

The Relationship Between The Use of Cotton Bud and Obturation Cerumen in Prima Indonesia University Faculty of Medicine Students, Class of 2021

Gymnastiar Siregar¹, Andika Zayani Tambunan², Yuliani Mardiaty Lubis³, R. Naina Aishwara⁴

^{1,4}Faculty of Medicine, University of Prima Indonesia, Medan, North Sumatera, 20117, Indonesia

^{2,3}Department of Otolaryngology, Faculty of Medicine, University of Prima Indonesia, Medan, North Sumatera, 20117, Indonesia

*Corresponding Author : Gymnastiarsiregar@gmail.com

Abstrak

Penggunaan *cotton bud* dinilai mampu menyebabkan impaksi serumen di saluran telinga luar. Meski demikian, penggunaan *cotton bud* di Indonesia masih cukup tinggi. Penelitian ini bertujuan untuk mengkaji hubungan antara penggunaan *cotton bud* dengan kejadian serumen obturans. Penelitian ini menggunakan desain studi *cross-sectional* yang melibatkan 56 responden yang rutin menggunakan *cotton bud*. Berdasarkan penelitian, diperoleh hubungan signifikan antara frekuensi dan kedalaman (p-value 0,026 dan p-value 0,008) penggunaan *cotton bud* dengan kejadian serumen obturans. Mahasiswa yang sering menggunakan *cotton bud* memiliki risiko 5,625 kali lebih besar untuk mengalami serumen obturans dibandingkan dengan mereka yang jarang menggunakannya. Mahasiswa yang menggunakan *cotton bud* hingga *pars osseus* (2/3 liang telinga dalam) memiliki risiko 4,444 kali lebih besar untuk mengalami serumen obturans dibandingkan dengan mereka yang hanya menggunakan *cotton bud* sampai *pars cartilaginosa* (1/3 liang telinga luar). Sebagai Kesimpulan, program edukasi kesehatan mengenai penggunaan *cotton bud* perlu dikembangkan untuk meningkatkan kesadaran mengenai cara menjaga kebersihan telinga yang aman dan efektif.

Kata kunci: impaksi, *cotton bud*, earwax, obturans, serumen

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Abstract

The use of cotton buds is considered to be able to cause cerumen impaction in the external ear canal. However, the use of cotton buds in Indonesia is still quite high. This study aims to examine the relationship between the use of cotton buds and the incidence of cerumen obturans. This study used a cross-sectional study design involving 56 respondents who routinely use cotton buds. Based on the study, a significant relationship was obtained between the frequency and depth (p-value 0.026 and p-value 0.008) of cotton bud use and the incidence of cerumen obturans. Students who frequently use cotton buds have a 5.625 times greater risk of experiencing cerumen obturans compared to those who rarely use them. Students who use cotton buds up to the pars osseus (2/3 of the inner ear canal) have a 4.444 times greater risk of experiencing cerumen obturans compared to those who only use cotton buds up to the pars cartilaginosa (1/3 of the outer ear canal). In conclusion, health education programs regarding the use of cotton buds need to be developed to increase awareness of how to maintain safe and effective ear hygiene.

Keyword: cerumen, cotton bud, earwax, impaction, obturans,

Introduction

Earwax or cerumen is a natural substance consisting of a mixture of sebum secretions with secretions from modified apocrine sweat glands and exfoliated epithelial cells, which is a normal substance found in the external auditory canal (external ear canal) (1). The outer ear area itself is the part that contains pilosebaceous glands consisting of sebaceous glands,

cerumen, and hair follicles that function to filter airborne dirt (2). Earwax functions to protect, lubricate, and clean the external auditory canal. However, when too much earwax accumulates in the ear, it will block the canal and in the medical world is called cerumen obturans or cerumen impaction (3). Nevertheless, the outer ear area itself can appear several pathological abnormalities such as boils, sebaceous cysts, glandular tumors, but the most common is the accumulation and impaction of cerumen (2).

Normally, earwax will naturally be removed from the ear canal through migration of the canal epithelial lining, assisted by jaw movement (1). Ear canal buildup is disrupted when the cleaning process is interrupted. This can also be influenced by regular use of cotton buds, use of hearing aids, to digital manipulation of the ear canal, all of which can push and compact earwax into the ear canal (4). The presentation of earwax impaction reaches 10 percent in children and 5 percent in healthy adults. In addition, the percentage increases in elderly people living in nursing homes (57%) and patients with mental retardation (36%) (2). In older people, earwax becomes drier due to atrophy of the earwax glands. This, coupled with the fact that the hair in the ear canal becomes coarser with age, results in a higher rate of earwax blockage in older patients (4).

Blockage of the middle canal by cerumen obturans can cause several symptoms such as hearing loss, ringing in the ears (tinnitus), a feeling of fullness, otalgia, itching, and the discharge of quite smelly fluid (1). Otitis externa can also occur as a result of long-term earwax impaction (2). Furthermore, people with cerumen obturans can experience hearing loss (4). In addition, people with cerumen impaction also often experience balance disorders. These symptoms are used to diagnose cerumen impaction with the help of an otoscope. Reversible cognitive impairment can occur in the elderly who experience hearing loss (5).

In the United States, cases of cerumen obturans reach 6% of the population, of which 10% are children and more than 30% occur in the elderly with hearing loss (6). Then, a greater prevalence also occurs in people who routinely use hearing aids, use cotton buds, and people with abnormalities of the external ear canal (6). In Indonesia, as many as 18.7% of the population experiences hearing loss, with 5.4% of them experiencing cerumen obturans and being the 4th country with the highest prevalence of cerumen impaction (7,8).

One of the causes of the high number of cases of cerumen obturans is cases of cerumen obstruction caused by the use of hearing aids to the use of cotton buds which cause the cerumen to be pushed deeper into the ear canal (9). This condition is exacerbated by the anatomy of the outer ear canal which supports the accumulation of cerumen. In Indonesia, the

use of cotton buds to clean ears is still quite high, because it is practical, economical, and easily available in markets, drug stores, and supermarkets (7). Generally, the use of cotton buds is still used by the public to overcome the accumulation of cerumen and relieve itching in the ears (7). However, this condition is actually considered to be the cause of the high number of cases of cerumen obturans. This is supported by a study where 14.5% of the population experiencing cerumen obturans are cotton bud users (10).

The use of cotton buds deep into the external auditory canal will counteract the natural cleaning process of the external auditory canal and push the cerumen further medially, causing the formation of cerumen obstruction (11). Previous studies have reported that frequent ear cleaning can disrupt the protective barrier of the external auditory canal and increase moisture in the external auditory canal. Inflammation and moisture in the external auditory canal will stimulate increased cerumen production and cause too much cerumen obstruction (11). Therefore, it is important to provide further education regarding the proper and correct use of cotton buds to prevent cerumen impaction. However, before starting education, it is important to conduct research on the relationship between the habit of using cotton buds to clean ears and the incidence of earwax impaction. Because of this background, researchers are interested in further studying the relationship between the use of cotton buds and the occurrence of cerumen obturans.

Methods

This study is a quantitative study with an analytical observational method and a cross-sectional study approach. The population in this study were students of the Faculty of Medicine, Universitas Prima Indonesia, Class of 2021 who routinely use cotton buds to clean their ears. A total of 56 students will fill out a questionnaire consisting of several questions such as demographic status to the frequency, depth, duration, and technique of using cotton buds. Then, respondents will be examined using an otoscope to assess the presence or absence of cerumen impaction. Data analysis was carried out univariately and bivariately using the SPSS Windows version 26 program, where the p value set was 0.05, meaning that if the p value is less than 0.05, there is a relationship between the use of cotton buds and the incidence of cerumen impaction. This study has obtained official ethical permission Number: 06/KEPK/UNPRI/IV/2024.

Results

Based on the results of the study (Table 1), the majority of respondents were 20 years old (46.4%), followed by 21 years old (41.1%), and 22 years old (12.5%). In terms of gender, more than half of the respondents were female (66.1%), while the rest were male (33.9%). A total of 53.6% of respondents reported having cleaned their ears at a health facility within less than 6 months, while 46.4% had never done so. The majority of respondents (73.2%) used adult-sized cotton buds, while 26.8% used baby-sized cotton buds. When using cotton buds, 89.3% of respondents used their right hand, and only 10.7% used their left hand. Regarding earwax buildup, the majority of respondents (92.9%) experienced bilateral earwax buildup (in both ears), while 7.1% experienced unilateral earwax buildup (in only one ear).

Tabel 1. Respondents Characteristics

Characteristics (n=56)	Frequency (n)	Percentage (%)
Age (years)		
20	26	46.4
21	23	41.1
22	7	12.5
Gender		
Male	19	33.9
Female	37	66.1
Ear cleaning at health facilities <6 months		
Ever	30	53.6
Not yet	26	46.4
Size of Cotton Bud		
Adult	41	73.2
Baby	15	26.8
Hands when using Cotton Bud		
Right	50	89.3
Left	6	10.7
Ears with cerumen impaction		
Bilateral	52	92.9
Unilateral	4	7.1

The results of univariate analysis showed that most students often used cotton buds (80.4%), while the rest rarely used them (19.6%). In terms of the depth of cotton bud use, 51.8% of students used cotton buds up to the pars cartilaginosa (1/3 of external ear canal), while 48.2% reached the pars osseus (2/3 of the inner ear canal). The duration of cotton bud use was also mostly in the ≥ 10 years group (80.4%), with only 19.6% using cotton buds for less than 10 years. Regarding the technique of use, more than half of the students (55.4%) used a circular technique or rotating motion when using cotton buds, while 44.6% tended to push the cotton bud into the ear. In more detail, the data is attached in table 2.

Tabel 2. Characteristics of Using Cotton Buds

Use of Cotton Buds (n=56)	Frequency (n)	Percentage (%)
Frequency		
Often	45	80.4
Rarely	11	19.6
Depth		
<i>Pars Cartilaginosa</i> (1/3 of the external ear canal)	29	51.8
<i>Pars Osseus</i> (2/3 inner ear canal)	27	48.2
Durasi		
≥10 years	45	80.4
<10 years	11	19.6
Usage Techniques		
Pushing in	25	44.6
Circular (rotating movement)	31	55.4

Based on the tabulation results (Table 3), 45 students who frequently (>1x/week) use cotton buds, 55.6% of them experience cerumen obturans, while 44.4% do not experience cerumen obturans. In contrast, of the 11 students who rarely (<1x/week) use cotton buds, only 18.2% experience cerumen obturans, and the other 81.8% do not experience it. The p-value obtained from this analysis is 0.026, which means that there is a statistically significant relationship between the frequency of cotton bud use and the incidence of cerumen obturans. The Odd Ratio obtained is 5.625 with a confidence interval (CI) of 1.806-3.346. This shows that students who frequently (>1x/week) use cotton buds are 5.625 times more likely to experience cerumen obturans compared to those who rarely (<1x/week) use cotton buds.

Tabel 3. Relationship between Frequency of Cotton Bud Use and Cerumen Obturans

Frequency		Cerumen Obturans		Total	P-value	Odd-Ratio
		Yes	No			
Often (>1x/week)	n	25	20	45	0.026	5.625 (1.806-3.346)
	%	55.6%	44.4%	100%		
Rare (<1x/week)	n	2	9	11		
	%	18.2%	81.8%	100%		
Total	n	27	29	56		
	%	48.2%	51.8%	100%		

Based on the tabulation results (Table 4), it was found that of the 29 students who used cotton buds only up to the pars cartilaginosa (1/3 of the external ear canal), 31% experienced cerumen obturans, and 69% did not experience cerumen obturans. On the other hand, of the 27 students who used cotton buds up to the pars osseus (2/3 of the inner ear canal), 66.7% of them experienced cerumen obturans, while 33.3% did not experience cerumen obturans. The

p-value obtained from this analysis was 0.008, indicating that there was a statistically significant relationship between the depth of cotton bud use and the incidence of cerumen obturans. The odds ratio obtained was 4.444 with a confidence interval (CI) of 1.447-13.650. This means that students who use cotton buds up to the pars osseus (2/3 of the inner ear canal) have a 4.444 times greater risk of experiencing cerumen obturans compared to those who only use cotton buds up to the pars cartilaginosa (1/3 of the external ear canal).

Tabel 4. Relationship between Depth of Cotton Bud Use and Cerumen Obturans

Depth		Cerumen Obturans		Total	P-value	Odd-Ratio
		Yes	No			
<i>Pars Cartilaginosa</i> (1/3 of the external ear canal)	n	9	20	29	0.008	4.444 (1.447-13.650)
	%	31%	69%	100%		
<i>Pars Osseus</i> (2/3 inner ear canal)	n	18	9	27		
	%	66.7%	33.3%	100%		
Total	n	27	29	56		
	%	48.2%	51.8%	100%		

The tabulation results in Table 5 showed that of the 45 students who had used cotton buds for ≥ 10 years, 53.3% of them experienced cerumen obturans, while 46.7% did not experience cerumen obturans. In contrast, of the 11 students who had used cotton buds for less than 10 years, only 27.3% experienced cerumen obturans, and the other 72.7% did not experience it. The p-value obtained from this analysis was 0.121, which indicated that there was no statistically significant relationship between the duration of cotton bud use and the incidence of cerumen obturans. The odds ratio obtained was 3.048 with a confidence interval (CI) of 0.715-12.998. Although this figure shows that students who have used cotton buds for ≥ 10 years have a 3.048 times greater risk of experiencing cerumen obturans compared to those who have used cotton buds for less than 10 years.

Tabel 5. Relationship between Duration of Cotton Bud Use and Cerumen Obturans

Duration		Cerumen Obturans		Total	P-value	Odd-Ratio
		Yes	No			
≥ 10 years	n	24	21	45	0.121	3.048 (0.715-12.998)
	%	53.3%	46.7%	100%		
<10 years	n	3	8	11		
	%	27.3%	72.7%	100%		
Total	n	27	29	56		
	%	48.2%	51.8%	100%		

Based on the data in Table 6, of the 25 students who used the technique of pushing cotton buds into the ear, 60% of them experienced cerumen obturans, while 40% did not

experience cerumen obturans. In contrast, of the 31 students who used the circular or rotating technique, 38.7% experienced cerumen obturans, and the other 61.3% did not experience it. The p-value obtained from this analysis was 0.113, indicating that there was no statistically significant relationship between the technique of using cotton buds and the incidence of cerumen obturans. The odds ratio obtained was 2.375 with a confidence interval (CI) of 0.808-6.981. Although this figure shows that students who use the technique of pushing cotton buds into the ear have a 2.375 times greater risk of experiencing cerumen obturans compared to those who use the circular technique.

Tabel 6. Relationship between Cotton Bud Usage Technique and Cerumen Obturans

Usage Techniques		Cerumen Obturans		Total	P-value	Odd-Ratio
		Yes	No			
Pushing in	n	15	10	25	0.113	2.375 (0.808-6.981)
	%	60%	40%	100%		
Circular (rotating)	n	12	19	31		
	%	38.7%	61.3%	100%		
Total	n	27	29	56		
	%	48.2%	51.8%	100%		

Discussion

The results of this study state that there is indeed a relationship between the use of cotton buds and the incidence of cerumen impaction in medical students at Prima Indonesia University. This study involved 56 students of the Faculty of Medicine, Universitas Prima Indonesia, with the majority of respondents aged 20 years (46.4%), followed by 21 years (41.1%), and 22 years (12.5%). Although age was not directly analyzed in relation to the incidence of cerumen obturans, this relatively young age reflects the population of students who are generally in the young adult phase. At this age, personal hygiene habits such as the use of cotton buds may have begun to form consistently, potentially influencing the risk of cerumen buildup. More than half of the respondents were female (66.1%), while the rest were male (33.9%).

This finding is interesting because the prevalence of cerumen obturans did not show any significant difference between genders in this study. However, the higher proportion of women may reflect the general population in medical schools, where there are usually more female students than male students. Other studies have suggested that hormonal factors and ear cleaning behavior may differ between men and women, but in the context of this study, gender did not appear to be a factor influencing cerumen obturans (12). As many as 53.6% of

respondents reported having had their ears cleaned at a health facility within less than 6 months, while 46.4% had never done so. This indicates a fairly good awareness among respondents regarding the importance of safe and professional ear cleaning. Ear cleaning at a health facility is usually carried out by trained medical personnel, which can help reduce the risk of excessive earwax buildup. However, for those who do not have their ears cleaned at a health facility, it is possible that they rely more often on the use of cotton buds at home, which can actually increase the risk of earwax obturans (13).

The majority of respondents (73.2%) used adult-sized cotton buds, while 26.8% used baby-sized cotton buds. The size of the cotton bud can affect the risk of earwax obturans because adult-sized cotton buds have larger tips, which can push earwax deeper into the ear canal, increasing the risk of buildup. In contrast, baby-sized cotton buds have smaller tips, which may be safer to use, but are still not recommended to be used too deeply (14). The majority of respondents (89.3%) used their right hand when cleaning their ears, while only 10.7% used their left hand. This right-handed preference may reflect right-handed dominance in the general population. The dominant hand may influence how deeply and how firmly the cotton bud is inserted into the ear. However, in this study, there was no specific analysis showing the influence of the hand used on the risk of cerumen obturans.

Most respondents (92.9%) experienced bilateral earwax buildup (in both ears), while 7.1% experienced unilateral earwax buildup (in only one ear). Bilateral earwax buildup may be due to similar ear cleaning habits in both ears, leading to an equal risk of buildup (15). Factors such as simultaneous use of cotton buds in both ears and consistency in cleaning techniques may contribute to bilateral earwax buildup. Some researchers suggest that cotton swab packaging should warn against “inserting” or “into” the ear canal, rather than recommending that users stay away from the ear canal or avoid the ear altogether. Additionally, doctors may find that they can avoid repeated needle use by providing advice on how ears should and should not be cleaned (16). The results showed that the frequency of cotton bud use had a significant relationship with the incidence of earwax obturans. Of the students who frequently used cotton buds, more than half experienced earwax obturans. The p-value of 0.026 supported a significant relationship between the frequency of cotton bud use and earwax obturans, with an odds ratio (OR) of 5.625. This means that students who frequently used cotton buds had a 5.625 times greater risk of experiencing earwax obturans compared to those who rarely used them. High frequency of cotton bud use can increase the risk of cerumen obturans because frequent use can push earwax deeper into the ear canal,

eventually causing buildup and blockage. Repeated use can also irritate the walls of the ear canal, triggering the formation of more cerumen as a protective mechanism for the body. This finding is consistent with the study by Money et al (2018). which showed that the use of cotton buds can cause cerumen obturans. According to Schwartz et al, the ear has the ability to clean earwax naturally through the movement of the epithelium outward (1). However, excessive use of cotton buds can actually push earwax deeper into the ear canal, so that earwax that should be removed naturally is trapped and causes accumulation, which ultimately leads to earwax obturans. In addition, this study is in line with the results of a study which stated that excessive use of cotton buds increases the risk of earwax obturans, because these tools often not only push earwax inward, but also cause irritation to the walls of the ear canal (17). Previous research also supports this finding, which states that routine use of cotton buds is associated with an increased risk of earwax obturans (17). They found that more than 50% of subjects who used cotton buds excessively experienced earwax buildup that caused hearing loss. Another study conducted in 2023 strengthened this by stating that individuals who often clean their ears using cotton buds have a higher prevalence of experiencing cerumen obturans than those who do not use the tool (7).

Overall, the results of this study support the theory and previous findings that the frequency of using cotton buds too often ($> 1x / \text{week}$) increases the risk of cerumen obturans. This study provides additional empirical evidence that this habit has a negative impact on ear health, and it is important to provide education on the right way to maintain ear hygiene to avoid complications of cerumen obturans. This study also found that the depth of use of cotton buds had a significant relationship with the incidence of cerumen obturans. This is reinforced by a p-value of 0.008. Students who use cotton buds up to the pars osseus (2/3 of the inner ear canal) have a 4.444 times greater risk of experiencing cerumen obturans compared to those who only use cotton buds up to the pars cartilaginosa (1/3 of the outer ear canal). The use of cotton buds up to the pars osseus (2/3 of the inner ear canal) can cause the earwax to be pushed deeper and difficult to remove naturally, causing more severe accumulation. This part is also more sensitive to mechanical trauma, which can trigger irritation and excessive earwax production. These results support the importance of paying attention to depth when using cotton buds to prevent the risk of earwax obturans.

The theory supporting these results refers to the anatomical structure of the ear and its natural cleaning function. According the newest study, the ear canal consists of two main parts, namely the pars cartilaginosa (1/3 outer) and the pars osseus (2/3 inner) (18). The pars

cartilaginosa is more flexible and able to withstand friction from foreign objects, while the pars osseus is very sensitive because it is closer to the tympanic membrane. The use of cotton buds that reach the pars osseus can cause deeper cerumen buildup and are more difficult to remove naturally, increasing the risk of cerumen obturans. This study is in line with previous study which found that using cotton buds too deep has a high risk of causing cerumen buildup in the ear (17).

This study also supports the findings presented by Faturrahman and Susanto, which showed that individuals who often use cotton buds to the inside of the ear canal have a higher risk of experiencing cerumen obturans compared to those who only clean their ears on the outside (7). This study found that students who used cotton buds for ≥ 10 years were 3.048 times more likely to experience cerumen obturans, but this result was not statistically significant (p -value = 0.121). Long duration of cotton bud use may contribute to an increased risk of cerumen obturans, but other factors such as technique and frequency of use may have a greater influence. Therefore, although there is a tendency for a higher risk in long-term use, this result is not strong enough to state a causal relationship. Further studies are needed to explore the impact of the duration of cotton bud use on ear health.

Using cotton buds for too long or repeatedly should be able to increase the risk of cerumen obturans, as explained by Schwartz et al that repeated use can cause cerumen to be pushed deeper into the ear, which over time can cause cerumen accumulation (1). However, in this study, although there was a tendency for an increased incidence of cerumen obturans in users with a duration of cotton bud use ≥ 10 years, this result did not reach statistical significance. This suggests that the duration of cotton bud use may not be the main determining factor in the formation of cerumen obturans, but rather other factors such as frequency or depth of use play a more significant role.

Previous research (supports that the use of cotton buds for too long or routinely is associated with an increased risk of cerumen obturans, but these results can vary depending on the method, frequency, and depth of use (17). Although this study did not find a significant relationship between the duration of use of cotton buds and cerumen obturans, it is important to consider that long-term use can still affect the structure of the ear canal and cause problems in certain individuals. Thus, although the odds ratio shows a higher risk in those who use cotton buds for a long period of time, this result cannot be said to be statistically significant. Therefore, to reduce the risk of cerumen obturans, education on the correct method and frequency of use of cotton buds is more important than just focusing on the duration of use.

The results of this study suggest that the duration of use of cotton buds is not the only factor that should be considered in preventing cerumen obturans, but other aspects such as the depth and frequency of use are more relevant in reducing the risk of cerumen buildup.

The results of the analysis showed that the cotton bud usage technique (pushing into the ear vs. rotating in a circular motion) had no significant relationship with the incidence of cerumen obturans (p -value = 0.113). Although students who used the pushing into the ear technique had a 2.375 times greater risk of experiencing cerumen obturans compared to those who used the circular technique. The cotton bud usage technique may affect how cerumen moves in the ear canal, but this factor does not seem significant enough to substantially increase the risk of cerumen obturans. Pushing a cotton bud into the ear can indeed cause cerumen to be pushed deeper, but variations in technique may not be consistent enough to provide statistically significant results. This suggests that the cotton bud usage technique may need to be combined with other factors such as frequency and depth to contribute to the risk of cerumen obturans.

The technique of using cotton buds that push dirt inward can worsen the condition of cerumen obturans because the cerumen that should come out is actually pushed deeper into the ear canal. Previous research explained that the act of pushing cotton buds into the ear can cause cerumen to be pushed deeper and block the ear, thus disrupting the natural cleaning process carried out by the ear. Earwax that is pushed deeper becomes more difficult to remove and is at risk of causing blockage, known as cerumen obturans (2). However, the results of this study do not fully support this theory because there was no significant relationship between the technique of pushing cotton buds and cerumen obturans. Some previous research also found that although the technique of using cotton buds can affect the incidence of cerumen obturans, other factors such as frequency and duration of use play a more important role in increasing the risk of cerumen buildup (17).

The results of this study indicate that although the technique of pushing cotton buds into the ear canal has the potential to increase the risk of cerumen obturans, the difference with the circular technique is not significant enough to be considered a dominant risk factor. Therefore, further education is needed on the proper way to clean the ears, especially in terms of frequency, depth, and safe cleaning techniques. Overall, this study shows that although there is a tendency for a higher risk in those who use the technique of pushing cotton buds inward, this result is not strong enough to conclude a significant effect. For the prevention of cerumen

obturations, focus should be given to more appropriate and safe ear cleaning techniques, as well as limiting the use of cotton buds that are excessive or too deep.

Conclusions and Suggestions

The researchers concluded that there was a significant relationship between the frequency of cotton bud use and the incidence of cerumen obturations. In addition, there was also a significant relationship between the depth of cotton bud use and the incidence of cerumen obturations. Therefore, the researchers suggested that a public health education program be formed to emphasize the risks of inappropriate cotton bud use on ear health. Campaigns and education in various media can be carried out to increase awareness of how to maintain safe and effective ear hygiene. Then, further research should involve larger and more diverse samples, covering various age groups, professions, and socio-economic backgrounds. This will help to see whether the findings of this study are consistent across populations.

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