Original Article

Journal of Iranian Medical Council, Volume 9, Issue no. 1
http://dx.doi.org/10.18502/jimc.v9i1.20493

Relation between Consequences of Untreated Dental Caries (Pufa Index) and Oral Health Related Quality of Life in 4 to 6 Years Old Children

Narjes Amrollahi[1], Sanaz Ziaee[1] and Shiva Ghasemi[2*]

1. Dental Research Center, Department of Pediatric Dentistry, Dental Research Institute, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran

2. Dental Students' Research Committee, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran

*** Corresponding author**

Shiva Ghasemi, DDS
Dental Students' Research Committee, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran
Tel: +98 31 3792 5539
Fax: +98 31 3668 7080
Email: shiva.ghasemi.daneshjoo@gmail.com

Received: 20 Oct 2024
Accepted: 19 Apr 2025

Citation to this article
Amrollahi N, Ziaee S, Ghasemi Sh. Relation between Consequences of Untreated Dental Caries (Pufa Index) and Oral Health Related Quality of Life in 4 to 6 Years Old Children. *J Iran Med Counc.* 2026;9(1):190-96.

Abstract

Background: Caries is one of the most common childhood diseases. PUFA/pufa index, as a consequence of untreated caries (describes as pulp involvement, ulcers, fistulas and abscesses) affect oral functions and social interactions of children and reduce their Oral Health-Related Quality of Life (OHRQoL). The aim of this study was to investigate the relationship between the pufa index and OHRQoL in children aged 4 to 6 years.

Methods: This descriptive-analytical, cross-sectional study was conducted on 200 children referred to the School of Dentistry and Dental Clinics of Isfahan University of Medical Sciences. The children were examined, and their parents completed an OHRQoL questionnaire. The examination was conducted by a practitioner. The data were then analyzed using SPSS 26 software, including mean and standard deviation, Spearman correlation coefficient, and T-Test. The significance level was set at <0.05.

Results: 200 children consisting of 95 boys (47.5%) and 105 girls (52.5%) were participated in this study. The mean score of OHRQoL was 59.77±9.66. There was a significant and inverse relation between p and pufa score with OHRQoL ($p<0.001$). u, f, and a indices had a negative relation with OHRQoL ($p<0/001$).

Conclusion: Based on the findings of this study, the consequences of untreated caries, including caries with pulp involvement, ulcers, fistulas and abscesses, have a significant and negative impact on children, reducing OHRQoL.

Keywords: Child, Dental caries susceptibility, Dental clinics, Entistry, Parents, Ulcer

Introduction

Dental caries is a significant public health concern, particularly in low-income countries (1,2). Oral health is a crucial component of children's overall well-being. The impact of oral and dental health on quality of life, especially for children, is substantial, affecting the daily activities of both children and their parents (3).

Early Childhood Caries (ECC) is characterized by the presence of one or more cavitated lesions on the smooth surfaces of maxillary anterior teeth, or more than four decayed, missing, or filled surfaces in 3-year-old children (4). The DMFT/dmft index (Decayed, Missing, and Filled Teeth) is commonly used to assess dental status across various populations and age groups. However, this index provides limited information regarding the consequences of untreated caries; it primarily documents the presence of caries, restorations, and missing teeth, but does not include details about more complex squeal (5).

Specifically, the DMFT/dmft index does not account for pulp involvement as a consequence of dental caries. In 2010, a new index, PUFA/pufa (presence of pulp involvement, ulceration caused by tooth fragments, fistula, and abscess), was introduced to quantify the frequency and severity of clinical outcomes resulting from untreated caries. This index specifically records exposed pulp, oral mucosal ulceration due to remaining roots, fistulas, and abscesses.(7 ,6)

The concept of Oral Health-Related Quality of Life (OHRQoL) was developed as a multi-dimensional construct that encompasses physical, social, and psychological aspects. OHRQoL reflects an individual's satisfaction with their oral condition and the degree to which their daily functioning is affected or impaired by this condition (8). ECC is one of the most prevalent chronic conditions among children and can significantly impair their OHRQoL by impacting fundamental activities such as eating, sleeping, and speaking, in addition to their general health. Untreated ECC may progress, potentially leading to serious complications and even hospitalization (9).

Cross-sectional studies have consistently demonstrated the negative impact of dental caries on children's quality of life across various age groups. The PUFA/pufa index aims to complement the DMFT/dmft index by providing additional information about the consequences of untreated dental decay. Untreated dental caries has been associated with a negative effect on general health, growth and development, academic performance, and OHRQoL (10-13).

This study assessed the specific impact of dental caries, as measured by the pufa index (pulp involvement, ulcers, fistulas, and abscesses), on the quality of life of children aged 4-6 years. Unlike other studies that often rely on the DMFT index, (11-14) this research focuses on the effect of specific sequelae of untreated caries, as captured by the pufa index in a preschool-aged population. The aim of this study was to investigate the relationship between the pufa index and OHRQoL in children aged 4 to 6 years.

Materials and Methods

This descriptive-analytical cross-sectional study was approved by the ethics committee of Isfahan University of Medical Sciences with ethics code IR.MUI.RESEARCH.REC.1399.774. The sample size was calculated to be 200 children (k=0.14, z=1.96, $\boldsymbol{\sigma}$=0.14). With this number of samples, there is 95% confidence that the mean of pufa index will be estimated with a maximum error ($\boldsymbol{\sigma}$) of 0.14.

$$n=\frac{z^2_{1-\frac{\alpha}{2}}\sigma^2}{d^2}=\frac{z^2_{1-\frac{\alpha}{2}}\sigma^2}{(k\,\sigma)^2}=\frac{z^2_{1-\frac{\alpha}{2}}}{k^2}=\frac{1/96^2}{0/14}=\frac{3/8416}{0/0196}=196\simeq 200$$

In this study, 200 children aged 4-6 who were referred to the School of Dentistry and Dental Clinics of Isfahan University of Medical Sciences were selected using convenience sampling method in 2023. The samples were collected over a period of 2 months, and an average of 5 patients were carefully examined daily. They were included in the study with the informed consent of their parents. Children who were uncooperative, had any systemic diseases or congenital disorders, showed symptoms of fluorosis or enamel developmental defects, had severe dental abnormalities, enamel and dentin disorders, or severe dental irregularities were excluded from the study.

After obtaining informed consent from the parents, the examination was conducted by a pediatric dentist with 10 years of experience. Using a mouth mirror under natural light, with the child standing in front of the practitioner, examination was conducted. Lesions were recorded by visual examination without taking radiographs. The P/p index was recorded in teeth with

visible exposed pulp (without probing) or remaining roots, considering only the worst condition for each tooth. The U/u index was determined as ulceration due to trauma from sharp pieces of dislocated tooth with pulpal involvement or root fragments. The F/f index was described as pus releasing sinus tract related to a tooth with pulpal involvement. The A/a index is related to pus containing swelling in a tooth with pulpal involvement (18). The oral condition of all 200 children was examined and their p, u, f, a and pufa indices were checked. The data obtained from the examination were recorded in the pufa checklist by the researcher. To assess the intra-examiner reliability about 10% of children were re-examined after two weeks and Kappa was determined 0.88 for pufa index which is reasonable.

Additionally, the parents completed the F-ECOHIS questionnaire (19) to assess their children's quality of life. The validity of the Persian version of this questionnaire has been confirmed in Jabarifar *et al*'s study (19). This questionare comprises 13 questions concerning the impacts of oral health on the daily activities of the child (9 questions) and the family (4 questions). Each question assesses the frequency of a problem related to oral health. To calculate the quality-of-life score in the F-ECOHIS questionnaire, a score of 5 was given for "never," 4 for "very rarely," 3 for "only a few times," 2 for "many times," 1 for "always," and 0 for "not knowing". The minimum possible score for OHRQoL is 0 and the maximum score is 73.

Data analysis was performed using SSPS Version 26.0 software and descriptive statistics methods, including calculation of mean and standard deviation, frequency and distribution tables, and analytical statistics methods (Spearman's correlation coefficient test and t-test). The significance level was considered to be <0.05.

Results

In this research, 200 individuals from the pediatric department and clinics of the Isfahan Faculty of Dentistry were included, consisting of 95 boys (47.5%) and 105 girls (52.5%), with 71 individuals (35.5%) in the 4-5 age group and 129 individuals (64.5%) in the 5-6 age group. The children's quality of life questionnaire was completed by a companion, with 49 fathers (24.5%), 143 mothers (71.5%), and 8 others (0.4%) participating in the questionnaire completion process (Table 1).

Table 1. Demographic information of the study participants

Demographic information		Frequency	
		Number	Percentage
Gender	Boy	95	47.5
	Girl	105	52.5
Sex	4-5 Years	71	35.5
	5-6 Years	129	64.5
Questionnaire completion	Father	49	24.5
	Mother	143	71.5
	Others	8	4.0

Table 2. Mean and standard deviation of the indices in the study

Index	Mean	SD
p[α]	1.38	1.63
u[ϕ]	0.09	0.31
f[β]	0.11	0.32
a[ε]	0.12	0.33
pufa	1.71	1.94
OHRQoL*	59.77	9.66

[α]Pulp involvement; [ϕ]Ulcer;[β]Fistula;[ε]Abscess

*Oral Health Related Quality of Life.

Table 3. Relation of p and pufa with OHRQoL

OHRQoL*	Spearman's correlation coefficient	p-value
p[α]	-0.483	<0.001
pufa	-0.569	<0.001

[α]Pulp involvement; *Oral Health Related Quality of Life.

The number of p index was recorded in the range of 0-7. However, u and f index were in the range of 0-2, A index in the range of 0-1 and pufa index in the range of 0-9. The mean of pufa index was 1.71±1.94, which was predominantly related to pulp involvement due to dental caries with the mean of 1.38±1.63. The effect of other factors such as abscess, fistula and ulcer were almost similar with means of 0.12±0.33, 0.11±0.32, and 0.09±0.31, respectively. In this population, the

Table 4. Relation of u, f, a indexes with OHRQoL

Index Percentage		Frequency		OHRQoL		p-value (T-test)
		Number	Mean score	SD		
uϕ	0	91.0	182	60.37	9.63	0.005
	1	8.5	17	53.58	8.00	
fβ	0	89.5	179	60.62	9.45	0.001
	1	10.0	20	52.90	8.54	
aε	0	87.5	175	60.88	9.34	<0.001
	1	12.5	25	51.96	8.25	

ϕUlcer;βFistula;εAbscess.

Table 5. Comparison of pufa and OHRQoL according to age group and gender

Index	Variables	p-value (T-test)
pufaα	Age group	0.204
	Gender	0.312
OHRQoL*	Age group	0.008
	Gender	0.101

*Oral Health Related Quality of Life; αPulp involvement, Ulcer, Fistula, Abscess.

OHRQoL score was in the range of 35-73 and with a mean of 59.77±9.66 (Table 2).

The calculation of Spearman's correlation coefficient revealed a significant reverse relationship between the p score and the OHRQoL of children aged 4-6 years ($p<0.001$, $r=-0.483$). Similarly, a significant reverse relationship was observed between the pufa score and OHRQoL ($p<0.001$, $r=-0.569$) (Table 3).

By examining the t-test, a significant difference was observed in the OHRQoL scores of children aged 4-6 with ulcers (u=0) and without ulcers (u=1) (p=0.005). Additionally, the t-test revealed a significant difference in OHRQoL scores of children with fistulas (f=0) and without fistulas (f=1) (p=0.001). Similarly, a significant difference was found in the OHRQoL scores of children with abscesses (a=0) and without abscesses (a=1), ($p<0.001$) (Table 4).

To investigate the relationship between the pufa index and the age of children, a t-test was conducted. The results showed no significant difference in the pufa index between 4-5-year-old children and 5-6-year ones. (p=0.204). Additionally, there was no significant difference in the pufa index between boys and girls aged 4-6 years. (p=0.312) The t-test results indicated a significant difference in the quality of life between 4-5-year-old children and 5-6-year ones, with the younger group having a higher quality of life (p=0.008). However, there was no significant difference in the quality of life between boys and girls. (p=0.101) (Table 5).

Discussion

Dental caries and overall oral health are critical determinants of children's general well-being. The impact of oral health on children's quality of life is substantial, influencing their daily activities. This study aimed to investigate the relationship between the pufa index (measuring the presence of pulp involvement, ulceration, fistula, and abscesses due to caries) and OHRQoL in children aged 4 to 6 years. The number of severely decayed teeth with pulp involvement (p index) in children negatively affected OHRQoL. Also, as the pufa score increased in children, their OHRQoL decreased. Children with oral ulcers (u index) have a lower quality of life compared to those without ulcers. Children with fistulas (f index) and abscesses (a index) have a lower quality of life than without ones.

The findings revealed a significant relationship between the pufa index and its components with OHRQoL. A higher pufa index was associated with a decrease in OHRQoL. This is likely due to tooth pain with pulp exposure when eating or drinking, ulcer-related discomfort during mastication and speech, and the severe pain and associated disruptions caused by

fistulas and abscesses, which can interfere with daily functioning and school activities. These findings are supported by several studies, including those by Correa-Faria *et al* (20), Karki *et al* (21), Mota-Veloso *et al* (12), and Duangthip *et al* (22), which all reported a negative impact of pufa on OHRQoL. Additionally, studies by Sharna *et al* (23) and Amiri *et al* (24) demonstrated that both pulp exposure and the overall pufa index contribute to reduced quality of life.

Similarly in Sajadi *et al* (25) study, an inverse relationship between caries and OHRQoL was observed. Furthermore, Nemati *et al* (26) also found that oral health negatively affects OHRQoL. In the study by Jaggi *et al* (27), while presence of ECC decreased OHRQoL, the pufa index did not have a significant effect, which can attribute to a small sample size.

The study found no significant association between the pufa index and children's gender, a result similar to Amiri *et al* (24). Similarly, no significant difference in pufa scores was observed between the 4-5- and 5-6-year age groups, which contrasts with the findings by Karki *et al* (21), who reported a reversed relationship between the pufa index and age. However, Jaggi *et al* (27) found increased ECC prevalence with age.

This study indicated a significant relationship between age and OHRQoL, with 4-5-year-olds exhibiting better OHRQoL than the 5–6-year-olds. This may be due to a growing awareness of dental conditions, pain, and aesthetics by increasing children age. These findings align with those of Karki *et al* (21) and Sajadi *et al* (25), which reported lower OHRQoL at older ages. However, other studies by Nemati *et al* (26) and Amiri *et al* (24) found no association between age and OHRQoL.

On the other hand, the current study found no association between gender and OHRQoL, consistent with other findings, such as those by Duangthip *et al* (22), Nemati *et al* (26), Jaggi *et al* (27), Sajadi *et al* (25) and Amiri *et al* (24).

The present study, consistent with existing literature, highlighted the significant impact of untreated caries (as measured by the pufa index) on children's OHRQoL. Despite the improvements in oral hygiene practices, early dental caries remains prevalent due to parental and child neglect. The consequences of untreated caries such as pain, pulp exposure, ulcers, fistulas, and abscesses significantly affect children's functioning, eating, speech, and overall well-being. The DMFT index does not fully capture these consequences, thus the pufa index is essential for assessing the impact of untreated caries on OHRQoL.

Implementing early childhood caries prevention programs targeting children from birth, focusing on education about the importance of primary teeth and establishing good oral hygiene habits from infancy is essential. Also, dental practitioners should consider Community-Based Programs that deliver preventive dental care to underserved populations, including fluoride varnish application, fissure sealants, and oral health education in schools and community centers.

Conclusion

Based on the findings of this study, the consequences of untreated caries, including caries with pulp involvement, ulcers, fistulas and abscesses, have a negative impact on children and their parents, reducing OHRQoL. This study highlighted the necessity for dental professionals, policymakers, and parents to prioritize oral health, particularly for primary teeth, to mitigate the negative impacts on children's overall well-being.

Acknowledgement

Ethics Committee of Isfahan University of Medical Sciences, Isfahan, Iran approved this research project with the ID number of IR.MUI.RESEARCH.REC.1399.774.

The authors would thank vice chancellor for research and technology, Isfahan University of Medical Sciences for its support from this project.

Conflict of Interest

There was no conflict of interest in this manuscript.

References

1. Petersen PE. The World Oral Health Report 2003: continuous improvement of oral health in the 21st century-The

approach of the WHO Global Oral Health Programme. Community Dent Oral Epidemiol 2003;31(Suppl 1):3-23.

2. Tiwari S, Dubey A, Singh B, Avinash A. Clinical consequences of untreated dental caries evaluated with the pulpal involvement–roots–sepsis index in the primary dentition of school children from the Raipur and Durg districts, Chhattisgarh State, India. Med Princ Pract 2015;24(2):184-8.

3. Correa-Faria P, Martins-Junior PA, Vieira-Andrade RG, Marques LS, Ramos-Jorge ML. Factors associated with the development of early childhood caries among Brazilian preschoolers. Braz Oral Res 2013;27(4):356–362.

4. Pakdaman A, Pourhashemi SJ, Ghalesalim MB, Ghadimi S, Baradaran-Nakhjavani Y. Comparison of children's oral health-related quality of life pre- and post dental treatment under general anesthesia using F-ECOHIS questionnaire. Iran J Pediatr 2014;24(1):121–2.

5. Vejdani J, Amrollahi N, Amrollahi M, Peirowfeiz Z, Alinejad D. Parental awareness about the presence of permanent first molars and its relation to DMFT index in 7-9-year-old children. J Islam Dent Assoc Iran 2018;30(4):165-72.

6. Bagińska J, Rodakowska E, Wilczyńska-Borawska M, Jamiołkowski J. Index of clinical consequences of untreated dental caries (pufa) in primary dentition of children from north-east Poland. Adv Med Sci 2013;58(2):442–7.

7. Ramazani N, Rezaei S. Evaluation of the prevalence of clinical consequences of untreated dental caries using PUFA/pufa index in a group of Iranian children. Iran J Pediatr 2017;27(1):e5016.

8. Kavand G, Younesian F, SAFAR SA, Dori M, Akbarzadeh BA, Khoushnevisan M. [Oral Health Related Quality of Life among Iranian children: Part I-Validity, reliability, prevalence and severity assessment of daily impact factors.] Shahid Beheshti Dent J 2010;3(1);217-24. Persian.

9. Mansoori S, Mehta A, Ansari MI. Factors associated with oral health-related quality of life of children with severe-early childhood caries. J Oral Biol Craniofac Res 2019;9(3):222–5.

10. Moura-Leite F, Ramos-Jorge J, Ramos-Jorge M, de Paiva S, Vale M, Pordeus I. Impact of dental pain on daily living of five-year-old Brazilian preschool children: prevalence and associated factors. Eur Arch Paediatr Dent 2011;12(6):293–7.

11. Martins MT, Sardenberg F, Bendo CB, Abreu MH, Vale MP, Paiva SM, et al. Dental caries remains as the main oral condition with the greatest impact on children's quality of life. PLoS One 2017;12(10):e0185365.

12. Mota-Veloso I, Soares MEC, Alencar BM, Marques LS, Ramos-Jorge ML, Ramos-Jorge J. Impact of untreated dental caries and its clinical consequences on the oral health-related quality of life of schoolchildren aged 8–10 years. Qual Life Res 2016;25(1):193–9.

13. Martins MT, Sardenberg F, Vale MP, Paiva SM, Pordeus IA. Dental caries and social factors: impact on quality of life in Brazilian children. Braz Oral Res 2015;29:1–7.

14. Bhadila GY, Farsi NJ, Aljishi H, Bagher SM. Clinical effects of dental caries on the quality of life of paediatric patients aged 8–10 years: utilisation of the PUFA index. Oral Health Prev Dent 2023;21:b4009717.

15. Masood M, Newton T, Bakri NN, Khalid T, Masood Y. The relationship between oral health and oral health-related quality of life among elderly people in the United Kingdom. J Dent 2017;56:78–83.

16. Alsaif AA, Alkhadra TA, AlJameel AH. Impact of DMFT, PUFA, DAI, and TDIs on oral health-related quality of life (OHRQoL) among foundling, delinquent, and mainstream school children: a preliminary study. Front Public Health 2022;10:894638.

17. Ribeiro Junior CA, Vettore MV, Rebelo Vieira JM, Corrêa de Queiroz AP, de Queiroz AC, Pereira JV, et al. The role of dental pain and psychosocial factors on the relationship between dental caries and oral health-related quality of life in children. BMC Oral Health 2022;22(1):340.

18. Monse B, Heinrich-Weltzien R, Benzian H, Holmgren C, van Palenstein Helderman W. PUFA—an index of clinical consequences of untreated dental caries. Community Dent Oral Epidemiol 2010;38(1):77–82.

19. Jabarifar SE, Golkari A, Ijadi MH, Jafarzadeh M, Khadem P. Validation of a Farsi version of the Early Childhood Oral Health Impact Scale (F-ECOHIS). BMC Oral Health 2010;10:4.

20. Corrêa-Faria P, Daher A, Freire MdCM, de Abreu MHNG, Bönecker M, Costa LR. Impact of untreated dental caries severity on the quality of life of preschool children and their families: a cross-sectional study. Qual Life Res 2018;27(12):3191–8.

21. Karki S, Päkkilä J, Laitala ML, Humagain M, Anttonen V. Influence of dental caries on oral health-related quality of life, school absenteeism and school performance among Nepalese schoolchildren. Community Dent Oral Epidemiol 2019;47(6):461–9.

22. Duangthip D, Gao SS, Chen KJ, Lo ECM, Chu CH. Oral health-related quality of life and caries experience of Hong Kong preschool children. Int Dent J 2020;70(2):100–7.

23. Sharna N, Ramakrishnan M, Samuel V, Ravikumar D, Cheenglembi K, Anil S. Association between early childhood caries and quality of life: Early Childhood Oral Health Impact Scale and PUFA index. Dent J (Basel) 2019;7(4):95.

24. Amiri M, Barfi R, Amiri S, Mansouri SR, Askarpour H, Naderi Lordjani M. The relationship between quality of life related to oral health status in 8–10-year-old students in Shiraz during 2016–2017. J Community Health Res 2020;4(2):320–5.

25. Sajadi FS, Pishbin L, Azhari SH, Moosazadeh M. Impact of oral and dental health on children's and parents' quality of life based on Early Childhood Oral Health Impact Scale (ECOHIS) index. Int J Dent Sci Res 2015;3(2):28–31.

26. Nemati S, Ghasempour M, Khafri S. Impact of oral and dental health on quality of life in Iranian preschool children and their families. Electron Physician 2016;8(11):3296–301.

27. Jaggi A, Marya CM, Nagpal R, Oberoi SS, Kataria S, Taneja P. Impact of early childhood caries on oral health-related quality of life among 4–6-year-old children attending Delhi schools: a cross-sectional study. Int J Clin Pediatr Dent 2019;12(3):215–20.