

# The Influence of Different Hand Hygiene Operations on the Hygiene of Acupuncture Needles - Including a Comparison of the Influence of Acupuncturist's Eyesight

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## Abstract

[Background] It is important to keep acupuncture needles clean to prevent infections, therefore keeping acupuncturists' hands clean is also necessary. In Japan, the job of an acupuncturist is not only for sighted people but also for visually impaired people. Whether visually impaired or not, acupuncture needles should be kept clean. Objectives: This study aimed to evaluate the condition of pathogenic microorganisms adhering to acupuncture needles for each hand hygiene condition including differences of acupuncturists' eyesight.

[Methods] The subjects were 10 visually impaired acupuncturists and 12 sighted acupuncturists. The acupuncturists touched the acupuncture needles with their fingers under four conditions: bare hands before washing their hands, bare hands after washing their hands and scrubbing, using nitrile gloves without disinfecting their hands and using nitrile gloves and then swabbing with ethanol. After touching the needles, we incubated the needles using agar plates and checked for bacterial colony appearance.

[Results] Before hand washing, bacterial colonies were detected on 11 of the 22 acupuncture needles after all subjects touched them. After washing their hands and scrubbing, bacterial colonies were detected on 4 of the 22 acupuncture needles after all subjects had touched them. Using gloves without disinfecting their hands, bacterial colonies were detected on only 2 of the 22 acupuncture needles after all subjects touched them. No bacteria were detected on the acupuncture needles in any subjects when gloves were used and swabbed with ethanol. Comparison between bare hands before washing their hands and after the three hand hygiene operations showed a difference in colony appearance ( $P=0.01$ ). Bacterial colony detection patterns did not reveal differences between visually impaired and sighted acupuncturists.

[Conclusions] Proper hand hygiene operations during acupuncture operations reduce bacterial contamination of acupuncture needles regardless of the acupuncturists' eyesight.

**Key words:** *hand hygiene operation, hands washing, gloves, disinfection, visually impaired people, acupuncture needle*

## I. Introduction

Acupuncture is a treatment method that uses thin acupuncture needles that penetrate the skin and are inserted into the human body. It is important to keep the medical instruments inserted into the body sterile to prevent infections<sup>1)</sup>, and acupuncture needles are also required. If the acupuncture needles are contaminated by microorganisms, they may enter the human body and cause infections. In the review

papers involving adverse incidents, several infectious adverse incidents related to acupuncture treatments have been reported<sup>2-4)</sup> and they can also become serious medical conditions.

Sterilized needles are used for acupuncture treatments. In addition, currently it is common to use sterile acupuncture needles for single use for acupuncture treatment. However, there is a possibility of touching the needles by acupuncturists during treatments. If the acupuncturist's hands are not clean,

microorganisms may adhere to the needles and enter the patient's body. Moreover, there is a possibility that the microorganisms cause infection. Therefore, keeping acupuncturist's hands clean during acupuncture procedures is necessary to keep the acupuncture needles inserted into the patient's body clean.

This is because hand hygiene operations such as washing hands using medical soap, hygienic hand rubbing using alcohol-based solutions and using medical gloves are recommended or mandated in various guidelines involving acupuncture<sup>5-7</sup>. If we use acupuncture needles with clean hands, the acupuncture needles might be kept clean. Sugawara et al. has observed Japanese acupuncturists' hand hygiene behavior during their clinical situation<sup>8</sup>. However, it has not been investigated how the hand hygiene operations affect the condition of the needles.

In Japan, the job of an acupuncturist is not only for sighted people but also one of the important jobs historically for visually impaired people<sup>9</sup>. For the visually impaired, touching things with their hands is an important sensory substitute for sight, and this action can sometimes cause their hands to become dirty. However, even visually impaired acupuncturists need to keep their fingers clean during their treatments. Thus, it is also necessary to confirm that the difference in vision status affects hand hygiene conditions.

This study aimed to evaluate the condition of pathogenic microorganisms adhering to acupuncture needles for each hand hygiene condition including differences of acupuncturists' eyesight.

## II. Materials and Methods

The subjects were 10 visually impaired acupuncturists, including 7 low vision and 3 totally blind acupuncturists, and 12 sighted acupuncturists. The subjects of this study were recruited using two

universities' bulletin boards and mailing lists. The characteristics of the subjects are described in Table 1. Before the experiment, the subjects were requested not to wash or disinfect their hands.

The subjects touched the acupuncture needles with their fingers under four conditions; bare hands before washing their hands, bare hands after washing their hands using medical soap and scrubbing with 70% alcohol-based hand sanitizer, putting on gloves (Glacier zero, Moraine Co., Ltd, Tokyo, Japan) without disinfecting their hands and putting on nitrile gloves and then swabbing with 70% ethanol cotton wipes to disinfect their hands. In hand washing parts, the subjects wet their hands under running water, applied soap thoroughly all over their hands, and then rinsed the soap under running water. After washing, the subjects dried their hands thoroughly with a single use towel. In the hand alcohol disinfection parts, the subjects used one pump of the nozzle of the hand sanitizer and applied it thoroughly to their hands, rubbed it in and until dry.

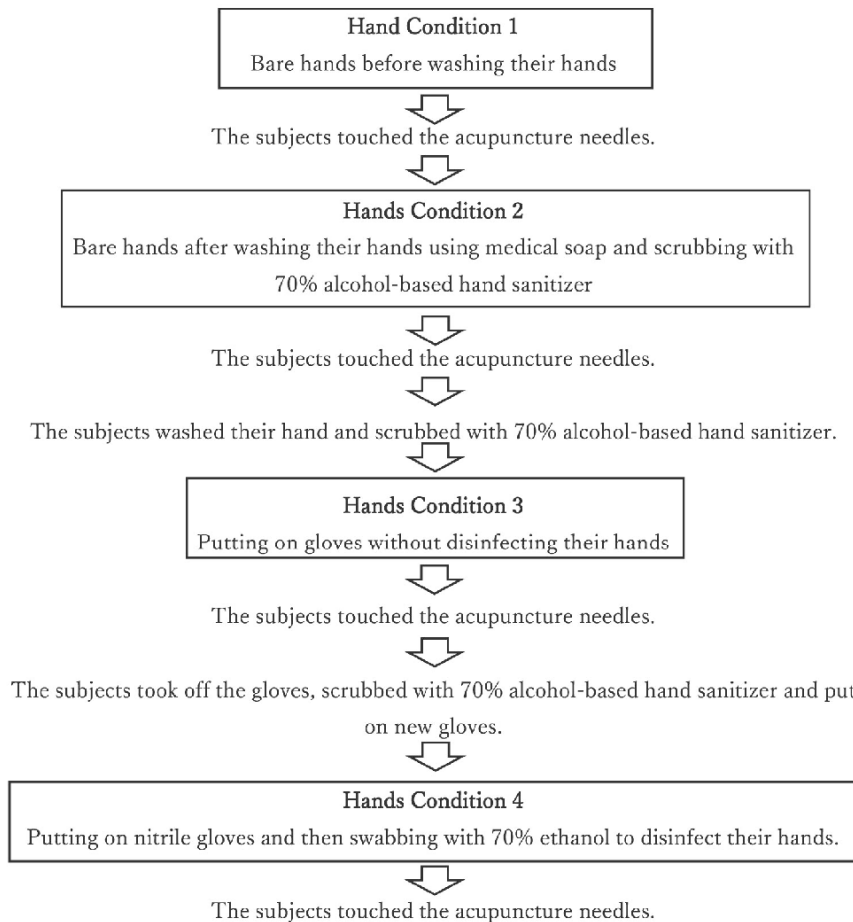
The subjects ran their fingers over sterilized acupuncture needles made of stainless steel (0.22×48 mm, Nissin Medical Instrument Co., Ltd, Osaka, Japan) 5 times from the base to tip with their fingers under the four conditions. Operations under the four hands conditions were conducted consecutively on the same day, as shown in Figure 1. The manipulations were performed in the university acupuncture practice room or the university acupuncture office. Although the subjects and the experimenter did not wear face masks, they tried to prevent speaking whenever possible during the operations.

After touching the acupuncture needles, the subjects put the needles on soybean casein digest agar plates (Nikken Biology Co., Kyoto, Japan). Those agar plates were incubated for 24 hours at 37°C. After the incubation, we checked for the formation of bacterial colonies on the plates as an indicator of the transfer of contamination from the subject's hands to the

**Table 1. Characteristics of the Subjects**

The categorical variables are expressed as n (%) and the continuous variables are expressed as mean (SD).

	Visually Impaired Acupuncturists (n=10)	Sighted Acupuncturists (n=12)
	Mean (SD) or n (%)	Mean (SD) or n (%)
<b>Age (years)</b>	31.1 (9.3)	33.2 (11.1)
<b>Gender</b>		
Male	7 (70%)	9 (75%)
Female	3 (30%)	3 (25%)
<b>Vision Status</b>		
Low Vision	3 (30%)	0 (0%)
Totally Blind	7 (70%)	0 (0%)



**Figure 1: Flow of The Experiment**

acupuncture needles. We compared the difference in bacterial colony appearance under the conditions of bare hands before washing their hands and after three hand hygiene operations: bare hands after washing their hands and scrubbing with alcohol-based hand sanitizer, putting on nitrile gloves without disinfecting their hands and putting on nitrile gloves and then swabbing with ethanol. Bacterial identification tests were performed when colonies were detected. Samples were analyzed by the SRL, Inc. using a Microflex instrument (Bruker, USA) with a matrix-assisted laser desorption/ionization time-of-flight mass spectrometer. In two cases, identification tests could not be carried out as they were later confirmed by photographs. Also, we compared the difference of bacterial colony appearance between visually impaired and sighted subjects in each of the four hands conditions.

Comparisons of two categorical variables were analyzed using Fisher's exact test. Statistical

significance level was set at  $P < 0.05$ . Data were analyzed by using SPSS14.0.

This study was carried out with the approval of the Ethics Committee of Teikyo Heisei University (Approval No. 29-116).

### III. Results

Before washing their hands, bacterial colonies were detected on 11 of the 22 acupuncture needles after all subjects touched them. Out of those 10, 5 were needles from the 10 visually impaired acupuncturists and 6 were from the 12 sighted acupuncturists (Table 2).

After washing their hands and scrubbing with alcohol-based hand sanitizer, bacterial colonies were detected on 4 of the 22 acupuncture needles after all subjects had touched them. Out of the 4, 2 were from visually impaired acupuncturists and 2 were from a sighted acupuncturist (Table 2). All four subjects

(Table 1, subject ID: V6, V9, S11 and S12) also had bacterial colonies detected at the "before hand washing" part of the experiment.

Putting on nitrile gloves without disinfecting their hands, bacterial colonies were detected on only 2 of the 22 acupuncture needles after all subjects touched them. The two subjects who had the bacteria detected on their needles were both sighted acupuncturists (Table 2).

Comparison between bare hands before washing their hands and after the three hand hygiene operations: bare hands after washing their hands and scrubbing with alcohol-based hand sanitizer, putting on nitrile gloves without disinfecting their hands and putting on nitrile gloves and then swabbing with ethanol, showed a statistical difference in colony appearance ( $P=0.01$ ) (Table 3).

Under the three conditions: before washing their hands, after washing their hands and scrubbing with alcohol-based hand sanitizer and putting on nitrile gloves without disinfecting their hands, bacterial colony detection patterns did not reveal significant differences between visually impaired and sighted acupuncturists ( $P=0.67$ ,  $P=0.63$  and  $P=0.29$ , respectively) (Table 2).

No bacteria were detected on the acupuncture needles in any subjects, neither visually impaired acupuncturists nor sighted acupuncturists when putting on gloves and then swabbing with ethanol (Table 2).

The isolated colonies from the needles after the subjects touched the acupuncture needles with their fingers before washing their hands were shown to be Coagulase-negative staphylococci (CNS), *Bacillus cereus*, *Bacillus* sp. (excluding *Bacillus cereus*), *Micrococcus* sp. and Glucose non-fermenting gram-negative rod (NF-GNR) (Table 2).

#### IV. Discussion

Acupuncturist hand hygiene conditions may affect the acupuncture needle hygiene conditions, thus we examined the relation between acupuncturist's hand hygiene operations and acupuncture needle contamination situations.

Before washing their hands, bacterial colonies were detected on half of the acupuncture needles after the subjects touched the acupuncture needles with their fingers. This means that in the cases where acupuncturists use acupuncture needles without proper hand hygiene operations, bacteria would adhere to nearly half of acupuncture needles. Also, bacteria on the needles may enter the patients' bodies and cause infection in the patients.

On the other hand, after washing their hands and scrubbing with alcohol-based hand sanitizer, there were four cases of bacterial adhesion to the

acupuncture needles. Thus, bacterial adhesion from their hands to the acupuncture needles was inhibited compared to before washing hands. The four subjects whose acupuncture needles tested positive for bacteria after washing their hands and scrubbing with alcohol-based hand sanitizer also tested positive for bacteria on the needles before washing their hands. When looking at different conditions of the hands, such as healthy versus damaged, rough hands, it has been reported that the total bacterial count on hands with damaged skin was higher than that on healthy hands<sup>10</sup>. Also, it has been reported that these states of hands change the conditions of bacteria microbiota on the hands<sup>10,11</sup>. Although we did not check the hand damage of our subjects, they may have had some characteristics as mentioned above, allowing the bacteria to easily adhere to the acupuncture needles even after washing their hands and scrubbing with alcohol-based hand sanitizer. In addition, there were two cases of bacterial adhesion to the acupuncture needle when putting on nitrile gloves without disinfecting their hands and no cases of bacterial adhesion to the acupuncture needles putting on nitrile gloves and then swabbing with ethanol. Results of comparison between before washing their hands and after the three hand hygiene operations showed a statistical difference in colony appearance, leading us to the conclusion that some proper hand hygiene operations may effectively inhibit bacterial adhesion to acupuncture needles.

For preventing acupuncture-related infections, some guidelines involving acupuncture recommend that acupuncturists should wash their hands before performing acupuncture, and also use gloves when more hygienic conditions are required<sup>3-7</sup>. In this study, we confirmed that proper hand hygiene operations inhibit bacterial adhesion to needles and may reduce acupuncture-related infections.

Nitrile gloves are not completely sterile, thus we set the condition that the surface of the nitrile glove be disinfected by 70% ethanol in this experiment. However, nitrile gloves are not usually disinfected using 70% ethanol on the surface. Also, disinfectants that contain alcohol have been reported to reduce the breaking load of nitrile gloves<sup>12</sup>. Gloves should be used a single time, and if a break is suspected, a new glove should be used.

Especially, in needling with tube method, the needle is pinched by an acupuncturist's fingers on the skin to stabilize, then inserted into the skin with the other hand. The technique was invented by the Japanese and made it possible to insert a thinner acupuncture needle with safety and less pain regardless of vision status<sup>9</sup>. However, needling with tube method is also a technique that requires directly touching the acupuncture needle while inserting it into the body

**Table 2. Each Hand Hygiene Conditions of the Subjects and Detection of Bacterial Colonies from the Acupuncture Needles**

Subject ID	Eyesight of the Subjects	Bare Hands Before Washing Their Hands	Bare Hands After Washing Their Hands and Scrubbing	Putting on Nitrile Gloves without Disinfecting Their Hands	Putting on Nitrile Gloves and Swabbing with Ethanol
V1	Totally Blind	+	-	-	-
V2	Low Vision	+	-	-	-
V3	Low Vision	CNS	-	-	-
V4	Low Vision	-	-	-	-
V5	Low Vision	-	-	-	-
V6	Totally Blind	+	+	-	-
V7	Low Vision	CNS	CNS	-	-
V8	Low Vision	-	-	-	-
V9	Totally Blind	+	+	-	-
V10	Low Vision	CNS	CNS	-	-
S1	Sighted	<i>Bacillus sp.</i>	-	-	-
S2	Sighted	NF-GNR	-	-	-
S3	Sighted	-	-	-	-
S4	Sighted	-	-	-	-
S5	Sighted	+	-	-	-
S6	Sighted	CNS	-	-	-
S7	Sighted	+	-	+	-
S8	Sighted	<i>Bacillus sp.</i>	-	<i>Bacillus sp.</i>	-
S9	Sighted	+	-	-	-
S10	Sighted	CNS	-	-	-
S11	Sighted	-	-	-	-
S12	Sighted	+	+	+	-
		CNS	CNS	-	-
<b>All Subjects (n=22)</b>		11 (50.0%)	4 (18.2%)	2 (9.1%)	0 (0.0%)
<b>Visually Impaired Acupuncturists (n=10)</b>		5 (50.0%)	2 (20.0%)	0 (0.0%)	0 (0.0%)
<b>Sighted Acupuncturists (n=12)</b>		6 (50.0%)	2 (16.7%)	2 (16.7%)	0 (0.0%)
<b>p value (Fisher's exact test)</b>		0.67	0.63	0.29	-

+: Bacterial colonies detected on acupuncture needles.

-: No bacterial colonies detected on acupuncture needles.

CNS: Coagulase-Negative Staphylococci

NF-GNR: Micrococcus and Glucose Non-Fermenting Gram-Negative Rod

The number of cases of bacterial colonies detected from the needles under each hands condition are given at the bottom of the table.

The p value indicates the result of comparing the patterns of visually impaired and sighted acupuncturists.

**Table3. Comparison of the number of bacterial colonies from the needles between bare hands before washing their hands and after the three hand hygiene operations**

Bare Hands Before Washing Their Hands (n=22)	Three hand hygiene operations :		p value (Fisher's exact test)
	(Bare Hands After Washing Their Hands and Scrubbing, Putting on Nitrile Gloves without Disinfecting Their Hands, Putting on Nitrile Gloves and Swabbing with Ethanol Their Hands) (n=66)		
Number of Bacterial Colonies Detected from the Needles	10	6	0.01

with the acupuncturist's fingers. Therefore, it is possible that the condition of the acupuncturist's hands is strongly related to the hygiene of the needles. As far as our findings are concerned, if the acupuncturists wash their hands and scrubbing, especially using gloves, the acupuncture needles can be kept clean even with needling with tube method.

Although the bacteria isolated in this study were mainly weakly pathogenic and indigenous bacteria, some of the bacteria has a possibility of causing infections, especially in immunocompromised patients or elderly people<sup>13-16</sup>. Albeit not being detected in this experiment and causal relationships are not clear in some cases, several acupuncture-related infections have been reported with *Staphylococcus aureus*<sup>17-21</sup> and *Streptococcus anginosus*<sup>22</sup>, which can be indigenous to the skin as well. Some of the patients in these reports were elderly or immunocompromised<sup>17-19, 22</sup>, but others had no underlying diseases<sup>20, 21</sup>. Moreover, these reports also included reports of serious outcomes such as death<sup>17</sup>, infectious aortitis<sup>18</sup> and quadriplegia<sup>19</sup>. Therefore, in order to provide hygienically safe acupuncture to patients, acupuncturists must perform hygienic acupuncture operations thoroughly.

Regarding the influence of vision status, there were no differences in bacterial adhesion to the needles between visually impaired and sighted subjects. Being an acupuncturist is one the major jobs for visually impaired people in Japan<sup>9</sup>. Within the method of this experiment, visual impairment did not affect acupuncture hygiene.

Although this experiment was conducted in a laboratory, the subjects almost only touched the acupuncture needles during the experiment. However, in clinical situations, acupuncturists may touch a lot of things other than acupuncture needles, for example

curtains for treatment booths, treatment instruments like beds and wagons and patients' bodies. Especially, visually impaired acupuncturists may touch things to confirm the situation around them instead of using eyesight. Therefore, it is necessary to conduct future experiments assuming clinical situations in which people have contact with various objects before the needling operation.

Also, we only checked acupuncture needle hygiene conditions. We did not check subjects' hand hygiene conditions, therefore we could not examine the impact of hand hygiene on acupuncture needles' hygiene. In addition, since this experiment was conducted in the university acupuncture practice room or the university acupuncture office and subjects and experimenter did not wear face masks, the possibility cannot be denied that falling bacteria or bacteria derived from the subject or experimenter's droplets may have adhered to the medium. The experiments that take into consideration hand hygiene conditions and experiments that are not be affected by external environments should be conducted in the future.

## V. Conclusions

Proper hand hygiene operations, washing hands and scrubbing and usage of clean gloves during acupuncture treatments suggest to reduce bacteria contamination of acupuncture needles regardless of acupuncturists' vision status.

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### Conflict of interest

The authors declare no conflicts of interest associated with this manuscript.

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