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"PROTECTIVE EFFECT OF COMMERCIALLY AVAILABLE BLUE-LIGHT BLOCKING LENSES AGAINST BLUE LED EXPOSURE ON STRUCTURAL AND FUNCTIONAL CHANGES IN THE HIGHER CORTICAL RGIONS IN WISTAR RATS"

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Abstract

Purpose: We aimed to assess the structural and functional changes in the higher cortical regions and protective efficacy of blue- blocking lenses (BBLs) post blue LED exposure in *Wistar rats*.

Method: After approval, adult male *Wistar rats* (n=24) of 8 weeks old age were procured. The animals were randomly allocated to four groups (6 per group) i.e., normal control (NC), light exposure (LE), BBL Crizal Prevencia (CP) and BBL DuraVision Blue (DB). LE group was given direct blue LED exposure, whereas the two BBL groups were given exposed to blue LED exposure with blue- blocking lenses attached on them for a period of 28 days (12:12 light: day). All the groups were trained for behavioral analysis (functional test) with Morris water maze test prior to performing memory retention (probe) test. After the completion of functional tests, the brain tissues of the animals were removed and sections were obtained for histopathological analysis using Golgi and Cresyl violet stain.

Results: Animals in the LE group showed statistical significance (p=0.024) in the functional test performed on the day 1 of training compared to the DB group. Structural analysis with Golgi stain showed significant alterations in the CA1 and CA3 neurons due to light exposure. CA1 neurons showed a significant treatment effect in apical branching points ($F_{18, 140} = 0.009$, $p < 0.05$) and basal branching points ($F_{18, 140} = 0.017$, $p < 0.05$). CA3 neurons showed significant treatment across all the dendritic arborization parameters: apical branching points ($F_{18, 140} = 0.001$, $p < 0.05$), apical intersections $F_{18, 140} = 0.005$, $p < 0.05$), basal branching points ($F_{18, 140} = 0.001$, $p < 0.05$) and basal intersections ($F_{18, 140} = 0.001$, $p < 0.05$). Histopathological analysis with Cresyl violet stain showed significance for both healthy and degenerated CA1 neurons (H= 39.154, p<0.001) as well as healthy and degenerated CA3 neurons (H= 39.154, p<0.001). Post hoc test revealed significance for healthy and degenerated CA1 neurons between LE and CP groups (i-j=-21.00, p=0.003) and between CP and DB groups (i-j=19.11, p=0.009). For CA3 neurons, significance was found between LE and NC (i-j=39.889, p<0.001), LE and CP (i-j=36.889, p<0.001) and LE and DB (i-j=38.00, p<0.001) groups. These results collectively demonstrate impairment of cognitive functions in *Wistar rats* under stressful conditions and amelioration with blue light blocking lenses.

Conclusion: Constant and cumulative exposure to blue LEDs had an adverse effect on the hippocampal neurogenesis in the CA1 and CA3 neurons. The BBLs demonstrated protective efficacy, especially the DuraVision Blue lenses.

Keywords: Light emitting diodes (LEDs), blue- light exposure, behavior analysis, retinal damage, photo thermal damage, blue- light protective lenses.