

ORIGINAL ARTICLE

## Severity of illness and extra pyramidal symptoms as predictors for oral diseases among patients with schizophrenia

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### ABSTRACT

**Objective:** The study explores the association between severity of illness (positive, negative, depressive and cognitive symptoms) and extra pyramidal symptoms (EPS) with dental caries, periodontal disease and prosthetic needs among patients with schizophrenia.

**Material and methods:** A total of 71 schizophrenic patients diagnosed based on ICD-10 criteria participated in the study. Clinical Global Impression – Schizophrenia (CGI-SCH) scale was used to evaluate positive, negative, depressive, cognitive symptoms and overall severity of schizophrenia. Simpson–Angus Scale (SAS) was used for assessment of EPS. Dental examinations were conducted as per WHO (1997) criterion.

**Results:** Mean DMFT and CPI scores with periodontal pockets were  $5.57 \pm 2.12$  and  $2.37 \pm 0.74$ ; significant differences being noted among those with and without EPS ( $p < 0.001$ ). Positive and EPS associated with dental caries with odds ratio of 5.26 (1.05, 26.2) and 8.52 (2.31, 31.4) ( $p < 0.001$ ). Depressive and EPS were associated with periodontal disease with odds ratio of 4.19 (1.53, 32.5) and 5.27 (1.29, 21.5), respectively ( $p < 0.001$ ). Cognitive and EPS were associated with dental prosthetic needs with odds ratio of 4.33 (1.47, 31.2) ( $p < 0.001$ ) and 7.78 (1.43, 42.2), respectively ( $p < 0.001$ ).

**Conclusions:** Patients with schizophrenia had high dental caries, periodontal disease and unmet dental prosthetic needs. Severity of the schizophrenic and EPS was associated with poor oral health. Efforts need to be focused on strengthening the evidence of its association with oral health indicators through further studies including cohort investigations.

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### Introduction

Schizophrenia is a complex, heterogeneous behavioural and cognitive syndrome that stems from disruption of brain development caused by genetic or environmental factors or both [1]. The illness is characterized by a breakdown of thinking, emotions and a loss of contact with reality. People with schizophrenia experience attrition of performance in day-to-day life over a protracted period of time [2]. It diminishes a person's abilities in the areas of social relations, school or work and self-care. During an episode of illness, patients with schizophrenia experience the world in a profoundly confused way, which often is disturbing and frightening for them. Although schizophrenia is not as common as other mental disorders, the symptoms can be very disabling [3].

Schizophrenia is characterized by positive, negative, depressive and cognitive symptoms [3]. Positive symptoms include hallucinations, delusions and other thought and speech disorders. Negative symptoms correlate with disruptions to conventional emotions and behaviours like reduced expression of emotions, reduced feelings of pleasure, difficulty in initiating actions and reduced speech.

Cognitive symptoms span from slight to more severe where patients may notice changes in their memory, attention levels or other features of thinking [4]. Concomitantly, these symptoms affect several regions of functioning, such as attention, executive functioning and memory.

Symptoms begin usually in young adulthood, and about 0.3–0.7% of people are affected during their lifetime. In 2013, there was projected to be 23.6 million cases globally [5]. In India, where about 1.2 billion people reside, the prevalence of schizophrenia is about 3/1000 individuals. It is more common in men, and in terms of age of onset, men tend to be younger by an average of about five years than women when they develop schizophrenia [6].

Extra pyramidal symptoms (EPS) also expressed as extra pyramidal side effects are drug induced movement disorders that comprises of acute and tardive symptoms [7]. These symptoms include dystonia (spasms and muscle contractions), akathisia (motor restlessness), pseudoparkinsonism (symptoms such as hypokinesia, rigidity and tremor) and tardive dyskinesia (jerky movements) [8]. Antipsychotics are often discontinued due to inefficacy or intolerable side effects such as EPS.

Schizophrenia has a chronic course and is associated with elevated risk for co-morbid somatic illnesses and premature mortality, but even in the face of increased risk, general health care needs in this population are often neglected [9,10]. Co-morbidities frequently reported in patients with schizophrenia have been ascribed to their sedentary lifestyle, poor self-care and side effects from psychotropic medications [5–10]. In this context, oral health is important because it is critical for overall systemic health. Poor oral health has a critical impact on quality of life, everyday functioning, social inclusion and self-esteem. Pain and discomfort caused by oral diseases can result in eating difficulties leading to poor levels of nutrition. However, oral health has not been perceived as a priority in people suffering with mental illness [9–11].

There is strong evidence suggestive of people with schizophrenia have a higher risk of experiencing oral disease and have greater oral treatment needs than the general population. It has been demonstrated that patients with schizophrenia have a more frequent occurrence and severity of dental caries, periodontal diseases and unmet prosthetic dental care. Risk factors associated with oral diseases in available literature include socio demographic factors, duration of mental illness, admission to psychiatry facility, drugs dependency, oral hygiene habits and psychiatric medication [10–15]. Our hypothesis was that the severity of the positive, negative, depressive, cognitive symptoms and EPS manifesting among patients with schizophrenia have an association with oral health, besides the other deliberated factors. To date, no such relationship has been studied for all the symptoms associated with the disease. The study aimed to explore the association between severity of illness and EPS with dental caries, periodontal disease and prosthetic needs among patients with schizophrenia.

## Material and methods

The target population for the cross-sectional study was consenting patient attending the Psychiatry Outpatient Services of All India Institute of Medical Sciences (AIIMS), Bhopal, for duration of six months and clinically diagnosed with schizophrenia, based on ICD-10 criteria [16]. A total of 71 patients participated in the study from July, 2105 to December, 2015; response rate being approximately 80%. Information on demographic characteristics was collected by means of personal interviews and a questionnaire administered by the examiner. The dental team comprised of two trained examiners assisted by a recording clerk.

The Clinical Global Impression – Schizophrenia (CGI–SCH) scale is an assessment instrument designed to evaluate positive, negative, depressive, cognitive symptoms and overall severity in schizophrenia [17]. The severity of illness category evaluates the situation during the week previous to the assessment, while the degree of change category evaluates the change from the previous evaluation. Each category contains five different ratings (positive, negative, depressive, cognitive and global) that are evaluated using a seven-point ordinal scale. The scale translates clinical judgment into

ratings that reflect the diversity of symptoms present in schizophrenia. Simpson-Angus Scale (SAS) is a 10-item rating scale that has widely been used for assessment of EPS in both clinical practice and research settings [18]. It consists of one item measuring gait (hypokinesia), six items measuring rigidity and three items measuring glabella tap, tremor and salivation respectively. Each item contains scores from 0 to 4; 0 being normal and scores from 1 to 4 reflecting an increase in symptoms. The examination was conducted in a room where the subject could walk a sufficient distance to allow him/her to get into a natural rhythm. Each side of the body was examined and the side with more pathology was recorded. The rating of the CGI–SCH and SAS was recorded after an interview that lasted approximately the same time as a clinical visit.

## Dental examination

Oral examinations were conducted in Department of Dentistry, AIIMS, Bhopal. Data was compiled for dental caries, periodontal disease, prosthetic status and prosthetic needs. Dental examinations were conducted as per WHO recommendations [19]. Decayed, missing and filled teeth counts were estimated using DMFT index. Community Periodontal Index (CPI) was used to assess the periodontal health utilizing a mouth mirror and a CPI probe. Three periodontal indicators used for assessment were gingival bleeding, calculus and periodontal pockets. Prosthetic status and prosthetic needs were recorded in both upper and lower jaw using WHO's criterion [19].

The index used for assessment of oral health status and prosthetic needs are valid and reliable tools and have been adopted by WHO for oral health surveys. Training and calibration of examiners for the oral health survey was conducted as recommended in WHO manual [19]. An experienced epidemiologist trained in recommended methodology for basic oral health survey was employed as a trainer and calibrator. A two day training session was conducted for standardization and calibration of the examiners within the Department of Dentistry. The Kappa statistic was performed and a score of 0.88 for inter examiner agreement was achieved. An intra-examiner agreement between 0.90 and 0.92 was achieved for the two examiners.

The CGI–SCH scale is a valid, reliable instrument to evaluate severity and treatment response in schizophrenia. Given its simplicity, brevity and clinical face validity, the scale is appropriate for use in observational studies and routine clinical practice [17]. SAS is also a reliable and valid instrument, when used among patients with psychiatric disorders [20]. A specialist from the Department of Psychiatry recorded the CGI–SCH and SAS. The examiner practiced the examination on a group of subjects with schizophrenia. The diagnostic criteria were applied on successive days on the same patients. Intra-examiner agreement score of 0.90 was achieved for the single examiner evaluating schizophrenia related questionnaires.

Ethical clearance was granted by the Institutional Ethics Committee of AIIMS, Bhopal (Project ID: IM00021).

Informed written consent from the study subjects was obtained prior to including them in the survey. Examination procedures were standardized for validity and reproducibility of data prior to and in between the survey. Duplicate examinations were conducted systematically on approximately 10% (every 10 sample) of the subjects by the two examiners throughout the survey and the kappa statistic was in range of 0.86–0.90.

### Statistical analysis

Data was collected, entered and analyzed using SPSS version 21.0 (SPSS Inc., Chicago, IL, USA) for windows. Chi Square and Mann–Whitney U-test were used to compare between two or more groups for categorical and quantitative variables. Linear and logistic regression analysis was performed to determine association of positive, negative, depressive, cognitive symptoms and EPS with dental caries, periodontal disease and prosthetic needs. A group of independent variables comprising age, gender, annual family income, literacy levels, tobacco consumption and admission to psychiatry facility and utilization of dental care were considered besides the severity of illness and EPS. Odds ratio was computed for the study variables with 95% confidence interval. Dependent variables being introduced for regression analysis were dichotomized. Significance was set at  $<0.05$ .

### Results

Overall, 71 participants comprised the sample; 47 (66.2%) male and 24 (33.8%) females. Fifteen (31.9%) male workers were illiterate as compared to 10 (41.7%) female workers who had not received any level of formal education. Annual family income noted among 37 (78.7%) male and 22 (91.7%) female participants was  $\leq 2000$  US \$. No significant gender, literacy and annual income differences were observed among comparable age groups (Table 1).

The study population had mean scores of  $4.76 \pm 1.28$ ,  $4.66 \pm 1.33$ ,  $4.47 \pm 1.10$ ,  $4.40 \pm 1.14$  and  $4.66 \pm 1.05$  for positive, negative, depressive, cognitive and overall symptoms in the CGI–SCH severity of illness scale (Table 2). The EPS mean scores noted among the research participants were  $0.25 \pm 0.52$ ,  $0.18 \pm 0.42$ ,  $0.09 \pm 0.30$ ,  $0.16 \pm 0.37$ ,  $0.14 \pm 0.35$ ,

$0.18 \pm 0.48$ ,  $0.12 \pm 0.33$ ,  $0.07 \pm 0.30$ ,  $0.45 \pm 0.60$  for gait, arms dropping, elbow rigidity, wrist rigidity, leg pendulousness, head dropping, glabella tap and tremors (Table 2).

Tobacco use was recorded among 52 (73.2%) subjects in study population, 23 (79.3%) with and 29 (69.1%) without EPS, however, no significant differences were noted (Table 3). A total of 51 (71.8%) subjects, 19 (65.5%) without and 32 (76.2%) with EPS had never visit a dentist ( $p = 0.67$ ). Eleven (26.1%) participants with EPS had been admitted in a psychiatric facility as compared to only 1 (3.4%) without such symptoms; noted difference being statistically significant ( $p < 0.001$ ). No significant differences were noted between mode, frequency, material used for cleaning teeth and type of medication used between study participants with and without EPS (Table 3).

Significant differences were also noted for mean DMFT among all three age groups ( $p < 0.001$ ). Mean DMFT scores of  $4.73 \pm 1.87$  and  $6.77 \pm 2.38$  were observed among study participants with and without EPS ( $p < 0.001$ ; Table 4).

**Table 2.** Mean CGI–SCH and Simpson–Angus Scale (SAS) scores among study participants.

	Minimum	Maximum	Mean	Std. Deviation
CGI–SCH scale – severity of illness (scale of 1–7)				
Symptoms				
Positive symptoms	1	7	4.76	1.28
Negative symptoms	2	7	4.66	1.13
Depressive symptoms	1	6	4.47	1.0
Cognitive symptoms	1	6	4.40	1.14
Overall severity	2	7	4.66	1.05
Simpson–Angus extra pyramidal side effects scale (scale of 0–4)				
Extra pyramidal symptoms				
Gait	0	2	0.25	0.52
Arm dropping	0	2	0.18	0.42
Shoulder shaking	0	1	0.09	0.30
Elbow rigidity	0	1	0.16	0.37
Wrist rigidity	0	1	0.14	0.35
Leg pendulousness	0	2	0.18	0.48
Head dropping	0	1	0.12	0.33
Glabella tap	0	2	0.07	0.30
Tremor	0	2	0.45	0.60
Salivation	0	2	0.18	0.45

**Table 3.** Oral health behavioural characteristics of study population.

Oral health related behaviour variables	Extra pyramidal symptoms		p value
	Absent N (%)	Present N (%)	
Mode of cleaning teeth			
Finger	5 (17.2)	7 (16.7)	0.94
Toothbrush	24 (82.8)	35 (83.3)	
Frequency of cleaning teeth			
Once daily	28 (96.6)	41 (97.6)	0.78
$\geq 2$ times a day	1 (3.4)	1 (2.4)	
Material used for cleaning teeth			
Toothpaste	23 (79.3)	35 (83.3)	0.67
Toothpowder	6 (20.7)	7 (15.7)	
Tobacco related habits			
Absent	6 (20.7)	13 (30.9)	0.33
Present	23 (79.3)	29 (69.1)	
Utilization of dental care			
Never visited	19 (65.5)	32 (76.2)	0.67
$\leq 1$ year back	3 (10.3)	5 (11.9)	
$> 1$ year back	7 (24.2)	5 (11.9)	
Admission to psychiatric facility			
Yes	1 (3.4)	11 (26.1)	0.001
No	28 (96.6)	31 (73.9)	
Type of medication			
Atypical and typical	7 (24.1)	10 (23.8)	0.38
Atypical	22 (75.9)	32 (76.2)	

**Table 1.** Demographic characteristics of study population.

	Gender		p value
	Male (%)	Female (%)	
Age group (years)			
18–34 years	27 (57.4)	11 (45.8)	0.52
35–44 years	14 (29.8)	10 (41.7)	
45–60 years	06 (12.8)	03 (12.5)	
Total	47 (100)	24 (100)	
Literacy status			
Illiterate	15 (31.9)	10 (41.7)	0.60
Completed high school (12th grade)	15 (31.9)	05 (2.1)	
Graduation and higher	17 (36.2)	09 (56.2)	
Total	47 (100)	24 (100)	
Annual income levels (Rs)*			
$\leq 65,000$ (~1000 US \$)	37 (78.7)	22 (91.7)	0.14
$> 65,000 \leq 260,000$ (~1000 to 4000 US \$)	10 (21.3)	02 (8.3)	
Total	47 (100)	24 (100)	

**Table 4.** Age wise distribution of dental caries, periodontal disease, prosthetic status and needs.

Age group (years)	Extra pyramidal symptoms		p value	Total
	Absent (%)	Present (%)		
<b>Mean DMFT</b>				
18–34 years	3.14 ± 0.36	5.50 ± 2.06	0.001	4.32 ± 1.21
35–44 years	4.31 ± 2.30	6.33 ± 2.94	0.001	5.32 ± 2.62
45–60 years	6.75 ± 2.95	8.50 ± 2.15	0.001	7.63 ± 2.55
Total	4.73 ± 1.87	6.77 ± 2.38	0.001	5.57 ± 2.12
<b>Mean CPI</b>				
18–34 years	1.57 ± 0.40	2.61 ± 0.82	0.001	2.09 ± 0.61
35–44 years	1.79 ± 0.53	2.89 ± 0.63	0.001	2.34 ± 0.58
45–60 years	2.10 ± 0.81	3.27 ± 1.24	0.001	2.68 ± 1.02
Total	1.82 ± 0.58	2.93 ± 0.90	0.001	2.37 ± 0.74
<b>Prosthetic status (number of participants with dental prosthesis)</b>				
18–34 years	0 (0)	1 (2.6%)	–	1 (2.6%)
35–44 years	0 (0)	0 (0)	–	0 (0)
45–60 years	0 (0)	0 (0)	–	0 (0)
Total	0 (0)	1 (2.3%)	–	1 (1.4%)
<b>Prosthetic needs (number of participants with prosthetic needs)</b>				
18–34 years	7 (33.3%)	14 (66.7%)	0.001	21 (29.6%)
35–44 years	7 (31.8%)	15 (68.2%)	0.001	22 (31%)
45–60 years	3 (50%)	3 (50%)	–	6 (8.5%)
Total	17 (58.6%)	32 (76.1%)	0.001	49 (69%)

Only, 2 (2.8%) participants had solitary dental restoration. Significant differences were noted within age groups of 18–34 years ( $p < 0.001$ ) 35–44 years ( $p < 0.001$ ) and 45–60 years ( $p < 0.001$ ) for CPI scores. Mean number of sextants with periodontal pockets were  $1.82 \pm 0.58$  and  $2.93 \pm 0.90$  among study participants with and without EPS ( $p < 0.001$ ; Table 4). Forty nine (69%) study subjects were in need of dental prosthesis; 17 (58.6%) subjects with and 32 (76.1%) without EPS ( $p < 0.001$ ). Edentulous condition was noted in 4 (5.6%) study participants. Only, one study participant had a dental prosthesis (Table 4). A tooth was considered as not replaced if there was adequate space to allow its replacement by a prosthetic tooth.

Linear regression analysis was carried out to evaluate caries and periodontal disease with independent variables comprising age, gender, literacy levels, annual income levels, frequency of cleaning teeth, utilization of dental care, tobacco consumption, admission to psychiatric facility, severity of schizophrenia and EPS. The regression equation explained for 34.2% and 79.8% variance in the DMFT and periodontal disease model respectively. In the DMFT model age, admission to psychiatric facility, severity of illness and EPS contributed towards 3.5%, 5%, 13.5% and 8.1% of the variance respectively ( $p < 0.001$ ; Table 5). Major contributory factors in periodontal disease model were age, tobacco consumption, admission to psychiatric facility, severity of illness and EPS with 19.8%, 5%, 27.4%, 7.2% and 6% contribution in the variance ( $p < 0.001$ ; Table 5).

Logistic regression analysis was operated with independent symptom variables of schizophrenia namely positive, negative, depressive, cognitive, overall severity and EPS to assess their association with dental caries, periodontal disease and dental prosthetic needs. The association between positive symptoms, overall severity and EPS with dental caries was evident with an odds ratio of 5.26 (1.05, 26.2) ( $p < 0.001$ ), 2.72 ( $p < 0.001$ ) and 8.52 (2.31, 31.4) ( $p < 0.001$ ; Table 6). Positive symptoms, depressive symptoms, overall severity and EPS were associated with periodontal disease

**Table 5.** Multiple linear regression model for DMFT and periodontal disease.

Model	R	R <sup>2</sup>	SE	R <sup>2</sup> change	p
<b>Multiple linear regression model for DMFT</b>					
1	0.187 <sup>a</sup>	0.035	2.27	0.035	0.001
2	0.255 <sup>b</sup>	0.065	2.25	0.030	0.05
3	0.260 <sup>c</sup>	0.068	2.27	0.003	0.192
4	0.268 <sup>d</sup>	0.072	2.28	0.004	0.288
5	0.268 <sup>e</sup>	0.072	2.30	–	0.421
6	0.268 <sup>f</sup>	0.072	2.31	–	0.554
7	0.287 <sup>g</sup>	0.082	2.32	0.004	0.586
8	0.368 <sup>h</sup>	0.136	2.27	0.05	0.001
9	0.368 <sup>i</sup>	0.136	2.27	–	0.472
10	0.521 <sup>j</sup>	0.271	1.83	0.135	0.001
11	0.594 <sup>k</sup>	0.352	1.83	0.081	0.001
<b>Multiple linear regression model for periodontal disease</b>					
1	0.445 <sup>a</sup>	0.198	0.76	0.198	0.001
2	0.465 <sup>b</sup>	0.216	0.76	0.018	0.05
3	0.509 <sup>c</sup>	0.259	0.74	0.043	0.05
4	0.536 <sup>d</sup>	0.287	0.74	0.028	0.05
5	0.555 <sup>e</sup>	0.308	0.73	0.021	0.05
6	0.584 <sup>f</sup>	0.342	0.72	0.034	0.05
7	0.626 <sup>g</sup>	0.392	0.69	0.050	0.001
8	0.816 <sup>h</sup>	0.666	0.52	0.274	0.001
9	0.820 <sup>i</sup>	0.672	0.73	0.006	0.31
10	0.863 <sup>j</sup>	0.744	0.51	0.072	0.001
11	0.897 <sup>k</sup>	0.804	0.51	0.060	0.001

<sup>a</sup>Predictors: age.

<sup>b</sup>Predictors: age, gender.

<sup>c</sup>Predictors: age, gender, literacy levels.

<sup>d</sup>Predictors: age, gender, literacy levels, annual income.

<sup>e</sup>Predictors: age, gender, literacy levels, annual income, frequency of cleaning teeth.

<sup>f</sup>Predictors: age, gender, literacy levels, annual income, frequency of cleaning teeth, utilisation of dental care.

<sup>g</sup>Predictors: age, gender, literacy levels, annual income, frequency of cleaning teeth, utilisation of dental care, tobacco consumption.

<sup>h</sup>Predictors: age, gender, literacy levels, annual income, frequency of cleaning teeth, utilisation of dental care, tobacco consumption, admission to psychiatric facility.

<sup>i</sup>Predictors: age, gender, literacy levels, annual family income, duration since insured, frequency of cleaning teeth, utilisation of dental care, tobacco consumption, admission to psychiatric facility, type of medication.

<sup>j</sup>Predictors: age, gender, literacy levels, annual family income, duration since insured, frequency of cleaning teeth, utilisation of dental care, tobacco consumption, admission to psychiatric facility, type of medication, overall severity of schizophrenia.

<sup>k</sup>Predictors: age, gender, literacy levels, annual family income, duration since insured, frequency of cleaning teeth, utilisation of dental care, tobacco consumption, admission to psychiatric facility, overall severity of schizophrenia, extrapyramidal symptoms.

**Table 6.** Logistic regression analysis with dental caries, periodontal disease and prosthetic needs as dependent variable.

Variables	B	SE B	p	OR (95%CI)
Dental caries as dependant variable (DT =0 vs DT ≥1)				
Positive symptoms	1.66	0.82	0.001	5.26 (1.05, 26.2)
Negative symptoms	0.17	0.81	0.05	1.18 (1.24, 5.86)
Depressive symptoms	0.55	0.92	0.05	1.74 (1.28, 10.7)
Cognitive symptoms	0.30	0.80	0.05	1.35 (1.28, 6.55)
Overall severity	0.15	1.04	0.001	2.72 (1.15, 9.16)
Extra pyramidal symptoms	2.14	0.67	0.001	8.52 (2.31, 31.4)
Periodontal disease as dependant variable (CPI <3 vs CPI ≥3)				
Variables				
Positive symptoms	0.74	1.06	0.001	2.10 (1.26, 17.0)
Negative symptoms	1.65	1.0	0.11	0.191 (0.03, 1.3)
Depressive symptoms	1.43	1.04	0.001	4.19 (1.53, 32.5)
Cognitive symptoms	0.44	0.76	0.001	1.56 (1.35, 6.9)
Overall severity	1.03	1.30	0.001	2.80 (1.22, 35.9)
Extra pyramidal symptoms	1.66	0.71	0.001	5.27 (1.29, 21.5)
Prosthetic need as dependant variable (prosthetic need: absent vs present)				
Variables				
Positive symptoms	1.46	1.12	0.001	4.33 (1.47, 31.2)
Negative symptoms	2.01	1.02	0.46	0.13 (0.02, 1.0)
Depressive symptoms	0.29	0.96	0.17	0.75 (0.11, 4.95)
Cognitive symptoms	2.05	0.86	0.001	7.78 (1.43, 42.2)
Overall severity	0.01	1.29	0.05	1.01 (1.08, 12.9)
Extra pyramidal symptoms	0.86	0.57	0.001	2.37 (1.76, 7.34)

Variables – positive symptoms: score ≤4 and ≥5; Negative symptoms: score ≤4 and ≥5; Depressive symptoms: score ≤4 and ≥5; Cognitive symptoms: score ≤4 and ≥5; Overall severity: score ≤4 and ≥5; Extra pyramidal symptoms: score 0 and ≥1.

with odds ratio of 2.10 (1.27, 17) ( $p < 0.001$ ), 4.19 (1.53, 32.5) ( $p < 0.001$ ), 2.80 (1.22, 35.9) ( $p < 0.001$ ) and 5.27 (1.29, 21.5), respectively ( $p < 0.001$ ; Table 6). Positive symptoms, cognitive symptoms and EPS were associated with dental prosthetic needs with odds ratio of 4.33 (1.47, 31.2) ( $p < 0.001$ ), 7.78 (1.43, 42.2) ( $p < 0.001$ ) and 2.37 (1.76, 7.34) ( $p < 0.001$ ; Table 6).

## Discussion

Our main finding is that there was a significant association between overall severity of schizophrenia and EPS with dental caries, periodontal disease and prosthetic needs. Individual symptoms associated with schizophrenia also had significant association with the oral health variables included in the study.

Nikfarjam and Pravin [21] used the Standard Anderson's Positive and Negative Scale questionnaires (SAPS, SANS) to assess the association of positive and negative symptoms with DMFT among 123 patients with schizophrenia in Iran. Association was noted between negative symptoms and DMFT. Negative symptoms were more strongly related to poor dental health than positive symptoms using the Positive and Negative Syndrome Scale (PANSS) among 66 patients in Spain (2011) [22]. In contrast, our study reported a stronger association for positive symptoms as compared to the negative symptoms with DMFT using the CGI-SCH scale. The novelty of our study lies in the fact that for the first time, each one of the symptoms related to schizophrenia were recorded and its association with poor oral health calculated. The study, thus further expands the available scientific literature among patients with schizophrenia by exploring all the individual symptoms associated with oral health.

High tobacco consumption was recorded among 52 (73.2%) subjects and low utilization of dental care was

noted among majority of the schizophrenic patients where 51 (71.8%) participants had never visited a dentist. However, the observed differences were insignificant between subjects with and without EPS. Similar findings of high tobacco consumption was noted among 107 (76.5%), (70%) and 181 (32.9%) study participants in France, Turkey and Japan respectively [10,23,24]. Comparable findings of low dental care utilization were also reported by studies conducted in UK and Sweden [25,26]. Significant differences were noted between patients with schizophrenia with and without EPS for admission to psychiatric facility ( $p < 0.001$ ). Apparent rationale being that subjects with higher severity and symptoms associated with disease were admitted more in psychiatric facilities. The use of atypical antipsychotics as line therapy for treatment of schizophrenia was based largely on their reduced risk of EPS compared with first generation antipsychotics. However, a systematic review of comparative effectiveness of typical versus atypical for treating schizophrenic adults concludes an insufficient and low evidence of advantages of atypical for safety for medical events as well as their efficacy [27].

A mean DMFT score of  $5.57 \pm 2.12$  was noted among the schizophrenic patients in our study which is considerably less as compared to studies conducted in France ( $15.8 \pm 8.8$ ), Iran ( $19.43 \pm 7.71$ ), Spain ( $13.5 \pm 7.8$ ), Japan ( $17.6 \pm 6.5$ ) and Israel ( $21.5 \pm 10.1$ ) [10,20,21,23,27,28]. Periodontal pockets were noted among 36% of study participants with CPI score of  $2.37 \pm 0.74$ , results being similar to studies conducted in Spain (34%) and Turkey (33%) [22,23]. Only, one participant had a dental prosthesis, whereas, as many as 49 (69%) participants had unmet dental prosthetic needs. Similar, high prosthetic need was noted among patients with schizophrenia in France (83.9%), Taiwan (70%) and Greece (71%) and [10,29,30].

Significantly higher DMFT, CPI and dental prosthetic need scores were noted among study participants with EPS

( $p < 0.001$ ). EPS, such as muscular rigidity, and involuntary and intentional tremors have a negative effect on fine motor movements and, consequently, on the patient's ability to effectively brush his/her teeth and perform oral hygiene activities. Regression model demonstrated that age, admission to psychiatric facility, severity of the disease and extrapyramidal symptoms significantly contributed to high DMFT values, poor periodontal scores and a high unmet prosthodontics need among patients with schizophrenia. Similar results associating tremors with higher DMFT values were reported from a study conducted in Japan [24].

Schizophrenic patients have a low dental care utilization and high tobacco consumption. These facts may explain the higher DMFT, CPI and dental prosthetic need scores. Poor dental health itself is associated with a lower quality of life [31]. Ponizovsky et al. [32] demonstrated that regular dental examinations and treatment for patients in psychiatric hospitals significantly improved the oral health of this population. These findings emphasize the need for attention to dental check-ups for patients with schizophrenia.

As regards to validity of our results, 19 (21.1%) people were excluded because they refused to participate. Patients who did not agree to take part in this survey were more likely to be reluctant to have a dental check-up because of their poor dental health. Therefore, a possibility of selection bias may not be discarded. However, even if this holds true, the actual DMFT score in patients with schizophrenia would be worse than the results of this study, which would further emphasize the need for dental care in this population.

Psychiatric disorders are a public health problem and rising in considerable proportions. Oral health of these patients is usually more affected than the rest of the population, as oral care is more neglected since, they do not get enough dental care and take several medications that relegates appropriate oral hygiene maintenance [33]. Advisable for caregivers of patients exhibiting tremors is to encourage and help the patient perform tooth brushing. The risk of suffering from dental diseases is very high, and thus it is necessary to create preventive and educational health programs for psychiatric patients consisting of a cross-disciplinary team in which treating physician bears an essential role.

## Conclusions

Patients with schizophrenia had high dental caries, periodontal disease and unmet dental prosthetic needs. Severity of the schizophrenic and EPS was associated with poor oral health. Efforts need to be focused on strengthening the evidence of its association with various oral health indicators through further studies including cohort investigations.

## Disclosure statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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