The importance of basic and engineering sciences for next generation research in the field of oral and maxillofacial surgery

Pil-Young Yun, D.D.S., Ph.D.

Section Editor of JKAOMS

Department of Oral and Maxillofacial Surgery, Section of Dentistry, Seoul National University Bundang Hospital, Seongnam, Korea

With the help of tremendous advancements in science and technology, there has been remarkable progress in the medical and dental fields. Recently, changes in research trends in dentistry have been accelerated[1]. Researchers on oral and maxillofacial surgery have to create additional and constant efforts to keep up with the rapid pace of changes and enhance national competitiveness in dental research. Therefore, it is important to broaden knowledge on basic and engineering sciences as well as consider how to apply such technological outcomes in dentistry to improve quality and widen the field of study.

One major field in dental research is artificial intelligence (AI), a branch of computer science based on deep learning and machine learning technology. Many trials have been implemented for training computers to read medical radiographic images through deep learning processes. It is expected that AI will be able to diagnose and create treatment plans for medical and dental diseases in the near future[2]. Research on dental radiographic image reading should be focused on preliminary readings or act as a backup option for dentists. Big data analysis (BDA) is one of the main themes of medical and dental sciences. The development of computing power allows large-size clinical data analysis. Although there are still issues on personal information protection and regulation, BDA will provide powerful tools to correct diag-

noses and develop treatment plans[3]. Furthermore, it will also be applicable for personal oral health status evaluation and prognoses prediction, and for setting up dental health care and prevention policies nationwide on the basis of medical and dental check-up data. Outcomes from BDA will provide desirable information to standardize dental treatment or to estimate reasonable dental fees. Therefore, it is necessary to learn basic information on BDA and programming languages such as python and Java to efficiently perform projects even if there is collaboration with machine learning specialists or participants in joint research. By obtaining this knowledge, researchers will be actively involved in the project at the level of generating ideas or performing research design.

Genomic analysis is regarded as the key factor of precision medicine or personalized medicine. There are relatively few trials in the field of oral cancer regardless of the considerable research outcomes that have been collected, especially in the field of oncology. Even though there are many advantages of saliva analysis including simple and noninvasive sample collection, studies on saliva analysis have yet to progress. It is essential that studies on saliva analysis continue in order to discover credible biomarkers in saliva. It is possible that microbiome research on oral microflora can provide evidence for future saliva treatment for chronic periodontitis[4,5]. To perform genomic and saliva related research effectively, researchers must have more than the basic level of knowledge on biotechnology and bioinformatics.

There are other themes related to cutting-edge technology including virtual reality/augmented reality (VR/AR) and robotics. VR/AR is a rising issue in dentistry[6] and has been applied in dentistry to reduce the anxiety of children during dental treatment or operations. The development of VR/AR content on dental practice training and education is also very helpful in order to improve clinical abilities because the assigned time for clinical practice has been shortened in train-

Pil-Young Yun
Department of Oral and Maxillofacial Surgery, Section of Dentistry, Seoul National University Bundang Hospital, 82 Gumi-ro 173beon-gil, Bundang-gu, Seongnam 13620, Korea
TEL: +82-31-787-7545   FAX: +82-31-787-4068
E-mail: pilyoung@snubh.org
ORCID: https://orcid.org/0000-0001-6097-1229

ing programs for dental students. Robotic surgery has yet to become popular in oral and maxillofacial surgery. However, it is evident that robotic surgery will provide solutions to overcome the limitation of narrow surgical fields in trans-oral approaches. Therefore, it is important to miniaturize robotic arms in order to perform surgery efficiently and safely without damaging intraoral structures including teeth. Also, there are several trials on navigation surgery systems combining imaging and location data in real time and controlling components including position and gyroscopic sensors, especially in the field of dental implant surgery[7]. Practically, the design of robots for suctioning or assistance in dental clinics is of great interest.

It is generally accepted that convergence studies are as important as traditional medical and dental studies. Therefore, communication among researchers in different specialties is critical to performing these convergence studies. If we have knowledge on basic and engineering sciences, we can play greater roles in research through participation in convergence studies or research consortiums.

It is recommended that courses on basic and engineering sciences be provided in the curriculum for dental students in order to train them to become our next generation of researchers and scholars in dental science[8-10].

Dental researchers should enrich their analysis from a generational idea and research design standpoint, and consequently, contribute to providing safe and appropriate treatments to patients with varied professional ideas that will provide patients with the greatest benefit.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

References

1. Baum BJ, Scott J, Bickel M, Gombos G, Greenspan JS, Guo W, et al. 5.3 Global challenges in research and strategic planning. Eur J Dent Educ 2002;6 Suppl 3:179-84.
2. Lee JH, Kim DH, Jeong SN, Choi SH. Diagnosis and prediction of periodontally compromised teeth using a deep learning-based convolutional neural network algorithm. J Periodontal Implant Sci 2018;48:114-23.
3. Balas EA, Vernon M, Magrabi F, Gordon LT, Sexton J. Big data clinical research: validity, ethics, and regulation. Stud Health Technol Inform 2015;216:448-52.
4. Chen C, Hemme C, Beleno J, Shi ZJ, Ning D, Qin Y, et al. Oral microbiota of periodontal health and disease and their changes after nonsurgical periodontal therapy. ISME J 2018;12:1210-24.
5. Khurshid Z, Zohaib S, Najeeb S, Zafar MS, Rehman R, Rehman IU. Advances of proteomic sciences in dentistry. Int J Mol Sci 2016;17:E728.
6. Huang TK, Yang CH, Hsieh YH, Wang JC, Hung CC. Augmented reality (AR) and virtual reality (VR) applied in dentistry. Kaohsiung J Med Sci 2018;34:243-8.
7. Sun X, Yoon Y, Li J, McKenzie FD. Automated image-guided surgery for common and complex dental implants. J Med Eng Technol 2014;38:251-9.
8. Baum BJ. Inadequate training in the biological sciences and medicine for dental students: an impending crisis for dentistry. J Am Dent Assoc 2007;138:16, 18, 20 passim.
9. Dennis MJ. Integration of medicine and basic science in dentistry: the role of oral and maxillofacial surgery in the pre-doctoral dental curriculum. Eur J Dent Educ 2010;14:124-8.
10. DePaola DP. The revitalization of U.S. dental education. J Dent Educ 2008;72(2 Suppl):28-42.