Perspective
Volume 10:3, 2023

Journal of Biomedical Systems & Emerging Technologies

ISSN: 2952-8526 Open Access

Biomedical Robotics and Automation Applications in Surgery and Rehabilitation: Perspective

Priya Sahoo*

Department of Robotics, University of the Cumberlands, Kentucky, USA

Introduction

Biomedical robotics and automation have revolutionized the field of healthcare by offering innovative solutions to improve surgical procedures and rehabilitation processes. This cutting-edge technology combines the precision and accuracy of robotics with the expertise of medical professionals, leading to better patient outcomes, reduced risks and enhanced efficiency in healthcare settings [1].

Biomedical robotics in surgery

Robotic-assisted surgery: Robotic-assisted surgery, also known as robot-assisted surgery, is one of the most prominent applications of biomedical robotics in the surgical domain. It involves the use of robotic systems to enhance the capabilities of surgeons during minimally invasive procedures [2]. Robotic surgical systems offer several advantages, such as increased dexterity, precise movements and reduced hand tremors, enabling surgeons to perform complex surgeries with greater accuracy.

Description

The da Vinci Surgical System is a leading example of robotic-assisted surgery. It consists of a console where the surgeon controls the robotic arms that hold surgical instruments. The system provides a 3D view of the surgical site and translates the surgeon's hand movements into smaller, more precise actions performed by the robotic arms. This technology has been successfully employed in various surgeries, including prostatectomy, gynecologic procedures and cardiac surgeries.

Benefits of robotic-assisted surgery

The integration of robotics in surgery brings several benefits to both patients and healthcare professionals. Firstly, the minimally invasive nature of robotic-assisted surgery results in smaller incisions, reducing the risk of infection and post-operative complications. Patients experience less pain and discomfort, leading to shorter hospital stays and faster recovery times.

Secondly, the increased precision of robotic systems allows surgeons to target specific areas with greater accuracy, preserving healthy tissues and minimizing damage to surrounding structures. This precision is especially crucial in delicate surgeries, such as neurosurgery and ophthalmic procedures [3].

Thirdly, robotic-assisted surgery enables experienced surgeons to remotely assist or train less experienced colleagues across geographical distances. This capability has significant implications for global healthcare, as it facilitates the dissemination of specialized medical expertise to regions with limited access to surgical care.

Challenges and future directions

Despite its promising potential, robotic-assisted surgery faces several challenges. High costs associated with acquiring and maintaining robotic systems can limit their widespread adoption. Additionally, concerns about the learning curve for surgeons and potential technical malfunctions during procedures require ongoing research and training.

To overcome these challenges, ongoing advancements in artificial intelligence (AI) and machine learning hold the promise of making robotic systems more intuitive, autonomous and efficient. The integration of haptic feedback, virtual reality and augmented reality could further enhance the surgeon's capabilities, enabling more natural interactions with robotic systems and improving surgical outcomes.

Biomedical robotics in rehabilitation

Robotic-assisted rehabilitation: Biomedical robotics and automation have also made significant contributions to the field of rehabilitation. Robotic-assisted rehabilitation involves the use of robotic devices to assist patients in regaining motor functions and improving physical strength and flexibility [4]. These devices offer personalized therapy programs and real-time feedback, which are essential for maximizing the effectiveness of rehabilitation treatments.

Robotic exoskeletons are a prominent example of robotic-assisted rehabilitation devices. These wearable robotic structures are designed to support and augment a patient's movements during therapy sessions. They can be used for various conditions, such as spinal cord injuries, stroke recovery and musculoskeletal disorders.

Benefits of robotic-assisted rehabilitation: Robotic-assisted rehabilitation offers several advantages over traditional rehabilitation methods. Firstly, these devices provide precise and controlled movements, ensuring that patients perform exercises correctly and consistently. This consistency is crucial for promoting neuroplasticity and accelerating recovery.

Secondly, robotic-assisted rehabilitation allows therapists to customize treatment plans according to each patient's needs and progress. The devices collect data on the patient's performance, enabling therapists to monitor progress, make data-driven adjustments and optimize the rehabilitation process.

Thirdly, robotic devices can assist patients with severe impairments in performing exercises that would otherwise be challenging or impossible [5]. This capability expands the scope of rehabilitation and offers hope to patients with limited mobility.

Challenges and future directions

Despite the potential benefits of robotic-assisted rehabilitation, there are challenges that need to be addressed. The cost of these devices can be prohibitive for some healthcare facilities and patients. Moreover, the compatibility of robotic devices with different rehabilitation protocols and the need for extensive training for therapists remain areas of concern.

Looking ahead, researchers are exploring the integration of brain-computer

***Address for Correspondence:** Priya Sahoo, Department of Robotics, University of the Cumberlands, Kentucky, USA, E-mail: priya.s28@cumberlands.edu*

Received: 09 May, 2023, Manuscript No. bset-23-108711; **Editor assigned:** 10 May, 2023, PreQC No. P-108711; **Reviewed:** 02 June, 2023, QC No. Q-108711, **Revised:** 12 June, 2023, Manuscript No. R-108711; **Published:** 23 June, 2023, DOI: 10.37421/2952-8526.2023.10.169

interfaces (BCIs) with robotic devices to create more intuitive and personalized rehabilitation experiences. BCIs can allow patients to control robotic devices using their brain signals, enabling a more natural and engaging interaction during therapy sessions.

Additionally, advancements in soft robotics, which involve the use of flexible and compliant materials, may lead to more comfortable and adaptable robotic devices, enhancing patient comfort and acceptance during rehabilitation.

Conclusion

Biomedical robotics and automation applications in surgery and rehabilitation have redefined the landscape of healthcare by offering novel solutions to improve patient outcomes and optimize the efficiency of medical procedures. Robotic-assisted surgery has enabled surgeons to perform complex operations with higher precision, reduced invasiveness and improved patient recovery. Similarly, robotic-assisted rehabilitation has enhanced the effectiveness of physical therapy, leading to better functional outcomes for patients with various neurological and musculoskeletal conditions.

The continued research and development in the field of biomedical robotics hold the promise of even more sophisticated and accessible technologies in the future. As we move forward, it is essential to address the challenges related to cost, training and integration to ensure that these technologies become widely available and bring transformative changes to the field of healthcare. The collaboration between engineers, medical professionals and researchers will pave the way for a new era in medicine, where biomedical robotics and automation play a central role in enhancing human health and well-being.

Acknowledgement

None.

Conflict of Interest

None.

References

1. Chakravarty, Sumit. "Biomedical robotics." In *Adv Method Biomed Sig Process Analy* (2023). 159-174.
2. Singh, Tegh. "Recent Developments of Soft Robotics in Medical Applications." *J Stud Res* 12 (2023).
3. Garcia-Gonzalez, Alejandro, Rita Q. Fuentes-Aguilar and Ivan Salgado et al. "A review on the application of autonomous and intelligent robotic devices in medical rehabilitation." *J Braz Soc Mech Sci Eng* 44 (2022): 393.
4. Pradhan, Bikash, Deepti Bharti, Sumit Chakravarty and Sirsendu S. Ray, et al. "Internet of things and robotics in transforming current-day healthcare services." *J Healthc Eng* 2021 (2021): 1-15.
5. Das, Apurba and M. Nabi. "A review on soft robotics: Modeling, control and applications in human-robot interaction." In *2019 Int Conf Comput Comm Intelli Sys (ICCCIS)* (2019): 306-311.

How to cite this article: Sahoo, Priya. "Biomedical Robotics and Automation Applications in Surgery and Rehabilitation: Perspective." *J Biomed Syst Emerg Technol* 10 (2023): 169.