Chapter 15
Emerging Role of Artificial Intelligence and Robotics in Physiotherapy:
Past, Present, and Future Perspective

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ABSTRACT

Artificial intelligence (AI) is an area of computer science with a mathematical foundation that can potentially improve the healthcare system through innovative delivery methods, well-informed decision-making, and the promotion of patient engagement. It is widespread in the healthcare system and can be programmed to perform a certain task. AI will expedite diagnosis, improve performance, and produce reliable findings for patients and healthcare professionals. An essential member of the medical team is the physiotherapist. They are an integral part of contemporary clinical practice. Various advancements in AI and robotics can be used in physiotherapy for various rehabilitation protocols for improvement and better quality of life (QOL). Intelligent systems analyze patient data to tailor interventions, while robotic devices assist in precise, repetitive movements for targeted therapy. This synergy between technology and physiotherapy promises more effective and individualized care.

INTRODUCTION

The remarkable development in AI and robotics has been noticed during the previous decade. The innovators are looking for methods to merge people with robots for a better rehabilitation process and to

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improve their quality of life. Now at the start of the twenty-first century, we are at an inflection point beyond which we will see human cognition first augmented and then surpassed by artificially created intelligence (Chhadi & Patil, 2022). algorithms process vast amounts of patient data, aiding in accurate diagnosis and personalized treatment plans. Robotics, including exoskeletons and robotic devices, assist therapists in delivering targeted exercises and monitoring progress. These innovations aim to optimize rehabilitation outcomes, improve patient engagement, and provide more efficient healthcare solutions. The various advancements in AI and robotics in health care boost patient treatment and care.

AI refers to computers' ability to do activities that typically need human intellect –in other words, computers that can think. AI is a technology that humans can utilize to improve health care. AI in health care is widespread and can be programmed to perform a certain task (Familiari et al., 2022). Robotics is a term that is used to combine multiple terms, such as engineering, technology, and rehabilitation. Rehab robotics are designed to create robots that help the recovery of patients who have suffered from serious physical injuries (Pillai et al., 2020). Physiotherapy is a therapeutic intervention used to improve injury care, physical strength, body functioning, and overall body activity through the participation of body movement rather than drug involvement and surgery. Physiotherapists often work with other healthcare professionals to satisfy individuals' healthcare needs (Chillura et al., 2020).

AI is the creation of technology used to conduct technological operations requiring human intelligence involvement. The four types of AI are the theory of mind, self-awareness, reactive machines, and limited memory (Morris et al., 2023). It has played a significant role in developing technology that can be used in physiotherapy for various rehabilitation protocols for better improvement and quality of life. AI-powered tools assist in creating tailored exercise regimens, monitor progress, and offer real-time feedback. This not only enhances the efficiency of physiotherapy but also enables more individualized and adaptive approaches to rehabilitation. The ongoing integration of AI in physiotherapy can potentially improve patient outcomes and optimize therapeutic interventions. It helps the therapist get the necessary tools and assistance to provide the requisite patient care and support. Many studies have explored the role of AI and its subgroups, such as machine learning and deep learning, in pre-rehabilitation and post-surgical rehabilitation (Volpini et al., 2017). One among AI is virtual reality, which uses a computer interface that involves real-time simulation of an environment, scenarios, or activity. It allows for various rehabilitation protocols as it provides visual feedback, motivation, and patient engagement (Llamas-Ramos et al., 2022).

AI TOOLS FOR AUTOMATING THE ASSESSMENT OF PATIENT MOVEMENT, POSTURE, AND BIOMECHANICS

Several AI tools such as computer vision, wearable devices, machine learning models, IoT sensors, virtual reality, and natural language processing can significantly enhance the assessment and monitoring of patient movement by analyzing the video footage from cameras to collect data, assess patient movement, track & monitor their progress thereby, providing real-time feedback and alerts, leading to more personalized and effective healthcare interventions. AI tools can aid physiotherapy assessments by offering motion analysis, personalized exercise programs, and progress tracking. Technologies like computer vision, wearable sensors, and machine learning algorithms can be employed for accurate movement assessments, enhancing the precision of physiotherapy interventions.

The pose estimation models such as Open Pose/ PoseNet use computer vision to detect key points in the body & determine posture (Cao et al., 2016). Depth sensing cameras such as Microsoft Kinect/