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Comparison of Restoration Recommendation and Adjustment Time of AI Belong to Two Different CAD Software

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Research Article

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ABSTRACT

Objectives: The purpose of the in vitro study is to compare the restoration recommendation time and adjustment process of artificial intelligence (AI) belonging to two different digital design software.
Materials and Methods: The maxillary right first premolar tooth was prepared for zirconia all-ceramic crown restoration in a phantom model (n=26). Then, models were scanned using an intraoral scanner, and the opposing arch, and the right- and left-sided occlusions were also recorded. Data were transferred to two computer-aided design software programs (Group Exocad and Group 3Shape) and two design processes were used. In both systems, fully anatomical monolithic zirconia crown design processes were carried out in library mode. The time taken by the AI to recommend the restoration and the time the dental technician spent adjusting the restoration were recorded and were analyzed statistically, both separately and in comparison, to one another (P<.05).
Results: Statistically significant differences were found between the values of AI restoration recommendation time and dental technician restoration adjustment time according to the different software designs (P<.05). Group Exocad showed lower values than Group 3Shape (P<.001).
Conclusions: Exocad provides a faster and easier restoration design in comparison with the 3Shape Dental System.

Keywords: CAD/CAM, crown design, artificial intelligence

İki Farklı CAD Yazılımına Ait Yapay Zekanın Restorasyon Öneri ve Ayarlama Süresinin Karşılaştırılması

Araştırma Makalesi

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ÖZET

Amaç: Bu in vitro çalışmanın amacı, iki farklı dijital tasarım yazılımına ait yapay zekanın restorasyon önerme sürelerini ve uyumlama sürecini karşılaştırmaktır.
Gereç ve Yöntemler: Üst çene sağ birinci premolar diş, fantom modelde (n=26) zirkonyum tam seramik kron restorasyonu için prepare edildi. Daha sonra, modeller bir intraoral tarayıcı kullanılarak tarandı ve karşıt ark ve sağ ve sol taraflı oklüzyonlar da kaydedildi. Veriler iki farklı bilgisayar destekli tasarım yazılım programına (Grup Exocad ve Grup 3Shape) aktarıldı ve iki tasarım süreci yürütüldü. Her iki sistemde de, tamamen anatomik monolitik zirkonyum kron tasarım süreçleri kütüphane modunda gerçekleştirildi. Yapay zekanın restorasyonu önermek için harcadığı süre ve diş teknisyeninin restorasyonu uyumlamak için harcadığı süre kaydedildi ve hem ayrı ayrı hem de birbirleriyle karşılaştırılarak istatistiksel olarak analiz edildi (P<.05).
Bulgular: Yapay zekanın restorasyon öneri süresi ve diş teknisyeni restorasyon ayarlama süresi değerleri arasında farklı yazılımlara göre istatistiksel olarak anlamlı farklar bulundu (P<.05). Grup Exocad, Grup 3Shape'ten daha düşük değerler gösterdi (P<.001).
Sonuçlar: Exocad, 3Shape Dental Sistemine kıyasla daha hızlı ve kolay bir restorasyon tasarımı sağlar.

Anahtar Kelimeler: CAD/CAM, kron tasarımı, yapay zeka

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Introduction

Artificial Intelligence (AI) technology has made significant advancements across many sectors, including dentistry, where it plays a crucial role in processing and managing large volumes of patient data.[1,2] It can be used in almost all areas of dentistry, such as oral, dental, and maxillofacial radiology, endodontics, implant surgery, restorative and prosthetic dentistry.[2,3] The applications of AI are particularly important in prosthetic dentistry.[4]

Computer - aided design / computer - aided manufacturing (CAD/CAM) is increasing trend in designing and manufacturing fixed restorations[5,6] and AI technologies are used in this systems.[7]

The primary trend in the design of CAD/CAM restorations is the library mode. In this method, the operator selects the design from the tooth data in the software and completes the restoration by adjusting it to the existing dentition.[8–11] Additionally, there is a correlation mode. The tooth is scanned before starting the tooth preparation, after which the prepared tooth is scanned with an intraoral scanner, and the initial scan data are superimposed. The crown is designed based on the initial scan data.[8] The occlusal morphology of an intact tooth is directly transferred to the permanent restoration.[12] Correlation mode is more effective and time saving way to design the well-shaped crowns compared to library mode but it is used only the tooth structure is intact. Even so, in both modes of design, a certain amount of time is required for the dental technician to adjust and create the prosthesis.[13,14] In addition, the time spent at the chairside during the prosthesis delivery stage is critical for both the patient and clinician.[15] CAD/CAM technology, which greatly simplifies and accelerates the manufacturing process, offers a solution to this problem. However, the data existing in tooth libraries of software programs is still insufficient to design an excellent customized restoration, a significant amount of manual input is required.[16,17]

Therefore, AI technology has been used to increase the effectiveness of CAD/CAM systems in clinical applications.[18,19] The first intervention which integrates AI with CAD/CAM was occurred by Raith et al.[18] to improve in chairside prosthetic application in 2017. With this intervention, digital restorations have gained new extent.[16,20] Design software, powered by AI, have techniques like convolutional neural networks (CNNs) for creating tooth figures through deep learning (DL). It uses a lot of clinical cases existing in library of design software.[21,22] AI obtains both easy to design restoration and prevention of human derived problems.[23–25]

The most significant advantage of AI is its ability to learn from new cases continually added to databases. It evaluates every situation and determines how successful restorations achieve optimal function based on ideal occlusion and appropriate marginal margins.[26] These developments make dentists and dental technicians turned towards automated restoration design made by AI. Various AI supported dental design software have been developed to meet this demand.[27,28] While the precision of restorations designed by AI is acceptable in mimicking the shape of the original tooth, additional manual input is needed.[13,16,29–31] Therefore, clinicians should focus on collecting and entering correct data into databases. This will soon elevate the use of AI in dentistry to the highest level.[4]

The similarity ratio between the restorations designed by AI and those designed by dental technicians has not been researched. It is not clear if AI could overcome the all extreme cases in terms of digital prosthetic dentistry.[32] Current AI technology can design basic prosthetic restorations such as inlays, single unit fixed partial dentures.[33] The comparison between the restoration designed by AI and those designed by experienced dental technicians is essential for advanced treatment plans.[34] Existing studies only evaluated the shape of teeth but they did not give information about fabrication of the restoration.[15]

Therefore, the abilities and effectiveness of AI in prosthetic restoration design remain unclear, and there is a lack of sufficient studies investigating this topic. This study investigated the time of restoration recommendation and adjustment process requirements of AI in two different digital dental design programs. The null hypothesis of this study was that there would be no difference between the AI recommendation time of the two design systems.

Material and Methods

The maxillary right first premolar tooth was prepared for zirconia all-ceramic crown restoration in a phantom model (ANA-4, Frasaco GmbH, Tettnang, Germany) by the same operator (G.B.) using a high-speed instrument (PanaAir FX, NSK, Kanuma, Japan) and diamond burs (314 S SG 881 012, 314 S SG 811 033, 314 G SG 859 018, DiaSwiss, Nyon, Switzerland) under water cooling. One mm circular shoulder was chosen for the preparation of the finish line. A 2-mm functional cusp reduction in the palatal tubercle and a 1.5 mm non-functional cusp reduction in the buccal tubercle were applied. Cusp bevels were formed in the middle triad on buccal surface and occlusal triad on both the buccal and palatal surface of the preparation.[35] The sample size for per group was determined as n=26 as a result of the Power Analysis performed with a significance of $P<.05$ and 90%. After teeth preparation, the phantom models were scanned using an intraoral scanner (IOS) (TRIOS 3 (T3), Cart version 1.4.7.5, 3Shape, Copenhagen, Denmark) by 10 years IOS experienced operator (L.K.) (Figs. 1A, B). The mandibular phantom model was then scanned as the opposing arch, and the right- and left-sided occlusions were recorded. After the final processing, the files were exported in stereolithography (STL) format. Data were transferred to two different computer-aided dental software programs: Group Exocad (version 3.0, Exocad DentalCAD, Exocad GmbH, Darmstadt, Germany) and Group 3Shape (3Shape Dental Manager, version 88.1.9, 3Shape Dental System, Copenhagen, Denmark), and two design processes were carried out by a dental technician (Ç.E.) with 10 years of experience. In both systems, a fully anatomical monolithic zirconia crown was selected for the maxillary right first premolar tooth; the minimum material thickness was set to 0.4 mm, and the cement gap was set to 0.2 mm (Fig. 2). The designs for both systems were created in library mode, and the time required for the restoration, as suggested by the AI software, was recorded using a digital chronometer. After that, the restorations

were adjusted and the adjustment time was also recorded. Tooth preparations, intraoral scanning procedures, and designing of the restorations were carried out separate operators who are blinded about the aim of the study. The time taken by the AI to recommend the restoration, the time the dental technician spent adjusting the restoration, and the time the dental technician spent on adjustments in two different dental design programs were analyzed statistically, both separately and in comparison, to one another.

Descriptive statistics of the data (number, percentage, mean, standard deviation, median, minimum, and maximum) were evaluated. The reliabilities of the scales used in this study were also assessed. The normality assumption was checked using the Shapiro-Wilk test as the first step of statistical analysis. The Mann–Whitney U test was employed to compare two independent groups that did not have a normal distribution. All data were analyzed using a software program (IBM SPSS Statistics v22.0; IBM Corp, New York, United States). A value of $P<.05$ was considered significantly different.

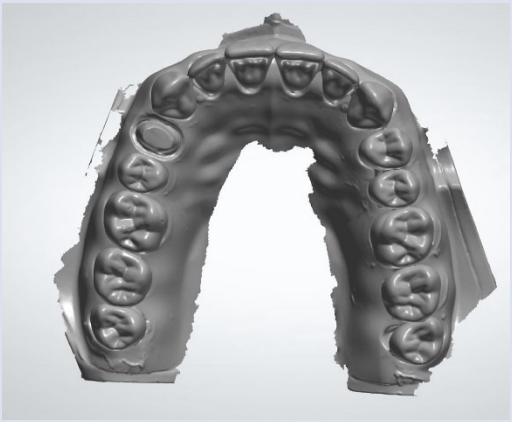

Figure 1A. *The occlusal view of digital impression of the prepared right maxillary first premolar tooth scanned with intraoral scanner*

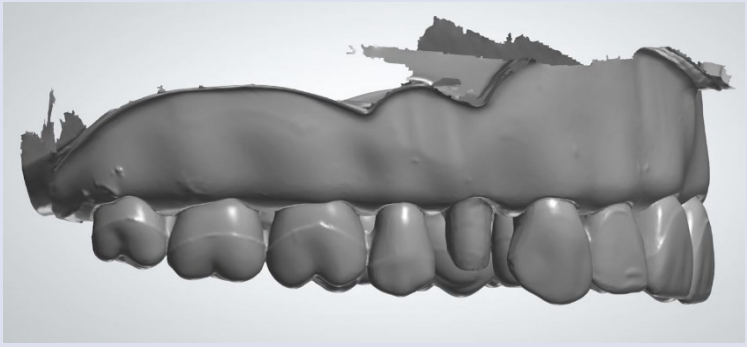

Figure 1B. *The buccal view of digital impression of the prepared right maxillary first premolar tooth scanned with intraoral scanner*

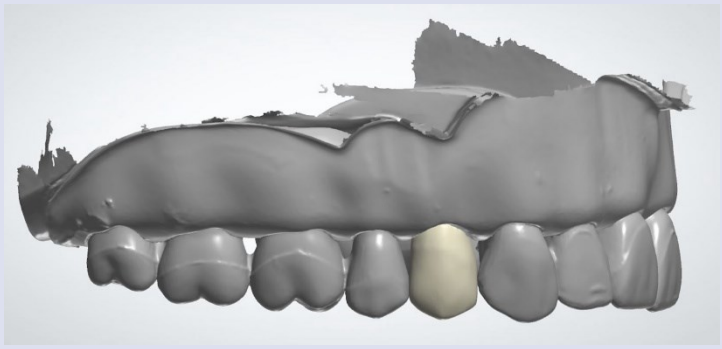

Figure 2. *Design of fully anatomical zirconia crown*

Results

According to the measurement methods, the recommendation time of the AI, the dental technician's restoration adjustment time, and the distribution of the differences between these two metrics are presented in Table 1. The time distribution graphs are shown in Fig. 3. Statistically significant differences were found between the values of AI restoration recommendation time and dental technician restoration adjustment time according to the different software designs (P<.05). For all the parameters subjected to statistical analyses, Group Exocad showed lower values than those of Group 3Shape (P<.001).

Table 1. *Comparison of artificial intelligence restoration recommendation time, dental technician restoration adjustment time and dental technician-system time according to the different design softwares*

Time (sec)	Groups	Min-Max	Median±SD	Test Statistics	*P**
Artificial intelligence restoration recommendation time	Exocad	3.21-4.21	3.93±0.22(3.96)	64.50	<.001*
	3Shape	2.85-6.90	4.97±1.05(5.17)		
Dental technician restoration adjustment time	Exocad	4.00-23.00	10.09±4.76(9.4)	0.000	<.001*
	3Shape	28.90-47.50	35.96±6.69(32.29)		

SD: Standard deviation.
**P<.05*

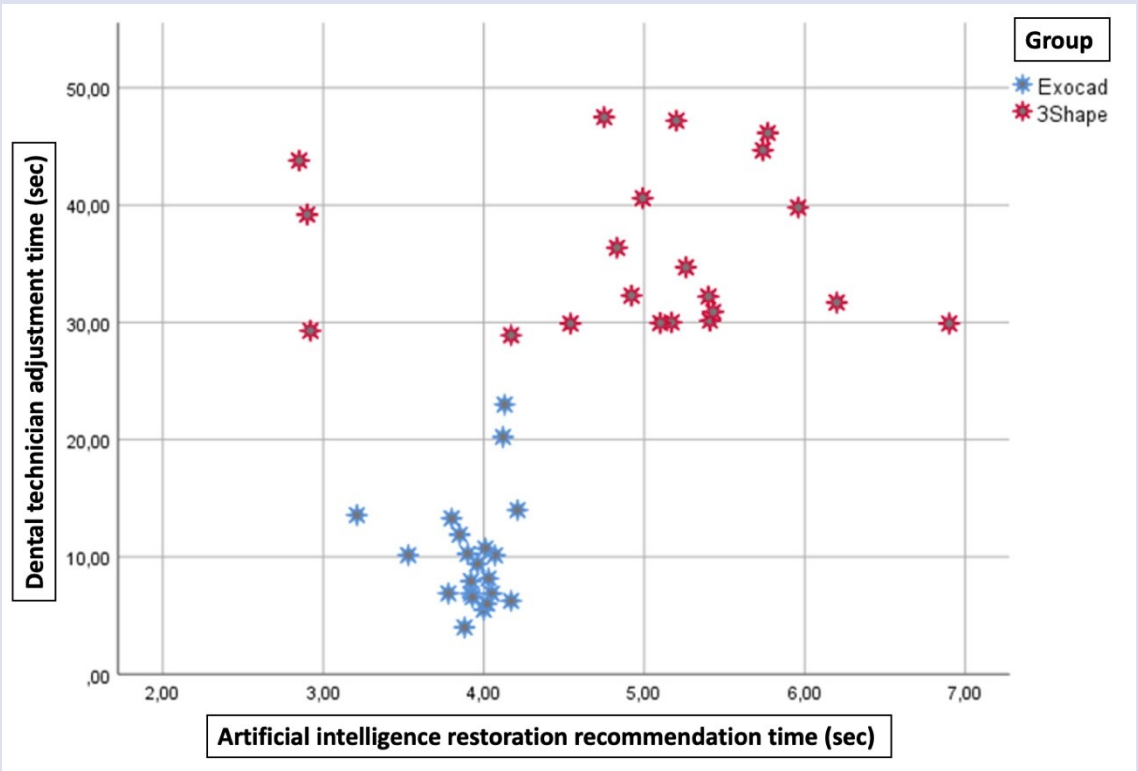

Figure 3. *Distribution of artificial intelligence restoration recommendation time and technician adjustment time according to design*

Discussion

In this study, the full anatomical crown recommendation time of Exocad and 3Shape Dental System software were compared. The findings revealed significant differences in the recommendation time of the full anatomical crown between the two systems. Statistical analysis showed that the 3Shape Dental System required a longer time to propose a fully anatomical crown and for the technician to adjust it. Based on the results of this study, the hypothesis that there would be no difference between the AI recommendation time of the two design systems was rejected.

The library mode is the generally preferred method in dental design programs. In this approach, the restoration is selected from the system library, and necessary adjustments are made by an operator.[8,9] Several studies compare the correlation mode and library mode of CAD designs.[8,9,30] When the structural integrity of the tooth to be restored is preserved, designing in correlation mode should be the first choice. Conversely, for teeth that have

experienced tissue loss owing to caries or trauma, it is recommended to use the library mode.[8] In our study, scanning was not performed before tooth preparation, and crown design was not conducted in the correlation mode. After preparation, the models were scanned with an intraoral scanner, and crowns were designed in library mode.

Wang et al.[8] compared the precision of crowns manufactured using different design theories and three CAD software programs. Four types of tooth deficiencies were created to mimic the different tooth deficiency. Full anatomical crowns were designed for the mandibular left first molar tooth prepared on plaster models obtained from patients using library and correlation modes in the 3Shape, CEREC and Exocad programs. Morphological deviations between the crowns designed automatically by the software and the original teeth were evaluated using a 3D matching system. According to the results of the study, crowns produced with the 3Shape and CEREC showed better results than those produced with the Exocad in case of tooth information loss. The CEREC showed higher stability than the 3Shape and Exocad software programs. When designing restorations, the CEREC and 3Shape systems create a line by determining the set of prominent points on the biological characteristic curves. In the Exocad system, a series of interaction points must be added to create biological curves.[36] This may explain the difference between automatically designed restorations. However, in the standard group, for which all data were provided, the Exocad system designed the best restorations. Consistent with the results of this study, because all teeth adjacent and opposite to the designed tooth were present in our study, the restoration recommendation skill of the Exocad system was better than that of the 3Shape system.

Recently, the sensory information in AI has developed significantly and it made the machines understand complex data. Two AI methods are commonly used for this purpose. The first method uses handcrafted features defined by mathematical equations that allow data to be quantified using computer programs. In the second method, DL algorithms learn by navigating the data space directly, which gives them superior problem-solving capabilities.[37] Despite the use of AI in dental design, expert intervention and additional processes are still required.[30] DL can be strengthened by inputting additional patient data into databases. Thus, faster and easier service can be provided to patients with restorations directly designed and created using AI.

Liu et al.[15] compared the design process of the full anatomical molar crown performed by AI and experienced dental technicians. They found that, AI had reduced the design time by %400 compared to dental technicians. Also, it was reported in another study that, the design time of the restoration proposed by systems powered by AI are lower statistically than the time of experienced dental technicians.[14] AI can decrease time required for the design of the dental crowns.[11,27,33] In the present study, the all designs, proposed by AI belong to two different software, were adjusted by the 10-year-experienced dental technician and comparisons were performed.

Programs that enable more detailed and precise restoration designs may negatively impact the automatic restoration recommendation time and the time required for technician adjustments. In the present study, the differences in the restoration design time between the Exocad and 3Shape dental systems may be attributed to the details of the design programs or differences in the databases. The feasibility of single crowns designed by AI is showed by Chau et al.[16] and they concluded the accuracy of dentures designed by AI can be developed by optimization. Excellent crown restoration designs and patients' comfort can be achieved by further research in AI and DL.[38,39] The more cases loaded into the system in advance, the larger is the database of the program. This can impact the design time in detailed systems. In the present study, the 3Shape Dental System suggested restorations in a longer time than the Exocad. It also took longer for the technician to adjust it to the existing dentition. A longer time may be required because the 3Shape Dental System allows for more precise details. Although there are many design programs, limited studies have evaluated the differences between them; thus, further studies are needed.[40]

The methodology of the present study that, firstly AI belong to two different design software had proposed the restorations after that all restorations were adjusted by 10-year experienced dental technicians. The proposing time and the adjustment time of the restorations were compared each other. AI designs and dental technician's design were not compared. It is a limitation of the present study. Another limitation of the study, the morphology and the accuracy of the restorations were not evaluated with a 3D assessment program reported in previous studies.[11,14,15,27] Also, the restorations were not manufactured and a comparison of manufactured restorations was not performed. Future in vitro and clinical studies are required.

Conclusions

Within the limitations of this study, the following conclusions can be drawn:

1. The restoration recommendation time of the AI in the Exocad system was lower than that of the 3Shape Dental System. Exocad recommends restoration within a significantly shorter time.
2. The time required for the technician to adjust the crown suggested by the AI of the Exocad system to the existing dentition was found to be significantly lower than that of the 3Shape Dental system.
3. Exocad provides a faster and easier restoration design compared to the 3Shape Dental System. In clinical practice, Exocad system is more suitable to deliver definitive prostheses quickly.

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References

1. Grischke J, Johannsmeier L, Eich L, Griga L, Haddadin S. Dentronics: Towards robotics and artificial intelligence in dentistry. Dent Mater. 2020;36:765-778.
2. Dwivedi YK, Hughes L, Ismagilova E, et al. Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. Int J Inf Manage. 2021;57:101994.
3. Tandon D, Rajawat J. Present and future of artificial intelligence in dentistry. J oral Biol craniofacial Res. 2020;10:391-396.
4. Singi SR, Sathe S, Reche AR, Sibal A, Mantri N. Extended Arm of Precision in Prosthodontics: Artificial Intelligence. Cureus. 2022;14:e30962.
5. Taşın S, Güvenir M, Ismatullaev A. Effects of Surface Characteristics of Conventionally Manufactured, CAD/CAM Milled, and 3D-Printed Interim Materials on Adherence of Streptococcus Mutans and Candida Albicans. Cumhur Dent J. 2023;26:227-234.
6. Aydiner SF, Duymus ZY, Yanikoglu N. Investigation of the Effect of Mouthwash on Bonding Temporary Crown Materials with Various Temporary Cements. Cumhur Dent J. 2023;26:359-366.
7. Abdalla-Aslan R, Yeshua T, Kabla D, Leichter I, Nadler C. An artificial intelligence system using machine-learning for automatic detection and classification of dental restorations in panoramic radiography. Oral Surg Oral Med Oral Pathol Oral Radiol. 2020;130:593-602.
8. Wang F, Zhang T, Zhou Q, Lu Y. Comparison of the morphological accuracy of automatic crowns designed by multiple computer-aided design software programs with different levels of dentition information acquisition. J Prosthet Dent. 2024;132:441-452.
9. Zhang R, Ding Q, Sun Y, Zhang L, Xie Q. Assessment of CAD-CAM zirconia crowns designed with 2 different methods: A self-controlled clinical trial. J Prosthet Dent. 2018;120:686-692.
10. Reiss B. Occlusal surface design with Cerec 3D. Int J Comput Dent. 2003;6:333-342.
11. Chen D, Yu M-Q, Li Q-J, He X, Liu F, Shen J-F. Precise tooth design using deep learning-based templates. J Dent. 2024;144:104971.
12. Schenk O. Biogeneric--another step closer to nature. V3.8: largest update since introduction of the 3D software. Int J Comput Dent. 2010;13:169-174.
13. Jedynakiewicz NM, Martin N. Functionally-generated pathway theory, application and development in Cerec restorations. Int J Comput Dent. 2001;4:25-36.
14. Wu Z, Zhang C, Ye X, et al. Comparison of the Efficacy of Artificial Intelligence-Powered Software in Crown Design: An In Vitro Study. Int Dent J. Published online July 2024.
15. Liu C-M, Lin W-C, Lee S-Y. Evaluation of the efficiency, trueness, and clinical application of novel artificial intelligence design for dental crown prostheses. Dent Mater. 2024;40:19-27.
16. Chau RCW, Hsung RT-C, McGrath C, Pow EHN, Lam WYH. Accuracy of artificial intelligence-designed single-molar dental prostheses: A feasibility study. J Prosthet Dent. 2024;131:1111-1117.
17. Li L, Chen H, Li W, Wang Y, Sun Y. The Effect of Residual Dentition on the Dynamic Adjustment of Wear Facet Morphology on a Mandibular First Molar Crown. J Prosthodont Off J Am Coll Prosthodont. 2021;30:351-355.
18. Raith S, Vogel EP, Anees N, et al. Artificial Neural Networks as a powerful numerical tool to classify specific features of a tooth based on 3D scan data. Comput Biol Med. 2017;80:65-76.
19. Revilla-León M, Gómez-Polo M, Vyas S, et al. Artificial intelligence models for tooth-supported fixed and removable prosthodontics: A systematic review. J Prosthet Dent. 2023;129:276-292.
20. Zhang B, Dai N, Tian S, Yuan F, Yu Q. The extraction method of tooth preparation margin line based on S-Octree CNN. Int j numer method biomed eng. 2019;35:e3241.
21. Wu C-H, Tsai W-H, Chen Y-H, Liu J-K, Sun Y-N. Model-Based Orthodontic Assessments for Dental Panoramic Radiographs. IEEE J Biomed Heal informatics. 2018;22:545-551.
22. Son LH, Tuan TM, Fujita H, et al. Dental diagnosis from X-Ray images: An expert system based on fuzzy computing. Biomed Signal Process Control. 2018;39:64-73.
23. Khanagar SB, Al-Ehaideb A, Maganur PC, et al. Developments, application, and performance of artificial intelligence in dentistry - A systematic review. J Dent Sci. 2021;16:508-522.
24. Wang J, Chen F, Ma Y, et al. XBound-Former: Toward Cross-Scale Boundary Modeling in Transformers. IEEE Trans Med Imaging. 2023;42:1735-1745.
25. Lai Y, Fan F, Wu Q, et al. LCANet: Learnable Connected Attention Network for Human Identification Using Dental Images. IEEE Trans Med Imaging. 2021;40:905-915.
26. Bhatia A, Tiwari S. Acta Scientific Dental Sciences (ISSN: 2581-4893) Artificial Intelligence: An Advancing Front of Dentistry. Published online September 25, 2020. doi:10.31080/ASDS.2019.03.0714
27. Cho J-H, Çakmak G, Yi Y, Yoon H-I, Yilmaz B, Schimmel M. Tooth morphology, internal fit, occlusion and proximal contacts of dental crowns designed by deep learning-based dental software: A comparative study. J Dent. 2024;141:104830.
28. Capobianco V, Baroudi K, Santos MJMC, et al. Post-fatigue fracture load, stress concentration and mechanical properties of feldspathic, leucite- and lithium disilicate-reinforced glass ceramics. Heliyon. 2023;9:e17787.
29. Hartung F, Kordass B. Comparison of the contact surface pattern between virtual and milled Cerec 3D full-ceramic crowns. Int J Comput Dent. 2006;9:129-136.
30. Ender A, Mörmann WH, Mehl A. Efficiency of a mathematical model in generating CAD/CAM-partial crowns with natural tooth morphology. Clin Oral Investig. 2011;15:283-289.
31. Ding H, Wu J, Zhao W, Matinlinna JP, Burrow MF, Tsoi JKH. Artificial intelligence in dentistry—A review. Front Dent Med. 2023;4.
32. Mrugalska B, Dovramadjiev T, Pavlova D, et al. Open source systems and 3D computer design applicable in the dental medical engineering Industry 4.0 – sustainable concept. Procedia Manuf. 2021;54:296-301.
33. Farook TH, Ahmed S, Jamayet N Bin, et al. Computer-aided design and 3-dimensional artificial/convolutional neural network for digital partial dental crown synthesis and validation. Sci Rep. 2023;13:1561.

34. Yuan F, Dai N, Tian S, et al. Personalized design technique for the dental occlusal surface based on conditional generative adversarial networks. Int j numer method biomed eng. 2020;36:e3321.
35. Herbert T. Shillingburg Jr, D. A. S., Edwin L. Wilson Jr, Joseph R. Cain, Donald L. Mitchell LJB& JCK. Fundamentals of Fixed Prosthodontics. 4th ed. Quintessence Pub Co.; 2012.
36. Li X, Wang X, Chen M. Accurate extraction of outermost biological characteristic curves in tooth preparations with fuzzy regions. Comput Biol Med. 2018;103:208-219.
37. Hosny A, Parmar C, Quackenbush J, Schwartz LH, Aerts HJWL. Artificial intelligence in radiology. Nat Rev Cancer. 2018;18:500-510.
38. Syed-Abdul S, Fernandez-Luque L, Jian W-S, et al. Misleading health-related information promoted through video-based social media: anorexia on YouTube. J Med Internet Res. 2013;15:e30.
39. Shan T, Tay FR, Gu L. Application of Artificial Intelligence in Dentistry. J Dent Res. 2021;100:232-244.
40. Bae E-B, Cho W-T, Park D-H, et al. Comparison of fit and trueness of zirconia crowns fabricated by different combinations of open CAD-CAM systems. J Adv Prosthodont. 2023;15:155-170.