Demyelination: A Research Into the Use of Electrical Models in the Study of Demyelinating Diseases

Gica, Despina Iuliana (School: Mihai Viteazul National College)

PURPOSE: Demyelination is a biological process that can cause serious motor, coordination and balance disturbances. This project aims to introduce the use of equivalent electric circuits into the study of demyelinating diseases by assessing the deformed signals within the framework of a certain kind of demyelinating disease. PROCEDURE: The project firstly entailed a detailed study into the anatomy and physiology of the nervous system and myelin itself. Afterwards, demyelinating diseases were described in a pathological context, and then they were defined in the context of electrical circuits, a process in which three distinct tiers were distinguished. An equivalent electrical circuit (the McNeal model) was then used in experiments to simulate deformed electrical signals inherent to demyelinating diseases. In the study of such signals, a number of conventional methods was used such as classical methods or harmonic methods. RESULTS: The main findings were that the ratio between the input tension and the output tension of the circuits was extremely high, meaning that a significant part of the energy of the signal was lost. Furthermore, the shape of the initial impulse was not preserved at all, becoming unrecognizable. CONCLUSIONS: This project highlights the immense potential that electrical circuit modelling holds in the study of demyelinating diseases.

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