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Frequency of occurrence of dental diseases in western Uttar Pradesh population: A retrospective radiographic study

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ABSTRACT

Background and Aim: Dental diseases now-a-days are emerging swiftly thus making its control and prevention a tedious task. The outcome of dental diseases is boundless extending from pit and fissure involvement till development of malignancy. Thus, the prevention as well as control of dental diseases has gained importance. A thorough knowledge of prevalence of disease along with profound clinical examination are two most criterion for determining the presence or severity of disease. Dental diseases can be prevented by early diagnosis followed by immediate treatment. However, the progression as well as the severity of the disease is determined by calculating the prevalence stroke frequency of occurrence of the particular diseases. In view of above mentioned background, the study was done to determine the frequency of occurrence of various dental diseases in Western Uttar Pradesh population. However, the present study was not community-based but rather commenced radiographically.

Materials and Methods: The present study was undertaken to estimate the prevalence of various dental diseases radiographically. The dental diseases considered in the study are dental caries, periodontal diseases such as horizontal bone loss, vertical bone loss, presence of root stumps and impaction status. In the study, a total of 1500 radiographs were selected randomly and evaluated and the prevalence of various above mentioned dental diseases were determined.

Results: The prevalence of different dental diseases varies sporadically. In the present study, among the dental diseases, highest prevalence was found for dental caries (76%) followed by periodontal involvement (70%) then mesioangularly impacted teeth (2.7%) and so on. From the results, it could be interpreted that mostly radiographs are recommended for dental caries followed by periodontal status determination and rest for other diseases. Conclusion: Radiographic evaluation is an adjunct of clinical diagnosis. Diseases like Dental caries, bone loss, root stumps which cannot be visualized clinically require the radiographic evaluation necessarily. Hence, judicious utilization of radiographic procedures should be practised for the benefit of the patients.

1. Introduction

Mouth is considered as a window to the health of a person. A holistic state of health cannot be achieved without a good dental health. Although dental diseases are not an important cause of mortality but may have serious consequences on the health of an individual. Poor dental health can have a significant impact on quality of life which not only increases the risk of other chronic diseases but also lead to poor nutrition. Both these factors create a vicious cycle, in which the overall health of an individual deteriorates. Maintaining good oral health means being free from dental

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caries, periodontal diseases, missing tooth, pain in the oral and facial region, absence of oral sore, lesions and other diseases that affect oral cavity. Oral health is considered as an important component of public health and oral diseases are considered among the preventable non-communicable diseases.[1] India is one of the major emerging market economies with a population of over 1 billion having diverse geography, culture, tradition, habits and race. This diversity also extends to literacy rates, health indicator rates, infant mortality rate (IMR) and hygiene practices.[2] There has been a general perception that oral health in India is considered to be the least important. At present, in India there are more than 267 dental colleges, producing approximately 19,000 dental graduates per year and almost 3,000 specialists. These dental colleges offer excellent tertiary care and too in a cost-effective manner. Also, India is becoming a favoured tourist destination for oro-dental treatment of international standards.[3] Despite of all these, the most basic oral health education and simple interventions like pain relief and emergency care are not available to the vast majority of population, especially in the rural areas. One of the reasons can be lack of epidemiological data to identify areas needing of oral health care.

Dental diseases are among the most widespread diseases worldwide. According to the World Health Organization (WHO), the prevalent oral diseases are dental caries, periodontal diseases & edentulousness. According to National Oral Health Survey and Fluoride Mapping (2002-2003) and Dental Council of India, New Delhi (2004), prevalence of dental diseases varies among different aspects of world; like worldwide prevalence of dental caries is approximately 52.3% which is almost similar to dental caries in India (i.e. 53.8%).[4,5] Moreover, the prevalence of periodontal disease in India has been found to be about 57%, 67.7%, 89.6% and 79.9% in the age groups 12, 15, 35-44 and 65-74 years, respectively. The higher prevalence of periodontal diseases is seen in older age and is attributed to loss of teeth in the elderly one.

With the above mentioned need and parameters, this study is done to report the prevalence, severity and progression of dental diseases in western Uttar Pradesh population. This study, therefore, can contribute a little to help dental and other public health care providers to better benefit the individuals and communities in preventing and controlling dental diseases. This can also enhance further research which may lead to overall improvements in oral health-related quality of life.

In past a number of studies have been done on determining the epidemiological data of dental diseases but all these studies are clinically –based studies. However, this is the first study determining the prevalence of dental diseases in the region of Western Uttar Pradesh which is purely based on radiographic evaluation.

2. Materials and Methods

A cross-sectional, observational and retrospective study was conducted on radiographic data available in digital system (data bank) of ITS-CDSR Dental College, Muradnagar, Uttar Pradesh w.e.f. 1^{st}-31^{st} January, 2016.

A total of 1500 intraoral periapical radiographs were evaluated. All the radiographs were selected randomly and had been visualized under same system (Sordex Scanner) under the same software (Digora Optime software) with similar visualization factors and background.

2.1. Inclusion criteria

Only standard radiographs without any error were included and all were selected randomly taken with in a period of one month (from 1^{st}-31^{st} January, 2016).

2.2. Exclusion criteria

All the poor quality and substandard radiographs such as having low resolution, cone-cut and other artefacts were excluded.

Radiographs of the undergoing or postoperative procedures were also elucidated.

2.3. Method

Analysis was done on randomly selected intra-oral radiographs. The selected radiographs were evaluated for the various dental conditions prevalent in the oral cavity without intervening about the case history of individual and rationale of radiographs. Contrast enhancement was done according to the requirement in order to rule out any second slant. The diseases were categorized under following headings such as bone loss and its type, dental caries and its types, root stumps and impaction status of maxillary and mandibular third molars.

Each disease was categorized under following headings and their respective sub-headings:

Heading 1: Bone loss

Dental bone loss occurs when the bone that surrounds and supports teeth shrinks as a result of disease or infection, and can lead to the teeth becoming loose, moving and spreading out. In periodontal disease, not only does the bone that supports the teeth, known as alveolar bone, reduce in height in relation to the teeth, but the morphology of the remaining alveolar bone is also altered.[6]

For bone loss only those radiographs are considered having competent set of teeth, no edentulous spaces, no pathology.

Bone loss can further subcategorized under following subheadings (Robert P et al.):[7]

1. Horizontal bone loss
2. Vertical or Angular loss
3. Dehiscence

4. Fenestration

Horizontal bone loss - Loss in height of alveolar bone where the crest is still horizontal but positioned more apically from CEJ's. More precisely can be defined as bone loss occurring in horizontal pattern.

Horizontal bone loss is further categorized as:

Stage I–Mild bone loss:

1. Localized erosions of the marginal bone
2. Thinning of crestal lamina dura
3. Loss of sharp border with the lamina dura of the adjacent teeth
4. Loss of spiking in the anterior
5. Slight loss of bone height

Stage II- Moderate bone loss:

1. Loss in height of the crestal bone around the teeth.
2. Radiolucent projections from crest into interdental septum indicates extension of destructive process
3. Stage III-Severe bone loss
4. Bone level is in the apical 1/3 of the root.
5. Bone loss may be more extensive than is apparent on the radiographs.
6. Height of interdental septum is progressively reduced by the extension of inflammation and resorption of bone occurs.

Angular / Vertical bone loss – bone loss that is localized to a single tooth and progresses down along the root of tooth.

Both Dehiscence and Fenestration are clinical defects involving the cortical bone. These cannot be visualized on the radiographs unless supported by a clinical diagnosis[8] and hence are not considered in our study.

Heading 2: Dental caries

Dental caries is an infectious microbiologic disease of the teeth that results in localized dissolution and destruction of calcified tissues (Sturdevant). Radiographically, dental caries appear as radiolucent line or area involving the calcified dental structure that is enamel, dentine and cementum.

In present study, Ekstrand's clinical classification for dental caries is considered.

According to Ekstrand et al (1997),[9] Dental Caries can be divided in the following subheadings:

Type I – Radiolucency involving the enamel

Type II – Radiolucency involving enamel and dentin both

Type III – Radiolucency seen involving enamel, dentin and pulpal region with or without involvement of the periapical region. All periapical pathologies arising due to involvement of enamel, dentin and pulp are also considered in the same subtype.

Type IV- Root Caries – Radiolucency involving the Cementum and dentin below the CEJ level.

Heading 3: Root stumps

Root stumps are conditions where the crown structure is missing either due to decay or fracture and only the root piece is left in the socket. Most common causes include extensive untreated dental caries, negligence to seek dental care, trauma and so on.[10]

Radiographically, root stumps are defined as radiopaque structure having density same as that of root stumps either embedded or lying at the alveolar crest.

Further special attention was taken to rule out the presence of any benign lesion such as odontome, cementoma, periapical cemental dysplasia from root stumps.

Heading 4: Impaction

Tooth impaction is a common dental condition ranging from 0.8–3.6% of the general population. A tooth normally erupts when half to three-quarters of its final root length has developed. Impaction is usually diagnosed well after the tooth should have erupted. The most commonly impacted teeth are, consecutively, mandibular and maxillary third molars, maxillary canines, mandibular premolars and maxillary central incisors.[11] Tooth impaction is generally asymptomatic and, because of that, only a small number of patients seek treatment. In most cases, tooth impaction is recognized by chance by general dentists or orthodontists, when a patient comes to their office for a routine check-up.[11]

Radiographically, impacted tooth is defined as any tooth having occlusal level below the occlusal level of adjacent tooth.[12] In our study, only impacted maxillary and mandibular third molars are considered because the third molars are the most frequently impacted as they are the last teeth to erupt; therefore they are the most likely to have inadequate space for eruption having the highest impaction rate (16.7% to 68.6%).

Impacted tooth is further categorized into different types (Winter's Classification).[13]

Subheadings:

1. Mesioangularly impacted: When the long axis of tooth is tilted mesially (towards) against the long axis of adjacent tooth.
2. Distoangularly impacted: When the long axis of tooth is tilted distally (away) against the long axis of adjacent tooth.
3. Horizontally impacted: When the long axis of tooth is tilted perpendicularly against the long axis of adjacent tooth.
4. Vertically impacted: When the long axis of tooth is parallel against the long axis of adjacent tooth.

Other types of impaction likewise Buccoangular, Linguoangular, Inverted and Unusual are excluded as it's not possible to determine the type of impaction in 2-D modality.

All the data was collected, categorized and entered into the Microsoft Excel 2010. Then statistical analysis was done

by Statistical Software SPSS Version 16.0.

3. Results

The normality of data was determined by Shapiro-Wilk test and found that our data was normally distributed.

The descriptive statistics, mean and standard deviation of different parameters were calculated and following results were obtained.

Bone loss: In the present study, it was found that the overall prevalence of periodontal involvement (Table 1) was 70.8% with the highest prevalence found for Type II and III bone loss i.e. moderate (27.5%) and severe (27.7%) then Type I (9.6%) and least for angular bone loss (5.9%).

Table 1: Frequency of periodontal diseases

Bone loss	Frequency	Percentage
Horizontal Bone Loss	973	64.8
Type I	144	9.6
Type II	413	27.5
Type III	416	27.7
Angular Bone Loss	89	5.9

Dental caries : Prevalence of dental caries was 76% (Table 2) with highest prevalence found for Type II dental caries (50.6%) followed by Type I dental caries (20%) then Type III lesions(19%).

Table 2: Frequency of occurrence of carious lesion

Categories	Frequency	Percent
Type I	310	20
Type II	759	50.6
Type III	286	19
Type IV	22	1.4

Root stumps: Radiographic prevalence for Root stumps was found approximately 17.8%(Table 3).

Table 3: Prevalance of root stumps and impacted teeth

Categories	Frequency	Percentage
Root stumps	268	17.8
Impactions		
Vertical	35	2.3
Mesioangular	41	2.7
Distoangular	8	0.5
Horizontal	20	1.33

Impacted teeth: In the present study, it was found that Mesioangularly impacted (2.7%) was more prevalent than vertically impacted (2.3%), followed by horizontal type (1.33%) and least for distoangular type (0.8%)(Table 3).

4. Discussion

The present study determines the prevalence of various dental diseases in western Uttar Pradesh population. Although, literature regarding the prevalence of dental diseases is sufficient but all are clinical based studies and this is the first study which determines the prevalence of dental diseases radiographically. Also, there is a lack of data regarding prevalence and severity of dental diseases among the Western Uttar Pradesh population. According to World Health Organization (WHO), estimation of global DMFT in the 188 countries, included in their database, is 200, 335, 280 among different age group. This is based on the data available in 2004 from the Who is a Oral Health Database, Country/Area Profile Program (CAPP). In the present study, various prevalent dental diseases like Periodontal diseases, dental caries, root stumps, impaction are included. Various considered parameters are discussed individually as below:

4.1. Bone loss

Periodontal diseases are inflammatory diseases of the oral cavity that can be confined only to the gingiva as in gingivitis or exceed beyond that to result in soft and hard tissue loss which affects the attachment of the teeth to the alveolar bone, as in periodontitis.[14] Research continues to define all the factors participating in the initiation and progression of periodontal diseases. Cekici et al. published a report in 2015 discussing this particular inflammatory process and the mechanisms behind its occurrence.[15] Overall, periodontal diseases have common etiological factors and many risk factors predisposing disease initiation and progression.[16,17] Several studies found that although periodontitis occurs in most age groups, it is more prevalent in older age groups and seniors. The use of radiographs to assess alveolar bone loss appears frequently in the literature.[18] In the present study, the highest cases were found for horizontal type of boneloss (70.8%) than angular bone loss (5.9%). Among the horizontal type of bone loss, commonly type II and type III were seen. Similar results were determined by Shah N et al[19] who reported highest prevalence of periodontal diseases in Maharashtra (96%), followed by Orissa (90%), Delhi (85.5%), Rajasthan (75%), Uttar Pradesh (68%) and Pondicherry (55%). According to Bansal M et al. (2015),[20] the prevalence of periodontal disease was found to be 96.30% whereas S Fotedar et al(2014)[21] found the prevalence of 75.1%. S. Sanadhya et al. (2015)[22] and Peter KP et al. (2014)[23] found the prevalence around 51.2% and 72% respectively. Paul et al. (2012)[24] found the prevalence of severity of periodontal disease as 1.8% with severe, 17.5% with moderate, and 7.0% with mild periodontitis.

According to National Oral Health Survey aided by Dental Council of India, New Delhi (2002-2003),[1] prevalence of periodontal diseases reported was 57%, 67.7%, 89.6% and 79.9% in the age groups 12, 15, 35-44 and 65-74 years respectively. However, no such differentiation was not found as age was not considered as criteria in the present study.

4.2. Dental caries

Epidemiological studies of caries have been undertaken for many decades, and some of the data available through the WHO and other organizations give an impression that we have plentiful comparable global data. In the present study, the prevalence of dental caries found was 76% as compared to other studies in which about 55% was prevalent. In 1940, the prevalence of dental caries in 5 and 12-year-old schoolchildren in India were 55.5% and it jumped to 68% in the 1960 and climbed to 89% in subsequent years. Prevalence of dental caries was about 50% in 5 year old children and close to 84.1% in older age population as reported by National oral health survey and fluoride mapping 2002-2003.[1] According to R Srivastava (2012),[13] the prevalence of dental caries experience ranged from 31.5% in Nagpur to 100% in Delhi. The Dental Council of India (DCI) in collaboration with Ministry of Health and Family Welfare in 2002-2003 conducted a multicentric study in 20 states of the country and reported the average prevalence of dental caries to be 85%.[25] Another multicentric study conducted in eight states of the country, by the Government of India along with WHO collaborative program on oral health, had reported the prevalence to be around 67.8%. The DMFT score in the multicentric study conducted in 2007 was 5.3, which ranged from 2.4 in Rajasthan to 15.5 in Uttar Pradesh.[19] Similar DMFT score (13.8) was also reported in the study by Patro et al.[26] and the multicentric study by the DCI (14.9).[25] But all these studies are clinically based studies.

4.3. Root stumps

Root stumps refers to the partial root structure that remains in the jaw. Root stumps can be retained both in dentulous and edentulous patients as a preventive measure to preserve the alveolar ridge resorption.[27,28] However, retained roots also have the propensity to cause pain and discomfort[29–31] to patients and can be a source of infection, especially if fractured during the extraction of non-vital teeth. In the present study, among all the scanned radiographs the presence of root stumps were found in 17.8% approximately. In past, there are no existing studies investigating the prevalence of root stumps radiographically. A number of studies are done previously determining the prevalence on the basis of age, gender. R Vignesh et al(2020)[32] found the prevalence of 2% in pediatric patients. According to Pillay SR et al(2020)[33] found the prevalence in three different age groups i.e. 35-40 years; 41-45 years; 50-55 years as 31.8%, 18.28%, 50.54% respectively.

4.4. Impaction

Impacted teeth are classically defined as retained in the jaw beyond their normal date of eruption, surrounded by their coronary bag and without communication with the oral cavity (Favre, 2003)[34] The results of different studies show variable numbers, which are not necessarily contradictory. These discrepancies come from the non-homogeneity of the samples studied. All are unanimous on the fact that the mandibular third molars are most frequently included, followed by their counterparts of maxillary and maxillary canines. The classic distribution in order of frequency of impaction of permanent teeth can be summarized as follows : lower third molars, upper third molars, upper canines, upper and lower premolars, upper incisors, lower canines, lower incisors, upper and lower first molars and upper and lower second molars [Ericsson, 2000; Quirynen, 2000).[35,36] In our study, it was found that the prevalence of mesioangularly impacted was highest that is 2.7%, followed by vertically impacted 2.3%, then horizontal impaction, that is 1.33%and lowest was found for distoangular 0.5%. P Santosh et al (2015),[37] Hattab FN et al (1999)[38] also found that the mesioangularly impacted third molars are most common type. Kumar et al. observed the prevalence of mesioangular alignment in 52.89% of cases in Eritrean residents.[39] These reports were confirmed in 2016 by Nagaraj and co-authors[40] presenting mesial-angle impaction in 47.1% of patients, as well as many other researchers.[41–44] In the studies of Al-Dajani et al.[45] and Yilmaz et al.[46] vertical impaction was found to be the most common position. The first team showed the occurrence of this impaction in 40.7% and mesioangular impaction in only 7.1% of patients; the second team showed vertical impaction in 53% and mesioangular impaction in 29% of patients. The differences in results may be due to the adoption of an incorrect modification of Winter's index in the studies of Al-Dajani et al.[45] and Yilmaz et al.[46]

5. Conclusion

Early detection and diagnosis of dental diseases reduce irreversible loss of tooth structure, the treatment costs and the time needed for restoration of the teeth. Accurate diagnosis is the requirement for formulating a treatment protocol. Proper diagnosis, however, cannot be achieved with clinical evaluation only but also require the radiographic examination. Radiographs are required to evaluate the inner and hidden pathologies which are not possible to determine by naked eyes. Although a number of clinical based studies have been done to determine the prevalence but utilization of radiographs for such studies have not been done yet. Radiographs not only lead to precise diagnosis but also help the clinician as well as patients in a better and more accurate diagnosis with judicious utilization of the limited resources available for dental health. India has a vast geographic area divided into different states, differing in cultural, socioeconomic, educational and behavioural aspects. These factors significantly affect the oral health status of different regions. The included studies emphasized on the role of cultural and social determinants like low

socioeconomic status, low level of education and deleterious oral habits on high prevalence of dental disease. It was found during our research that there were many parts in India where no studies have been carried out to judge the oral status of its residing population, these regions are mainly Northern, North Eastern and Eastern parts of India. Thus, nationwide multicentric studies are required to assess the true percentage of prevalence of diseases affecting the Indian population. But for obtaining a veracious prevalence, there should be a general representative survey involving both clinical as well as radiograph -based evaluation. Our study also determined that most commonly radiographs are prescribed for dental caries, then for bone loss and so on. However, radiographs are prescribed only for severe cases and no trend for screening purpose is present. Hence, incorporation of radiographic examination with clinical evaluation could be more fruitful if applied day to day practice.

6. Limitations

There are some limitations for this study. First likely, the actual prevalence of dental diseases is not possible by evaluating the radiographs only. In this study, random evaluation of radiographs were done without any knowledge of clinical scenario so there will be a possiblity that the calculated results will not be in actual value to the original prevalence of the determined conditions.

Also in daily routine practice, radiographs are prescribed only for the offended or concerned tooth which may lead in missing out some of the hidden diseases.

Again radio graphically, it's not possible to determine whether the lesion is active or arrested so confusion could arise in gathering and distribution of data.

However, all these limitations can be overcome by following proper protocol of clinical examination along with radiographic evaluation not only for complaining region but for suspected region as well.

7. Future Directions

Nationwide multicentric studies are required to assess the true prevalence rate of dental disease amongst the general population of India so the appropriate interventions should be provided to the affected individuals resulting in good oral health of the individuals. A proper study design should be formulated so as to assess the extent and severity of the disease in complete dentition both clinically as well as radiographically.

8. Conflict of Interest

None.

9. Source of Funding

None.

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