

Short Report

A Comparative Analysis of Bacterial Growth with Earphone Use

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Abstract:

Background: Recently the worldwide usage of earphones has increased especially among the school and college students who have a high rate of sharing among them. Alike airline headsets, headphones and stethoscope ear-pieces, ear phones can easily be a vector of potential pathogens, which can give rise to otitis externa. **Purpose:** To compare the bacterial growth of the external ear in association with earphone and assess the role of earphones as vector or microorganisms. **Material and Methods:** 50 voluntary male subjects (age 18-25 years) were chosen and divided into two groups, A and B, according to the use of earphones. Swabs were taken from their left ear and the left earpiece of the earphone. Samples were processed as recommended. **Results:** In group A, bacteria were found in 20 (80%) ear and 14 (56%) earphone swabs. In group B, bacteria were found in 23 (92%) ear and 17 (68%) earphone swabs. Group B showed heavy growth and a significant increase in the number of bacterial growths after frequent and constant use. **Conclusion:** Frequent and constant use of earphones increases the bacterial growth in the ear and sharing of earphones might be a potential vector of commensals. It is therefore, always better not to share or else to clean the earphones before sharing. **Key Words:** Bacterial profile, ear, earphone, student

Introduction: The external auditory canal normally harbors many bacterial colonies which form the normal commensal bacterial flora of the ear. They are predominantly non-pathogenic and mostly aerobic, which include Staphylococci (like *Staphylococcus auricularis*, *Staphylococcus epidermidis*, *Staphylococcus capitis* and occasionally *Staphylococcus aureus*), Coryneforms (like *Turicella otitidis*)¹, alpha hemolytic streptococcus², *Pseudomonas aeruginosa*^{2,3} and some species of microcococcus.⁴

Otitis externa is actually a collection of disorders of the external auditory meatus. Otitis externa can be divided into four types - namely acute diffuse, acute localized, chronic and invasive otitis externa. It is principally caused by *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Heat, retained moisture, desquamation and maceration of the epithelium add to the disease condition.⁵ There are some reports on airline headsets⁷, headphones⁸ and stethoscope ear-pieces⁹ where there was a positive relationship between the usage of headphones or stethoscopes and the occurrence of otitis externa. Recently the worldwide usage of earphones has increased due to the gaining popularity of mobile phones, portable music and MP3 players. Apple has sold more than 40 million iPods since they hit the market in 2001.⁶ Majority of school or college students have a right rate of sharing among them and the practice of cleaning the earphones properly before use is not at all in vogue. People have raised concerns over the fact that it causes hearing damage, but extensive Medline search (PubMed) showed that no study so far has been done with earphones as a bacterial growth inducer and a possible vector of commensals. The aim of the study was to determine the association of constant and frequent use of earphones with bacterial growth inside the ear and the potential role of earphones as vector of commensals.

Methods:

Fifty male medical students, who were not yet exposed to the hospital environment, volunteered for the project as healthy individuals. Each volunteer signed an informed consent form and filled up a questionnaire. Observable signs of infection that were looked for in the ear canal include swelling and reddening of the ear canal, discharge and foul odour of the ear canal. Symptoms included itching, pain and tenderness upon manipulation of the pinna and feeling of fullness in the ear. Only such students were included in the study who did not have any such signs or symptoms. Swabs were collected from the left ear and the left ear piece of the earphone.

They were divided into two groups of 25 each. Group A subjects were students of ages 18 to 25 years (average 21 ± 2.2) who infrequently use or never use earphones. In this group, the swabs (ear and earphones) were collected at random. The group B subjects were students aged 18 to 25 years (average 20.84 ± 2.5) who used to listen music with earphone constantly and always at a stretch of at least 30

minutes. The swabs (ear and earphones) were collected immediately after earphone usage.

The swabs were inoculated in sheep blood agar and incubated aerobically overnight at 37°C and the bacteria were identified according to the recommended procedure.¹⁰

Statistical analysis

The data were analyzed using SPSS 15 for windows. The different variables were tested and the test of significance was done using chi square test.

Results:

A total of 43 ear samples (86%) and 31 earphone samples (62%) showed bacterial growth, ranging from very scanty to heavy. In Group A, 20 samples (80%) from ear and 14 samples (56%) from earphones, and in Group B, 23 samples (92%) from ear and 17 samples (68%) from earphones had growth (Table 1). In Group A, 10 (40%) and in Group B, 14 (56%) used to share their earphones with other students. The bacteria were identified to be methicillin sensitive coagulase negative Staphylococcus (MSCONS) from 73 samples (73%), alpha-haemolytic Streptococci from 10 samples (10%), Corynebacterium spp. from 7 samples (7%) and *Acinetobacter baumannii* from 1 sample (1%) (Table 1). In Group B, growth was heavy ($\geq 10^5$ CFU/ml) in 96% (24/25) students, whereas in Group A, growth was scanty ($10^1 - 10^2$ CFU/ml) in 64% (16/25) or moderate ($10^3 - 10^4$ CFU/ml) in 36% (9/25) students.

Table 1: The distribution of isolates in Group A and B (ear and earphones)

		Group A (n = 25)		Group B (n = 25)	
		Ear (%)	Earphones (%)	Ear (%)	Earphones (%)
MSCONS	73	20 (80%)	14 (56%)	23 (92%)	16 (64%)
αHS	10	02	00	07	01
Diphtheroids	7	02	00	05	00
<i>A. baumannii</i>	1	01	00	00	00
Total	91	25	14	34	17

MSCONS - Methicillin sensitive coagulase negative staphylococcus, αHS - alpha haemolytic streptococcus.

In both groups, the growth in the earphone sample always simulated with the growth from the corresponding external ear as confirmed by biotyping and antibiogram. Group B students showed a significant increase (p <0.05) of bacterial growth obtained from the earphone samples (68% as compared to 56% of Group A) as well as from the external ear samples (92% as compared to 80% of Group A).

Discussion:

The use of headphones and stethoscopes has been studied as a potential cause of aural hygiene problems and infection in the ear canal^{1,2,5}. Earphone usage among the students has been increased in last few years. Alike headphones or earplugs, it could have been a possible predisposing factor for external ear infection since its continuous use can increase the temperature and humidity of the canal, create the potential for skin abrasion and provide a vehicle for the introduction of organisms into the canal skin as well. The majority of the isolates were *Staphylococcus spp.* (MSCONS) which although a normal skin flora most often, could well be a pathogen if the condition is congenial. Cheaper quality or improper use may give rise to abrasion, leading to breakage of the skin which might be a portal of infection. It might be speculated that if the earphones are also used in the hospitals during leisure hours, it might give rise to colonization of potential pathogens that may be drug resistant on some occasions. The significantly higher bacterial growth (ear and earphones) in Group B indicates a positive relationship between bacterial growth, and frequency and duration of use of earphones. The incidence of greater colonization with continuous and regular use of earphones is a significant finding of this study, which shows that infrequent and intermittent use may reduce colonization rate probably contributing to less incidence of otitis externa. The findings correspond well with the other similar studies with the stethoscope¹ and the airline headset² where *Staphylococcus* was the commonest isolate (63.89 % and 55% respectively).

It can be concluded that bacterial transfer does increase with frequent and continuous use and the chance of it being transferred is high while people tend to share earphones while listening to music. This may increase a chance of otitis externa as well especially if there is any abrasion in the external ear. The cleansing of the diaphragms of the stethoscopes with alcohol has been shown to reduce the colonization rate and the same procedure can be adopted to prevent transmission of colonization flora from one to another when earphones are exchanged. It is suggested therefore not to share earphones or to share with caution, like cleaning it before giving it to or taking it from someone else. This pilot study would be a healthy base for future hospital and community based epidemiological studies of studying the role of earphones in bacterial growth in ears.

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Contribution by authors:

CM: Conception and design of the study, and manuscript writing

SB: Collection of data and sample, and manuscript writing

SG: Sample processing and interpretation in laboratory

KC: Analysis and interpretation of data, and manuscript writing

IB: Final approval of the version to be published

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