

Use of Pulsed Photobiomodulation in Nerve Regeneration after Injury-Induced Peripheral Neuropathy in *Danio rerio*: Effect of Mitochondrial Protein Genetic Variant, mpv17, in A Delta and C Nerve Fiber Growth

Ansari, Nadia (School: Sage Hill School)

I examined if photobiomodulation (PBM) treatment can result in improved stress response and peripheral nerve regeneration, particularly of A delta and C nerve fibers, after caudal fin injury in wild type and mutant (Casper) *Danio rerio*. Wild type (wt) (n=16) and Casper (n=8) (a mutant for mitochondrial protein mpv 17) *D. rerio* were randomized to control or PBM treatment when caudal fin was clipped and were placed in the novel tanks with grids and video was acquired. Caudal fins were clipped again after 14 days of daily or every other day PBM treatment. The fins were stained with peripherin polyclonal antibody and a fluorescence microscope was used to detect nerve fiber regrowth. Video was analyzed for stress response and swimming distance. Experimental groups with PBM treatment had more growth than the control group. The group with PBM dose of 10 sec every other day had the most growth (266% more than control). Experiment group wt showed much greater A delta and C nerve fiber regrowth than experiment Casper, which lacks the mpv 17 mitochondrial protein (536% more growth in wt vs. mutant) (p<.003). PBM treatment prior to fin clip improved fin function in both wt and mutant as assessed by swimming distance (160% greater in experimental vs control, p<.001). PBM after nerve injury results in faster recovery of fin function and faster peripheral nerve growth, with a possible mitochondrial pathway mechanism, involving the mpv17 protein. A delta and C nerve fibers are damaged in many conditions including diabetes, post-chemotherapy and autoimmune disorders, like Guillain-Barre. PBM therapy could be helpful in these conditions, affecting 600 million people worldwide, lessening dependence on pain medications and possibly improving sensory nerve regrowth and function.

Awards Won:

Fourth Award of \$500

National Aeronautics and Space Administration: Second Award of \$750