

Abstract

Traumatic spinal cord injury (SCI) is severe condition with devastating long-lasting consequences. There is still no available treatment. After initialing mechanical trauma, there is a huge cascade of secondary reactions which amplifies the damage. This thesis is focused on potential therapeutic effect of photobiomodulation, natural anti-inflammatory compounds epigallocatechin-3-gallate (EGCG), curcumin, their combination and extrapure synthetic form of curcumin called „nanocurcumin“ on impacts of experimental model of SCI in rats.

Photobiomodulation using combination of two synchronized wavelengths 808 and 905 nm improved functional recovery after SCI evaluated by battery of locomotor tests and somatosensory plantar test. The group treated by photobiomodulation obtain better results in all tests. The histopathological analysis showed a positive effect on white and gray matter sparing and our data suggests an upregulation of M2 microglia/macrophages in photobiomodulation treated rats assessed by immunohistochemical and RT-qPCR analysis. Our results demonstrated that the photobiomodulation is a promising non-invasive therapy for improving functional recovery and tissue sparing after SCI.

EGCG and curcumin are natural compounds known in Chinese medicine for centuries. Their neuroprotective and immunomodulatory effect was investigated in second part of the thesis. Both compounds influenced the immune response and tissue regeneration through changes in cytokine levels and glial scar formation after severe SCI. We did not observe the synergistic response of combination EGCG and curcumin. The synthetic nanocurcumin offers a new delivery system of curcumin with higher biological availability. We found significant changes in the locomotor patterns of the hindlimbs, histology and immunohistochemistry revealed protection of the white matter and reduction of the glial scar. It also has immunomodulatory properties which ameliorate the local immune response in the early stage of the SCI.

Our data suggests the potential of all investigated therapies to mitigate the impact of SCI.

Key words: spinal cord injury, photobiomodulation, EGCG, curcumin, neuroregeneration