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Artificial Intelligence and Digital Workflow Innovations in Prosthodontics

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Abstract

Artificial intelligence (AI) introduction and its integration with digital workflows are a revolutionary step in the present-day prosthodontics. The practice of prosthodontics is increasingly revolutionized to lessen the reliance on the traditional analogue methods and more towards digitally guided processes that incorporate intraoral scanning, computer-aided design and manufacturing (CAD/CAM), and additive manufacturing. In more recent times AI technologies have been brought onto the scene to augment these digital processes through data-driven decision making, automation and predictive analysis. To achieve the objective of this narrative review, an impartial and detailed overview of the application of AI in digital prosthodontic processes will be examined, with emphasis placed on its clinical importance, advantages, and drawbacks in the present day. The literature-based narrative methodology was used to compile the evidence on AI-based diagnostic processes, treatment design, prosthetic designing, and manufacturing in prosthodontics. The topics covered in the review are not speculative or futuristic and the technologies reviewed are clinically applicable, which makes them relevant in the modern practice of prosthodontics. AI has already shown great potential in enhancing the quality of diagnostics in the form of automated processing of intraoral scans and radiographic images, helping with the planning of treatment and the choice of prostheses. During the design stage, AI-based CAD systems support automated margin recognition, occlusive optimization and highly personalized prosthesis design, limiting operator variability and time wastage. Moreover, the implementation of AI in digital manufacturing operations leads to a better quality control and material wastage and high reproducibility of prosthetic restorations. All these developments have been linked to enhanced efficiency of workflow, precision of prosthetics and patient outcomes. Nonetheless, there are still issues, such as the reliance on high-quality datasets, a lack of long-term clinical validation, ethical issues and privacy, and a requirement to have their clinical oversight. Recent reports indicate that AI is not supposed to be used as an alternative to clinical expertise but as an aiding tool. To sum up, the concept of AI-driven digital workflows has massive potential in the field of prosthodontic care, including its increased accuracy,

efficiency, and customization. It still needs more research, standardization, and ethical integration to achieve their full potential in daily clinical practice.

Introduction

Prosthodontics has had a long history of being a field of work that is based on careful clinical judgment, hand skills and close interaction between the clinicians and the dental technicians (Afzal et al., 2022). Traditional methods, which are founded on elastomeric impressions, stone casts, mechanical articulators, and handmade prostheses have been the basis of decades of prosthetic rehabilitation (Butterworth et al., 2025). Although the predictable results have been achieved through these approaches, they are labor-intensive and prone to errors that are introduced at various levels such as distortion of impressions, inaccuracy of casts and subjective interpretation during the process of producing the prosthesis (Powell et al., 2020). The need to be more precise, efficient and more comfortable to the patient has led to slower but unswerving shift towards the use of digital workflows in prosthodontic practice (Smith, 2024).

The use of electronic technologies such as intraoral scanning, digital occlusal analysis, virtual articulation and CAD/CAM fabrication has redesigned modern prosthodontics (Alghazzawi, 2016). Digital processes can be used to visualize the oral structures in 3D, make the design of the prosthetics to be more reproducible, and simplify the interaction between the laboratory and a clinical facility (Sorrentino et al., 2024). These developments have particularly been effective in fixation and implant based prosthodontics in which accuracy and passive adaptation are the keys to long-term success. These advantages notwithstanding, only digital workflows work solely on the input and knowledge of the operators, and issues regarding the interpretation, standardization, and optimization of digital data still persist (Lobo et al., 2025).

Artificial intelligence (AI) is a relatively new technology that has become an additional solution to the constraints of digital prosthodontics in the recent years (Iosif et al., 2024). Using machine learning and deep learning algorithms, AI systems can process large datasets obtained by intraoral scans, radiographs, and clinical records to assist in the accuracy of diagnostics and automate the complex decision-making processes (Revilla-León et al., 2023). AI has already shown good outcomes in the field of dentistry, with prospects of its application in the workflow of prosthodontics (Ai in Diagnostic Imaging, Treatment Planning, and Outcome Prognosis). In the field of prosthodontics, AI is currently under investigation to be used with automated margin detection, optimization of the occlusal scheme, customization of prostheses design, and quality control in the process of digital production (Samaranayake et al., 2024).

The reason behind AI implementation in the digital processes of making prosthodontics is that it may lead to greater precision, less variation that is clinician-dependent, and greater overall effect of the treatment process but with a personalized approach to a patient (Goyal, 2024). Artificial intelligence-driven systems have the potential to provide more reliable results in any clinical environment due to the ability to engage in predictive and adaptive prosthodontic planning. Nonetheless, the swift integration of AI also brings up key issues about data quality, ethical accountability, transparency, and clinical validation (Rahim et al., 2024). The purpose of this review is to critically analyze the present place of artificial intelligence in the digital procedure of prosthodontics, detailing the applications of AI, its advantages and disadvantages, and finding gaps in the literature and future opportunities. The targeted scope of this review is specifically on clinically relevant innovations to give prosthodontists an evidence-based approach to the current digital and intelligent world in the modern prosthodontics.

Overview of Digital Workflow in Prosthodontics

The traditional steps in prosthodontics are predominantly, physical impressions, stone casts, mechanical articulators and manual laboratory processes that are highly dependent on the skill of the operator and experience of the technician (Jagger & Klineberg, 2016). These processes normally have numerous clinical and laboratory processes which promote the occurrence of cumulative mistakes and prolong the treatment duration (Chidyllo & Taub, 2014). Digital, on the other hand, is a type of prosthodontic workflow that is based on intraoperative or extraliminal scanning, computer-aided design and production (CAD/CAM) systems that use virtual articulation to produce a prosthetic restoration in a mainly virtualized setting (Strub et al., 2006). Digital workflows lower reliance on the physical model, allow the accurate visualization of the oral structures in three-dimension, and transfer of data between clinicians and dental laboratories without complications, thereby leading to higher quality and efficiency (Dobrzański & Dobrzański, 2020).

The general elements of a complete digital workflow in the area of prosthodontics are three related parts of digital workflow: digital data acquisition, digital design, and digital manufacturing (Cristache et al., 2021). Digital data acquisition entails the use of intraoral scanners, cone-beam computed tomography and facial scanning technology in order to capture precise three-dimensional images of the oral anatomy of the patient (Conejo et al., 2021). Such datasets serve as a basis of further planning and designing. Digital design is performed on CAD software, in which the virtual models are articulated, margins are drawn and the prosthetic restorations are modeled with control over occlusion, contour, and esthetics. The last phase, digital manufacturing, converts virtual designs into real prostheses using the subtractive milling or additive manufacturing approaches like three-dimensional printing so that they can be fabricated precisely and in large quantities (Kim et al., 2022).

Digital prosthodontic work flows have a number of benefits as they provide more accuracy, less time in the chair and the laboratory, the absence of traditional impressions, and better uniformity of the prosthesis production. Also, computer records enable storage of data over time and further editing or replicating restorations. Nevertheless, there are still constraints, including the high cost of initial investment, technical training requirement, reliance on the compatibility of software and hardware and possible inaccuracy due to scanning or software errors. Moreover, online processes also demand clinical skills to interpret and make a decision (Bessadet et al., 2025).

To date, the use of digital workflows in prosthodontics is still growing, especially in the fixed and implant prosthodontics where the precision is most important (Gracis et al., 2023). Although the early adopters have been major practices and academic centers, the availability of technology and a declining cost is encouraging the wider use in regular clinical practice (Spallek et al., 2010). However, the uptake is still different in different regions and clinical environments, which indicates the persistence of infrastructure, training, and cost-efficiency issues.

Fundamentals of Artificial Intelligence Relevant to Prosthodontics

In the healthcare and dental fields, AI systems are aimed at processing large and varied data to enhance clinical decision making and not to substitute clinical judgment (Semerci & Yardımcı, 2024). The algorithms, models, training data, feature extraction, and optimization of a system can be seen as the key concepts that make AI to help systems to improve their output, through the process of iterative learning (Sarker, 2022). AI is mostly used in prosthodontics as a decision-support and automation system that facilitates better accuracy in diagnosis, design accuracy, and efficiency of workflow in the digital space (Adekunle et al., 2021).

There are a number of subtypes of AI that are especially applicable in dentistry and prosthodontics. Machine learning is a set of algorithms which learns to make predictions or classifications based on given labeled or unlabeled data without being specifically programmed to work on a particular task. Deep learning A subdivision of machine learning, deep learning classifies more intricate and higher-dimensional data such as three-dimensional scans, radiographic images, and so forth, with multi-layered neural networks, allowing more advanced pattern recognition (Khanum et al., 2015). Computer vision (communicating frequently with deep learning methods) represents the ability of AI systems to analyze visual information by detecting structural features of the image or digital model (e.g., anatomical landmarks, margins, occlusal surfaces, and structural relationships in dental images and digital models). Most AI-based prosthodontical solutions are based on these subtypes to provide the technological backbone of the technology (Sen et al., 2019).

Prosthodontic AI implementations are based on a wide range of data, which can consist of intraoral scan files, cone-beam computed tomography, digital radiographs, facial scans, and electronic clinical records (Alshadidi et al., 2023). These datasets contain anatomical, functional, and esthetic data which can be utilized to train AI models to perform a task including serializing margin detection, analyzing the occlusal, and designing a prosthesis. These data sources have quality, diversity, and representativeness that are vital in determining the AI performance and in generalizing it across the patient population. The development of reliable AI systems includes the training and validation steps. Models should be trained with large and well annotated datasets, after which serious validation should be done on independent datasets to determine the accuracy and strength of the model (Iosif et al., 2024).

AI-Assisted Diagnostic and Treatment Planning Applications

The use of artificial intelligence in the diagnostic analysis and treatment design has created new standards of accuracy and efficiency of the prosthodontic process. Analysis Automated intraoral scan and radiograph examination is enabling AI systems to handle complex visual images very quickly, reveal anatomical features, and detect clinically significant items that may not be detected during a manual examination. The system of AI-assisted interpretation of digital impressions/radiographic images helps to identify structural discrepancies, prosthetic space-related issues, and any possible restorative problems earlier, which can contribute to an increase in the level of diagnostic consistency and decrease the workload of clinicians (Samaranayake et al., 2024).

The smart systems have also been extended to the assessment of occlusion, tooth morphology, and edentulous ridges by use of AI, thereby enhancing the application of these systems in prosthodontic planning (Iosif et al., 2024). Through the analysis of 3D data, AI algorithms are able to assess occlusal correlations, cusp structure, arches, and ridges anatomy with excellent reproducibility. AI tools are capable of helping in the classification of ridges, estimation of the prosthetic space, and the choice of useful prosthetic designs in edentulous cases. Through such automated testing, there is objective support of clinical decision making with minimal subjective variability that comes with the traditional means of evaluation (Serafin, 2025).

The integration of AI has also contributed to the development of digital smile design, which allows planning the esthetics better based on the data analysis of facial features, proportions of teeth, and dynamics of smiles. Matched with AI, the tailored smile proposals produced can be based on the correlation of dental and facial parameters, which enables the clinician to visualize the treatment result and involve patients in more active participation in the planning process. This practice enhances the efficiency of communication, greater patient acceptance and easier esthetics-directed prosthodontic rehabilitation (Singh et al., 2025).

Another important innovation is predictive analytics, since AI models have the capacity to process past and patient-specific data and assist in the selection of prostheses and predict treatment outcomes. Such systems can be used to help clinicians select the right restorative materials, prosthetic design or implant-supported solutions, based on predicted performance and risk profiles. Altogether, AI-managed diagnostics and planning lead to better accuracy, shorter treatment duration, and more efficient workflow, which supports the idea that AI as a supplementary tool of modern prosthodontics is not as harmful as a substitute of clinical skills (Rani, 2025).

AI Integration in Digital Prosthodontic Design

In the field of prosthodontics, artificial intelligence is being incorporated into computer-aided design (CAD) systems to empower the efficiency, precision, and dependability of prosthetic design development, with AI-based systems able to examine three-dimensional computer-generated models and instruct through big data of prior restorations to create designs that meet established morphological, functional, and esthetic principles (Alshadidi et al., 2023). A key clinical application is automated margin detection and restoration modeling, in which deep-learning and computer-vision algorithms are applied to identify preparation finish lines more accurately and recreate anatomically-appropriate contours, which makes methods less sensitive, inter-operator, and less expensive in terms of time (Sawangsri et al., 2025). AI can also be used to optimize occlusal schemes by modeling the distribution of forces and functionally moving in the virtual world, which allows better distribution of forces and the reduction of interferences to enhance the life of prosthesis and patient comfort (Khaohoen et al., 2025). These systems are also capable of high patient customization of crowns, bridges, dentures, and implant supported prostheses through the adjustment of designs to fit individual anatomy, occlusalis relationships, and esthetic needs. In comparison to the traditional CAD processes, AI-enhanced processes are more automated, less reliant on operators, and more reproducible, but clinician involvement is still necessary to critically analyze the AI-produced designs and to make sure that the biological, functional, and esthetic factors are considered in every prosthodontic scenario (Alqutaibi, 2023).

AI and Advanced Manufacturing in Prosthodontics

Artificial intelligence is also having an effect on computer-aided manufacturing (CAM) in the field of prosthodontics enhancing the accuracy, efficiency, and reliability of computer-generated restorations through AI-based manufacturing systems that process design data and production settings and direct milling and additive manufacturing processes with an aim to minimize human intervention and error (Rahman et al., 2025). Among the most extensive applications is in milling and optimization of parameterization in three-dimensional printing, where AI can take into account such parameters as tool-path strategy, spindle speed, feed rate, layer thickness, and build orientation to achieve the best surface quality and structural integrity and continually modify those parameters depending on the prior manufacturing outcome to accommodate different materials and segmental restorations, such as implant-supported and full-arch restorations. The quality control and error detection is also a pivotal aspect of AI because it keeps track of fabrication during real-time or compares the finalized prosthetic to the initial digital algorithm to detect the presence of marginal deviations, internal flaws, or surface anomalies, which will decrease the incidence of remakes and increase uniformity. Moreover, AI-based predictive models can be used to facilitate the selection of materials and predict performance by incorporating information about material behavior, fabrication, and clinical performance which can be used to reduce the risk of failure. On the whole, AI implementation in the workflow of CAMs increases the accuracy, repeatability, and turnaround time in the production of prosthodontics and does not affect key clinical criteria (Arinez et al., 2020).

Clinical Performance, Accuracy, and Patient-Centered Outcomes

The accuracy and fit of AI-assisted prostheses have become increasingly a clinical performance parameter that determines the long-term prosthodontic outcome and AI-advanced workflows are associated with better marginal adaptation and internal fit due to highly developed digital design, automated margin identification, and streamlined manufacturing processes (Dawood et al., 2026). These enhancements cause less inconsistencies in design as well as fabrication which result in more predictable performance in cases, especially in complicated restorations like implant-supported and full-arch prostheses, and also increase functional performance and reduces the necessity of on-the-job adjustments and remakes. Moreover, as part of the digital workflows, the implementation of AI has been linked to significant improvements in workflow efficiency and decreased chairside time with automated diagnostic analysis, design support, and optimization of manufacturing phases minimizing treatment planning and lab time, which in some cases has led to reduced clinical visits (ElShamally, 2020). On the patient side, AI-guided prosthodontic care is associated with an increase in patient satisfaction and better esthetic outcomes because of the higher level of digital smile design, increased personalization, and more predictive outcomes, and visual pre-fabrication simulations can additionally contribute to patient engagement and shared decision-making. Although these have their benefits, there are still barriers associated with the learning curve of AI-based systems, such as usability, training needs, clinician confidence in AI-generated output, and the role of professional oversight cannot be ignored (Alfaraj et al., 2024).

Ethical, Legal, and Practical Considerations

The development of artificial intelligence into the workflow of prosthodontics provokes significant ethical, legal, and practical questions that should be reflected on to ensure safe and responsible clinical usage, especially regarding data privacy and security since AI systems are currently dependent on huge amounts of sensitive patient data, including digital impressions, radiographs, facial scans, and clinical records, so it is necessary to ensure that data protection regulations, secure information storage, and controlled information exchange are strictly observed, especially when cloud-based solutions are used (Rahim et al., 2024; Rokhshad et al., 2025). Explainability and transparency are also issues, with most AI models, especially deep learning systems being black boxes, where the output is provided without much understanding of the decision-making process and the results may influence clinician confidence, accountability, and informed assessment of AI-generated designs, which adds to the relevance of explainable AI methods in clinical dentistry (Alshadidi et al., 2023).

Current Limitations and Research Gaps

Although there has been substantial progress, the clinical application of AI in the field of prosthodontics is not yet broadly applicable due to the required use of high-quality and heterogeneous datasets, the presence of an algorithmic bias, the lack of clinical validation over time, and the inability to extend the performance results to other healthcare environments and patient groups (Alshadidi et al., 2023). Moreover, the absence of universal measures of evaluation and a relative dearth of prosthodontic-focused AI studies contribute to the necessity of adequately designed longitudinal studies and specific investigations to facilitate the safe, reliable, and evidence-based inclusion in the daily practice (Aljulayfi et al., 2024).

Future Directions in AI-Driven Digital Prosthodontics

The prospect of artificial intelligence in prosthodontics is considered to enhance the digital workflows with an increasing number of chairside and cloud-based solutions, which will provide the opportunity to process data in real-time, collaborate remotely, integrate clinics and laboratories, and provide diagnostic, design, and manufacture services instantly. The development of real-time adaptive workflows will enable dynamic anatomical and functional data to update the designs of prosthetics and enhance the fit, occlusion, and accuracy. The rising contribution of AI in the field of prosthodontic education is also probable by the means of simulation-based training, virtual case analysis, and objective feedback, which will contribute to standardizing competencies and minimize the learning curves. Predictive modeling will also enable the most personalized prosthetic care by incorporating patient-specific data to maximize treatment planning and long-term patient outcomes and move the role of the prosthodontist to higher clinical decision-making, communication, and supervision of intelligent systems without losing the ethical patient-centered care..

Conclusion

In conclusion, the adoption of artificial intelligence into the electronic process of the work of a prosthodontist is a major advancement in the modern practices in the sphere of prosthodontics since it enhances the quality of the diagnostic, design, manufacturing, and the general efficiency of the working process. The systems assisted by AI aid in information-based decision-making, reducing variability according to operators, and more predictable and patient-centered results of the prosthetic, but it is necessary to have the expertise of clinicians to approve and take ethical responsibility of the systems, which is not always straightforward to do. It does not rule out the concerns of data quality, long-term clinical validation, regulatory controls, and accessibility which although they have proved to yield positive results should be implemented carefully and with evidence-based contents. Because the concept of AI has undergone constant evolution, the use of the AI-based specifically on the field of prosthodontics, standardized measurements devices and long-term clinical trials will be required to obtain the value of clinical reliability in its entirety. Lastly, the concept of artificial intelligence should be viewed as a facilitative tool that complements and does not replace the work of the prosthodontist but enables the establishment of a future of more customized, effective and specific prosthodontic procedures.

References

Adekunle, B. I., Chukwuma-Eke, E. C., Balogun, E. D., & Ogunsola, K. O. (2021). Machine learning for automation: Developing data-driven solutions for process optimization and accuracy improvement. Machine Learning, 2(1).

Afzal, H., Ahmed, N., Lal, A., Al-Aali, K. A., Alrabiah, M., Alhamdan, M. M.,…Abduljabbar, T. (2022). Assessment of communication quality through work authorization between dentists and dental technicians in fixed and removable prosthodontics. Applied Sciences, 12(12), 6263.

Alfaraj, A., Nagai, T., AlQallaf, H., & Lin, W.-S. (2024). Race to the moon or the bottom? applications, performance, and ethical considerations of artificial intelligence in prosthodontics and implant dentistry. Dentistry journal, 13(1), 13.

Alghazzawi, T. F. (2016). Advancements in CAD/CAM technology: Options for practical implementation. Journal of prosthodontic research, 60(2), 72-84.

Aljulayfi, I. S., Almatrafi, A. H., Althubaitiy, R. O., Alnafisah, F., Alshehri, K., Alzahrani, B., & Gufran, K. (2024). The potential of artificial intelligence in prosthodontics: A comprehensive review. Medical Science Monitor:

International Medical Journal of Experimental and Clinical Research, 30, e944310-944311.
Alqutaibi, A. Y. (2023). Artificial intelligence models show potential in recognizing the dental implant type, predicting implant success, and optimizing implant design. Journal of Evidence-Based Dental Practice, 23(1), 101836.
Alshadidi, A. A. F., Alshahrani, A. A., Aldosari, L. I. N., Chaturvedi, S., Saini, R. S., Hassan, S. A. B.,…Minervini, G. (2023). Investigation on the application of artificial intelligence in prosthodontics. Applied Sciences, 13(8), 5004.
Arinez, J. F., Chang, Q., Gao, R. X., Xu, C., & Zhang, J. (2020). Artificial intelligence in advanced manufacturing: current status and future outlook. Journal of Manufacturing Science and Engineering, 142(11), 110804.
Bessadet, M., Drancourt, N., & El Osta, N. (2025). Time efficiency and cost analysis between digital and conventional workflows for the fabrication of fixed dental prostheses: A systematic review. The Journal of prosthetic dentistry, 133(1), 71-84.
Butterworth, C., Vosselman, N., Malhotra, T., & Dawood, A. (2025). Prosthetic rehabilitaton. In Stell & Maran's Head and Neck Surgery and Oncology (pp. 344-367). CRC Press.
Chidyllo, S. A., & Taub, P. J. (2014). Impressions, models, and splints: the basic maxillofacial laboratory. In Ferraro's Fundamentals of Maxillofacial Surgery (pp. 481-492). Springer.
Conejo, J., Dayo, A. F., Syed, A. Z., & Mupparapu, M. (2021). The digital clone: intraoral scanning, face scans and cone beam computed tomography integration for diagnosis and treatment planning. Dental Clinics, 65(3), 529-553.
Cristache, C. M., Tudor, I., Moraru, L., Cristache, G., Lanza, A., & Burlibasa, M. (2021). Digital workflow in maxillofacial prosthodontics—an update on defect data acquisition, editing and design using open-source and commercial available software. Applied Sciences, 11(3), 973.
Dawood, E. A., Van Aelst, S., Elgarba, B. M., Fontenele, R. C., & Jacobs, R. (2026). Mapping the Artificial Intelligence Role in the Design of Digital Prosthetics: A Scoping Review. Digital Dentistry Journal, 100069.
Dobrzański, L. A., & Dobrzański, L. B. (2020). Dentistry 4.0 concept in the design and manufacturing of prosthetic dental restorations. Processes, 8(5), 525.
ElShamally, H. (2020). AI and Digital Dentistry in Prosthodontics: A Systematic Review. Artificial intelligence (AI), 2(3).
Goyal, K. (2024). Artificial Intelligence for Autonomous Growth Pattern Forecasting in Mixed Dentition Using Skeletal Maturation Signals. Indian Journal of Pharmaceutical and Biological Research, 12(04), 39-45.
Gracis, S., Appiani, A., & Noè, G. (2023). Digital workflow in implant prosthodontics: The critical aspects for reliable accuracy. Journal of Esthetic and Restorative Dentistry, 35(1), 250-261.
Iosif, L., Țâncu, A. M. C., Amza, O. E., Gheorghe, G. F., Dimitriu, B., & Imre, M. (2024). AI in prosthodontics: a narrative review bridging established knowledge and innovation gaps across regions and emerging frontiers. Prosthesis, 6(6), 1281-1299.
Jagger, R., & Klineberg, I. (2016). Articulators, transfer records, and study casts. In Functional Occlusion in Restorative Dentistry and Prosthodontics (pp. 117-128). Elsevier.
Khanum, M., Mahboob, T., Imtiaz, W., Ghafoor, H. A., & Sehar, R. (2015). A survey on unsupervised machine learning algorithms for automation, classification and maintenance. International Journal of Computer Applications, 119(13).
Khaohoen, A., Yoda, N., Rungsiyakull, P., Rungsiyakull, C., & Taichi, T. (2025). Can artificial intelligence optimize treatment planning and outcome prediction in

fixed tooth-and implant-supported prosthodontics? A scoping review. BMC Oral Health, 26, 104.
Kim, Y.-J., Jha, N., Gupta, S., Zvirin, A., Qendro, A., Zere, E.,…Sinha, S. (2022). Principles and applications of various 3D scanning methods for image acquisition for 3D printing applications in oral health science. In 3D Printing in Oral Health Science: Applications and Future Directions (pp. 7-45). Springer.
Lobo, S., Argolinha, I., Machado, V., Botelho, J., Rua, J., Li, J., & Mendes, J. J. (2025). Advances in Digital Technologies in Dental Medicine: Enhancing Precision in Virtual Articulators. Journal of Clinical Medicine, 14(5), 1495.
Powell, S. K., Cruz, R. L., Ross, M. T., & Woodruff, M. A. (2020). Past, present, and future of soft-tissue prosthetics: advanced polymers and advanced manufacturing. Advanced Materials, 32(42), 2001122.
Rahim, A., Khatoon, R., Khan, T. A., Syed, K., Khan, I., Khalid, T., & Khalid, B. (2024). Artificial intelligence-powered dentistry: Probing the potential, challenges, and ethicality of artificial intelligence in dentistry. Digital health, 10, 20552076241291345.
Rahman, A., Ali, M. H., Mahmood, M. A., & Liou, F. (2025). Industry 5.0, human–machine interface, and smart manufacturing in additive manufacturing—a recent trend. The International Journal of Advanced Manufacturing Technology, 1-32.
Rani, P. (2025). From Data to Diagnosis: Unleashing AI and 6G in Modern Medicine. EKSPLORIUM-BULETIN PUSAT TEKNOLOGI BAHAN GALIAN NUKLIR, 46(1), 69-103.
Revilla-León, M., Gómez-Polo, M., Vyas, S., Barmak, A. B., Gallucci, G. O., Att, W.,…Krishnamurthy, V. R. (2023). Artificial intelligence models for tooth-supported fixed and removable prosthodontics: A systematic review. The Journal of prosthetic dentistry, 129(2), 276-292.
Rokhshad, R., Ducret, M., Seifi, S., Mansouri, M., & Schwendicke, F. (2025). Artificial Intelligence: Limitations, Safety, and Regulatory Considerations in Dentistry. In Artificial Intelligence for Oral Health Care: Applications and Future Prospects (pp. 165-171). Springer.
Samaranayake, L., Tuygunov, N., Schwendicke, F., Osathanon, T., Khurshid, Z., Boymuradov, S. A., & Cahyanto, A. (2024). Artificial intelligence in prosthodontics: transforming diagnosis and treatment planning. Asian Journal of Periodontics and Orthodontics, 4(1-2024), 9-18.
Sarker, I. H. (2022). AI-based modeling: techniques, applications and research issues towards automation, intelligent and smart systems. SN computer science, 3(2), 158.
Sawangsri, K., Bekkali, M., Lutz, N., Alrashed, S., Hsieh, Y.-L., Lai, Y.-C.,…Hammoudeh, H. S. (2025). Acceptability and deviation of finish line detection and restoration contour design in single-unit crown: Comparative evaluation between 2 AI-based CAD software programs and dental laboratory technicians. The Journal of prosthetic dentistry.
Semerci, Z. M., & Yardımcı, S. (2024). Empowering modern dentistry: the impact of artificial intelligence on patient care and clinical decision making. Diagnostics, 14(12), 1260.
Sen, P. C., Hajra, M., & Ghosh, M. (2019). Supervised classification algorithms in machine learning: A survey and review. In Emerging technology in modelling and graphics: Proceedings of IEM graph 2018 (pp. 99-111). Springer.
Serafin, M. (2025). ARTIFICIAL INTELLIGENCE AVAILABLE TO THE DEVELOPMENT OF A VIRTUAL REALITY SOFTWARE FOR AN AUTOMATED CEPHALOMETRIC ANALYSIS OF ULTRA-REDUCED CBCT FOV.

Singh, A. K., Ahuja, D., Mallick, S., Jose, N. P., Bhardwaj, I., Batra, P., & Rana, A. (2025). Artificial intelligence in digital smile design: a review of technological innovations and clinical integration.

Smith, Z. (2024). From Analog to Digital: Transforming Traditional Prosthodontic Techniques with Digital Workflows. Journal of Dental Care, 1(2), 79-85.

Sorrentino, R., Zarone, F., Cantile, T., Mastrosimone, A., Cervino, G., & Ruggiero, G. (2024). The Use of Digital Tools in an Interdisciplinary Approach to Comprehensive Prosthodontic Treatments. In (Vol. 6, pp. 863-870): MDPI.

Spallek, H., Song, M., Polk, D. E., Bekhuis, T., Frantsve-Hawley, J., & Aravamudhan, K. (2010). Barriers to implementing evidence-based clinical guidelines: a survey of early adopters. Journal of Evidence based dental practice, 10(4), 195-206.

Strub, J. R., Rekow, E. D., & Witkowski, S. (2006). Computer-aided design and fabrication of dental restorations: current systems and future possibilities. The Journal of the American Dental Association, 137(9), 1289-1296.