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Original Research Article

Readiness and Willingness to Adopt Artificial Intelligence and Digital Technologies in Maxillofacial Prosthetic Rehabilitation among Oral Healthcare Professionals in Southeastern Nigeria

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Abstract: ***Background*:** Artificial intelligence (AI) and digital technologies have considerable potential to improve diagnosis, treatment planning, prosthetic design, and patient follow-up in maxillofacial rehabilitation. However, their successful integration into clinical practice may depend on healthcare professionals' readiness, institutional preparedness, and willingness to invest in these technologies. ***Aim*:** To assess oral healthcare professionals' willingness and readiness to adopt AI and digital technologies in maxillofacial prosthetic rehabilitation in southeastern Nigeria, with particular emphasis on training needs, perceived institutional preparedness, anticipated benefits, and willingness to invest in AI technologies. ***Methods*:** A total of 220 oral healthcare professionals participated in the study. Data on respondents' sociodemographic characteristics, readiness for AI adoption, perceptions of institutional preparedness, anticipated usefulness of AI, and willingness to invest in AI technologies were analysed using descriptive statistics and Pearson's chi-square test. Cramer's V was used to assess the strength of association between perceived institutional preparedness and willingness to invest in AI. ***Results*:** The respondents had a mean age of 38.64 ± 9.96 years, and the largest age group was 30–39 years (33.6%). Dental therapists/hygienists constituted 31.8% of respondents, while 47.7% had 5–10 years of professional experience. All respondents (100.0%) expressed willingness to receive formal AI training. Most respondents (56.8%) anticipated that AI would become routine in maxillofacial rehabilitation in southeastern Nigeria after more than 10 years. Regarding institutional preparedness, 79.1% considered their institutions ready to adopt AI, while 82.3% expressed willingness to invest in AI technologies. AI was considered extremely useful for developing individualised prosthetic treatment plans by 44.5% of respondents and very useful by 37.7%. Digital intraoral and facial scanning (46.4%) and three-dimensional printing (43.6%) were the most frequently identified technologies likely to have the greatest impact on maxillofacial rehabilitation. Perceived institutional preparedness was significantly associated with willingness to invest in AI (Pearson's $\chi^2 = 158.5$, df = 1, $p < 0.001$; Cramer's V = 0.85), indicating a very strong association. ***Conclusion*:** Oral healthcare professionals in southeastern Nigeria demonstrated substantial willingness to undertake AI training, invest in AI technologies, and recognise their potential value in individualised maxillofacial prosthetic rehabilitation. Nevertheless, expectations regarding the routine integration of AI suggest that adoption may be gradual. Training opportunities, institutional support, and investment in relevant digital infrastructure may help facilitate implementation. Further research should investigate the practical barriers to adoption and assess whether expressed willingness translates into actual clinical use.

Keywords: Artificial Intelligence, Digital Dentistry, Maxillofacial Prosthetic Rehabilitation, Institutional Preparedness, Oral Healthcare Professionals, Nigeria.

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1. INTRODUCTION

Artificial intelligence (AI) and digital technologies are increasingly transforming healthcare by supporting data analysis, pattern recognition, diagnostic interpretation, prediction, and clinical decision-making [1]. In dentistry, the integration of AI with computer-aided design and manufacturing (CAD/CAM), intraoral and facial scanning, cone-beam computed tomography (CBCT), and three-dimensional (3D) printing is creating new opportunities to improve diagnostic accuracy, treatment planning, prosthesis fabrication, and personalised patient care [1-3]. Although dental professionals generally recognise the potential benefits of AI, their knowledge and practical exposure to these technologies remain variable (Dashti *et al*., 2024).

These developments are particularly relevant to oral and maxillofacial prosthetic rehabilitation, where conventional approaches often involve physical impressions, manual modelling, and multiple stages of laboratory fabrication and clinical adjustment. Despite their continued clinical value, these procedures can be labour-intensive and technique-sensitive, particularly when restoring complex facial defects requiring anatomical precision, symmetry, and colour matching. Digital workflows incorporating CAD/CAM, facial scanning, CBCT, virtual treatment planning, and 3D printing may improve precision, reproducibility, customisation, and collaboration between clinicians and dental technologists [1-6]. AI may further support selected aspects of image interpretation, treatment planning, and individualised prosthetic design, although its clinical benefits depend on the specific application and available evidence.

In Nigeria, the adoption of these technologies may be influenced by access to specialised equipment, digital infrastructure, technical support, training, and institutional resources. Southeastern Nigeria provides a relevant setting for examining these issues because its teaching hospitals, federal medical centres, and specialist healthcare institutions provide clinical services and professional training. Assessing oral healthcare professionals' readiness to integrate AI and digital technologies in these settings is important for understanding their perceived usefulness, training needs, willingness to invest, and expectations regarding future clinical applications.

Despite growing international interest in AI in dentistry, evidence concerning its potential adoption in maxillofacial prosthetic rehabilitation remains limited, particularly in resource-constrained healthcare settings. Context-specific evidence on professionals' readiness, willingness, perceived institutional preparedness, and anticipated barriers is therefore needed. Understanding these factors can inform professional education, institutional planning, and investment in appropriate digital infrastructure. This study consequently assessed readiness and willingness to adopt AI and digital technologies in maxillofacial prosthetic rehabilitation among oral healthcare professionals in southeastern Nigeria. The findings are intended to inform strategies for professional training and technology integration, particularly given the respondents' universal willingness to receive formal AI training, their favourable perceptions of AI's potential usefulness, and the observed association between perceived institutional preparedness and willingness to invest in AI technologies.

2. METHODOLOGY

2.1 Study Area

The study was conducted in southeastern Nigeria, one of the six geopolitical zones of the country. The region comprises Abia, Anambra, Ebonyi, Enugu, and Imo States. It has an established network of healthcare institutions, including teaching hospitals, federal medical centres, and specialist hospitals that provide dental and other oral healthcare services. These institutions also contribute to the training and professional development of dental personnel. Oral healthcare services within the region involve professionals with different educational backgrounds and clinical responsibilities, including general dental practitioners, dental technologists, dental therapists, dental hygienists, dental nurses, and dental surgery technicians. Their roles in patient assessment, treatment planning, dental laboratory procedures, and clinical care make them relevant to the assessment of readiness to adopt artificial intelligence (AI) and digital technologies in maxillofacial prosthetic rehabilitation. The study area was considered appropriate for examining professionals' willingness to undertake AI training, perceptions of institutional preparedness, anticipated benefits of AI, and willingness to invest in emerging technologies. These findings may provide context-specific evidence to inform professional education, institutional planning, and the integration of digital technologies into maxillofacial prosthetic rehabilitation in southeastern Nigeria.

2.2 Study Design

A descriptive cross-sectional study design was employed to assess the readiness and willingness of oral healthcare professionals to adopt AI and digital technologies in maxillofacial prosthetic rehabilitation in southeastern Nigeria. The design enabled the collection of information on respondents' characteristics, perceptions, anticipated clinical applications, training needs, and willingness to invest in AI technologies at a specific point in time. It also permitted an assessment of the association between perceived institutional preparedness and willingness to invest in AI.

2.3 Sampling Procedure

Participants were recruited from selected healthcare institutions within southeastern Nigeria. The sampling technique used was Multistage sampling, where multiple institutions and professional categories

were involved; the selection procedure described how the participating facilities and individual respondents were identified and recruited.

2.4 Instrument Validation

The questionnaire underwent face and content validation procedures. Fifteen questionnaires were pretested in health facilities with characteristics similar to those included in the final survey. Reliability testing using Cronbach's alpha yielded a coefficient of 0.73, indicating acceptable internal consistency.

2.5 Data Collection and Analysis

Data collection lasted five months and involved trained members of the research team administering questionnaires in both English and the local Igbo language after obtaining informed consent from participants. Data were analysed using IBM SPSS Statistics version 23, using descriptive statistics and correlation analysis at a significance level of 5%.

3. RESULTS

Table 3.1: Socio-demographic characteristics, n=220 (100%)

Variables	Frequency	Percentage
***Age of Respondents**		
20-29 years	46	20.9
30 - 39 years	74	33.6
40 - 49 years	63	28.6
50 years and above	37	16.9
Professional Category		
General Dental Practitioner	41	18.6
Dental Technologists	68	30.9
Dental Therapists/Hygienist	70	31.8
Dental Nurses	30	13.6
Dental Surgery Technician	11	5.0
Highest Educational Qualification		
HND	77	35.0
BSc	80	36.4
BDS	30	13.6
MSc	17	7.7
Fellowship	11	5.0
PhD	5	2.3
Years of Professional Practice		
Less than 5 years	20	9.1
5-10 years	105	47.7
11-15 years	50	22.7
Greater than 15 years	45	20.5
Type of Dental Centre		
Teaching Hospital	102	46.4
Federal Medical Centres	78	35.5
Specialist Hospitals	40	18.1

***Mean age = 38.64 ± 9.96 years**

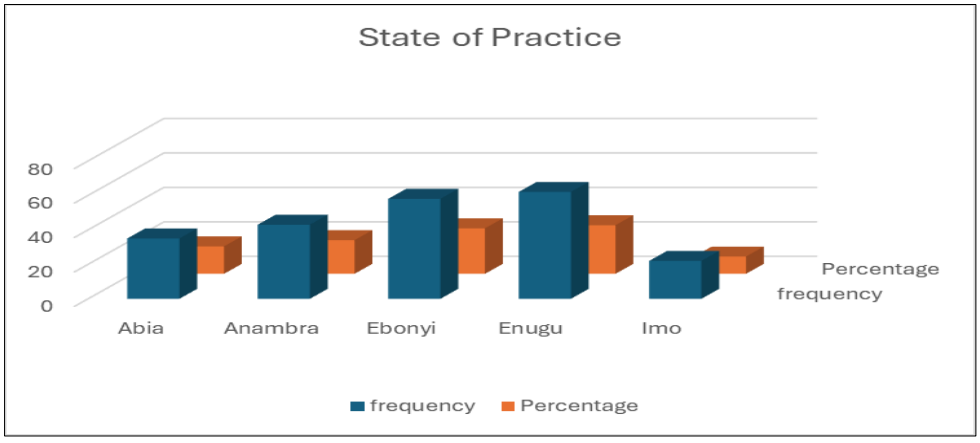


Fig. 3.1: State of Practice, n=220 (100%)

Table 3.2: Readiness to use AI and Modern Technologies, n=220 (100%)

Variables	Frequency	Percentage
Willingness to receive formal AI training		
Yes	220	100.0
No	00	00.0
How soon do you think AI will become routine in maxillofacial rehabilitation in Southeast Nigeria?		
Within 5 years	13	05.9
6 - 10 years	55	25.0
More than 10 years	125	56.8
Never	27	12.3
Not sure	00	00.0
***Which area will benefit you most from AI?**		
Diagnosis	97	44.1
Treatment planning	42	19.1
Prosthetic Design	83	37.7
Patient follow-up	46	20.9
All of the above	135	61.7

* Multiple *responses permitted; percentage may exceed 100%*

Table 3.3: Prospects of AI and Modern Technologies, n=220 (100%)

Variables	Frequency	Percentage
Do you think your Institution is prepared to adopt AI technologies?		
Yes	174	79.1
No	46	20.9
Would you invest in AI technologies for Maxillofacial rehabilitation?		
Yes	181	82.3
No	39	17.7
Undecided	00	00.0
In the future, how useful do you expect AI to be in developing individualised prosthetic treatment plan?		
Not useful	00	00.0
Slightly useful	22	10.0
Moderately useful	17	07.7
Very useful	83	37.7
Extremely useful	98	44.5
Anticipation of the role of AI in maxillofacial rehabilitation over the next 5-7 years		
Minimal Role	13	05.9
Limited Role	27	12.3
Moderate Role	40	18.2
Major Role	48	21.9
AI may become an essential component of clinical practice	92	41.8
***Which modern technology do you believe will have the greatest impact on maxillofacial rehabilitation?**		
Artificial intelligence	43	19.5
3D Printing/additive manufacturing	96	43.6
Digital intraoral and facial scanning	102	46.4
CAD/CAM Technology	83	37.7
Virtual/Augmented Reality	12	05.5

**Based on multiple responses*

Table 3.4: Association between institutional preparedness and willingness to invest in AI

Perceived Institutional Preparedness		**Willingness to invest in AI**		**Total**
		Yes	**No**	
	Yes	174 (100.0%)	0 (0.0%)	174
	No	7 (15.2%)	39 (84.8%)	46
Total		**181 (82.3%)**	**39 (17.7%)**	**220**
Pearson χ^2= 158.5, Df- 1, P-value < 0.001, Cramer's V- 0.85, significance level = 0.05				

3.1: Socio-Demographic Characteristics, N=220 (100%)

Table 3.1 presents the sociodemographic characteristics of the 220 respondents included in the study. The respondents had a mean age of 38.64 ± 9.96 years. The largest proportion of respondents were aged 30–39 years, accounting for 74 (33.6%) respondents. Regarding professional category, Dental Therapists/Hygienists constituted the largest proportion of respondents, with 70 (31.8%), With respect to highest educational qualification, respondents with a BSc constituted the largest proportion, accounting for 80 (36.4%). In terms of years of professional practice, the majority of respondents, 105 (47.7%), had 5–10 years of professional experience. Regarding the type of dental centre, Teaching Hospitals accounted for the largest proportion of respondents, with 102 (46.4%).

Figure 3.1 illustrates the distribution of respondents according to their state of professional practice in Southeast Nigeria. The highest proportion of respondents was recorded in Enugu State, with 62 (28.2%) respondents, followed by Ebonyi State, with 58 (26.4%) respondents. Anambra State accounted for 43 (19.5%) respondents, while Abia State had 35 (15.9%) respondents. Imo State recorded the lowest proportion, with 22 (10.0%) respondents.

3.2: Readiness to use AI and Modern Technologies, n=220 (100%)

Table 3.2 presents respondents' readiness to use AI and modern technologies in maxillofacial rehabilitation. All 220 (100.0%) respondents indicated that they were willing to receive formal training in AI. Regarding respondents' perception of when AI would become routine in maxillofacial rehabilitation in Southeast Nigeria, the largest proportion, 125 (56.8%), believed that this would occur after more than 10 years. Regarding the areas expected to benefit from AI, 135 (61.7%) respondents selected all the listed areas, including diagnosis, treatment planning, prosthetic design and patient follow-up.

3.3: Prospects of AI and Modern Technologies, n=220 (100%)

Table 3.3 presents respondents' views regarding the prospects and potential application of AI and modern technologies in maxillofacial rehabilitation. Regarding institutional preparedness, 174 (79.1%) respondents believed that their institutions were prepared to adopt AI technologies. Similarly, 181 (82.3%) respondents indicated that they would invest in AI technologies for maxillofacial rehabilitation. With respect to the expected usefulness of AI in developing individualized prosthetic treatment plans, 98 (44.5%) respondents considered AI extremely useful. Regarding the anticipated role of AI in maxillofacial rehabilitation over the next 5–7 years, 92 (41.8%) respondents believed that AI may become an essential component of clinical practice. Regarding modern technology expected to have the greatest impact on maxillofacial rehabilitation, digital intraoral and facial scanning was the most frequently selected, with 102 (46.4%).

3.4: Association between Institutional Preparedness and Willingness to Invest In AI

Table 3.4 shows a Pearson chi-square result indicating a statistically significant association between perceived institutional preparedness and willingness to invest in AI, $\chi^2(1, N=220) = 158.5$, $p < 0.001$. The effect size, Cramer's V = 0.85, indicates a very large association between the two categorical variables.

4. DISCUSSION

The respondents had a mean age of 38.64 ± 9.96 years, with those aged 30–39 years constituting the largest age group (33.6%). Dental Therapists/Hygienists and Dental Technologists constituted the largest professional categories, while BSc was the most frequently reported educational qualification. Nearly half of the respondents (47.7%) had 5–10 years of professional experience, and teaching hospitals constituted the largest practice setting. This is in contrast with a similar study by Imran *et al*., (2026), where the highest age bracket of 31-45 years was 35.2%. It is also in contrast with the study conducted by Klaire and Alkahtani, where most of the respondents (34.9%) had BDS as their highest qualification. The diversity of professional backgrounds is relevant to this study because AI-supported maxillofacial rehabilitation increasingly involves multidisciplinary digital workflows involving diagnosis, treatment planning, digital scanning, computer-aided design and prosthesis fabrication [7, 8].

The finding that 62.7% of respondents lacked recent training in AI or digital dentistry directly underscores the widespread demand for further education. While increased training opportunities emerged as the primary catalyst for AI adoption (33.6%), implementation remains heavily restricted by a lack of institutional support (42.7%) and high costs (34.6%). These barriers align with the findings of Singh *et al.,* and Deepshikha *et al*., who highlighted significant gaps in AI training and technical readiness among dental professionals, ultimately advocating for structured educational curricula and robust institutional backing.

Respondents generally expressed positive expectations about the future of AI. Most considered that their institutions were prepared to adopt AI (79.1%), would be willing to invest in AI technologies (82.3%), and regarded AI as very or extremely useful for developing individualised prosthetic treatment plans. Digital intraoral and facial scanning (46.4%) and 3D printing (43.6%) were the technologies most frequently expected to have the greatest impact. These findings are consistent with emerging evidence that AI is increasingly being integrated with digital imaging, CAD/CAM and additive manufacturing to facilitate personalised

maxillofacial rehabilitation [8]. However, the current study cautions that the evidence base remains heterogeneous and that further prospective clinical validation and standardisation are required before widespread routine implementation.

5. CONCLUSION

Overall, the findings suggest that oral healthcare professionals demonstrate considerable openness to AI and digital technologies in maxillofacial prosthetic rehabilitation. Translating this willingness into effective clinical adoption will require structured professional training, investment in appropriate digital infrastructure, institutional support, and improved access to relevant technologies. Further research should examine practical barriers to implementation and evaluate the extent to which professionals' expressed readiness translates into actual clinical use. These measures may help support the responsible and sustainable integration of AI and digital technologies into maxillofacial prosthetic rehabilitation in southeastern Nigeria.

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Consent for Publication: Not applicable.

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