

# Oral Health Status and Treatment Need Among Institutionalised Hearing-Impaired and Blind Children and Young Adults in Udaipur, India. A Comparative Study

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## Abstract

**Aim:** The aim of this study was to assess and compare the oral health status and the treatment needs of the institutionalised hearing-impaired and blind children and young adults in the city of Udaipur, Rajasthan, India.

**Methods:** A descriptive cross-sectional study was conducted among 498 institutionalised hearing-impaired and blind people, aged 4 to 23 years, in the city of Udaipur, Rajasthan. The World Health Organization oral health assessment basic methods and form (1997) were used for data collection. Clinical examinations were carried out in the institute's medical room or classroom by single examiner with the aid of a mouth mirror, explorer and Community Periodontal Index (CPI) probe under adequate natural light (Type III examination). The resulting data were entered into statistical software and analysed by applying the chi-square test, ANOVA, *t*-test and stepwise multiple linear regression analysis.

**Results:** The 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. The F component of 0.08 was very low. Mean DMFT/dft was greater among hearing-impaired than among blind subjects. Overall, 159 (32%) were periodontally healthy (CPI=0), 162 (32%) had shallow pockets (CPI=3) and 36 (7%) had deeper pockets (CPI=4). A higher percentage of the blind (87; 43%) than the hearing-impaired (72; 24%) subjects were periodontally healthy (CPI score=0). One-surface fillings were the most commonly provided form of past treatment.

**Conclusion:** The findings in this study highlight the lack of dental treatment for this group. Overall oral health status was poorer in the hearing-impaired than in the blind subjects.

*Key Words:* Hearing Impaired, Blind, Dental Caries, Periodontal Disease

## Introduction

Oral health has strong biological, psychological and social consequences because it affects aesthetics and communication, and quality of life is influenced by oral health status [1]. Good oral health is important for proper mastication, digestion, appearance, speech and health. Oral health is linked to happiness and good general health and there is evidence that aesthetically unacceptable and functionally inadequate dentitions affect self-esteem, confidence and socialisation [2].

Normal facial morphology and its components are necessary for harmony and the aesthetics of the

craniofacial complex. Oral and dental anomalies are a frequent problem for special needs patients, including those who have hearing impairment and/or are blind. The oral cavity plays an important role in the satisfaction to be achieved from life through functions such as mastication, aesthetics, phonetics, communication and expression [3].

The oral health of disabled people may be neglected because of a focus on their disabling condition, other major disease(s) or limited access to oral health care. It has been reported that "dental treatment is the greatest unattended health need of the disabled" [4]. Some of the reasons for this may be

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inadequate recall systems, practical difficulties during treatment sessions, the socio-economic status of the disabled person, pain, underestimation of treatment needs, communication problems and poor patient cooperation.

The magnitude and severity of oral health problems in disabled people are worse than in the general population and disabled people have more untreated dental diseases and more problems accessing dental care [5]. The severity of oral problems in disabled people has been attributed to lack of awareness about oral hygiene, an inability to access oral care facilities, diet, eating patterns, medication, physical limitations, lack of oral hygiene and attitudes of parents and health providers, all of which contribute to poor oral health [6].

People with disabilities represent a substantial section of the community and it is estimated that worldwide there are about 500 million people with disabilities [7]. Historically, they have been ignored, vilified or even hidden away in institutions. Providing health care services for children with special care needs will continue to be a challenge in the 21st century [8].

According to the Indian National Sample Survey of 2003 [9], about 2% of the population were mentally handicapped, and another 1.8% were physically, visually or hearing-impaired. The 2003 census in India identified 21,906,769 disabled citizens representing 2.13% of the population [9].

Visual impairment was the most frequently occurring disability, followed by speech, hearing, movement and mental disabilities [10]. In poor societies, many disabled persons find it difficult to survive; nutritional status is very low and services are inadequate and hence disabled people often live in extreme poverty, misery and despair, leading to dependency and deprivation [10].

In 2003, sensory impairment (visual and hearing together) accounted for the largest percentage of disability in India. There were 10,634,881 visually impaired people who represented nearly 49% of all the disabled Indians [9]. A legal definition of a blind person is one who, even with the best optical correction, can see less at 20 feet than a person with normal vision can see at 200 feet (a visual acuity is 20/200) or whose field of vision is limited to a narrow angle [11]. Visual defects are one of the most common causes of disability in the world, and visual impairment in childhood is often part of a multiple disability disorder [11].

Data from the National Sample Survey Organisation 2003 have estimated that about 0.3 million children in the age group 0 to 6 years have hearing impairment in India. In addition to this, over 21,000 children are born deaf every year, which implies that one child per every 1,000 live births is hearing-impaired. In India in 2003, hearing impairment accounted for 1,261,722, or 5.76% of the total number of disabled [9].

Two main types of deafness may be described, conductive and sensory neural. The degree of hearing loss resulting from these impairments may range from slight (average loss not exceeding 40 decibels) to profound (average loss in excess of 95 decibels) and may be unilateral or bilateral [12]. Four degrees of hearing loss have been suggested. They are: mild (26-40 db), moderate (41-70 db), severe (71-90 db) and profound (>90 db). Deaf children constitute one of the major groups of disabled children [13].

Various studies on the oral health status of the normal population have been carried out in the past. However, very little information is available on the dental health of the handicapped population and in particular, the institutionalised visually and hearing-impaired children and young adults in the city of Udaipur in Rajasthan. These people range in age from 4 to 23 years.

### Aim

Against this background, the aim of the present study was to assess and compare the oral health status and treatment needs of the institutionalised blind and hearing-impaired handicapped groups in the city of Udaipur, Rajasthan, India.

### Methods

A descriptive cross-sectional study was conducted to assess the oral health status and treatment needs of all 554 institutionalised hearing-impaired and blind students in Udaipur, Rajasthan. All the students were institutionalised, with low socio-economic status and poor background, and they were under the guidance of carers.

A pilot was conducted on 25 hearing-impaired and 25 blind subjects in April 2009. One examiner (MJ) performed this pilot. Intra-examiner reliability was assessed by using the weighted kappa statistic. The resulting scores were excellent: 0.9 for dft, 0.91 for DMFT (decayed-missing-filled teeth) and 0.81 for the Community Periodontal Index (CPI).

This study was reviewed by the institutional ethical committee of Darshan Dental College and

Hospital and clearance was obtained. Institutional consent was taken from the Head of the Institutes, because the subjects were not in a position to understand or sign the consent form.

**Inclusion criteria**

All institutionalised hearing-impaired and blind students resident in the various institutions of Udaipur were included in this study.

**Exclusion criteria**

Children affected with mental retardation, physically and mentally handicapped, orthopaedic defects, cerebral palsy and medically compromised were excluded from the study as were subjects who were absent on the day of examination, did not cooperate and who were systemically ill.

**Pro forma details and method of obtaining data**

The World Health Organization (WHO) oral health assessment pro forma (1997) was used to collect the personal information and assessment of oral health was performed according to the WHO basic methods (1997) [14].

Clinical examinations were carried out at the institute’s medical room or classroom by single examiner (MJ) with the aid of a mouth mirror, explorer and CPI probe under adequate natural light (Type III examination).

**Statistical analysis**

The resulting data were entered into statistical software (Statistical Package for the Social Sciences

version 15; SPSS Chicago, USA) and were analysed by applying the chi-square test, ANOVA, *t*-test and stepwise multiple linear regression analysis. Significance level was set at  $P \leq 0.05$ .

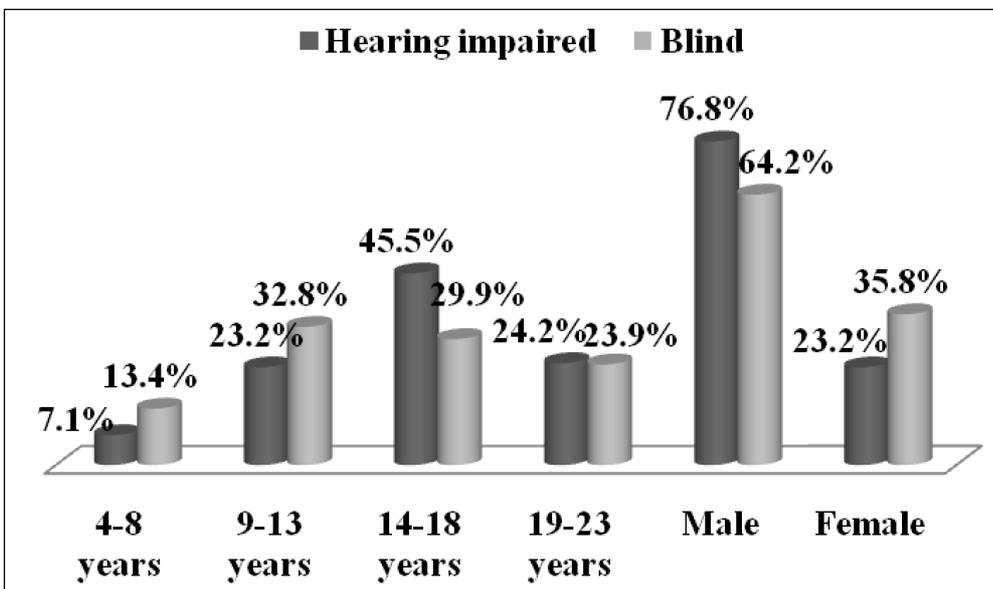
**Results**

The final sample consisted of 498 subjects out of the possible 544. Of the 46 who were not assessed, 20 were absent, 18 did not cooperate and 8 were systemically ill. The response rate was 89.9%

Among the 297 hearing-impaired subjects, 228 (76.8%) were male and 69 (23.2%) were female; among the 201 blind subjects, 129 (64.2%) were male and 72 (35.8%) were female (*Figure 1*).

The overall mean DMFT and mean dft scores were 1.77 and 0.27, respectively. The largest component of DMFT was the D, with the mean of 1.49, and the F component of 0.08 was far lower. There was a statistically significant difference between various age groups. Mean DMFT was greater among hearing-impaired than blind subjects. There was a statistically significant difference between both groups for mean DMFT/dft ( $P=0.001$ ) (*Table 1*).

Of the 498 subjects, 159 (31.9%) had a CPI score of 0, a healthy periodontium. A further 81 (16%) had a CPI score of 2, which implies that they had gingivitis but no pockets over 3.5 mm. Sixty (12%) had calculus but no pocketing. CPI scores of 3 or 4 were found in 198 (40%) of subjects. Periodontal health was better in the blind than in the hearing-impaired subjects, in that 43.3% of blind subjects had a CPI score of 0 (periodontal health) as opposed to 24.4% of the hearing-impaired and only 24.2% of the blind had CPI



*Figure 1.* Distribution of the subjects according to age groups and gender.

**Table 1.** Mean caries prevalence according to age groups and type of handicap in primary and permanent dentition

Age groups (years)	DT Mean±SD	MT Mean±SD	FT Mean±SD	DMFT Mean±SD	dt Mean±SD	Ft Mean±SD	dft Mean±SD
4-8	0.56±0.71	0.06±0.24	0.00±0.00	0.63±0.79	0.75±1.10	0.00	0.75±1.11
9-13	0.93±0.01	0.13±0.34	0.06±0.25	1.13±1.15	0.62±1.11	0.08±0.29	0.73±1.24
14-18	1.54±1.16	0.23±0.46	0.09±0.29	1.83±1.77	0.00	0.00	0.00
19-23	2.4±1.62	0.33±0.69	0.13±0.33	2.85±1.82	0.00	0.00	0.00
Total	1.49±1.51	0.21±0.49	0.08±0.28	1.77±1.72	0.24±0.74	0.02±0.15	0.27±0.81
F-value	31.73	5.008	2.585	35.16	37.56	11.71	39.38
P-value	0.001	0.002	0.050	0.001	0.001	0.001	0.001
<b>Type of handicap</b>							
Hearing-impaired	1.68±1.73	0.20±0.49	0.09±0.29	1.97±1.93	0.23±0.76	0.02±0.14	0.26±0.85
Blind	1.21±1.06	0.22±0.48	0.07±0.26	1.48±1.29	0.25±0.70	0.03±0.17	0.28±0.75
t-value	3.43	0.489	0.640	3.163	0.317	0.688	0.283
P-value	0.001	0.625	0.522	0.002	0.751	0.492	0.777

**Table 2.** Distribution of CPI scores according to the age groups, type of handicap and gender

Age groups (year)	Healthy 0	Bleeding 1	Calculus 2	Shallow pocket 3	Deep pocket 4	Chi-square	P-value
4-8	39 (7.8%)	3 (0.6%)	6 (1.2%)	0 (0%)	0 (0%)		
9-13	99 (19.9%)	24 (4.8%)	12 (2.4%)	0 (0%)	0 (0%)		
14-18	15 (3.01%)	33 (6.6%)	24 (4.8%)	105 (21.0%)	18 (3.6%)	9.378	0.05
19-23	6 (1.2%)	21 (4.2%)	18 (3.6%)	57 (11.4%)	18 (3.6%)		
Total	159 (31%)	81 (16%)	60 (12%)	162 (32%)	36 (7.2%)		
<b>Type of handicap</b>							
Hearing-impaired	72 (24.2%)	63 (21.2%)	33 (11.1 %)	105 (35.4 %)	24 (8.1%)		
Blind	87 (43.3%)	18 (8.9 %)	27 (13.4 %)	57 (28.4%)	12 (6.0%)	27.76	0.001
<b>Gender</b>							
Male	111 (22 %)	57 (11.4%)	36 (7.2%)	126 (25.3%)	27 (5.4%)		
Female	48 (9.65)	24 (4.8%0)	24 (4.8%)	36 (7.2%)	9 (1.8%)	7.53	0.113

scores of 3 or 4 as opposed to 43.1% of those with hearing impairment. There was no statistically significant difference for the different CPI scores between males and females (Table 2).

In terms of the mean number of sextants, the number with a CPI score of 0 fell as age increased such that in the 19 to 23 year-olds the mean number of sextants with periodontal health was 1.02, whereas in those under 13 years of age it was over 5. In the 19 to 23 year-olds, a mean of 2.15 sextants had a CPI score of 3 and a mean of 0.48 had a CPI score of 4. Apart from the CPI score of 1 (gingival bleeding), there were no statistically significant differences between the mean sextant scores for the CPI categories between those with impaired hearing and the blind. There was no statistically significant

difference among male and female subjects in terms of sextant scores (Table 3).

Overall, the need for a one-surface filling was the most frequent treatment need in the population studied. Those with impaired hearing showed significantly higher two-surface filling treatment need (21.2%) than the blind (9.0%). Overall, pulp care and restoration was required by 10.2%, with a higher percentage of the blind requiring this treatment. Extractions were required by 12.7% of the study population, with a higher percentage of the blind requiring this treatment. A veneer or laminate was required by 30.1% of the subjects and 13.3% of the study population needed orthodontic treatment, with a higher need in those with impaired hearing (Table 4).

**Table 3.** Distribution of mean number of sextant affected by periodontal diseases according to age groups, type of handicap and gender

Age groups (years)	Healthy Mean±SD	Bleeding Mean±SD	Calculus Mean±SD	Shallow pocket Mean±SD	Deep pocket Mean±SD
4-8	5.25±1.62	0.31±0.85	0.44±1.29	0.00±0.00	0.00±0.00
9-13	5.33±1.32	0.36±0.88	0.27±0.77	0.00±0.00	0.00±0.00
14-18	2.09±1.87	1.92±1.40	0.62±0.93	1.12±1.06	0.22±0.74
19-23	1.02±1.26	1.70±1.31	0.65±1.09	2.15±1.52	0.48±0.90
Total	3.02±2.39	1.29±1.41	0.51±0.98	0.97±1.30	0.20±0.66
F-value	216.44	59.74	4.513	108.60	13.47
P-value	0.001	0.001	0.004	0.001	0.004
<b>Type of handicap</b>					
Hearing-impaired	2.93±2.19	1.46±1.48	0.49±1.03	0.96±1.25	0.15±0.63
Blind	3.15±2.65	1.03±1.25	0.54±0.91	0.99±1.37	0.27±0.71
t-value	1.009	3.419	0.472	0.215	1.945
P-value	0.313	0.001	0.637	0.830	.052
<b>Gender</b>					
Male	2.93±2.39	1.32±1.42	0.55±1.03	1.03±1.34	0.21±0.70
Female	3.23±2.38	1.21±1.37	0.50±0.96	0.81±1.18	0.17±0.56
t-value	1.270	0.761	0.588	1.748	0.606
P-value	0.205	0.447	0.557	0.08	0.545

**Table 4.** Distribution of overall treatment need according to type of handicap

Treatment need	Type of handicap		Total	Chi-square	P- value
	Hearing-impaired	Blind			
1. One-surface filling	184 (65.3%)	126 (62.7%)	300 (60.2%)	0.842	0.359
2. Two-surface filling	63 (21.2%)	18 (9%)	81 (16.2%)	34.90	<0.001
3. Crown for any reason	39 (13.1%)	27 (13.4%)	66 (13.3%)	0.009	0.922
4. Veneer or laminate	72 (24.2%)	78 (38.8%)	150 (30.1%)	12.00	<0.001
5. Pulp care & restoration	12 (4.0%)	39 (19.4%)	51 (10.2%)	6.68	0.01
6. Extraction	18 (6.0%)	45 (22.3%)	63 (12.7%)	4.16	0.04
7. Preventive care	42 (14.1%)	24 (11.9%)	66 (13.3%)	0.505	0.471
8. Fissure sealant	30 (10.1%)	24 (11.9%)	54 (10.8%)	0.419	0.517
9. Orthodontic treatment	48 (16.2%)	18 (9.0%)	66 (13.3%)	5.41	0.002

A stepwise multiple linear regression analysis was executed to estimate the linear relationship between the DMFT and CPI as a dependent variable and various independent variables. DMFT and CPI show great association with age. Age, snacks between meals, toothbrushing frequency and level of education explained a variance of 16.9%, 3.7%, 2.6% and 1.0% with DMFT, although age, toothbrushing frequency, previous visits to a dentist, socio-economic status and gender explained a variance of 46.4%, 1.4%, 1.1%, 0.8% and 0.4% with CPI, respectively. It also revealed that all the independent variables were significantly associated with DMFT and CPI (Table 5).

## Discussion

The greatest challenge that people who are handicapped have had to face has been society's misperception that they are a "breed apart", because historically they have been pitied, ignored or even hidden away in homes and institutions. Providing health care services for individuals with the special health care needs of these handicapped individuals will continue to be a challenge in the 21st century.

Although these handicapped (hearing-impaired and blind) subjects are entitled to the same standards of health and care as the general population, there is evidence that they experience poorer general and oral health, and have unmet

**Table 5.** Stepwise multiple linear regression analysis with DMFT and CPI as a dependent variable

	<b>R</b>	<b>R<sub>2</sub></b>	<b>F</b>	<b>P</b>
1	0.411 (a)	0.169	100.73	0.001 (a)
2	0.454 (b)	0.206	64.10	0.001 (b)
3	0.482 (c)	0.232	49.86	0.001 (c)
4	0.492 (d)	0.242	39.30	0.001 (d)
a Predictors: (constant), age				
<b>DMFT</b>				
c Predictors: (constant), age, snacks in between meals, toothbrushing frequency				
d Predictors: (constant), age, snacks in between meals, toothbrushing frequency, level of education				
<b>CPI</b>				
1	0.681 (a)	0.464	430.0	0.001 (a)
2	0.691 (b)	0.478	226.52	0.001 (b)
3	0.699 (c)	0.489	157.65	0.001 (c)
4	0.705 (d)	0.497	121.66	0.001 (d)
5	0.708 (e)	0.501	98.83	0.001 (e)
a Predictors: (constant), age				
b Predictors: (constant), age, toothbrushing frequency				
c Predictors: (constant), age, toothbrushing frequency, previous visit to dentist.				
d Predictors: (constant), age, toothbrushing frequency, previous visit to dentist, socioeconomic status				
e Predictors: (constant), age, toothbrushing frequency, previous visit to dentist, socioeconomic status, gender				

Notes:

R is a measure of the correlation between the observed value and the predicted value of the criterion variable. R<sub>2</sub> is the square of this measure of correlation and indicates the proportion of the variance in the criterion variable which is accounted for by our model.

F & P are the values obtained by regression analysis, F is the test value and P is significance value for particular F value.

health needs and a lower uptake of screening services [15]. Oral health and quality oral health care contribute to holistic health, which should be a right rather than a privilege [16].

It was seen in the institutes for both the blind and the hearing-impaired that the number of males was significantly higher than that of the females. Among 498 subjects, 357 (71.7%) were male and 141 (28.3%) were female. This may be attributed to the fact that the rural population of India still perceives that female child education does not contribute to the economic development of a family.

The present study showed that the overall mean DMFT for hearing-impaired subjects was  $1.97 \pm 1.93$ , which was significantly higher ( $P=0.002$ ) than that of the blind subjects ( $1.48 \pm 1.29$ ). It also found that mean dft was  $0.26 \pm 0.85$  for the hearing-impaired and  $0.28 \pm 0.75$  for the blind subjects. The hearing-impaired subjects had a higher percentage of CPI scores of 3 and 4.

A previous study in Mangalore, Karnataka, India, found a mean DMFT of  $2.48 \pm 2.02$  in hearing-impaired and 5.92 in blind children (aged 6 to 18 years), which is high compared to the present study. In the same study, the mean dft was  $2.6 \pm 3.37$  for hearing-impaired and 0 for visually impaired subjects [10].

Broadly similar findings came from a study in Davangere, Karnataka, which reported a mean DMFT 1.64 for the deaf [8], and from another study in Bangalore, Karnataka, which reported a mean DMFT 2.1 for blind children [17].

A study conducted over 25 years ago in the United Kingdom (UK) reported a mean DMFT of 1.76 among the deaf, which is slightly lower than that found in the present study, whereas among blind it was 1.82, which is slightly higher than in the present study [18].

In general, the DMFT and dmft scores found in the current study are lower than those from elsewhere in the world and some previous Indian stud-

ies. For example, studies from the Middle East found a mean DMFT score for the deaf of 5.0 and 2.8 for the blind, probably due to differences in lifestyle and dietary habits, and the mean dft was 5.3 for deaf and 3.7 for blind in Kuwait [19] and the mean DMFT of 5.12 in Saudi Arabia [20].

Meaningful comparisons between many previous studies are difficult because some took place more than 18 years ago [21-23] and only included children from a more limited age range such as 12 to 14 years [21].

The lack of treatment is reflected when the results from the current study (in which the D component of the mean DMFT was 1.68 in those with impaired hearing and 1.21 in the blind) are compared with those from a study performed in Birmingham, UK, in the mid-1980s, in which the mean D component was 0.18 in hearing-impaired and 0.23 in blind children [18].

The difference in the mean decayed teeth scores in the studies reviewed in this paper may arise for many reasons, including the fact that some were performed over 25 years ago, in different countries with different cross-cultural differences in living standards, dietary habits and genetic predisposition, and that the WHO recommendation for the diagnosis of caries in epidemiological studies changed in 1997 [14]. As can be seen from the very high D component of the DMFT scores in the current study and the low D component in the Birmingham study [18], the opportunities for obtaining treatment also differ widely from country to country. Even over 25 years ago, in Birmingham treatment was readily available free of charge to all those under 18 years of age. This is not the case in many other countries, including India.

At the time when the current study was performed, in many countries it was usual to use the CPI scores and criteria recommended by WHO in 1997 [14] in epidemiological surveys. The shortcomings of this approach have been well documented [24]. In particular, it is entirely possible to have calculus present without gingival inflammation [25,26], loss of periodontal attachment is not assessed [27], and a number of pockets, especially in those aged under 25 years, may be due to gingival hyperplasia (false pockets) rather than because of periodontal breakdown.

In the present study, 339 (68.1%) subjects had CPI scores of 1 or more and a healthy periodontium (CPI=0) was seen in 159 (31.9%) subjects. The greatest concern should be the high overall percent-

age of subjects with CPI scores of 3 (162; 32%) and 4 (36; 7.2%). These scores were found only in those aged 14 to 23 years and are high when compared to those for others in this age group in other countries. For example in the UK, the 2009 Adult Dental Health Survey found that 19% of 16 to 24 year-olds had a pocket or pockets of 4 mm or 5 mm and only 1% had a pocket or pockets of  $\geq 6$  mm [28].

In the present study, the periodontal health of those with hearing impairment was worse than that of the blind, in that 43.3% of the blind subjects had a CPI score of 0 as opposed to 24.2% of the hearing-impaired subjects and 43.1% of the hearing-impaired subjects had CPI scores of 3 or 4 as opposed to 34.4% of the blind subjects. This was similar to the findings of a previous Indian study [6]. Those who are blind may well have better manual dexterity than those whose hearing is impaired and therefore be able to perform better oral hygiene.

In the present study, gingival bleeding was seen more in hearing-impaired subjects (21.2%) than in the blind subjects (9.0%) whereas calculus was seen more in blind subjects (13.4%) than in hearing-impaired subjects (11.1%). A similar pattern was reported in a study of 12 to 14 year-olds in Bombay, where bleeding was seen in 53% of the hearing-impaired and 38% of the blind subjects and calculus was seen in 27% of hearing-impaired in comparison to 48% of the blind subjects [21].

The higher levels of dental disease in these handicapped people seem to be due to poor use of dental services and lack of dental awareness. Improved access to dental services as well as oral health education is necessary to ensure that optimum dental health is within the reach of these less fortunate children [23].

The removal of plaque from teeth is a skill that can be mastered only when the individual has the dexterity to manipulate a toothbrush and an understanding of the objectives of this activity. It is obvious that many disabled individuals will find the maintenance of their own oral hygiene much more difficult than normal individuals because those with hearing impairment cannot understand and respond to the instructions given and those who are blind lack the vision to understand and master the technique of oral hygiene practices. Studies have shown that oral hygiene can be improved significantly by providing intensified daily brushing by dental personnel, by the development of self-help workshops, by providing effective staff training, or by a combination of all these approaches [18].

In India and in many other countries, the academic curriculum does not train dentists to treat these children. Hence, there is a need to make dental personnel and dental students aware of the special problems posed by these handicapped children and to provide suitable training, if any dental health programmes for the rehabilitation of these children is to be attempted. However, in some countries these problems have been recognised and dental hygienists [29] and dental therapists [30] provide care for such children. Furthermore, in the UK a specialty of Special Needs Dentistry has been created and there is a three-year postgraduate training programme for dentists who wish to become specialise in this area.

The poor oral health of the children and young adults surveyed in this study is due to poor oral health care and the attitude and lack of awareness among the carers in these institutions to overcome these problems. It is suggested that:

1. Primary prevention approaches should be taught to the staff of institutions, to the caregivers and, when appropriate, to the individual children and young adults.
2. Pit and fissure sealants should be applied to the permanent molars and premolars soon after eruption and parents should be advised of the need for regular monitoring and maintenance of fissure sealants.
3. The children and young adults should be given suitable toothbrushes and fluoride toothpaste and shown how to brush their teeth and gingival crevices.
4. Fluoride varnish should be applied to any areas of enamel decalcification for children with poor tolerance of dental procedures.
5. Regular school-based programmes of toothbrushing should be implemented and reinforced in all these groups with disabilities. Children should be instructed to clean their teeth twice a day and oral hygiene should be practised at school and supervised by teachers.
6. Educational institutions should include oral health as part of training or socialisation programmes.

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7. In-service training in the promotion of good oral health for children with disabilities and in how to access oral care ought to be provided for teachers, institutional staff and parents.
8. Positive links between educational establishments and dental services should be established to promote the oral health of children with disabilities. To enhance oral health outcomes, advanced training is recommended for dental providers and the staff of schools.

## Conclusion

The findings in this study highlight the lack of dental treatment for this group. Overall, oral health status was poorer in the people with impaired hearing than in those who are blind.

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## Contributions of each author

- MJ was principal investigator and was responsible for designing the study and writing the paper.
- SPB was responsible for statistical analysis and data entry.
- LSK helped in data collection as organising clerk.
- DC helped in data collection as recording clerk.
- DP helped in writing, editing, and correcting the paper as first author's co-guide.
- SK helped in writing, editing, and correcting the paper as first author's guide.

## Statement of conflict of interest

As far as the authors are aware, there are no conflicts of interest.

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