ORIGINAL ARTICLE
DOI: 10.33897/fujd.v5i1.408

Oral Health status of Visually Impaired Adolescents in schools of Karachi

Umeed Jawaid[1], Shama Asghar[2], Kulsoom Rizvi[3], Maria Moin[4], Meisha Gul[5]

Received: 16 Apr 2024 / Revised: 11 Dec 2024 / Accepted: 31 Dec 2024 / Published online: 22 Jan 2025

ABSTRACT

Objectives: The primary objective of this study was to evaluate the oral hygiene condition, gingival index, and DMFT (Decayed, Missing, and Filled Teeth) among visually impaired adolescents aged 12-18 years, and to explore the factors that influence these parameters.

Materials and Methods: An analytical cross-sectional study was conducted from October 2022 to April 2023 at four distinct special schools/institutions for visually impaired children located in Karachi, Pakistan. A total of 234 visually impaired children, with ages ranging from 12 to 18 years, were enrolled in this study**.** To analyze, the data was categorized into binary data. DMFT < 3 and >3, OHI <1.8 and >1.8, GI <1 and >1. The SPSS version 21 was used to perform statistical analysis of the data.

Results: Out of total participants, 55.1% reported brushing their teeth once a day, while 44.9% reported brushing their teeth twice or more. Majority of participants had an OHI-S score of ≤ 1.8 and an OHI-S score of <1. OHI-S > 1.8 was less frequent in females than in males, GI >1 was more frequent when the year of education in school increases.

Conclusion: Within the limitations of this study, it can be inferred that most of the children displayed inadequate oral hygiene, as observed in their oral health condition. There is a need for regular school-based oral health programs to train teachers, parents, and guardians to improve oral health related quality of life of visually impaired children.

Keywords: Dental Caries, Oral Hygiene, Visually Impaired Persons

[1]Senior Registrar, [2]Professor, [5]Assisstant Professor, Department of Operative Dentistry, Bahria University Health Sciences Campus, Karachi, Pakistan.

[3]Professor, [4]Assistant Professor, Department of Community Dentistry, Bahria University Health Sciences Campus, Karachi, Pakistan.

Corresponding author: Umeed Jawaid, Bahria University Medical & Dental College, Bahria University Health Sciences Campus, Sailor Street, Karachi Cantonment, Karachi, Pakistan.

Email: umeedjavaid@hotmail.com

DOI:10.33897/fujd.v5i1.408

How to cite this Article:

Jawaid U, Asghar S, Rizvi K, Moin M, Gul M. Oral Health Status of Visually Impaired Adolescents in Schools of Karachi. Found Univ J Dent. 2025;5(1):16-24

DOI: 10.33897/fujd.v5i1.408

INTRODUCTION

Oral health is an indispensable aspect of overall well-being, thereby positively influencing the mental and physical well-being, interpersonal relationships and appearance, of individuals, thus contributing to their quality of life.[1] The ability of individuals to manage their routine personal hygiene practices, such as dental hygiene, is crucial for maintaining an independent existence.[1] The significance of oral health extends to children, especially those with special health needs, for whom it assumes even greater importance.[2]

Pakistan is one of the developing nations that is confronted with various disabilities, among which visual impairment is on the rise. According to estimates by the World Health Organization (WHO), approximately 2.2 billion people globally experience either near or distance vision impairment, with nearly half of these cases remaining untreated.[3] The occurrence of blindness in children varies across different countries, with developed countries reporting a prevalence of 0.3 cases per thousand children, while developing countries report a prevalence of 1.5 cases per thousand children[4]

Visual impairment as a disability appears to present challenges when it comes to achieving optimal dental health. Routine habits like using toothpaste containing fluoride, replacing toothbrushes that are worn out, rinsing the mouth, following a healthy diet, and regularly visiting the dentist are generally not difficult for typical children. However, children with visual impairments face daily challenges in acquiring fundamental skills, and maintaining proper oral hygiene is one of the difficulties they encounter.[5] Studies have indicated that when compared to their classmates with normal vision, these kids typically practice poorer oral hygiene.[6] Therefore, it is crucial to provide sufficient instruction on the appropriate maintenance of dental and oral tissues.

Multiple studies have reported about the complexity and difficulty of managing oral health issues for children with disabilities, who frequently struggle with the implementation of the necessary skills for controlling the dental plaque. Studies have also reported poor oral hygiene associated with visual impairment.[7] Individuals with visual impairment face additional social and psychological pressures. In some cases, blindness may be part of a syndrome, thereby exacerbating other medical challenges that surpass oral hygiene issues in magnitude.[8] This situation has a profound impact on visually impaired children, leading to feelings of sadness, depression, isolation, and anxiety.[9]

The study done in 2017 conducted to examine status of oral health of visually impaired children in Pakistan shows 66% visually impaired children have never visited the dentist.[10] Another study conducted in India (Bihar) in 2021 revealed that 78.7% exhibited changes in oral hygiene, including both soft and hard tissues.[8] Similarly, a study in Malaysia demonstrated a caries prevalence of 85.2%.[11] A study conducted in Riyadh found that only 22.8% had good oral hygiene.[7] However, it is important to highlight that numerous detailed studies have been conducted to evaluate the oral health status of adolescents with speech and hearing impairments. The study referenced have reported an overall caries incidence rate of 51% within this subset of the population.[12]

Visual impairment is a significant disability that affects a considerable proportion of the global population. Disabled children should receive equal opportunities for oral health and hygiene compared to their healthy peers.[13] At present, there is limited information about the state of oral health of visually impaired children in Pakistan. Considering the insufficiency of satisfactory and comprehensive data pertaining to the current state of oral health among this specific demographic of children, it is imperative to undertake further investigation through this study. The primary aim of this study was to evaluate the oral hygiene condition, gingival index, and DMFT (Decayed, Missing, and Filled Teeth) among visually impaired adolescents aged 12-18 years, and to explore the factors that influence these parameters.

MATERIALS AND METHODS

An analytical cross-sectional study was conducted from October 2022 to April 2023 at four distinct special schools/institutions for visually impaired children located in Karachi, Pakistan. A total of 234 visually impaired children, with ages ranging from 12 to 18 years, were enrolled in this study. The sample size calculation was performed using WHO sample size calculator using data from study of Syed H et al.[10] reporting frequency of DMFT in visually impaired children as 67%. Keeping a relative precision of 9%, and a 95% confidence interval, the required sample size was 234. Consent was obtained

DOI: 10.33897/fujd.v5i1.408

beforehand from the relevant authorities of the schools/centers and the parents/guardians prior to assessing the oral health of these children. Approval from the ethics committee of Bahria University Dental College, Bahria University of Health Sciences campus Karachi, Pakistan was obtained in accordance with ethical guidelines. Children who were unable to comprehend the questions due to mental or physical disabilities, or were medically compromised, were excluded from the study.

The examination procedure and criteria employed were in accordance with the recommendations set forth in a modified version of WHO oral health assessment form from 1997.[13] Furthermore, general characteristics such as the children's age, gender, and duration of schooling were also documented in the form. The following questions were posed to determine the current oral health status of the patients (Table 1). During the administration of the questionnaire, the students were allowed to seek clarification from the examiner as needed.

Table 1: Questions Asked to Assess Oral Health Status

1)	Do you rinse your mouth with water after every meal?
2)	Do you brush your teeth?
3)	How frequently do you brush your teeth?
4)	How long do you brush your teeth?
5)	Do you experience a metallic taste after brushing?
6)	Do you use mouthwash?
7)	Have you experienced tooth sensitivity?
8)	Have you noticed any unpleasant odor while speaking?
9)	Have you ever visited a dentist before?
10)	If yes, what was the reason for your visit?

All visually impaired students underwent a detailed and thorough clinical examination by a calibrated examiner. A comprehensive analysis was conducted on the oral cavity with the purpose of identifying any occurrences of oral lesions. The dental caries experience of the children was recorded by utilizing the dmft and DMFT indices. In addition, the gingival condition was evaluated by employing the Gingival index, which was devised by Sillness and Loe.[14] The oral cleanliness of the children was assessed by utilizing the Simplified Oral Hygiene Index developed by Greene and Vermillion JK.[15]

The examination was conducted on visually impaired children at their respective educational institutions or centers, with the children being seated on a conventional chair, and suitable illumination being provided either by natural light or a handheld torch. Throughout this examination, a sterile mouth mirror and a CPITN probe were utilized, while adhering to appropriate procedures and standard guidelines for controlling cross infection, which included the use of disposable gloves, gowns, and masks. The collected data was organized in a tabular format and subjected to statistical analysis.

For the purpose of analysis, the data was categorized into binary data. DMFT < 3 and >3, OHI <1.8 and >1.8, GI <1 and >1.

The SPSS version 21 was used to perform statistical analysis of the data. Descriptive statistics was performed to calculate the Frequencies, means and SD of qualitative and quantitative variables. Logistic regression model was utilized to identify the effect of demographic variables (Gender, age, years in school) and behavioral variables (brushing habit, frequency, and duration of brushing, rinsing habit, use of mouthwash, frequency of dental visit, reason for visit) on the probability of affecting the health status represented by indices like DMFT, OHI and GI. A p value ≤ 0.05 was considered as statistically significant.

RESULTS

Descriptive results

General characteristic:

A total of 234 children between the ages of 12-18 from four different special schools dedicated for blind children in Karachi Pakistan, participated in the study.

Out of total 234 participants 140 (59.8%) were males and 94 (40.2%) were female children. Among the participants, 173 (73.9%) were between the ages of 12-14 and 61 (26.1%) were between the ages of 15-18. Most students had less than 5 years of education (Table 2).

DOI: 10.33897/fujd.v5i1.408

Table 2: General Characteristics of 12–17-Year-Old Visually Impaired School Children (n = 234)

Variable	Frequency (N)	Percentage (%)
Gender		
Male	140	59.8
Female	94	40.2
Age		
12-14	173	73.9
15-18	61	26.1
Years in school		
1-4	176	75.2
5-8	54	23.1
9-12	4	1.7

Oral health-related variables:

Oral health-related variables: Among all the individuals, 55.1% reported brushing their teeth once a day, while 44.9% reported brushing their teeth twice or more. A small percentage of children (5.1%) reported never brushing their teeth, and approximately 65% of them brushed their teeth for at least 1-2 minutes. Additionally, 50.4% of the children reported rinsing after every meal, and 10% of the participants used mouthwash in addition to tooth brushing. Most of the children (77.8%) had never visited a dentist, while 22.2% had visited the dentist before. Of those who visited the dentist, 30% reported doing so due to pain and sensitivity in their teeth.

Clinical examinations:

The average DMFT score in this study was 3.50 ± 5.83. Approximately 41.0% of the participants had a DMFT score of three or more. The DT component had the highest contribution to the DMFT score. The mean OHI-S score was 1.22 (1.32) and the mean GI score was 0.19 (0.414). The majority of participants had an OHI-S score of ≤ 1.8 and an OHI-S score of <1 (Table 3).

Table 3: Clinical Characteristics of 12–17-Year-Old Visually Impaired School Children (n = 234)

Variable	Frequency (N)	Percentage (%)
DMFT		
<3	**138**	**59.0**
≥ 3	**96**	**41.0**
OHI		
≤ 1.8	**174**	**74.4**
> 1.8	**60**	**25.6**
GI		
< 1	**200**	**85.5**
≥ 1	**34**	**14.5**
	Mean (SD)	**Range**
DMFT	**3.50 (5.83)**	**0.00-39.20**
OHI	**1.22 (1.32)**	**0.0-5.9**
GI	**0.19 (0.414)**	**0.0-2.0**

OHI-S oral hygiene index-simplified, DMFT Decayed, Missing and Filled teeth, GI Gingival Index

Analytical results:

Binary logistic regression was employed to examine the association between demographic variables (gender, age, years in school) and behavioral variables (brushing habit, frequency, and duration of brushing, rinsing habit, use of mouthwash, frequency of dental visit, reason for visit) on the likelihood of affecting oral health status as represented by DMFT, OHI, and GI indices.

DMFT:

Data was analyzed using Univariate analysis to identify the factors affecting the oral health status of these children. The results showed that dental visits during the last 12 months (P = 0.001, OR = 0.33, 95% CI: .179-0.64) and gender (P = 0.01, OR = 2.00, 95% CI: 1.17–3.41) significantly influenced the prevalence of dental caries in visually impaired school children. The odds of having a DMFT score ≥ 3 were higher in females. Additionally, participants who did not require dental visits were less likely to have a DMFT score > 3 compared to those who visited the dentist (Table 4)

DOI: 10.33897/fujd.v5i1.408

Table 5: Association of DMFT/dmft, OHI-S, GI and Behavioral Factors in 12–17 Visually Impaired School Children (n = 234)

Variable	N (%)	DMFT			OHI-S			GI		
		p- value	OR	95% CI	p- value	OR	95% CI	p- value	OR	95% CI
Brushing frequency										
Atleast once a day[a]	222 (94.8)	0.963	1.02	0.31-3.34	0.461	1.59	0.46-5.50	0.539	0.521	0.065-4.16
Never	12 (5.12)									
Brushing Duration										
Atleast 2 minutes[a]	142	0.42	0.79	0.45-1.39	0.20	1.50	0.80-2.82	0.225	1.59	0.75-3.35
More than 2 minutes	80									
Mouth rinse with water after each meal										
Once or more[a]	177(75.6)	0.461	0.79	0.42-1.46	0.75	0.89	0441-1.81	0.58	0.77	0.319-1.89
never	57 (24.3)									
Dental visit in the past 12 months										
Yes[a]	52 (22.2)	0.001[b]	0.339	.179-0.64	0.394	0.740	0.37-1.47	0.27	0.63	0.28-1.43
No	182 (77.7)									
Reason for the last dental visit										
Pain or sensitivity[a]	15 (28.8)	0.629	0.733	0.208-2.58	0.37	1.92	0.455-8.10	0.11	0.313	0.075-1.30
Others	37 (71)									

a Reference category, b Statistically significant
OHI-S oral hygiene index-simplified, DMFT Decayed, Missing and Filled teeth, GI Gingival Index

OHI:

The results also reported that gender (P = 0.03, OR = 0.49, 95% CI: 0.25–0.94), age (P = 0.03, OR = 2.00, 95% CI: 1.06–3.78) and years of education in school (P = 0.006, OR = 2.49, 95% CI: 1.30–4.78) were significantly predictors of OHI-S > 1.8. OHI-S > 1.8 was less frequent in females than in males, however, the frequency of OHI-S > 1.8 was higher in 15-18 years age groups and with greater years of education in school (Table 5).

DOI: 10.33897/fujd.v5i1.408

Table 5: Association of DMFT/dmft, OHI-S, GI with Demographic Variables in Visually Impaired School Children (n = 234)

Variable	N (%)	DMFT> 3			OHI-S >1.8			GI≥ 1		
		p- value	OR	95% CI	p- value	OR	95% CI	p- value	OR	95% CI
Gender										
Male[a]	140 (59.8)	0.01[b]	2.00	1.17-3.41	0.034[b]	0.495	0.25-0.94	0.80	0.90	0.43-1.92
Female	94 (40.1)									
Age (years)										
12-14[a]	173 (73.9)	0.07	0.56	0.30-1.04	0.03[b]	2.00	1.06-3.78	0.08	1.96	0.91-4.20
15-18	61 (26)									
Years in school										
1-4[a]	176 (75.21)	0.46	0.79	0.42-1.48	0.006[b]	2.49	1.30-4.78	0.001[b]	3.69	1.72-7.91
5-8	54 (23.07)									
9-12	4 (1.70)	0.49	0.45	0.04-4.40	0.99	0.00	0.00	0.99	0.00	

a Reference category, b Statistically significant
OHI-S oral hygiene index-simplified, DMFT Decayed, Missing and Filled teeth, GI Gingival Index

GI:
GI >1(P = 0.001, OR = 3.69, 95% CI: 1.72–7.91) was also significantly affected by years of education in school. GI >1 was more frequent when the year of education in school increases.

DISCUSSION

Visually impaired children in our setting do not have access to proper healthcare, so the status of oral health is always a problem. Health care systems must develop curated programs to address the needs of visually impaired individuals.[16,17] As a community health provider, we must develop customized programs to improve the oral health of blind individuals. Previously done studies shared data indicating lack of knowledge among visually impaired individuals regarding oral health care.[18] The present investigation was aimed to determine the oral hygiene status, gingival index and DMFT, among 12-18 years old visually impaired adolescents and to identify the predicting factors.

Several studies[19-21] conducted to ascertain the occurrence of oral diseases in disabled populations have reported notably inadequate levels of oral hygiene, as confirmed by the current investigation. It was evident and apparent from our research that these children demonstrated average to substandard levels of oral hygiene. This observation can be attributed to a specific cause, specifically reduced ability of visually impaired children to maintain their oral hygiene adequately. The underlying reason behind this inadequacy is due to lack of manual-visual coordination that these children face and encounter daily.

In the current investigation, most of the children used a toothbrush daily, thus aligning with the results of prior research. [22-24] Over fifty percent of the participants engaged in brushing for a duration of 1-2 minutes, yielding outcomes that are analogous to the investigation conducted by Jhon et al[23], Arora et al[24] and Parker et al.[25] The analysis demonstrated that a substantial number of visually impaired individuals engaged in rinsing after meals, but a small minority utilized mouthwash for this purpose. The reasons behind this phenomenon could be attributed to a lack of awareness regarding plaque buildup or the additional expenses highlighted in other scholarly investigations.[26,27] Results indicated that these individuals exhibited a limited inclination towards seeking dental treatment, potentially attributable to the prioritization of other systemic issues or heightened levels of stress related to dental care. Consequently, compromised oral health ensued, aligning with prior research findings.[24,25]

Within the current investigation, females demonstrated higher DMFT scores, consistent with previous studies[9], yet in contrast to a study conducted in India which showed lower DMFT scores.[27] Our findings also revealed slightly

DOI: 10.33897/fujd.v5i1.408

elevated OHI scores among males compared to females, which concurs with existing literature.[24] This distinction may be attributed to a less serious attitude exhibited by males towards oral healthcare. Notably, the association between the GI and OHI with age indicated a decline in oral care as individuals grew older, signifying a lack of dental visits and diminished prioritization of dental care. Furthermore, the OHI and GI exhibited an inverse relationship with the duration of schooling, suggesting inadequate training among teachers and staff members.

The participants in the study group demonstrated varying levels of gingivitis, with a considerable number displaying moderate to severe gingivitis. The heightened inflammation of the gums in these children may be attributed to unsupervised brushing, which can result in ineffective removal of plaque. This finding is consistent with the results reported by Ohito et al.[28] and Bhavsar et al.[29]

Present study showed that 77.7% of the participants did not visit the dental healthcare facility in past 12 months, these results are in accordance with previously done studies which showed 92% have never visited dentist.[30-31] Furthermore, it was observed that 28% of these individuals sought dental treatment due to pain and sensitivity. Notably, sensitivity emerged as a prominent factor for seeking dental care, which is consistent with previous research findings.[23]

The primary obstacles to guaranteeing equitable delivery of dental care for people with disabilities seem to be insufficient infrastructure and constrained time, as well as a dearth of suitable expertise and the overall challenges associated with delivering care to this specific demographic.[32] These stressors encompass financial burdens, apprehension, and unfavorable attitudes towards dental care.[33,34] In spite of the endeavors undertaken in developed nations to improve the oral well-being of these underprivileged youngsters, the health authorities in developing nations have not yet prioritized addressing this issue.[35]

The strength of the study is that it is done in multiple centers of visually impaired children in Karachi, Pakistan. Limitations include limited sample size, cross-sectional study design and use of subjective parameters like DMFT that can underestimate the caries prevalence and inclusion of children from schools only.

Future recommendations include study with large sample size, comparative study group and objective method of assessment. We also recommend oral health care training programs and workshops at special schools for teachers, parents, and guardians of these children with a focus on preventive procedures. A standardized community health program should be formulated and implemented with the help of health authorities. The collaboration between dental professionals and oral healthcare should be practiced in conjunction with general healthcare to attain a more comprehensive comprehension of an individual's physiological and psychological well-being.

CONCLUSION

Within the limitations of our study, it can be inferred that most of the children displayed inadequate oral hygiene, as observed in their oral health condition. Gender, dental visits in the past 12 months, age and years of education in school were found to be significant predictors of oral health status. Additionally, most of the children had a marked rise in the prevalence of dental caries, and many of them had untreated carious teeth and moderate to severe inflammation of the gums. Thus, the provision of adequate training and education about oral health is required for this group of society. There is a need for regular school based oral health programs to train teachers, parents, and guardians to improve oral health related quality of life of visually impaired children.

DISCLAIMER

None to declare.

CONFLICT OF INTEREST

There is no conflict of interest among the authors.

ETHICAL STATEMENT

Ethical approval was provided by the Ethical Review Committee at Bahria University. Ref No: ERC 20/2023

FUNDING DISCLOSURE

The author(s) received no financial support for the research, authorship, and/or publication of this article.

AUTHORS CONTRIBUTION

Conception and design of the study: M. Moin, K. Rizvi
Acquisition of data: S. Asghar

DOI: 10.33897/fujd.v5i1.408

Analysis and interpretation of data: U. Jawaid, M. Gul
Drafting of the manuscript: U. Jawaid, M. Gul
Critical review of the manuscript: M. Gul, S. Asghar, M. Moin
Approval of the final version of the manuscript to be published: U. Jawaid, S. Asghar, M. Gul, M. Moin, K. Rizvi

REFERENCES

1. Barranca-Enríquez A, Romo-González T. Your Health Is in Your Mouth: A Comprehensive View To Promote General Wellness. Front Oral Health 2022;3:971223.

2. Kinneresh RV, Reddy LV, Sai RY, Priyanka BS, Rashmika K, Sri G. Oral Health Status of Disabled Children Attending Special Schools in Vishakhapatnam City. Ind J of Dent Educ. 2024;17(1):32-5.

3. World Health Organization. Increasing eye care interventions to address vision impairment. February 2023.

4. Wani RT. Socioeconomic Status Scales-Modified Kuppuswamy and Udai Pareekh's Scale Updated For 2019. J Family Med Prim Care. 2019; 8:1846-1849.

5. Sharififad N, Sargeran K, Gholami M. Perception of Oral Health And Medical Conditions As Possible Predictors Of Oral Health Status In Visually Impaired Adolescents: A Cross-Sectional Study. BMC Oral Health. 2021; 21:1-11.

6. Beange HP. Caring For A Vulnerable Population: Who Will Take Responsibility For Those Getting A Raw Deal From The Health Care System? Med J Aust. 1996; 164:159-60.

7. AlSadhan SA, Al-Jobair AM, Bafaqeeh M, Abusharifa H, Alagla M. Dental and Medical Health Status And Oral Health Knowledge Among Visually Impaired And Sighted Female Schoolchildren In Riyadh: A Comparative Study. BMC Oral Health. 2017;17: 1-6

8. Anand S, Kavita K, Pandey A, Verma S, Singh R, Singh R. Assessment of Oral Health Status with Visually Impaired Children in Patna City, Bihar. J Pharm Bioallied Sci. 2021;13: S1709-S1712.

9. Shrivastava R, Khanduja R, Gojanur S. A comparative evaluation of oral health status among institutionalized totally blind children using different methods–A randomized clinical trial. Dent Res J (Isfahan). 2022;19.106

10. Syed H, Butt SA, Anis M, Fakhruddin M. Comparison of Caries and Gingival Health Status Of Deaf With Blind Children, Karachi. Int J Dent Health Sci. 2017; 4:791-797

11. Vinoven K, Rahman NA, Adnan MM, Shatriah I. Oral Health Status of Visually Impaired Children and Oral Health Knowledge, Attitude and Practice of their Caregivers at Hospital Universiti Sains Malaysia: A Preliminary Study. Mal J Med Health Sci. 2021; 17:63-72.

12. Azfar M, Khan I, Quershi S, Zia N, Abid K. Oral health status among hearing and speech impaired children of Karachi, Pakistan. J Pak Dent Assoc. 2008; 27:181-5.

13. Crowder L. Is the oral health of visually impaired children and adolescents different compared to their sighted peers? Evid Based Dent. 2022; 23:104-105.

14. Löe H. The Gingival Index, the Plaque Index and the Retention Index Systems. J Periodontal. 1967; 38:610-6.

15. Greene JC, Vermillion JR. The Simplified Oral Hygiene Index. J Am Dent Assoc. 1964; 68:7-13.

16. Salah A, Hashim R, Salah S, Majeed AS, Al-Hamdan SA, Mohamed M. Dentists' Attitude Towards Dental Treatment of Disabled Patients. Adv Med Educ Pract. 2022; 14:13:1489-1496

17. Sardana D, Goyal A, Gauba K, Kapur A, Manchanda S. Effect of specially designed oral health preventive programme on oral health of visually impaired children: use of audio and tactile aids. Int Dent J. 2019; 69: 98-106.

DOI: 10.33897/fujd.v5i1.408

18. Chang C.-H. S., Shih Y.-H. Knowledge of dental health and oral hygiene practices of Taiwanese visually impaired and sighted students. J Vis Impair Blind. 2004; 98:289–303.

19. Murray JJ, McLeod JP. The dental condition of severely subnormal children in three London boroughs. Br Dent J. 1973; 134:380-5.

20. Brown JP, Schodel DR. A review of controlled surveys of dental disease in handicapped persons. ASDC J Dent Child. 1976; 43:313-20.

21. Morton ME. Dental disease in a group of adult mentally handicapped patients. Public Health Rep. 1977; 91:23-32.

22. Singh A, Kumar A, Berwal V, Kaur M. Comparative study of oral hygiene status in blind and deaf children of Rajasthan. J Adv Med Dent Sci. 2014; 2:26-31.

23. John JR, Daniel B, Paneerselvam D, Rajendran G. Prevalence of Dental Caries, Oral Hygiene Knowledge, Status, and Practices among Visually Impaired Individuals in Chennai, Tamil Nadu. Int J Dent. 2017; 2017:9419648.

24. Arora A, Nargundkar S, Fahey P, Joshua H, John JR. Social determinants and behavioural factors influencing toothbrushing frequency among primary school children in rural Australian community of Lithgow, New South Wales. BMC Res Notes. 2020; 13:403-408.

25. Parkar S, Patel N, Patel N, Zinzuwadia H. Dental health status of visually impaired individuals attending special school for blind in Ahmedabad city, India. Indian J Oral Sci. 2014; 5:73-77.

26. Potes Gallego MP, Ríos Herrera N, Romero López SP, García Restrepo HD, Takada Pulgarín Y, Agudelo Ramírez A. Salud bucal en la población con discapacidad visual: revisión de literatura. [Oral health in visually impaired patients: a literature review]. Rev Fac Cien Med Univ Nac Cordoba. 2022; 79:272-276.

27. Watson EK, Moles DR, Kumar N, Porter SR. The oral health status of adults with a visual impairment, their dental care and oral health information needs. Br Dent J. 2010;208: E15.

28. Ohito FA, Opinya GN, Wang'ombe J. Dental caries, gingivitis and dental plaque in handicapped children in Nairobi, Kenya. East Afr Med J. 1993; 70:71-4.

29. Bhavsar JP, Damle SG. Dental caries and oral hygiene amongst 12-14 years old handicapped children of Bombay, India. J Indian Soc Pedod Prev Dent. 1995; 13:1-3.

30. Gao X, Ding M, Xu M, Wu H, Zhang C, Wang X, Feng X, Tai B, Hu D, Lin H, Wang B. Utilization of dental services and associated factors among preschool children in China. BMC Oral Health. 2020; 20:1-0.

31. Murphy K, Gondro JV, Moharrami M. Factors associated with the use of oral health care services among Canadian children and youth. Health Rep. 2024; 35(2):15-26

32. Zimmer S, Didner B, Roulet JF. Clinical study on the plaque-removing ability of a new triple-headed toothbrush. J Clin Periodontol. 1999; 26:281-5.

33. Hallberg U, Strandmark M, Klingberg G. Dental health professionals' treatment of children with disabilities: a qualitative study. Acta Odontol Scand. 2004; 62:319-27.

34. Edwards DM, Merry AJ. Disability part 2: access to dental services for disabled people. A questionnaire survey of dental practices in Merseyside. Br Dent J. 2002; 193:253-5.

35. Hayashi M, Haapasalo M, Imazato S, Lee JI, Momoi Y, Murakami S, Whelton H, Wilson N. Dentistry in the 21st century: challenges of a globalising world. Int Dent J. 2014; 64:333-42.