



# Relationship between oral clinical conditions and daily performances among young adults in India – A cross sectional study

Ramesh Nagarajappa <sup>a,\*</sup>, Mehak Batra <sup>b</sup>, Sudhanshu Sanadhya <sup>c</sup>, Hemasha Daryani <sup>d</sup>, Gayathri Ramesh <sup>e</sup>

<sup>a</sup> Department of Public Health Dentistry, Rama Dental College Hospital and Research Centre, A-1/8, Lakhanpur, Kanpur, Uttar Pradesh, India

<sup>b</sup> Department of Public Health Dentistry, Pacific Dental College and Hospital, Airport Road, Debari, Udaipur, Rajasthan, India

<sup>c</sup> Department of Public Health Dentistry, Government Dental College, Subhash Nagar, Jaipur, Rajasthan, India

<sup>d</sup> Department of Public Health Dentistry, Hitkarni Dental College, Jabalpur, Madhya Pradesh, India

<sup>e</sup> Department of Oral and Maxillofacial Pathology, Rama Dental College Hospital and Research Centre, A-1/8, Lakhanpur, Kanpur, Uttar Pradesh, India

Received 1 October 2014; received in revised form 10 March 2015; accepted 11 March 2015

Available online 23 March 2015

## KEYWORDS

Adults;  
India;  
OIDP;  
Oral health status;  
Young

**Abstract** Objective of the present study was to investigate relationship between oral health-related quality of life using Oral Impacts on Daily Performances (OIDP) scale and specific clinical dental measures. A cross sectional descriptive survey was conducted among 800 students. Oral health status and impacts were assessed using WHO guidelines and OIDP index respectively. Chi square test and multiple logistic regressions were employed for statistical analysis. Participants with caries were significantly ( $p \leq 0.05$ ) more likely to have an impact on cleaning (OR = 2.487) and sleeping and relaxing (OR = 8.996). Similarly participants with oral mucosal conditions were more likely to have an impact on eating (OR = 3.97), cleaning (OR = 2.966) and physical activities (OR = 11.190). Dental Aesthetic Index (DAI) impacted on cleaning (OR = 2.134), emotional stability (OR = 3.957) and social contact (OR = 3.21). OIDP Index showed acceptable psychometric properties in the

\* Corresponding author at: Department of Public Health Dentistry, Rama Dental College Hospital and Research Centre, A-1/8, Lakhanpur, Kanpur 208024, Uttar Pradesh, India. Tel.: +91 9621168883.

E-mail address: [rameshpcd@yahoo.co.in](mailto:rameshpcd@yahoo.co.in) (R. Nagarajappa).

context of an oral health survey. Subjects presented a strong and consistent relationship between dental status and perceived impacts.

© 2015 Ministry of Health, Saudi Arabia. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## 1. Introduction

From the contemporary definitions of health clinical measures have serious limitations. They tell us nothing about functioning of the oral cavity and symptoms such as pain and discomfort. Furthermore, they do not consider the attitudes and behavior of patients, which in turn influence the effectiveness of treatments in oral health [1]. Additional motivation for measuring both negative and positive changes in oral health status has stimulated the development of sociodental indicators to supplement clinical indicators, by adding a social impact dimension [2]. Sociodental indicators are the measures of oral health-related quality of life (OHRQoL) which have been developed from basic conceptual frameworks of role function.

Oral Impacts on Daily Performance (OIDP) is a newly developed indicator that attempts to measure oral impacts that seriously affect the person's daily life. OIDP was developed in 1996, earlier it was called as Dental Impacts on Daily Life (DIDL) [3]. OIDP was used first among low dental disease Thai population [4], and in 2003 it was used among Tanzanian students [5]. It is based on an explicit conceptual framework, the World Health Organization's International Classification of Impairments, Disabilities and Handicaps, ICDH, which has been amended for dentistry by Locker consisting of the following key points; impairments, functional limitations, pain and discomfort and disability and handicap. Impairments refer to immediate biophysical outcomes of disease, commonly assessed by clinical indicators. Functional limitations are concerned with functioning of body parts whereas pain and discomfort refer to the practical aspects of oral conditions in terms of symptoms. Finally, ultimate outcomes of disability and handicap refer to any difficulty in performing activities of daily living and to broader social disadvantages.

The use of oral health-related quality of life indicators and measures of perceived needs has highlighted the large difference between normative and perceived assessments of dental treatment needs, and demonstrated an inconsistent relationship between clinical measures and oral symptoms and impacts. Overall the associations

between clinical indicators of normative needs and measures of oral health-related quality of life were weak. However, the associations were better for specific clinical conditions such as missing teeth, particularly anterior teeth [6]. Because of different findings for overall and specific clinical conditions it was worthwhile an attempt to investigate the relationship between oral health-related quality of life using the OIDP scale and specific clinical dental measures for need assessment among students attending various colleges located in Udaipur city, Rajasthan, India.

## 2. Materials and methods

### 2.1. Study design and study population

A cross-sectional descriptive survey was conducted among students attending various degree colleges of Udaipur city, Rajasthan, India from September 2011 to February 2012. Subjects willing to participate, who were mentally and physically fit for the study were included. Subjects with systemic diseases and on antibiotic therapy in the previous six months were excluded from the study.

### 2.2. Ethical considerations

Our research was conducted in full accordance with the World Medical Association Declaration of Helsinki. The study protocol was reviewed by Institutional Ethics Committee of Pacific Dental College and Hospital, Udaipur and was granted ethical clearance. An official permission was obtained from respective Principals of the concerned colleges. Subjects who agreed to participate signed a written informed consent form.

### 2.3. Pilot survey

A pilot study was carried out among 100 students from 2 private colleges to determine the feasibility of using the OIDP scale and to check its psychometric properties, validity and reliability in Udaipur city. Face and content validity were tested in the pilot study with regard to content, wording, scoring method and ease and appropriateness of questionnaire administration. For internal reliability,

corrected item-total correlations, standardized alpha coefficient and alpha if item is deleted was estimated. A single examiner (MB) was standardized and calibrated by a senior Faculty member to ensure uniform interpretations, understanding and application of codes and criteria for diseases to be observed and recorded and also to ensure consistent examination. Stability of Oral Impact on Daily Performance scale was further assessed by test–retest reliability using intraclass correlation coefficient. The first 10% of respondents were again contacted and subjected to the same procedure after a week. For criterion and construct validity, associations with perceived needs and OIDP scores were determined. Modifications required were done and difficulties experienced were overcome by redesigning the proforma. Depending on prevalence obtained in the pilot study (66%), 95% confidence level and 5% allowable error, the minimum sample size required was 791 which was rounded off to 800.

#### 2.4. Sampling design

Before the instigation of main study, list of all colleges (public and private) in Udaipur city was obtained from Mohanlal Sukhadia University, Udaipur, India. Due to disproportion between public and private colleges and for the purpose of having a homogenous sample, it was decided to include private colleges only. A two-stage random sampling procedure was used to select the study sample. First stage units were all colleges in Udaipur city. Twenty percent of the total number (102) of colleges was randomly selected using the lottery method. In the second stage, eligible students from all identified 20 colleges were selected based on systematic sampling procedure to obtain a sample size of 800.

#### 2.5. Methodology

Data were collected by means of an interviewer-administered questionnaire, which consisted of two parts. First part was used to collect information on socio-demographic data and second part contained Oral Impacts on Daily Performance scale. This scale measures the physical, psychological and social aspects of performances. Physical performance includes eating, cleaning teeth, speaking, and physical activities; psychological performance includes sleeping, smiling, and emotional stability; social performance includes major role activity (carrying out work) and contact with people [7].

Subjects were asked to identify oral problems that they perceived in the last six months. If a participant experienced an oral impact on any daily performance in the last 6 months, then its frequency and severity were scored using 5-point ordinal scales (excellent, good, fair, poor and very poor). Satisfaction with dental appearance was assessed by responses (yes/no). If no impact was experienced, then a zero score was assigned. Performance scores were estimated by multiplying the corresponding frequency and severity scores. Overall OIDP score was the sum of nine performance scores multiplied by 100 and divided by the maximum possible score (225). OIDP intensity was estimated as the most severe impact on any of ten daily performances, ranging from none to very severe intensity. OIDP extent was calculated as number of performances affected by impacts, ranging from 0 to 9.

#### 2.6. Clinical assessment

All participants were clinically examined according to WHO guidelines (1997) on a proforma attached with their respective questionnaire. Subjects were made to sit on a chair and oral cavity was examined standing on right side of the chair (Type III Examination). On an average, examination of each subject took 15–20 min. Duplicate examination was conducted on 5% ( $n = 40$ ) of the population during the course of study (kappa statistic = 90%).

#### 2.7. Statistical analysis

Recorded data were analyzed using SPSS version 15.0 (SPSS Inc., Chicago, Illinois, USA). Independent variables to be studied were TMJ clicking, oral mucosal conditions, enamel opacities, dental fluorosis, community periodontal index (CPI), loss of attachment, DMFT, prosthetic status, prosthetic need, and DAI. Dependent variables were OIDP and each performance activity.

Descriptive statistics included computation of percentages, means and standard deviations. Multiple logistic regression analysis was applied with OIDP and its performance activities as dependent variables. Variables found to be significantly associated with OIDP in Bivariate analysis (chi-square test) were dichotomized and were entered as independent variables in the OIDP model. For regression involving performance activities, all independent variables were considered. A Hosmer–lemeshow test of model coefficients was used to evaluate how well the models performed. Nagelkerke  $R^2$  was used to estimate fit of

the models. Confidence interval and  $p$ -value were set at 95% and  $\leq 0.05$  respectively.

### 3. Results

A total of 800 students [males: 536 (67%) and females 264 (33%)] participated in the survey. Majority perceived their present condition of mouth as good (43.8%) to fair (36%). Reported perceived grades did not show any statistical significance between gender ( $p = 0.053$ ). Merely over half (57.9%) the subjects were satisfied with appearance of their teeth and the difference observed among gender group was not significant ( $p = 0.322$ ). Overall proportion of subjects accounted with Oral Impacts on Daily Performance was 60%. Though no statistically significant difference was apparent by gender ( $p = 0.357$ ) OIDP was more in males (68.3%) than females (31.7%).

Corrected item correlation ranged from 0.40 to 0.68 being above the minimum recommended level of 0.20 for inclusion of items in the scale and meeting the stringent criterion of item convergent validity of  $>0.40$ . Cronbach's alpha of the scale was 0.82 with alpha values (if any item being deleted) lower than original value. The present alpha value falls within a recommended minimum of 0.70 [8]. Finally, test-retest reliability was also found to be satisfactory (ICC = 0.91) (Table 1).

Table 2 illustrates at least one oral impact on daily performance in the last six months among 480 (60%) students. Cleaning was the most commonly affected daily performance (24%), followed by eating (12%) and smiling (12%). Impacts affecting carrying out work (1%) and speaking (2%) were uncommon. Overall mean OIDP score was  $2.49 \pm 3.92$ , which ranged from  $0.06 \pm 0.59$  (carrying out work) to  $1.60 \pm 4.49$  (cleaning). Among those participants with impacts, 18.3% reported fairly severe and 3.3% very severe intensity. Smiling (33.3%), emotional stability (33.3%) and

social contact (28.6%) predominantly contributed to fairly severe effect. Majority (48%) of the study subjects reported effects on one daily performance and the enduring 11% and 1%, had impacts on two and three daily performances respectively.

Table 3 represents bivariate analysis of relationship between oral impacts on daily performance and clinical status. Significant association ( $p \leq 0.05$ ) was observed in oral impacts on daily performances with age, presence of dental fluorosis, oral mucosal conditions, prosthetic need, caries, CPI score and DAI score. No association ( $p \geq 0.05$ ) was found between oral impacts on daily performance and gender, presence of TMJ clicking, loss of attachment, enamel opacities and prosthetic status, respectively.

Multivariate logistic regression considering association between dependent variable (OIDP) and independent variables is shown in Table 4. All independent variables that demonstrated significant association with OIDP in bivariate analysis (as in Table 3) were analyzed together after controlling for age. Four significant factors for probability of having one or more impact were identified: presence of oral mucosal condition (OR 4.614, 95% CI:1.800–9.633), presence of caries (OR 4.225, 95% CI:3.039–5.873), prosthetic need (OR 0.486, 95% CI:0.267–0.884) and DAI score,  $\geq 34 / < 34$  (OR 2.735, 95% CI:1.257–5.952).

Significant association ( $p \leq 0.05$ ) of difficulty in cleaning teeth performance with oral mucosal condition and CPI was found. Eating performance was significantly ( $p \leq 0.05$ ) associated with dental caries, prosthetic need and oral mucosal condition. Dental fluorosis was significantly associated ( $p \leq 0.05$ ) with all performances except eating, cleaning and sleeping and relaxing. TMJ clicking was not associated with any of the performance activity (Table 5).

Multivariate logistic regression analysis with each performance activity of OIDP as outcome

**Table 1** Internal consistency reliability of OIDP items among the study population.

Performances	Corrected item total correlation	Alpha if item deleted
1. Eating	0.54	0.79
2. Cleaning teeth	0.51	0.79
3. Speaking	0.44	0.79
4. Physical activities	0.45	0.79
5. Sleeping and relaxing	0.56	0.76
6. Smiling	0.61	0.76
7. Emotional stability	0.40	0.77
8. Carrying out work	0.47	0.77
9. Social contact	0.58	0.79
OIDP		0.82

**Table 2** Prevalence, overall OIDP score, severity and extent of oral impacts.

Statistics	Overall	Eating	Cleaning	Speaking	Physical activities	Sleeping and relaxing	Smiling	Emotional stability	Carrying out work	Social contact
<i>Prevalence of oral impacts</i>	480 (60)	96 (12)	192 (24)	16 (2)	32 (4)	40 (5)	96 (12)	48 (6)	8 (1)	56 (7)
<i>Overall OIDP score</i>	2.49(3.92)	0.87(3.07)	1.60(4.49)	0.10(0.71)	0.16(0.88)	0.39(2.65)	1.31(4.22)	0.61(2.92)	0.06(0.59)	0.51(2.13)
<i>Severity of oral impacts n (%) among those reporting impacts</i>										
Very minor	137 (28.5)	24 (25)	88 (45.8)	0 (0)	8 (25)	16 (40)	0 (0)	16 (33.3)	0 (0)	16 (28.6)
Fairly minor	135 (28.1)	40 (41.7)	56 (29.2)	0 (0)	16 (50)	0 (0)	40 (41.7)	0 (0)	8 (100)	0 (0)
Moderate effect	104 (21.7)	16 (16.7)	16 (8.3)	8 (50)	8 (25)	16 (40)	24 (25)	16 (33.3)	0 (0)	24 (42.8)
Fairly severe effect	88 (18.3)	16 (16.7)	24 (12.5)	8 (50)	0 (0)	0 (0)	32 (33.3)	16 (33.3)	0 (0)	16 (28.6)
Very severe effect	16 (3.3)	0 (0)	8 (4.2)	0 (0)	0 (0)	8 (20)	0 (0)	0 (0)	0 (0)	0 (0)
<i>Extent of impacts (number of performance impacts experienced)</i>										
Affected	0	1	2	3	4	5	6	7	8	9
n (%)	320 (40)	384 (48)	88 (11)	8 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

variable revealed that clinical indicators of oral disorders accounted for 31.4% (Nagelkerke's  $R^2 = 0.314$ ) and 10% (Nagelkerke's  $R^2 = 0.10$ ) of explainable variance for eating and cleaning respectively (Table 6). Participants with caries were more likely to have an impact on cleaning (OR = 2.487) and sleeping and relaxing (OR = 8.996) than those without caries. Similarly participants with oral mucosal conditions were more likely to have an impact on eating (OR = 3.97), cleaning (OR = 2.966) and physical activities (OR = 11.190) than those without oral mucosal conditions. DAI impacted more on cleaning (OR = 2.134), emotional stability (OR = 3.957) and social contact (OR = 3.210).

### 4. Discussion

Execution of epidemiological studies and dissemination of data such as those of the present study seek to advocate that different strategies need to be planned for improvement of the oral health status of the population. Strategies need to take into account both normative and subjective needs as assessed by professionals and socio-dental indicators respectively. Younger individuals perceive oral health as having a greater impact on their life quality than older people. Indeed, many quality of life indicators in dentistry have focused primarily on older age groups, partly on the assumption that they would have had a lifetime's experience of oral ill health and thus are likely to perceive oral health as having a greater impact on their quality of life [9]. Therefore the present study had focussed on younger age group.

Oral Impacts on Daily Performance (OIDP) is one of the most widely used sociodental indicators which focus on measuring serious oral impacts on a person's ability to perform daily activities. The approach provides advantages, not only in terms of being easier to measure the behavioral impacts on performances than the feeling-state dimensions, but also in being short [10]. It has been successfully tested for reliability and validity in adult and elderly populations in different settings [11]. In line with previous studies [12,13], all examined relationships between OIDP scores and subjective oral health measures were statistically significant and showed a clear trend in the expected direction; worst the subjective oral health rating, higher the OIDP scores ( $p < 0.001$ ).

In our study, about 43.8% subjects perceived their present condition of mouth as 'good' and 57.9% of subjects were satisfied with the appearance of teeth which is comparable to the findings of Masalu and Astrom (2003) [5]. Proportion of

**Table 3** Bivariate analysis of relationship between oral impacts on daily performance and clinical status.

Clinical indicators		No impact (n = 320) n (%)	Having one or more oral impact (n = 480) n (%)	Chi-square value	p-Value
Sex	Males	208 (65)	328 (68.3)	0.956	0.357
	Females	112 (35)	152 (31.7)		
Age	17–20	176 (55)	336 (70)	18.750	0.001*
	21–24	144 (45)	144 (30)		
TMJ clicking	No	313 (97.8)	473 (98.5)	0.594	0.583
	Yes	7 (2.2)	7 (1.5)		
Oral mucosal condition	Absent	312 (97.5)	438 (91.3)	12.800	0.001*
	Present	8 (2.5)	42 (8.7)		
Enamel opacities	Absent	221 (69.1)	362 (75.4)	3.922	0.052
	Present	99 (30.9)	118 (24.6)		
Dental fluorosis	Absent	199 (62.2)	256 (53.3)	6.137	0.013*
	Present	121 (37.8)	224 (46.7)		
CPI score	Healthy	48 (15.0)	51 (10.6)	3.389	0.042*
	Unhealthy	272 (85.0)	429 (89.4)		
Loss of Attachment	Absent	297 (92.8)	441 (91.9)	0.236	0.687
	Present	23 (7.2)	39 (8.1)		
Dental caries	Absent	187 (58.4)	115 (24)	97.874	0.001*
	Present	133 (41.6)	365 (76)		
Prosthetic status	No	302 (94.4)	457 (95.2)	0.274	0.626
	Yes	18 (5.6)	23 (4.8)		
Prosthetic need	Absent	284 (88.8)	456 (95)	10.811	0.001*
	Present	36 (11.3)	24 (5)		
DAI score	≤34	309 (96.9)	445 (92.7)	5.263	0.029*
	>34	11 (3.4)	35 (7.3)		

\* Test applied-chi-square test,  $p \leq 0.05$  statistically significant.

**Table 4** Multivariate logistic regression considering association between the dependent variable (OIDP) and independent variables.

Clinical indicators	Adjusted OR	p-Value	95% Confidence interval
Oral mucosal condition Present/Absent	4.614	0.001*	1.800–9.633
Dental fluorosis Present/Absent	1.316	0.096	0.952–1.818
Highest CPI score Unhealthy/healthy	1.129	0.609	0.709–1.799
Dental caries Present/Absent	4.225	0.001*	3.039–5.873
Prosthetic need Present/Absent	0.486	0.018*	0.267–0.884
DAI score ≤34/>34	2.735	0.011*	1.257–5.952

\*  $p \leq 0.05$  statistically significant. Nagelkerke  $R^2 = 0.545$ .

subjects who reported impacts on daily activities at least once or twice a month ranged from 75% concerning physical activities to 0% regarding carrying out work. Comparable with findings of Masalu and Astrom (2002) [14], 32.3% subjects perceived the impact on eating at least once or twice a month.

An unexpectedly high prevalence of young adults (60%) reported that an oral problem had affected them on at least one daily performance in the 6 months preceding the survey which was higher than the prevalence obtained by Masalu and Astrom (2002) [14] in Tanzania (51%), Astrom et al. (2006) [15] in Norway (18.3%) and Soe et al.

**Table 5** Distribution of subjects according to clinical dental status and its impacts on daily performances.

Clinical dental status <i>n</i> (%)		Impacts on daily performances								
		Eating	Cleaning teeth	Speaking	Physical activities	Sleeping and Relaxing	Smiling	Emotional stability	Carrying out work	Social Contact
		<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
TMJ clicking	Abs 786 (98.3)	93 (11.8)	190 (24.2)	16 (2)	32 (4.1)	38 (4.8)*	96 (12.2)*	48 (6.1)*	8 (1)	53 (6.7)
	Pre 14 (1.7)	3 (21.4)	2 (14.3)	0 (0)	0 (0)	2 (14.3)*	0 (0)*	0 (0)*	0 (0)	3 (21.4)
Oral mucosal conditions	Abs 750 (93.8)	80 (10.7)*	169 (22.5)*	16 (2.1)	25 (3.3)*	40 (5.3)	89 (11.9)	43 (5.7)	8 (1.1)	51 (6.8)
	Pre 50 (6.3)	16 (32)*	23 (46)*	0 (0)	7 (14)*	0 (0)	7 (14)	5 (10)	0 (0)	5 (10)
Enamel opacities	Abs 583 (72.9)	77 (13.2)	149 (25.6)	13 (2.2)	22 (3.8)	21 (3.6)	67 (11.5)	34 (5.8)	8 (1.4)	40 (6.9)
	Pre 217 (27.1)	19 (8.8)	43 (19.8)	3(1.4)	10 (4.6)	19 (8.8)	29 (13.4)	14 (6.5)	0 (0)	16 (7.4)
Dental fluorosis	Abs 455 (56.9)	51 (11.2)	119 (26.2)	8 (1.8)	25 (5.5)*	32 (7)	35 (7.7)*	16 (3.5)	0 (0)*	16 (3.5)*
	Pre 345 (43.1)	45 (13)	73 (21.2)	8 (2.3)	7 (2)*	8 (2.3)*	61 (17.7)*	32 (9.3)*	8 (2.3)*	40 (11.6)*
CPI	Abs 99 (12.4)	6 (6.1)	13 (13.1)*	0 (0)	8 (8.1)*	0 (0)*	8 (8.1)	8 (8.1)	0 (0)	8 (8.1)
	Pre 701 (87.6)	90 (12.8)	179 (25.5)*	16 (2.3)	24 (3.4)*	40 (5.7)*	88 (12.6)	40 (5.7)	8 (1.1)	48 (6.8)
Loss of attachment	Abs 738 (92.3)	92 (12.5)	177 (24)	16 (2.2)	23 (3.1)*	40 (5.4)	95 (12.9)*	42 (5.7)	7 (0.9)	52 (7)
	Pre 62 (7.7)	4 (6.5)	15 (24.2)	0 (0)	9 (14.5)*	0 (0)	1 (1.6)*	6 (9.7)	1 (1.6)	4 (6.5)
Dental caries	Abs 302 (37.8)	0 (0)*	48 (15.9)*	8 (2.6)	16 (5.3)	3 (0.9)*	24 (7.9)	8 (2.6)*	0 (0)*	16 (5.3)
	Pre 498 (62.3)	96 (19.3)*	144 (28.9)*	8 (1.6)	16 (3.2)	37 (7.4)*	72 (14.5)	40 (8)	8 (1.6)*	40 (8)
Prosthetic status	Abs 759 (94.9)	91 (12)	187 (24.6)	16 (2.1)	32 (4.2)	40 (5.3)	83 (10.9)*	40 (5.3)*	5 (0.7)*	54 (7.1)
	Pre 41 (5.1)	5 (12.2)	5 (12.2)	0 (0)	0 (0)	0 (0)	13 (31.7)*	8 (19.5)*	3 (7.3)*	2 (4.9)
Prosthetic need	Abs 740 (92.5)	88 (11.9)*	176 (23.8)	16 (2.2)	32 (4.3)	40 (5.4)	96 (13)*	48 (6.5)*	8 (1.1)	56 (7.6)*
	Pre 60 (7.5)	8 (13.3)*	16 (26.7)	0 (0)	0 (0)	0 (0)	0 (0)*	0 (0)*	0 (0)	0 (0)*
DAI	≤34, 745 (94.3)	90 (93.8)	184 (24.4)*	16 (2.1)	32 (4.2)	38 (5.1)	89 (11.9)	40 (5.3)	0 (0)*	46 (6.1)*
	>34, 46 (5.8)	6 (6.3)	8 (17.4)*	0 (0)	0 (0)	2 (4.3)	7 (15.2)	8 (17.4)*	8 (17.4)*	10 (21.7)*

\*  $p \leq 0.05$  statistically significant.

**Table 6** Multivariate logistic regression considering association between each performance as dependent and independent variables.

Clinical indicators	TMJ clicking	Oral mucosal conditions	Enamel opacities	Dental fluorosis	CPI	Loss of attachment	Caries	Prosthetic status	Prosthetic need	DAI	Nagelkerke R <sup>2</sup>
Eating	0.523	3.97*	0.503	0.818	0.812	0.513	6.595	0.563	4.246*	0.692	0.314
Cleaning	0.278	2.966*	0.596	0.666	1.164*	1.602	2.487*	0.303	1.364	2.134*	0.102
Speaking	0.103	0.000	0.794	1.151	2.545	0.000	0.618	0.000	0.000	0.000	0.175
Physical activities	0.000	11.190*	1.039	0.497	0.635	5.898	0.442	0.000	0.000	0.000	0.23
Sleeping and relaxing	6.029	0.000	2.915	0.176	2.545	0.000	8.996*	0.000	0.000	0.849	0.293
Smiling	0.000	1.240	1.080	2.836*	1.328	0.087	1.131	2.926*	0.000	1.316	0.183
Emotional stability	0.139	2.293	1.038	2.572	0.717	1.425	2.080	2.051	0.000	3.957*	0.147
Carrying out work	0.000	0.127	0.000	9.456	22.850	5.906	0.323	10.817	0.802	2.645	0.888
Social contact	0.157	1.242	1.304	3.156*	0.595	0.992	1.408	0.587	0.000	3.210*	0.234

\* Odds ratio values;  $p \leq 0.05$  statistically significant.

(2004) [16] in Myanmar (15.8%). This impact was clearly below those of about 70% observed in western populations with high dental disease levels [17,18]. In the present study, OIDP frequency scores showed a significant difference among age groups with younger age groups reporting more impact. Gift et al. (1996) [19] also reported age as a significant predictor of perceived dental status in US adults aged 17–74 years. On the other hand, Locker and Miller [17,20] found younger Canadians to be as likely as their older counterparts to report impacts of oral diseases.

Apart from methodological differences such as variations in measures of oral health related quality of life that has been used, there are several reasons as to why the prevalence of oral impacts could vary between populations. First, as the prevalence and severity of oral conditions vary among populations in different countries, they may also experience oral impacts related to different aspects of their lives in varying frequencies. Secondly, people of different social, cultural and ethnic groups differ in their perception of what aspects of their oral health will affect their quality of life. Thirdly, values and attitudes toward oral health could strongly influence the reporting of impacts. Individuals who place little value on their teeth are probably less likely to report being self conscious or emotionally disturbed due to their oral health. Fourthly, the phenomenon of “internalization” or “adaptation” by which an individual learns to live with the symptoms could influence the reporting of impacts. For example, an individual who had experienced tooth loss could adapt to such a condition and may respond by learning to live with the symptoms such as difficulty in chewing. As a consequence the symptoms may not have an impact on the individual [21].

Despite the fact that oral impacts were very frequent among Udaipur college students, they were not severe; this population had a mean OIDP score of  $2.49 \pm 3.92$  and almost half of those with impacts had very minor or fairly minor severity of impacts which is in conformity with results obtained by Astrom and Okullo (2003) [2] among students with a mean age of 16.3 years. Around two third participants reported an impact only on 1 or 2 performances. Consistent with results reported in previous OIDP surveys [4,5,22,23], difficulty with eating, cleaning teeth and smiling were the impacts most frequently reported.

By examining relationships between OHRQoL and clinical variables in a single regression model, it was possible to obtain better understanding of combined effects of these variables and to

compare the predictive power of each. In regard to temporomandibular joint assessment, TMJ clicking was the only sign observed, prevalence being 1.7% which was lower compared to study conducted by Vojdani et al. (2012) [24]. TMJ clicking was found to be significantly associated with sleeping and relaxing (OR = 6.029) which is in accordance with previous evidence [25].

Results of the present study pointed out a significant impact of oral mucosal conditions on eating, cleaning and physical activities (OR = 3.97, 2.966, 11.190). Comparable results were concluded in another study by Suliman et al. (2012) [26]. Oral lesions can cause discomfort or pain that interferes with mastication, swallowing, and speech, and they can produce symptoms such as halitosis, xerostomia, or oral dysesthesia, which interfere with daily social activities [27].

The presence of developmental defects of enamel did not have any significant impact on any of the performances which is in harmony with the preceding survey [28]. However, fluorosis was almost thrice as likely to report an impact on smiling (OR = 2.836), emotional stability (OR = 2.572) and social contact (OR = 3.156), indicating Udaipur students concern about their dental appearance. This finding was supported by a previous research conducted by Crosato et al. (2005) [29].

Wandera et al. [30] provided confirmation to non significant associations between OIDP and CPI and with regard to individual items, between cleaning teeth (OR = 1.164) performance and clinical periodontal status. The reason behind this could be bleeding gums as perceived by a majority (56.3%) of the students. In another study conducted by Adulyanon (1996) [4], cleaning teeth was impacted chiefly by gum abscess (28.6%), toothache (23.3%) and oral ulcer (12.6%). The present study depicted a non-significant impact of loss of attachment on performances which is in conformity with the results obtained by Needleman et al. (2004) [31]. However, this diverges from findings of Ng and Leung (2006) [32], where a significant impact was observed. Disease does not always negatively affect subjective perceptions of well-being, and when it does; its impact is influenced by nature of the disease as well as expectation, preferences and financial, social and psychological resources [33].

Untreated dental caries were strongly associated with OIDP (OR = 4.225), corroborating with previous studies [34,35]. Reason could be attributed to dental pain resulting from dental caries, a finding observed in a similar study [36]. Cleaning, sleeping and relaxing were most frequently

affected performances (OR = 2.487, 8.996) as a consequence of caries substantiated by another study in which sleeping and cleaning performances were associated with pain resulting from tooth decay [37].

Participants with prosthesis were about 2.9 times more likely to report impact on smiling than those without prosthesis. Impact of prosthetic status on daily performances might have resulted from inadequate adaptation, retention or extension of the prosthesis. These significant differences in the experience of oral impacts were expected, because partially edentulous subjects with aforementioned denture deficiencies might experience increased functional difficulties such as eating, speaking, avoiding smiling as well as other psychological and social impacts [3]. Consistent with the odds reported by other researchers [2], the present data revealed a significant impact of tooth loss on eating (OR = 4.246). Loss of posterior teeth is the main cause of chewing deficiency [38].

In accordance with the previous study [39], considering psychosocial impacts of student's orthodontic status, the present results suggested that malocclusion was significantly associated to OIDP (OR = 2.735), predominantly emotional stability (OR = 3.957), cleaning teeth (OR = 2.314) and social contact (OR = 3.21). Reason could be attributed to facial appearance which plays an important psychosocial role in individual's life and interpersonal relations. Furthermore, dentofacial esthetics and self-perceptions of occlusal appearance as well as attitudes toward malocclusion and orthodontic treatment are important factors in deciding to seek orthodontic treatment.

Main limitation in our study is its cross-sectional nature which poses problems in relation to hypothesis testing since data on risk factors and outcome are assessed at the same time, but this particular issue does not seem to affect our result. An imbalance in the number of males and females in our study sample may also be a limitation since the impact of oral conditions could be different in relation to sex. Future longitudinal studies are needed to better understand and interpret OHRQoL measures in students; although these are difficult to conduct in developing countries due to financial restraints and lack of population records. Further research is also recommended to assess whether measures of oral health-related quality of life as a patient-centered outcome are sensitive to changes in clinical dental status over time and also at the level of the individual.

In conclusion, a strong and consistent relationship between most of the clinical measures of oral

health status and perceived impacts in college students was observed. These findings have significant implications for employment of patient-centered outcome measures as objective clinical parameters of dental diseases in assessment, planning and provision of treatment, and subsequent evaluation of care. Professionals perhaps need to utilize this tool to evaluate if successful therapist-centered outcome co-relates with patient-centered outcome.

### Authors contributions

RN contributed with the design, acquisition, analysis and interpretation of data and took part in drafting of the manuscript. MB contributed with the design, analysis and interpretation of data and took part in drafting of the manuscript. SS, HD and GR contributed with drafting of the manuscript, analysis and interpretation of data and revised it critically. All authors listed on the title page have read the manuscript, attest to the validity and legitimacy of the data and its interpretation, and agree to its submission.

### Conflict of interest

None declared.

### Source of funding

Nil.

### Acknowledgements

The authors would like to thank the study participants for their participation and kind cooperation throughout the study.

### References

- [1] Tsakos G. Combining normative and psychosocial perceptions for assessing orthodontic treatment needs. *J Dent Educ* 2008;72:876–85.
- [2] Astrom AN, Okullo I. Validity and reliability of the Oral Impacts on Daily Performances (OIDP) frequency scale: a cross-sectional study of adolescents in Uganda. *BMC Oral Health* 2003;3:5–14.
- [3] Robinson PG, Gibson B, Khan FA, Birnbaum W. A comparison of OHIP-14 and OIDP as interviews and questionnaires. *Community Dent Health* 2001;18:144–9.
- [4] Adulyanon S, Vourapukjaru J, Sheiham A. Oral impacts affecting daily performance in a low dental disease Thai population. *Community Dent Oral Epidemiol* 1996;24:385–9.
- [5] Masalu JR, Astrom AN. Applicability of an abbreviated version of the oral impacts on daily performances (OIDP) scale for use among Tanzanian students. *Community Dent Oral Epidemiol* 2003;31:7–14.
- [6] Tsakos G, Marcenes W, Sheiham A. Relationship between clinical dental status and oral impacts in an Elderly population. *Oral Health Prev Dent* 2004;2:211–20.
- [7] Zeng X, Sheiham A, Bernabe E, Tsakos G. Relationship between Dental Status and Oral Impacts on Daily Performances in Older Southern Chinese people. *J Public Health Dent* 2010;70:101–17.
- [8] World Health Organization. Oral health surveys, basic methods. Fourth edition, Geneva, 1997.
- [9] McGrath C, Bedi R, Gilthorpe MS. Oral health related quality of life – views of the public in the United Kingdom. *Community Dent Health* 2000;17:3–7.
- [10] Slade GD, editor. Measuring oral health and quality of life. Chapel Hill: University of North Carolina, Dental Ecology; 1997.
- [11] Jung SH, Ryu JI, Tsakos G, Sheiham A. A Korean version of the Oral Impacts on Daily Performances (OIDP) scale in elderly populations: Validity, reliability and prevalence. *Health Qual Life Outcomes* 2008;27:17–25.
- [12] Tsakos G, Marcenes W, Sheiham A. Evaluation of a modified version of the index of Oral impacts on daily performances (OIDP) in elderly populations in two European countries. *Gerodontology* 2001;18:121–30.
- [13] Dolan TA, Gooch BF, Bourque LB. Associations of self-reported dental health and general health measures in the Rand health insurance experiment. *Community Dent Oral Epidemiol* 1991;19:1–8.
- [14] Masalu JR, Astrom AN. Social and behavioral correlates of oral quality of life studied among university students in Tanzania. *Acta Odontol Scand* 2002;60:353–9.
- [15] Astrom AN, Haugejorden O, Skaret E, Trovik TA, Klock KS. Oral impacts on Daily Performances in Norwegian adults: the influence of age, number of missing teeth, and socio-demographic factors. *Eur J Oral Sci* 2006;114:115–21.
- [16] Soe KK, Gelbier S, Robinson PG. Reliability and validity of two oral health related quality of life measures in Myanmar adolescents. *Community Dent Health* 2004;21:306–11.
- [17] Locker D, Miller Y. Subjectively reported oral health status in adult population. *Community Dent Oral Epidemiol* 1994;22:425–30.
- [18] Cushing AM, Sheiham A, Maizels J. Developing Socio-dental indicators-the social impact of dental diseases. *Community Dent Health* 1986;3:3–17.
- [19] Gift HC, Atchison KA, Drury TF. Perceptions of the natural dentition in the context of multiple variables. *J Dent Res* 1998;77:1529–38.
- [20] Locker D, Miller Y. Evaluation of subjective oral health status indicators. *J Public Health Dent* 1994;54:167–76.
- [21] Perera I, Ekanayake L. Prevalence of oral impacts in a Sinhala-speaking older population in urban Sri Lanka. *Community Dent Health* 2003;20:236–40.
- [22] Cortes MIS, Marcenes W, Sheiham A. Impact of traumatic injuries to the permanent teeth on the oral health related quality of life in 12–14 year old children. *Community Dent Oral Epidemiol* 2002;30:193–8.
- [23] Tsakos G, Marcenes W, Sheiham A. Cross-cultural differences in oral impacts on daily performance between Greek and British older adults. *Community Dent Health* 2001;18:209–13.
- [24] Vojdani M, Bahrani F, Ghadiri P. The study of relationship between reported temporomandibular symptoms and clinical dysfunction index among university students in Shiraz. *Dent Res J (Isfahan)* 2012;9:221–5.
- [25] Montero J, Bravo M, Albaladejo A. Validation of two complementary oral-health related quality of life indicators (OIDP and OSS 0–10) in two qualitatively distinct

- samples of the Spanish population. *Health Qual Life Outcomes* 2008;18:101–15.
- [26] Suliman NM, Johannessen AC, Ali RW, Salman H, Astrom AN. Influence of oral mucosal lesions and oral symptoms on oral health related quality of life in dermatological patients: a cross sectional study in Sudan. *BMC Oral Health* 2012;12:19–30.
- [27] Triantos D. Intra-oral findings and general health conditions among institutionalized and non-institutionalized elderly in Greece. *J Oral Pathol Med* 2005;34:577–82.
- [28] Vergas-Ferreira F, Ardenghi TM. Developmental enamel defects and their impact on child oral health-related quality of life. *Braz Oral Res* 2011;25:531–7.
- [29] Crosato EM, Haye Biazevic MG, Crosato E. Relationship between dental fluorosis and quality of life: a population based study. *Braz Oral Res* 2005;19:150–5.
- [30] Wandera MN, Engebretsen IM, Rwenyonyi CM, Tumwine J, Astrom AN, PROMISE-EBF study group. Periodontal status, tooth loss and self-reported periodontal problems effects on oral impacts on daily performances, OIDP, in pregnant women in Uganda: a cross-sectional study. *Health Qual Life Outcomes* 2009;7:89–99.
- [31] Needleman I, Mc Grath C, Floyd P, Biddle A. Impact of oral health on the life quality of periodontal patients. *J Clin Periodontol* 2004;31:454–7.
- [32] Ng SKS, Leung WK. Oral health-related quality of life and periodontal status. *Community Dent Oral Epidemiol* 2006;34:114–22.
- [33] Tsakos G, Steele JG, Marcenes W, Walla AWG, Sheiham A. Clinical correlates of oral health-related quality of life: evidence from a national sample of British older people. *Eur J Oral Sci* 2006;114:391–5.
- [34] Peres KG, Peres MA, Araujo CLP, Menezes ANB, Hallal PC. Social and dental status along the life course and oral health impacts in adolescents: a population-based birth cohort. *Health Qual Life Outcomes* 2009;7:95–105.
- [35] Krisdapong S, Prasertsom P, Rattananarangsima K, Sheiham A. Relationships between oral diseases and impacts on Thai schoolchildren's quality of life: Evidence from a Thai national oral health survey of 12- and 15-year-olds. *Community Dent Oral Epidemiol* 2012. <http://dx.doi.org/10.1111/j.1600-0528.2012.00705.x> [Epub ahead of print].
- [36] Mashoto KO, Astrom AN, David J, Masalu JR. Dental pain, oral impacts and perceived need for dental treatment in Tanzanain school students: a cross-sectional study. *Health Qual Life Outcomes* 2009;7:73–82.
- [37] Ababneh KT, Faisal Abu Hwaj ZM, Khader YS. Prevalence and risk indicators of gingivitis and periodontitis in a Multi-Centre study in North Jordan: a cross sectional study. *BMC Oral Health* 2012;12:1–8.
- [38] Pereira LJ, Gazolla CM, Magalhaes IB, Ramos-Jorge ML, Marques LS, Gameiro GH, et al. Treatment of chronic periodontitis and its impact on mastication. *J Periodontol* 2011;82:243–50.
- [39] Mtaya M, Astrom AN, Brudvik P. Malocclusion, psycho-social impacts and treatment need: a cross-sectional study of Tanzanian primary school-children. *BMC Oral Health* 2008;8:14–24.

Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

**ScienceDirect**