PREFACE

Since orthopedic surgery was first performed, innovation has driven technological advancements in the diagnosis and treatment of patients with musculoskeletal injuries. The evolution of computers with Internet and cloud technology, improvements in imaging, and the development of artificial intelligence (AI) and additive manufacturing have created a "paradigm shift" in orthopedic surgery and overall health care. Diagnostic challenges are being met by high-tech improvements in imaging, such as three-dimensional (3D) computerized tomography and four-dimensional MRI. Computer navigation and simulation programs are now assisting with preoperative planning. Robot-assisted surgery has become common in many facilities, playing a crucial role in total joint arthroplasty, spine surgery, and tumor reconstruction. These robotic systems offer better precision and accurate implant placement, resulting in reproducible patient outcomes. Sensor-based technology now allows monitoring of postoperative recovery and rehabilitation after joint replacement, and AI is finding its way from basic science to clinical applications in areas of preoperative risk assessment and image recognition that will aid surgeons in making clinical decisions. Current technology will continue to expand and be incorporated into orthopedic practices, and it is imperative that these new developments be implemented only after a careful study of risks versus benefits as well as costs.

This issue is devoted to these rapidly evolving technologies. It includes articles on robot-assisted total joint replacement of the hip, knee, and shoulder, with findings that suggest improved functional positioning of implants leads to better patient outcomes. These robotic and navigational systems likely represent the future of total joint arthroplasty, and reports indicate they can be done safely and efficiently in ambulatory-surgery settings in select patients. Also gaining traction are telemedicine and remote patient monitoring via wearable or implantable sensors, which are showing promising results especially in total joint rehabilitation.

The integrity and longevity of implants have long been concerns in arthroplasty. Corrosion occurs with metal alloys and can occasionally impair function or adversely affect patients. This is one area where AI can assist by determining the likelihood of that occurring. With translational studies on AI lacking, this issue includes a systematic review of the literature on AI and its use in predicting implant corrosion. Also included is a survivorship study of 3D-printed unicompartmental knee arthroplasties in 92 patients that notes favorable early outcomes with an 8.6% overall complication rate.

The use of robotics has gained a foothold in total joint reconstruction, but the most frequent application is in spine surgery. Two studies published in this issue, one in adult and one in pediatric spine surgery, note that computer navigation increases accuracy of pedicle screw placement and can achieve maximum deformity correction while avoiding vascular or neurologic complications. Decreased radiation exposure to surgeons and minimally invasive surgery application are additional benefits.

Technological advancements have occurred in the field of cartilage repair as well. This issue discusses the treatment of osteochondral lesions of the ankle, including augmentation with biologic adjuvants for small lesions and the use of osteochondral transplantation for large lesions that can be enhanced by using biologic adjuvants.

As always, I thank the authors for their outstanding contributions and hope that readers find these articles useful as they contemplate incorporating newer technologies into their practices.

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Orthop Clin N Am 54 (2023) xv
https://doi.org/10.1016/j.ocl.2023.01.001