Biomechanical and Morphological Approach to Assess Recovery After Peripheral Nerve Injury in Animal Model

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BACKGROUND: Classical and newly developed methods of assessing peripheral nerve recovery do not necessarily predict the reestablishment of motor and sensory functions [3]. Furthermore, correlation between morphological and functional assessment is usually poor [13]. Functional recovery after peripheral nerve repair has been the question that promotes investigation of our research team on both therapeutic techniques and on assessment methods. We have introduced biomechanical approach on research methodology to assess aspects of functional recovery like dynamics.

APPROACH/METHODS: We have used the rat sciatic nerve crush model. Ankle kinematics was carried out on twelve adult male Sasco Sprague Dawley rats prior to injury and every two weeks during 12-week follow-up time. We have constructed a Perspex tract where rats walked and it was video recorded. 2D biomechanical model was carried out using the bone references of the proximal edge of the tibia, lateral malleolus and fifth metatarsal head. Quantitative morphology was carried out on regenerated nerve fibers.

RESULTS: Ankle joint motion of the rat during the walk remained significantly different in control and injured animals in 12 weeks. At the instant of heel-rise, an abnormal pattern of ankle position persisted during the whole 12-week follow-up time. Only two morphological parameters (myelin thickness/axon diameter ratio and fiber/axon diameter ratio) returned to normal values.

CONCLUSIONS: Recovery from crush injury has been reported to be complete within 8 weeks but we provided evidence that even after 12 weeks recovery, morphological and ankle joint kinematic changes were still present. Methods of recovery assessment should combine both morphological and functional analysis. Moreover, the potential for biomechanical gait analysis to assess hindlimb muscle function requires precise motion capture system combined with others instruments that allow understanding of the altered properties of supportive connective tissue, muscle, and nerve.

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