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Piecing Together the Puzzle: The Interplay of Malocclusion, Dental Caries, and Oral Health Status in Special Needs Children

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ABSTRACT

Children with special needs are at greater risk of oral health challenges due to physical, cognitive, and sensory limitations that hinder oral hygiene practices. Such children face oral health challenges due to functional limitations, leading to dental caries, tooth loss, poor hygiene, and malocclusion. **Objectives:** To assess the association between types of children's disability with dental caries, oral health status, and malocclusion among children attending Falah Foundation, Lahore. **Methods:** A cross-sectional study was conducted in children with special needs in which oral examinations were performed. Dental caries was measured by the DMFT index, malocclusion using Angle's molar classification, oral hygiene using the Plaque Index, and the Gingival Index, while associations were assessed by using the Chi-square test. **Results:** Most participants were mentally disabled (49.5%) and had higher caries severity among mentally and physically disabled children. Physically disabled children showed the highest abundance of plaque accumulation (38.1%), while severe gingival inflammation was observed in blind (40.0%), followed by physically disabled children (31.0%). **Conclusions:** Oral health status, dental caries experience, and malocclusion patterns vary significantly by type of disability among Special healthcare need children. Targeted preventive strategies, improved caregiver education, and enhanced access to dental services are fundamental to addressing the oral health disparities in this vulnerable population. Moreover, parental education is also very important to help reduce oral diseases in this group.

INTRODUCTION

Children with special healthcare needs have physical, developmental, mental, sensory, behavioral, cognitive, or emotional conditions that necessitate medical care and healthcare support. In India, 18.49 million people have disabilities, with 6–10% of children born with disabilities, likely making up one-third of the entire population of the disabled group [1]. Despite their increased vulnerability, these children often experience neglect in oral healthcare. Compared to typically developing children, those who are disabled or socioeconomically disadvantaged frequently receive limited familial and societal support, making oral health one of their most overlooked healthcare needs [2]. Various impairments, including visual, hearing, and cognitive disabilities, create substantial barriers to maintaining adequate oral hygiene. The limitations in vision, communication, and awareness further complicate routine oral care practices, placing these individuals at a disadvantage compared to the general population [3]. In addition, physical and mental challenges may hinder their ability to perform daily oral hygiene measures independently, thereby increasing reliance on caregivers for basic oral care [4]. Oral health problems among children

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with special healthcare needs (SHCN) are complex and arise from multiple interrelated factors. Dietary habits such as frequent consumption of sugary drinks, prolonged bottle feeding, difficulties in swallowing, and reliance on soft or pureed diets markedly increase their susceptibility to dental caries. In addition, the presence of systemic illnesses and the use of long-term medications may further compromise oral health by reducing salivary flow and altering the oral microbial environment, thereby increasing the risk of both dental caries and periodontal diseases [5]. The socioeconomic conditions and parental education significantly influence the oral health status of children with special healthcare needs, as these factors determine the level of awareness, preventive practices, and timely utilization of dental care services. The limited caregiver knowledge, inadequate oral health literacy, and restricted access to specialized dental care services often result in delayed treatment and higher levels of untreated oral disease in this vulnerable population [6]. Periodontal disease is the most common oral health concern in disabled children, yet over 75% lack access to dental care. Prevalence and severity of diseases affecting the periodontium also vary by type of disability, as 45.5% of hearing-impaired children in India showed bleeding on probing and had severe gingivitis [7]. Furthermore, inadequate access to oral health education resources, including adapted materials such as Braille, along with poor fine motor skills, makes routine practices like brushing and flossing particularly challenging [8]. The maintenance of good oral hygiene, through regular brushing with fluoride toothpaste and the restriction of sugary foods and beverages, is essential for the prevention of dental caries. However, in children with special healthcare needs, this process is often complicated by a range of physical, behavioral, and sensory limitations that make effective self-care difficult. As a result, many of these children rely heavily on their caregivers for daily oral hygiene practices. Unfortunately, caregiver-related factors such as lack of time, limited awareness of oral health importance, and competing responsibilities may reduce the consistency and quality of oral care provided, thereby increasing the risk of dental caries [9]. There is a need to improve oral health, especially among individuals with sensory or physical impairments, to equip them and their communities with knowledge and skills on oral hygiene, healthy habits, and preventive care, which can significantly enhance both oral and overall well-being [10].

Children with disabilities encounter multiple barriers, such as physical, sensory, cognitive, and communication-related barriers, that limit effective oral care and access to specialized dental services. As a result, they are at increased risk of dental caries, plaque accumulation, gingival diseases, and malocclusion. Additionally, the lack of sufficient local data restricts the development of targeted interventions. Therefore, this study evaluates the oral health status and related dental conditions among children with special needs in Lahore. This study aimed to assess the association of types of children's disability with dental caries, oral health status, and malocclusion, which is crucial to designing individualized care strategies and supporting caregivers and healthcare providers in preventive efforts.

METHODS

A cross-sectional study was carried out from 1st October 2024 to 1st April 2025, and ethical approval for the study was acquired before the start of the study from the Institutional Ethical Committee of Lahore Medical and Dental College (Ref No. LMDC/FD/4491/24, Dated: 18-9-24), and permission was also obtained from the concerned non-profit organization, FALAH Foundation. A convenience sampling technique was employed. The sample size consisted of 204 children and was calculated by using a prevalence of 15.7% for special needs children, with an assumed confidence level of 95% [11]. However, additional participants were recruited to compensate for potential missing data. Children aged 12 and more than 12 years and those whose parents provided written informed consent were included in the study. Participants were also informed that they can leave the study at any time. Additionally, a pilot survey was conducted by the researcher to validate the questionnaire in 10 special children. Data were obtained through dental examinations conducted at the school premises, with participants seated on standard chairs. The examinations were performed under natural daylight using a mouth mirror and dental explorer. Oral examinations were carried out in accordance with the World Health Organization (WHO) Oral Health Survey basic methods, in which dental caries was evaluated using the Decayed, Missing, and Filled Teeth (DMFT) index [12]. The Plaque Index (PI), as defined by Anusha *et al.* was used to measure oral hygiene status. All teeth were evaluated by passing an explorer over the tooth surfaces, and four surfaces per tooth (distobuccal, buccal, mesiobuccal, and lingual) were recorded. Plaque scores ranged from 0 to 3. Scores were interpreted as excellent (0), good (0.1–0.9), fair (1.0–1.9), and poor (2.0–3.0) [13], and the Gingival Index (GI) developed by Zeng *et al.* in which all teeth were examined by gently moving a blunt probe along the gingival margin, with four surfaces per tooth recorded. Gingival scores ranged from 0 to 3. The severity of gingivitis was categorized as mild (0–1.0), moderate (1.1–2.0), and severe (2.1–3.0) [14]. The malocclusion was evaluated using Angle's molar classification. Class I malocclusion occurs when the mesiobuccal cusp of the maxillary first permanent molar

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occludes with the mesiobuccal groove of the mandibular first permanent molar, while Class II is when it is positioned mesially, and Class III when it is distal to the mesiobuccal groove of the mandibular first molar [15]. Demographic variables, including age, gender, and type of disability, were recorded by the team of six researchers, in which four were involved in data collection, while the remaining two ensured data quality by checking the completeness of the questionnaire. All collected data were kept confidential and used solely for research purposes.

Data were analyzed using Statistical Package for Social Sciences (SPSS) software version 24.0. Descriptive statistics were calculated to determine frequencies and percentages for demographic characteristics and oral health variables. Pearson's chi-square test was used to assess the association between types of disability and malocclusion, dental caries, plaque index, and gingival indices. A p-value of ≤0.05 and a confidence interval of 95% were considered statistically significant.

RESULTS

The data showed that 49.5% of the children were mentally disabled, and 82.4% of the children brushed their teeth. The parental supervision was common (70%); once-daily brushing was the most common practice (59.5%), indicating inadequate oral hygiene habits (Table 1).

Table 1: Characteristics of the Study Participants

Variables	Category	n (%)
Disability Types	Blind	25 (11.9%)
	Mentally Disabled	104 (49.5%)
	Deaf	39 (18.6%)
	Physically Disabled	42 (20.0%)
Gender	Male	126 (60.0%)
	Female	84 (40.0%)
Teeth Brushing	Yes	173 (82.4%)
	No	37 (17.6%)
Parent Supervision	Yes	147 (70.0%)
	No	63 (30.0%)
Brushing Frequency	Once A Day	125 (59.5%)
	Twice A Day	74 (35.2%)
	Thrice A Day	4 (1.9%)
	None	7 (3.3%)

The blind participants mostly exhibited very low DMFT scores (56.0%); however, mentally disabled individuals showed higher proportions of low and high categories of DMFT (20.2%). The deaf and physically disabled showed very low DMFT scores (35.9% and 42.9%) (Table 2).

Table 2: Association of Types of Children's Disability and DMFT

Disability Types	DMFT					p-value
	Very Low	Low	Moderate	High	Very High	
Blind	14 (56.0%)	8 (32.0%)	0 (0.0%)	3 (12.0%)	0 (0.0%)	0.027*
Mentally Disabled	36 (34.6%)	21 (20.2%)	16 (15.4%)	21 (20.2%)	10 (9.6%)	
Deaf	14 (35.9%)	3 (7.7%)	7 (17.9%)	12 (30.8%)	3 (7.7%)	
Physically Disabled	18 (42.9%)	9 (21.4%)	2 (4.8%)	6 (14.3%)	7 (16.7%)	

*Fisher's exact p-value, significant

The results showed that plaque and gingival status differed significantly across disability types. Physically disabled participants exhibited the highest abundance of plaque (38.1%), while blind participants showed more moderate plaque (40.0%). Normal gingiva was most common among deaf participants (48.7%), whereas severe gingival inflammation was highest in blind participants (40.0%) (Table 3).

Table 3: Distribution of Plaque and Gingival Indices among Different Disability Types

Index / Category	Blind, n (%)	Mentally Disabled, n (%)	Deaf, n (%)	Physically Disabled, n (%)	p-value
Plaque Index					
No plaque	8 (32.0%)	21 (20.2%)	5 (12.8%)	5 (11.9%)	<0.001*
Film of plaque on the free gingival margin	7 (28.0%)	48 (46.2%)	14 (35.9%)	20 (47.6%)	
Moderate plaque in the gingival pocket	10 (40.0%)	23 (22.1%)	15 (38.5%)	1 (2.4%)	
An abundance of plaque in the gingival pocket	0 (0.0%)	12 (11.5%)	5 (12.8%)	16 (38.1%)	
Gingival Index					
Normal gingiva	3 (12.0%)	44 (42.3%)	19 (48.7%)	9 (21.4%)	0.029*
Mild inflammation (slight color change, slight edema)	6 (24.0%)	24 (23.1%)	7 (17.9%)	9 (21.4%)	
Moderate inflammation (redness, edema, glazing)	6 (24.0%)	18 (17.3%)	4 (10.3%)	11 (26.2%)	
Severe inflammation (marked redness & edema)	10 (40.0%)	18 (17.3%)	9 (23.1%)	13 (31.0%)	

Significant = *

The table's result showed that Angle's Class I molar relationship was the most prevalent across all disability types, mainly

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among deaf participants (74.4% left 1), and it showed significant associations between disability type and molar classification for both left (p=0.042) and right molars (p=0.050), with Class II and III varying by disability group (Table 4).

Table 4: Association of Types of Disability and Molar Classification

Angle's Molar Class	Blind, n (%)	Mentally Disabled, n (%)	Deaf, n (%)	Physically Disabled, n (%)	p-value
Angles Molar Left 1					
Class 1	10 (40.0%)	60 (57.7%)	29 (74.4%)	21 (50.0%)	0.042*
Class 2	8 (32.0%)	13 (12.5%)	2 (5.1%)	8 (19.0%)	
Class 3	7 (28.0%)	31 (29.8%)	8 (20.5%)	13 (31.0%)	
Angles Molar Right 1					
Class 1	10 (40.0%)	62 (59.6%)	28 (71.8%)	21 (50.0%)	0.050*
Class 2	10 (40.0%)	11 (10.6%)	3 (7.7%)	10 (23.8%)	
Class 3	5 (20.0%)	31 (29.8%)	8 (20.5%)	11 (26.2%)	

Significant = *

DISCUSSION

The current study showed that the mentally disabled were 49.5%. Most children reported brushing their teeth (82.4%), commonly once daily (59.5%), with parental supervision present in 70.0% of cases. The current study indicated that a significant association was observed in DMFT scores (p=0.027) in disabled children. Blind children mostly had very low DMFT (56.0%), whereas mentally disabled children showed higher caries burden, with 20.2% in high and 16.7% in very high DMFT categories in physically disabled children, because the physically disabled, due to loss of manual dexterity, have difficulty maintaining oral hygiene, whereas the mentally disabled have cognitive barriers and a resistance to dental care. A study reported that among children aged 6–12 years, 37.2% exhibited a DMFT score of 0 when assessed within the primary dentition, whereas this proportion declined to 11.7% when overall DMFT was considered, but the score of the gingival index (GI) indicated that only 5.3% of children had healthy, non-inflamed gingiva. Furthermore, a statistically significant difference in gingival status was observed (p=0.012) [16]. Another study also reported similar results, that the mean DMFT score was 0.74, with mentally disabled children exhibiting slightly higher values compared to physically disabled children (mean = 0.72). Similarly, gingival health was poorer among mentally disabled children than their physically disabled counterparts [17]. A study conducted by Kesavan *et al.* reported that normal children had a higher mean number of decayed teeth (1.83%) compared to special children (1.38%). However, children with special needs exhibited more missing teeth (0.16) and no filled teeth (0.00%). Additionally, 81% of special children were affected by gingivitis, largely due to inadequate plaque control associated with limited manual dexterity. These findings emphasize the need for improved oral health education and tailored oral care resources for children with special needs [18]. Another study reported that the categories of disability impact DMFT scores and found disability to be a primary determinant of dental decay [19]. The current study showed that physically disabled children had the highest abundance of plaque (38.1%), while blind children mostly showed moderate plaque (40.0%). Mentally disabled children predominantly had a film of plaque on the gingival margin (46.2%), and 38.1% of an abundant amount of plaque was found occurring in physically disabled special needs children. The previous study reported that a higher percentage of special children with mild (71.8%) to moderate (66.7%) gingival inflammation, which may be attributed to difficulties in proper cleaning and brushing due to physical impairments [20]. The study found no statistically significant differences in SHCN for the gingival index (p=0.238) and DMFT scores (p=0.311); however, the plaque index was significantly lower in the disabled children group (p=0.001) [21]. In contrast, another study reported that higher plaque accumulation was associated with increased dental caries, gingivitis, and poor oral hygiene among visually impaired children [22]. These findings highlight that enhancing knowledge, skills, and healthy habits can improve oral health, as individual-level measures such as specialized toothbrushes and supervised programs effectively control plaque and hygiene. However, conventional oral health education relying on visual methods is less effective for visually impaired individuals, emphasizing the need for tactile and auditory approaches [23]. According to the current study results, severe gingival inflammation was most common among blind (40.0%) and physically disabled children (31.0%), likely due to increased plaque accumulation and poor oral hygiene. A study reported that the severity of gingivitis varied among participants, with severe gingivitis observed in 28.7%, moderate gingivitis in 47.5%, and mild gingivitis in 23.8% in children with special needs [7]. The present study revealed that a significant association was found between the type of disability and Angle's molar classification for both left (p=0.042) and right molars (p=0.050). Class I molar relationship was most prevalent, particularly among deaf children (left: 74.4%, right: 71.8%), while Class II and Class III malocclusion were relatively more frequent in blind and physically and mentally disabled children. Similar findings were reported in a special needs school, which showed a significantly higher prevalence of Class II malocclusion and a greater tendency for delayed eruption of permanent molars in the permanent dentition [24]. Similarly, other studies reported that less than 42% of children with SHCN had normal or minor malocclusions, 17–24% had definite malocclusion,

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9-23.6% had severe malocclusion, and 32% had very severe malocclusion [25]. The previous study reported that mental disability (25.9%) was the most common disability, while deafness and hearing loss (9.3%) and multiple disabilities (7.4%) were less frequent. Regarding malocclusion, Class II was more common in children with mental disability (33%), whereas children with deafness and hearing loss and multiple disabilities showed an equal distribution of Class II and Class III malocclusions (50%) [26]. Hence, disability types impact oral health significantly, with physical, visual, and mental impairment leading to increased caries, plaque, and malocclusion in the special need's population [17].

This study was conducted using data collected from a single school, which may have led to under-representation of children with special healthcare needs and limits generalizability. Additionally, being cross-sectional, it also provides only a snapshot of the situation at a single point in time, without showing changes over time, which is another limitation. Importantly, while we recommend parental workshops and improved access to care, our study did not directly collect data on parental education levels, socioeconomic status, household income, distance to dental clinics, or caregivers' oral health literacy. Consequently, we cannot statistically attribute the observed poor oral health outcomes to these specific barriers. The recommendations offered are therefore logical deductions based on the high disease burden observed, rather than direct evidence drawn from our analytical results. Future research on this population must prioritize rigorous methodological standardization, including formal inter-examiner and intra-examiner calibration with Kappa statistics and duplicate examinations, to ensure the reproducibility and validity of clinical findings. Concurrently, investigators should incorporate validated caregiver questionnaires that quantitatively capture parental education, household income, oral health literacy, and geographic barriers to dental care, thereby enabling direct statistical attribution of socio-behavioral determinants to observed clinical outcomes. Large-scale, multi-center surveys are urgently required to generate and correctly cite country-specific disability prevalence and oral health data, avoiding the geographic misattribution and reference errors that plague the current literature. Finally, well-designed longitudinal and interventional studies ideally complemented by qualitative interviews with caregivers are essential to empirically test whether targeted educational workshops, facilitated access, and customized oral hygiene aids actually reduce disease burden in this vulnerable population, moving beyond speculative recommendations toward evidence-based policy.

CONCLUSIONS

Children with special healthcare needs showed a high prevalence of dental caries, plaque, gingival disease, and malocclusion, which are commonly present in disabled groups, though they brush once a day. These findings emphasize the need for targeted prevention, caregiver education, and improved access to dental care, so special workshops should be conducted for the parents to reduce the oral diseases in this vulnerable group.

Authors' Contribution

Conceptualization: SLSS
Methodology: SLSS, HM, KY, MK, SNF, MI
Formal analysis: SLSS
Writing and Drafting: SLSS, HM, KY, MK, SNF, MI
Review and Editing: SLSS, HM, KY, MK, SNF, MI

All authors approved the final manuscript and take responsibility for the integrity of the work

Conflict of Interest

All the authors declare no conflict of interest.

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