Acta Scientific Orthopaedics (ISSN: 2581-8635)

Volume 8 Issue 7 July 2025

Editorial

The Evolving Role of Artificial Intelligence in Orthopaedics—A New Era of Precision and Possibility

Gunarathna K*

Department of Physiotherapy, Rajiv Gandhi University of Health Sciences/Harsha Institutions, India

***Corresponding Author:** Gunarathna K, Department of Physiotherapy, Rajiv Gandhi University of Health Sciences/Harsha Institutions, India.

Received: May 23, 2025

Published: June 01, 2025

In recent years, artificial intelligence (AI) has transitioned from a futuristic concept to a practical tool with growing relevance in clinical medicine, including orthopaedics. As healthcare increasingly embraces digital innovation, orthopaedic surgery and musculoskeletal care stand to benefit significantly from AI applications. From diagnostics and surgical planning to patient monitoring and rehabilitation, AI is poised to enhance decision-making, improve outcomes, and streamline clinical workflows.

One of the most immediate impacts of AI in orthopaedics is in imaging. Machine learning algorithms, particularly deep learning models, have shown remarkable accuracy in interpreting radiographs, CT scans, and MRIs. For instance, AI systems can now detect fractures, grade osteoarthritis, and even predict the progression of spinal deformities with precision comparable to expert radiologists. This not only improves diagnostic efficiency but also aids clinicians in areas with limited access to subspecialty expertise.

Surgical planning is another frontier being reshaped by AI. Advanced algorithms can analyse vast datasets to optimize implant selection, predict surgical risks, and model biomechanical outcomes. Robotic-assisted orthopaedic surgery, while not strictly AI-driven, increasingly incorporates machine learning to refine intraoperative decisions based on real-time data. As these technologies mature, we can expect a paradigm shift toward more personalized and predictive surgical care.

AI also holds promise in postoperative care and rehabilitation. Wearable sensors and smart devices, when combined with AI, offer real-time insights into patient recovery, enabling clinicians to adjust rehabilitation protocols dynamically. This has the potential to reduce complications, detect early signs of failure, and improve patient adherence to prescribed therapies.

However, the integration of AI into orthopaedic practice is not without challenges. Ethical concerns around data privacy, algorithmic bias, and the dehumanization of care must be addressed. Moreover, clinicians must remain vigilant against overreliance on AI systems, ensuring that human judgment and patient-centric care remain at the forefront.

The care continuum in orthopaedics does not end in the operating room. Recovery, rehabilitation, and long-term functional outcomes are equally critical. AI can play a pivotal role in postoperative management through the integration of wearable devices, remote monitoring platforms, and telemedicine.

Wearable sensors embedded in braces or clothing can capture real-time data on joint movement, muscle activation, and gait patterns. AI algorithms then analyse this data to assess recovery progress, detect early signs of complications, and suggest personalized exercise regimens. A notable application is in anterior cruciate ligament (ACL) rehabilitation, where smart knee braces can monitor range of motion and load distribution, adjusting protocols dynamically.

Tele-rehabilitation, supported by AI-powered chatbots and virtual assistants, is gaining popularity, especially in the post-COVID-19 landscape. These platforms can guide patients through exercises, monitor adherence, and flag abnormal trends, thereby reducing the need for frequent in-person visits and improving access to care. As we look to the future, it is essential that orthopaedic surgeons engage with these technologies critically and collabora-

tively. Research must continue to validate AI tools across diverse populations and settings, and training programs must evolve to include data literacy and digital competence.

In conclusion, AI is not a replacement for the orthopaedic surgeon—it is a powerful adjunct that can augment our capabilities and improve care delivery. By embracing innovation while upholding the principles of clinical excellence and ethical responsibility, the orthopaedic community can lead the way in shaping a future where technology and human expertise work hand in hand.