Perspective
Volume 12:02, 2023

Journal of Spine

ISSN: 2165-7939

Open Access

Review of Applications, Limitations and Challenges for Multi-body Models of the Thoracolumbar Spine

Aaer Liu*

Department of Orthopaedics and Traumatology, Dalian University of Technology, Liaoning, China

Introduction

The thoracolumbar spine plays a crucial role in maintaining stability, mobility, and overall functionality of the human body. Spinal disorders, such as degenerative disc disease, herniated discs, and scoliosis, can significantly impact an individual's quality of life. To better understand these conditions and develop effective treatment strategies, researchers have turned to multibody modeling techniques. In this article, we will explore the concept of multibody models of the thoracolumbar spine, their advantages, applications, and how they contribute to advancing the field of spinal biomechanics [1].

Description

The complex nature of the thoracolumbar spine, comprising multiple vertebrae, intervertebral discs, ligaments, and muscles, makes it challenging to comprehend its mechanical behavior using traditional analytical methods. Multibody models offer a computational approach that allows researchers to simulate the interactions between different spinal components and study their biomechanical responses.

Constructing accurate multibody models of the thoracolumbar spine involves several steps. First, detailed anatomical data is collected through imaging techniques like magnetic resonance imaging (MRI) and computed tomography (CT) scans. This data provides insights into the geometric properties of the spine, including vertebral dimensions, disc heights, and curvatures.

Next, biomechanical properties of spinal components, such as stiffness and range of motion, are measured experimentally or obtained from literature sources. This information is integrated into the model to accurately represent the mechanical behavior of the spine [2,3]. To simulate the interactions between spinal components, researchers employ computational algorithms, such as the finite element method or the rigid-body spring model. These algorithms consider the contact forces, joint constraints, and muscle forces acting on the spine, enabling the prediction of spinal motion and load distribution [4]. Multibody models of the thoracolumbar spine offer several advantages and find wide-ranging applications in the field of spinal biomechanics [5,6].

Conclusion

Multibody models enable researchers to assess the kinematics and kinetics of the spine during various activities, such as walking, lifting, and bending. This information aids in understanding the load distribution, stress patterns, and risk factors associated with spinal disorders. By simulating surgical interventions, such as spinal fusion or disc replacement, multibody models assist surgeons in planning procedures, optimizing implant design, and evaluating postoperative outcomes. These models also aid in developing patient-specific treatment strategies by considering individual anatomical variations. Preventive measures, such as ergonomic interventions and lifting techniques, in reducing the risk of spinal injuries. Additionally, these models aid in designing rehabilitation protocols and assessing their impact on spinal function and recovery. Multibody models facilitate the design and evaluation of spinal prostheses, such as artificial discs or spinal braces. By simulating the interaction between the prosthesis and the spine, researchers can optimize the design parameters, assess the biomechanical performance, and improve patient outcomes.

Acknowledgement

None.

Conflict of Interest

None.

References

1. Byrne, Ryan M., Ameet K. Aiyangar and Xudong Zhang. "Sensitivity of musculoskeletal model-based lumbar spinal loading estimates to type of kinematic input and passive stiffness properties." *J Biomech* 102 (2020): 109659.
2. Kim, Hyun-Kyung and Yanxin Zhang. "Estimation of lumbar spinal loading and trunk muscle forces during asymmetric lifting tasks: Application of whole-body musculoskeletal modelling in OpenSim." *Ergonomics* 60 (2017): 563-576.
3. Von Arx, Michael, Melanie Liechti, Lukas Connolly and Christian Bangerter, et al. "From stoop to squat: A comprehensive analysis of lumbar loading among different lifting styles." *Front Bioeng Biotechnol* 9 (2021): 769117.
4. Wang, Wei, Dongmei Wang, Friedl De Groote and Lennart Scheys, et al. "Implementation of physiological functional spinal units in a rigid-body model of the thoracolumbar spine." *J Biomech* 98 (2020): 109437.
5. Pearsall, David J., J. Gavin Reid and Lori A. Livingston. "Segmental inertial parameters of the human trunk as determined from computed tomography." *Ann Biomed Eng* 24 (1996): 198-210.
6. Han, Kap-Soo, Thomas Zander, William R. Taylor and Antonius Rohlmann. "An enhanced and validated generic thoraco-lumbar spine model for prediction of muscle forces." *Med Eng Phys* 34 (2012): 709-716.

***Address for Correspondence:** Aaer Liu, Department of Orthopaedics and Traumatology, Dalian University of Technology, Liaoning, China, E-mail: aaerl@gmail.com*

Received: 03 April, 2023, Manuscript No. jsp-23-95833; **Editor Assigned:** 05 April, 2023, PreQC No. P-95833; **Reviewed:** 17 April, 2023, QC No. Q-95833; **Revised:** 22 April, 2023, Manuscript No. R-95833; **Published:** 29 April, 2023, DOI: 10.37421/2165-7939.2023.12.588

How to cite this article: Liu, Aaer. "Review of Applications, Limitations and Challenges for Multibody Models of the Thoracolumbar Spine." *J Spine* 12 (2023): 588.