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Schizophrenia and Oral Health: A Comorbidity Model Integrating Oxidative Stress, Nutrition and Perspectives for Predictive Artificial Intelligence

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Abstract: *Schizophrenia is a severe psychiatric disorder characterized by profound cognitive, emotional and behavioral impairments, frequently accompanied by somatic comorbidities that remain underrecognized. Among these, oral health deterioration emerges as a significant concern. This pilot study compares male patients with schizophrenia (n = 20) and a matched control group without psychiatric or systemic disorders, examining the interplay between salivary oxidative stress biomarkers, dietary habits and oral health indicators, with the aim of constructing a schizophrenia-centred comorbidity model. Oral health was assessed using the DMFT index (Decayed, Missing and Filled Teeth), a standard measure reflecting cumulative dental caries experience. Oxidative stress was evaluated through malondialdehyde (MDA) levels, a marker of lipid peroxidation and superoxide dismutase (SOD) activity, an antioxidant enzyme reflecting the body's defence against free radicals. Nutritional habits were recorded to explore lifestyle contributions to oral pathology. Moderate correlations between oxidative stress biomarkers and oral health parameters suggest that schizophrenia-related lifestyle and metabolic factors contribute to dental deterioration. No artificial intelligence (AI) methods were implemented in this study; however, the findings highlight the conceptual potential for future AI-based predictive models that integrate biochemical, behavioural and clinical data to identify oral health risks specifically in populations with schizophrenia. This pilot study highlights the interplay between oxidative stress, nutrition and oral health in schizophrenia. Overall, this pilot work provides a preliminary dataset and conceptual framework that may inform future computational and AI-driven predictive studies in larger, gender-balanced and more diverse cohorts.*

Keywords: *schizophrenia; oral health; oxidative stress; saliva; DMFT; predictive modelling.*

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1. Introduction

Schizophrenia is a chronic and complex psychiatric disorder affecting approximately 1% of the global population, characterised by persistent cognitive, emotional, and behavioural impairments (McCutcheon et al., 2020). Beyond its core psychiatric symptoms, individuals with schizophrenia frequently experience adverse physical health outcomes, among which oral health deterioration is particularly prevalent yet often neglected. Factors contributing to poor oral health in this population include impaired self-care due to negative symptoms, side effects of psychotropic medications, socioeconomic challenges and behavioural or motor difficulties such as infrequent brushing or hand tremors (Yang et al., 2018; Velasco-Ortega et al., 2017).

Psychotropic medications, commonly used in schizophrenia management, can induce hyposalivation or xerostomia, thereby increasing the risk of dental caries, oral infections, and masticatory discomfort (Moore et al., 2015; Urien et al., 2024). Lifestyle factors, including a higher prevalence of smoking compared to the general population, further exacerbate oral and systemic health risks (Chu et al., 2012; Ding et al., 2021). Oral health can be assessed using the DMFT index (Decayed, Missing and Filled Teeth), which provides an objective measure of cumulative dental caries experience, reflecting both current and historical oral disease burden.

Emerging evidence indicates that oxidative stress (OS) is implicated both in schizophrenia pathophysiology and oral health deterioration. OS arises when reactive oxygen species (ROS), highly reactive molecules involved in cellular signalling and stress responses, exceed the body's antioxidant defence capacity, leading to cellular damage (van der Pol et al., 2019; Teleanu et al., 2022). Salivary biomarkers such as malondialdehyde (MDA), a product of lipid peroxidation and superoxide dismutase (SOD), an antioxidant enzyme, allow non-invasive assessment of oxidative stress status and have been associated with periodontal disease and oral mucosal pathology (Sczepanik et al., 2020; Sardaro et al., 2019).

Nutrition also plays a pivotal role in modulating oxidative stress and maintaining oral health. Adequate intake of antioxidants, vitamins (C, E) and polyphenols has been shown to reduce ROS-induced damage and influence oral microbiome composition, highlighting the interconnected roles of diet, oxidative stress and dental health (Trofin et al., 2025; Najeeb et al., 2016).

Given the multifactorial determinants of oral health in schizophrenia, including oxidative stress, nutrition, behavioural factors and medication effects, there is growing interest in integrating these data into predictive frameworks. Recent advancements in AI have demonstrated its potential in analysing complex biomedical datasets, including those related to psychiatric disorders and oral health. Machine learning models have already been successfully applied to classify patients with schizophrenia based on peripheral biomarkers (Pawar et al., 2025) and to detect abnormalities in EEG and other physiological signals (Oh et al., 2020; Zhang et al., 2024). These developments suggest that AI-driven approaches could be used to integrate oxidative stress biomarkers, nutritional data and oral health indicators, enabling predictive modelling of oral health risk and supporting precision health strategies.

The relevance of this multidimensional data, salivary oxidative stress markers, nutritional status and behavioural factors, to neuroscience lies in its reflection of systemic physiological disturbances, including neuro-inflammation and oxidative stress, which are increasingly recognized as core pathophysiological mechanisms in schizophrenia. For AI models, these diverse, quantifiable and longitudinally collectible data types provide the rich, high-dimensional feature sets necessary to train robust algorithms that can capture the complex, non-linear interactions between a patient's biology, behavior and disease trajectory.

While no computational models were applied in the present study, the collected biochemical, clinical and lifestyle data provide a conceptual foundation for future AI-driven models capable of predicting oral health risk in populations with schizophrenia. Such models could leverage machine learning techniques to integrate multidimensional data and support precision health strategies, highlighting the potential for interdisciplinary approaches at the intersection of psychiatry, dentistry, and computational biology.

2. Materials and Methods

2.1. *Study Design and Participants*

This was a cross-sectional observational study conducted between October 2024 and February 2025. Two groups of participants were included: (1) patients diagnosed with schizophrenia, and (2) healthy controls without psychiatric or systemic disorders.

Patients were recruited from the "Socola" Institute of Psychiatry, Iasi, Romania. From a total eligible population of approximately 100 inpatients, the first consecutive male patients who met inclusion criteria and provided consent were enrolled. The decision to include only male participants was based on epidemiological evidence of a slightly higher prevalence and earlier onset of schizophrenia in men (Jauhar et al., 2022), and aimed to minimise gender-related variability in oxidative stress and oral health indices. Exclusion criteria included intellectual disability, severe uncooperativeness, aggressive behaviour or systemic illnesses that could confound oral health outcomes, and acute oral pathologies likely to alter salivary measurements.

Controls were recruited from individuals seeking routine dental care at the "Apollonia" University, Iasi, Faculty of Dental Medicine. Only participants with no psychiatric history or systemic illness, as confirmed by a structured health survey, were included.

The Ethics Committees of both institutions approved the study. Written informed consent was obtained from all participants or their legal guardians, with strict adherence to anonymity and confidentiality.

2.2. Data Collection and Clinical Assessment

For patients with schizophrenia, demographic and clinical data (age, sex, diagnosis, medication profile) were extracted from medical records by attending psychiatrists.

Nutritional habits and lifestyle factors were assessed using a structured questionnaire consisting of 20 items. The instrument addressed socio-demographic characteristics, dietary intake (including frequency of fruit, vegetables, sugary foods and beverages), smoking and alcohol consumption, and adherence to special diets. The questionnaire was adapted from validated food frequency questionnaires (FFQ) used in nutritional epidemiology and administered under psychiatrist supervision to ensure reliability in the patient group. The structured format and psychiatrist-supervised administration were intended to enhance reliability among patients with schizophrenia. Responses were digitised and coded into four categories: daily, 2-4 times/week, ≤1 time/week, and never.

Oral health status was evaluated in both groups by a qualified dentist using the World Health Organization (WHO) criteria for the Decayed, Missing, and Filled Teeth (DMFT) index (Rudnika et al., 2020). DMFT scores were calculated individually and then averaged per group to reflect the mean dental health burden.

2.3. Saliva Collection and Biochemical Analyses

Unstimulated saliva samples were collected in the morning, at least 60 minutes following food or liquid intake. Participants were instructed to allow saliva to accumulate in the oral cavity and expectorate into sterile, single-use containers until a minimum of 1–2 mL was obtained. Samples were aliquoted into sterile, labelled Eppendorf tubes and stored at -20°C until batch analysis. For long-term storage, -80°C is recommended and this represents a methodological limitation of the present study. For long-term storage of salivary samples is best performed at -80°C. Our deviation from this recommended protocol constitutes a methodological constraint for this study.

Salivary pH was determined using indicator strips, with results compared to the manufacturer's reference scale.

Biochemical markers of oxidative stress were analysed as follows:

- SOD activity was measured spectrophotometrically using a commercial kit (DORABIO, China), based on inhibition of the xanthine oxidase reaction and expressed as units/mL of saliva.
- MDA concentration was quantified by competitive inhibition ELISA (Mindray MR-96A, Shenzhen, China), expressed as µmol/L of saliva.

All samples were processed in duplicate to ensure reproducibility.

2.4. Exploratory AI Component

No AI algorithms were implemented in this study. Instead, a structured literature search was performed in PubMed, Web of Science, and Scopus using the keywords "artificial intelligence", "schizophrenia", "oral health" and "oxidative stress". Representative studies were identified to illustrate current applications of AI in dentistry and psychiatry, thereby framing the conceptual potential for predictive modelling. This step aimed to provide context for future integration of biochemical, clinical, and lifestyle data into AI-driven predictive frameworks.

2.5. Statistical Analysis

Data analysis was performed using Minitab 19 (Minitab Inc., 2019). Results were expressed as mean ± standard error of the mean (SEM). Between-group comparisons were conducted using Student's t-tests and one-way ANOVA, where appropriate.Bivariate associations, such as those between oxidative stress biomarkers, nutritional patterns and DMFT indices, were assessed using Pearson's or Spearman's correlation coefficients, depending on data distribution. Statistical significance was set at $p < 0.05$.

No formal sample size calculation was performed; therefore, findings should be considered exploratory and hypothesis-generating.

3. Results

The study findings are presented below, beginning with dental status by group, demographic and lifestyle observations, dietary patterns, biochemical-clinical correlations, and exploratory integration of AI.

3.1. Dental Status (DMFT Index)

Table 1 summarises the distribution of decayed, missing, and filled teeth in the schizophrenia group (n = 20) and control group (n = 20).

Table 1. Comparison between schizophrenia group and control group – DMFT index

Indicator	Schizophrenia Group	Control Group
Decayed Teeth	111 (48.68%)	70 (34.65%)
Filled Teeth	1 (0.44%)	67 (33.17%)
Missing Teeth	116 (50.88%)	65 (32.18%)

Note: Percentages were calculated relative to the total number of teeth examined in each group. Schizophrenia group: 20 participants; total teeth examined = 228. Control group: 20 participants; total teeth examined = 202.

In the schizophrenia group (n = 20), nearly half of the observed teeth were decayed (48.68%), only 0.44% had received restorative care, while 50.88% were missing. This profile indicates a predominance of untreated caries and reliance on extractions. By contrast, controls presented fewer untreated caries (34.65%), higher rates of restorative interventions (33.17%), and fewer missing teeth (32.18%). These findings suggest greater utilisation of preventive and restorative services in the control group.

3.2. Demographic and Lifestyle Context

The schizophrenia cohort consisted exclusively of male patients and had a higher mean age compared with the control group. Given that advanced age and male gender are risk factors for tooth loss, this demographic skew partly explains the observed dental outcomes. Smoking prevalence was also markedly higher among patients (80% vs. 40% in controls), reinforcing a well-established risk factor for caries, periodontal disease, and tooth loss. In addition, psychosocial determinants such as unemployment, institutionalisation, and limited autonomy constrained regular dental attendance. Table 2 illustrates these demographic and lifestyle contrasts.

Table 2. Comparative observations between the schizophrenia group and the control group

Aspects	Schizophrenia group	Control group
Age and Dental Care	Older adults, especially with mental health conditions, rely heavily on family support.	Younger adults are slightly more proactive but face financial barriers.
Gender and Dental Care	This includes only men, who statistically pay less attention to oral hygiene.	The presence of women balances visit frequency, as they tend to value dental aesthetics more
Education and Oral Hygiene	Those with primary or no education seek care mainly in emergencies (e.g., severe pain).	Participants with secondary and higher education understand the value of check-ups.
Lifestyle, Diet and Oral Hygiene	A sedentary lifestyle and social isolation. A poor consumption of healthy foods (fruits, vegetables, dairy).	More active lifestyle. There is a more balanced distribution of the frequency of consumption for healthy, fibre-rich foods
Smoking Habits	High smoking prevalence (80%), a major oral health risk factor.	Moderate smoking prevalence (40%).

3.3. Diet, Nutritional Patterns and Oral Hygiene Behaviours

Questionnaire data indicate that participants with schizophrenia reported a more unbalanced diet in food groups such as fruits, vegetables, dairy products, and, to some extent, meat, compared to controls. This dietary pattern suggests potential insufficiencies in essential nutrients, including calcium, iron, zinc, and protein, which may negatively impact both systemic and oral health. Contributing factors include institutionalisation, limited ability to plan or prepare meals, low nutritional education, and side effects of antipsychotic medications that can alter appetite and food preferences.

In contrast, the control group demonstrated frequent consumption of these food groups, with a higher proportion of participants consuming fruits, vegetables, meat and dairy two or three times per week or daily, reflecting greater nutritional awareness and attention to a diversified diet.

In addition to dietary differences, oral hygiene behaviours varied markedly between groups. Patients with schizophrenia faced multiple barriers to maintaining proper oral care. Factors such as infrequent tooth brushing, hand tremors, lack of motivation and limited access to dental services contributed to poor oral hygiene.

Psychotropic medications, which often cause hyposalivation and xerostomia, exacerbated these difficulties by increasing discomfort during chewing and predisposing to dental caries and infections.

The control group, in contrast, displayed higher adherence to regular dental care, including routine brushing, preventive visits, and use of restorative dental services. These behavioural differences, together with demographic factors such as age and gender, helped explain the observed disparities in dental outcomes (DMFT index) between the two groups.

3.4. Relationship Between Salivary Biochemistry and Dental Outcomes

To further elucidate the interplay between oral health and biochemical status, correlation analyses were performed, examining associations between salivary parameters and clinical dental measures. These analyses provide insight into potential mechanisms linking oxidative stress, oral environment, and dental pathology in individuals with schizophrenia.

Analysis of salivary pH revealed a statistically significant moderate negative correlation with the number of cavities ($r = -0.374$, $p = 0.018$). As salivary pH decreased, indicating a more acidic environment, the incidence of carious lesions increased. This trend underscores the critical role of oral acidity in promoting demineralisation and cavity formation, reflecting the importance of maintaining neutral salivary pH as a protective factor against dental decay (Chart 1).

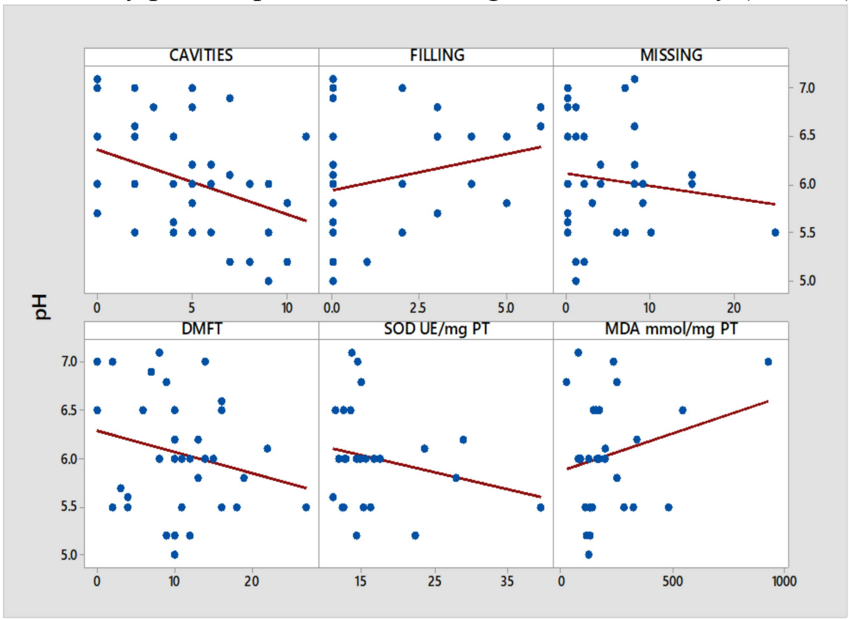

Chart 1. Relationship between unstimulated salivary pH and the number of carious lesions. Each point represents an individual participant; regression line indicates correlation ($r = -0.374$, $p = 0.018$)

A clear downward trend demonstrates that lower pH values are associated with higher caries prevalence, highlighting the mechanistic link between oral environment and tooth integrity.

The DMFT index was strongly correlated with the number of missing teeth ($r = 0.814$, $p < 0.001$), indicating that tooth extractions are the principal contributor to overall dental burden in this population.

The relationship was nearly linear, reflecting that missing teeth significantly elevate the DMFT score. Additionally, a weaker but significant positive correlation existed between DMFT and the number of decayed teeth ($r = 0.332$, $p = 0.036$), confirming that untreated caries also influence the overall index, albeit to a lesser extent than extractions (Chart 2).

The ascending trend highlights the disproportionate impact of tooth loss on cumulative dental morbidity, emphasising the consequences of delayed or absent restorative interventions.

Biochemical correlations between malondialdehyde (MDA, expressed as µmol/L), a marker of oxidative stress, and superoxide dismutase (SOD, expressed as U/mL), an antioxidant enzyme, revealed a moderate positive relationship ($r = 0.470$, $p = 0.024$).

These findings suggest that elevated oxidative stress in saliva triggers a compensatory upregulation of antioxidant defences, reflecting an adaptive biological response. However, the persistence of oxidative imbalance may indicate that this response is insufficient to fully counteract cellular oxidative damage in individuals with schizophrenia (Chart 3).

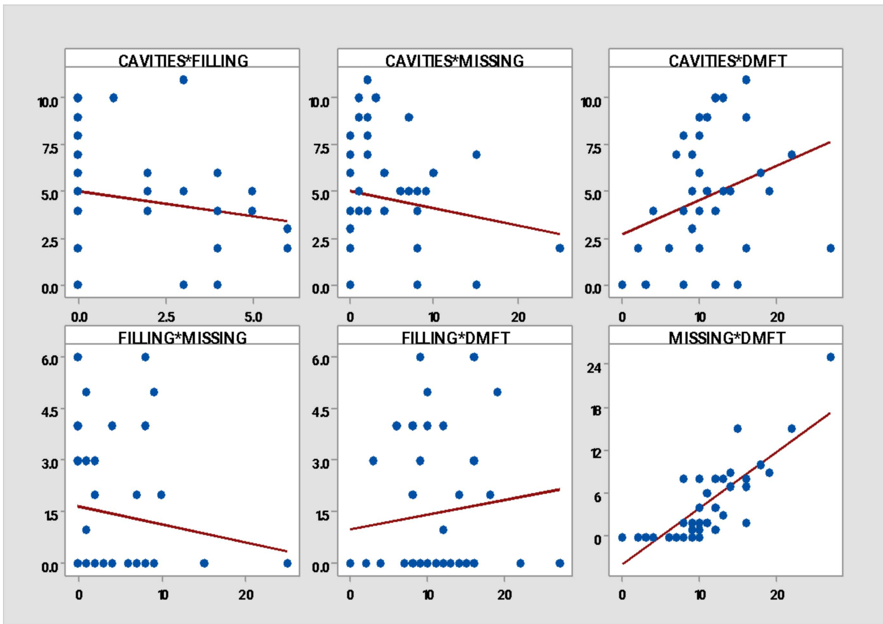

Chart 2. Correlation between DMFT index and the number of missing teeth. DMFT calculated according to the WHO criteria (r = 0.814, p < 0.001)

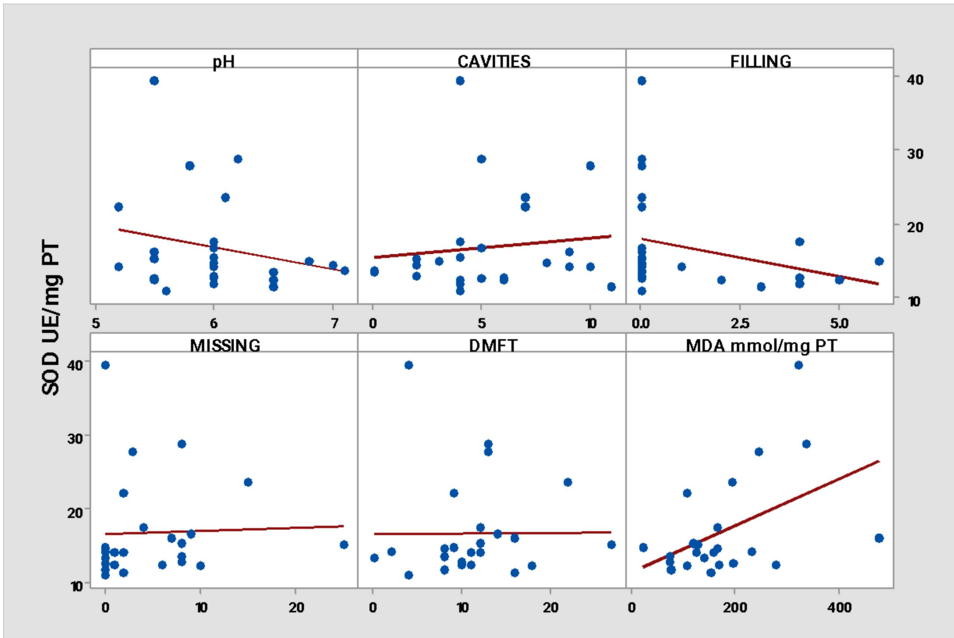

Chart 3. Correlation between salivary MDA concentration and SOD activity. Each pointrepresents an individual participant (r = 0.470; p = 0.024)

The graph demonstrates that higher MDA concentrations are accompanied by increased SOD activity, representing the dynamic but limited capacity of the antioxidant system to mitigate oxidative stress.

3.5. Exploratory Integration of AI

The present study does not employ AI methodologies; rather, it provides a conceptual framework for integrating AI into the assessment of oral health in patients with schizophrenia. While no computational modelling was implemented in this work, the findings suggest that combining salivary oxidative stress biomarkers, oral health indices (DMFT), and lifestyle factors could serve as a foundational dataset for developing predictive models tailored to this population.

Recent advances in machine learning have demonstrated high accuracy in forecasting dental caries, periodontal disease, and treatment needs from heterogeneous datasets that integrate clinical, behavioural, and imaging data (Reyes et al., 2021; Schwendicke et al., 2020). Extending these approaches, AI has increasingly been applied to combine biochemical markers with clinical features, enabling the development of individualised risk scores (Myszczynska et al., 2020). In psychiatry, precision health initiatives are beginning to leverage multimodal AI models to stratify patients not only by psychiatric symptomatology but also by comorbid somatic risk profiles (Meisner et al., 2022; Huang et al., 2025).

Specifically in schizophrenia, predictive models that utilise peripheral inflammatory biomarkers have shown promise in distinguishing patients from healthy individuals, demonstrating the potential utility of AI in psychiatric diagnostics (Kozyrev et al., 2023). Additionally, multimodal frameworks combining audio, video, and text data have been proposed to classify individuals within the schizophrenia spectrum (Premananth et al., 2024). These approaches indicate that AI could integrate diverse data types, including clinical, behavioural, biochemical, and imaging measures, to generate robust predictive models for individualised patient risk assessment.

In the context of oral health, patients with schizophrenia frequently exhibit compromised oral hygiene, which can exacerbate general health complications (Santosh Kumar et al., 2023). Furthermore, alterations in the oral microbiota have been observed in drug-free patients with schizophrenia, suggesting a potential bidirectional link between oral health and psychiatric status (Huang et al., 2025). The conceptual integration of these findings implies that future AI-driven models could predict which patients are most vulnerable to oral health deterioration and guide targeted preventive interventions, aligning psychiatric care with precision medicine principles.

Although AI was not directly applied in this study, the conceptual framework developed herein highlights the potential for integrating multimodal datasets, encompassing biochemical, clinical, behavioural and lifestyle information, to support predictive modelling in schizophrenia. This framework lays the groundwork for future research aimed at using AI to improve both oral health and psychiatric outcomes in this vulnerable population.

4. Discussions

The present study investigated the intricate relationship among schizophrenia, oral health, nutrition, and oxidative stress, while outlining translational perspectives for future AI-based predictive modelling. By integrating biochemical, behavioural and clinical parameters, our findings provide a more comprehensive understanding of the multifactorial mechanisms underlying oral health deterioration in this vulnerable population.

4.1. Oral Health Status and Treatment Inequities in Patients with Schizophrenia

Our results revealed a high prevalence of decayed and missing teeth, with extremely low rates of restorative treatment in patients with schizophrenia. This profile reflects untreated caries and reliance on extractions rather than conservative dental care. Comparable findings have been reported by Ramon et al. (2003) and Jovanovic et al. (2010), who documented elevated DMFT indices in psychiatric populations, reflecting similarly high burdens of dental decay and tooth loss. Arnaiz et al. (2011) also found that institutionalised patients exhibited higher rates of tooth loss, attributing this to neglect and limited access to restorative services, findings that align closely with our observations. By contrast, Thomas et al. (1996) documented somewhat higher fill rates in community-dwelling patients, suggesting that setting and service accessibility may moderate treatment outcomes.

4.2. Sociodemographic and Lifestyle Influences

The exclusive inclusion of male participants in our study likely contributed to poorer dental outcomes. Yang et al. (2018) demonstrated that male gender is consistently associated with reduced oral hygiene practices, while Velasco-Ortega et al. (2017) confirmed better preventive behaviours among female patients. Furthermore, the strikingly high smoking prevalence in our cohort (80%), double that of controls, amplifies oral morbidity. Janardhanan et al. (2021) and Arnaiz et al. (2011) reported similar findings, emphasising that tobacco acts synergistically with psychiatric vulnerability to accelerate periodontal disease and tooth loss. Our data therefore reinforce the notion that schizophrenia interacts with gender and lifestyle factors to exacerbate oral deterioration.

4.3. Nutritional Patterns and Oral Health

Dietary assessment revealed limited intake of fruits, vegetables,and dairy products, echoing prior evidence of nutritional deficiencies in schizophrenia. Gondivkar et al. (2019) highlighted that inadequate micronutrient intake impairs saliva quality and promotes caries, while Hornick (2002) underscored the broader role of the diet in enamel resistance and oral microbiome balance. In our study, reliance on soft and processed foods further reflected institutional dietary constraints. Scardina & Messina (2012) similarly demonstrated that low-fibre, cariogenic diets promote bacterial imbalance and demineralisation. Together, these findings support the interpretation that poor nutrition, both qualitative and textural, is a key but underappreciated determinant of oral health in schizophrenia.

4.4. Oxidative Stress as a Biological Mediator

Biochemical analysis indicated a moderate positive correlation between MDA and SOD, consistent with the compensatory yet insufficient antioxidant responses previously reported by Tothova et al. (2015) and Seethalakshmi et al. (2016). The negative correlation between salivary pH and caries incidence in our cohort further corroborates the mechanistic role of acidic environments in enamel demineralisation, as described by Sardaro et al.(2019). These convergent findings suggest that oral health disparities in schizophrenia cannot be fully explained by behavioural factors alone; rather, chronic oxidative imbalance and altered salivary homeostasis likely act as biological mediators of disease burden.

4.6. Translational Perspectives: Artificial Intelligence (AI) Integration

Although this study did not implement computational models, our dataset highlights the translational potential of AI-based predictive tools. By integrating salivary oxidative stress biomarkers, DMFT scores, and lifestyle factors, the cohort provides a foundational framework for developing schizophrenia-specific predictive models. Such models could transcend traditional symptom-based approaches by quantifying the interplay between peripheral oxidative stress, which mirrors central nervous system pathology and clinical outcomes, thereby offering a neurobiologically-grounded tool for comorbidity risk stratification (Huang et al., 2025). In dentistry, machine learning approaches have demonstrated high accuracy in forecasting caries, periodontal disease, and tooth loss from heterogeneous datasets that combine clinical, behavioural, and imaging data (Reyes et al., 2021; Schwendicke et al., 2020; Pawar et al., 2025). Extending these approaches, AI has been successfully applied to incorporate biochemical markers into predictive pipelines, enabling the generation of individualised risk scores (Myszczynska et al., 2020).

In psychiatric research, precision health initiatives are increasingly adopting multimodal AI models to stratify patients not only by psychiatric parameters but also by coexisting somatic risk factors (Meisner et al., 2022; Huang et al., 2025). For schizophrenia specifically, predictive frameworks incorporating peripheral inflammatory biomarkers have successfully differentiated patients from healthy controls (Kozyrev et al., 2023), while multimodal systems that combine audio, video, and text data have further refined patient classification within the schizophrenia spectrum (Premananth et al., 2024). These findings demonstrate AI's capacity to integrate heterogeneous data, including clinical, behavioural, biochemical, and imaging variables, into individualised risk profiles.

Patients with schizophrenia often present with poor oral hygiene, which can compound systemic health risks (Santhosh Kumar et al., 2023). Observed alterations in the oral microbiota of drug-free patients further suggest a bidirectional relationship between oral and psychiatric health (Huang et al., 2025). Conceptually combining these domains indicates that AI-driven models could pinpoint individuals most vulnerable to oral health deterioration, enabling precise and timely preventive strategies that align with the principles of precision medicine. This represents a paradigm shift towards a "neuro-translational" dentistry, where AI models decipher the complex pathways linking systemic oxidative stress, neuroinflammation, and oral mucosal integrity, bridging the gap between psychiatric and somatic health (Meisner et al., 2022).

Although this study did not apply AI directly, the proposed framework empirically demonstrates the feasibility of leveraging multimodal datasets to support predictive modelling. This approach establishes a conceptual foundation for future research aiming to harness AI to improve both oral and psychiatric health outcomes in this high-risk population.

4.7. Limitations and Future Directions

Several limitations must be acknowledged. First, the study sample consisted exclusively of institutionalised male patients with schizophrenia, which limits the generalisability of the findings and introduces potential gender bias. Second, the relatively small cohort size precluded robust statistical modelling and increased the risk of a false-negative error. Third, dietary information was based on self-reported questionnaires, raising the possibility of recall bias despite the structured format and psychiatrist supervision. Finally, while artificial intelligence perspectives were discussed conceptually to frame potential future applications, no computational algorithms were implemented in this study. Future research should therefore include larger, gender-balanced cohorts, employ fully validated dietary instruments, and integrative supervised machine learning approaches (e.g., random forests, support vector machines, neural networks) with transparent cross-validation procedures. Such designs could rigorously test whether the addition of oxidative stress biomarkers provides incremental predictive value beyond established behavioural and clinical parameters.

5. Conclusions

This study highlights the multifactorial determinants of oral health deterioration in patients with schizophrenia, encompassing behavioural, nutritional, and biological factors, including oxidative stress. The high prevalence of untreated caries, tooth loss, and poor restorative care underscores the compounded vulnerability of this population. Nutritional deficiencies and chronic oxidative imbalance emerge as key mediators of oral pathology, complementing the influence of lifestyle and psychiatric factors.

Importantly, the integration of clinical, biochemical, and behavioural data offers a conceptual foundation for future AI-driven predictive models, capable of identifying high-risk individuals and guiding personalised preventive strategies. These findings emphasise the need for interdisciplinary approaches combining psychiatry, dentistry, nutrition, and computational modelling to improve oral health outcomes and overall quality of life in schizophrenia.

Ultimately, this pilot work posits that oral health in schizophrenia is a reflection of underlying neuropsychiatric trajectory, and its study through AI-driven stratification opens new avenues for holistic patient management.

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