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An assessment of periodontal health in patients with schizophrenia and taking antipsychotic medication

Abstract: *Background and objective:* Severe periodontal disease is prevalent among patients with schizophrenia and is caused by the side effect of their medication, poor dental hygiene and smoking. The objective of this study was to evaluate whether the rate of periodontal disease could be modulated by changing the salivary flow rate (SFR) because of the use of antipsychotic medications in patients with schizophrenia. *Methods:* Group A (n = 33) included patients who used medications that may cause xerostomia, or dry mouth and Group B (n = 20) included patients who used medications that may cause sialorrhea, an excessive secretion of saliva. The participants' periodontal status was assessed using the plaque index (PI), assessing bleeding on probing (BoP), probing pocket depth (PPD) and clinical attachment levels (CAL). *Results:* The mean of PI and BoP was significantly higher in Group A than in Group B ($P < 0.001$), but the PPD, CAL and decayed, missing and filled teeth (DMFT) scores were not significantly different in the two groups according to the statistical results ($P > 0.05$). *Conclusions:* The researcher concluded that there is a high risk of periodontal disease among patients with schizophrenia, and there is an even higher risk of periodontal disease induced by medication that increased SFR. Preventive dental protocol should be increased during the dental health care of this disadvantaged patient group.

Key words: periodontitis; salivary flow; schizophrenia

Introduction

Periodontal disease is caused by an infection resulting in inflammation within the supporting tissues of the teeth, progressive attachment and bone loss. It is characterized by pocket formation and/or gingival recession (1). Researchers have estimated that it is responsible for about 20% of all tooth loss (2). Multiple factors, such as poor oral hygiene, other dental diseases, systemic conditions, medications, socio-economic disadvantages, inadequate access to care, behavioural problems and decreased motor function, may be responsible for periodontal disease (3). Epidemiological studies have shown that periodontitis does not affect all subjects in the population in a similar way (4). In other words, despite a high prevalence of gingivitis, only a relatively small proportion of individuals exhibited periodontitis (5). The above findings gave rise to the concept that some individuals present risk conditions that make them more susceptible to develop periodontal disease (4).

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Schizophrenia is a chronic disease that afflicts approximately 1% of the population worldwide (6), but approximately 2% of the Turkish people are diagnosed with the condition (7), and this patient group is at a particularly high risk of periodontal disease compared to the general population (8–10). Multiple interrelated factors, such as the side effects of their medication, poor dental hygiene and smoking, are considered as causes of this relationship (11). Previous studies have found poorer oral health in patients with schizophrenia, including the fact that they have a greater number of missing teeth than the general population (12, 13).

As antipsychotic medication can cause both xerostomia and sialorrhea, they can affect oral health (14, 15). A majority of the antipsychotic medications, such as risperidone, quetiapine and olanzapine, reduce salivary secretion and cause xerostomia, which can lead to dental caries, gingivitis, glossitis, stomatitis, parotiditis, fissured tongue, tongue atrophy and oral ulcers (15). The consequence of hyposalivation is the worsening of periodontal diseases and rapid development of caries (14).

One of the common side effects during treatment with antipsychotic medications such as clozapine is sialorrhea (16). Approximately one-third of the individuals treated with clozapine complain of drooling during the daytime and of a wet pillow following a night's sleep (17, 18). Although clozapine is a potent anticholinergic agent, the pathogenesis of sialorrhea is still unclear. Despite the fact that sialorrhea might influence the quality of life for these patients, treatment choices and their efficacy for this side effect are limited; there have been no studies to assess the relationship between periodontal disease and sialorrhea because of the use of antipsychotic medications.

The contribution of psychological factors to the development and progression of periodontal disease has recently become an area of increased research activity (8–10), but little is known about the effects of psychiatric disorders on periodontal health. Additionally, the periodontal clinical significance of change in salivary flow rate (SFR) induced by the medical status among this patient group has not yet been established, so this is the first study addressing the issue. This study was carried out to evaluate the association between periodontal health and schizophrenia and to evaluate whether a change in the SFR because of the use of an antipsychotic medication can modulate periodontal disease.

Materials and methods

Participants and study design

This cross-sectional study used a random sample of schizophrenics. The study received ethical approval from the Regional Ethics Committee at Inonu University and was conducted following the principles outlined in the Declaration of Helsinki on experimentation involving human subjects. All participants provided written informed consent.

The study population consisted of 53 patients (29 women and 24 men; mean age, 20–52 years) diagnosed with schizophrenia and undergoing therapy that included antipsychotic medications. They were referred by the Psychiatry Outpatient Clinic of the Department of Psychiatry, Inonu Faculty of Medicine. Information about their diagnoses was obtained from the psychiatric services with the patients' consent. All patients were diagnosed according to met the DSM-IV-TR criteria for schizophrenia. The following inclusion criteria were used: (i) diagnosis of schizophrenia, (ii) have had the psychiatric condition for at least 2 years, (iii) have taken antipsychotic medication for at least 2 years and (iv) over 20 years old. Criteria for exclusion from the study were (i) within child and youth psychiatry sections, (ii) have received periodontal therapy within the last 12 months, (iii) systemic diseases that could affect periodontal treatment outcomes and (iv) have taken systemic antibiotics within the last 6 months.

Participants were divided into two groups. Group A (n = 33) included patients who used medications (risperidone, quetiapine and olanzapine) that may cause xerostomia. Group B (n = 20) included patients who used medications (clozapine) that may cause sialorrhea. Demographic variables, including age, gender, duration of psychiatric disease, type of antipsychotic medication and duration of antipsychotic medication therapy, were recorded for all subjects.

Psychiatric assessments

The clinical history of patients was collected, and their psychopathological state was assessed using the Positive and Negative Syndrome Scale (PANSS) (19).

Collection of saliva

Unstimulated whole saliva (UWS) samples were collected three times before the clinical assessment. UWS was collected using the spitting method (20), with small modifications as previously described (21). Briefly, all subjects were instructed to refrain from smoking, eating, drinking and brushing their teeth for 1 h prior to the saliva collection periods. Before collection, their mouths were rinsed with tap water. Before saliva collection started, patients were instructed to void the mouth of saliva by swallowing. Subsequently, saliva was allowed to accumulate on the floor of the mouth, and the subjects were instructed to spit into preweighed test tubes every 30 s. Each saliva collection period was 5 min long. The volume of saliva was measured and this volume was divided by 5 to obtain the SFR (ml min^{-1}).

Clinical assessments

Each patient's periodontal status was assessed using plaque index (PI) (22), bleeding on probing (BoP) (23), probing pocket depth (PPD) and clinical attachment levels (CAL). All clinical parameter measurements were taken using a manual periodontal probe (Williams' periodontal probe, PCP-12; Hu-Friedy, Chicago, IL, USA). PI and BoP measurements were assessed on four surfaces per tooth (mesial, distal, buccal and lingual or palatal surface), while PPD and CAL measurements

were taken on six surfaces per tooth (mesio-buccal, mid-buccal, disto-buccal and mesio-lingual, mid-lingual, disto-lingual or palatal surface).

Probing pocket depth was used to measure the distance between the gingival margin and the deepest aspect of the pocket. CAL measured the distance between the cement enamel junction of the tooth and the deepest aspect of the pocket. The presence or absence of bleeding after measurement of PPD was recorded.

In addition, using the DMFT index, the examiner recorded the teeth that were decayed, missing and filled, according to the criteria established by the World Health Organization (WHO). All clinical parameters were recorded by one calibrated examiner (S.D.E.), who had no knowledge about the type of antipsychotic medications used by patients.

Statistical analysis

All statistical analyses were carried out using the SPSS 16.0 statistical software for Windows (SPSS Inc., Chicago, IL, USA). The variable associations between the two groups were compared using the student's *t*-test. Correlation between SFR and clinical measurements was analysed using Pearson's correlation test. The level of significance was set at $P < 0.05$.

Results

A total of 53 patients with schizophrenia participated in this study, and they were classified into Group A ($n = 33$) if they used medications that may cause xerostomia and Group B ($n = 20$) if they used medications that may cause sialorrhea. The characteristics of both groups are presented in Table 1. In Group A, there were 19 women and 14 men and their mean age was 31.8 ± 9.3 years. In this group, while the mean duration of the psychiatric disorder was 6.1 ± 4.7 years, the mean duration of antipsychotic drugs therapy usage was 5.6 ± 3.9 years. Group B included 10 women and 10 men and their mean age was 29.3 ± 9.7 years. While the mean duration of their psychiatric disorder was 7.4 ± 5.1 years, the mean duration of antipsychotic drugs therapy usage was 6.3 ± 4.3 years. While 26 of the participants in Group A were smokers, 15 of the participants in Group B were smokers. Only three of the subjects in Group A brushed their teeth daily, and two of the subjects in Group B did so. In both groups, patients were similar in age, gender, psychiatric disorder duration and use of antipsychotic medications duration ($P < 0.05$).

The data regarding clinical periodontal scores and SFR of patients with schizophrenia undergoing antipsychotic medication therapy are shown in Table 1. The mean flow rate of UWS was significantly higher in Group B (1.12 ± 0.94 ml min^{-1}) than in Group A (0.23 ± 0.25 ml min^{-1}; $P < 0.001$). The mean clinical values of Group A were PI, 80%; BoP, 73%; average of teeth PPD > 4 mm, 24%; average of teeth CAL > 4 mm, 29%; and DMFT index, 8.4. In Group B, the mean clinical values were PI, 58%; BoP, 49%; average of teeth PPD > 4 mm, 22%; average of teeth CAL > 4 mm, 31%; and DMFT index, 8.2 (Table 1). The mean of PI and BoP was significantly higher in Group A than in Group B ($P < 0.001$), but the PPD, CAL and DMFT scores were not significantly different in the two groups according to the statistical results ($P < 0.05$).

Table 1. **Distribution of demographic characteristics and clinical parameters of groups**

Characteristics	Type of antipsychotic medication	
	Group A $n = 33$	Group B $n = 20$
Female/male, *n* (%)	19:14 (57:43)	10:10 (50:50)
Mean age (years, mean ± SD)	31.8 ± 9.3	29.3 ± 9.7
Smoking, *n* (%)	26 (79)	15 (75)
Mean duration of psychiatric disease (years, mean ± SD)	6.1 ± 4.7	7.4 ± 5.1
Duration of antipsychotic medication (years, mean ± SD)	5.6 ± 3.9	6.3 ± 4.3
Tooth brushing, *n* (%)		
Daily once	3 (9)	2 (10)
Occasionally	18 (54)	10 (50)
Never	12 (36)	8 (40)
Plaque index (%)	80 ± 39	58 ± 41*
Bleeding on probing (%)	73 ± 32	49 ± 37*
Mean probing pocket depth (PPD) (mm)	3.4 ± 2.1	3.5 ± 2.0
Mean clinical attachment levels (CAL) (mm)	3.9 ± 2.6	4.0 ± 3.1
% sites with PPD > 4 mm	24 ± 17	22 ± 17
% sites with CAL > 4 mm	29 ± 21	31 ± 19
DMFT index	8.4 ± 5.6	8.2 ± 6.3
Salivary flow rate (ml min^{-1})	0.23 ± 0.25	1.12 ± 0.94*

Mean values ± SD are given. *P* values were obtained from Student's *t*-test.
*Difference is significant ($P < 0.001$).

Table 2. **Correlation between clinical parameters and schizophrenia-related factors**

	Salivary flow rate	Duration of antipsychotic medication	Duration of psychiatric disease
Plaque index	−0.716**	0.747**	0.802**
Bleeding on probing	−0.728**	0.761**	0.798**
PD	−0.148	0.328	0.573*
Clinical attachment levels	−0.119	0.349	0.544*
DMFT	−0.121	0.403	0.551*

r values were obtained from the Pearson's correlation test.
*Correlation is significant ($P < 0.05$).
**Correlation is significant ($P < 0.001$).

Table 2 shows the relationship between clinical periodontal scores and the characteristic features of subjects. There was a clear association between increased PI and BoP with levels of SFR ($P < 0.001$) (Fig. 1) as well as the duration of psychiatric disease and the duration of the use of antipsychotic medication ($P < 0.05$). No association between PPD, CAL, and DMFT and levels of SFR ($P > 0.05$) was found, but PD, CAL and

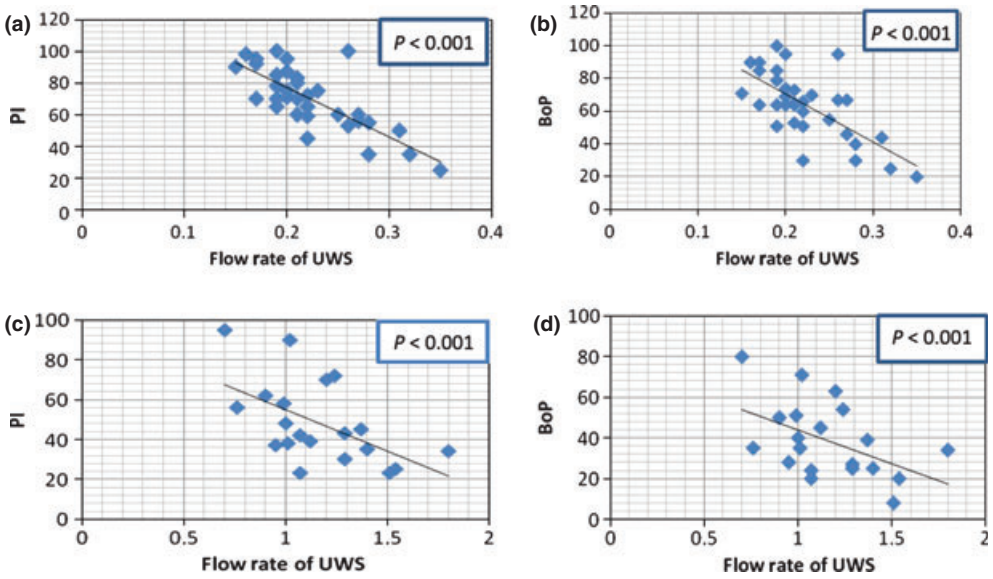

Fig. 1. The evaluation of relationship between flow rate of unstimulated whole saliva with plaque index (PI) and bleeding on probing (BoP). (a) Relationship between PI and salivary flow rate (SFR) of patients in Group A. (b) Relationship between BoP and SFR of patients in Group A. (c) Relationship between PI and SFR of patients in Group B. (d) Relationship between BoP and SFR of patients in Group B.

DMFT were associated with the mean duration of psychiatric disease ($P < 0.05$) (Table 2).

Discussion

This is the first study to assess whether there is a link between severe periodontal disease and a change in SFR (medication-induced sialorrhea and medication-induced xerostomia) caused by antipsychotic medications in patients with schizophrenia. The study revealed two principal findings. First, patients in Group A who may have xerostomia induced by antipsychotic drug intake were more likely to have higher PI and BoP scores than those in Group B. Secondly, in both groups, there were similar PPD, CAL and DMFT scores. In addition, this study discovered high PI, BoP, PD, CAL and DMFT scores in the patients with schizophrenia. These findings provide new information regarding the aetiology of periodontal disease in patients with schizophrenia.

Kenkre *et al.* evaluated the periodontal health and treatment needs of institutionalized psychiatric patients ($n = 153$) whose 63% were diagnosed with schizophrenia. They found that only 5.4% had a healthy periodontium, whereas 16.27% required complex periodontal therapy (8). Mirza *et al.* (24) reported that 88%, 88% and 65% of acute inpatients had gum inflammation, plaque and dental caries, respectively. Thomas *et al.* (25) evaluated the oral health status of patients with schizophrenia using the Oral Hygiene Index and DMFT scores, and they reported that the extent of dental disease among inpatients was directly related to the severity of positive and negative symptoms. Conversely, Levis reported that the oral hygiene of the dentate population was poor, but there was little periodontal disease. Treatment needs were satisfied by scaling and polishing. There were no significant differences found between subgroups within the population (9).

Velasco *et al.* (26) reported that the average number of dental caries in institutionalized Spanish psychiatric patients was eight, and the mean number of missing teeth was 17. In another study, the mean number of dental extractions and conservative treatment required in institutionalized Italian patients was 6 and 3, respectively (27).

The available evidence suggests a higher prevalence and severity of periodontal disease among patients with psychiatric problems compared to the general population. Multiple interrelated factors have been considered in an effort to explain this relationship. It was previously reported that the side effects of their medications, poor dental hygiene and smoking caused severe periodontal disease in psychiatric patients (11). In addition, dental treatment is difficult for these patients because of their lack of motivation, limited cooperation, low adaptability to new prostheses, mobility difficulties, fear of treatment, poor communication and financial considerations (11). Similar to previous studies that suggested that there is a high prevalence of periodontal disease and high DMFT scores in people with schizophrenia (8, 10, 25, 26), the results of this study showed that both groups have quite high clinical scores, especially PI and BoP.

A sizeable proportion of psychiatric patients do not have good oral health habits, such as regularly visiting a dentist or brushing their teeth (12). The perceived need for dental care among psychiatric patients is low (28), and only a small proportion of them are aware of the caries-inducing potential of psychotropic drugs (29). A high percentage of people with schizophrenia are smokers, and this behaviour is associated with emphysema, lung cancer, cardiac disease and oral cancer

(15). Like previous studies, the results of this study demonstrated smoking and poor dental hygiene are common in both groups. Only five of the participants in this study brushed their teeth every day, and more than three-fourths of the participants were smokers. We hypothesize that these are the main factors causing the widespread periodontal disease in patients with schizophrenia.

This study included two groups according to the type of antipsychotic medication they used. Each type of drug had an opposite effect on SFR. The mean SFRs were 0.23 ± 0.25 and 1.12 ± 0.94 ml min^{-1} in Group A and Group B, respectively. According to our knowledge, in healthy humans, the UWS normally ranges from 0.35–1.05 ml min^{-1} (30). The mean SFR of patients in Group A was lower than normal, and it was higher than normal in Group B. In other words, while there was evidence of xerostomia in Group A patients, there was sialorrhea in Group B. In this respect, the results of this study were consistent with the results of previous studies (14–16), which reported that one of the main factors causing a change in salivary flow is antipsychotic medications.

Saliva plays a key role in maintaining oral health and protecting oral tissues (31, 32). It lubricates the oral mucosa, aiding in phonation, deglutition and mechanical cleansing of the oral tissues by removing food particles. Saliva makes these functions via flow rate as biochemical properties as, and an increased or decreased salivary flow would have adverse effects on oral conditions (33). However, little information is available about the effect of salivary dysfunction on periodontal health (33).

It was previously reported that a majority of the antipsychotic medications cause xerostomia, stomatitis and glossitis, and a smaller percentage of these medications have been identified as causing sialadenitis, gingivitis, oedema and discolouration of the tongue. On the other hand, some antipsychotic medications (e.g., clozapine) are a potent anticholinergic agent, and daytime and night-time hypersalivation is common among those who take this drug (17, 18). Unfortunately, we found no data in the literature that assessed the relationship between the severity of periodontal disease and sialorrhea-induced antipsychotic medications. Therefore, this study aimed to assess the relationship between periodontal status and an altered flow rate of UWS in patients with schizophrenia undergoing antipsychotic medications.

The results of this study showed there was a correlation between rising PI and BoP and a reduction in SFR, but we did not find a correlation between PPD and CAL and a reduction in SFR. Because of saliva's mechanical cleansing and antimicrobial properties, some studies have suggested that gingival and periodontal health are related to salivary function (31). However, there is little to support this association, and no studies have been conducted to assess the relationship between SFRs and periodontal health. Crow and Ship (33) reported that there is no consistent relationship between salivary gland flow rates and gingival and periodontal conditions in healthy people. Hirotomi *et al.* (34) suggested that a low SFR alone is not related to the periodontal conditions in Sjogren Syndrome, but both high Sjogren Syndrome and low SFR would be a potential risk factor for periodontal disease. Generally, there was no consensus of opinion in the literature about an association between periodontal disease and SFR. The results of this study were conflicting because PPD, CAL and DMFT scores were similar in both groups, and the PI and BoP scores were higher in Group A than in Group B.

This study has two important limitations. First, we had no knowledge about oral conditions of participants before the start of their psychiatric disorder and taking antipsychotic medications. Second, the lubricating action of saliva is essential for oral health. It facilitates movement of the tongue and lips during swallowing and eating. The efficacy of saliva as a lubricant depends on its viscosity, but this study did not include an assessment of the physical properties of the saliva collected. For this reason, further research is necessary over a longer-term and with comparisons of salivary content.

After the present study, we conclude that there is a high risk of periodontal disease among patients with schizophrenia and a higher risk of periodontal disease in those with reduced SFR induced by their medication compared with schizophrenic patients with increased SFR. Preventive dental protocol should be increased in the dental health care of this disadvantaged patient group. In addition, both sialorrhea and xerostomia should be considered having a negative impact on quality of life. For this reason, practitioners who see patients with reduced SFR induced by antipsychotic medications should recommend agents that increase salivary flow. The type or dosage of the drugs that cause sialorrhea could be changed following consultation with the psychiatric doctor.

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