

# The Impact of Lifestyles on Dental Caries of Adult Patients in Udupi District: A Cross-Sectional Study

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ABSTRACT

**Background:** Dental caries is preventable if favorable health behavior is successfully established. Exploring the broader concept of lifestyle will be useful to determine that how lifestyle of people can affect dental caries. **Aim:** The aim of this study was to determine the impact of overall lifestyle of an individual (analyzed using health practice index) on dental caries of adult population. **Material and Methods:** This cross-sectional study comprising structured questions on health practice index, sociodemographic variables, and oral health-related behavior was conducted on 800 study subjects of age 20–50 years attending outreach dental setups of a dental school in India. Dental caries was recorded with decayed, missing, and filled teeth (DMFT) index. Statistical analysis was carried out using frequency distribution for variables related to lifestyle, mean ± standard deviation for DMFT, and negative binomial regression to predict a dependent variable (DMFT) that consisted of “count data.” **Results:** The study subjects who were older age, women, unemployed, and unskilled; those with lower education, lesser income, and lower socioeconomic status; those never visited dentist; and those with lesser frequency of cleaning teeth, overall poorer lifestyles, and moderate lifestyles were more prone to have dental caries than their counterparts. **Conclusion:** Dental caries is a multifactorial disease. Patients’ involvement in self-care by promoting healthy behaviors such as brushing twice a day, visiting dentist regularly, negating orally abusive substance addiction, having breakfast every day, eating a balanced diet, and reducing stress leads to an overall good lifestyle. These factors along with sleeping a minimum of 7–8 h per night and working for 8–9 h per day and ample daily exercise may help patients improve or protect their oral health for years to come.

**KEYWORDS:** Cross-sectional study, dental caries, health practice index, Indian population, lifestyle

Received : 17-07-19.  
Revised : 25-01-20.  
Accepted : 05-02-20.  
Published : 05-03-20.

## INTRODUCTION

Dental caries is greatly determined by number of unhealthy lifestyle factors. Lifestyle constitutes the behaviors performed by an individual, which are linked directly to health outcomes. Healthy lifestyles are the behaviors performed by an individual to protect and promote his or her health. Healthy mouth requires the promotion of healthy lifestyles. Some of the major risk factors for dental caries related to unhealthy lifestyles are consumption of sugar-rich diet, poor nutrition, and

use of tobacco, inadequate oral hygiene practices, stress, and inferior living conditions. Unhealthy lifestyles have been found to be correlated with a higher occurrence of dental caries in the previous studies.<sup>[1-5]</sup> Moreover, presence of two or more unhealthy habits together in a person can have a larger impact on health than any

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**How to cite this article:** Singla N, Acharya S, Singla R, Nayak P. The Impact of Lifestyles on Dental Caries of Adult Patients in Udupi District: A Cross-Sectional Study. J Int Soc Prevent Communit Dent 2020;10:189-95.

Access this article online	
<b>Quick Response Code:</b> 	<b>Website:</b> www.jispcd.org
	<b>DOI:</b> 10.4103/jispcd.JISPCD_293_19

one habit alone. This study is an attempt to find the collective influence of all possible unhealthy lifestyle factors existing in an individual on the dental health. Hence, it is recommended that comprehensive nature of whole behavior of the person should be taken into consideration in the prevention of caries.<sup>[6]</sup>

The concept of lifestyle highlights the personal characteristics of an individual and allows to study behavior in a broader sense. However, there is no uniform concept as to what composes a “lifestyle.” According to Abel,<sup>[7]</sup> the particulars that measure lifestyle can be selected in accordance with the research purpose. Breslow had recommended seven habits that can be considered for overall healthy lifestyle such as adequate sleep, no habit of smoking, occasional drinking of alcohol, keeping good weight, routine exercise, having daily breakfast, and reduced eating in between meals.<sup>[8]</sup> In this study, the eight item self-administered questionnaire to measure health practice index (HPI) developed by Morimoto was used to assess the lifestyle of the people.<sup>[9-13]</sup> This approach of categorizing lifestyles has been found helpful for the assessment of individual lifestyle practices in various studies.<sup>[14,15]</sup>

Dental caries is preventable if favorable health behavior is successfully established. Exploring the broader concept of lifestyle will be useful to determine that how overall lifestyle of people can affect dental caries. A number of studies have been conducted on single lifestyle-related risk factor, which affect dental caries.<sup>[16-19]</sup> However, very few studies have considered the relation of overall lifestyles, that is, collective influence of all possible lifestyle-related risk factors of an individual or web of many risk factors on the dental health.<sup>[1,2,20-22]</sup> To our knowledge, no previous studies in the Udupi district of south Karnataka have investigated whether overall lifestyles of the people can influence their dental health status. The aim of this study was to evaluate the impact of overall/combined lifestyle of an individual (analyzed using HPI) on dental caries of adult population. Determining the influence of overall lifestyles on dental caries can help in developing appropriate oral health promotion strategies.

## MATERIAL AND METHODS

### STUDY DESIGN

This was a cross-sectional study performed on the subjects of age over 18 years attending the outreach dental setups of a dental school in India. Ethical approval to conduct the study was acquired from the Kasturba Hospital Ethics Committee, Manipal (IEC 84/2011). Patients were recruited from the various

dental camps organized at randomly selected locations from the Udupi district map. Informed consent was obtained from each participant preceding the study.

### SAMPLING METHOD AND CRITERIA

A pilot survey on 50 subjects was carried out prior to the start of the study to measure their dental caries experience. Of these enrolled subjects, 80% ( $n = 40$ ) had at least one decayed, missing, filled teeth (DMFT). The sample size required to carry out the study was calculated taking 95% confidence level ( $Z$ , standard value of 1.96) and 5% margin of error ( $d$ , standard value of 0.05). Calculating the sample size by the given prevalence, the minimum sample size required was 245.<sup>[23]</sup> Although the study objective had three comparison groups for lifestyles, a final sample size of 800 was chosen considering up to 10% lack of response.

The self-administered questionnaires were then distributed to 800 subjects, of which 780 participants returned the completed questionnaires with the acceptable response rate of 97.5%. The eligibility criteria that had been used for inclusion of the subjects in the study were those who were willing to participate and those able to read the questionnaire.

A structured questionnaire was prepared consisting of four parts:

1. The first part of the questionnaire included respondents' sociodemographic characteristics in terms of age, gender, income/month, education, occupation, and religion. The socioeconomic status of the subjects was calculated with the help of Kuppaswamy scale by adding education, occupation, and income of the subjects.<sup>[24]</sup>
2. The second part of the questionnaire was in regards to dental health behavior to know about frequency and device of cleaning and frequency of dental visits.
3. The third part of the questionnaire was an “eight item HPI scale” for the evaluation of the total lifestyle, developed by Morimoto which included information regarding smoking, consuming alcohol, having breakfast/day, duration of sleep/night, duration of work/day, physical workout, eating nutritional/balance diet, and mental stress.<sup>[9-12]</sup> Subjects chosen one of two to six multiple choices of each question, and the answers were categorized as either “good” or “poor” health practices as per Morimoto's criteria.

The language of the questionnaire was translated from English to Kannada (regional language of Karnataka). The face validity of the questionnaire was ensured by back translation method, that is,

blind retranslation into English by experts in both languages.

#### Observational Parameters:

The “good” health practices were coded as 1 and “poor” health practices were given a code of 0. The total score of each participant varied between 0 and 8 depending upon quantity of good health practices. It was further sorted into poor lifestyles (score = 0–3), moderate lifestyles (scores = 4, 5), and good lifestyle (scores = 6 or higher).

- The fourth part consisted of information on dental caries status. Dental caries was recorded in accordance with DMFT index (1986 criteria) using mouth mirror and explorer.

Single trained and calibrated examiner collected the clinical data along with a trained recorder noting down the observations. Intra-examiner reliability was assessed using kappa statistic, which was 0.95 for the DMFT index indicating good conformity in the observations.

### STATISTICAL ANALYSIS

The data were analyzed using Statistical Package for the Social Sciences software program, version 16 (SPSS, Chicago, Illinois). Descriptive statistics was used for frequency distribution of study population and calculation of mean  $\pm$  standard deviation (SD) for DMFT and total DMFT as per subject characteristics. Negative binomial regression was applied to calculate the adjusted odds ratio and the association between the dependent (DMFT—count data) and independent variables. The *P* value of 0.05 or less was set as statistical significance.

### RESULTS

Table 1 shows the distribution of the study population in accordance to their demographics, dental health behavior, and lifestyles. The mean age of 780 participants was 35.5 years. There was an approximately equal distribution of the study sample with respect to age and gender of the population. Majority of the study subjects belonged to upper lower (369, 47.3%) and middle class (317, 40.6%) category of socioeconomic status. All the subjects reported to use toothbrush and half of them reported to brush twice daily. Nearly one third of the study population (250, 32.1%) reported that they had never visited the dentist. The study included majority of people with good lifestyle (571, 73.2%) followed by moderate lifestyle (171, 21.9%) and poor lifestyle (38, 4.9%).

Table 2 shows the mean of DMFT and total DMFT scores of subjects based on their various characteristics. Negative binomial regression was applied considering

discrete nature and over dispersion of the dependent variable (DMFT) with mean = 6.04 and SD = 4.8. The model fitted the data well as Pearson chi-square value for goodness of fit of the model was 0.53 and a highly statistically significant omnibus test for the overall model ( $P < 0.001$ ). Negative binomial regression model identified the following variable, which had

**Table 1: Distribution of study population according to their demographic variables, dental health behavior, and overall lifestyles**

Variables		No. of subjects (%)
Gender	Male	386 (49.5%)
	Female	394 (50.5%)
Age	20–35 years	394 (50.5%)
	36–50 years	386 (49.5%)
Location	Urban	392 (50.3%)
	Rural	388 (49.7%)
Occupation	Unemployed	347 (44.5%)
	Unskilled	137 (17.6%)
	Skilled/semiskilled	111 (14.2%)
	Clerical, farmer, and business	158 (20.3%)
Education	Semiprofessional/professional	27 (3.5%)
	Primary school	144 (18.5%)
	Middle school	125 (16%)
	High school	173 (22.2%)
	P.U.C/diploma	146 (18.7%)
Income/month	Graduate/postgraduate	192 (24.6%)
	<10,356	500 (64.1%)
	10,357–20,714	134 (17.2%)
	20,715–41,429	67 (8.6%)
SES	>41,430	79 (10.1%)
	Upper	14 (1.8%)
	Upper middle	135 (17.3%)
	Lower middle	182 (23.3%)
Religion	Upper lower	369 (47.3%)
	Lower	80 (10.3%)
	Hindu	464 (59.5%)
	Christian	211 (27.1%)
	Muslim	102 (13.1%)
Frequency of dental visits	others	3 (0.4%)
	Once in 1–2 years	247 (31.7%)
	Rarely	283 (36.3%)
Frequency of brushing	Never	250 (32.1%)
	Once	390 (50%)
	Twice	382 (49%)
Overall lifestyle	More	8 (1%)
	Poor lifestyle	38 (4.9%)
	Moderate lifestyle	171 (21.9%)
	Good lifestyle	571 (73.2%)
	Total	780 (100%)

P.U.C = Pre-university college, SES = Socio-economic status

**Table 2: Decayed, missing, and filled teeth (DMFT) and total DMFT according to subject characteristics**

Variables		Decayed Mean ± SD	Missing Mean ± SD	Filled Mean ± SD	DMFT Mean ± SD
Gender	Male	2.39 ± 2.9	1.35 ± 1.9	1.4 ± 2.6	5.14 ± 4.2
	Female	2.9 ± 2.8	2.14 ± 3	1.89 ± 3.1	6.93 ± 5.2
Age	20–35 years	2.57 ± 2.7	0.96 ± 1.5	1.42 ± 2.7	4.95 ± 4.4
	36–50 years	2.73 ± 3	2.57 ± 3.1	1.87 ± 3.1	7.16 ± 4.9
Location	Urban	1.91 ± 2.1	1.68 ± 2.7	2.73 ± 3.5	6.32 ± 4.9
	Rural	3.39 ± 3.3	1.82 ± 2.4	0.55 ± 1.6	5.77 ± 4.6
Occupation	Unemployed	2.73 ± 2.6	2.05 ± 3	1.79 ± 3.2	6.57 ± 5.2
	Unskilled	3.42 ± 3.3	2.36 ± 2.5	0.41 ± 1.1	6.19 ± 4.7
	Skilled/semiskilled	1.89 ± 2.6	1.44 ± 2.1	1.68 ± 3	5.02 ± 4.36
	Clerical, farmer, and business Semiprofessional/professional	2.41 ± 3.1	0.96 ± 1.6	2.01 ± 2.9	5.38 ± 4
Education	Primary school	2.15 ± 2.6	0.74 ± 0.8	3.74 ± 3.5	6.63 ± 4.2
	Middle school	3.37 ± 2.9	2.26 ± 2.5	0.29 ± 1	5.92 ± 4.5
	High school	3.46 ± 4	2.2 ± 3.2	0.66 ± 1.7	6.31 ± 5.5
	P.U.C/diploma	2.38 ± 2.3	1.79 ± 2.4	1.61 ± 2.9	5.78 ± 4.4
	Graduate/postgraduate	2.49 ± 2.9	1.29 ± 2	1.6 ± 2.6	5.37 ± 4.5
Income/month	<10,356	1.94 ± 2.1	1.4 ± 2.6	3.38 ± 3.8	6.71 ± 5
	10,357–20,714	2.83 ± 2.9	1.93 ± 2.7	1.17 ± 2.6	5.94 ± 4.9
	20,715–41,429	2.51 ± 3.2	1.55 ± 2.2	2.17 ± 3	6.24 ± 4.6
	>41,430	2.45 ± 2.1	1.60 ± 2.5	1.78 ± 2.6	5.82 ± 4.5
SES	Upper	1.86 ± 2.3	1.09 ± 2.1	3.62 ± 3.9	6.57 ± 4.9
	Upper middle	3.21 ± 3.1	0.79 ± 0.8	3.07 ± 3	7.07 ± 4.3
	Lower middle	1.85 ± 2	1.23 ± 2.2	2.98 ± 3.8	6.06 ± 4.8
	Upper lower	2.46 ± 2.9	1.23 ± 1.9	2.66 ± 3.2	6.35 ± 4.7
	Lower	2.75 ± 3	2.01 ± 2.7	0.88 ± 2.3	5.63 ± 4.9
Religion	Hindu	3.85 ± 2.9	2.83 ± 3.1	0.36 ± 1.1	7.04 ± 4.9
	Christian	2.67 ± 2.8	1.87 ± 2.8	1.45 ± 2.8	5.99 ± 5
	Muslim	2.92 ± 3.1	1.50 ± 2.1	2.11 ± 3.2	6.54 ± 4.8
	others	2.05 ± 2.2	1.78 ± 2.3	1.50 ± 2.7	5.33 ± 3.8
Frequency of dental visits	Once in 1–2 years	0.67 ± 1.2	0.33 ± 0.58	3.33 ± 3.1	4.33 ± 2.9
	Rarely	2.27 ± 2.5	2.24 ± 3.1	3.23 ± 3.8	7.74 ± 5.3
	Never	2.59 ± 2.7	1.67 ± 2.2	1.10 ± 2	5.36 ± 4.4
Frequency of brushing	Once	3.08 ± 3.2	1.36 ± 2.3	0.70 ± 1.9	5.14 ± 4.3
	Twice	2.95 ± 2.9	1.64 ± 2.4	1.19 ± 2.4	5.78 ± 4.4
	More	2.36 ± 2.7	1.87 ± 2.7	2.11 ± 3.3	6.35 ± 5.1
Overall lifestyle	Poor lifestyle	1.38 ± 2.3	1.88 ± 2	1.50 ± 1.3	4.75 ± 2.8
	Moderate lifestyle	4.08 ± 4.4	1.63 ± 1.7	0.68 ± 1.9	6.39 ± 3.9
	Good lifestyle	3.08 ± 3	2.33 ± 2.4	1.10 ± 2.2	6.5 ± 4.5
		2.42 ± 2.6	1.59 ± 2.6	1.87 ± 3.1	5.9 ± 4.9

SD = standard deviation, DMFT = decayed, missing, and filled teeth

shown statistically significant effect on dental caries, that is, age ( $P < 0.001$ ), gender ( $P < 0.001$ ), occupation ( $P < 0.001$ ), education ( $P < 0.001$ ), income ( $P = 0.05$ ), socioeconomic status ( $P < 0.001$ ), frequency of dental visit ( $P < 0.001$ ), frequency of brushing ( $P = 0.02$ ), and whole lifestyles ( $P < 0.001$ ). All the variables in the model showed a significant effect on dental caries except the location ( $P = 0.98$ ) and religion ( $P = 0.11$ ).

The study subjects those with older age (RR = 1.48), those were females (RR = 1.24), those were unemployed (RR = 1.27) and unskilled (RR = 1.37), with lower education (RR = 0.80), with lesser income (RR = 1.15), with lower socioeconomic status (RR = 0.71), those

never visited dentist (RR = 1.45), those with lesser frequency of cleaning teeth (RR = 1.56), those with overall poorer lifestyles (RR = 1.32), and those having moderate lifestyles (RR = 1.20) were more prone to have dental caries than their counterparts [Table 3].

## DISCUSSION

The healthy lifestyle directly relates to good health is a well-understood concept.<sup>[21,25]</sup> Studies in the past had proven that people with unhealthy lifestyles had more general health and oral health-related problems.<sup>[20]</sup> There may be more than one risk factor in the same individual that can impact his/her health as explained

**Table 3: Negative binomial regression model: dependent variable: total decayed, missing, and filled teeth**

Variables		Adjusted RR (95% CI)	P value
Gender	Female	1.24 (1.14–1.35)	<0.001
	Male	1	
Age	36–50 years	1.48 (1.39–1.58)	<0.001
	20–35 years	1	
Location	Rural	1.00 (0.92–1.83)	0.975
	Urban	1	
Occupation	Unemployed	1.27 (0.97–1.67)	0.008
	Unskilled	1.37 (1.04–1.82)	0.03
	Skilled/semiskilled	0.99 (0.75–1.30)	0.94
	Clerical, farmer, and business	0.90(0.69–1.17)	0.42
	Semiprofessional/professional	1	
Education	Primary school	0.80(0.70–0.91)	0.001
	Middle school	1.02 (0.91–1.14)	0.05
	High school	0.90 (0.82–1.0)	0.04
	P.U.C/diploma	0.88 (0.80–1.0)	0.008
	Graduate/postgraduate	1	
Income/month	<10356	1.15 (0.91–1.44)	0.05
	10,357–20,714	1.01 (0.81–1.24)	0.96
	20,715–41,429	0.94 (0.82–1.08)	0.38
	>41,430	1	
SES	Lower	0.71 (0.43–1.17)	<0.001
	Upper lower	0.65 (0.40–1.05)	0.01
	Lower middle	0.92 (0.60–1.43)	0.72
	Upper middle	0.84 (0.60–1.17)	0.3
	Upper	1	
Religion	Hindu	1.77(1.01–3.09)	0.11
	Christian	1.85(1.06–3.24)	0.45
	Muslim	1.78(1.01–3.13)	0.98
	others	1	
Frequency of dental visits	Never	1.45 (1.34–1.57)	<0.001
	Rarely	1.02 (0.95–1.11)	<0.001
	Once in 1–2 years	1	
Frequency of brushing	Once	1.56 (1.12–2.16)	0.01
	Twice	1.49 (1.07–2.07)	0.02
	More	1	
	Good lifestyle	1	
Lifestyle	Poor lifestyle	1.32 (1.14–1.53)	<0.001
	Moderate lifestyle	1.20 (1.12–1.29)	<0.001
	Good lifestyle	1	

RR = risk ratio, CI = confidence interval

Model: (intercept), age, gender, location, occupation, education, income, socioeconomic status, religion, frequency of dental visits, frequency of brushing, and overall lifestyles

$p < 0.05$  = Significant

by web of causation concept.<sup>[8,26]</sup> Hence, overall lifestyle concept that is based on all possible health-related risk factors will be able to explain better health-orientated behavior of a person than the previous studies based on one or two risk factors. In other words, this concept gives an opportunity to study overall self-care behavior of a person. According to HPI used in this study, good lifestyles encompass not to smoke, not to consuming alcohol daily, to eat healthy breakfast daily, to sleep at least 7–8 h every night, not to work more than 10 h per day, to exercise at least once a week, to eat a nutritionally

healthy diet, and to keep mental stress levels moderate. The purpose of this study was to evaluate the impact of overall/combined lifestyle of an individual (analyzed using HPI) on dental caries of adult population.

It was ascertained in this study that subjects with poorer lifestyles had much greater risk of getting caries than the subjects with good lifestyles. This was in accordance with the earlier findings reported in the past that unhealthy lifestyle was directly related to more frequency of occurrence of dental caries.<sup>[1-5,16-19]</sup> It was noticed in this study that subjects with poorer lifestyles

had much higher decayed teeth and very less filled teeth than good lifestyle subjects, which strengthens the explanation of their lack of health-oriented behavior. A number of lifestyle diseases including dental caries are partly preventable by developing behaviors that are beneficial for their health. If health has to be promoted, efforts must be taken at the individual level for developing self-care practices such as good oral hygiene behavior and regular dental visits.

It was also noticed that female subjects had higher risk for dental caries than the males in this study. But, in explaining this usual tendency of caries being more in females, other contributing factors can be taken into account such as hormonal, diet, and genetic variations, along with social roles among their family.<sup>[27]</sup> In addition, subjects with better education, occupation, income, and socioeconomic status also had lesser risk of dental caries. This was in accordance with a large number of epidemiological studies that had reported a greater prevalence of dental caries in those people with worse socioeconomic indicators.<sup>[28]</sup> It is believed that subjects with low socioeconomic status may be having less accessibility, affordability to dental services and oral hygiene products, poorer knowledge, and less awareness regarding oral health and oral hygiene, which might lead to greater frequency of dental caries.<sup>[29]</sup> Socially disadvantaged individuals have been reported to experience low health in general.<sup>[30]</sup> Even in this study, rural group was found to have much higher decayed teeth and much lesser filled teeth than the urban group. Hence, it is important to consider social inequalities to improve population health.

Lack of self-care behavior and poor use of dental health services are major contributing factors to the high prevalence of dental caries. Oral health-promoting behaviors such as brushing habit of study subjects and habit of regularly visiting dentist are required for maintaining good oral health. It was ascertained in this study that subjects who had taken care of their oral health by brushing more than once and visited dentist regularly had better lifestyles and less dental caries than their counterparts. This was in line with the studies that reported routine dental attendance was associated with better oral health<sup>[31]</sup> and self-reported infrequent brushers' showed higher carious lesions than frequent brushers.<sup>[32]</sup>

## CONCLUSION

This study's linkage between lifestyle calculated using HPI including eight lifestyle factors and dental caries proves the concept that behavior should be taken in a broader sense for the prevention of dental caries. Maintaining a healthy lifestyle could be simply by inheriting healthy behaviors in ones lives. Patients' involvement in self-care

by promoting healthy behaviors such as brushing twice a day, visiting dentist regularly, negating orally abusive substance addiction, having breakfast every day, eating a balanced diet, and reducing stress leads to an overall good lifestyle. These factors along with sleeping a minimum of 7–8 h per night and working for 8–9 h/day and ample daily exercise may help patients improve or protect their oral health for years to come. The public health programs emphasizing on individual lifestyle as a determinant of health are needed.

## ACKNOWLEDGEMENTS

Nil.

## FINANCIAL SUPPORT AND SPONSORSHIP

Nil.

## CONFLICTS OF INTEREST

There are no conflicts of interest.

## AUTHOR CONTRIBUTIONS

The authors' responsibilities were as follows- NS and SA: designed the research. NS, RS wrote the manuscript; NS and RS: conducted the research and had primary responsibility for the final content of the manuscript; and all authors: read and approved the final manuscript. None of the authors had a conflict of interest.

## ETHICAL POLICY AND INSTITUTIONAL REVIEW BOARD STATEMENT

The authors confirm that the study has been conducted as per the ethical guidelines laid down by Deceleration of Helsinki and approved by the Kasturba Medical College and Kasturba Hospital Institutional Ethics Committee, Manipal (IEC 84/2011).

## PATIENT DECLARATION OF CONSENT

The authors confirm that all the study subjects were explained about the details of the study through Participation Information Sheet and the Informed written Consent was obtained for voluntary participation. Participants were given freedom to withdraw from the trial at any point. Regular care was ensured to the participant in the case of withdrawal. They were explained that data related to this study will be maintained confidentially and will be used only for academic purpose or may be published in journals without disclosing their identity.

## DATA AVAILABILITY STATEMENT

The data that support the study results are available from the corresponding author (Dr. Ritesh Singla, e-mail: ritesh.singla@manipal.edu) on request.

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