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The graph theory applied to the study of the human locomotor system: a simulated amputation changes the characteristics of the system

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The study of the relationships between the different structures of the human locomotor system still to date raises great interest. In fact, the human body networks and in particular the myofascial system "myofascial system network" underlie posture and movement and new knowledge could be useful and applied to many fields such as medicine and prosthetics. The hypothesis of this study was to verify the possibility of creating a structural network representing the human locomotor system as well as to study and describe the relationship between the different structures considered.

The graph theory was applied to a network of 2339 body parts (nodes) and 7310 links, representing the locomotor system. The open source platform software Cytoscape was used for data entry (nodes and links) as well as for debugging. In addition, the "Network Analyzer" plugin was used for the descriptive statistics of the network obtained. In order to achieve a better rendering, the results of the network parameters gained were then imported into Gephi (www.Gephi.org).

At the end of this procedure, we obtained a image of a human being in an orthostatic position with a precise distribution of the nodes and links.

By simulating the common amputations at the level of the foot and leg (as for necrotic complications of diabetes) the balance between the parts and the whole structure of the graph are profoundly modified.

Key words

Locomotor system, Graph theory, Tensegrity, Diabetes.