


# The Correlation between Hands Hygiene before Doing Eye Exercise and Eye Diseases Diagnostic Rates

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**Abstract:** Many eye diseases such as keratitis and ophthalmitis that occur in China harm the eye health of the public. This study research the relationship between the hands and the potential infection rate of ophthalmitis and keratitis without reaching the degree of cleanliness during their eye exercises. This study mainly used two methods: questionnaire and experimental method. The experimental group was group 1 and the control group was group 2. Group 1 washed their hands before doing eye exercises, while Group 2 did not wash their hands before doing eye exercises. Subjects in group 2 were found to have a higher potential prevalence of ophthalmitis, keratitis. Therefore, it is believed that when doing eye exercises, the substandard cleanliness of the hand will improve the potential risk of student infection of ophthalmitis and keratitis. The purpose of this study is to publicize the relationship between hand cleanliness and ophthalmitis and keratitis, reduce the risk of infection in students while doing eye exercises, and protect eye health.

## 1 INTRODUCTION

There is a lot of literature on ophthalmitis, how keratitis occurs and whether contact by hand when doing eye exercises is a good way. Basically, one point of view is to make less contact with your hands and your eyes. It is also mentioned that the use of surgical disinfection or quick dry hand sanitizer can indeed effectively antivirus bacteria (Liu 2020, Chen 2012, Zhang 2020), because the eye is an exposed organ, where the cornea, lens, vitreous are avascular transparent tissue, their own resistance is weak, very vulnerable to the invasion of microorganisms. Most of the infections with conjunctivitis are caused by no attention to hand hygiene. Some articles say that most of the infection with conjunctivitis is caused by no attention to hand hygiene because of many hands and eye contact during eye exercises. If the hand does not fit the degree of cleanliness, then it may cause conjunctivitis and keratitis in the eyes of the (Gao 2019). Some people have done experiments on the relationship between visual eye exercises and eye exercises and eye infections. Eye care eye exercises

is an eye exercise but does not need the hand to touch the eyes. Article concluded whether the eyes are hand touched is an important cause of conjunctivitis, so do exercises do not let hand contact can effectively alleviate the occurrence of keratitis (Li 2020, Huang 2013). People also mentioned that conjunctivitis is mainly by contact transmission, contact with hand bacteria transmission (Wang 2012). People also directly mentioned although high hand bacteria rate before washing hands, but after washing hands, hand bacteria rate greatly reduced, they show that this is a good way to reduce hand bacteria infection (Li 2011). In this paper, in the effect of simplifying the three-step washing method on the effect of sanitary hand disinfection, the three-step washing method refers to the use of three-step washing hands, which is easier than the six-step washing method. In her article, she opposed the idea that the group can only use seven-step washing techniques to achieve cleanliness (Gu 2020). Many papers supporting the hypothesis of this study, among which the analysis of hand health cognitive status and influencing factors in ophthalmic patients is the most supportive group. Overall, the above literature section does not use one hand to support the production of conjunctivitis is mainly caused by bacteria in the

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hand. In two eye exercises and children eye conjunctival infection, and use the data is separate, just the second grade students as an experimenter, he only selected a subject, through a grade data is unscientific, because he is the default age this variable, which makes the experiment has accidental, is not universal. It makes the final conclusion not universal. We will avoid this limitation as much as possible when we do experiments. We will send questionnaires for statistics, interview individual students, and select cross-grades and schools. Although there are views to support the groups, there are also opposition groups. We want to refer to this part of the opinion, but the author still want to study the analysis of the data to draw a conclusion.

## 2 RESEARCH METHODS

Through the data collection process of our group, we obtained the questionnaire data and the experimental detection data, and will take descriptive statistical analysis, chi-square analysis, correlation analysis and other methods to study the relationship between different variables and differences, use the collected data to verify the study hypothesis, and obtain relevant conclusions about the study. For the questionnaire data, the study will be presented using the chart in the descriptive statistics, with the objectives of the questionnaire design: to investigate the current attitude of school teenagers about eye exercise and the understanding of hand health affecting eye health during eye exercise. The understanding of the knowledge of periocular pathogenic bacteria and the hand washing habits of eye health exercises were regression and analyzed. Do not pay attention to hand cleaning before doing eye exercises

For the experimental data, we will first perform the average t-test of the number of hand colonies in the control group and the experimental group to explore whether the number is significantly different between the hand and the eye. If there is a significant difference in the number of hand colonies, the seven-step wash with hand sanitizer is significant, but the reasons for the significant difference in the number of periocular colonies need to be further explored. Regarding the effect of hand washing opponents and the positive rate of peripheral eye tests (positive criteria:  $> 10\text{CFU} / \text{cm}^2$ ), square analysis will be used. Chi-square analysis can determine whether hand washing is significantly different in the positive rate of hand and eye

circumference, so we can verify the conjecture that hand cleaning before eye exercises can effectively prevent hand bacteria landing around the eye and cause harm to eye health. The validation was also performed using a control experimental method. A total of 40 subjects were divided into control and experimental groups of 20 individuals each. The experimental group performed a hand cleaning using a seven-step wash, without treatment in the control group. Hand flora was sampled from 40 students. A cotton swab soaked in 0.03mol/L phosphate buffer or saline sampling solution was rubbed back and forth from both hands finger root to finger end twice. The cotton swab was sampled, cut off the hand contact site, and put the cotton swab into the test tube containing 10ml sampling liquid for inspection. After the experimental group and control group began to do eye exercises, after the two groups of the eye skin quickly samples: will have saline cotton swab in the eye exercises skin rub 3~5 times, turn the sampling cotton swab, cut off the hand contact site, the cotton swab into the tube containing 10ml sampling fluid. All experimental collected samples were handed over to the third party testing company "Golden domain" for inspection.

## 3 RESULT

### 3.1 Statistical Analyses

A survey on hand hygiene and hand cleaning found that 44.38% of students would not understand the complete seven-step washing method, nearly 92.31% of students wash their hands for less than 30 seconds, indicating that there is a considerable year. Some students do not understand the scientific and effective methods of hand washing, and the hand washing time is relatively short, can not be guaranteed more

Good hand hygiene, fingertips and nails in the normal state is likely to hide a lot of fine fungus. In the survey of the understanding of pathogenic bacteria leading to eye diseases, 42% of students did not know their hands at all. On the potential eye disease treatment of bacteria, 47% of the students have a certain understanding of the existence of eye disease pathogenic bacteria, only 11% of students clearly understand what pathogenic bacteria that will cause eye diseases in their hands, indicating that many students do not understanding that germs on the hand will spread to the eyes (eye exercises, eye rubbing, etc.), leading to the occurrence of eye

disease. In addition, for some are not easy to use questionnaire survey, we carried out the survey in the form of depth interview, in the interview of the students to reduce washing frequency and shorten the washing time have the following reasons: bathroom queuing, toilet environment, bathroom facilities shabby or no hot water, etc. In the interview with experts, I learned that direct hand contact with eye disease pathogens meets the eye or the eye will improve the probability of obtaining eye disease. Through the overall investigation, the

following situation: a considerable majority of students do not usually pay attention to hand hygiene, and do not do hand cleaning before eye exercises, may be due to the not understanding of the pathogenic bacteria caused by eye diseases.

In the preliminary descriptive statistics of the experimental data, the hand positive rate was 10% and the control eye was positive

The rate was as high as 65%; the hand positive rate was 0% and the periocular positive rate was 5%. (positive criteria For > 10CFU / cm<sup>2</sup>)

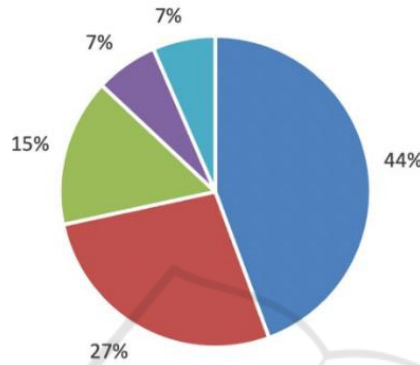


Figure 1: Hand washing habits before eye exercises.

The hand flora showed hand positive rate of 10% and 65%, hand positive rate, 0% and 5%. (Positive label is > 10CFU/cm<sup>2</sup>)

exercises ("always" is 5 points and "often" is 4, "average" is 3, "less" is 2, "never" is 1), which will average every day. The frequency of the hand assigns the four options in the problem to valid numbers according to the degree size, ("0-2" was set to 1, "3-5" to 2, "6-8" to 3, and "> 9" to 4)

### 3.2 Study Results and Analytical Discussion

The results of the correlation of opponent hygiene and hand washing habits before eye exercises are shown in Table 1:

#### 3.2.1 Analysis of the Questionnaire Results

The same score is given for hand washing before eye

Table 1: Regression analysis of the attention of hand hygiene and the frequency of hand washing before eye exercises.

	Coefficients	Std Error	t Stat	P-value	Lower 95%	Upper 95%	Minimum 95%	Max 95%
Intercept	1.38394	0.30795	4.494	1.3E-05	0.77596	1.99193	0.77596	1.99193
X Variable	0.22451	0.10221	2.19645	0.02271	0.02271	0.42631	0.02271	0.42631

Since the P-value of the coefficient of 0.029437 is less than the cutoff of 0.05, the regression model is valid and has significant differences; although Multiple R=0.17 is relatively small, the correlation between the two. It shows that the more people who pay attention to hand hygiene, the more they will choose to wash their hands before eye exercises, and

it also proves to a certain extent that people who pay attention to hand hygiene will also pay attention to eye hygiene

The results of the understanding of eye disease pathogens on the opponent and the correlation of hand washing before eye exercises are shown in Table 2.

Table 2: Regression analysis of understanding of eye diseases and frequency of hand washing before eye exercises.

	Coefficients	Std Error	t Stat	P-value	Lower 95%	Upper 95%	Minimum 95%	Max 95%
Intercept	1.22865	0.29297	4.19377	4.44E-05	0.65025	1.80705	0.65025	1.80705
X Variable	0.31116	0.108201	2.87583	0.004555	0.09754	0.52478	0.097549	0.52478

Judging the P-value of the variable coefficient in the regression found that  $P = 0.004 < 0.05 < 0.05$ , less than the level of significance, is enough to prove the effectiveness of the regression model is effective. Even if Multiple  $R=0.22$  is relatively small, the positive correlation between the two variables indicates that the higher the understanding score in the opponent, the more attention will be paid to washing before eye exercises. It shows that there is a knowledge reserve of pathogenic bacteria of eye diseases, realize the importance of eye health, will clean the hands before eye exercises, thus reducing the risk of hand bacteria landing around the eye, and then reduce the risk of eye disease.

### 3.2.2 Effect of Hand Washing on the Flora of Hand Colonies

This part of the study uses the data in the experimental test report, to facilitate data analysis, the positive test form of " $> 10$ " in the test report was converted to " $=10$ " at data input for approximate processing. The number of colonies obtained from the hand sampling test (in the control group before the eye exercise) was subjected to the two-sample heteroscedvariance test (mean t-test); variable 1 is the number of hand colonies in the control group, and variable 2 is the number of hand colonies in the experimental group. By exploring the significant difference in the seven-step number of colonies between the two groups, it was used to determine whether a seven-step wash could effectively clean the hands.

The results of the two-sample heterovariance test for the flora of colonies sampled from the control and experimental groups are shown in Table 3.

Table 3: Two-hand heterovariance test of the effect of hand washing on the flora of hand colonies.

	variable 1	variable 2
average	8.209	2.117
variance	7.866830526	7.15372737
observed value	20	20
The mean variance was assumed	0	
Df	38	
T Stat	7.029620189	
P (T<=t)	1.12131E-08	
T single-tailed critical	1.68595446	

The P-value is 0.004635  $< 0.05$ , which is less than the significance level, rejecting the original hypothesis that the mean difference is equal to 0, indicating that the mean between the two variables and the mean of variable 1 is larger than variable 2, proving that the flora of colonies before washing is significantly higher than after washing; and also shows that the seven-step wash method can effectively reduce the flora of colonies.

### 3.2.3 Effect of the Mean Flora of Periocular Colonies in the Hand Wash or Not Control Group and the Experimental Group

In this section, the positive test report of " $> 10$ " was approximately treated as " $=10$ " for data analysis. The two-sample heterovariance test of the number in the control group (mean t-test); variable 1 is the number of periocular colonies in the control group and variable 2 is the number of periocular colonies in the experimental group. By exploring whether there were significant differences in the mean between the two variables, we initially verified whether the bacteria on the hand after eye exercises caused differences in the number of periocular bacteria (direct contact leads to bacterial transfer).

The results of the two-sample heterisovariance test in the control and experimental groups are shown in Table 4.

Table 4: Two-sample heterovariance test for the flora of colonies tested in perieye samples after eye exercises

	variable 1	variable 2
average	2.832	0.8415
variance	8.66392211	1.30250816
observed value	20	20
The mean variance was assumed	0	
Df	25	
T Stat	2.81792895	
P (T<=t)	0.004635	
T single-tailed critical	1.70814076	

The P-value was far less than 0.05, indicating that the flora of bacteria varied significantly between the two groups, and that the average flora of

periocular colonies in the control group was much larger than that in the experimental group, which partly showed that the flora of hand bacteria in eye exercises affected the flora of periocular bacteria. However, considering the problem of controlling the variables in the experiment, there may be an unequal flora of periocular bacteria before the experiment (the sex ratio between the experimental and control groups was unequal, and the periocular hygiene was inconsistent between individuals).

We further explored the above mean differences, using cross-table analysis and chi-square test

The method to test whether hand washing is a real opponent and perieye positive rate, to verify eye care. Washing our hands before exercise can effectively reduce the positive rate of our hands and around the eyes. We will first wash our hands and set corresponding values ("No wash" is 0, "wash" is 1; Hand negative (colonies <10 CFU / cm<sup>2</sup>) is 0 and "Hand positive (colonies > 10 CFU / cm<sup>2</sup>) is 1).

In view of the difference in mean mentioned above, cross-table analysis and chi-square test were used to test whether hand washing had a real opponent and periocular positive rate. The results are shown in Table 5:

$$\text{Pearson } \chi^2(1) = 2.1053 \quad \text{Pr} = 0.147$$

Table 5: Cross-table analysis of the effect of hand washing.

wash	Hand		amount to
	0	1	
0	18	2	20
1	20	0	20
amount to	38	2	40

From the above chi-square analysis, the probability  $P=0.147$ , although greater than the above-mentioned level of 0.05, remains relative close to 0.05, it can not explain whether the positive rate of the opponent has a significant impact, but due to the normal start, testing is less positive, and there is still a greater grasp (85.3%) shows that the positive rate of hand washing will be the opponent

It will have an impact, and hand washing can see that hand washing reduces the positive rate. Set the corresponding value of hand washing or not and periocular sex (0 do not wash hands and 1; perieye negative (colonies <10 CFU / cm<sup>2</sup>) is 0 and perieye positive (colonies > 10CFU / cm<sup>2</sup>) = 1).

Chi-square tests of hand washing and sex of the perieye are shown in Table 6,

$$\text{Pearson } \chi^2(1) = 15.8242 \quad \text{Pr} = 0.000$$

Table 6: Chi-square test of the effect of hand washing on the periocular positive rate.

wash	periorbital		amount to
	0	1	
0	7	13	20
1	19	1	20
amount to	26	14	40

$P=0.000$  was significantly less than 0.05, indicating whether hand washing had a significant effect on the perieye positive rate, and cross-tables showed that hand washing before eye exercises can effectively reduce the positive rate around the eye.

## 4 CONCLUSIONS

After research found that the vast majority of students can not do the effective cleaning of the opponent before the eye exercises. The main reasons for this situation are: 1. Lack of understanding of eye hygiene; 2. Unable to correctly grasp the hand washing methods; 3. Restricted objective conditions, such as low water temperature in winter, the bathroom needs to wait. Secondly, the experiment proved that after the seven cleaning techniques can do hand hygiene, the hands can reach a very clean level, at the end of the eye exercises. Later, there were fewer bacteria around the eyes compared to the experimental group that did not wash hands, demonstrating that washing hands prior to eye exercises. Reduce the number of periocular bacteria and reduce the risk of developing bacterial eye diseases. That is to say, to do eye exercises. Hand washing before according to the seven-step washing method can indeed reduce keratitis, the potential infection rate of ophthalmitis because of the use of seven, step-by-step washing method can ensure that every part of the finger is cleaned, can ensure that every part is obtained. Germicidal rather than universal hand washing, which can lead to residual bacteria in some parts. There are pictures that show that the five fingers and the gaps between them are the easiest places to forget.

Killing the bacteria will naturally reduce the infection rate, so our assumption is naturally true. Through second-hand data. In the literature, there are many suggestions that the disease of conjunctivitis and keratitis is mainly determined by the bacteria in the hand. Because when people use



their hands to contact the eyes are close to the eyes, bacteria can easily enter the eye to cause disease. Disease. There are also papers on visual eye exercises that do not touch the eye exercises to keep the eyes from bacteria

The infection is much better than normal eye care, which provides theoretical evidence for our experimental hypothesis that our control and experimental variables of whether hand washing will lead to conjunctivitis, and keratitis disease provides filling. The basis of the score. Because in fact, not allowing the hand to contact the eyes and using the seven-step wash a good hand and then touching the eyes is almost the same in essence, the eyes have been protected. Physical eye exercises that do not make contact with the eye are significantly better than general eye care. Exercise has an advantage in not letting bacteria enter the eye, so it can be introduced when doing eye exercises

The degree of compound cleanliness can be related to the potential infection rate of ophthalmitis and keratitis.

## 5 DISCUSSION

Due to the lack of money and time, the group selected volunteers from men to women was unbalanced because the proportion was not taken into account in the control and experimental groups. And the volunteers' faces were not disinfected before doing the experiment. When the experimental nature leads to the bacteria around the second eye extraction, it may be possible that the experimental group already has the bacteria around the eye, thus affecting the experimental result. This limitation is difficult to solve, because the group cannot disinfect the students' faces. At the same time, even if the group has minimized the time students stay in the air after washing their hands, the group can not fully solve this problem without professional training, which may lead to the experimental group, the bacteria of the hands into the eye again. For the experimental data, we will conduct a two-sample mean difference t-test of the hand colony number in the controls and the number of periocular colonies in the control and experimental groups to explore whether there are significant differences in the number of colonies between the controls and around the experimental group, respectively. If there is a significant difference in the number of hand colonies, the seven-step wash with hand sanitizer is significant, but the reasons for the significant difference in the number of periocular colonies need

to be further explored. In addition, for some are not easy to use questionnaire survey, we carried out the survey in the form of depth interview, in the interview of the students to reduce washing frequency and shorten the washing time have the following reasons: bathroom queuing, toilet environment, bathroom facilities shabby or no hot water, etc. In the interview with experts, I learned that direct hand contact with eye disease pathogens meets the eye or the eye will improve the probability of obtaining eye disease. Through the overall investigation, the following situation: a considerable majority of students do not usually pay attention to hand hygiene, and do not do hand cleaning before eye exercises, may be due to the not understanding of the pathogenic bacteria caused by eye diseases.

With the rapid development of science and technology, people use their eyes more and more frequently. The eye is one of the important organs in the human body. In order to ensure that the eyes of primary and middle school students are protected, the state has implemented eye health exercises. However, primary and middle school students still have a higher conjunctivitis, the prevalence of keratitis. This study concluded that the lack of cleanliness of the hand during eye exercises has a relationship with ophthalmitis and the potential infection rate of keratitis. And exactly what kind of bacteria directly lead to ophthalmitis, keratitis disease occurrence, will be the focus of later research.

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