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MODERN METHODS AND PREVENTION OF ASSESSING THE ORAL CAVITY CONDITION OF SMOKERS

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Abstract: Smoking remains one of the major risk factors for oral diseases, significantly influencing the structure and function of oral tissues. This study aimed to evaluate modern methods for assessing the oral cavity condition among smokers and to identify effective preventive strategies to mitigate tobacco-related oral damage. A total of 100 participants were examined, including 70 smokers and 30 non-smokers as a control group. Clinical indices such as the Plaque Index, Gingival Index, and Community Periodontal Index were used to assess oral hygiene and periodontal status. Saliva samples were analyzed for pH, total antioxidant capacity, nicotine, and cotinine levels. Digital radiography, fluorescence imaging, and polymerase chain reaction (PCR) techniques were applied for diagnostic evaluation. Results revealed that smokers had significantly higher plaque accumulation, gingival inflammation, and alveolar bone loss compared to non-smokers ($p < 0.001$). Moreover, salivary pH and antioxidant capacity were markedly reduced in smokers. Preventive measures, including professional dental cleaning, antioxidant supplementation, and smoking cessation counseling, were effective in improving oral health outcomes. The study concludes that integrating modern diagnostic technologies with targeted preventive interventions can significantly enhance the assessment and management of oral health among smokers, providing a comprehensive framework for clinical and public health applications.

Keywords:smoking, oral cavity, oral health, diagnostic methods, prevention, saliva analysis, antioxidant capacity, periodontal disease, nicotine, cotinine.

Introduction

Smoking is one of the most significant risk factors affecting oral and dental health worldwide. Numerous studies have shown that tobacco use leads to various pathological changes in the oral cavity, including periodontal diseases, delayed wound healing, discoloration of teeth, halitosis, and an increased risk of oral cancer [1–3]. The toxic substances found in cigarette smoke, such as nicotine, carbon monoxide, and tar, contribute to vascular constriction, immune suppression, and cellular damage, which result in progressive tissue destruction within the oral cavity [4].

In recent years, modern diagnostic and preventive methods have been developed to assess and improve the oral health of smokers. Advanced imaging technologies, such as digital radiography and fluorescence-based detection systems, allow for early diagnosis of soft and hard tissue lesions [5]. Additionally, biochemical and microbiological analyses of saliva have emerged as non-invasive tools for evaluating oxidative stress levels, inflammatory markers, and microbiota alterations associated with smoking [6].

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Preventive strategies for smokers are now more comprehensive, focusing not only on oral hygiene practices but also on behavioral interventions and smoking cessation programs. The integration of motivational interviewing techniques, fluoride therapy, and antioxidant supplementation has shown promising results in maintaining oral health among smokers [7,8].

This study aims to review and analyze the modern methods used to assess the oral cavity condition in smokers, as well as to identify effective preventive measures that can reduce smoking-induced oral pathologies. The findings may contribute to developing more effective clinical and public health strategies for protecting oral health in populations at risk.

Materials and Methods

This study was conducted to evaluate modern diagnostic and preventive methods for assessing the oral cavity condition among smokers. The research took place over six months at the Department of Dentistry and Oral Health Sciences, including both clinical and laboratory components.

The study involved 100 participants, of whom 70 were smokers and 30 were non-smokers serving as the control group. Smokers included in the study had smoked at least 10 cigarettes per day for the past five years. Individuals with systemic diseases, alcohol dependency, or those who had taken antibiotics within the last month were excluded from the study.

Each participant underwent a complete oral examination to determine the overall oral health condition. The evaluation included the Plaque Index to measure plaque accumulation, the Gingival Index to assess inflammation, the Community Periodontal Index to evaluate periodontal status, and the Oral Hygiene Index to determine the general cleanliness of the oral cavity. Examinations were conducted under standard aseptic and clinical conditions using appropriate dental instruments and lighting.

Saliva samples were collected from all participants between 9:00 and 11:00 a.m. to avoid diurnal variations. Samples were analyzed for pH, total antioxidant capacity, and nicotine and cotinine concentrations. The pH was determined using a digital pH meter, the total antioxidant capacity was measured spectrophotometrically, and nicotine and cotinine levels were analyzed through the enzyme-linked immunosorbent assay (ELISA) method.

Digital radiography was used to assess alveolar bone condition, while fluorescence-based imaging systems such as DIAGNOdent were applied to detect early carious and mucosal changes. In addition, salivary microbiota composition was studied in selected cases using the polymerase chain reaction (PCR) technique to identify bacterial species associated with periodontal disease.

After diagnostic assessment, participants received individualized preventive recommendations, including professional dental cleaning, fluoride and chlorhexidine mouth rinses, antioxidant supplementation with vitamins C and E, and motivational counseling aimed at supporting smoking cessation.

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Statistical analysis was performed using SPSS software version 25. Descriptive statistics were used to summarize data, while comparisons between smokers and non-smokers were carried out using Student's t-test and Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Results and Discussion

The findings of this study revealed significant differences in the oral health parameters between smokers and non-smokers. Clinical examination showed that smokers had a markedly higher plaque index, gingival index, and community periodontal index values compared to non-smokers. Salivary analysis also demonstrated a decrease in pH and total antioxidant capacity among smokers, along with an increased concentration of nicotine and cotinine levels. These results indicate that smoking contributes to the deterioration of the oral microenvironment and increases the susceptibility to oral diseases.

Digital radiography results showed that smokers exhibited greater alveolar bone loss and early radiographic signs of periodontal tissue destruction. Fluorescence-based DIAGNOdent analysis further confirmed the presence of early carious lesions and mucosal pigmentation in smokers, which were less frequent among non-smokers.

The salivary microbiota analysis revealed a higher prevalence of Porphyromonas gingivalis, Treponema denticola, and Tannerella forsythia among smokers, confirming that smoking alters the microbial balance in the oral cavity and enhances the growth of pathogenic bacteria associated with periodontal disease.

Preventive interventions, including professional oral hygiene procedures, antioxidant supplementation, and motivational counseling, resulted in measurable improvements in oral hygiene scores and gingival health over a six-month observation period, especially in participants who reduced or stopped smoking.

Table 1. Comparison of Oral Health Parameters Between Smokers and Non-Smokers

Parameter	Smokers (n=70)	Non-Smokers (n=30)	p-value
Plaque Index (PI)	2.15 ± 0.45	1.08 ± 0.31	<0.001
Gingival Index (GI)	1.95 ± 0.40	0.92 ± 0.28	<0.001
Community Periodontal Index (CPI)	3.10 ± 0.62	1.55 ± 0.44	<0.001
Oral Hygiene Index (OHI)	2.30 ± 0.50	1.10 ± 0.35	<0.001
Salivary pH	6.20 ± 0.25	7.05 ± 0.30	<0.001

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Parameter	Smokers (n=70)	Non-Smokers (n=30)	p-value
Total Antioxidant Capacity (mmol/L)	0.85 ± 0.10	1.25 ± 0.12	<0.001
Nicotine (ng/mL)	45.2 ± 10.4	0.0	<0.001
Cotinine (ng/mL)	35.6 ± 8.9	0.0	<0.001

The statistical analysis demonstrated highly significant differences in almost all measured parameters ($p < 0.001$). The reduction in salivary antioxidant capacity and pH, along with higher plaque accumulation, suggest that smoking promotes oxidative stress and disrupts the natural defense mechanisms of the oral cavity.

Overall, the results support the hypothesis that smoking negatively affects oral health, and that early diagnostic monitoring combined with preventive measures can significantly reduce the adverse effects.

Conclusion

The results of this study clearly demonstrate that smoking has a profound negative impact on oral health, affecting both soft and hard tissues of the oral cavity. Smokers exhibited significantly higher levels of plaque accumulation, gingival inflammation, and periodontal destruction compared to non-smokers. Furthermore, biochemical analysis of saliva revealed a considerable decrease in pH and total antioxidant capacity, alongside elevated concentrations of nicotine and cotinine. These findings confirm that smoking disrupts the oral ecological balance, weakens local immune defense mechanisms, and accelerates tissue damage.

Radiographic and fluorescence-based diagnostic assessments proved to be valuable tools for the early detection of smoking-induced changes in oral tissues. The increased presence of pathogenic bacteria such as Porphyromonas gingivalis and Treponema denticola in smokers' saliva underscores the microbial component of tobacco-related oral diseases.

The study also highlights that modern preventive approaches, including professional oral hygiene care, fluoride and antioxidant therapies, and behavioral counseling for smoking cessation, can significantly improve oral health outcomes among smokers. Promoting these preventive measures, combined with public health education and early screening programs, is essential for reducing the burden of tobacco-related oral diseases.

In conclusion, integrating advanced diagnostic technologies with targeted preventive strategies offers a comprehensive framework for assessing and managing oral health in smokers. Continued research in this area is crucial for developing more effective intervention protocols aimed at protecting and restoring oral health among individuals exposed to tobacco.

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