Original Article

The Effect of Antipsychotic Drugs on Salivary Flow Rate and Dental Caries in Schizophrenic Patients

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Abstract - This study sought to ascertain how antipsychotics affected patients with schizophrenia's salivary flow and risk of dental caries. 24 individuals with recently diagnosed schizophrenia who were given antipsychotic medication by a licensed psychiatrist made up the study population. Patients with schizophrenia who are on first-generation antipsychotic medications make up 12 participants, while patients with schizophrenia who are taking second-generation antipsychotic medications make up another 12 participants. Participants' oral health status was assessed using the decay index/missing/filled teeth (DMFT) and salivary flow rate. The results of this study indicate that in the first-generation group, 50.0% of patients were hydrated for 30 to 60 seconds, 66.7% of patients had foamy or bubbly saliva, 50% of patients had a PH of 6.0 to 6.8, and the mean salivation rate was 0.13 ± 0.06 milliliters per minute. In the second-generation group B, the mean salivation rate was 0.24 ± 0.09 (ml/min), 66.7% of patients had frothy or bubbly saliva, 66.7% had saliva with a PH of 6.8–7.8, and 58.3% had hydration 30 seconds. In terms of DMFT, 41.6 and 41.7% of patients in both groups they have had DMFT 0 at day zero. The DMFT score of zero, however, rapidly reduced in the second-generation group while remaining constant in the first-generation group. At 12 months, the variations in DMFT between the two groups were statistically significant (P <0.005). In conclusion, 2nd generation drug recipients with schizophrenia had much better oral health than the 1st generation group.

Keywords - Schizophrenia, Dental problem, 1st generation drug, 2nd generation drug, DMFT.

1. Introduction

Because it is so important for general health and well-being, individuals are becoming increasingly concerned with their dental health to improve their quality of life. Oral degeneration occurs throughout a lifetime due to several systemic diseases. Psychiatric diseases significantly affect oral health, which can lower a person's quality of life, sense of well-being, and self-esteem since it impacts their ability to eat, communicate, and engage in other social and psychological activities.[1] Dental caries is a multi-cause infectious illness largely reliant on a diet. It is the final consequence of a complicated interaction between the host (tooth enamel and salivary features), the cause (oral biofilm), and the environment (diet and eating habits). Caries and periodontal disease are both caused by the same underlying mechanism (dental plaque).[2]

Dental plaque is a soft, organic, bacterial biofilm that forms on teeth as well as in other areas of the oral cavity. It is defined as being colorless, opalescent, organic, and bacterial. In terms of the pathogenic mechanism causing caries, bacteria consume complex carbohydrates found in dental plaque for their metabolism. As a byproduct, the resulting acids cause the pH of the oral cavity to decrease. The disruption of the mineral component of the enamel (Ca^{+2} and $PO4^{+3}$-ions diffuse from the tooth enamel) and subsequent cavitations, which result in early caries lesions, occur in this environment when the demineralization process outpaces the remineralization process.[2]

Numerous studies have compared the dental health of psychiatric patients with mentally healthy individuals. In people with a mental health condition, dental illnesses are more prevalent, caries susceptibility is higher, tooth extraction is more common, and filled teeth are less common.[3,4,5,6] Numerous factors contribute to this, including the nature and severity of psychiatric disorders, poor oral hygiene, a particular dental phobia, difficulty accessing

healthcare facilities, the side effects of psychiatric medications, an unhealthful diet, self-neglect, and the knowledge and attitudes of dental professionals. These patients' lack of enthusiasm and apathy, limited collaboration, low adaption to new prostheses, movement issues, dread of treatment, poor communication, as well as financial constraints make dental care challenging for them.[7]

In addition to worsening the mouth's condition, psychiatric illnesses can contribute to a decline in general health. It is estimated that more than 450 million individuals worldwide struggle with a mental illness of some kind. People of various ages and socioeconomic backgrounds are impacted by mental illness. By interfering with their level of functioning and changing their perception, it has an impact on their general behavior. Due to misinformation, stigma, fear, misconceptions, and unfavorable views, this group is frequently ignored.[8]

Schizophrenia is the most prevalent severe psychiatric condition among those. Previous research has demonstrated that schizophrenia is a chronic mental illness with remissions and exacerbations that results in patients' social and occupational incapacity. One of the top 10 primary causes of impairment in people between the ages of 15 and 44, the condition affects 1% of the overall population.[3] Schizophrenia affects between 0.16 and 0.28 people per 1,000 people each year. 4000 to 5000 per million are affected, or roughly 1.1% in men and 1.9% in women. Urban and industrialized areas have higher prevalence, morbidity, and severity of clinical symptoms than rural areas. Additionally, while incidence is similar across all socioeconomic classes, prevalence is higher in lower socioeconomic levels.[2] It is also the most complicated psychiatric condition ever to affect humans. The majority of persons with schizophrenia have a higher risk of dying, as well as a number of co-occurring health conditions (including emphysema, obesity, lung cancer, and heart disease).[9,10,11,12]

For the treatment of schizophrenia, a variety of first-generation and second-generation antipsychotic medications are available. Many first-generation antipsychotics, including chlorpromazine, fluphenazine, haloperidol, thioridazine, sulpiride, and thiothixene, have been registered in Bangladesh. Due to their strong affinity for dopamine D2 receptors, all medications of this generation cause extrapyramidal symptoms and have a sizable risk of tardive dyskinesia. The effectiveness of some in treating positive psychotic symptoms is greater than that in treating negative ones. Aripiprazole, clozapine, risperidone, olanzapine, quetiapine, ziprasidone, and amisulpride are examples of second-generation antipsychotics. Because these antipsychotics work on more than only the dopaminergic D2 receptor system, the activity of neurotransmitters is more

balanced after their administration. Sadly, in addition to their beneficial therapeutic outcomes, antipsychotics have several side effects.[2]

Psychotropic medications have been demonstrated to have negative effects in numerous investigations. The salivary glands' hypofunction, which results in decreased salivation (dry mouth), can be brought on by psychotropic medicines. Due to unfavorable changes in the oral environment, this condition frequently intensifies the cariogenic microflora and speeds up the development of dental caries.[9] They are also linked to oral ulcers, bruxism, tongue edema, tongue discoloration, parotitis, fissured tongue, dysphagia, sialadenitis, dysgeusia, stomatitis, gingivitis, and glossitis.[13,11] Drug therapy for schizophrenia is primarily a long-term chronic illness, so it is important to demonstrate the likelihood that there will not be any adverse effects on oral health. Consequently, the goal of this research is to ascertain whether antipsychotics are associated with dental caries.

2. Materials and Methods

This observational longitudinal comparative study was carried out at the Bangabandhu Sheikh Mujib Medical University's Conservative Dentistry and Endodontics Department in Shahbagh, Dhaka. Patients with recently diagnosed schizophrenia disorders from the psychiatry outpatient clinic at BSMMU (Bangabandhu Sheikh Mujib Medical University) and NIMH. A case of schizophrenia that was identified by a licensed psychiatrist, and for which medications from groups A and B of the first generation of antipsychotics were provided. A sampling technique with a purpose was used. The following are the inclusion requirements: a case of a patient with schizophrenia who has been identified by a licensed psychiatrist, who has been prescribed antipsychotic medicine by a psychiatrist but has not yet begun taking it, who is at least 18 years old, who is male or female, and willing to provide information.
Study procedure:

The aforementioned pre-established inclusion and exclusion criteria were used to select cases of schizophrenia that a licensed psychiatrist had diagnosed. First-generation and second-generation antipsychotics were prescribed to patients with schizophrenia in groups A and B, respectively. To meet the exclusion criteria, some standard tests (such as CBC, FBS, chest X-rays, and dental OPGs), as well as standard dental intraoral and extraoral clinical examinations, were conducted. A clinical examination was carried out at the Department of Conservative Dentistry and Endodontics after getting approval from the pertinent authorities and the patients' family members' or guardians' agreement. Before the clinical examination, the patient and family members were interviewed to gather demographic and medical information.

Table 1. Distribution of the study patients by sociodemographic profile (n = 24)

	1st generation (n=12)		2nd generation (n=12)		*p* value
	n	**%**	**n**	**%**	
Age (years)					
25-30	6	50.0	6	50.0	
31-35	3	25.0	3	25.0	
>35	3	25.0	3	25.0	
Mean ± SD	32.9±7.4		32.7±7.4		[a]0.948[ns]
Range (minimum to maximum)	25 to 48		24 to 48		
Sex					
Male	7	58.3	6	50.0	[b]0.682[ns]
Female	5	41.7	6	50.0	
Educational Level					
Illiterate	2	16.67	2	16.67	
Primary	3	25.00	3	25.00	
Secondary	3	25.00	3	25.00	[b]1.000[ns]
Higher Secondary	2	16.67	2	16.67	
Graduate	2	16.67	2	16.67	
Social background					
Peri-Urban	4	33.33	4	33.33	
Urban	2	16.67	2	16.67	[b]1.000[ns]
Rural	6	50.00	6	50.00	
Economical Status					
Lower Class	3	25.00	1	8.33	
Lower Middle Class	3	25.00	5	41.67	[b]0.606[ns]
Middle Class	3	25.00	4	33.33	
Higher Middle Class	3	25.00	2	16.67	
Occupation					
Unemployed	4	33.33	3	25.00	
Homemaker	4	33.33	5	41.67	
Service holder	2	16.67	2	16.67	
Businessman	2	16.67	2	16.67	

[ns]= not significant   [a]p value reached from Unpaired t-test
[b]p value reached from the Chi-square test

Table 2. Distribution of the study patients by DMFTstatus (n=24)

DMFT	1st generation (n=12)		2nd generation (n=12)		p value
	n	%	n	%	
At 0 days					
0	5	41.6	5	41.7	
1	3	25.0	4	33.3	0.924ns
2	2	16.7	1	8.3	
3	2	16.7	2	16.7	
At 03 months					
0	1	8.3	5	41.7	
1	6	50.0	4	33.3	0.308ns
2	2	16.7	1	8.3	
3	3	25.0	2	16.7	
At 06 months					
0	0	0	1	8.3	
1	1	8.3	6	50.0	
2	6	50.0	2	16.7	0.123ns
3	4	33.3	2	16.7	
4	1	8.3	1	8.3	
At 09 months					
1	0	0.0	4	33.3	
2	4	33.0	5	41.7	
3	3	25.0	1	8.3	0.93ns
4	5	41.7	2	16.7	
At 12 months					
1	0	0.0	3	25	
2	0	0.0	5	41.7	
3	5	41.7	1	8.3	0.010s
4	5	41.7	3	25.0	
5	2	16.7	0	0.0	

s= significant ns= not significant p value reached from Fishers exact test

Table 3. Distribution of the study patients by saliva (n = 24)

Saliva	Group I (n=12)		Group II (n=12)		p value
	n	%	n	%	
Hydration (Sec)					
< 30 seconds	2	16.7	8	66.7	
30-60 seconds	6	50.0	4	33.3	[a]0.018s
> 60 seconds	4	33.3	0	0.0	
Viscosity					
Frothy/Bubbly	8	66.7	8	66.7	
Sticky	4	33.3	0	0.0	[a]0.018s
Watery/Clear	0	0.0	4	33.3	
PH					
5.0-5.8	4	33.3	0	0.0	
6.0-6.6	6	50.0	5	41.7	[a]0.032s
6.8-7.8	2	16.7	7	58.3	
Quantity (ml/min)					
Mean±SD	0.13±0.06		0.24±0.09		[b]0.001s
Range (min, max)	0.05,0.23		0.05,0.36		

s= significant

[a]p value reached from the Chi-square test

[b]p value reached from Unpaired t-test

Age, gender, education, occupation, and socioeconomic standing are all included. According to the researcher's questionnaire, they were also questioned about their personal habits (such as smoking, using tobacco, or betel), oral hygiene routines (such as how frequently they used toothpaste and what kind of toothpaste they used), and any prior dental treatment they may have received. The questionnaire was pre-tested among schizophrenia patients before the study's launch to ensure an appropriate approach.

Before beginning antipsychotic treatment, baseline data were gathered. Following recording baseline data, patients and caregivers were told to start taking antipsychotic medications as directed by a psychiatrist. The investigators simultaneously provided identical oral hygiene instructions to all patients or their caretakers to ensure proper oral hygiene maintenance. Follow-up data were gathered every three months, six months, nine months, and twelve months.

3. Results

Table I displays the sociodemographic breakdown of the study participants. In both groups, it was found that 50.0% of the patients were between the ages of 25 and 30. In the first generation, the mean age was 32.9±7.4 years, and in the second generation, it was 32.7 ± 7.4 years. In the first generation, 58.3% of patients and 50% of patients in the second generation were men. The patient's educational background accounted for 25.0% of the total in both groups. In both categories, 50% of patients are from rural areas. In the first generation, 25.0% of patients had a lower middle-class economic position, while 5 (41.67%) in the second generation did. Patients from the first generation (33.33%) and the second generation (51.67%) were primarily homemakers. The difference between the two groups was statistically insignificant (p>0.05).

The distribution of the study participants by level of dental caries is shown in Table 2. 41% of patients in both groups had DMFT 0 at day zero. 50.0% of patients in the first generation and 4(33.3%) of patients in the second generation had DMFT 1 at 3 months. At 6 months, 50.0% of first-generation patients and 16.7% of second-generation patients developed DMFT 2. Additionally, at 9 months, 16.7% of patients in the second-generation group and 41.7% of patients in the first-generation group had DMFT 4 each. At the end of the 12-month observation period, the DMFT 4 rate was 41.7% in the first generation and 25.0% in the second generation group. The differences between the two groups 3 months of DMFT were statistically significant (P <0.005).

The distribution of the study participants by saliva is shown in Table 3. In the first generation, 50.0% of patients and 4 (33.3%) in the second generation group were found to have received hydration for between 30 and 60 seconds. Both groups' viscosities were foamy or bubbly in two-thirds

(66.7%) of the patients. In the first generation, 50.0% of patients (n=5) and in the second generation, 41.7% (n=5) belonged to the PH 6.0–6.8 range. In the first generation, the mean quantity was 0.13 ± 0.06 ml/min; in the second generation, it was 0.24 ± 0.09 ml/min. The difference between the two groups was statistically significant (p <0.05).

4. Discussion

The findings of this investigation supported the idea that individuals with schizophrenia taking first-generation antipsychotics and those taking second-generation antipsychotics have different dental problems. Patients with schizophrenia who were using second-generation or atypical medications displayed comparable superior oral health. Plaque scores in this trial's group B remained good to fair in all (100%) individuals throughout the study period; however, in group A, which received first-generation medicines, the plaque scores declined from good to fair at three months and terrible at twelve months. This might be because second-generation medications tend to induce less xerostomia than most first-generation medications. Antipsychotic medications may produce both xerostomia and sialorrhea, according to a prior study.[14]

This study supports the hypothesis that, as consumption time increased, dental and periodontal disorders worsened due to hyposalivation. On the other hand, daytime and overnight hypersalivation are brought on by second-generation medications like clozapine, which are strong anticholinergic medicines.[15] The findings of this study further supported the notion that both groups, particularly PI and BOP, had clinical scores that were comparatively high. Eltas A et al.[14] findings of high PI, BOP, PPD, and DMFT scores in schizophrenia patients using antipsychotic medications, as well as the fact that group A's xerostomia was more severe than group B's, provide more support for this illness. In addition, Kenkre et al.[16] and Thomas et al.[17] revealed a similar finding that only 5.4% of schizophrenia patients had a healthy periodontium, and 16.27% needed extensive periodontal care. On the other hand, Mirza et al. (2001) observed that gingivitis, plaque, and cavities were present in 88%, 88%, and 65% of schizophrenia patients, respectively.[1]

In this study, the issue of caries development was also essential. It was discovered that drug usage in both generations was to blame for a rise in rotting teeth, missing teeth, full teeth, and higher DMFT scores. According to a prior study, individuals treated with a typical first-generation medicine have a much higher DMFT index and more missing teeth and fewer fillings than patients who received second-generation drugs. The DMFT score was greater in group A patients. This disorder results from a decrease in saliva flow and insufficient saliva rinsing, which were insufficient to clean the mouth cavity thoroughly.

Similar findings were made in a prior study by Djordjevic et al.[3], which showed that patients on traditional first-generation antipsychotics had more pronounced hyposalivation. Atypicals are more compliant than typicals because they experience fewer neurological side effects, such as less dyskinesia, higher judgment and more lasting remission are related to higher adherence, and these factors encourage patients to follow oral hygiene routines and seek necessary dental care early on, which eventually results in more restorations and fewer extractions.

Our findings imply that improvements in dental care-seeking behavior may be associated with improved dental status in patients treated with atypical preparations. This relationship may be caused by a better understanding of these patients' needs for dental care, improved oral hygiene, or both. Negative symptoms are thought to be lessened somewhat more by atypical treatments than by normal ones. These unpleasant symptoms, presumably brought on by social withdrawal, which may lessen help-seeking behavior, may contribute to the poor dental health of mentally ill individuals.[19] In order to effectively treat schizophrenia with pharmacotherapy, doctors should give antipsychotics and other medications as infrequently as possible,[20,21,22] and ensure prompt dental referral.

According to previous research, people with schizophrenia who experienced hyposalivation, or decreased salivary flow, had a higher chance of developing periodontal disease than those who experienced enhanced salivation.[14] The findings of earlier investigations were likewise corroborated by the current study. 90% of people with a mental health condition (schizophrenia: 61% of patients) had poor periodontal health, according to a cross-sectional oral health survey conducted in central Taiwan using the Community Periodontal Index (CPI).20 Another study conducted in Hong Kong found that, according to the World Health Organization's standardized dental examination, 98.5% of patients with chronic schizophrenia had poor periodontal health.[20] However, due to the small to medium-sized sample sizes of most prior studies and the complex antipsychotic regimens that research participants were given, there is no evidence of the negative effects of antipsychotics on periodontal disease in individuals with recently diagnosed schizophrenia.[14,20,21] Dental treatment is also challenging for these patients due to a lack of motivation, limited collaboration, low adaption to new prostheses, mobility issues, treatment-related dread, poor communication, and financial considerations. This study found that individuals with schizophrenia have high rates of periodontal disease and high DMFT scores, which is consistent with other research.[14,21]

A special biological fluid called saliva is created by numerous salivary glands. About 99% is water, while the remaining 1% contains proteins and salts. The oral cavity's homeostasis is kept in check by saliva. It has antibacterial, antifungal, digestive, and anti-inflammatory benefits and offers protection against mechanical and chemical harm. In this study, group A (50%) and group B (33%) of the patients received hydration for 30 to 60 seconds. This indicates that patients in group A are most likely to experience hyposalivation. This outcome is comparable to the Taiwan study.[23]

Another study carried out in Turkey came to the same conclusion.[14] Most frequently, disorders in salivary secretion are to blame for adverse medication effects. After taking antipsychotic medications such as aripiprazole, pernazine, and risperidone, the patient frequently complained of reduced salivary production. This failure of saliva secretion exacerbates dental and periodontal disease.[14] UWS is typically in the range of 0.35 to 1.05 ml/min in healthy individuals. The mean SFRs of the patients in group A were below average, but those in group B were mainly normal. In other words, patients in group A exhibited xerostomia, whereas sialorrhea predominated in group B. In this regard, the findings of this study were in line with those of earlier investigations, which found that antipsychotic medications were one of the main causes of the change in salivary flow.

Saliva's viscosity is a rheological characteristic of the complex salivary fluid related to its glycoprotein concentration. The lubricating and moistening processes required for maintaining mucosal integrity depend on viscoelastic characteristics. This study found that two-thirds (66.7%) of patients exhibited foam/bubble viscosity in both groups. Comparatively, 33% of patients in Group A and 33% of patients in Group B had sticky saliva and watery/clear saliva, respectively. In group A, 50.0% of patients (and 41.7% in group B) had a PH of 6.0–6.8. In group A, 33.3% of the patients had critical PH 5.0–5.8, which is when dental caries started.

In group A, the mean flow rate was 0.13 ± 0.06 ml/min; in group B, it was 0.24 ± 0.09 ml/min. Between the two groups, there was a statistically significant difference ($p < 0.05$). This finding demonstrated that patients in group A are more susceptible to dental and periodontal issues than those in group B because saliva is essential for protecting oral tissues and preserving oral health. Assists in phonation, deglutition, and mechanical cleaning of oral tissues by removing food particles while lubricating the oral mucosa. As the biochemical characteristics and an increase or reduction in saliva flow would negatively impact oral conditions, saliva performs these duties through flow.

Additionally, oral illnesses frequently rank lower on the priority list for people with schizophrenia's overall health care, despite having a detrimental effect on their quality of life. The establishment of dentistry programs requires applying a multidisciplinary strategy incorporating both

mental and oral health. These initiatives must inform and raise dental health awareness among psychiatrists and psychiatric nurses. The majority of dental issues in persons with schizophrenia can be improved with access to expert dental care.

5. Conclusion

The clinical results of this study show differences in salivary flow rate and dental health between schizophrenia patients in Group A and Group B who are receiving first-generation antipsychotics compared to those receiving second-generation antipsychotics. More precisely, second-generation drug-treated schizophrenia patients in Group B had much better oral health than individuals in Group A.

6. Ethical Issue

Ethical clearance was taken from Institutional Review Board, Bangabandhu Sheikh Mujib Medical University (NO. BSMMU/2020/8463)

Acknowledgement

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