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The relationship between dental caries and vision impairment based on the DMFT Index: A literature review

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Abstract

Objectives: This study aims to explore the relationship between dental caries and vision impairment, specifically in individuals assessed using the Decayed, Missing, and Filled Teeth (DMFT) index. The research focuses on identifying the prevalence of dental caries, factors influencing oral health, and the challenges faced by visually impaired individuals in maintaining good oral hygiene.

Methods: A literature review method was employed to gather data from international scientific journal articles accessed through databases such as Google Scholar, PubMed, and ScienceDirect. Keywords used for the search included "Dental Caries", "Vision Impairment", and "DMFT". Only articles published in the last ten years (2015-2024) were considered. The selected studies were analyzed to draw conclusions regarding the oral health status of visually impaired individuals.

Results: The review found a consistently high prevalence of dental caries among individuals with visual impairments, with mean DMFT scores ranging from 1.23 to 2.71. Contributing factors include difficulties in maintaining oral hygiene, limited access to dental care, lack of awareness about proper brushing techniques, and dietary habits such as frequent snacking. Gender differences were noted, with female participants generally showing poorer oral health outcomes.

Conclusion: The study highlights the significant oral health challenges faced by visually impaired individuals, including a high prevalence of dental caries. Interventions focusing on education for both caregivers and patients, improved access to dental care, and preventive measures such as fluoride toothpaste use are crucial. This study emphasizes the importance of addressing these challenges to improve the quality of life and health outcomes for visually impaired individuals.

Keywords: Dental caries; Vision Impairment; DMFT Index; Oral Hygiene; Preventive Care; Snacking Habits; Gender Differences

1. Introduction

A person with special needs will certainly feel their own challenges in maintaining their oral health. The term “special needs” here refers to people who require assistance for disability conditions that can be medical, mental, or psychological conditions [1]. In daily life, vision is an important aspect that can help humans in their activities. A person with good vision is very likely to get good educational results, have a high level of productivity, and even reduce one's sense of inequality [2]. At least as many as 2.2 billion people in the world have near or far vision impairment according to WHO. Half of them or about 1 billion people have preventable or treatable disorders [3]. That is why visual impairment is considered to affect a person's quality of life and it is a fact that cannot be ignored.

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In the oral cavity, teeth play an important role where a person will start to face problems with mastication, aesthetics, speech, and even self-confidence when they lose their teeth. On the other hand, people with visual impairments will find it difficult to recognize the presence of caries at an early stage. Most of them will only realize it after the pain or discomfort that is considered to interfere with their daily lives [1]. Caries is defined as a condition when the layers of the tooth such as enamel, dentin, and cementum experience a localized damage. This is known to occur due to several risk factors, which are the host, agent or microorganism, substrate, and the time. Not only that, the risk of caries development can also be influenced by things such as the individual's behavior, environment, and their access to health care [4].

In conducting epidemiological studies on caries, the DMFT index is the most commonly used instrument which is also recommended by the World Health Organization (WHO) [5]. DMFT represents permanent teeth that are damaged (D), missing (M), or filled tooth (F), while dmft represents deciduous teeth that are damaged (d), missing (m), or filled tooth (f) [6].

2. Material and methods

This article was prepared using the literature review method. Data were collected from international scientific journal articles accessed through databases such as Google Scholar, PubMed, and ScienceDirect using keywords like “Dental Caries”, “Vision Impairment”, and “DMFT”. The inclusion criteria for this article are scientific articles published within the last ten years (2015-2024). The collected data will be analyzed and conclusions will be drawn based on the analysis.

3. Results and discussion

Based on the collected and analyzed articles, the findings are presented as follows:

Table 1 List of Articles

No.	Author	Method	Result
1	John et al. (1)	Cross-sectional	The present study shows that while visually impaired individuals have fair oral hygiene status, they lack knowledge about proper brushing techniques, which is one reason for the high rate of dental caries.
2.	Natarajan et al. (7)	Cross-sectional	The mean DMFT score was 0.57 ± 0.80. The decayed component and missing teeth component accounted for 98.6 and 1.4% of the total DMFT value of study participants, respectively. The filled component was nil. The mean deft score was 1.13 ± 1.11. The major contribution to the total deft value was from the decayed component (99.3%). Extracted and filled teeth component contribution to deft score were 0.7 and 0%, respectively.
3.	Lee et al. (8)	Cross-sectional epidemiological study	A total of 73 participants were recruited, of whom 57.5% were male. Their mean (SD) age was 12.9 (4.7) years. Their mean DMFT score (SD) was 1.0 (1.8), and 43.8% had caries experience. Their caries experience was significantly associated with their snacking habits ($p = 0.013$). Male participants had poorer oral hygiene than females ($p = 0.048$).
4	Macharia et al. (9)	Descriptive cross-sectional	In general, the participants in this study had fair oral hygiene with gingivitis being highly prevalent (88.1%), and almost half of the study population suffering from dental caries (44.7%). Most participants were unaware of using fluoridated toothpaste or the need to change toothbrushes within 3 months. Oral hygiene practices did not influence oral hygiene status and dental caries status. However, an association was reported between frequency of toothbrush replacement and gingival index score.
5	Das et al. (10)	Cross-sectional	A statistically significant difference in mean decayed, missing, and filled teeth (DMFT/dmft) was observed in children consuming liquid sugar as compared to solid and those consuming sticky sugars as compared to non sticky. Caries prevalence for primary dentition was 15% as 37 participants had a caries experience (decayed, missing, and filled teeth [dmft] >0) and 201 participants had no caries experience (dmft = 0). Similarly, for permanent dentition, caries

			prevalence was 46% as 109 participants had a caries experience (DMFT >0) and 129 had no caries experience (DMFT = 0).
6	Suresan, V. (11)	Descriptive cross-sectional study	The caries prevalence of the study population was 69.2%. Mean DMFT was 1.23 ± 2.16 for permanent teeth and mean dmft 0.1 ± 0.46 for primary dentition (age ≤12 years, n= 137).
7	Li et al. (12)	Cross sectional	The prevalence of dental caries in visually impaired was 66.10%. The mean number of DMFT in visually impaired students was 2.71±3.06 respectively. The results of the multivariate logistic analysis showed that fluoride use and parents' educational background had an impact on the caries experience of visually impaired students.
8	Khan et al. (13)	Cross-sectional	A total of 91 visually impaired students (41 blind, 50 low vision) within the age group of 13 to 17 years old participated in this study. The mean DMFT score of total students were 0.80 (SD 1.62). Male students demonstrated significantly better oral health status than female in relation to prevalence and mean score of dental caries.
9	Amrollahi et al. (14)	Cross-sectional and descriptive-analytical study	Mean DMFT in the studied children was 2.40±1.32 and highest score was related to decayed tooth, followed by filled tooth.
10	Singh et al. (15)	Descriptive cross-sectional study	There was a high dental caries prevalence of 57.7% among the visually impaired children with a mean DMFT of 1.64 and mean deft of 1.53.

Based on the 10 articles presented in Table 1, this discussion will focus on identifying the relationship between dental caries and vision impairment, particularly in individuals assessed using the DMFT index.

Visual impairment is a type of disability characterized by eyesight that cannot be restored to a "normal level", as defined by the Centers for Disease Control and Prevention (CDC) (13). Visual impairment is a significant health care concern that requires attention (7). Most of the visually impaired individuals depend on others for assistance with daily tasks around the clock. Oral health problems among people with disabilities tend to be more severe compared to the general population with higher rates of untreated dental conditions and greater challenges in accessing dental care. Dental caries is a prevalent issue within this group, primarily caused by the presence of plaque and calculus. Understanding the formation of plaque and calculus is easier when observed rather than explained, which poses a challenge for visually impaired individuals. Using disclosing agents to illustrate plaque and calculus is often ineffective for them. However, maintaining good oral hygiene is essential to preventing dental caries (1).

The experience of dental caries was assessed using the Decayed, Missing, and Filled Teeth (DMFT) index. This index comprises three components: D for decayed teeth, M for teeth missing due to caries, and F for teeth that have been filled. The total DMFT score for each individual is calculated by summing these components with possible scores ranging from 0 to 28 (13). The DMFT index for the first permanent molar was recorded by a single examiner using a mouth mirror, explorer, and headlight, following the criteria established by the World Health Organization (WHO) (14).

According to research by Singh et al. (15), there was a high dental caries prevalence of 57.7% among the visually impaired children with a mean DMFT of 1.64 and mean deft of 1.53. Another study by Li et al. (12) also showed that the prevalence of dental caries among individuals with vision impairment was high, reaching 66.10% with the mean number of DMFT was 2.71±3.06. Research by Suresan, V. (11) showed that the caries prevalence of the study population was 69.2% with the mean DMFT was 1.23 ± 2.16 for permanent teeth and mean dmft 0.1 ± 0.46 for primary dentition.

Research by Natarajan et al. (7) showed that the average DMFT score was 0.57 ± 0.80, with the decayed and missing teeth components contributing 98.6% and 1.4% to the total DMFT value, respectively. There were no filled teeth recorded. Meanwhile, the mean deft score was 1.13 ± 1.11, predominantly influenced by the decayed component, which accounted for 99.3% of the total. The extracted and filled teeth components contributed 0.7% and 0%, respectively, to the deft score. Another study by Amrollahi et al. (14), the average DMFT among the children studied was 2.40 ± 1.32, with the highest contribution coming from decayed teeth (mean 1.74 ± 1.26), followed by filled teeth. No significant association was found between parental knowledge and the mean DMFT score ($p = 0.30$). However, there was an inverse

relationship with the number of extracted teeth (p = 0.02) and a positive relationship with the number of filled teeth (p = 0.04).

Findings from three studies offer contrasting perspectives. According to study by Khan et al. (13), male students demonstrated significantly better oral health status than female in relation to prevalence and mean score of dental caries. Nearly three-quarters (71.4%; n=65) of students were free from dental caries (DMFT = 0). Among male students, 78.6% (n=44) were caries-free, while 21.4% (n=12) had DMFT score ranging from 1 to 8. In contrast, only 60% (n=21) of female students had healthy teeth, a lower proportion compared to males. Additionally, a significantly higher percentage of female students (40%) had experienced dental caries compared to their male counterparts ($p<0.05$). Female students also had a significantly higher average DMFT score than male students ($p<0.05$). Another study conducted by Das et al. (10) also explained the mean DMFT was greater among females (2.02 ± 2.78) compared to males (1.25 ± 1.83), with this difference being statistically significant ($P < 0.05$). However, in the study conducted by Lee et al. (8) showed that Male participants had poorer oral hygiene than females. This observation could be linked to the tendency of females to pay closer attention to their oral hygiene, making them more motivated to practice proper oral care routines. Consequently, future preventive programs might consider offering more comprehensive oral hygiene training specifically targeted at male participants.

Research by John et al. (1) showed that while visually impaired individuals have fair oral hygiene status, they lack knowledge about proper brushing techniques, which is one reason for the high rate of dental caries. Several factors can be considered to explain the severity of dental caries, including biochemical variations in salivary buffering capacity, differences in living environments, dietary habits, the composition of salivary components, and potential chemical differences in saliva. Furthermore, parents of visually impaired individuals often overlook the importance of early dental care. Another study conducted by Macharia et al. (9) revealed that most participants were unaware of using fluoridated toothpaste or the need to change toothbrushes within 3 months. Oral hygiene practices did not influence oral hygiene status and dental caries status. Another study by Lee et al. (8) highlighted a significant connection between their snacking habits and caries experience. In this study, a significant relationship was observed between the frequency of daily snacking and caries prevalence (p = 0.013). Participants who consumed snacks two or more times per day showed a higher prevalence of dental caries. While parents often use snacks as rewards for their school-aged children, students with visual impairments may rely on others to choose their food and snacks due to their inability to see and select them independently. Therefore, it is important to educate parents and caregivers of visually impaired students about the link between frequent snacking and dental caries.

4. Conclusion

In conclusion, the studies reviewed highlight a significant prevalence of dental caries among individuals with visual impairments, as assessed using the DMFT index. The findings consistently show that visually impaired individuals experience higher rates of dental caries compared to the general population, with high DMFT scores primarily driven by decayed teeth. Factors contributing to this include challenges in maintaining oral hygiene, limited access to dental care, and lack of awareness about proper oral hygiene practices, such as brushing techniques. Additionally, dietary habits, particularly frequent snacking, and limited parental awareness further exacerbate the problem. Gender differences were also observed, with female participants generally having worse oral health outcomes than males, though the findings on this aspect were mixed across different studies.

This study underscores the need for tailored oral health interventions for visually impaired individuals, including education for both caregivers and patients on the importance of oral hygiene, the risks of frequent snacking, and the use of fluoride toothpaste. The findings also suggest the importance of early and consistent dental care and the potential benefits of preventive programs focused on enhancing oral health literacy. Addressing these issues can significantly improve the oral health outcomes of individuals with visual impairments, ultimately benefiting society by promoting better overall health and quality of life for this vulnerable population. Going forward, more comprehensive studies focusing on preventive dental care and its accessibility for visually impaired individuals are essential.

Compliance with ethical standards

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Disclosure of Conflict of interest

No conflict of interest to be disclosed.

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