Non-comunicable diseases

Oral health and nicotine dependence in tobacco users visiting a Dental Institution in North India

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Keywords

Tobacco Users • Nicotine Dependency • Hygiene • Dental Caries • Gingivitis

Summary

Objective. *The cross-sectional study was intended to evaluate the oral health and nicotine dependence among tobacco users.*
Material & Methods. *Fagerstorm Test for Nicotine Dependence estimated nicotine dependence and clinically oral examination was performed in recording the dentition status, oral hygiene, gingivitis and periodontal health. Descriptive statistics was computed using mean, percentage and standard deviation. Association was estimated using Independent T Test. Binary logistic regression and multiple regression analysis was used in inferential statistics.*
Results. *In general, 55.3% had dental caries, followed by 92.6% having gingivitis and 7.4% had clinical attachment loss. Mean DMF was 2.60 (± 3.88) and the subjects mean oral hygiene score was 3.49 (± 1.11). The mean DMF score of tobacco users worsened with increasing age. Current smokers were 1.07 times more predisposed to get dental caries than former smokers and smokeless tobacco chewers had higher odds of 1.060 times to fall susceptible to dental caries than those smoking tobacco. Dependence on tobacco substantially worsened oral hygiene.*
Conclusions. *Tobacco cessation practices shall be effectively enforced to minimize the burden of nicotine dependence.*

Introduction

India is the second largest producer of Tobacco [1]. The worldwide health implications of tobacco have been relentlessly emphasized time and again, still tobacco consumption persists with 28.6% consuming tobacco in smokeless and smoke form [2]. The current rate of progression of tobacco usage is projected upto 8 million as anticipated by 2030 [3]. In India the consumption of smokeless tobacco is more rampant owing to low cost. Promotion of tobacco products through surrogate advertisements is condemnable and adds the cumulative increase in consumption of smokeless tobacco [4]. Irrespective of the form in which tobacco is consumed it is source of lung cancer, oral cancer, cancer of nasal cavity, pharynx, oesophagus, urinary bladder and myeloid leukemia [5]. Smoking practice is prevalent in India since ancient times and is consumed in multiple forms such as beedis, cigarettes in smoking form and large fragment of population consume smokeless tobacco (SLT) mixed with different concoctions for example pan masala, gutkha, khaini, zarda *etc.* One out of 4 individuals are hooked to smokeless tobacco which is cheap and readily available. Substantially 199.4 million adults consume tobacco in smokeless form and 0.35 million Indians succumb to death every year due to this habit [6], Illness arising due to consumption of tobacco affect the productivity, raise out of pocket expenses spent on health care and contribute to non-communicable diseases (NCD's) [7, 8]. Tobacco addiction with advancing age increases susceptibility of muscular illness, cognitive decline, hearing loss, vision changes and dementia [7]. Commendable measures have been introduced for instance 'Cigarettes and Other Tobacco Products Act (COPTA) act, banning sale of loose cigarettes in certain states, displaying pictorial health warnings labels on packets and forbidding the usage of plastic to pack tobacco products [6, 9]. Despite the fact that tobacco control laws have been imposed there are several shortcomings such as imposition of tax on tobacco products, monitoring sale of tobacco to minors and pushing the legal age to purchase tobacco up to 21 years [6]. Smoking cigarette also poses environmental threat due to release of toxins for example microplastics raising concern of plastic pollution and carbon footprint added out of production of tobacco [10, 11]. Even though the National Tobacco Control Programme has been operational but the ground reality of tobacco epidemic requires consistent awareness from grassroot level involving multiple stakeholders such as academicians, members from civil society, NGO's and assistance from trained social health workers [12]. The National Tobacco Control Programme (NTCP) is also offering Tobacco Cessation services by training health workers who could help in offering assistance, empathy and support to those who are willing to quit tobacco [12]. From the latest National Family Health Survey-5 in the state of Himachal (NFHS-2019-20) there has been an upward rise in tobacco consumption with 32.3% of men consuming tobacco in some form [12] and sustainable action plan need to be formulated to decelerate the dependency of tobacco. The bulk of research is exploring knowledge attitude and perception towards tobacco usage targeting

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adolescents and school-going children [13] and there is limited literature accounting oral health of those addicted to tobacco in Himachal. Hence, a study is demanded to evaluate the oral health of tobacco users and to estimate the nicotine dependence among tobacco users [14].

Material & Methods

A cross-sectional study was conducted for a period of 4 months after obtaining ethical approval from Institutional Ethical Committee with protocol number-BDC/C-10/1260-A dated 20th December 2022. Considering margin of error at 5%, confidence level set at 95%, with expected response distribution of 34% and considering 10% dropout the final sample size was rounded to 380. The investigator who collected the data was calibrated and trained. The inter-rater reliability obtained using cohen'skappa statistics was κ = 0.81, 0.74, 0.86 and 0.82 for dental caries, oral hygiene, gingival condition and periodontal health. A pre-tested FagerstormTest for Nicotine Dependence was used to estimate nicotine dependency and the scale reliability was assessed before beginning the study with Cronbach's alpha 0.95 which was strongly acceptable.

Subjects who were 18 years of age and above were enrolled in the study and written informed consent was obtained from those who were ready to participate. Those who suffered from systemic conditions such as diabetes mellitus and hypertension were excluded from the study. Subjects who were dependent drug abusers and alcohol users were kept out from the study. Patients visiting OPD were enquired about smoking habitand evaluated using pre-tested Fagerstorm Test for Nicotine Dependence [15, 16]. Subjects were asked questions pertaining to smoking status and duration of habit by doing face-to face interview using close-ended Fagerstorm Test for Nicotine Dependence. Depending upon the literacy status of participants the FTND questionnaire was used in English and a translated version of FTND in Hindi language was deployed. The Fagerstorm Test for Nicotine Dependence is a standardized tool based on aordinal scale that consists of six items in evaluating the consumption of tobacco, the obsession to use and the severity of addiction to tobacco. During scoring of Fagerstorm Test for Nicotine Dependence the scores from all items are summed up and greater score corresponds to severe physical dependence to nicotine. The subjects were further stratified into low nicotine dependence and significant nicotine dependence on basis of judgement by Fagerstorm Test for Nicotine dependence [15, 16]. Smokers were likewise segregated into current smokers and formers smokers on basis of classification given by Centre for Disease Control and Prevention [17]. Smokers oral health was judged clinically by recording their dentition status, oral hygiene, gingival health and periodontal health using DMF Index, Oral hygiene Index simplified OHI(s), Loe and Silness Gingival Index and Community Periodontal Index [18-20].

Statistical analysis

Data curation and statistical analysis was done using statistical package for social sciences version 21.0, Armonk, NY: IBM Corp [21]. Descriptive statistics was computed using mean, percentage and standard deviation. Comparison was estimated using Independent T Test and P Value less than 0.05 was treated statistically significant. Inferential statistics was computed by estimating binary logistic regression and multiple regression analysis.

Results

The mean age of subjects was (34.7 ± 11.27) years and the median duration of tobacco chewing was 10 years (IQR: 4-19) 98.2% were males and just 1.8% constituted females 44.2% (n= 168) were smokeless tobacco users, 40.2%(n= 153) smoked tobacco and 15.6%(n= 59) were dual users that is they smoked and chewed tobacco. Four-fifth (88.2%) were current smokers and less than one-fifth (11.8%) were former smokers. 21.5% most commonly smoked beedi and 18.6% smoked cigarette. Most commonly chewed (SLT) product was (36.3%), zarda followed by gutka (27.9%) and rest consumed products such as paan, supari and khaini. Around half of the subjects 53.9% showed significant nicotine dependence and 46.1% were having low to moderate dependence on nicotine. 58% smoking tobacco (ST) had significant nicotine dependence and rest 42% smoking tobacco (ST) had low to moderate dependence to nicotine. Among smokeless tobacco users (SLT) 45.8% were having significant nicotine dependence and 54.2% SLT users showed low to moderate dependence to nicotine. Unusually 64% dual users had significant nicotine dependence. Advancing age additionally influenced nicotine dependency with three-fourth (75%) in age range of 45-70 years having significant nicotine dependency and notably half of tobacco consumers (48.9%) in age range of 18-44 years had significant nicotine dependence. The mean Fagerstorm Test Nicotine Dependence Score (FTND) in 15.6% of dual users was (7.50 ± 3.63), followed by (5.30 ± 3.29) in those who smoked tobacco (40.2%) and concurrently (3.75 ± 2.75) was the mean score amongst those chewing tobacco (44.2%).

55.3% had dental caries, followed by 92.6% having gingivitis and 7.4% had clinical attachment loss. 83.4% had fair oral hygiene and 16.6% comprised poor oral hygiene. Mean DMF score of tobacco consumers was 2.60 (± 3.88) and the subjects mean oral hygiene score was 3.49(± 1.11) which was interpreted poor. 0.93(± 0.21) was the total mean gingival score. The mean DMF score of tobacco users worsened with increasing age and smokeless tobacco users had less DMF score 2.19 (± 3.67) in comparison to mean DMF of smokers 2.98(± 4.30). Nicotine dependent subjects had non-significant relationship with mean DMF score except with a smaller number of retained teeth seen in those with significant dependence to nicotine (Tab. I).

Tab. I. Comparing Dental Caries status and Oral Hygiene among Nicotine Dependent using Independent T Test.

Nicotine Dependence	Decayed Teeth Mean (± SD)	F Value	P value	Mean (± SD)- Debris Index-DI (s)	F value	p value
Low to Moderate Dependence	1.46 (± 1.87)	.087	0.86	0.82 (± 0.39)	18.046	0.01*
Significant Dependence	1.42 (± 1.94)			0.94 (± 0.48)		
	Missing Teeth Mean (± SD)	18.994	0.00*	**Mean (± SD) Calculus Index-CI (s)**	18.994	0.00*
Low to Moderate Dependence	0.49 (± 1.06)			1.24 (± 0.31)		
Significant Dependence	1.34 (± 3.96)			1.35 (± 0.39)		
Low to Moderate Dependence	**Filled Teeth Mean (± SD)**	.295	0.76			
	0.16 (± 0.68)					
Significant Dependence	0.13 (± 0.76)					
	Total Mean DMF			**OHI(s)- Mean (± SD)**		
Low to Moderate Dependence	2.13 (± 2.40)	15.873	0.00*	0.16 (± 0.68)	.295	0.00*
Significant Dependence	3.00 (± 4.70)			0.13 (± 0.76)		

Comparison of mean oral hygiene (OHIs) scores between significantly dependent nicotine users and moderately dependent nicotine users clearly stated poor oral hygiene which was statistically significant ($p < 0.00$) (Tab. I).

The mean number of decayed teeth and filled teeth had non-significant comparison between current smokers and former smokers however mean number of missing teeth were more predominant in former smokers than current smokers with significant association ($p < 0.00$). (Tab. II) Comparison of gingival inflammation showed that mean Gingival index scores between significant dependent nicotine users and moderate dependent nicotine users were non-significant and like-wise non-significant difference was observed in gingival scores obtained between current smokers and former smokers. (Tab. III).

There was non-significant association drawn in comparing oral hygiene and gingival inflammation between current smokers in addition to former smokers. (Tab. III). The multiple regression was run to predict DMF score from smoking status and nicotine dependence. The variables significantly predicted DMF score, F, (2, 377) = 6.842, $p < 0.05$, R2 = 0.03. Binary logistic regression showed the odd's ratio of 1.078 (that is, current smokers were 1.07 times more pre disposed to get dental caries than former smokers) and smokeless tobacco chewers had higher odds of 1.060 times to fall susceptible to dental caries than those smoking tobacco (Tab. IV). None of the interviewed participants solicited advise for tobacco cessation.

Discussion

In the above study 40.2% smoked tobacco and the prevalence rate was higher with previous studies involving tobacco consumers [22, 23], but was slightly less in comparison with study from north-central India [24].

Tab. II. Dental caries and Oral Hygiene of Current smokers *vs* Former smokers using Independent T Test.

Nicotine Dependence	Decayed Teeth Mean (± SD)	F Value	P value	Mean (± SD)- Debris Index-DI(s)	F value	p value
Smokers	1.45 (± 1.93)	0.57	0.81	0.88 (± 0.44)	.110	0.31
Former smokers	1.40 (± 1.75)			0.95 (± 0.45)		
	Missing Teeth Mean (± SD)	39.319	0.00*	**Mean (± SD) Calculus Index -CI(s)**	.195	0.27
Smokers	0.76 (± 2.15)			1.31 (± 0.36)		
Former smokers	2.37 (± 6.42)			1.24 (± 0.34)		
Smokers	**FilledTeeth Mean (± SD)**	1.880	0.17			
	0.13 (± 0.72)					
Former smokers	0.22 (± 0.79)					
	Total Mean DMF			**OHI(s)- Mean (± SD)**		
Smokers	2.41 (± 3.40)	11.655	0.01*	2.18 (± 0.74)	.183	0.93
Former smokers	4.00 (± 6.31)			2.19 (± 0.74)		

Tab. III. Comparing Gingival Inflammation of Current smokers *vs* Former smokers and Nicotine Dependents using Independent T Test.

Gingival Index	Mean (± SD)	F value	p value
Smokers	0.92 (± 0.43)	1.092	0.22
Former smokers	1.00 (± 0.37)		
Low to Moderate Dependence	0.92 (± 0.36)	14.346	0.72
Significant Dependence	0.94 (± 0.47)		

Tab. IV. Binary Logistic Regression.

Group	Wald	B	p value	Odds Ratio
Current smokers	5.782	.076	0.01	1.078
Smokeless tobacco	3.420	.058	0.06	1.060
smokers	3.260	-.246	0.07	.782

55.9% (n= 127) had a strong urge not to give up the first cigarette smoked early in morning which was slightly lower than study from South India [25] and 44.2% of tobacco users chewed tobacco but the prevalence was smaller to previous studies [22, 23] involving smokeless tobacco users. Significant dependence to nicotine was observed and the prevalence was comparable with a study reported from north India [26] but the prevalence escalated in comparison with earlier studies [22, 27]. Dental caries rate was less in tobacco users [14] because smoking raises thiocyanate level in saliva which has the property to curb dental caries, nevertheless decrease buffer capacity of saliva and increased levels of streptococcus mutans may aggravate dental caries [28]. 48.6% smoked 11-30 cigarettes which was lower when compared smoking rate from Nepal and South India [25, 29]. Alarmingly 60.4% smoked tobacco immediately within waking up after 6-30 minutes which is disturbing trend contrary to GATS India Report 2016-17 [8]. Quarter of subjects (27.5%) placed their dip within 6-30 minutes which was in agreement with tobacco chewing practices from South-east Asia [29] but contrary to study from North western India [30] and 46.4% used to chew more frequently during first few hours after awakening [30]. 14.6% intentionally swallowed tobacco juice and this observation was concurrent with findings from South-east Asia study [29]. More than one-third SLT users consumed zarda and gutka which was comparable with a recent study [31] but barely one-fourth (24.5%) chewed more than 3 pouches/week of (SLT) which was significantly less than previous studies [25, 32]. Around one-fifth (26.8%) had the urge to chew tobacco when they were unwell and bedridden. In smokers 58% had significant dependence to nicotine which was equivalent to study conducted in Nepal [28] and 70% found it strenuous to refrain from smoking in public places coorelating with previous literature [26]. More than two-third (75%) in the age-group of 45-70 years had significant nicotine dependence and this corresponded with earlier study [23]. 75% of those who consumed tobacco for greater than 40 years were helpless towards nicotine dependence and crucially 58.3% consuming tobacco for more than 20 years were also significantly dependent on nicotine. Thus, raised nicotine dependence commensurate with smoking duration.

Overall half (45.8%) of smokeless tobacco users and those smoking tobacco had significant dependence on nicotine despite twin imposition of ban and punishment on sale of both smokeless tobacco and loose beedis [33]. The limitations of our study involved change in mind-set of those responding because some of them may have suppressed the information culminating into social desirability bias. It is a natural tendency that we intend to alter our response when interviewer ask questions which are socially unacceptable. Another constraint in our study was that we did not explore the association of smoking with other Non-Communicable Diseases (NCD's).

Recommendations

Concerted measures practically applied can be such as raising price of purchase of SLT which could effectively reduce the demand and affordability of SLT. Another novel measure which may curtail the demand of both smoked products and SLT would be enforcement of retail licensing which will restrict the number of tobacco vendors selling tobacco products [6]. We need to further assess how far tobacco companies are complying with Food Safety and Standard Authority of India (FSSAI) by not blending tobacco with ingredients such as spices, sweeteners, flavouring agents and scents in making tobacco products palatable and pleasant [6].

Given the high burden of disease and out of pocket health expenses arising from consumption of tobacco introspection is required to check how committed the government is in reducing the prevalence of tobacco by 30% achievable before 2025 [34]. Social media should also be utilized to sensitize the youth about the harms of tobacco [34, 35]. It is need of hour to scale up tobacco-cessation campaigns to reduce the burden of tobacco consumption.

Conclusions

Approximately half of the subjects had significant dependence to nicotine. Pronounced dependence to nicotine worsened oral hygiene of individuals and likewise dental caries weakened with marked dependency to nicotine. Thus, oral health of tobacco users was neglected.

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Informed Consent Statement

Informed Consent was obtained from participants before commencement of study.

Conflicting interest statement

Authors declare no conflict of interest.

Authors' contribution

AA: study conception and design, acquisition of data, drafting of manuscript.
AA, KA: analysis and interpretation of data, critical revision.

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