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Review Article

A Short Review on Artificial Intelligence and Implant Dentistry

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Abstract

According to recent studies, the use of AI in implant dentistry had shown almost accurate and precise post-operative outcomes which has indirectly enhanced post-operative primary stability results. Therefore, we have conducted this review article to document the available material on AI algorithm use, advantage, disadvantage and results.

Keywords: AI; Implant Dentistry; Outcomes; Advantage; Use; Stability

Introduction

According to studies, the integration of AI in dentistry represents a rapidly evolving domain, focused on enhancing the quality of patient care through the optimization of clinical procedures and the efficient use of time [1,2]. The technology also enables the dentist to perform multiple functions within a dental clinic which includes appointment scheduling & assisting in the development of diagnosis [3]. Because of this element, dentists have the capacity to proactively address potential issues and build more specialized plans for the treatment that are tailored to the unique needs of each patient [4]. A study have also shown that, dentists can use it to provide more effective and efficient care to the patient [5]. In addition to above, studies have shown that, by combing finite element analysis (FEA) calculation and AI models, design of implant can be optimized which would further enhance function and acceptance of prosthodonticc treatment later on [6,7]. Furthermore, this technology according to a studies, it improve implant procedure accuracy, precision, reduce human error & enhance quality of restoration [8-10].

Review of literature

Study have also shown that, AI can be of assistance to dentist who all were facing difficulties in the evaluation of CBCT scans, thereby enabling the identification of anatomical structures and the comprehensive planning of implants [11]. Below are some of the past studies that where different authors have used AI algorithm to fasten their planning of the treatment to cure their patients are as follows

Advantage [11,30]

- Accuracy
- Updated Information
- Automated task performing
- Save time and resource
- Assist in research
- Minimized surgical truama
- Reduce risk of nerve damage
- Enhanced stability and longevity

Author	Year	Finding
Moufti., *et al*. [12]	2023	MBL showed superior accuracy.
Fontenele., *et al*. [13]	2023	Results were comparable to those of the manual segmentation.
Oliveira-Santos., *et al.* [14]	2023	Demonstrating accuracy even in the presence of an anterior loop.
Mangano., *et al*. [15]	2023	Time efficiency and effectiveness
Sakai., *et al*. [16]	2023	AI model successfully predicted the drilling technique.

Table a

Author	Year	Findings
Li., *et al*. [17]	2019	Support vector regression for implant optimization is dependable and efficient, serving as a viable alternative to the finite element approach.
Roy., *et al*. [18]	2018	An effective optimization strategy for converting FEA results with reduced computing costs is the ANN model.
Zaw., *et al*. [19]	2009	The RBM-NN method demonstrated accuracy, efficiency, and reliability.

Table b: AI and Implant type.

Author	Objective	AI-model	Accuracy
Widisari M., *et al.* [20]	To detect anatomical landmarks	Dental-YOLO	99.46%
Moufti., *et al.* [21]	Monitor edentulous area on CBCT	"U-Net" CNN	78%
Bayrakdar., *et al.* [22]	Measure anatomical area	Diagnocat AI system	72.2%, 66.4% and 95.3%
Kung PC., *et al.* [23]	Improve the design	U-net, ANN, and random forest models	86%
Alsomali M., *et al.* [24]	Automatically localize the position of radiographic stent	DL model	83%
Sakai T., *et al.* [25]	Implant drilling suitable protocol using CBCT.	LeNet-5	93.8%

Table c: AI and Treatment planning.

Author	Objective	AI- model	Accuracy
Liu., *et al*. [26]	Detect MBL	R-CNN	73%
Rekwak., *et al*. [27]	Predict failure and peri-implantitis.	Logistic regression (LR), random forest classifiers (RFC), SVMs and ensemble methods.	87.2% to 84%
Mameno., *et al*. [28]	Develop predictive models for peri-implantitis.	LR, SVMs random forests.	63%,64% and71%
Chen YC., *et al*. [29]	Evaluate the extent of damage.	CNN model	90.45%

Table d: AI and Peri-implantitis.

Disadvantage [11,30]

- Need human surveillance
- Overlook social problems
- Increase in unemployment situation
- Effect on healthcare education
- Inaccuracy
- Limited data available
- AI requires investment in hardware, software and training.
- Regulation and ethical concern need to evolve alongside.
- Successful implant treatment still relies heavily on dentist knowledge and ability to interpret data and make critical decision.

Future scope [30]

- Revolutionary step in diagnosis, prognosis & treatment planing
- Optimize surgical precison
- Enhance patient experience by educating them for their disease
- Can act as a road map to continue offer feedback during surgery

Conclusion

Although, the use of AI in dental implant has opened a new age of accuracy, efficiency & ability to forecast outcomes. However, there are still practical constraints in its implementation in clinical settings. Therefore, additional research and validation via clinical trials are required.

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