Bölüm 1

Ağız, Diş ve Çene Cerrahisi Alanında Yapay Zeka

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Giriş

"İnsan benzeri zeki makineler özellikle de zeki bilgisayar programları yapma bilimi ve mühendisliği" olarak McCarthy tarafından tanımlanan "Yapay zekâ" teriminin ilk olarak ortaya çıkışı 1956'da Hannover, New Hampshire, Dartmouth College'da yapılan bir konferansta gerçekleşmiştir (1). Yapay zekâ tanım olarak bir karar verme ve problem çözme modelidir (2).

Yapay zekânın tıp ve diş hekimliği alanındaki uygulamaları son yıllarda giderek artış göstermektedir. Bunun sebebi olarak yapay zekâ ve derin öğrenme uygulamalarının performansının, alanında uzman klinisyenlerle kıyaslandığında gösterdiği yüksek doğruluk ve verimlilik oranları gösterilebilir (3).

Diş hekimliğinde yapay zekâ ağız diş ve çene radyolojisi, ağız, diş ve çene cerrahisi, periodontoloji, ortodonti, adli diş hekimliği, restoratif diş hekimliği gibi birçok uzmanlık alanında kullanılmaktadır (4-9).

Bu çalışmada son yıllarda popüler hale gelmiş olan yapay zekâ sistemleri ile diş hekimliğinde ve ağız, diş ve çene cerrahisi alanında yapılan çalışmalardan ve uygulamalardan bahsedilecektir.

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Tablo 2. Ağız, Diş ve Çene Cerrahisi Alanında Yapay Zekâ Uygulamaları	
Ağız, Diş ve Çene Cerrahisinde Yapay Zekâ	
Yazarlar	Uygulama Alanı
Zhang ve ark. (52)	Diş çekimi sonrası postoperatif şişlik tahmini
Orhan ve ark. (53)	Üçüncü molar dişlerin tespiti ve anatomik yapılarla ilişkilerinin değerlendirilmesi
Vinayahalingam ve ark. (54)	Üçüncü molar dişlerin ve inferior alveolar kanalın segmentasyonu
Yoo J-H ve ark. (55)	Üçüncü molar dişlerin çekim zorluğunun değerlendirilmesi
Hadj Said ve ark. (57)	Dental implant tanımlaması
Lee ve ark. (58)	Dental implantlarda fraktür tespiti
Sakai ve ark. (59)	Dril protokolü tahmini
Cha ve ark. (42)	Peri-implantitis tanısı
Bayrakdar ve ark. (60)	İmplant planlama protokolleri
Patcas ve ark. (61)	Ortognatik tedavinin tahmini etkileri
Choi H-I ve ark. (62)	Cerrahi operasyon gerektiren ve gerektirmeyen ortodonti hastalarının belirlenmesi

Sonuç

Sonuç olarak ilerleyen dönemlerde ağız, diş ve çene cerrahisi alanında da yapay zekâ uygulamalarını içeren eğitim ve yayın kalitesinde iyileştirmeler beklenmektedir. Ağız, diş ve cerrahisi asistanları ve uzmanları eğitim programlarını optimize etmeli, klinik uygulanabilirliğini anlamalı ve rutin klinik süreçte nasıl kullanılabileceği ve düzenlenebileceği konusunda araştırmalar yapmalıdır.

KAYNAKÇA

1. Moor J. The Dartmouth College artificial intelligence conference: The next fifty years. *Ai Magazine.* 2006;27(4):87-. doi.org/10.1609/aimag.v27i4.1911
2. Chen Y-w, Stanley K, Att W. *Artificial intelligence in dentistry: current applications and future perspectives.* Quintessence Int. 2020;51(3):248-57.
3. Eschert T, Schwendicke F, Krois J, et al. A survey on the use of artificial intelligence by clinicians in dentistry and oral and maxillofacial surgery. *Medicina*. 2022;58(8):1059. doi.org/10.3390/medicina58081059
4. White SC, Pharoah MJ. *Oral radiology-E-Book: Principles and interpretation:* Elsevier Health Sciences; 2014.

5. Lee J-H, Kim D-h, Jeong S-N, et al. Diagnosis and prediction of periodontally compromised teeth using a deep learning-based convolutional neural network algorithm. *Journal of periodontal & implant science.* 2018;48(2):114-23. doi.org/10.5051/jpis.2018.48.2.114
6. Rasteau S, Ernenwein D, Savoldelli C, et al. Artificial intelligence for oral and maxillofacial surgery: A narrative review. *Journal of Stomatology, Oral and Maxillofacial Surgery.* 2022. doi.org/10.1016/j.jormas.2022.01.010
7. Xie X, Wang L, Wang A. Artificial neural network modeling for deciding if extractions are necessary prior to orthodontic treatment. *The cAngle Orthodontist.* 2010;80(2):262-6. doi.org/10.2319/111608-588.1
8. De Tobel J, Radesh P, Vandermeulen D, et al. An automated technique to stage lower third molar development on panoramic radiographs for age estimation: a pilot study. *The Journal of forensic odonto-stomatology*. 2017;35(2):42.
9. Srivastava MM, Kumar P, Pradhan L, et al. Detection of tooth caries in bitewing radiographs using deep learning. *ArXiv preprint ArXiv:*171107312. 2017. doi.org/10.48550/arXiv.1711.07312
10. Kaplan A, Haenlein M. Siri, Siri, in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence. *Business Horizons.* 2019. doi.org/10.1016/j.bushor.2018.08.004
11. Kositbowornchai S, Siriteptawee S, Plermkamon S, et al. An artificial neural network for detection of simulated dental caries. *International Journal of Computer Assisted Radiology and Surgery.* 2006;1(2):91-6. doi.org/10.1007//s.11548-006-0040-x
12. Khajanchi A. *Artificial neural networks: the next intelligence. USC,* Technology Commercalization Alliance http://www.usc. edu/org/techalliance/Anthology2003/Final_Khajanch pdf. 2003.
13. Khanagar SB, Al-Ehaideb A, Maganur PC, et al. Developments, application, and performance of artificial intelligence in dentistry–A systematic review. *Journal of dental sciences.* 2020. doi.org/10.1016/j.jds.2020.06.019
14. Nichols JA, Chan HWH, Baker MA. Machine learning: applications of artificial intelligence to imaging and diagnosis. *Biophysical reviews.* 2019;11(1):111-8. doi.org/10.1007/s12551-018-0449-9
15. Neri E, de Souza N, Brady A, et al. What the radiologist should know about artificial intelligence-an. *European Society of Radiology.* 2019. doi.org/10.1186/s13244-019-0738-2
16. Brotchie P. *Machine learning in radiology.* Wiley Online Library; 2019.
17. Murphy KP. *Machine learning: a probabilistic perspective:* MIT press; 2012.
18. Lee J-G, Jun S, Cho Y-W, et al. Deep learning in medical imaging: general overview. *Korean journal of radiology.* 2017;18(4):570. doi.org/10.3348/kjr.2017.18.4.570
19. Bouletreau P, Makaremi M, Ibrahim B, et al. Artificial intelligence: applications in orthognathic surgery. *Journal of stomatology, oral and maxillofacial surgery*. 2019;120(4):347-54.
20. Lessick J, Abadi S, Agmon Y, Keidar Z, Carasso S, Aronson D, et al. Multidetector computed tomography predictors of late ventricular remodeling and function after acute myocardial infarction. E*uropean journal of radiology.* 2012;81(10):2648-57. doi.org/10.1016/j.ejrad.2011.12.016
21. Estava A, Kuprel B, Novoa R, et al. Dermatologist level classification of skin cancer with deep neural networks. *Nature.* 2017;542(7639):115-8.

22. Kim JH, Kim CH, Hur H, et al. Surgical Management For Rectal Gastrointestinal Stromal Tumor; Single institution experiences. *Korean Journal of Clinical Oncology.* 2012;8(2):105-11. doi.org/10.14216/kjco.12024
23. Hogarty DT, Mackey DA, Hewitt AW. Current state and future prospects of artificial intelligence in ophthalmology: a review. *Clinical & experimental ophthalmology.* 2019;47(1):128-39. doi.org/10.1111/ceo.13381
24. Bibault J, Burgun A, Giraud P. Artificial intelligence applied to radiation oncology. *Cancer Radiotherapie: Journal de la Societe Francaise de Radiotherapie Oncologique.* 2017;21(3):239-43. doi.org/10.1016/j.canrad.2016.09.021
25. Marr B. *First FDA approval for clinical cloud-based deep learning in healthcare*. Forbes Forbes Publishing Company, New York City. 2017.
26. Otake T. *IBM big data used for rapid diagnosis of rare leukemia case in Japan.* The Japan Times. 2016.
27. Ghassemi M, Celi LA, Stone DJ. State of the art review: the data revolution in critical care. *Critical Care.* 2015;19(1):1-9. doi.org/10.1186/s13054-015-0801-4
28. Zhong F, Xing J, Li X, et al. Artificial intelligence in drug design. *Science China Life Sciences.* 2018;61(10):1191-204. doi.org/10.1007/s11427-018-9342-2
29. Allen Jr B, Seltzer SE, Langlotz CP, et al. A road map for translational research on artificial intelligence in medical imaging: from the 2018 National Institutes of Health/RSNA/ACR/The Academy Workshop. *Journal of the American College of Radiology.* 2019;16(9):1179-89. doi.org/10.1016/j.jacr.2019.04.014
30. Khanna S. Artificial intelligence: contemporary applications and future compass. *International dental journal.* 2010;60(4):269-72. doi.org/10.1922/IDJ_2422Khanna04
31. Khanagar SB, Al-Ehaideb A, Maganur PC, et al. Developments, application, and performance of artificial intelligence in dentistry–A systematic review. *Journal of dental sciences.* 2021;16(1):508-22. doi.org/10.1016/j.jds.2020.06.019
32. Krois J, Ekert T, Meinhold L, Golla T, Kharbot B, Wittemeier A, et al. Deep learning for the radiographic detection of periodontal bone loss. *Scientific reports.* 2019;9(1):1-6.
33. Davies A, Mannocci F, Mitchell P, et al. The detection of periapical pathoses in root filled teeth using single and parallax periapical radiographs versus cone beam computed tomography–a clinical study. *International endodontic journal.* 2015;48(6):582-92. doi.org/10.1111/iej.12352
34. Chen H, Zhang K, Lyu P, et al. A deep learning approach to automatic teeth detection and numbering based on object detection in dental periapical films. *Scientific reports*. 2019;9(1):1-11. doi.org/10.1038/s41598-019-40414-y
35. Tuzoff DV, Tuzova LN, Bornstein MM, et al. Tooth detection and numbering in panoramic radiographs using convolutional neural networks. *Dentomaxillofacial Radiology.* 2019;48(4):20180051. doi.org/10.1259/dmfr.20180051
36. Orhan K, Bayrakdar I, Ezhov M, et al. Evaluation of artificial intelligence for detecting periapical pathosis on cone-beam computed tomography scans. *International endodontic journal.* 2020;53(5):680-9. doi.org/10.1111/iej.13265
37. Kılıc MC, Bayrakdar IS, Çelik Ö, et al. Artificial intelligence system for automatic deciduous tooth detection and numbering in panoramic radiographs. *Dentomaxillofacial Radiology*. 2021;50:20200172. doi.org/10.1259/dmfr.20200172

38. Orhan K, Yazici G, Kolsuz ME, et al. An Artificial Intelligence Hypothetical Approach for Masseter Muscle Segmentation on Ultrasonography in Patients With Bruxism. *Journal of Advanced Oral Research.* 2021:23202068211005611. doi.org/10.1177/23202068211005611
39. Birnbaum NS, Aaronson HB. Dental impressions using 3D digital scanners: virtual becomes reality. *Compend contin educ dent*. 2008;29(8):494-6.
40. Mackin N, Sims-Williams J, Stephens C. Artificial intelligence in the dental surgery: an orthodontic expert system, a dental tool of tomorrow. *Dental update.* 1991;18(8):341-3.
41. Cantu AG, Gehrung S, Krois J, et al. Detecting caries lesions of different radiographic extension on bitewings using deep learning. *Journal of Dentistry.* 2020;100:103425. doi.org/10.1016/j.jdent.2020.103425
42. Cha, J. Y., Yoon H. I., Yeo I. S., et al. Peri-Implant Bone Loss Measurement Using a Region-Based Convolutional Neural Network on Dental Periapical Radiographs. *Journal of Clinical Medicine.* 2021;10(5): 1009. doi.org/10.3390/jcm10051009
43. Fadel HT, Abu-Hammad O, Ghulam OA, et al. Are Artificial Neural Networks Useful for Predicting Overhanging Dental Restorations? A Cross-sectional Study. World. 2020;11(2):100. doi.org/10.5005/jp-journals-10015-1709
44. Askar H, Krois J, Rohrer C, et al. Detecting white spot lesions on dental photography using deep learning: A pilot study. *Journal of dentistry.* 2021;107:103615. doi.org/10.1016/j.jdent.2021.103615
45. Lim K, Moles D, Downer M, et al. Opportunistic screening for oral cancer and precancer in general dental practice: results of a demonstration study. *British dental journal*. 2003;194(9):497-502.
46. Rosmai MD, Sameemii AK, Basir A, Mazlipahiv IS, Norzaidi M. The use of artificial intelligence to identify people at risk of oral cancer: empirical evidence in Malaysian University. *International Journal of Scientific Research in Education.* 2010;3(1):10-20.
47. Ilhan B, Lin K, Guneri P, et al. Improving oral cancer outcomes with imaging and artificial intelligence. *Journal of dental research*. 2020;99(3):241-8. doi.org/10.1177/0022034520902128
48. Kar A, Wreesmann VB, Shwetha V, et al. Improvement of oral cancer screening quality and reach: The promise of Artificial Intelligence. *Journal of Oral Pathology & Medicine.* 2020;49(8):727-30. doi.org/10.1111/jop.13013
49. Patil V, Vineetha R, Vatsa S, et al. Artificial neural network for gender determination using mandibular morphometric parameters: A comparative retrospective study. *Cogent Engineering.* 2020;7(1):1723783. doi.org/10.1080/23311916.2020.1723783
50. Ruppin J, Popovic A, Strauss M, et al. Evaluation of the accuracy of three different computer-aided surgery systems in dental implantology: optical tracking vs. stereolithographic splint systems. *Clinical oral implants research.* 2008;19(7):709-16. doi.org/10.1111/j.1600-0501.2007.01430.x-i2
51. Widmann G. Image-guided surgery and medical robotics in the cranial area. *Biomedical imaging and intervention journal*. 2007;3(1). doi.org/10.2349%2Fbiij.3.1.e11
52. Zhang W, Li J, Li Z-B, et al. Predicting postoperative facial swelling following impacted mandibular third molars extraction by using artificial neural networks evaluation. *Scientific reports.* 2018;8(1):1-9. DOI:10.1038/s41598-018-29934-1

53. Orhan K, Bilgir E, Bayrakdar IS, et al. Evaluation Of Artificial Intelligence For Detecting Impacted Third Molars On Cone-Beam Computed Tomography Scans. *Journal of Stomatology,* Oral and Maxillofacial Surgery. 2020. doi.org/10.1016/j.jormas.2020.12.006
54. Vinayahalingam S, Xi T, Bergé S, et al. Automated detection of third molars and mandibular nerve by deep learning. *Scientific reports.* 2019;9(1):1-7. doi.org/10.1038/s41598-019-45487-3
55. Yoo J-H, Yeom H-G, Shin W, et al. Deep learning based prediction of extraction difficulty for mandibular third molars. *Scientific Reports*. 2021;11(1):1-9. doi.org/10.1038/s41598-021-85813-2
56. Lang NP, Jepsen S. Implant surfaces and design (Working Group 4). *Clinical Oral Implants Research.* 2009;20:228-31. doi.org/10.1111/j.1600-0501.2009.01771.x
57. Hadj Said M, Le Roux M-K, Catherine J-H, et al Development of an Artificial Intelligence Model to Identify a Dental Implant from a Radiograph. *International Journal of Oral & Maxillofacial Implants.* 2020;35(6). doi: 10.11607/jomi.8060
58. Lee D-W, Kim S-Y, Jeong S-N, et al. Artificial intelligence in fractured dental implant detection and classification: evaluation using dataset from two dental hospitals. *Diagnostics.* 2021;11(2):233. doi.org/10.3390/diagnostics11020233
59. Sakai T, Li H, Shimada T, et al. Development of artificial intelligence model for supporting implant drilling protocol decision making. *Journal of Prosthodontic Research.* 2022:JPR_D_22_00053. doi.org/10.2186/jpr.JPR_D_22_00053
60. Bayrakdar SK, Orhan K, Bayrakdar IS, et al. A deep learning approach for dental implant planning in cone-beam computed tomography images. *BMC Medical Imaging.* 2021;21(1):1-9. doi.org/10.1186/s12880-021-00618-z
61. Patcas R, Bernini DA, Volokitin A, et al. Applying artificial intelligence to assess the impact of orthognathic treatment on facial attractiveness and estimated age. *International journal of oral and maxillofacial surgery.* 2019;48(1):77-83. doi.org/10.1016/j.ijom.2018.07.010
62. Choi H-I, Jung S-K, Baek S-H, et al. Artificial intelligent model with neural network machine learning for the diagnosis of orthognathic surgery. *Journal of Craniofacial Surgery.* 2019;30(7):1986-9. *DOI:* 10.1097/SCS.0000000000005650