Seasonal Trends in the Prevalence of Oral Diseases among the Population of Greater Noida between 2011-12 and 2017-2018: A Longitudinal Analysis

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Abstract

Introduction: Along with various oral conditions, dental caries in particular is considered to be one of the major public health problems and seasonal trends might also play an influential role in its development.

Aim: To document and assess the association between seasonal trends and the prevalence of oral diseases (Dental caries, Plaque/Calculus, Pockets and Recession and Mobility) in the population of Greater Noida between the years of 2011-2012 and 2017-2018.

Materials and Method: Data for this longitudinal study was collected between two points of time i.e. between 2011-12 and 2017-2018 by screening 17,127 patients attending the various camps organized by the department of Public Health Dentistry in Greater Noida through a pre-validated proforma recording Dental caries, Plaque/Calculus, Pockets and Recession and Mobility. Data regarding seasons was downloaded from IMD website and divided into four seasons namely Summer (April-June), Monsoon (July-Sept), Autumn (Oct-Nov) and Winter (December-March). After standardizing the data, descriptive statistics were applied followed by the independent samples t-test, Pearson's correlation and Post hoc t-test (Bonferroni test) to find out statistical differences (using PSS 21.0) in the analyzed data, if any.

Results: Of the total 17,127 patients screened, 8729 (50.97%) males and 8398 (49.03%) females. The most prevalent dental condition observed was dental caries (39.73%) followed by pockets and recession (20.21%) and tooth mobility (3.77%). The percentage change of dental diseases remained within the range of 70-76% in autumn, winter and summer seasons while only 23% increase was seen in the monsoon season. A decreased trend (-9%) was seen in the monsoon season (pockets and recession) and apart from winter season, a significant difference was seen in the caries incidence between the study group ($p \leq 0.5$).

Conclusion: While the present study found significant associations between seasonal trends and the incidence of dental diseases, we suggest more longitudinal studies in the future to support our results.

Keywords: Seasonal Trends; Dental Caries; Pockets; Recession; Mobility

Introduction

As per the conditions recorded in the Global Burden of Disease (GBD) Study, the incidence of untreated dental caries in permanent teeth now has been considered as the most prevalent condition and, as per the FDI (2015), it affects more than 40% people across the globe [1-3].

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The incidence is dental caries is preferably seen in populations who lead their lives in difficult socioeconomic conditions as it is a common finding that low income leads to an overall deterioration in one's general health which has a direct association with one's oral conditions [2,4].

In addition, is seen that the prevalence of oral conditions is increasing in developing countries as these countries might lack/ have insufficient access to oral health care services and access to preventive measures like fluorides which reduces the burden of dental caries significantly [5].

The incidence of Dental caries in Greater Noida has varied over the years from 30.06% in pre-school children (2012) [6] to 69.8% and 51.9% in the children aged 7 - 9 and 10 - 12 years (2016) [7]. This data from these respective studies provide an alarming picture that data that with an increase in age, the prevalence of dental caries is also increasing.

Literature reports have suggested various factors that play an important role in the incidence of dental caries, which range from poor oral hygiene (host factors) to bacteria (agent factors), time and one's environmental factors. In the context of the environmental factors, seasonal variations might play an increased role in the development of caries as India and its surrounding areas are experiencing an overall rise in temperature with every passing year. This rise in temperature, inturn can lead to an increased bacterial enzymatic activity, leading to faster replication and increased incidence of various oral conditions [8].

The prevailing climate in Greater Noida is referred to as a local steppe climate with little rainfall throughout the year (mean rainfall: 749 mm). The climate of this city is considered to be BSh according to the Köppen-Geiger climate classification and the temperature here averages 25.1°C. With an average of 34.1°C, June is the warmest month. The lowest average temperatures in the year occur in January, when it is around 14.4°C [9]. It has been stated that an increase/ decrease in the hours of sunlight (as seen in summers and winters) and temperature is associated with dental caries [10].

In support of the above statements, an attempt was made to document and assess the association between seasonal trends and the prevalence of oral diseases (Dental caries, Plaque/Calculus, Pockets and Recession and Mobility) in the population of Greater Noida between the years of 2011 - 2012 and 2017 - 2018.

Materials and Methods

This longitudinal study was carried out between two points in time i.e. between 2011-12 and 2017-2018 wherein data was collected by organizing various dental screening and treatment camps in Greater Noida for the benefit of its population. The study protocol was approved by the ethical committee of the Institutional Review Board (IRB) once adequate measures (data coding and limited access to the analysed data) were undertaken to ensure the confidentiality of the data of the study subjects.

Patients visiting camps during the study years were thoroughly screened for any dental diseases (Dental caries, Plaque/Calculus, Pockets and Recession and Mobility) and their data was entered in a pre-validated proforma. They were also distributed oral hygiene kits and given health education. A total of 17,127 patients were screened for dental diseases.

The climate profile of India was downloaded from the website of the Indian Meteorological Department (IMD) [11]. Due to large geographical variations in climate leading to an extension or decrease in the duration (in months) of the season, local data regarding the duration of the seasons in and around Greater Noida was taken in account [12]. For greater ease and comprehensibility, the data was divided into four seasons namely Summer (April-June), Monsoon (July-Sept), Autumn (Oct-Nov) and Winter (December-March).

The examinations were an ADA type IV examination conducted in the two dental chairs present in the dental van. In certain areas, where it was difficult to park the dental van at the camp site due to narrow lanes, the screenings were done in an open, clean and spacious area which provided adequate natural/artificial light to clearly observe the patient's oral cavity. The camps were always planned in advance as to ensure proper standardization of the examiners who were only selected for the camp once the inter-observer variability

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(Cohen's Kappa, κ) was found to be in substantial agreement (0.61 - 0.80). Data for each camp was first transferred into Microsoft excel the very next day for record maintenance.

Data analysis (descriptive and inferential) was done using SPSS version 21.0 [13] and the data was standardized to calculate the percentage increase/decrease in the observed values of the longitudinal data. The independent sample t-test was applied to for finding significant season differences with oral conditions, following which, the data was analyzed using Pearson's correlation and Post hoc t-test (Bonferroni test) to find out statistical differences in the analyzed data, if any.

Results

Table 1 depicts the combined data for the years 2011-12 and 2017 - 2018 in relation to various dental conditions. A total of 17,127 people were screened in the camps organized in the department, of which there were 8729 (50.97%) males and 8398 (49.03%) females. While plaque/calculus was seen in 66.46% of the people, the most prevalent dental condition observed was dental caries (39.73%) followed by pockets and recession (20.21%) and tooth mobility (3.77%). The mean age of the subjects included in the study was 26.14 ± 16.79, which diverts our attention to the fact that young people were more interested in getting themselves screened for oral diseases.

(Males/Females)	8729/8398	Total:17127
Mean Age Males Females	26.14 ± 16.79 26.14 ± 16.76 26.13 ± 16.796	
	Present	**Absent**
Plaque/Calculus	11383 (66.46%)	5744 (33.54%)
Pockets and Recession	3462 (20.21%)	13665 (79.79%)
Mobility	645 (3.77%)	16482 (96.23%)
Dental Caries	6804 (39.73%)	10323 (60.27%)
Total	22294	63341

Table 1: Aggregate data of dental diseases screened in the study population for the years 2011-2012 and 2017-2018.

The season wise comparison of dental disease is shown in table 2. The range of the mean ages of the study subjects ranged from 21 - 30 Years. It was observed that while the percentage change of dental diseases remained within the range of 70 - 76% in autumn, winter and summer seasons, only 23% increase was seen in the monsoon season. While the standardized values of all dental diseases increased, a decreased trend (-9%) was seen in the monsoon season with regard to the presence of pockets and recession among the study subjects. The highest increase among all dental conditions was seen in pockets and recession [90%, winter and summer seasons (Significant difference)]. Apart from winter season, a significant difference was seen in the caries incidence between the study group (p ≤ 0.5).

The results of the correlation and post-hoc test between the two study points is described in table 3. While all values were found to be non-significant, dental caries was an exception and had a correlation of 0.81 (strong positive linear relationship) and an significance of <.03 in the post hoc modified bon-ferroni test.

Discussion

The present study, which aimed to document and assess the association between seasonal trends and the prevalence of oral diseases (Dental caries, Plaque/Calculus, Pockets and Recession and Mobility) in the population of Greater Noida between the years of 2011-2012

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	2011 - 2012		2017 - 2018		Statistical Analysis	
Summer Season (April-June)						
Males/Females	654/494	Total: 1148	2123/1610	Total: 3733	Increase in % (Standardized) (Rounded off)	Significance (independent samples t- test)
Mean Age **Males** **Females**	28.13 ± 17.78 27.73 ± 17.78 27.45 ± 17.66		28.32 ± 15.84 28.32 ± 15.84 28.37 ± 15.87			
	Present	**Absent**	**Present**	**Absent**		
Plaque/Calculus	509	639	3080	653	72%	NS
Pockets and Recession	72	1076	1398	2335	90%	< 0.025
Mobility	33	1115	784	2949	92%	NS
Dental Caries	176	972	605	3128	55%	< 0.001
Total	790	3802	5867	9065	76%	
Monsoon Season (July-Sept)						
Males/Females	766/549	Total:1315	1457/1337	Total: 2794		
Mean Age Males Females	21.34 ± 16.61 21.23 ± 16.60 21.34 ± 16.61		30.52 ± 17.48 30.51 ± 17.47 30.53 ± 17.50			
Plaque/Calculus	631	684	1139	1655	29%	NS
Pockets and Recession	234	1081	194	2600	-9%	NS
Mobility	311	1004	417	2677	15%	NS
Dental Caries	349	966	671	2123	32%	< 0.01
Total	1525	3735	2421	8755	23%	
Autumn Season (Oct-Nov)						
Males/Females	456/274	Total: 730	1900/1273	Total: 3174		
Mean Age Males Females	25.93 ± 16.27 25.93 ± 16.27 25.83 ± 16.30		21.83 ± 14.96 21.82 ± 14.97 21.86 ± 15.01			
	Present	**Absent**	**Present**	**Absent**		
Plaque/Calculus	311	419	1933	1241	72%	< 0.033
Pockets and Recession	138	592	358	2816	44%	NS
Mobility	102	628	391	2783	59%	NS
Dental Caries	207	523	1139	2035	69%	< 0.027
Total	758	2162	3821	8875	67%	
Winter Season (December-March)						
Males/Females	566/354	Total: 920	2023/1300	Total: 3313		
Mean Age Males Females	28.23 ± 17.78 28.15 ± 17.80 27.56 ± 17.61		28.84 ± 15.85 28.84 ± 15.85 28.83 ± 15.84			
Plaque/Calculus	509	411	3080	233	72%	NS
Pockets and Recession	72	848	1398	1915	90%	NS
Mobility	217	703	405	2908	30%	< 0.047
Dental Caries	361	559	1575	1738	63%	NS
Total	1159	2521	6458	6794	70%	

***Table 2:** Season wise comparison of dental conditions.*

Citation: Sahil Thakar., *et al.* "Seasonal Trends in the Prevalence of Oral Diseases among the Population of Greater Noida between 2011-12 and 2017-2018: A Longitudinal Analysis". *EC Dental Science* 18.9 (2019): 1970-1976.

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	2011-2012 VS 2017-2018 [(Pearson's Correlation(r)]	Post hoc t-test (Bonferroni test)
Plaque/Calculus	0.17	NS
Pockets *and* Recession	0.22	NS
Mobility	0.47	NS
Dental Caries	0.81	< .03
2011-2012 VS 2017 - 2018	1 (Constant)	---

***Table 3:** Correlation/ Poc-hoc test (Correlation is significant at the 0.01 level (2-tailed).*

and 2017 - 2018 revealed that over an 8 year time difference, the major oral condition was dental caries (39.73%) followed by pockets and recession (20.21). While the percentage dental caries in India is reported to be about 50 - 60% [14], the results of this study contradicted those findings.

The above results are in disagreement to Mehta A [5], who documented that the pooled caries prevalence in children was between 50.84% and 62.41% at 5-year interval. However, the data analyzed by the author was a systematic analysis 69 studies, and our results could have varied due to the differences in geographic location which affects the attitudes of the patients towards maintenance of their oral health. Similarly, Kundu H., et al. [15] in their respective study also contradictorily revealed that the pooled prevalence of dental caries was found to be highest in 15-year olds (62.02%) and is higher as compared to the results of the present study.

An interesting finding of the present study was that while the standardized percentages of dental conditions (Dental caries, Plaque/ Calculus, Pockets and Recession and Mobility) between the two study points remained within the range of 70 - 76% in autumn, winter and summer seasons, only 23% increase was seen in the monsoon season. JM Dunning stated that dental disease (in particular caries) increases with latitude and with distance from seacoast, suggesting that the caries incidence in our study area should have shown decreased trends [16]. Almost same percentage of caries was seen in both coastal areas and areas away from the coast [68.1% [17] and 89.6% (first molar caries) in Mangalore [18], 70.5% (Ramgarh, district Chhindwara, Madhya Pradesh) [19] and 82.4%(New Delhi) [20]]. These findings show a weak correlation of seasonal trends and the above-mentioned caries prevalence can be attributed more to differences in one's motivation and practices regarding oral health.

It was hypothesized that rainfall blocks sunlight (Average hours of sunlight received per day) and this causes a decrease in caries incidence. This statement is supported by our study results wherein the highest standardized percentages of dental conditions (Dental caries, Plaque/Calculus, Pockets and Recession and Mobility) were seen in the summer season (79%). Sunlight is an important factor for receiving vitamin D and it has been scientifically documented that Vitamin D status in childhood and adolescence might play an important role in the prevalence of dental caries as well as periodontal disease [21]. Interestingly, the incidence of vitamin D deficiency was more common in people living in sunny countries (Italy, Spain and Greece) as compared to those people who were living in countries where exposure to sunshine exposure is considered to be relatively less/insufficient [22,23]. During summers, there is immense heat in the region of Greater Noida and many people prefer to stay indoors and therefore may have deficient vitamin D levels, increasing the possibility of dental diseases. Another temperature related factor to be considered is relative humidity as data from Australian states showed a higher correlation (0.829) between dental caries and relative humidity when compared to any other climatic factor [24].

During summers, the intake of liquids (sweetened lemonade, sugarcane juice, buttermilk, aerated drinks, etc.) by people to cool themselves is significantly increased which may be high in sugar content and increase the incidence of dental caries/ periodontal diseases. This reason can also be justified for students also, who have their summer break and stay indoors, consuming more snacks sweetened beverages. Hence, we postulate that apart from sunshine, dietary changes due to variations in season can also be a reason for increase in the incidence of dental diseases.

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The prevalence of pockets and recession in the present study was 20.21% and this is almost double as compared to global figures as per Frencken JE., *et al.* [25], who state that approximately 10% of the global population is affected by severe periodontitis and need urgent, immediate dental care. However, the percentage of periodontitis observed in the present study is quite less in frequency as compared to 89.6% (National Oral Health Survey) [26] and 73.62% [27] documented in the population of India among people aged 35 - 44 years. This decrease in the prevalence of periodontal related problems could be attributed to the fact that there are two dental colleges in Greater Noida, both of which since inception in 2006 are actively organizing outreach (screening and treatment camps) and have dedicated transport services to bring patients in need of dental care to the college on a daily basis. Other factors include the increase in patient education through affordable mediums like internet, television coupled with an easy access to oral care products in the villages itself, the younger generation seems to be motivated regarding their oral health.

A comprehensive literature search revealed little or no studies that tried to assess the longitudinal effect of seasonal trends and oral conditions, making us believe that this study is one of the pioneer studies aiming to do so and promises to open avenues for authors to research and compare data. A limitation of the study is that we had to compare the results of the study mostly with children aged 15 years due to dearth of longitudinal data regarding the prevalence of dental caries and other oral conditions among adults in India. To compensate for this, we tried to include results from systematic and meta-analysis so that the results compared are standardized and are pooled in nature. Also, the mean age of our subjects was around 26 years, and hence comparison of the results can be justified. In this study, due to the difficulty in identifying secondary caries as no bitewing radiographs were taken, the above rates might be an underestimation of the actual value of dental caries present in the population of Greater Noida. Another limitation is that while adequate measures were implemented, the inadvertent, yet minimal data entry bias might have crept in while copying the manual data to Microsoft Excel and SPSS.

Conclusion

From the results of the present study, we suggest more longitudinal studies in the future so that the associations found in the present study can be compared in relation to seasonal trends and dental conditions.

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