Clinical consequences of untreated dental caries evaluated using PUFA index in orphanage children from India

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ABSTRACT

Background: To determine the prevalence and severity of oral condition related to untreated dental caries with PUFA index and to relate period of institutional stay, oral hygiene practice and diet of orphan children to caries experience ratio.

Materials & Methods: A cross sectional survey conducted among 488 children of 12-14 years living in 5 different orphanages of Mysore district, India. Data regarding oral hygiene practices and oral health status (PUFA, DMFT, OH I-S and GI) were collected through structured questionnaire and by type III clinical oral examinations. The collected data were processed statistically.

Results: The PUFA ratio indicates 21% of decayed component had progressed to pulp involvement and abscess formation. The overall prevalence of PUFA was 37.7%. 31.1% children showed one or more pulpally involved tooth in their oral cavity. Correlation between periods for being the child in the institute to DMFT showed negative value indicting decrease in DMFT as the duration of stay in orphanage increases.

Conclusion: The result show oral health condition in orphan children was neglected. Children from this disadvantaged background have shown a high prevalence of dental caries with low dental care utilization. PUFA index is an effective index in evaluating clinical consequences of un-treated caries.

Key Words: Dental neglect, Oral health, PUFA Index, Orphanage Children, Socially handicapped.

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Introduction

Socially handicapped children are those children whose healthy personality development and full unfolding of potentialities are hampered by certain elements in their social environment such as parental inadequacy, environmental deprivation, and emotional disturbances.[1] The vast majority of children are placed in orphanages as a result of neglect, parental absence, parental substance abuse or abandonment. Many children enter orphanages with chronic health, developmental, and psychiatric disorders, reflecting the neglect and abuse experienced before placement in addition to the trauma from being separated from their parents.[2] The pattern of orphanage living is different from family living as the former provides physical security, food, and shelter but is devoid of psychological security. These children form a

population at risk with reference to abnormal psychosocial development.[3] More disturbing, however, is evidence that their health care is often neglected while in orphanages.[2] In 1995, the US General Accounting Office found that young children in orphanage do not receive adequate preventive health care while in placement, many significant problems go undetected, or, if diagnosed, are not evaluated and treated.[4] Children from orphanages have shown a high prevalence of dental caries,[5] gingivitis, and dental trauma.[6] This has been attributed to overcrowding, lack of adequate staff, poor oral hygiene, improper dietary habits, inadequacies in the orphanage system, as well as inadequacies in the health care system.[3, 4]

Dental caries is a global public health problem, especially in children. Most caries in developing countries remains untreated. The burden of untreated caries in children has been documented in several studies.[7-9] The consequences of untreated caries often present as dental emergencies in children's hospitals.[10] Research suggests that untreated caries can have an effect on children's growth and their general health.[11-13] Only limited data are available on the clinical consequences of untreated dental caries because there is no measure to quantify the prevalence and severity of oral conditions resulting from untreated dental caries.[7-8] For the last 70 years, data on caries have been collected worldwide using the DMFT/dmft index.[14] This classical index provides information on caries and restorative and surgical treatment but fails to provide information on the clinical consequences of untreated dental caries, such as pulpal involvement and dental abscess, which may be more serious than the caries lesions themselves.[15-16] The PUFA index records the presence of severely decayed teeth with visible pulpal involvement (P/p), ulceration caused by dislocated tooth fragments (U/u), fistula (F/f) and abscess (A/a); capital letters are for permanent and lower-case letters are for deciduous teeth. The PUFA/pufa score is calculated cumulatively representing the number of teeth that meet the PUFA/ pufa diagnostic criteria.[17] In this study an attempt has been made to relate caries prevalence with PUFA and oral health practice of orphanage children. First objective of the study is to determine the prevalence and severity of oral condition related to untreated caries. Second objective is to relate

oral hygiene practice to that of caries experience with PUFA ratio (Untreated caries) in orphanage children from India.

Materials and Method

This cross-sectional survey was conducted among 488 children of 12-14 years with mean age of 13.6 years of which 216 (44.26%) were boys and 272(55.74%) were girls, living in 5 different orphanage houses of Mysore district, Karnataka state, India. Participants were randomly selected from 5 different orphanage houses which were either run by government authority or aided by government. For this study, a minimum sample size of 456 children was required to estimate the association between caries experience (DMFT > 0) and child's overall well-being, with 95% confidence interval, 80% statistical power and assuming 45% prevalence of impacts in children with and without caries experience, respectively.

Ethical approval for the study was obtained from the institutional ethical committee board and University board. A letter was sent to primary care giver of all five orphanages explaining the aims of the study and asking them for their consent for concerned orphanage children to participate in the study and written consent was obtained. Also children who participated in the study informed regarding the aim of the study and assent was obtained. Total 512 children were participated in the study. Among 512 children 24 were excluded due to obtaining of incomplete information. The final sample size were included was 488.

Data Collection

Two examiners who had experience in epidemiological surveys carried out the study. They had a training and calibration exercise before the survey. A sample of 25 children was used to train the examiners and test the feasibility of the dental examination and the interview procedures. These 25 children were not included in the main study. During the fieldwork, duplicate examinations were carried out on randomly selected children to assess intra- and inter-examiner agreement. Intra and inter examiner reliability was assessed using kappa statistics that was in the range of 0.8.

Questionnaire survey

The questionnaire survey included 11 items with closed ended questions. The questioner was prepared to assess the attitude and practice of children who are living in the orphanages. The questionnaire was translated to regional language (kannada) by language expert which is validated and reliability was checked before using in the main study. The questionnaire consisted of three parts. First two questions (question no. 1 and 2) assessed attitude, next eight questions (question no. 3-10) assessed oral health practice and last question (question No. 11) assessed pain frequency of orphanage children. Children themselves recorded questionnaire provided to them. Furthermore, the investigator was always available during the completion of the questionnaire and the participants were encouraged to approach the investigator, whenever they needed to clarify at any point. For each child data regarding the year of being in the institution was also recorded.

Clinical examination

Children were clinically examined seated on a chair with back rest under natural light. Before the clinical examination, wet gauze pads were used to clean the tooth surfaces of loose debris. Type III clinical examination was carried out. Radiographs were not taken.

Dental caries was recorded at tooth level according to the WHO diagnostic criteria[18], and the DMFT index was used to obtain the prevalence of dental caries. The simplified oral hygiene index (OHI-S) (Green and Vermillion 1964) was used to assess the oral hygiene status.[19] The OHI-S has two components, the Debris Index-S and the Calculus Index-S. Each of these indices, in turn, is based on numerical determinations representing the amount of debris or calculus found on the preselected tooth surfaces. The six surfaces examined for the OHI-S were selected from four posterior and two anterior teeth. The average individual or group debris and calculus scores were combined to obtain the Simplified Oral Hygiene Index. The CI-S and DI-S values may range from 0 to 3; the OHI-S values from 0 to 6. OHI-S score represents both debris and calculus (proxy indicators of oral hygiene)

in one score, thereby permitting the correlation of oral hygiene with attitude and practice scores separately. Gingival index (Loe and Silness 1963) [20] was used to assess the gingival health status. The Gingival Index records qualitative changes in the gingiva. It scores the marginal and interproximal tissues separately. GI assesses the prevalence and severity of gingivitis with score indicating from 0.1-1.0 = mild inflammation; 1.1-2.0 = moderate inflammation from, and 2.1-3.0 signifies severe inflammation.

The severity of oral conditions resulting from untreated dental caries was recorded using the PUFA index17, which was assessed separately from the condition of teeth. The PUFA index recorded the presence of severely decayed teeth with visible pulp involvement (P), ulceration of the oral mucosa owing to root fragments (U), presence of fistula (F) and presence of abscess (A). The index is recorded separately from DMFT. Lesions in the surrounding tissues that are not related to a tooth with visible pulpal involvement as a result of caries are not recorded. The assessment is made visually without the use of an instrument. Only one score was assigned per tooth In case of doubt concerning the extent of odontogenic infection the basic score was assigned.[17] For the children with positive history of pain the reason of pain was clinically assessed and noted.

The collected data were processed by means of the Statistical package for the social sciences (SPSS) version 17.0. Attitude and practice scores were calculated separately and were then correlated with OHI-S, DMFT and Gingival Index scores. Spearman's correlation test was used to measure the correlation. Chi-Square test was used for comparison of proportion of, reason for pain to DMFT and frequency of pain to PUFA. PUFA ratio was calculated with formula PUFA*100/D.[17]

Results

Structured questionnaire

1) **Oral health attitude**

   81.8% of children said they know how to keep their oral cavity clean. However 90.2% of them want to know more regarding method, aids and other relevant information regarding keeping their oral cavity clean and healthy (Table 1).

2) **Oral health practice**

All the children reported that they are cleaning their teeth with brush and paste twice daily. However before joining to orphanage only 72.1% of children were using brush and paste for cleaning their teeth. Other 27.9% were using other methods namely tooth powder and brush (9.6%), tooth powder and finger (3.5%), finger and salt (9.2%), finger and charcoal (3.3%) and neem stick (2.3%) respectively. Before joining to orphanage 95.1% of children used to clean their oral cavity once daily. No child is using mouth rinse or floss as an oral hygiene aid before or after joining the orphanage. 88.7% children had never visited the dentist in their life time (Table 1).

Clinical examination

DMFT, OHI-S, GI and PUFA

Of 488, 88.5% children showed one or more decayed tooth in their oral cavity. 60.6% of children showed more than 4 caries teeth in their oral cavity. Comparison of mean DMFT values with respect to the gender, girls showed little higher values (3.73) compa-

SN	Question	Response	Number	Percentage
Table 1: Frequency table for question and answer				
1	Do you know how to keep your teeth clean?	Yes	399	81.8
		No	89	18.2
2	Do you want to know more about how to keep your teeth clean?	Yes	440	90.2
		No	48	9.8
3	Do you clean your teeth with tooth brush and paste?	Yes	488	100
		No	0	00
4	Before joining to orphanage you were using brush and paste to clean teeth	Yes	352	72.1
		No	136	27.9
5	If No, what you were using to clean the teeth?	A*	47	9.6
		B	17	3.5
		C	11	2.3
		D	45	9.2
		E	16	3.3
6	Frequency of brushing after joining the orphanage twice?	Once	00	00
		Twice	488	100
7	Frequency of cleaning the teeth before joining the orphanage?	Once	464	95.1
		Twice	24	4.9
8	Do you use dental floss to clean your teeth?	Yes	00	00
		No	488	100
9	Do you use mouth rinse?	Yes	00	00
		No	488	100
10	Have you been to a dentist past years?	Yes	55	11.3
		No	433	88.7
11	How often do you experience pain in oral cavity	Never	344	70.5
		Occasionally	81	16.6
		Often	63	12.9

* For Question no 5

A. Tooth brush and Tooth powder

B. Finger and Tooth powder

C. Neem stick

D. Finger and salt

E. Finger and charcoal

Table 2: Mean values for DMFT				
	Decayed	**Missing**	**Filled**	**DMFT**
Mean	3.43	0.09	0.08	3.56
Std. Deviation	2.03	0.35	0.38	2.06
Minimum	0.00	0.00	0.00	0.00
Maximum	9.00	2.00	2.00	9.00

Table 3: Frequency values for PUFA	
Mean	3.43	0.09
Std. Deviation	2.03	0.35
Minimum	0.00	0.00
Maximum	9.00	2.00

Table 4: Mean values for PUFA				
	P	U	F	A
Mean	0.52	0.05	0.07	0.08
Std. Deviation	0.86	0.22	0.31	0.31
Minimum	0.00	0.00	0.00	0.00
Maximum	3.00	1.00	2.00	2.00

with moderate gingival inflammation.

The overall prevalence of PUFA was 37.7% (Table 3). 31.1% children showed one or more pulpally involved tooth in their oral cavity. 4.7% children showed fistula and 6.8% showed presence of abscess in their oral cavity. Over all in PUFA, P (Pulp involvement) component showed highest value with mean of 0.52 followed by A (abscess) 0.08, F (fistula) 0.07 and U (ulcer) 0.05 (Table 4). The untreated caries PUFA ratio is 21% calculated with formula PUFA*100/D. This

Table 5: Correlation between Practice and Oral health status				
Spearman's rho		**DMFT**	**OHI-S**	**GI**
Practice	Correlation Coefficient	-0.661(**)	-0.620(**)	-0.597(**)
	Sig. (2-tailed)	0.001	0.001	0.001
** Correlation is significant at the 0.01 level (2-tailed).				

red to that of boys (3.33). Comparing DMF components D component showed maximum value with mean of 3.42 followed by filled 0.375 and missing 0.348. The overall mean DMFT value was 3.55 (Table 2).

Frequency table for OHI-S showed 47.5% children with fair and 32.8% with poor oral hygiene. Only 19.7% children were having good oral hygiene. GI showed 36.1% children with mild gingival inflammation 27.9%

indicates 21% of decayed component had progressed mainly to pulpal involvement.

29.5% children said they had pain in oral cavity at least once in past three months, of which 16.6% experienced pain occasionally and 12.9% experienced pain often. Clinical evaluation of children with pain revealed, decayed tooth as the main reason for pain followed by traumatic injuries of tooth and other reasons, like

Table 6: Relation of PUFA with frequency of pain with chi-Square Tests			
	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	185.079(a)	10	0.001
Likelihood Ratio	147.290	10	0.001
Linear-by-Linear Association	75.460	1	0.001
N of Valid Cases	488		

6 cells (33.3%) have expected count less than 5. The minimum expected count is 1.18

Table 7: Relation of DMFT with reason of pain with chi-Square Tests			
	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	65.148(a)	27	0.001
Likelihood Ratio	63.689	27	0.001
Linear-by-Linear Association	1.041	1	0.308
N of Valid Cases	488		

21 cells (52.5%) have expected count less than 5. The minimum expected count is .39.

erupting tooth, oral ulcer, temporo-mandibular joint pain etc.

Correlation between all the data

Correlation between practice to OHI-S, DMFT and Gingival index shows highly significant negative relation, suggesting children with poor practice have poor oral hygiene, poor gingival health status and more number of decayed tooth. Highly significant positive correlation was observed between OHI-S and Gingival Index suggesting children with good oral hygiene have better gingival health status. DMFT showing highly significant positive correlation with OHI-S suggesting children with good oral hygiene have less number of caries (Table 5). Relation of pain frequency to PUFA showed highly significant correlation with $p<0.001$ (Table 6) and relation between reason for pain to decayed tooth also showed highly significant correlation with $p<0.001$(Table 7). Correlation between periods for being the child in the institute to DMFT showed statistically non significant negative value suggesting, as the duration of stay increases in the orphanage DMFT decreases (Table 8 and 9).

Discussion

The modern concept of dental caries involves the interaction between genetic and environmental factors in which biological, social, behavioral, and psychological components are expressed in a highly complex and interactive manner [21]. There are very few specific studies describing the status of dental caries in orphan children living under institutionalized care in India. [22-23] However no study is reported which describes the clinical consequences of untreated caries in theses deprived group of children. In present study the 5 different orphanages from which children selected, are either run by the government or government aided. Each orphanage is provided with teaching and non teaching faculty who along with primary caregiver of the orphanage takes care of the children. Looking at the dietary pattern and habit of these children, type of food selection is strictly done by government authority which makes sure that children are provided with nutritious, healthy, and fibrous food which is low in sugar content. The frequency and

timing of the breakfast, lunch and dinner is fixed. No in between snacking is permitted. Weekly once children are provided with sweets made of jaggery and supplied at the time of lunch. Hence dietary habit of children looks to be non- cariogenic in nature.

Table 8: Mean period for being the child in the institution

Mean	Std. Deviation	N
5.4936	2.63349	488

Table 9: Correlation between period for being the child in the institute to DMFT

Spearman's rho		period for being the child in the institute
DMFT	Correlation Coefficient	-0.036
	Sig. (2-tailed)	0.432

Correlation is significant at the 0.01 level (2-tailed).

Looking at the oral hygiene practice each child is provided with brush and fluoridated paste and it is made compulsory to brush twice daily. In-spite 88.5% children showed one or more decayed tooth in their oral cavity and of which 60.6% children have more than four decayed teeth in their mouth with overall mean DMFT value being 3.55. The results of this study are not in accordance with a generally accepted opinion that institutionalized children tend to be less susceptible to caries attack. There are number of factors pertaining to variance of the result of present study with other studies. The children of this study had a variable period of institutionalization with mean period being 5.5 years and were not brought up in such institutions from infancy. When we look at the oral hygiene practice of children before their joining to orphanage the oral cavity cleaning habit shows large variation in terms of both aids used and in frequency. 95.1% children use to clean their oral cavity once daily and 28% never used brush and paste to clean their oral cavity before joining the orphanage. Past caries experience, before the children were institutionalized, and which was negelectedcould be the reason for high dental caries scores of these children.

The prevalence of dental caries of Indian children aged

12-14 who were born and brought up by parents ranged from 60.41% to 79.48 % [Mishra and Shee 1979; Chopra et al, 1983; Damle and Patel, 1994; Gauba et al, 1986] which is less than the values that we obtained (88.5 %). According to the National Oral Health Survey, 2002-2003, the mean DMFT/deft is 1.8 in the 12 years of age groups in India [Dixit S et al., 2009]. However, the mean DMFT/deft was found to be 3.55 in the orphanages in the 12-14 years age groups, which is significantly higher than the index values in the general population.

Correlation between periods for being the child in the institute to DMFT showed decrease in DMFT as the duration of stay in orphanage increases. Taanenbaum and Miller [24] reported that caries attack rate was less in children staying in the institution for a longer period. An interesting observation of this study was that children were allowed to visit their relatives and homes during school vacations. During this period, not only was their pattern of living disturbed, but also important changes in their daily diet may have occurred. Similar kind of findings were seen by Suher [25] As far as restriction of refined sugar intake was concerned, the people felt sympathetic toward the plight of these children and pampered them with sweets and snacks at the orphanages on social occasions.

In many low- and middle-income countries, cavitated teeth are not being treated for various reasons [26] Low and middle income countries as well as deprived communities within high income countries where in people have little access even to the most basic forms of care we need a diagnostic index that address the advanced stages of untreated caries lesion. The commonly used DMF index does not address the consequences of untreated advanced stages of carious lesion progression beyond dentine, which PUFA does. PUFA is, therefore, an index emerged because of the lack of an index that could describe the burden of untreated cavitated caries lesions at the tooth and surrounding tissue stages.[17]

Looking at the PUFA index of this study 37% of children showed positive scores of which 31% showed frank pulpal involvement. PUFA ratio showed 21% of decayed tooth because of neglect underwent pulpal involvement. This finding clearly shows neglected oral health condition in orphan children living under institutionalized care. The main reason for this may be low dentist attendance. The dentist attendance by children showed very low scores with only 11% of children visited the dentist in their life time. Comparison of decayed component to filled component clearly shows only 10% is treated of 87% decayed tooth which supports low dentist attendance. Children from these disadvantaged backgrounds have shown a high prevalence of dental caries and their utilization of dental care is low. Similar findings were reported by Saravanan S et al 2008; [27]

Second reason may be negligence, lack of supervision and reinforcement of authorities of orphanages. Correlation between pain and PUFA showed statistically significant relation indicating children with positive scores for PUFA had often suffered pain in oral cavity. Whenever pain comes children are given symptomatic medication to relive pain but no dental visit are planned or treatment is arranged for these children. Other reason may be the cost. The socio-economic status of government run orphanages in our country is low, with limited money granted for their maintenance. This results in a very low budget for food, medical and odontological attention. These orphanages are sponsored to a large extent by donations.[28] Also provision of oral health care in developing countries like India is limited due to lack of adequate dental manpower, financial resources, and lack of perceived need for dental care among the people.[27] Utilization of dental services is mainly for the relief of pain where the mother plays the primary motivating factor.[29] But the children from our study even are suffering from pain due to oral conditions related to untreated caries are neglected and not being treated. Preventive services are seldom received by these children.

Siddiqui[3] reported that in most of the orphanages of India, there was no health facility available and there was a total absence of health education. Manati and Saraswati[30] further stated that most of the institutions were overcrowded; underfunded; there was lack of trained staff and were not equipped to meet the developmental needs of children. Therefore, the difference in caries could have been due to lack of awareness, motivation, and accessibility to health care combined with prohibitive cost of dental health care.

Conclusion

PUFA index is an effective index in evaluating clinical consequences of un-treated caries and help to understand and plan for treatment program in large for these socially deprived group of society. The result show oral health condition in orphan children living in institutionalized care was neglected. Children from this disadvantaged background have shown a high prevalence of dental caries with low dental care utilization. We recommend

- Teaching staff of orphanage should be educated regarding oral health care and its maintenance and they in turn educate the children regarding the same with proper supervision and reinforcement.

- It should be made mandatory for these children of orphanages to visit dentist either to dental college or government hospital at least once in 6 month.

- Implementation of prevention oriented comprehensive dental health care programs (CDHP) could help in reducing the burden of oral diseases.

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