Training of a Joint Replacement Surgeon in India: Past, Present, and Future Perspectives

Kunal Aneja[1,2], Ponnanna Karineravanda Machaiah[3], Ashok Shyam[4]

Learning Point of the Article:

The training of joint replacement surgeons in India has transitioned from traditional apprenticeship models to a more structured, technology-driven approach. Emerging technologies such as augmented reality and virtual reality and fully automated, indigenously developed MISSO joint robotic system designed to carter the global population, are transforming the landscape of surgical training. These innovations offer surgeons enhanced precision and diverse practice opportunities, thereby elevating their expertise.

Collaboration with industry leaders, particularly with companies like Meril Healthcare Pvt. Ltd., India plays a crucial role in driving these advancements. Through specialized courses, workshops, and mentorship programs, these partnerships foster skill development and knowledge exchange. This continuous evolution ensures that Indian surgeons remain at the forefront of global orthopedic practices, setting benchmarks for excellence in joint replacement surgery.

Introduction

In recent years, the landscape of joint replacement surgery in India has undergone significant transformation, not only in the scope of procedures but also in the training pathways for surgeons specializing in this field [1]. As the incidence of joint-related ailments, such as osteoarthritis, continues to rise, the need for highly skilled joint replacement surgeons becomes increasingly critical [2]. This editorial explores the evolution of surgeon training in India, highlighting key milestones from traditional methods to modern-day advancements, and how the future holds exciting prospects for further skill acquisition, particularly with the support of industry partners in India.

The Past: Apprenticeships and Cadaveric Training

Historically, the training of joint replacement surgeons in India was heavily based on an apprenticeship model, where budding surgeons learned by observing and assisting senior experts in real-world surgical settings [3]. While effective, this method had inherent limitations in terms of scalability and availability of high-volume learning opportunities.

Cadaveric courses have been pivotal in surgical training for decades, offering young surgeons the opportunity to practice and refine their techniques on human anatomy. However, access to cadaveric specimens was often limited, especially in regions with underdeveloped healthcare infrastructure. As a result, hands-on learning in the early stages was restricted to a few privileged learners who had access to leading institutions [4].

The Present: Structured Training Programs and Technological Integration

Today, the training paradigm has shifted significantly toward a more structured and technologically advanced model. A multitude of specialized courses, workshops, and fellowships have emerged to provide comprehensive education in joint replacement techniques. Saw bone workshops simulate real-life surgical scenarios on artificial bones, allowing trainees to repeat

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Author's Photo Gallery


Dr. Kunal Aneja


Dr. Ponnanna Karineravanda Machaiah


Dr. Ashok Shyam

[1]Department of Orthopedic, Max Super Speciality Hospital Shalimar Bagh, New Delhi, India,
[2]Department of Orthopedic, Naveda Healthcare Centers, New Delhi, India,
[3]Department of Orthopedic, Sparsh Hospital Yeshwanthpur, Bengaluru, Karnataka, India,
[4]Department of Orthopedics, Sancheti Institute for Orthopedics and Rehabilitation, Pune, Maharashtra, India.

Address of Correspondence:
Dr. Kunal Aneja,
Department of Orthopedic Surgeon, Max Super Speciality Hospital, Shalimar Bagh, Delhi, India and Naveda Healthcare Centers, Delhi, India.
E-mail: drkunalaneja@gmail.com

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the steps of joint replacement without the pressures of a live operation [5]. This repetitive practice is crucial for mastering complex techniques, such as robotic-assisted knee arthroplasty and hip replacements.

The rise of hip and knee master courses, involving experts from around the world, provides specialized guidance in the latest techniques and technologies, further improving the capabilities of Indian surgeons [6]. Another critical aspect of current training is surgeon exchange programs and fellowships, which provide exposure to diverse surgical techniques and patient populations. International surgeon visitations and traveling fellowships allow Indian surgeons to observe best practices globally and apply them in local contexts, broadening their perspectives and skills [6].

Remote mentorship and virtual platforms, particularly during and after the COVID-19 pandemic, have opened avenues for continuous learning and real-time guidance from global experts, thereby overcoming geographical barriers [5].

The Future: Technology-Driven Training Innovations

As we look to the future, technology will play an increasingly pivotal role in shaping the training landscape. Augmented reality (AR) has the potential to revolutionize how surgeons are trained in joint replacement procedures [7]. AR can simulate 3D models of joints, overlaying them onto real-time environments, allowing trainees to visualize and practice complex procedures with greater precision and accuracy [8]. AR-guided surgeries can offer step-by-step feedback, providing an unparalleled learning experience [8].

The MISSO Joint Robotic System (Meril Healthcare Pvt. Ltd., Gujarat, India) represents a significant advancement in orthopedic surgery, offering personalized pre-operative planning and precise bone resections. Designed to cater to a global population, MISSO is a fully automatic, versatile joint robot and can accommodate anatomical variations across different ethnicities, making it suitable for patients worldwide. By integrating MISSO robotic system into surgical training programs, trainees can gain hands-on experience with cutting-edge robotic technology, enhancing their proficiency in joint replacement procedures. The system's ability to create accurate 3D bone models from patient CT scans allows for virtual surgeries, enabling trainees to practice and refine their skills in a controlled, risk-free environment. This approach not only improves surgical precision but also accelerates the learning curve for emerging surgeons.

Virtual reality (VR) simulators are also expected to become integral to surgical education. These platforms will allow for immersive, risk-free practice of complicated joint replacement techniques, further boosting the confidence and competence of future surgeons [9].

Addressing Challenges in the Training Ecosystem

While the advancements in technology and structured programs have significantly improved the training landscape, several challenges remain. Access to high-quality training can be limited by geographical and financial constraints, particularly in rural areas where resources for cutting-edge technology may not be readily available. Despite the growing number of specialized courses, not all aspiring joint replacement surgeons in India have equal access to these opportunities [1].

Language and cultural barriers may also affect the effectiveness of surgeon exchange programs and international fellowships. While global exposure is critical for skill development, there can be challenges in applying these techniques in the Indian context, where patient demographics, anatomical variations, and socioeconomic factors may differ from the settings in which they are initially learned [10].

Solutions and the Way Forward

To address these challenges, virtual learning platforms and remote mentorship programs have proven to be valuable tools. They allow surgeons from all regions of the country to participate in world-class training without the need for extensive travel or significant financial burdens [9]. In addition, telemedicine and tele-education platforms offer real-time feedback and case discussions, fostering continuous learning [11].

National and international collaborations between healthcare institutions, training academies, and industry players are vital in expanding the reach of these programs. Moreover, government and regulatory bodies must play a proactive role in setting guidelines for the integration of new technologies such as AR and VR in medical training [12]. Standardizing curriculums for joint replacement surgery and ensuring that all surgeons have access to accredited programs will further raise the standard of orthopedic care across the country.

The Importance of Lifelong Learning

As technologies continue to evolve, so too must the education and training of joint replacement surgeons. The concept of lifelong learning has become critical in modern healthcare, particularly in highly technical fields like joint replacement surgery [5]. Surgeons must continuously adapt to new tools, implants, and surgical techniques to provide the best possible

outcomes for their patients.

Industry partners like Meril Healthcare Pvt. Ltd., India, along with academic institutions and professional societies, are crucial in facilitating this ongoing education through refresher courses, advanced fellowships, and continuous professional development programs.

The Role of Industry

Industry partnerships are an essential component of the evolving training ecosystem, and Meril Healthcare Pvt. Ltd., a prominent Indian medical device company, has been at the forefront of supporting educational initiatives for joint replacement surgeons [13]. Through Meril Academy, the company has established itself as a key player in organizing structured training programs, including cadaveric workshops, AR-assisted training sessions, and specialized courses on the latest advancements in joint replacement technology [14].

Meril's focus on fostering innovation in orthopedic education is evident in their support for surgeon visitation programs and fellowships, which provide Indian surgeons with opportunities to train with global experts and adopt best practices from around the world [14]. By collaborating with key opinion leaders, Meril has contributed significantly to elevating the standard of care in joint replacement surgery in India [13].

Moreover, Meril's contributions to training using cutting-edge implants and surgical tools are directly influencing the quality of outcomes in joint replacement surgeries. Their commitment to providing high-quality educational resources and hands-on workshops is not only helping to improve surgeon skill levels but also ensuring that Indian patients benefit from world-class care [14].

Other industry leaders such as J and J, Smith and Nephew, and Stryker have also been contributors. They provide cutting-edge surgical implants, robotic systems, and training workshops that elevate the standard of care in India. These partnerships foster innovation, with surgeon visitation programs and fellowships offering invaluable exposure.

Conclusion

The training of joint replacement surgeons in India has evolved from the traditional apprenticeship model to a sophisticated, technology-driven paradigm. The future promises even greater advancements, with AR, VR and remote mentorship poised to redefine surgical education. The contributions of industry partners like Meril Healthcare Pvt. Ltd., India, have been instrumental in this evolution, providing much-needed support through structured programs and access to the latest technologies.

As the demand for joint replacement surgeries continues to rise in India, so does the need for highly skilled surgeons capable of performing complex procedures with precision. Through continued innovation in training methods and collaborative efforts between educational institutions and industry leaders, the future of joint replacement surgery in India looks brighter than ever.

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