

Importance of education on infection control and on the hand skin health of dental personnel

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Abstract

Background. Hand hygiene plays a significant role in infection control, yet it is performed correctly only 40% of the time. The daily use of soap, disinfectants and gloves can also affect hand skin health. Periodical educational interventions regarding hand hygiene can improve infection control.

Objectives. The current study aimed to identify the existing hand hygiene practices applied by dental personnel, to evaluate knowledge about infection control, to determine the adverse effects of hand hygiene on the skin, and to assess the effectiveness of the educational interventions concerning these topics.

Material and methods. This study was carried out at the Vilnius University Hospital Žalgiris Clinic, Lithuania. At the 1st stage, data was collected by using a self-administered questionnaire. At the 2nd stage, dental personnel underwent an educational intervention and the surveys were redistributed to determine any changes in the level of knowledge.

Results. In most cases, dental workers performed hand hygiene when it was needed. The proper method was selected by 53.4% on average. The main mistakes were the excessive use of soap and only occasional use of a disinfectant. The reported hand skin side effects included dryness (68.8%) and fissures (37.5%). Only half (50.5%) of the staff regularly used emollients. After the educational intervention, there was a 24.9% improvement in hand hygiene compliance.

Conclusions. The correct procedure for hand hygiene was reported by half of the participants. Washing hands with soap was the preferable choice, while alcohol-based hand rub (ABHR) was avoided. Skin problems were reported by more than 70% of the respondents. Training had a positive impact on the hand hygiene knowledge of the dental personnel.

Keywords: education, dentistry, infection control, hand hygiene, skin care

Cite as

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Introduction

The human mouth contains one of the most diverse microbiomes in the human body. More than 1,000 species of bacteria are found in the oral cavity.¹ Regarding the recent COVID-19 pandemic, the issues of infection control and hand hygiene in the dentistry field have come to light. Dental personnel is exposed to an immense risk due to the specificity of dental procedures, which involve face-to-face contact with patients, frequent exposure to saliva, blood and other fluids, the handling of sharp instruments, and the generation of aerosols and droplets.² Although appropriate hand hygiene is a routine procedure in dental practice, the compliance rates are relatively low.² Data shows that proper hand hygiene is achieved only in 40% of cases.³ Given the current situation, improvement in this area is of utmost importance.

The World Health Organization (WHO) has declared that hand hygiene is necessary before and after touching the patient, before handling invasive devices, after removing sterile or non-sterile gloves, and after contact with blood and other body fluids or inanimate surfaces and objects.⁴ Data shows that hand hygiene is most often performed after exposure to organic fluids (98.5%), before invasive procedures (87.5%), before clean/aseptic/surgical procedures (83.1%), and between patients (81.4%).⁵ However, proper hand hygiene after contact with patient surfaces is usually not achieved.⁵ Such behavior increases the risk of cross-contamination between the patient and medical personnel.^{6,7}

Hand hygiene includes cleaning the hands with soap and water and/or alcohol-based hand rub (ABHR). Indications for hand washing are as follows: before the first patient; after using a toilet; when the hands are visibly dirty or soiled with blood or other body fluids; or if there is no ABHR.⁴ In all other clinical situations, dental personnel should use just ABHR. According to studies, ABHR is well-tolerated and safe, while the frequent use of soap increases the risk of developing a dermatological pathology.^{8–10} Unfortunately, healthcare workers often ignore ABHR due to the erroneous belief that it provokes adverse skin effects, and use soap unnecessarily.⁶ This often leads to the deterioration of the hand skin condition, including impaired barrier function, a change in the skin flora, increased bacterial shedding and sensitivity of the skin, or other adverse reactions.¹⁰ Moreover, severe dermatological pathologies, such as contact and allergic dermatitis, can develop.^{4,7,9}

The use of gloves is part of the standard precautions against cross-contamination in medical offices.¹¹ Latex gloves may cause allergic reactions because of various chemical agents (antioxidants, accelerators, activators, etc.) used during the manufacturing process or due to their protein content. Latex allergy occurs in 1–2% of the total population, but the sensitization rates in healthcare providers are 2 times higher than in the general population.¹² The main reasons for sensitization are 'wet work' and long working hours while using gloves.¹³

Hand hygiene interventions are described as hand sanitization programs to increase hand hygiene compliance. These interventions vary from simple (e.g., increased availability of cleaning agents) to complex (e.g., multimodal programs involving education, environmental restructuring, reminders, and performance feedback).^{14,15} Single-component interventions improve hand hygiene practices, but multimodal strategies are more effective over a long term.¹⁶ Education, feedback, support from a team leader, and the accessibility and visual reminders of hand hygiene are all elements that increase compliance.¹⁶ Numerous studies have found positive effects on hand hygiene quality after educational interventions.^{14–18} However, the compliance rates decline with time; therefore, regular post-interventions should be considered.¹⁶

The present study aimed to identify the existing practices reported by dental personnel for hand hygiene, to evaluate their knowledge about infection control, to determine adverse effects on hand skin, and to assess the effectiveness of the educational interventions concerning these topics.

Material and methods

The study was conducted in 2 stages. At the 1st stage, data was collected using a self-administered questionnaire. The questionnaire included multiple-choice questions about hand hygiene habits (daily cleaning with soap and ABHR), infection control knowledge (questions from the WHO's "Guidelines on hand hygiene in health care"⁴), hand skin health, the use of gloves, and the manifestations of adverse reactions, such as dryness or redness. The study included dental specialists, general dentists, dental resident doctors, and dental assistants/nurses working the day shift in the Žalgiris Clinic, Vilnius University Hospital, Lithuania. The day shift in the Žalgiris Clinic lasts from 8 a.m. to 2 p.m. or from 2 p.m. to 8 p.m. (in general, 6 h). Only 120 dental workers from the Žalgiris Clinic met these criteria, and all of them were given a first-stage questionnaire. After analyzing the results from the 1st stage, we assessed the most common mistakes. Accordingly, we prepared educational material and introduced it to the dental personnel at the 2nd stage. The instructional video material was uploaded to the Žalgiris Clinic intranet and informational posters were hung in each consulting room above the washing sink at eye level. A week later, the same questionnaires were redistributed among those who participated in the 1st phase of the study and saw the instructional video material to determine any changes that occurred after exposure to the educational intervention.

Statistical analysis

Statistical analysis was performed using the IBM SPSS Statistics for Windows software, v. 23 (IBM Corp., Armonk, USA). Data normality was checked.

The χ^2 test of independence was used to determine statistically significant associations between 2 variables, and the non-parametric McNemar's test was used to assess changes between first- and second-stage responses. A statistically significant difference was assumed at 5% ($p \leq 0.05$).

Results

A total of 120 persons participated in the 1st phase of the study. The response rate was 80% (96/120). The majority of respondents were women (92.7%), and the age of the participants ranged from 20 to 66 years (39.02 ± 11.17 years). For further analysis, the groups were divided according to specialization (nurses/dental assistants, resident doctors, dental specialists, and general dentists). The majority of respondents in both phases were nurses/dental assistants. In the 2nd phase, 96 individuals participated and the response rate was 87.5% (84/96). The majority of respondents were also women (89.3%), and the age ranged from 24 to 66 years (40.41 ± 11.70 years) (Fig. 1).

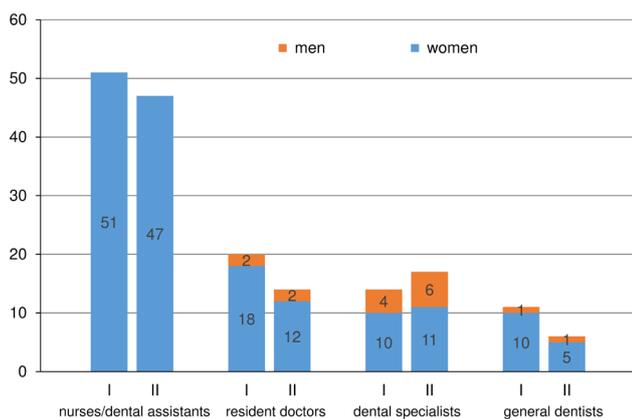


Fig. 1. Distribution of respondents by occupation and gender at the 1st and 2nd stage of the study

Knowledge about infection control

Nearly 100% of the respondents identified the situations where hand hygiene was necessary. However, the proper hand hygiene method (the use of soap and water and/or ABHR) was selected by only 53.4%. Table 1 shows to what extent correct hand hygiene measures were complied with at the 1st and 2nd stage of the study. At the 1st stage, 89.6% of respondents chose the proper hand hygiene method after exposure to organic fluids and 76.0% before invasive procedures. With regard to other measures, less than 34% replied correctly. After the educational intervention, a 21.4% improvement was observed in the selection of the proper hand hygiene method. However, at the 1st stage, when the respondents were asked to self-evaluate (on a 100% scale) to what extent they performed appropriate hand hygiene, a high rate of compliance was indicated (82.7%).

Eighty-three percent of the respondents correctly answered the question about the recommended hand washing time when using soap (Fig. 2). In addition, 79.8% knew the time required for the use of ABHR (Fig. 3).

At the 1st stage of the study, 47.9% of the respondents knew that during hand washing, the direction of water flow should be from the wrists to the fingers. After the educational intervention, a 25.9% improvement in this aspect of knowledge was observed (Table 1).

A difference in the opinions of the respondents regarding hand washing with soap and the use of ABHR at the 1st and 2nd stage was evident. After the intervention, the average improvement was 30.3% (Fig. 4).

Self-evaluation showed that 80.6% of the dental personnel believed they had enough knowledge about infection control and hand hygiene. A borderline statistically significant difference ($p = 0.049$) was observed between different professions, where 42.9% of general dentists indicated a lack of information as opposed to only 10.4% of nurses/dental assistants.

Table 1. Correct answers to the same questions at the 1st and 2nd stage of the study

Questions	Answers at the 1 st stage N = 96	Answers at the 2 nd stage N = 84	p-value
Appropriate hand hygiene before each patient	32 (33.3)	51 (60.7)	<0.001*
Appropriate hand hygiene after removing gloves	30 (31.3)	54 (64.3)	<0.001*
Appropriate hand hygiene after exposure to organic fluids	86 (89.6)	76 (90.5)	0.791
Appropriate hand hygiene before invasive procedures	73 (76.0)	71 (84.5)	0.700
Appropriate hand hygiene after using a toilet	27 (28.1)	26 (31.0)	0.607
Hands should be disinfected for 20–30 s	71 (74.0)	67 (79.8)	0.845
Water should flow from wrists to fingers	46 (47.9)	62 (73.8)	<0.001*
Soap dries skin more than ABHR	61 (63.5)	74 (88.1)	0.003*
Frequent hand washing with soap causes hand skin problems	72 (75.0)	67 (79.8)	1.000
Frequent use of ABHR does not cause hand skin problems	28 (29.2)	35 (41.7)	0.091

Data presented as number (percentage) (n (%)). ABHR – alcohol-based hand rub.

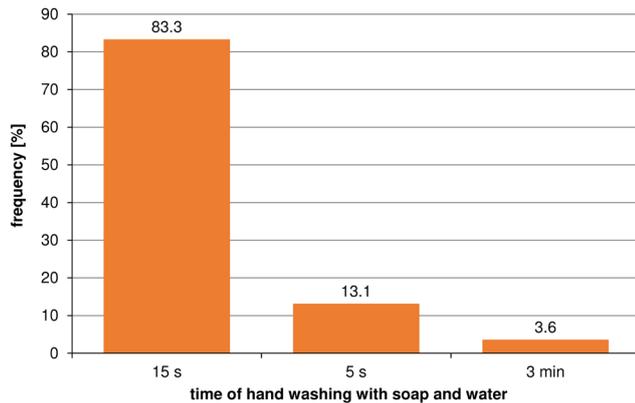


Fig. 2. Time required for hygienic hand preparation with soap and water

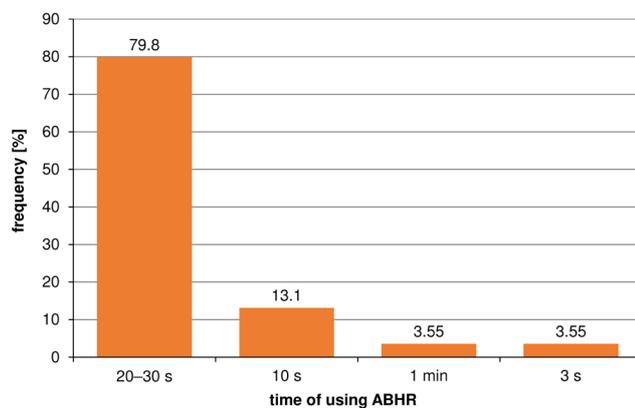


Fig. 3. Time required for hygienic hand preparation with alcohol-based hand rub (ABHR)

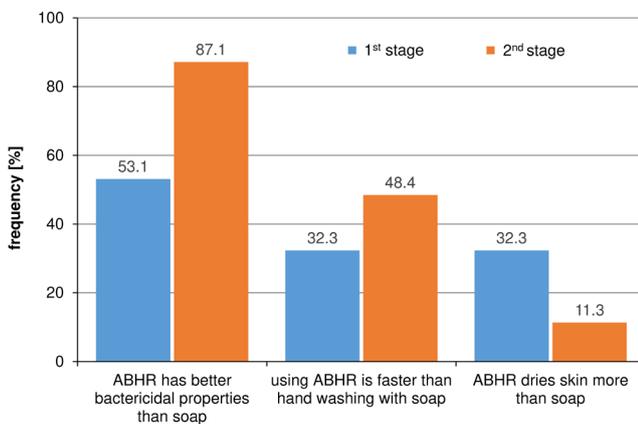


Fig. 4. Opinions on the use of soap and alcohol-based hand rub (ABHR) during hand hygiene procedures

Hand skin health

According to the self-reports, the prevalence of eczema and atopic dermatitis was 8.5% and 4.2%, respectively. Most often, the dental personnel indicated having a dry (45.8%) or mixed (32.3%) hand skin type.

A total of 50.5% of the respondents regularly used hand cream/lotion. However, only 38.5% used hand cream/lotion 3–4 times a day. Mostly emollients were used to counteract hand dryness (35.1%). The use of emollients after the edu-

cational intervention increased up to 77.4%, and a 26.9% improvement was evident. All healthcare workers who had atopic dermatitis ($p < 0.05$) and 50% of those who had eczema did not use hand skin emollients regularly. Only 19.8% of the respondents indicated that they did not have adverse hand skin effects, with the remaining participants specifying various complaints. There were no statistically significant differences in the distribution of various skin side effects within particular profession groups (Fig. 5).

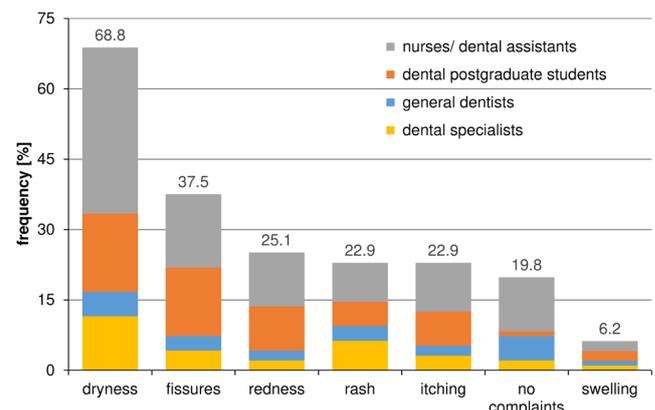


Fig. 5. Distribution of adverse hand skin reactions according to different professions

Use of gloves

A total of 62.4% of the respondents wore gloves for 7 h or more, 36.6% for 3–6 h, and 1.0% for up to 2 h. Half of the respondents indicated working with gloves for 10 years or more.

During the day, 57.3% changed their gloves 11 times or more, 34.4% 6–10 times, and the remaining 8.3% up to 5 times. Of those who changed their gloves up to 5 times ($n = 8$), 62.5% ($n = 5$) had 6–10 patients per day, and of those who changed their gloves 6–10 times ($n = 33$), 9.1% ($n = 3$) had 11 or more patients per day.

Most often, nitrile (47.7%) or latex (46.7%) gloves were used. Approximately 1/3 of the participants (27.4%) reported irritation reactions linked to the wearing of latex gloves, 6.4% to nitrile gloves and 6.3% to vinyl gloves.

Effectiveness of the educational intervention

The answers to the same questions were compared between the 1st and the 2nd stage. The responses to 4 out of the 10 questions were significantly improved after the educational intervention (Table 1). The average improvement after educational training was 25.4%.

Most respondents (95.2%) agreed that educational training had an impact on their knowledge. A total of 54.75% of the healthcare workers indicated that infection control and hand hygiene training should be carried out every year, 29.75% indicated every 6 months, and 15.5% every 3 years or more.

Discussion

One of the critical issues in hand hygiene is recognizing situations when particular hand preparation is required.⁴ Medical personnel tend to forget about hand hygiene when contact with patient surfaces is expected as well as after it.⁵ This study found that the compliance rates declined after the removal of gloves, but the results were much better after the educational intervention. After such an intervention, appropriate hand hygiene was performed by 100% of the personnel in all other situations (after contact with organic fluids, before invasive procedures, before each patient, and after using a toilet). Although dental workers self-evaluated their knowledge as very good, the answers about the correct method to use in different situations revealed that their knowledge was inadequate. At the 1st stage, only half of the staff knew which situations required washing hands with soap and/or ABHR.

Sodium lauryl sulfate (SLS) is a detergent commonly used in soap due to its cleansing properties. However, it affects the natural skin barrier and causes skin dryness, irritation and allergic reactions.¹⁹ Also, it is widely known that SLS irritates the skin more than ABHR.⁹ For this reason, the use of soap should be avoided in situations that do not require it. In this study, the majority of dental personnel washed their hands with soap before each patient and after removing gloves, while these situations require only the use of ABHR. In another study, 68% of respondents reported that they washed their hands with soap between patients and 65% after removing gloves; in contrast, only 3% used ABHR between patients and 6% after removing gloves.²⁰ After the educational intervention, improvement in choosing the proper hand hygiene method was evident, and fewer workers believed that ABHR dried skin to a greater extent than soap.

Another essential aspect concerning hand hygiene is the adequate application time for soap and ABHR. Using ABHR for less than 15 s does not destroy certain pathogens, while using it for more than 15 s is not contraindicated, as despite its enhanced antiseptic properties, ABHR does not irritate the skin.²¹ On the contrary, in the case of soap, a long application time is not recommended, as soap contributes to hand skin dryness.⁹ One study found that the majority of health professionals washed their hands with soap for 15 s or longer, while others chose a shorter time.²² In the present study, the majority of dental personnel washed their hands with soap for the recommended time (15 s), but some selected a longer duration of 3 min. Most of the respondents followed the recommended time for hand disinfection with ABHR.

It is well known that during hygienic hand preparation, water should flow from the wrists to the fingers. Washing in this manner allows water to flow from the least contaminated area (the wrists) to the most contaminated parts (the fingers).⁴ In the first-stage questionnaire, only half of the respondents answered this question correctly.

It might be due to the fact that some respondents confused this question with surgical hand preparation. This aspect was mentioned in the educational video material and a significant improvement was achieved.

There is no doubt that the daily use of soap and disinfectants, working with gloves, and 'wet work' affect hand skin health. A European population survey showed that 54.1% of the population had a dry hand skin type.²³ In the present study, nearly half of the respondents also had dry skin. This type of skin is even more vulnerable to irritants, and thus side effects can appear quickly.²³ In a study by Harnoss et al., the most common adverse hand skin reactions among surgeons of various specialties were dryness, nail splitting and cracking, itching, and redness between the fingers, whereas 49% of doctors reported no complaints.²⁴ In this study, the most common side effect was also dry hand skin, but it occurred almost 5 times more often, while the response 'no complaints' was noted 2.5 times less frequently than in the abovementioned study. Both studies had different population samples. In the first one, most of the respondents were men and all of them were surgeons, for whom there are specific hand hygiene requirements. In our study, there were more women, and all the respondents were dental personnel.

Due to specific working conditions, dental personnel are at high risk of developing a dermatological pathology.⁹ The incidence rate of eczema varies in the literature. The 1-year prevalence among dentists in Japan was 36.2%.⁹ In healthcare workers in Denmark²⁵ and Sweden,⁸ the prevalence was 21%, and in Dutch healthcare workers it was 12%.²⁶ The prevalence rate in the present study was less than 9%, but this may have been due to the small-scale study population, and also to the fact that no objective tests were carried out to confirm the diagnosis. The age of patients with eczema was lower than in the general study population, and the same tendency has been observed by other researchers.^{9,26} One possible explanation for this finding is that eczema tends to develop at the early stages of working, and health workers who are severely affected may leave their profession at a young age.⁹ The prevalence of another common disease – atopic dermatitis – also varies. In Japan, its incidence among dental practitioners was 15.8%,⁹ and in healthcare workers in Denmark and Sweden, the incidence was 14.5%⁸ and 22%,²⁷ respectively. The prevalence of atopic dermatitis in this study was also low (4.2%).

Latex allergy is an occupational hazard for medical personnel. According to various studies, latex allergy affects about 4% of healthcare professionals.^{28,29} In one study, 41.4% of nurses experienced irritation reactions caused by latex gloves.³⁰ Nurses who reported an irritation reaction were given a skin prick test and 9.8% of them were diagnosed with latex allergy. In the present study, the prevalence of an irritation reaction related to wearing latex gloves was 27.4%. As a skin prick test was not performed, no verified data on latex allergy was available.

The regular use of skincare products could help to prevent dermal side effects in healthcare workers. The protective action of such products most likely comes from 2 different components of the cream (oil and wax), which prevent, to some extent, the evaporation of epidermal water, and polyalcohols, such as glycerol and propylene glycol, which have moisturizing properties.³¹ It is recommended to use hand lotion or cream after each hand washing.³¹ Alcohol-based hand rub should be used no sooner than 5 min after lotion application.³² However, for various reasons, the use of emollients among medical personnel varies. According to some studies, 25% of surgeons and 91% of nurses use hand cream/lotion.^{24,33} Regarding the use of handcare products, emollients are usually used when the skin is dry, before and after work, or randomly during the day, and rarely before and after each patient.²⁴ The same tendencies were evident in this research; skincare products were used irregularly only by half of the staff. After the educational intervention, the use of emollients increased significantly.

An important aspect of this study was the educational intervention. The most common mistakes from the 1st stage were identified and targeted for improvement in the intervention. This study demonstrated that it is unnecessary to repeat all information, and that only targeted data can be provided. According to Dale's Cone of Experience, humans remember only 10% of the information they read and 30% of what they see.³⁴ That is why the current educational intervention used a poster (readable information) and instructional video (visual communication) material. A crucial and novel aspect is that after receiving the selected information, the respondents answered the questions about hand hygiene and use of the hand hygiene methods in different situations much more accurately, and a general improvement was observed. Therefore, this study demonstrates that repeating targeted information is sufficient to achieve better knowledge. Moreover, it can be predicted that the workers adapted this knowledge into practice, and that hand skin health also improved.

Overall, the current data suggests that educational interventions are effective and lead to improved hand hygiene practice.^{14–18,35} A recent systematic review concluded that multimodal training approaches raised hand hygiene compliance from a baseline of 51.5% to 80.1%.¹⁸ Another long-term study found that before training, hand hygiene was performed 63.6% of the time, and after 8 years of monitoring and multiple interventions, it improved to the level of 84.4%.³⁵ The researchers also noted that due to this improvement, less hospital-related infections occurred.³⁵ The results of this study confirm that educational interventions can improve knowledge about the hand hygiene practice and infection control principles.

Conclusions

The dental personnel performed hand hygiene correctly in 53.4% of cases. Generally, the hands were washed with soap too often, while ABHR was avoided. Only 19.8% of the respondents never experienced skin problems. Training has a positive impact on hand hygiene and improves the knowledge of dental personnel.

Ethics approval and consent to participate

The study was approved by the institutional Ethics Committee at the Žalgiris Clinic, Vilnius University Hospital, Lithuania (No. S(5.2.)-716). Written informed consent was obtained from all participants.

Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Consent for publication

Not applicable.

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