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Editorial

Evolution or Revolution: Is Robotics the New Age Digital Shift in Dental Education?

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Editorial

For years, technology has been the primary driver of dentistry's evolution. Advancements in radiology, biomaterials, scanning, and milling technologies have forged a path for clinicians to expand their scope of practice, offering patients more predictable and accepted outcomes, with shortened chairside times needed for care delivery.

Recent developments in haptic robotic guidance systems for implant placement, YOMI© (Neocis Inc, Miami, Florida, USA), is no exception. The testing grounds for many new technologies are at educational institutions. One of the United States' premier educational institutions, New York University - College of Dentistry, has been at the forefront of this endeavor, integrating this technology into its undergraduate DDS curriculum. Broader adoption of this platform in an academic institution will allow students to gain exposure to the industry's most advanced technology and gain access to aspects of dentistry that have not traditionally been seen at the undergraduate level. Allowing students access to this state-of-the-art technology has allowed them the ability to learn, practice, and apply material taught in didactic courses to real-life clinical experiences.

The United States Food and Drug Administration (FDA) approved this robot-guided implant system for use in 2017. The system functions to augment precision during implant surgery, allowing the clinician to deliver implants with limited positional and angular errors from the treatment planned location. The technology requires a two-person team composed of a driver

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and a surgeon. The driver is accountable for using the computer-borne software to help calibrate, configure, and direct the surgeon while the surgeon treatment plans the ideal placement of the implant and conducts the surgery. Both positions offer ample opportunity for students to learn the nuances of implant surgery. It is imperative that competency in traditional implant workflow is demonstrated prior to utilizing this technology.

In their didactic coursework, undergraduate DDS students learn the basics of implantology, indications and contraindications, osseous structure requirements, techniques, and materials used during the steps of implant surgery but seldom apply this knowledge clinically. On May 4th, 2022, three students at NYU Dentistry became the first pre-doctoral students in the United States to perform a dental implant surgery using robotic-guided technology under the Perspectives direct supervision of two clinical associate professors in the Department of Oral and Maxillofacial Surgery. The students had previously observed and assisted for approximately 20 faculty-led implant procedures using the YOMI robotic system prior to the day of the surgery.

Additionally, the students participated in supplemental didactics and in-person training sessions with faculty in advance of the procedure to ensure proficiency and understanding of implant procedural steps and armamentarium, surgical treatment planning using the computer software, and interpretation of CBCT imaging. Throughout the school year, the students who completed the surgery were also actively involved in organizing and leading a series of events through the oral surgery and periodontal clubs at NYU Dentistry for other interested third- and fourth-year DDS students. These "Clinical Pearls of Implantology" events emphasized interdisciplinary practice between the Oral Surgery, Periodontics and Implant Dentistry, and Prosthodontics departments. Faculty participation and student involvement from each discipline not only increased engagement among the NYU community, but also highlights the fact that implants are quickly becoming ubiquitous throughout dentistry, with applications in general dentistry and nearly every specialty. This event series included dental implant treatment planning case reviews with faculty mentors, hands-on simulations with the robotic technology using typodonts, and practice sessions with representatives from various implant manufacturers. Additionally, there was also a mandatory journal club component to the "Clinical Pearls" where students were required to read articles on guided bone regeneration and implant workflow to prepare for the simulation sessions. Faculty from each discipline were instrumental in these lectures and hands-on sessions, and they provided tremendous mentorship and knowledge about the field of implant dentistry.

With social media becoming an ever-present part of daily life, the tosee for how dental schools and residency programs have leveraged this technology for educational purposes has already been started. It is only natural that dental schools embrace this technology instead of shying away from it. In our experiment, social media and email newsletters were used to promote the event series, which offered a unique opportunity to educate students on dental implants in a way that is readily accessible and easy to digest. Social media is an intriguing frontier that is just beginning to be explored, and it will be interesting to see the impact the medium has on the field of dentistry in terms of the rapid sharing of ideas, opportunities for collaboration, connectedness, and educational reach. Preceding the surgery, the students evaluated the patient's overall health and oral status to determine if the patient was deemed an acceptable recipient for an implant. Since the edentulous site was an extraction site, students applied their

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clinical knowledge to coordinate a bone grafting procedure with our postgraduate residents. After satisfactory healing, the students then reevaluated the socket preservation site and determined that it would be acceptable as a recipient site for the implant. Integrating their restorative curriculum into the implant workflow, the students then created intraoral scans and a digital wax-up to ensure that restorative outcomes and parameters were met following implant placement.

On the day of surgery, the students were able to collaborate with a radiologist to take a cone beam computed tomography (CBCT) scan and interpret the results. The students took time before the surgery to identify key anatomic landmarks, adequacy of the patient's alveolar ridge, angulation, and depth of the proposed implant, in addition to screening for incidental findings on the scan. Throughout surgery, the traditional steps of implant workflow were adhered to. Sequential osteotomy and angulation checks were performed periodically during the procedures. The students exercised their knowledge of tapping, placing implant, and parameters surrounding placing and torquing the implant. Overall, the students employed a multidisciplinary approach to conducting the implant surgery, which exercised their knowledge and competency in the aforementioned topics to deliver results.

Looking ahead, NYU Dentistry is excited to continue the process of incorporating robotic-assisted implant dentistry into the formal undergraduate DDS curriculum. NYU Dentistry is already in the preliminary stages of implementing this new program through the "Clinical Pearls of Implantology" event series, and the goal is for the Class of 2025 students to have access to a brand-new set of learning modules and in-person simulation experiences that are included in their curriculum by their D2 year. This virtual "Surgical Classroom" consists of online lectures and assessments designed to promote a strong foundation in surgical principles related to implant dentistry, flap design and wound healing, and the use of robotic-assisted technology.

Technology has served as the cornerstone for scientific understanding and clinical applications. The integration of robotically assisted implant systems into the pre-doctoral DDS curriculum highlights how technology can also be used to provide students with exciting opportunities to perform procedures that have been previously limited to experienced clinicians. The new robotically assisted surgical implant curriculum at NYU Dentistry has dramatically increased excitement and enthusiasm regarding dental implantology among DDS students, making the procedure more tangible and accessible, while still being a safe and controlled environment. Given the increasing number of students entering private practice, not to mention the rising popularity of dental implants, educational institutions should utilize new technologies that can empower students for clinical practice in the real world.

"Therefore, the shift to digital needs to be the new norm in dentistry for the connected student".

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