World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(REVIEW ARTICLE)

Check for updates

Intelligence-Assisted Diagnosis and Treatment Planning in Orthodontics: A Systematic Review

Ivan Rachman Rizaldy [1,*], Dany Firsta Martino [1], Frinsky Smartura Yuristra [1] and Ervina Restiwulan Winoto [2]

[1] *Undergraduate Student,Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia*
[2] *Department of Orthodontic, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia*

World Journal of Advanced Research and Reviews, 2025, 28(01), 1871-1881

Publication history: Received on 28 August 2025; revised on 16 October 2025; accepted on 19 October 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.28.1.3533

Abstract

Introduction: The use of artificial intelligence (AI) in orthodontics has rapidly developed in recent years. This systematic review aims to evaluate the effectiveness and accuracy of AI applications in orthodontic diagnosis and treatment planning.

Methods: Data collection in this literature review followed the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines. Articles published in the last 5 years were screened from various literature sources through PubMed and Science Direct databases.

Results: Out of 672 identified articles, 15 studies met the inclusion criteria. The most common AI applications included cephalometric analysis, prediction of extraction needs, and treatment outcome simulations. The majority of studies reported AI accuracy comparable to or better than conventional methods. Several studies demonstrated significant reduction in diagnosis time with the use of AI.

Conclusion: Available evidence indicates great potential for AI in improving the accuracy and efficiency of orthodontic diagnosis and treatment planning. However, further research with more rigorous designs and larger sample sizes is needed to validate the effectiveness of AI in daily clinical practice.

Keywords: Orthodontics; Artificial Intelligence; Diagnosis; Treatment Planning

1 Introduction

Artificial intelligence (AI) is a specialized area within computer science that enables machines to replicate human cognitive functions. In recent years, AI has demonstrated significant potential for addressing a wide range of tasks. Two key branches of AI include expert systems and machine learning. While expert systems rely on predefined rules and knowledge, machine learning emphasizes the ability to learn from training data, thereby enhancing its performance. Machine learning is particularly noteworthy for its adaptability, generalization abilities, and capacity to handle large datasets, combined with a wealth of open-source algorithms, making it a highly promising technology in the field of AI [1].

Artificial Intelligence (AI) algorithms have proven their capability in handling complex and abstract tasks, emerging as a promising tool in healthcare. These advanced systems are assisting medical professionals in analyzing medical images, diagnosing diseases, and supporting therapeutic decisions. AI's impact extends beyond clinical applications, revolutionizing healthcare administration through features like online appointment scheduling, digital check-ins, electronic health record management, and automated reminders for follow-ups and immunizations. AI also enhances

* Corresponding author: Ivan Rachman Rizaldy

medication safety by flagging potential adverse interactions in multi-drug prescriptions. In the specialized field of orthodontics, where treatment focuses on altering occlusion and managing dentoalveolar development and growth abnormalities, AI shows potential to improve the critical process of problem assessment. This enhancement could lead to more accurate determination of treatment needs and priorities, potentially ushering in a new era of precision in orthodontic care [2].

Artificial Intelligence (AI) has demonstrated significant potential in enhancing the efficiency of clinical orthodontic practice, as evidenced by numerous studies. The field has seen the widespread adoption of AI-driven software programs, such as 3Shape Dental System, Uceph, and Mastro 3D, which are now integral to orthodontic care. As AI algorithms advance, computing power increases, and more extensive data sets become available, the scope and performance of AI applications in orthodontics continue to expand and improve. Staying abreast of these rapid developments through timely reviews is crucial for researchers and practitioners. While AI has shown promising results in orthodontics, there remains substantial room for growth and refinement. This evolving landscape encompasses AI applications in diagnosis, treatment planning, and clinical practice. However, current limitations persist, necessitating ongoing research and development. By providing a comprehensive overview of AI's current state in orthodontics and offering insights into future directions, reviews in this field aim to facilitate the seamless integration of AI into orthodontic practice, potentially revolutionizing patient care and treatment outcomes [3].

This systematic review aims to analyze the accuracy of AI compared to conventional methods, its impact on diagnosis time, and its potential to transform orthodontic practice. Additionally, we will highlight areas where further research is needed to validate the effectiveness of AI in daily clinical settings. This introduction sets the stage for a comprehensive examination of AI's current capabilities and future potential in orthodontics, providing valuable insights for practitioners, researchers, and technology developers in this rapidly evolving field.

2 Material and methods

2.1 Data sources

This systematic review was conducted following the (Preferred Reporting Items for Systematic Review and Meta-Analysis) PRISMA guidelines, focusing on the application of artificial intelligence in orthodontics. The researchers performed an extensive search across major electronic databases, including PubMed and ScienceDirect. The literature review covered publications from 2019 to 2024, employing key search terms such as “orthodontics”, “artificial intelligence”, “diagnosis” and “treatment planning”.This comprehensive approach aimed to gather and analyze the latest developments in AI applications within orthodontics, providing a thorough overview of advancements and potential uses in diagnosis and treatment planning in orthodontics over the past a decade.

2.2 Inclusion criteria

- The article must be focused on AI and its application should be related to orthodontics.
- There must be some predictive or measurable outcomes so they can be quantified.
- There has to be a proper mention of datasets that are used to assess a model.

2.3 Exclusion criteria

- The articles that are related to non-AI areas.
- Articles that consisted of only abstracts without the full text.
- Articles that were not written in English.

2.4 Keyword research

The keywords used in this research article are keywords and Boolean operators (AND, OR). The keywords in this literature review are adapted from the Medical Subject Heading (MeSH). The search was conducted in September 2024. The database source used is Publish or Perish. The data sought includes articles published from 2019-2024 with the keywords "orthodontics", "artificial intelligence", "diagnosis" and "treatment planning".

2.5 Data analysis

The data obtained from the literature review using Publish or Perish is compiled in a table (Table 1).

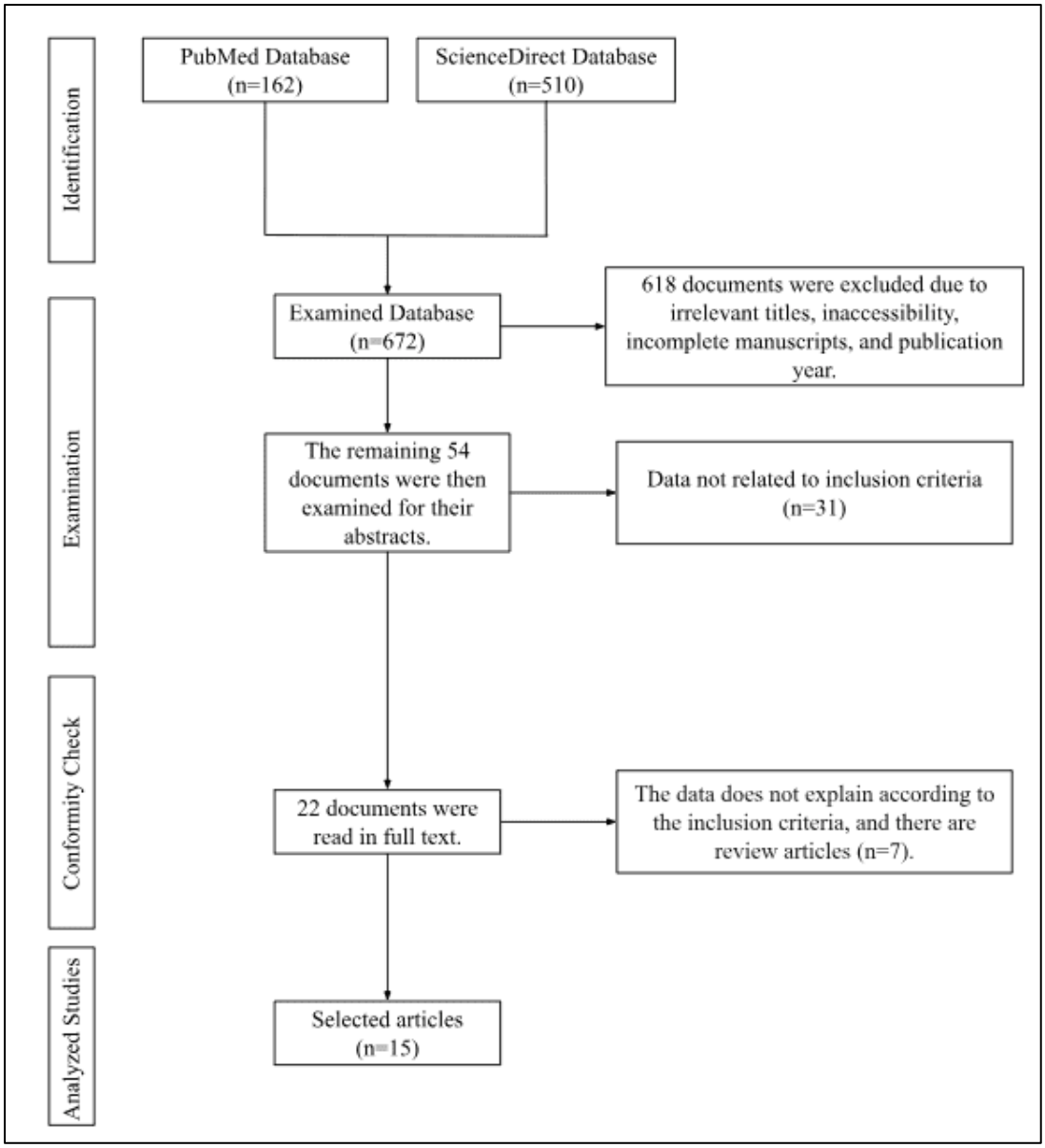

Figure 1 Flowchart of the study selection process for the reviewed articles

3 Results and discussion

Based on the literature review results, articles were identified from PubMed and Science Direct. Subsequently, the articles were published and relevant articles were retrieved to identify articles that met the inclusion criteria. To receive selected articles that meet the requirements. The stages of selection of the identified articles are shown in Figure 1. Based on the results of the literature review conducted through a systematic review over the last 5 years of research for articles that meet the eligibility criteria. A summary of the research materials is in Table 1.

Table 1 Literature Review of AI Applications in Orthodontics

No.	Title	Researcher	Method	Result
1.	A Comparison of Reproducibility of Artificial Intelligence Assisted	John et al., 2023	This study aims to compare the reproducibility of AI-assisted cephalometric analysis using the WebCeph application on two	The research findings indicate that the WebCeph application provides consistent and reproducible

	Cephalometric Analysis Using Webceph on Android and Ios Operating Systems- A Short Study		different operating systems, namely Android and iOS. A total of 15 pre-treatment lateral cephalometric radiographs were randomly selected according to the inclusion criteria. Cephalometric analysis was performed using the WebCeph application on Android and iOS-based smartphones. Steiner analysis, which is one of the most commonly used cephalometric methods in orthodontic practice, was performed automatically with the aid of AI. Data was analyzed using the Mann Whitney U test to compare the results between the two operating systems	analysis results on both Android and iOS operating systems. While this application is effective and fast, orthodontists still play a crucial role in integrating diagnostic medical records to determine an accurate diagnosis
2.	Artificial Intelligence in Orthodontics : Evaluation of A Fully Automated Cephalometric Analysis Using a Customized Convolutional Neural Network	Kunz et al., 2020	This study aims to evaluate the accuracy of a fully automated cephalometric analysis system utilizing an AI-based Convolutional Neural Network (CNN) algorithm. A total of 12 expert examiners marked 18 cephalometric landmarks on 1,792 X-ray images to train the CNN network. Subsequently, 50 cephalometric X-ray images not included in the training data were analyzed by the AI and the examiners. 12 common orthodontic parameters were analyzed by the AI and compared to the human gold standard obtained from the median values of the human examiners for each parameter. The comparison was conducted through paired sample t-test, Pearson correlation, and Bland-Altman plots to determine the agreement between the AI results and the human standard.	The analysis demonstrates high accuracy of the AI in detecting cephalometric landmarks and calculating orthodontic parameters. This implementation of AI holds significant potential for improving the efficiency and consistency of cephalometric analysis in everyday orthodontic practice
3.	Obstacles Behind the Innovation- A Peek Into Artificial Intelligence in The Field of Orthodontics – A Literature Review	Butul & Sharab, 2024	This research is a literature review that examines the application of Artificial Intelligence (AI) in orthodontics. Literature sources were gathered from various databases, including PubMed, MEDLINE, NIH, Science Direct, WILEY, and ORAL HEALTH GROUP. The reviewed articles are from studies published to date and focus on the application of AI in orthodontic treatment, including cephalometric analysis, treatment planning, and the challenges faced in AI implementation	AI has the potential to revolutionize the field of orthodontics by enhancing the efficiency and quality of care. However, existing challenges need to be addressed to ensure the effective and ethical implementation of AI in orthodontic clinical practice.
4.	Clinical Evaluation of Artificial Intelligence	Snider et al., 2024	This study aims to evaluate the accuracy of Artificial Intelligence	The AI algorithm from DM has a high specificity but low

	Driven Remote Monitoring Technology for Assessment of Patient Oral Hygiene During Orthodontic Treatment		Driven Remote Monitoring (AIDRM) technology in detecting oral hygiene in patients undergoing orthodontic treatment. 24 patients with metal braces were involved in this study. They were monitored using the Dental Monitoring (DM) protocol for 10 visits. At each visit, a direct clinical examination was performed to assess the presence of plaque, gingivitis, and gingival recession. These results were compared to the results from AI-based image analysis from DM. Measures used to evaluate AI performance included sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV).	sensitivity, indicating a tendency to underestimate the presence of plaque, gingivitis, and recession. However, if these conditions are detected, the likelihood is very high that the results are accurate. Further research is recommended to better understand the role of AI in detecting oral hygiene conditions and its impact on the health of orthodontic patients.
5.	Evaluating The Accuracy of Automated Cephalometric Analysis Based on Artificial Intelligence	Bao et al., 2023	This study aims to evaluate the accuracy of AI-based automated cephalometric landmark determination compared to computer-assisted manual analysis. The data used in this study was obtained from 85 patients who underwent cone-beam computed tomography (CBCT), with reconstructed lateral cephalogram images (RLC).	AI-based automated cephalometric analysis is approaching an acceptable level of accuracy for clinical use, but it cannot fully replace manual analysis yet. Additional manual supervision is still needed to improve the accuracy and efficiency of the automated program.
6.	Can Artificial Intelligence-driven Cephalometric Analysis Replace Manual Tracing? A Systematic Review and Meta-analysis	Hendrickx et al., 2024	This research is a systematic review and meta-analysis aimed at evaluating the accuracy and efficiency of artificial intelligence (AI)-assisted cephalometric landmark detection on two-dimensional (2D) lateral cephalogram images and three-dimensional (3D) cone-beam computed tomography (CBCT) images. Relevant studies were identified through electronic database searches, including PubMed, Web of Science, and Embase up to January 2024. Inclusion criteria included studies that used AI algorithms to detect cephalometric landmarks and compared their results to manual tracing by experts. Data extraction was performed independently by two researchers, and risk of bias was assessed using the QUADAS-2 tool.	AI-assisted automated cephalometric landmark detection on 2D and 3D images holds potential in terms of accuracy and time efficiency. However, further development is needed to improve the generalization and robustness of these AI systems.
7.	Artificial Intelligence and Machine Learning for Automated	Rauniyar et al., 2023	This research is a systematic review and meta-analysis evaluating the accuracy of automated identification	AI and machine learning-based methods show comparable results to

	Cephalometric Landmark Identification: A Meta-Analysis Previewed by a Systematic Review		of cephalometric landmarks using artificial intelligence (AI) and machine learning (ML), compared to manual tracing. This study followed the PRISMA-DTA guidelines, with literature searches conducted from databases such as PubMed, Embase, Scopus, and Google Scholar between January 2001 and November 2022. Out of a total of 137 articles identified, only 7 articles met the inclusion criteria for inclusion in the analysis. Data was extracted according to the PICO format (Participants, Intervention, Comparison, Outcomes), and meta-analysis was performed based on the Success Detection Rate (SDR), with a prediction error threshold of 2 mm.	manual tracing, with some studies even demonstrating AI to be more accurate for certain landmarks. The use of AI in cephalometric landmark identification has shown promising results compared to manual methods. AI can help improve diagnostic accuracy, time efficiency, and clinical decision-making, particularly in orthodontic treatment planning.
8.	Clinical Audit of An Artifcial Intelligence (AI) Empowered Smile Simulation System: a Prospective Clinical Trial	Adel et al., 2024	This research is a prospective clinical trial aiming to evaluate the predictability of an artificial intelligence (AI)-based smile simulation tool, Invisalign SmileView, by comparing digital smile simulations with the final outcome of orthodontic treatment. Twenty-four adult patients (12 male and 12 female) with mild to moderate malocclusion requiring treatment with clear aligners were recruited. Digital smile simulations were taken before treatment using SmileView, and after that, orthodontic treatment was performed with Invisalign aligners for an average of 18 ± 6 months. These digital smile simulations were then compared to post-treatment photographs taken after treatment completion.	Overall, the Invisalign SmileView tool showed limited predictability in smile simulation, especially for qualitative parameters, although some quantitative parameters could be predicted accurately. Further research is needed to evaluate the effectiveness of this tool in the context of more complex treatment.
9.	Artificial Intelligence for Classifying and Archiving Orthodontic Images	Li et al., 2022	This study aims to develop and evaluate a deep learning-based artificial intelligence (AI) system for automated classification and archiving of orthodontic images. The study utilizes a dataset of over 14,000 orthodontic images encompassing 14 image categories, including six categories of intraoral photographs, six categories of extraoral photographs, and two types of radiographs. The deep learning model used is based on DeepID, which combines Convolutional	AI can process 100 patients (1,420 images) in 0.08 minutes, which is significantly faster compared to the average time of 18.93 minutes taken by orthodontists for the same task. AI was proven to be 236 times faster compared to manual classification by humans. The use of AI can significantly reduce orthodontic workload, allowing more time to focus

			Neural Networks (CNN) for feature extraction and a joint Bayesian algorithm for verification. Data from 1,000 patients was used to train and validate the model, while data from an additional 100 patients was used as an external dataset to test the model's performance. The model's results were compared to manual classification by three orthodontists.	on clinical care. Additionally, this model offers potential for implementation in everyday orthodontic practice, enhancing the efficiency of clinical image archiving and retrieval.
10.	Artificial Intelligence for Detecting Cephalometric Landmarks: A Systematic Review and Meta-analysis	de Queiroz et al., 2023	This research is a systematic review and meta-analysis aiming to evaluate the accuracy rate of artificial intelligence (AI) in detecting cephalometric landmarks on digital images, comparing it to manual detection by professionals. Eligible studies for this review were retrieved from 9 electronic databases, including PubMed, Scopus, and Web of Science. Two researchers independently selected studies, extracted data, and assessed risk of bias using the QUADAS-2 tool. Meta-analysis was performed using a random effects model to combine results from various studies.	Evidence suggests that AI holds promise for automatically detecting cephalometric landmarks, however, further research is needed to validate the strength and accuracy of AI on diverse samples.
11.	Applications of Artificial Intelligence and Machine Learning in Orthodontics: A Scoping Review	Bichu et al., 2021	This study is a scoping review aiming to examine the existing evidence regarding the use of artificial intelligence (AI) and machine learning (ML) in the field of orthodontics. The review was conducted in accordance with the PRISMA-ScR guidelines, where relevant literature was identified from the PubMed database up to July 2020. A total of 62 articles were selected that involved AI/ML applications in orthodontics, with various algorithms used, including Artificial Neural Networks (ANN), Convolutional Neural Networks (CNN), and Support Vector Machines (SVM).	Research shows that there has been an exponential increase in the number of studies involving AI/ML in orthodontics over the past decade. AI has been widely applied in diagnosis and treatment planning, as well as automating cephalometric landmark detection, with the potential to reduce human error and enhance efficiency. However, despite its promise, widespread adoption of AI still faces several challenges, including limitations on clinical evidence and the need for further research for more complex applications.
12.	Artificial Intelligence: Applications in Orthognathic Surgery	Bouletreau et al., 2019	This article discusses the application of Artificial Intelligence (AI) in orthognathic surgery, focusing on the use of AI to assist in various aspects of orthognathic surgery planning and execution. Relevant literature is reviewed to explain how AI can be used at various stages, including	AI shows great potential in enhancing accuracy and efficiency in various aspects of orthognathic surgery, from diagnosis to follow-up. However, it is crucial to maintain a balance between AI usage and human clinical

			image acquisition, treatment planning, customized surgical guide fabrication, and post-treatment follow-up. The use of techniques such as deep learning, machine learning, and convolutional neural networks (CNN) in medical image analysis is also explored to demonstrate the benefits of AI in optimizing diagnosis and treatment planning.	judgment to ensure optimal outcomes and preserve clinical skills. A positive symbiosis between AI and human clinical capabilities is key to the successful integration of AI into orthognathic surgery.
13.	Application of Artificial Intelligence in Orthodontics: Current State and Future Perspectives	Liu et al., 2023	This article is a comprehensive review aiming to explore the application of artificial intelligence (AI) and machine learning (ML) in the field of orthodontics. The authors classify AI applications into three main categories: diagnosis, treatment planning, and clinical practice. The article covers a literature review of various studies published between 2010 and 2023, using data from electronic databases, including PubMed and Scopus. It focuses on various AI algorithms such as Artificial Neural Networks (ANNs), Convolutional Neural Networks (CNNs), and other deep learning methods, as well as AI-powered diagnostic tools currently available in clinics.	AI has proven to be highly efficient in detecting cephalometric landmarks, performing dental analysis, and assessing upper airway obstruction. AI systems such as CephX and WebCeph have shown accurate results with an average error margin in the range of 1-2 mm. Research suggests that AI can assist orthodontists, especially those less experienced, in making more accurate decisions.
14.	Cephalometric Analysis in Orthodontics Using Artificial Intelligence—A Comprehensive Review	Subramanian et al., 2022	This article is a comprehensive review of the use of artificial intelligence (AI) in cephalometric analysis in the field of orthodontics. The method used is a narrative review of available literature. Literature searches were conducted using Google Scholar, EMBASE, PubMed, MEDLINE, and Science Direct in August 2021. This study covers various types of AI applied in cephalometric analysis, including machine learning, deep learning, artificial neural networks (ANN), and convolutional neural networks (CNN). This research assesses the progress, efficiency, accuracy, and future prospects of AI application in orthodontic diagnosis.	AI has the potential to be a reliable and efficient tool in routine orthodontic practice and big data-based research. AI has been used for a variety of purposes, including landmark identification, prediction of orthognathic surgery, facial structure analysis, and tooth extraction decisions. AI has proven to save time and reduce subjective errors in cephalometric analysis, which is important for improving diagnosis and more accurate treatment planning. Although AI has shown many advantages, its use in orthodontic practice still requires further research to improve accuracy and adaptability in complex clinical situations.
15.	AI in Orthodontics: Revolutionizing	Kazimierczak et al., 2024	This article is a comprehensive review of the application of artificial	AI shows highly accurate results in detecting

	Diagnostics and Treatment Planning—A Comprehensive Review		intelligence (AI) in orthodontics, specifically in diagnosis and treatment planning. The review is based on a literature search in several databases including PubMed, Web of Science, Scopus, and Google Scholar up to December 2023. A total of 509 potential articles were identified, and after screening, 139 relevant articles were included for further analysis. This article explores various AI applications such as cephalometric analysis, skeletal age determination, temporomandibular joint (TMJ) evaluation, as well as decision-making for tooth extraction and orthognathic surgery.	cephalometric landmarks with several studies demonstrating accuracy rates exceeding 90%. AI is used to support decisions in orthodontic treatment such as tooth extraction and orthognathic surgery. AI has great potential in transforming the way diagnosis and treatment planning are performed in orthodontics. With increasingly sophisticated algorithms, AI can improve efficiency, accuracy, and consistency in various areas such as cephalometric analysis, skeletal age determination, and TMJ evaluation

Artificial Intelligence (AI) has significantly transformed the field of orthodontics by enhancing accuracy and efficiency in diagnosis, treatment planning, and outcome assessment [4]. One of the most prominent applications is cephalometric analysis, where AI has expedited the process of identifying crucial anatomical landmarks that were previously performed manually. Research indicates that AI, particularly utilizing artificial neural networks like Convolutional Neural Networks (CNNs), has demonstrated the ability to improve accuracy and reduce the time required for analysis compared to manual methods [5]. These systems significantly contribute to reducing errors that typically arise due to human fatigue and inter-observer variability in cephalometric landmark identification. In cephalometric analysis, AI-based systems are capable of mimicking human intelligence by automating landmark identification, reducing analysis time, and enhancing reproducibility by minimizing errors due to human fatigue [6]. Tools such as WebCeph have exhibited high reproducibility in the measurements generated, and their accuracy compared to manual methods makes them a reliable tool in orthodontic diagnostics [4].

In a study by, AI was shown to be capable of automating cephalometric landmark identification with reasonably high accuracy, although it still requires manual supervision to enhance its efficiency [7]. AI systems such as Planmeca Romexis and Dolphin Imaging enable automatic landmark identification with minimal error rates and have been proven to accelerate the cephalometric analysis process, which traditionally takes longer when performed manually [8].

The role of AI is not limited to diagnostic imaging, but also encompasses treatment planning and outcome prediction. Deep learning models such as Convolutional Neural Networks (CNNs) have successfully recognized patterns in orthodontic imaging, facilitating automated detection of cephalometric landmarks with minimal error rates [9]. CNNs have also proven to surpass manual methods in terms of speed and consistency, making orthodontic treatment more accessible to non-specialist personnel [10,3]. Furthermore, AI enables the simulation of post-treatment outcomes, thereby assisting clinicians in designing more effective and evidence-based treatment plans [6].

On the other hand, AI also plays a significant role in orthodontic treatment planning. For instance, AI has been employed in the automated classification of orthodontic images, reducing the clinical workload for orthodontists. A study conducted by [11] demonstrated that deep learning models, such as DeepID, can perform orthodontic image classification with exceptionally high accuracy (99.4%) and faster than human experts, highlighting the immense potential of AI in orthodontic clinics [11]. AI has also shown the ability to enhance accuracy in 3D image analysis from CBCT (Cone Beam Computed Tomography), although 2D use remains the primary choice in many instances due to radiation and cost considerations[5].

Beyond cephalometric analysis, AI has been utilized for orthodontic treatment planning and outcome simulation. For example, AI-powered Invisalign SmileView technology enables patients to visualize a digital smile simulation before treatment commences, serving as a crucial communication tool between doctor and patient. Studies evaluating the accuracy of these smile simulations indicate that simulated outcomes generally correlate with post-treatment results,

although certain variables show better outcomes after treatment compared to initial simulations [12]. This underscores the potential of AI not only to aid in treatment communication but also to enhance the accuracy of orthodontic treatment outcomes.

While AI offers numerous benefits, challenges exist in its implementation. A study by Butul and Sharab (2024) indicated that although AI has shown promising results in many instances, it has not yet fully replaced human involvement in cephalometric analysis and treatment planning [13]. The variability of AI performance across different clinical settings remains a concern, particularly in complex cases requiring manual supervision [10]. Moreover, AI's ability to continuously learn raises issues related to data privacy and ethical considerations that need to be addressed as its adoption becomes more widespread in clinical practice [3]. Additionally, although AI can enhance clinical efficiency, manual supervision remains necessary to ensure the quality of outcomes, especially in more complex cases [2].

4 Conclusion

In conclusion, artificial intelligence (AI) has revolutionized orthodontics by enhancing accuracy, efficiency, and communication in diagnosis, treatment planning, and outcome assessment. AI applications like cephalometric analysis, treatment simulation, and image classification have shown promising results in improving diagnostic accuracy and treatment outcomes. While AI offers significant benefits, challenges such as variability in performance, ethical considerations, and the need for manual supervision persist. Despite these challenges, AI's potential to transform orthodontic practice by improving precision, efficiency, and patient care remains evident. Continued research and development are essential to harness the full potential of AI in orthodontics and address the current limitations for seamless integration into clinical practice.

Compliance with ethical standards

Disclosure of conflicts of interest

No conflict of interest to be disclosed.

References

[1] Wang, X. L., Liu, J., Li, Z. Q., & Luan, Z. L. (2021). Application of Physical Examination Data on Health Analysis and Intelligent Diagnosis. BioMed Research International, 2021, 8828677. https://doi.org/10.1155/2021/8828677

[2] Kunz, F., Stellzig-Eisenhauer, A., Zeman, F., & Boldt, J. (2020). Artificial Intelligence in Orthodontics : Evaluation of A Fully Automated Cephalometric Analysis Using A Customized Convolutional Neural Network. Journal of orofacial, 81(1), 52–68. https://doi.org/10.1007/s00056-019-00203-8

[3] Liu, J., Zhang, C., & Shan, Z. (2023). Application of Artificial Intelligence in Orthodontics: Current State and Future Perspectives. Healthcare (Basel, Switzerland), 11(20), 2760. https://doi.org/10.3390/healthcare11202760

[4] John. (2023). A Comparison of Reproducibility of Artificial Intelligence Assisted Cephalometric Analysis Using WebCephTM on Android and iOS Operating Systems - A Short Study. International Journal of Science and Research (IJSR), 12(6), 420-423.

[5] Hendrickx, J., Gracea, R. S., Vanheers, M., Winderickx, N., Preda, F., Shujaat, S., & Jacobs, R. (2024). Can Artificial Intelligence-Driven Cephalometric Analysis Replace Manual Tracing? A Systematic Review and Meta-Analysis. European Journal of Orthodontics, 46(4), cjae029. https://doi.org/10.1093/ejo/cjae029

[6] Rauniyar, S., Jena, S., Sahoo, N., Mohanty, P., & Dash, B. P. (2023). Artificial Intelligence and Machine Learning for Automated Cephalometric Landmark Identification: A Meta-Analysis Previewed by A Systematic Review. Cureus, 15(6), e40934. https://doi.org/10.7759/cureus.40934

[7] Bao, H., Zhang, K., Yu, C., Li, H., Cao, D., Shu, H., Liu, L., & Yan, B. (2023). Evaluating the Accuracy of Automated Cephalometric Analysis Based on Artificial Intelligence. BMC oral health, 23(1), 191. https://doi.org/10.1186/s12903-023-02881-8

[8] Subramanian, A. K., Chen, Y., Almalki, A., Sivamurthy, G., & Kafle, D. (2022). Cephalometric Analysis in Orthodontics Using Artificial Intelligence-A Comprehensive Review. BioMed Research International, 2022, 1880113. https://doi.org/10.1155/2022/1880113

[9] Bichu, Y. M., Hansa, I., Bichu, A. Y., Premjani, P., Flores-Mir, C., & Vaid, N. R. (2021). Applications of Artificial Intelligence and Machine Learning in Orthodontics: A Scoping Review. Progress in orthodontics, 22(1), 18. https://doi.org/10.1186/s40510-021-00361-9

[10] Kazimierczak, N., Kazimierczak, W., Serafin, Z., Nowicki, P., Nożewski, J., & Janiszewska-Olszowska, J. (2024). AI in Orthodontics: Revolutionizing Diagnostics and Treatment Planning-A Comprehensive Review. Journal of Clinical Medicine, 13(2), 344. https://doi.org/10.3390/jcm13020344

[11] Li, S., Guo, Z., Lin, J., & Ying, S. (2022). Artificial Intelligence for Classifying and Archiving Orthodontic Images. BioMed Research International, 2022, 1473977. https://doi.org/10.1155/2022/1473977

[12] Adel, S. M., Bichu, Y. M., Pandian, S. M., Sabouni, W., Shah, C., & Vaiid, N. (2024). Clinical Audit of an Artificial Intelligence (AI) Empowered Smile Simulation System: A Prospective Clinical Trial. Scientific Reports, 14(1), 19385. https://doi.org/10.1038/s41598-024-69314-6

[13] Butul, B., & Sharab, L. (2024). Obstacles Behind the Innovation- A Peek Into Artificial Intelligence in the Field of Orthodontics - A Literature review. The Saudi Dental Journal, 36(6), 830–834. https://doi.org/10.1016/j.sdentj.2024.03.008