



## Original Research Article

## Oral health status among visually and hearing impaired individuals- A systematic review

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## ABSTRACT

**Objective:** To review and study the oral health status among visually and hearing-impaired individuals.**Data Sources and extraction:** A literature was performed in main databases like- Pub Med Central, Cochrane Library, Embase and Google Scholar from year 2001 to 2020. This systematic review study was done according to PRISMA guideline.**Data synthesis:** It was found that disabled individuals had poor oral health status as compared to the non-disabled individuals. Blind children experienced more caries than hearing-impaired children in permanent, whereas it was opposite in primary dentition. Braille language and text instructions can be very useful for visually impaired individuals irrespective of the degree of blindness and can help them to maintain oral hygiene. Hearing impaired individuals are taught with actions and visualisations.**Conclusion:** As a public health personnel, the fact, it is extremely difficult to change people's attitudes rapidly. The sighted must know how to deal with the blind individuals and learn to overcome their own ambiguity, or their undesirable attitudes may be implemented and talk of social acceptance should not be felt in mind.© This is an open access article distributed under the terms of the Creative Commons Attribution License (<https://creativecommons.org/licenses/by/4.0/>) which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

## 1. Background

Oral cavity is a mirror of the rest of the body and oral health is reflection of quality of life.

Physically disabled population is one of the most alienated and excluded groups in society. We all have the right to be treated as equals regardless of identity at any phase of life but it has been observed that physically disabled people are avoided by society.<sup>1</sup>

According to Center for disease and control, disability is any condition of the body or mind (impairment) that makes it more difficult for the person with the condition to do certain activities (activity limitation) and interact with the world around them (participation restrictions).<sup>2</sup>

The International Classification of Functioning, Disability and Health (ICF) is a framework for describing

functioning and disability in relation to a health condition. The ICF focuses on three components: body, activities, participation (at individual and societal levels) and contextual (personal and environmental).<sup>3</sup>

The WHO definition of “deafness” or hearing loss/hearing impairment refers to the complete loss of hearing ability in one or two ears. Approximately 15% of the world's adult population has some degree of hearing loss. About one third of those who are affected, have disabling hearing loss.<sup>4</sup>

According to WHO (2018) data, hearing impairment (HI) individual's prevalence residing in India is around 6.3% (63 million people suffers from significant auditory loss). The estimated prevalence of adult-onset deafness in India is 7.6% and childhood-onset deafness is 2%.<sup>5</sup>

Globally there are around 285 million population in every age group who suffer from any type of disability, of whom 39 million are blind. The major causes of visual

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impairment are untreated refractive errors, deficiencies and among all the causes, first cause of blindness is cataract (51%).<sup>6</sup> Survey released in 2019 on visually impaired population states that prevalence of blindness in India is 1.99%. Uttar Pradesh has the highest population suffering from blindness. Around 3.67% of the district are blind and 21.82% suffer visual impairment.<sup>7</sup>

Oral health care is a key aspect which reflects general health. Mostly people do not receive dental care. In the United States, there are reports of dental care disparities in relation to race and ethnicity, age, gender, income, education, access to dental insurance, and disability status.<sup>8</sup>

World report on disability states that world's population with an estimation of 15% is surviving with different kinds of disability.<sup>9</sup> Approximately 650 million people are affected with the disability which is rising with increase in population, ageing process and spread of chronic diseases.

According to the National Sample Survey Organization (NSSO), there are 18.49 million persons with disabilities in India which constitutes around 1.8% of the total population.<sup>10</sup> According to Oral health has a great impact on our overall health including both physical and psychological. The interrelationship between oral and general health has been proven by evidence. The WHO defines quality of life as "individual's perception of their position in life in the context of culture value system, in which they live and in relation to their goal, standards, and concerns."<sup>11</sup>

Oral health-related quality of life (OHRQOL) is a relatively new but rapidly growing phenomenon which has emerged over the past two decades.<sup>12</sup> OHRQoL is a multidimensional construct that includes a subjective evaluation of the individual's oral health, functional well-being, emotional well-being, expectations and satisfaction with care, and sense of self. It has wide-reaching applications in survey and clinical research. OHRQoL is an integral part of general health and well-being.

Children with physical disabilities comes under a group as "special needs population". They have little about their oral health; also experience considerably higher levels of dental diseases and also more difficulty for accessing oral health care.<sup>13</sup>

Oral disease is a paramount and crucial oral health problem for every age group population with disabilities having a higher prevalence and severity of oral disease when compared to the general population.<sup>14</sup> Poor oral health leaves a negative impact on diet, digestion, chewing habit, facial shape and speech.

### 1.1. Need for the study

Worldwide poor oral hygiene practices among different population are associated with higher risk of problems like infections, pain, discomfort, social acceptance, quality of life, etc. Highest number of disabled has been reported

from the state of Uttar Pradesh (3.6million).<sup>(16)</sup> There are several studies which have been reported with visually and hearing impaired individuals to explore the accuracy of their oral health knowledge and how their disability impacts their oral health behaviors. Unless magnitude of visual and hearing impairment population is not clear and set within the parameter of the experience of a person who is visually and hearing impaired, methods or ideas for promotion of oral health literacy and behaviors may be unproductive and non-profit. Hence, review is conducted to have in-depth knowledge about oral health care among visually impaired and deaf individuals with sociodemographic variables and quality of life.

## 2. Aim

### 2.1. Research question

To review and study the oral health status among visually and hearing-impaired individuals.

## 3. Materials and Methods

### 3.1. Information sources and search strategy

This systematic review study was executed according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline. PECO question were kept in mind to search vocabulary (MeSh terms) and free keywords:

1. Population (P): Visually and hearing-impaired individuals.
2. Exposition (E): Not applicable (determinants that influence the use of dental care and have been found during this systematic review)
3. Comparison (C): Not applicable
4. The outcome (O): Oral hygiene status, dental caries, periodontal status and oral health related quality of life.

### 3.2. Search method for identification of studies

We devised the search strategy for each database for the identification of the studies to be included in this review. The search strategy used a combination of controlled vocabulary and free text terms like oral health status, visually and hearing-impaired individuals, periodontal status, oral health related quality of life, dental caries, oral hygiene practices, Center for disease and control, International classification of functioning, disability and health, disabilities, etc. The main electronic database used to access the studies- PubMed, PubMed Central, Cochrane Review, Embase and Google Scholar [Table/Fig-1]. A manual search was performed of the reference lists for all primary studies to obtain additional relevant publications. The related article links of each primary study in the PubMed database were also assessed.

Table 1:

Author (s)Name & Year	Objective	Type of Study	Sample size	Age Group	Duration	Result	Conclusion
<b>Shyama M, Al-Mutawa SA, Morris RE, Sugathan T, Honkala E (2001)<sup>14</sup></b>	To determine dental caries prevalence among disabled children and young adults in Kuwait, to set baseline data and determine treatment need.	Cross-sectional study	832 disabled children and young adults	3-29 years; mean age 12.1 years	Not specified	The mean dmft and dmfs were 5.4 and 15.2 respectively, being highest in the Down's syndrome and lowest in the blind. The mean DMFT was 4.5 and the DMFS 8.7, being highest in the Down's syndrome and lowest in the blind. Prevalence of untreated decay was highest in hearing impaired (86%). The caries experience of first permanent molars represented the largest proportion of the DMFT score (53.6%).	There is a confirmed need for strengthening organised preventive and restorative care for this population in Kuwait.
<b>Altun C, Guven G, Akgun OM, Akkurt MD, Basak F, Akbulut E (2010)<sup>15</sup></b>	To assess the prevalence of dmft-DMFT indices and the oral hygiene status of 136 individuals attending a special school for the disabled.	Cross-sectional study	136 individuals	2-26 years	Not specified	DMFT according to age group were reported to be- 2-6 years: dmft=2.04±2.24; 7-12 years: dmft=2.24±2.60, DMFT=0.98±2.5; 13+years: DMFT=2.68±2.9. 15.4% of children had no caries or fillings.	Dentist should focus on promoting preventive approach and oral health education.
<b>Suma G, Das UM, Akshatha BS (2011)<sup>16</sup></b>	To determine the oral health status and oral hygiene practices among children with hearing and speech impaired in RV Integrated school.	Cross-sectional study	76 children	5 to 18 years	May-August, 2011	Results showed 42% dental caries among children and gingivitis in 35% of the children and malocclusion in 19%.	Dentist should concentrate on promoting good oral hygiene practices and clear understanding to implement proper brushing technique.

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*Table 1 continued*

<b>Reddy VK, Chaurasia K, Bhambal A, Moon N, Reddy E (2013)</b> <sup>17</sup>	To compare the oral hygiene status and dental caries experience among institutionalized visually impaired and hearing-impaired children of age between 7 and 17 years in Bhopal city of Madhya Pradesh located in Central India.	Cross-sectional study	2013	95 visually and hearing impaired school going children.	7-17 years	Mean OHI(S) score for hearing impaired was $1.15 \pm 0.72$ while it was $1.51 \pm 0.93$ for visually impaired children ( $P < 0.05$ ). Mean DMFT score was $1.4 \pm 1.95$ and $0.94 \pm 1.45$ among hearing impaired and visually impaired respectively. The hearing impaired had a mean dft score of $0.47 \pm 1.01$ and in visually impaired it was $0.19 \pm 0.79$ .	Parents or caretakers of disabled individuals should be taught about the oral hygiene practices so that they can take care of their children properly.
<b>Bennadi D, Mythri H, Bharteesh JV (2013)</b> <sup>18</sup>	To provide the input on which aspects of oral health promotions and services that need to be improved.	Cross-sectional study	76	5-17 years	Not specified	There was 68.9% of dental caries prevalence among study participants.	Preventive care should be focused among disabled population to further prevent progression of oral diseases.
<b>Sanjay V, Shetty SM, Shetty RG, Managoli NA, Gugawad SC, Hitesh D (2014)</b> <sup>19</sup>	To assess the dental caries status among disabled children as dental health is an integral part of general body health and this group is deprived of health care needs. Study was conducted in a blind institute.	Cross-sectional	310	6-20 years	Not specified	The overall mean for DMFT scores for males and females was 2.11 and 1.75 respectively. Similarly overall mean for dft was 0.31 for males and 0.27 for females. Mean DMFT of blind students was more as compared to hearing impaired ones as 2.16 and 1.80 respectively. Age factor showed a significant increase in the mean DMFT scores with advancing age at $p \leq 0.001$ .	Oral hygiene status of hearing impaired individuals was better than visually impaired children.

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Table 1 continued

<b>Pradhan M, Joshi U, Poudyal P, Reshu D (2015)<sup>20</sup></b>	To assess the oral health status of deaf and hard of hearing people in two centers in Kathmandu, Nepal	Cross-sectional study	81	Above 18 years	3 months from August 2015 to October 2015.	The mean periodontal index of deaf participants was higher ( $0.38 \pm 0.74$ ) than that of the hard of hearing group ( $0.19 \pm 0.27$ ).	There was lack of treatment among the studied group and overall oral health status was poorer in the hearing-impaired than in the blind subjects. Oral hygiene status of hearing impaired individuals was better than visually impaired children.
<b>Priyadarshini P, Pushpanjali K, Sagarkar A, Bhoomik A, Shenoy S (2015)<sup>21</sup></b>	To assess the oral health practices, status and caries experience among the visually impaired children.	Cross-sectional study	43 individuals	3 to 18 years. Mean age-15.37 years.	Month of November, 2014	The mean DMF score was 1.58 and complete OHI was 1.21. The D component shows mean score of 1.02 and F component was 0.05.	There is urgent need of both comprehensive and incremental dental care for this subgroup of population.
<b>Mohan N, Indushekar KR, Saraf BG, Sheoran N (2016)<sup>22</sup></b>	To assess the oral health status in visually impaired children and adults aged 6-25yrs attending special schools in Delhi.	Cross-sectional study	1131 individuals	13-25 years	Not Specified	The overall mean of the oral hygiene status in the study groups of the 6 – 12- year division is 1.05 and that of 13 – 25 years is 1.77. The overall mean of the oral hygiene status noted in children is 1.51 and that of adults is 1.85. The difference noted is statistically significant ( $p < 0.001$ ) and males were found to have better oral hygiene as compared to females among children and adults.	They revealed an association between dental diseases and the type and the severity of the disability.

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Table 1 continued

<b>Johnson WH, Dobbertin K (2016)<sup>23</sup></b>	To examine differences in dental insurance, receipt of dental check-ups, and delayed and unmet needs for dental care by type and complexity of disability in Household Component of the Medical Expenditure Panel Survey (MEPS), USA.	Cross-sectional study	187,039 adults	18-64 years	Analysis of 2002–2011 data from the Medical Expenditure Panel Survey.	All disability types population had significantly higher adjusted odds of dental diseases without dental insurance as compared to people with limitations.	Oral health promotion program should be provided aimed at the deaf and hard of hearing community and also efforts should be made to seal the communication gap.
<b>Shahabudin S, Hashim H, Omar M (2016)<sup>24</sup></b>	To assess the effectiveness of dental health education tools for visually impaired students in two schools in Bukit Mertajam, Penang.	Experimental study	38	6-17 years	Not Specified	The score difference in the totally blind group was significant (p=0.025). Reductions in plaque scores were also observed in stratified data (based on age); with the partially blind aged 12-17 years showing the greatest reduction. However, the difference was not statistically significant (p=0.067).	Proper planning is needed and programmes should be organised to provide oral health education and services for such special group.
<b>Sandeep V, Kumar M, Vinay C, Chandrasekhar R, Jyostna P (2016)<sup>25</sup></b>	To evaluate the oral health status and treatment needs of CHI attending a special school in Bhimavaram Town, India.	Cross-sectional study	180	Group-I (6–8 years), Group-II (9–12 years), and Group-III (13–16 years)	November 2012	Prevalence of dental caries in the sample was found to be 65% with a mean level of caries prevalence (DMFT) of $1.6 \pm 1.3$ in Group-I, $1.9 \pm 1.2$ in Group-II, and $2.2 \pm 1.2$ in Group-III. About 91.7% of the total children examined needs treatment. The mean plaque and gingivitis scores of the sample were $1.70 \pm 0.61$ and $1.59 \pm 0.58$ , respectively.	Among children and adults also; males exhibited better oral health status as compared to females and there was a statistical significant difference observed only in children.

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Table 1 continued

<b>Debnath A, Srivastava BK, Shetty P, Eshwar S (2017)</b> <sup>26</sup>	To assess the effectiveness of oral health innovative educative method among visually impaired children of Bengaluru city of India.	A non-randomized contro-l trial	40 visually impaired individuals	8-18 years	6 months	Results showed that there 80% of the children had fair plaque scores in the preintervention period to 30% in the postintervention period.	Disparities in care were seen even in presence of dental insurance.
<b>Prasad M, Patthi B, Singla A, Gupta R, Niraj L K, Ali I (2018)</b> <sup>11</sup>	To assess dental caries experience, oral hygiene status, periodontal status, and prevalence of malocclusion among differently abled children attending special schools in Delhi.	Cross-sectional study	1060 (610 males and 450 female) Differently abled children.	12 to 19 years	Period of 3 months from May to July 2017.	Majority 56.4% (598) had dental caries with the mean (DMFT) being 1.10. Prevalence of dental caries was high in visually impaired group (63.2%) and least in hearing and speech impaired group (51.7%). The overall oral hygiene status recorded was good in 58.5%, fair in 40.8%, and poor in 0.7% of the study population.	Oral health education module should be implemented to increase the awareness about dental health effectively.
<b>Shivaku-mar KM, Raje V, Kadashet-ti V (2018)</b> <sup>27</sup>	To determine dental caries prevalence and oral hygiene status among the hearing and speech impaired children of Karad city, Maharashtra	Cross-sectional study	100 children	5-18 years	Not specified	The largest component of DMFT/dmft was the decayed component, with a mean of $2.83 \pm 0.94$ . ( $P < 0.05$ ) The simplified calculus index and OHI&#8209;S index showed a significant difference between males and females of the study population ( $P < 0.05$ , S).	Visually impaired children suffered from more systemic illness and poorer oral health status when compared to non-disabled individuals.
<b>Mustafa M, Asiri FY, AlGhannam S, AlQarni IA, AlAteeg MA, Anil S (2018)</b> <sup>28</sup>	To assess the awareness level among individuals with hearing and speech impairments in relation to their oral health and dental treatment needs.	Cross-sectional study	240 people	15-30 years age group	June 2016-February 2017	Majority of the participants described that they did not visit qualified dentists in the past and many of them did not know the right way of doing tooth brushing. Hence, deaf and dumb individuals lack basic knowledge about oral health and dental treatment needs.	Dental health education and awareness are necessary to ensure the good oral health.

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<b>Rezaei F, Mardani A, Moradi AH, Nikkerdar N (2019)<sup>29</sup></b>	To assess oral hygiene and needs of deaf and blind 6–12 years old exceptional school children in Kermanshah in 2015.	Cross-sectional study	51 children	6-12 years	Year, 2015	The mean and standard deviation of GI and PI of the 51 deaf and blind students examined turned out to be $1.39 \pm 0.30$ and $0.86 \pm 0.15$ , respectively; DMFT, dmft, and UTN of the blind students were $1.31 \pm 1.20$ , $2.81 \pm 2.81$ , and $0.76 \pm 0.34$ , respectively; these values turned out to be $1.81 \pm 2.16$ , $2.08 \pm 3.48$ , and $0.85 \pm 0.31$ , respectively, in case of deaf students.	Oral health education should be promoted among guardians of the disabled people to ensure their children good oral health.
<b>Kumar S, Tyagi R, Kalra N, Khatri A, Khandeelwal D, Kumar D (2019)<sup>30</sup></b>	To assess and compare the oral health status and treatment needs among visually impaired and normal healthy school-going children residing in New Delhi and to investigate the factors that influence oral health.	Cross-sectional study	640 children.	6-14 years school going children	2019	The total caries experience (Decayed, Missing, and Filled Surface + decayed, missing, filled surface) was found to be more in normal healthy children 2.72 than the visually impaired children 2.22 and it was found to be statistically significant ( $P < 0.05$ ). Oral hygiene simplified index of normal healthy children and visually impaired children were 0.74 and 1.33, respectively, and found to be statistically significant ( $P < 0.05$ ).	Awareness level of oral health and dental treatment needs is low among individuals with hearing and speech impairments (deaf and dumb) in Saudi Arabia.
<b>Liu L, et al (2019)<sup>31</sup></b>	To assess the oral health status of visually impaired schoolchildren in northeast China, and to investigate the influencing factors	Cross-sectional study	103 visually impaired school going children	Mean age of $15.93 \pm 4.28$ years (range, 6–20 years)	May, 2015	The prevalence of caries was 78.64%. The prevalence of deciduous and permanent teeth was 65.22 and 71.84%, respectively. The prevalence of gingival bleeding and dental calculus were 44.66 and 67.96%, respectively.	Since hearing and visual disabilities have definitely helped the rate of oral diseases increase, it seems quite possible to prevent further complications in case of these children.

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Table 1 continued

<b>Rohmetra A, Gupta N, Jaiswal A, Tandon R, Singh K (2020)</b> <sup>32</sup>	To assess the prevalence of dental caries, oral hygiene status, deft and oral hygiene habits inspecial health care needs in Lucknow district.	Cross-sectional study	1041 children.	4-15 years of age group	2020	Dental caries prevalence was found to be higher in male 24.45% as compared to females 21.49% and the difference was statistically significant (P<0.05).	The dental professionals should prepare themselves to play their part in improving disabled people's oral health.
<b>Uwayezu D, Gatarayiha A, and Nzayirambaho M (2020)</b> <sup>33</sup>	To determine the prevalence of dental caries and associated risk factors among children with disabilities.	Cross-sectional study	226 with physical disabilities	7-20 years	2020	The prevalence of dental caries found in children with disabilities were 42.4%. Oral hygiene status (p=0.000) was respectively significantly associated with dental caries. In logistic regression model, children who take once or more times per day sugary food like biscuits, cake, chocolates and sweets are almost 6 times higher at risk of developing dental caries [OR: 5.945, CI: 1.187; 29.774, P=0.03) while a good oral hygiene status was protective against dental caries [OR: 0.296, P=0.000].	Dental caries is a reality among children living with disabilities. Appropriate measures should be taken to protect these children and these measures should mainly focus on identified factors.

Full-text versions of the papers that appeared to meet the inclusion criteria were retrieved for further assessment and data extraction.

### 3.3. Eligibility criteria

Cross sectional studies were included that assessed the oral health status among visually and hearing-impaired individuals as an outcome. The articles published in English from the year 2001 to 2020 were included in this review. The focus was to include broadly as much relevant existing data as reasonably possible.

### 3.4. Inclusion criteria

1. Original research articles
2. The articles emphasizing on the oral health status among visually and hearing-impaired individuals

### 3.5. Exclusion criteria

1. Narrative reviews
2. Case reports and case series
3. Unpublished articles in press and personal communications

### 3.6. Ethical clearance

Ethical approval was taken from the Institutional Review Board Committee prior to the conduct of the study.

### 3.7. Study selection and data collection process

At initial stage, papers were selected by title and abstract and duplicate studies were deleted. Full reports were obtained in case of insufficient material in order to be clear. Subsequently, full-text papers were acquired and 2 reviewers classified according to the inclusion criteria. All these information was kept in mind for each inclusion criteria that is authorship and year of publication, methods including study design and outcome of interest and statistical analysis.

### 3.8. Summary measures and synthesis of the results

Data analyses were conducted with the following extracted information: author/year, title, country, study design, sample size, characteristics and source of the study population, outcome, and study findings (demographic factors, socioeconomic, psycho-logical, and behavioral factors, and perceived need). Study characteristics and results were tabulated, and statistically significant factors were reported. The explanatory framework for the visually and hearing-impaired individuals were included.

## 4. Discussion

World Health Organisation elucidate disability as a complex umbrella term in today's contemporaneous sphere because people tainted or tagged with the term disability contributes to the biases and limitations which puts them into box of negligence and downside compared to the individuals without any disability or who do not have any problem.<sup>34</sup>

### 4.1. Oral hygiene practices among visually and hearing impaired individuals

Oral hygiene plays an important role in maintaining and promoting the health of society.<sup>35</sup>

A study conducted by Prasad M, et al in 2018 at Delhi among differently abled children reported that the overall oral hygiene status recorded was good in 58.5%, fair in 40.8%, and poor in 0.7% of the study population. 99.1% visually impaired and deaf participants used to clean their teeth once in a day with toothbrush and paste.<sup>11</sup> A study conducted by Suma G, et al in 2011 among visually and hearing impaired children found that 82.89% participants brushed once in a day and more than 90% of them cared about their teeth equally as other parts of the body.<sup>16</sup> Similarly, a study conducted by Shiv Kumar KM, et al in 2013 at Maharashtra among visually and hearing impaired children reported mean OHI-S score to be  $1.63 \pm 0.84$ . The OHI-S score was reported to be higher in males than females and the difference was statistically significant ( $P < 0.05$ )<sup>27</sup> According to a study done by Folakemi A, et al in 2003 at Lagos among deaf adolescents reported that ninety-four percent brushed their teeth once daily, with no significant sex difference ( $P > .05$ )<sup>36</sup> According to a study done by John JR, et al in 2017 at Tamil Nadu among visually impaired college undergraduates reported that around 42% of individuals had fair oral hygiene status, 33% had good hygiene followed by 25% having poor oral hygiene.<sup>37</sup> According to a study done by Singh A, et al at Rajasthan in 2013 among visually and hearing impaired children reported findings of oral hygiene status good to be 0.14 and 0.16, in fair category was 0.04 and 0.02 and in poor category was 0.22 and 0.33 in visually impaired children and deaf children respectively. It was observed in the study that 54% of the visually impaired and 45% deaf children used tooth brushes and tooth paste was used by all the visually impaired and deaf children.<sup>38</sup> Plaque removal from teeth is a mastered skill and can be practiced and used regularly only when the individual has the ability to manipulate a toothbrush and a clear understanding of its objectives. Many disabled individuals will find it difficult to maintain their oral hygiene due to limitations as compared to non-disabled individuals. Since the hearing impaired cannot understand and respond to the instructions given to them, they are unable to implement the right technique of oral hygiene practices and on the other hand visually impaired

individuals cannot see their surrounding so they can not see the initial changes in the oral cavity which leads to the progression of oral diseases to late pathogenesis phase.<sup>39</sup>

#### 4.2. Dental caries among visually and hearing-impaired individuals

Dental caries is a disease that develops through gradual complex biological interactions of acidogenic bacteria, fermentable carbohydrates and host factors such as the teeth and saliva, during time. The disease develops due to multifactorial aspects, since biological to social aspects that the oral health professional should be aware of.<sup>40</sup>

Dental caries is the most prevalent condition stated in the 2015 Global Burden of Disease Study, ranking first permanent teeth decay (2.3 billion people) and 12th for deciduous teeth (560 million children).<sup>41</sup> According to a recent survey by Global Oral Health Data Bank, the prevalence of dental caries varies in the range of 49% to 83%.<sup>42</sup> and National Oral Health Survey conducted in 2003–2004, caries prevalence in India was 51.9% ,63.1% and 53.8% at ages 5, 12 and 15 years and mean DMF values were 2, 1.8, and 2.3 respectively.<sup>43</sup> According to one of the studies done in Udaipur by Jain M, et al (2013) among visually impaired and deaf children reported that total mean DMFT (decayed-missing-filled teeth) and mean dft scores were 1.77 and 0.27 respectively. The largest component of DMFT was the D, with a mean of 1.49 whereas the F component of 0.08 was very low, mean DMFT/dft was greater among hearing impaired and 56.4% had dental caries with the mean decayed, missing, and filled teeth index (DMFT) being 1.10 (standard deviation  $\pm 1.26$ ). It was observed that prevalence of dental caries was high in visually impaired group (63.2%) and least in hearing and speech impaired group (51.7%).<sup>38</sup> In a study done in 2011 by Suma G et al among hearing and speech impaired children showed that 42% study participants had dental caries and the largest component of DMFT/dmft was the decayed component, with a mean of  $2.83 \pm 0.94$ .<sup>16</sup> DMFT and dmft, of the blind students were  $1.31 \pm 1.20$  and  $2.81 \pm 0.81$  respectively whereas these values were different in a study done in Karamshah in the year 2015 among hearing and visually impaired population reporting mean DMFT/dmft as  $1.81 \pm 2.16$ ,  $2.08 \pm 3.48$ , respectively.<sup>27</sup> and almost same values were seen in another study conducted in 2017 by Prasad M,<sup>11</sup> et al among disabled children residing in Delhi NCR which reported that oral health status of blind and deaf children is much lower than the standards of the WHO oral health status report and National Health Survey reports. This may be due to lack of knowledge, improper brushing habits and inability to maintain good oral hygiene due to their own limitations.<sup>11</sup>

A recent study done in China in 2019 reported that the prevalence of caries in deciduous and permanent teeth was 65.22% and 78.64%, respectively. Visually impaired

schoolchildren group exhibited a high prevalence of dental caries as compared to adults. The probable reason could be reluctance of parents to co-operate with their disabled or special child and in most of the cases disowning them and leaving in orphanages or institutions where proper care is not possible.<sup>44</sup> The proportion of caries free subjects in the primary dentition (3-12-year-old children) was 11.2%. According to a study conducted in Kuwait in 2013, it was found that the mean dmft was 5.4, and dmfs 15.2, in disabled population. The proportion of caries-free subjects in permanent dentition, over 5 years of age was 24.2%. The smallest percentage of caries-free subjects was found in the hearing impaired (16.4%) and highest percentage in the blind (35.5%). The mean DMFT was 4.5 and the DMFS was 8.7. Prevalence of untreated decay was highest in hearing impaired (86%) children. Caries experience was clearly seen in the disabled children as compared to disabled adults.<sup>45</sup>

This observation might be because hearing-impaired population can see or look in their mouth and are more capable to keep oral cavity healthier as compared to visually-impaired ones as they cannot even see food debris or initial accumulation of calculus and dental caries.

Disabled individuals find difficult to carry out day to day life activities due to their limitations to see and hear and they lack knowledge about proper brushing techniques which is one of the reasons for progression of early stages to late pathogenesis state. Visually impaired individuals find difficult to understand the importance of oral hygiene because they can not see that on tooth surfaces which results in the progression of dental caries as well as inflammatory disease of the periodontium whereas on the other side, hearing impaired individuals are unable to hear the instructions of the instructors for maintaining good oral hygiene, so it's difficult for them to follow each and everything about the maintenance of oral cavity.

#### 4.3. Periodontal disease among visually and hearing impaired individuals

Biofilms are usually associated with the etiopathogenesis of periodontal diseases.<sup>46</sup>

Periodontal disease is a chronic inflammatory disease of periodontium and its advanced form is characterized by periodontal ligament loss and destruction of surrounding alveolar bone. It is the main cause of tooth loss and is considered one of the two biggest threats to the oral health.<sup>47</sup>

Periodontal diseases are highly prevalent in developed and as well as in developing countries and affect about 20-50% of global population. High prevalence of periodontal disease in adolescents, adults, and older individuals makes it a public health concern.<sup>48</sup> A study done by Rezai F, et al in 2015 at Karamshah found mean gingival and plaque index score among deaf and blind students to be  $1.39 \pm 0.30$  and  $0.86 \pm 0.15$  respectively.<sup>27</sup>

According to a study done in 2015 by Alsdhan S, et al at Riyadh among visually impaired and normal sighted children reported moderate gingivitis (26.5%) in visually impaired compared with only 6.9% gingivitis in normal sighted group.<sup>30</sup> The probable reason might be that visually impaired children suffered from systemic illness more followed by poor oral health as compared to normal sighted individuals. Moreover, mothers of visually impaired individuals were reported to be illiterate so making their children practice good oral hygiene practice was a hard task. Similarly, a study conducted by Sandeep V, et al in 2012 at Bhimavaram among 6-16years of disabled children reported mean gingival index score of the children to be  $1.59 \pm 0.58$ . This study showed a poor gingival health of the Hearing-Impaired children with 71.1% prevalence of periodontal problems. This may be attributed to the individual's attention, quality of care given by parents, caretakers, and community oral health programmers.<sup>25</sup>

A study done at Odisha by Jnaneswar A, et al in 2013 among visually and hearing-impaired children reported that out of 540 study children, 156 (28.9%) were healthy, 129 (23.9%) had bleeding on probing, and 255 (47.2%) had calculus. The mean score for the CPI Index among deaf and mute children was found to be 0.42 and 0.32 respectively.<sup>49</sup> According to a study done at Warora in 2010 by Rawlani S, et al among deaf and mute children reported that gingival clinical attachment loss to be  $0.26 \pm 0.15$  mm. Possible reasons for findings in the study might be because children with physical disabilities know little about their oral health; also experience considerably higher levels of oral health diseases and greater food debris and also more difficulty for accessing oral health care.<sup>50</sup>

According to a study done in 2015 by Pradhan M, et al among hearing impaired adults reported that periodontal index was  $0.38 \pm 0.74$ <sup>20</sup> and another study done in 2010 by Rawlani S, et al among deaf and mute children reported periodontal index to be  $0.42 \pm 0.32$ . The probable reason stated was lack of oral hygiene education among disabled groups.<sup>25</sup> A study conducted in 2010 by Jain M, et al among deaf and blind children and adults reported that 32% participants were periodontally healthy while the remaining participants had shallow and deep pockets and higher percentage of blind participants that is 43% were periodontally healthy than 24% of hearing-impaired participants.<sup>50</sup> The reason for the poor periodontal health of hearing-impaired participants as compared to blind participants was due to lack of treatment among the former group. A study done in 2012 by Ameer N, et al among special needs teenagers reported that 32% physically handicapped participants had loss of attachment with 4-5mm pockets and 7% in intellectually disabled population. The reason cited in study was due to the lack of coordination, understanding, physical disability or muscular limitations.<sup>51</sup> Another study conducted in 2017 by Yadav

OP, et al among deaf and mute children reported community periodontal index (CPI) score to be 45.53% had bleeding on probing, 31.13% and 2.72% had calculus & periodontal pocket 4-5 mm respectively.[54] The reason for unhealthy periodontal status might be attributed to the negligence on the part of parents, caretakers, school authorities and family members as their failure to provide dental treatment to deaf and mute individuals. Either these individuals do not have support or due to their limitations they can't observe initial changes leading to progression stages in oral cavity.

#### 4.4. Oral health related quality of life among visually and hearing impaired individuals

The term is under protection comprising social acceptance, physical beauty, emotional stability, health, education, nutrition, communication, shelter, finance, satisfaction, physical functioning, happiness etc. Physically disabled people experience more restrictions in social activities than healthy people, which are associated with lower level of well-being and poor quality of life (QoL). Findings have revealed that quality of life has decreased beyond negative graph in disabled population as visually impaired population are deprived of beautiful vision of life and need support at ever phase and hearing-impaired need to work according to actions. Moreover, it has been seen that visually impaired population has more disrupted quality of life as compared to hearing impaired population.

A study conducted by Singh A, et al in 2017 at Uttarakhand among 9-15 years visually impaired, 30.45% children reported the overall severity of impact on daily activities and the overall frequency of impact on daily activities was 29.7%. The Oral Impacts on Daily Performances for children (C-OIDP) impact reported highly significant positive correlation with age, study group, and significant negative correlation with DMFT. The visually impaired male individuals reported to have higher C-OIDP scores as compared to visually impaired females. Children who showed dentofacial deformities, dental caries, and traumatic dental injuries reported higher C-OIDP scores stating unfavorable OHRQoL. The relation between school performance and mean df-t was reported to be statistically significant ( $p < 0.001$ ). The reasons for the findings were because of the pain due to dental caries leading to distraction from performances and daily activities. If left untreated, the pain and infection due to dental caries can lead to problems in performing daily activities.

## 5. Conclusion

The present review has emphasized on oral health status among visually and hearing-impaired individuals. There is urgent need for both comprehensive and incremental dental care for this subgroup of population. Dental camps should be organized at their schools, institutions or areas and dental

services like insurance, transport facilities to the dental hospitals according to their comfort and understanding should be organized. The goal of the dentist or hygienist should be to train and encourage the blind individuals to accomplish these tasks independently.

## 6. Recommendations

1. As a Public Health Dentist, we should come forward in implementing new strategies for the successful treatments and for special or disabled population.
2. School dental health education – The students should be taught about oral health and teachers, parents and caretakers should be taught regarding maintenance of oral hygiene.
3. School dental health services should be conducted and camps with transportation and treatment facilities should be provided for the people in treatment needs.
4. Self-modelling can be used efficiently to provide dental health instructions. Models, audiotapes, magnifying aids, large print materials, raised label markers, Braille scripts, bold scripts, etc. can be used as instructional aids.
5. Positive reinforcement of the information provided is a very important factor in building a strong foundation, especially in the case of visually impaired children.
6. The dentist, therefore, must carefully evaluate the patient's disabilities as well as his abilities so that an effective plan can be developed. As a dentist, we should start treatment with short appointments till a friendly and comfort ambience is established between the patient and the dentist. A 'tell, feel, do' technique can be used instead of the 'tell, show, do' technique to demonstrate the ongoing procedures to the patient. After the patient becomes familiarized with the sounds, tastes, and smells, only verbal guidance is required. The patient has to be informed prior, if the operating personnel is moving away from his chair. Sudden jerky movements, of the chair or of the operating personnel or of the instruments should be avoided. In essence, the dental team member must maintain a running conversation that vividly paints a mental picture of appointment for the patient.

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## 8. Conflicts of Interest

There are no conflicts of interest.

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