Original Article

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Clinical consequences of untreated dental caries in youth population using pulpal involvement, ulceration, fistula, and abscess index

Kharel S,[1] Dixit PB,[2] Shrestha D,[3] Ghimire S,[4] Dahal S,[5] Dhakal S[6]

[1]Smriti Kharel, Lecturer, Department of Conservative Dentistry and Endodontics, Kathmandu Medical College, Duwakot, Bhaktapur; [2]Punam Basnet Dixit, Professor, Department of Conservative Dentistry and Endodontics, Siddhi Dentistree Dental Clinic, Dillibazar, Kathmandu; [3]Deepti Shrestha, Associate Professor; [4]Siddharth Ghimire, Assistant Professor, Department of Conservative Dentistry and Endodontics, Kathmandu Medical College, Duwakot, Bhaktapur; [5]Sirjana Dahal, Assistant Professor, Department of Community Dentistry, Maharajgunj Medical Campus, Maharajgunj, Kathmandu; [6]Samikshya Dhakal, Dental Surgeon, Kathmandu Medical College, Duwakot, Bhaktapur, Nepal.

Abstract

Background: Dental caries is a major health problem worldwide despite improvements in oral health. It is one of the leading causes for extraction of teeth. Untreated caries may lead to pain and infection causing negative impact on a patient's personal well-being. Implementation of preventive strategies is the most cost-effective measure to prevent dental caries and its consequences.

Objectives: To find out the consequences of untreated dental caries in the youth population using pulpal involvement, ulceration, fistula, abscess index.

Methods: A descriptive cross-sectional study was carried out in 295 patients aged 15 to 24 years visiting the Department of Conservative Dentistry and Endodontics at Kathmandu Medical College with a complaint of dental caries from October 2021 to February 2023 after obtaining ethical approval. The data obtained were entered and analysed using Statistical Package for Social Sciences. Mean, median, standard deviation, frequency and percentage were calculated depending upon the nature of data.

Results: Among various consequences of untreated dental caries, pulpal involvement was the most common consequences followed by abscess. Pupal involvement was found in 57 (19.32%) individuals and abscess in two (0.68%) individuals. None of the participants presented with ulceration and fistula. There was no significant association seen between age and sex with presence of pulpal involvement, ulceration, fistula and abscess among the individuals examined.

Conclusion: Dental caries is a global issue that affects many people. It is possible to reduce the prevalence of caries and mitigate its associated consequences by increasing awareness and implementing preventive strategies on a national level.

Key words: Decayed, missing, and filled teeth index; Dental fistula; Pulpal involvement, fistula, and abscess index; Youth.

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INTRODUCTION

Dental caries is considered one of the most significant public health problems globally even with great improvements in oral health.[1] Dental caries continues to be a serious oral health issue impacting 60-

Address for correspondence

Dr. Smriti Kharel
Lecturer, Department of Conservative Dentistry and Endodontics,
Kathmandu Medical College Teaching Hospital,
Duwakot, Bhaktapur, Nepal.
E-mail: dr.smritikharel@gmail.com

90% of school children and the vast majority of adults even in developed nations.[2] The classical Decayed, Missing, and Filled Teeth (DMFT/dmft) index developed by Klien, Palmer, and Knutson in 1938 has been used to assess dental caries for several decades worldwide.[3]

The DMFT index is a valid and reliable index which provides information on dental caries and treatment experiences such as carious tooth restoration and extraction restoration. However, DMFT index fails to provide information on the clinical consequences of untreated dental caries such as pulp involvement, ulcer, fistula and abscess.[3,4]

In 2010, Monse et al.,[5] developed a new index to evaluate the prevalence and severity of oral conditions resulting from untreated dental caries known as pulpal involvement, ulceration, fistula, and abscess (PUFA) index. Large number of surveys have been conducted on consequences of untreated caries in children, but study on the effects of untreated caries in youth population is limited.[6-9] Therefore, this study was carried out to assess the consequences of untreated dental caries in the youth population.

METHODOLOGY

A descriptive cross-sectional study was carried out in the Department of Conservative Dentistry and Endodontics in Kathmandu Medical College (KMC) from 2021 October to 2023 February after the ethical approval from Institutional Review Committee of KMC on January 4, 2021 (Ref. 1712202007).

This study included patients visiting the Department of Conservative Dentistry and Endodontics with an age range of 15 years to 24 years with dental caries having all permanent teeth who gave informed consent to participate in the study. In the case of minors (patient below 18 years of age), consent was taken from attending parents/guardians.

Convenience sampling method was used for selecting the sample. Sample size was calculated using the formula, $n = Z^2pq/e^2$ where Z (confidence level at 95%) = 1.96, p = 0.24 (24% from a similar study by Yani et al.);[6] q = 1-p; e = 005 (5% margin of error). Adding a 5% non-response rate, sample size of 295 was taken.

Initial dental caries and lesions in the surrounding tissue that were not related to the tooth with visible pulp involvement as a result of caries were excluded from the study. Furthermore, initial dental caries is non-cavitated lesion which may be difficult to diagnose and may undergo remineralisation. Clinical examination was conducted in a dental chair using a mouth mirror and an explorer by the principal investigator. A proforma was used to gather data, with the first section consisting of socio-demographic information and the second section consisting of clinical indices for dental caries as the DMFT/dmft Index and the PUFA/pufa Index.[3,5] The codes and criteria for DMFT and PUFA index are as follows:

DMFT/dmft index (D/d):[7] Lesion (decay) in a pit or fissure or smooth tooth surface with detectable cavitated soft floor or wall in permanent/primary tooth, temporary restoration present in a tooth, secondary caries in restored tooth. Missing (M/m): a permanent/primary tooth that is extracted due to caries. Filled (F/f): a permanent/primary tooth that is filled due to caries.

PUFA/pufa index (P/p):[5] Pulpal involvement is recorded when the opening of the pulp chamber is visible or when the coronal tooth structures have been destroyed by the carious process and only roots or root fragments are left. No probing is performed to diagnose pulpal involvement. Ulceration (U/u): Ulceration due to trauma from sharp pieces of tooth is recorded when sharp edges of a dislocated tooth with pulpal involvement or root fragments have caused traumatic ulceration of the surrounding soft tissues, e.g., tongue or buccal mucosa. Fistula (F/f): Fistula is scored when a pus releasing sinus tract related to a tooth with pulpal involvement is present. Abscess (A/a): Abscess is scored when a pus containing swelling related to a tooth with pulpal involvement is present.

Upper case letters were used for the permanent teeth while lower case letters were used for the primary teeth. Data analysis was done using SPSS for Windows, version 20 (IBM Corp., Armonk, N.Y., USA) and descriptive statistics were performed. Chi-square test was done to test for association.

RESULTS

The mean age of study participants was 20.21 ± 3.46 years. Out of 295 individuals studied, 136 (46.1%) were males and 159 (53.9%) were females. Among them, 57 (19.3%) were examined to have pulp involvement and two (0.6%) had abscess present in at least one tooth (Figure 1). Distribution of DMFT and PUFA scores based on the number of teeth involved (Tables 1, 2). Mean scores of DMFT and PUFA are tabulated (Table 3). The teeth that had maximum number of pulpal involvements were mandibular molars (47) followed by maxillary molars (18). Abscess was seen in mandibular molars (Table 4). There was no significant association seen between age and sex with presence of PUFA among the individuals examined (p = 0.274 and p = 0.338 respectively, Table 5).

Figure 1: **Distribution of individuals based on PUFA scores (N = 295)**

Table 1: **Distribution of DMFT scores based on number of teeth involved**

Characteristics	Number of teeth examined	No. of teeth involved n (%)
Decayed teeth (D)	8207	932 (11.3)
Missing teeth (M)	8207	53 (0.6)
Filled teeth (F)	8207	279 (3.4)
Total DMFT	**8207**	**1264 (15.4)**

Table 2: **Distribution of PUFA scores based on number of teeth involved**

Characteristics	No. of decayed teeth examined	No. of teeth involved n (%)
Visible pulpal involvement (P)	932	72 (7.7)
Ulcer (U)	932	-
Fistula (F)	932	-
Abscess (A)	932	2 (0.2)
Total PUFA	**932**	**74 (7.9)**

Table 3: **Mean scores of DMFT and PUFA indices among individuals examined**

Characteristics	No. of individuals examined	Mean ± SD
DMFT	295	4.31±2.28
PUFA	295	0.25±0.56

Table 4: **Distribution of PUFA on different teeth examined (%)**

Tooth involved	Pulpal involvement	Abscess
Maxillary anteriors	1	-
Maxillary premolars	2	-
Maxillary molars	18	-
Mandibular anteriors	1	-
Mandibular premolars	3	-
Mandibular molars	47	2

Table 5: Association of PUFA scores with demographic characteristics

Characteristics	Category	No. of study participants, n (%)		p-value
		PUFA score 0	PUFA score ≥1	
Age in years	<18	79 (84.0)	15 (16.0)	0.274
	≥18	158 (78.6)	43 (21.4)	
Sex	Male	106 (77.9)	30 (22.1)	0.338
	Female	131 (82.4)	28 (17.6)	

DISCUSSION

Dental caries continues to be a common infectious disease despite the advancement in its detection and prevention.[10] The untreated decay of permanent teeth is widely regarded as the most common oral health condition worldwide.[11] Multiple studies have indicated that leaving a caries untreated can result in issues such as difficulty sleeping, eating, and maintaining a healthy weight, as well as increased school absenteeism and work loss. These problems can ultimately have a negative impact on a person's overall well-being. The classical DMFT index provides information on dental caries, restorative and surgical treatment but fails to provide information on the clinical consequences of untreated caries such as pulp involvement and tooth abscess. These complications are more serious than the carious lesion themselves. The failure of DMFT index to provide the information on the clinical ramifications of untreated dental caries is the basis for the development of PUFA index. PUFA index records the advanced stages of untreated carious lesion which is not possible with DMFT index.[5,9,12-15]

This study was carried out in a hospital setting to assess untreated caries in young adults of 15 to 24 years age. The patients reporting with the dental caries were selected and the consequences of untreated dental caries were assessed by means of PUFA index.

When considered independently, the "decayed" element of DMFT played a significant role in contributing to the cumulative index score aligning to the study by Khanal et al.[7] in Nepal but no missing and filled component were reported in the study in permanent dentition.

Among various PUFA scores, pulpal involvement was found to be the most common consequence comprising 57 (19.3%) individuals. This finding corresponds to the study conducted in Nepal by Khanal et al. in permanent dentition.[7] A few (2%) cases of abscess were found in this study. However, no cases of abscess were reported in a similar study by Khanal et al.,[7] in permanent dentition, Manivannan et al.,[16] in age group 6 years to 17 years and Yani et al.,[6] in teenagers. The intermittent nature of abscess may have led to the underestimation of abscess.[17] Fistula and ulceration were not present in our study similar to the study by Manivannam et al.,[16] and Khanal et al.[7], although negligible (0.8%) fistula were seen in the study conducted by Yani et al.[6]

The average score for PUFA among individuals examined was 0.25±0.56, which is consistent with the results reported by Praveen et al.[20] (mean score of 0.40) in a study that included participants aged 19 to 60 years and Khanal et al.,[7] (mean score of 0.11 ± 0.48) specifically in the context of permanent dentition. The participation of females (159, 53.9%) was higher than that of males (136, 46.1%) in this study. Furthermore, there was no significant association between age, sex, and the presence of PUFA among the individuals examined, which is consistent with the results of a study conducted by Manivannan et al.[16]

When analysing the distribution of the PUFA index across the different teeth examined, it was found that mandibular molars exhibited the highest level of pulp involvement followed by maxillary molars, premolars and anteriors. This could possibly be due to the fact that mandibular first molar is the initial permanent tooth to erupt. This condition increases the tooth's susceptibility to decay, and if left untreated, may eventually result in the need for extraction.[21-23] There are number of studies related to the clinical consequences of untreated dental caries.[5-7,9,11,16,17,24] However our study identified the clinical consequences of untreated caries along with its distribution on number of teeth examined. PUFA index evaluates four clinical stages related to untreated tooth decay, which provides a comprehensive view of the condition, however it should be noted that this is not an index of treatment need.[24]

A limitation of this study is that it was conducted at a single centre and had a limited sample size, which means that its findings may not be generalisable to the entire population of the country.

Within this study, the combined use of both DMFT index and PUFA index yielded invaluable insights into the overall count of untreated caries cases that progressed to severe consequences. Health planners can obtain useful information in making oral health policies in Nepal by using PUFA index along with DMFT.[5]

CONCLUSION

The present study identified a lack of attention given to oral health among the youth population which led to pulpal involvement and odontogenic infections earlier in life. The PUFA index used in this study is a relevant and valuable measurement tool that can effectively address the neglected issue of untreated caries and its associated consequences. However, it is important to note that implementing preventive strategies to decrease the prevalence of caries would be more cost-effective and help avoid the clinical consequences highlighted by PUFA scores.

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