ORAL HEALTH CONDITIONS AND BEHAVIORS AMONG HEARING IMPAIRED AND NORMAL HEARING COLLEGE STUDENTS AT RATCHASUDA COLLEGE, NAKHON PATHOM, THAILAND

Tippanart Vichayanrat[1] and Waritorn Kositpumivate[2]

[1]Department of Community Dentistry, Faculty of Dentistry, Mahidol University, Bangkok; [2]Dental Department, Ratchaburi Hospital, Ratchaburi, Thailand

Abstract. This study aimed to explore oral health and oral health related behaviors among hearing impaired and normal hearing students at Rachasuda College. The association between socioeconomic factors, hearing status, oral health behaviors, oral hygiene levels and dental caries status were also examined. The students filled out a self-administered questionnaire with assistance of a sign language video to obtain personal and behavior information. A total of 180 students, 83 normal hearing and 97 hearing impaired students completed the questionnaire and underwent an oral examination. The prevalences of caries were 53.6% and 50.6% among students with hearing impairment and normal hearing, respectively (p=0.354). After age stratification, the hearing impaired students aged 18-21 years had significantly less filled teeth (p=0.012), and those older than 21 years had less missing teeth due to caries than normal-hearing students (p=0.023). Poor oral hygiene was found in 51.8% and 42.2% of normal and hearing-impaired students, respectively (p=0.365). Caries status was significantly associated with maternal education level (OR 3.56; 95% CI: 1.52-8.32) and oral hygiene (OR 3.26; 95% CI: 1.64-6.45). The high prevalence of dental caries and poor oral hygiene among college students is alarming. Hearing impairment did not appear to affect the prevalences of these conditions compared to those with normal hearing. Oral health education tools need to be developed and utilized for both normal hearing and hearing impaired college students in Thailand.

Keywords: dental caries, oral hygiene, oral health practice, hearing impairment, college students, deaf

INTRODUCTION

Hearing impairment is a disability that can limit the chance of acquiring information and significantly affect personal health (Ajami *et al*, 2007). However, studies regarding the impact of impaired-hearing on oral health are scarce. Jain *et al* (2008) reported a higher caries prevalence and higher mean number of decayed teeth in children aged 9-17 years with hearing difficulties than in the general population in India. Oredugba (2004) found that only 12% of deaf adolescents received dental care, but more than 90% were willing to have a dental check-up in Nigeria. Oral

Correspondence: Tippanart Vichayanrat, Department of Community Dentistry, Faculty of Dentistry, Mahidol University, Bangkok 10400, Thailand.
Tel: 66(0) 2200 7809; Fax: 66(0) 2200 7808
E-mail: tippanartv@hotmail.com

hygiene among children and young adults with hearing impairment was found to be significantly associated with age, economic status, and education of parents, especially maternal education (Kumar *et al*, 2008). In Thailand, a survey by the National Statistics Office in 2007 found 389,402 people were hearing impaired, which was approximately 21% of persons with disabilities aged ≥7 years (National Statistic Office, 2007). A study of the oral health status of deaf and blind students in 1995 and 1998 and oral health promotion efforts at 12 special schools concluded that the oral health promotion program reduced caries in the permanent dentition and reduced periodontal disease (Poldeeyiam *et al*, 2002).

Ratchasuda College, Mahidol University, is an institute for tertiary education in Nakhon Pathom Province, Thailand founded in 1993. This college was initially under the Her Royal Highness Princess Maha Chakri Sirindhorn initiative that aimed to improve quality of life for disabled persons by believing in their ability to learn and work. At present, it provides a Diploma in sign language and Bachelor degree in deaf studies for both normal and hearing impaired students and a Master of Arts Program in Rehabilitation Science for Persons with Disabilities. This college is unique in that it allows both normal and hearing impaired students to study together in the same program in order to learn and understand the differences between those with normal and impaired hearing. The institute also serves and develops a variety of information technology resources for handicapped persons, such as audio books, electronic media, Braille documents and multi-media for blind and deaf persons including an online database of research and journals about disabilities.

Due to the limited literature regarding the oral health status of persons with hearing impairment, especially among young adults, this study was initiated to explore the oral health condition of students at Ratchasuda College. The aims of this study were to determine dental caries status, oral hygiene, and oral health related behaviors among college students from Ratchasuda College, Thailand, and to explore the relationships between the various factors and their oral health status.

MATERIALS AND METHODS

The students attending Ratchasuda College studying for a Bachelor of Arts (major in deaf studies) and Diploma programs (major in sign language interpreter) aged 18 and over were invited to participate in the study. A total of 98 normal hearing and 119 hearing impaired students were recruited. The investigators and interpreters informed the participants about the objectives of the study, procedures and general information about oral diseases, then written informed consent was obtained. A self-administered questionnaire accompanied by a sign language video explaining the questions were employed to obtain student's personal and behavior information. The investigator and interpreter were present throughout the questionnaire administration. The levels of hearing impairment were self-evaluated as normal, hardly hear or total loss of hearing. Two dentists examined all the students: one dentist examined the oral hygiene and another dentist examined the dental caries status. Two dental assistants trained in recording oral hygiene and dental caries status helped each dentist to record in the dental chart of the oral examination results. Oral hygiene was recorded as present (score =1) or not pres-

ent (score = 0) for plaque at gingival areas using a mouth mirror and periodontal probe. The mesial line angle to the distal line angle of the buccal and the lingual surfaces of each tooth except third molars were examined (Silness and Loe, 1964). Plaque scores for each tooth were summed and divided by the number of teeth examined. The plaque scores for each student was classified as good (plaque less than 20%), fair (plaque = 20%-40%), and poor (plaque >40%) (Lang and Tonetti, 1996). Decay, missing (due to caries) and filled teeth (DMFT) were recorded according to WHO criteria (WHO, 1997). Dental sealants were recorded if sealant was present during oral examination. A history of dental trauma was evaluated by the presence of a chipped tooth, discoloration of the tooth and/or class IV restoration present for the anterior teeth with the student's confirmation of a dental accident.

This research project was approved by the Faculty of Dentistry/Faculty of Pharmacy, Mahidol University Institutional Review Board (MU-DT/PY-IRB) Reference No. MU-DT/PY-IRB 2011/080.2812.

Statistical analysis

The association between socioeconomic factors, hearing status and oral health practices and caries status were analyzed with the chi-square test and odds ratio. Comparisons in caries status, oral health practice, dental history and source of dental information between normal hearing and hearing impaired students were analyzed with the chi-square test. The mean numbers of DMFT were compared between the normal and hearing-impaired students with the Mann-Whitney *U* test. Binary logistic regression was performed to measure the influence of variables (gender, age, hearing status, mother's education and oral hygiene level) on dental caries status (yes/no). The significance level was set at $p<0.05$.

RESULTS

Characteristics of study population

A total of 180 students, consisting of 83 normal hearing and 97 hearing impaired students, completed the questionnaire and presented for the oral examination. Females comprised 89.2% and 69.1% of normal and hearing impaired students, respectively. The mean ages of the students were 20.01±1.82 and 22.21±2.27 years in the normal and hearing impaired students, respectively. The education levels of the mothers and fathers were mostly high school or lower. Among the hearing-impaired students, the methods of communication with parents were written language (41.8%), speaking (22.4%), and sign language (19.4%). The demographic characteristics of the students in this study are shown in Table 1.

Oral health practices, history of dental care and sources of dental information

The majority of students with normal (97%) and impaired hearing (86%) reported brushing their teeth twice or more a day. The proportion of students who brushed at least twice daily was greater among the normal hearing than hearing impaired students ($p<0.008$). The reports of dental flossing, seeing dentists, receiving orthodontic treatment and history of dental trauma were not significantly different between normal and hearing impaired students ($p>0.05$). One point two percent and 2.1% flossed regularly, 20.5% and 15.8% saw dentist regularly among normal and impaired hearing students, respectively. Students reported receiving oral health information mostly from schools or dentists. There were no differences between the sources

Table 1
Characteristics of study population by hearing status.

Characteristics	Total (n=180) No. (%)	Normal hearing (n=83) No. (%)	Hearing impaired (n=97) No. (%)
Gender			
Male	39 (21.7)	9 (10.8)	30 (30.9)
Female	141 (78.3)	74 (89.2)	67 (69.1)
Age (years)			
18-21	109 (61.2)	65 (78.3)	44 (46.3)
>21	69 (38.3)	18 (21.7)	51 (53.7)
Maternal education level			
High school or lower	126 (77.3)	53 (68.8)	73 (84.9)
College or higher	37 (22.7)	24 (31.2)	13 (15.1)
Paternal education level			
High school or lower	118 (76.6)	50 (67.6)	68 (85.0)
College or higher	36 (23.4)	24 (32.4)	12 (15.0)
Maternal hearing status			
Normal hearing	175 (97.8)	81 (98.8)	94 (96.9)
Impaired hearing	4 (2.2)	1 (1.2)	3 (3.1)
Paternal hearing status			
Normal hearing	176 (98.9)	80 (98.8)	96 (99.0)
Impaired hearing	2 (1.1)	1 (1.2)	1 (1.0)
Methods of communicating with parents (may use more than 1 method)			
Speaking	96 (53.3)	81 (98.7)	15 (22.4)
Writing	29 (16.1)	1 (1.2)	28 (41.8)
Sign language	13 (7.2)	0 (0.0)	13 (19.4)
Mouth reading	6 (3.3)	0 (0.0)	6 (9.0)
Gestures	5 (2.8)	0 (0.0)	5 (7.5)

of information received from schools or dentists between students with and without hearing impairment (p>0.05). However, students with hearing impairment were less likely to receive oral health information from their parents (p = 0.024) and media/advertisements compared to normal hearing students (p = 0.005). Having a history of dental sealant, dental trauma or orthodontic treatment were not significantly different between students with and without hearing impairment. Oral health practices, history of dental care, and sources of dental information are shown in Table 2.

Caries prevalence, DMFT, and oral hygiene status

The caries prevalences among normal and hearing impaired students were 85.5% and 82.5%, respectively (p=0.577). The mean DMFT scores were 4.83 ± 4.39 and 3.90 ± 3.22 among the students with normal hearing and impaired hearing, respectively (p=0.134). Prevalences of dental caries and DMFT are shown in Tables 3 and 4.

Table 2
Association between oral health practices, history of dental care and sources of dental information and hearing status.

	Normal hearing (n=97) No. (%)	Hearing impaired (n=83) No. (%)	p-value
Tooth brushing			
Less than twice a day	2 (2.4)	13 (13.8)	0.008[a]
Twice or more a day	81 (97.6)	81 (86.2)	
Dental flossing			
Never/sometimes	82 (98/8)	95 (97.9)	0.654
Regularly	1 (1.2)	2 (2.1)	
Seeing dentist			
Never /when having symptom	66 (97.5)	80 (84.2)	0.416
Regularly	17 (20.5)	15 (15.8)	
Orthodontic treatment			
Having (or had) braces	8 (9.6)	3 (3.1)	0.068
Never	75 (90.4)	94 (96.9)	
Dental trauma			
History of dental trauma	2 (2.4)	1 (1.0)	0.471
No history of dental trauma	81 (97.6)	96 (99.0)	
Sources of oral health information (may have more than 1 answer)			
Parents	57 (68.7)	50 (52.1)	0.024[a]
School	76 (91.6)	90 (93.8)	0.575
Dentist	65 (78.3)	68 (71.6)	0.302
Media/advertising	64 (78.0)	56 (58.3)	0.005[a]

[a]Chi-square test, significance is $p < 0.05$.

Oral hygiene levels were not significantly different between the normal and hearing impaired students (p = 0.365). Poor oral hygiene was found in 51.8% and 42.2% of normal and hearing impaired students, respectively. The oral hygiene levels in the normal and hearing impaired students are shown Table 4.

Associations with socioeconomic factors, oral health practice, and oral hygiene status, and dental caries status

Age, gender and hearing status were not associated with dental caries in this study. Maternal education level and oral hygiene level were significantly associated with caries status (p = 0.003 and p = 0.001, respectively). Students were 3.56 times more likely to have dental caries if their parents had a high school or lower education level, compared to those with parental education higher than high school level. Oral hygiene levels were significantly associated with caries status (p = 0.001). Students with poor oral hygiene were 3.26 times more likely to have dental caries, compared with those with good or fair oral hygiene. The associations with socioeconomic factors, oral health practice, oral hygiene status, and dental caries are shown in Table 5.

Table 3
Association between caries status, oral hygiene level and hearing status.

Oral health status	Hearing status		*p*-value (Chi-square)
	Normal hearing (n = 83) No. (%)	Hearing impaired (n = 97) No. (%)	
Caries status			0.577
Caries free	12 (14.5)	17 (17.5)	
At least one DMFT	71 (85.5)	80 (82.5)	
Oral hygiene level			0.365
Good	4 (4.8)	6 (6.2)	
Fair	36 (43.4)	51 (52.6)	
Poor	43 (51.8)	40 (42.2)	

Table 4
Comparison of mean of decayed, missing, and filled teeth score by hearing status.

Hearing status	Decay teeth Mean (SD)	Missing teeth Mean (SD)	Filled teeth Mean (SD)	DMFT score Mean (SD)
Normal (n = 83)	1.34 (1.92)	0.33 (0.66)	3.17 (3.98)	4.83 (4.39)
Impaired (n = 97)	1.63 (2.24)	0.32 (0.72)	1.95 (2.30)	3.90 (3.22)
p-value	0.323	0.861	0.015[a]	0.134

[a]Mann-Whitney *U* test, significant difference at $p < 0.05$.
DMFT = decayed, missing, and filled teeth.

DISCUSSION

In our study, hearing impaired students were more likely to be older, be male and have more parents with lower education level compared to their normal hearing counterparts. Although the prevalence and severity of caries among hearing impaired students were comparable to those with normal hearing, hearing impaired students were less likely to have access to dental treatments such as tooth filling. Our results are in contrast to those of a previous study by Wei *et al* (2012) who found a higher prevalence of DMFT among deaf adolescents compared to a control group. Caries prevalence among hearing impaired students in our study (82.5%) was much higher than a previous study (55.9%) (Wei *et al*, 2012). Both normal hearing and hearing impaired students in our study had poor oral hygiene. The problem of dental caries and poor oral hygiene among young adults in Thailand is alarming.

The findings in our study among hearing impaired students are unexpected and may not represent hearing-impaired young adults in general. The college students in our study were all studying in a deaf and sign language program. There may be certain characteristics that influenced the oral health behaviors in

Table 5
Association between variables and dental caries status.

Variables	Number	Adjusted odds ratio[a]		*p*-value
		OR	95% CI	
Gender				
Female	141	0.57	0.25-1.33	0.197
Male	39	1[b]		
Age (years)				
>21	69	1.22	0.58-2.56	0.604
18-21	111	1[b]		
Hearing status				
Hearing impaired	97	0.86	0.41-1.79	0.685
Normal hearing	83	1[b]		
Maternal education level				
≤High school	126	3.56	1.52-8.32	0.003[c]
>High school	37	1[b]		
Oral hygiene level				
Poor	83	3.26	1.64-6.45	0.001[c]
Good/Fair	97	1[b]		

[a]Adjusted for all variables in table; [b]Reference group; [c]$p < 0.05$.

this group as compared to other hearing impaired young adults. This theory is supported by the questionnaire results regarding oral health practices, such as tooth brushing, flossing, seeing a dentist, and having a history of receiving dental care which showed hearing impaired students had the same oral health care behaviors as normal hearing students as found on the National Oral Health Survey (Bureau of Dental Health, 2012). The mean number of DMFT among students with hearing impairment in this study was 3.90, lower than a previously reported study of 4.48 in 2002 (Poldeeyiam *et al*, 2002).

In this study, significantly more students with normal hearing reported tooth brushing twice daily, and hearing impaired students were less likely to receive oral health education from their parents and the media. Thus, dental practitioners and related health organizations need to increase their efforts to produce media and appropriate health education that can be accessed by populations with hearing impairment.

Our results show hearing impairment was not associated with caries or DMFT. However, similar to a previous study (Kumar *et al*, 2008) parental education level was strongly associated with caries status. Caries are significantly related to oral hygiene status.

These findings suggest that oral health education for college students, whether with normal or hearing impairment is needed. Oral health media for persons with hearing impairment is greatly needed to increase their access to oral health information. Various methods can be used to communicate with this population including sign language videos. Dental professionals should consider utilizing an interpreter while delivering

oral health care, and should be aware of the lack of accessibility to dental services in this population.

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