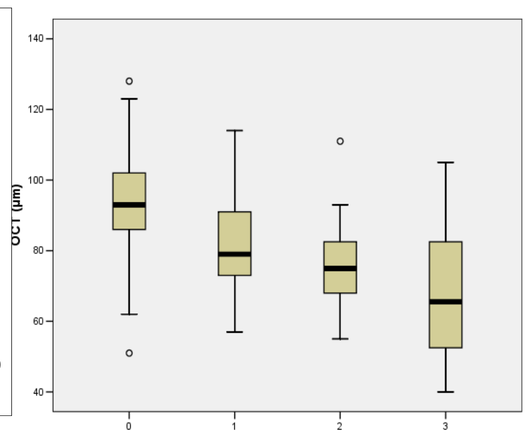

Figure 3 - Box plot of global RNFL thickness in all eyes categorized by VEP score.

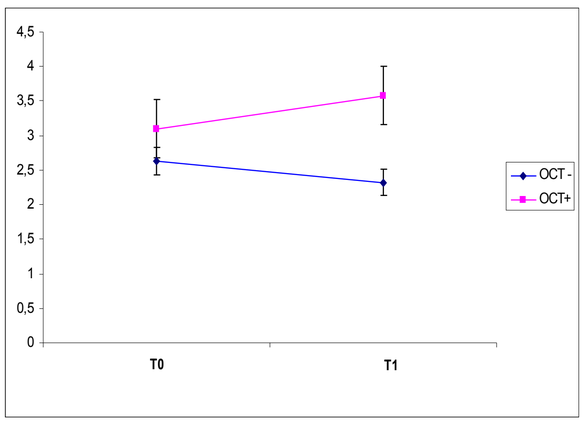

Figure 4 – T0 and T1 EDSS in patients with normal (-) and altered (+) basal OCT;
Conover test, main factor group: $F_{0,66}$=4.294 p=0.042.

Conclusions

The present findings confirm a higher sensitivity of VEPs in the subacute phases of optic neuritis (less than 3 months) and in asymptomatic eyes; the last finding is consistent with previous literature (8). In our work, this discrepancy fades off after more than 3 months from the ON episode, allowing for retrograde degeneration to occur and thus increasing OCT sensitivity. Even at this stage, the combination of the two exams allows to increase our overall sensitivity in detecting optic nerve damage. Finally OCT alteration in ayes without previous optic neuritis was associate with higher disability after 2 years confirming the role of OCT as a good tool for monitoring the disease. Further longitudinal study are needed to confirm our findings.

Bibliography and Acknowledgments

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Part of this work was financially supported by Merck Serono S.A., Geneva, Switzerland. Merck Serono is the biopharmaceutical division of Merck KGaA, Darmstadt, Germany.