

Glove use among hairdressers: difficulties in the correct use of gloves among hairdressers and the effect of education

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Summary

Background. Hand eczema is frequent among Danish hairdressers, and they are advised to use gloves as protection. However, studies indicate that a significant proportion use gloves inappropriately.

Objectives. To determine whether hairdressers and apprentices use protective gloves in the correct way, and to determine whether a demonstration of correct use could cause an improvement.

Methods. Forty-three hairdressers and apprentices were asked to perform a hair wash while wearing gloves. The shampoo used was contaminated with an ultraviolet (UV) trace material. Two rounds of hair washing were carried out by each person, interrupted by a demonstration of how to use gloves correctly. Photographs were taken to compare UV contamination before and after the demonstration.

Results. All of the participants (100%) had their hands contaminated during the first round; the area ranged between 0.02 and 101.37 cm² (median 3.62 cm²). In the second round, 55.8% were contaminated (range 0.00–3.08 cm²; median 0.01 cm²). The reduction in contaminated skin areas was statistically significant ($p < 0.001$), proving an effect of the glove demonstration. There were no significant differences between hairdressers and apprentices.

Conclusions. Hairdressers and apprentices lack knowledge on how to handle gloves correctly. A short demonstration of correct glove use made a significant difference in the skin protection provided by gloves.

Key words: contamination; education; gloves; hairdressers.

Hairdressers are exposed to a wide number of chemicals, soap and water through their work (1), and hairdressing is one of the occupations with the highest incidence of occupational contact dermatitis in Europe (2, 3). Hand eczema is reported by 42.3% of all Danish hairdressers (4).

On average, hairdressers stay in the profession for 8.4 years, and a significant reason for them leaving is hand eczema (4). Danish hairdressers are advised to use gloves to protect themselves against exposures from wet work and chemicals (5); however, studies indicate that a significant proportion use gloves inconsistently and inappropriately, for example by turning used gloves inside out, and drying disposable gloves for reuse (1), which may cause additional skin problems.

Recently, the Danish Labour Inspectorate, with the assistance of experts in occupational medicine, reviewed the potential occupational problems of hairdressers, and concluded that there were no concerns regarding

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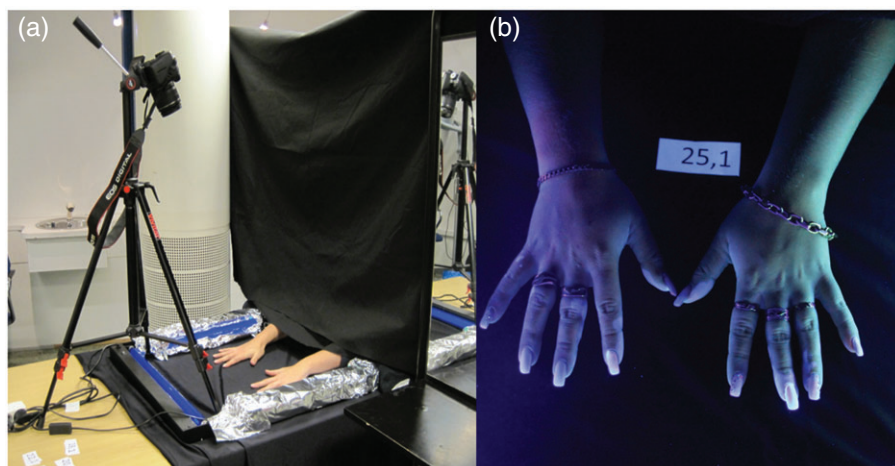


Fig. 1. Photographs were taken of the hands after each round of hair washing in a blinded fashion, so that the hairdresser could not see the result. (a) The photography arrangement. (b) Photograph taken under ultraviolet light showing bright areas of skin with contamination.

contamination of the hands if the hairdressers used gloves as recommended (6). Gloves that protect against hairdressing chemicals are available (7). However, studies show that hairdressers may have their hands contaminated by hair dye substances during the hair-colouring process, in spite of using proper protective gloves. This indicates that not only the glove material but also the way in which the gloves are handled is important (8).

The aim of this study was to investigate whether hairdressers and apprentices can use protective gloves without having their hands contaminated in a simulated real-life scenario. The second aim was to determine whether a demonstration of the correct use of gloves would reduce the amount of contamination on their hands.

Materials and Methods

This was a crossover intervention study. Hairdressers and hairdresser apprentices were eligible. The participants were recruited from hairdressing schools in Copenhagen, in salons, and on Facebook™ by advertisement. The ethical committee of the Region of Copenhagen found that the study was not a biomedical research project, and therefore no permission was needed (H-4-2013-163).

Inclusion criteria were: age between 18 and 50 years age, speaking and understanding Danish, and, for apprentices, being in the last year of education.

Exclusion criteria were being pregnant or breastfeeding.

In total, 21 hairdressers (mean age 26 years; range 21–45 years) and 22 apprentices (mean age 22 years; range 19–29 years) participated.

Before entering the trial, all participants were asked to fill in a short, open questionnaire about how often they used gloves.

The hairdressers and apprentices were asked to perform a simple hair wash on a doll while wearing gloves. The doll's hair was contaminated with a trace material that glows under ultraviolet (UV) light (Visirub; BODE Chemie GmbH, Hamburg, Germany www.mediqdanmark.dk). A mixture was made consisting of 30 ml of tracer added to 70 ml of shampoo (Tusindfryd™ shampoo; Irma, Copenhagen, Denmark), which was applied to the doll's hair by the instructor before the trial. Blue nitrile accelerator-free and powder-free gloves, as recommended by the Research Centre for Hairdressers and Beauticians, Department of Dermato-Allergology, Copenhagen University Hospital Gentofte, were provided in several sizes, and the hairdressers themselves chose which size to use.

The hairdressers were informed that the study was about observing them in a work situation. They were told to wear gloves during the hair wash, but were not informed about the UV material during first round of hair washing.

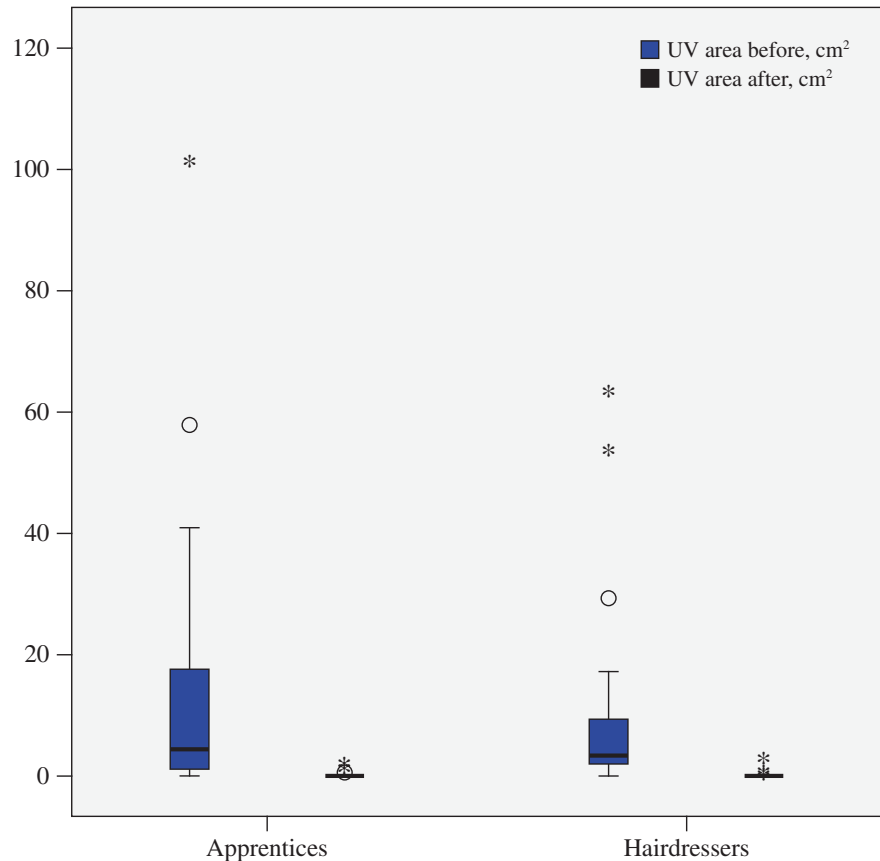
After the first round, photographs were taken of the hairdressers' hands under UV light, without them being able to see the result on their own hands (Fig. 1). The hands were then given a good wash to remove the UV material.

The intervention consisted of a 10-min demonstration of how to use and remove gloves correctly, performed by the lead investigator. The demonstration focused on how to remove gloves without any skin contamination, so that the outside of the gloves did not make contact with the skin at any point. After a second round of hair washing, new photographs were taken.

Outcome measures and data analysis

The outcomes were the proportion of participants who had their hands contaminated with the UV tracer, before

Fig. 2. The area of skin in cm², contaminated during hair washing or by removal of gloves as demonstrated by the presence of UV-tracer, is given on the Y-axis. The results are given for hairdressers and apprentices separately and before (blue color) and after (black color) demonstration of how to remove gloves correctly (intervention). Circles and stars represent individual outliers in the study population. UV: ultraviolet.



and after the intervention, and the sizes of areas of contaminated skin before and after the 10-min demonstration of glove use.

All of the photographs taken during the study were allocated blinded and randomly assigned numbers by a technician not involved in the trial. The UV-active areas, if any, were measured with a Tamaya Marbel 10S Planix, which is used for measuring areas on maps. It has a measurement uncertainty of $\pm 0.1\%$ on an area of 100×100 mm (<http://www.tamaya-technics.com>).

In all photographs, the areas of the right hand and wrist were measured, and a mean area was then calculated for each participant and used for both hands.

The code for blinding the photographs was broken, and the UV-contaminated skin areas on the photographs taken before the glove demonstration were then compared with the UV-contaminated skin areas on the photographs taken afterwards.

Statistics

Data were stored and analysed in SPSS™ for Windows™ (IBM SPSS statistics, version 19).

The proportions of contaminated persons before and after the demonstration were calculated, and the difference was analysed with a χ^2 -test.

The Wilcoxon non-parametric rank sum test was used to compare the sizes of UV-contaminated area on the hands before and after the demonstration in the same individuals. The Mann–Whitney test was used for analysis of differences between the hairdressers and the apprentices.

The level of significance was set at $p < 0.05$.

Results

All of the hairdressers and apprentices (43/43; 100%) had their hands contaminated during the first round. For the hairdressers, the contaminated area ranged between 0.02 and 63.42 cm² (median 3.46 cm²). For the apprentices, the contaminated area ranged between 0.02 and 101.37 cm² (median 4.44 cm²). In the second round, 55.8% ($n = 24$) of all participants had contaminated skin (range 0.00–3.08 cm²; median 0.01 cm²). The contaminated areas of hairdressers' hands ranged between 0.0 and 3.08 cm² (median 0.00 cm²); in the apprentices, they ranged from 0.00 to 2.22 cm² (median 0.02 cm²).

As shown in Fig. 2, there were outliers in both groups before and after the demonstration.

The reduction in UV-contaminated skin areas from the first to the second round was statistically significant for the whole group ($p < 0.001$), proving an effect of the glove demonstration.

There were no significant differences between hairdressers and apprentices ($p = 0.618$) regarding the improvement from the first to the second round, according to the Mann–Whitney test.

According to the questionnaire, 30 of 43 participants used 3–10 pairs of gloves daily, and 10 used 10–25 pairs of gloves daily. One never used gloves, and 2 answered insufficiently.

Of the participants, 32.6% were observed to have artificial and/or long fingernails, and 58.1% were wearing jewellery that made it impossible to use gloves in a satisfactory way, for example rings bridging between fingers.

Discussion

All ($n = 43$) hairdressers and apprentices had contaminated skin areas on their hands after the first round of hair washing, despite the use of gloves. After the demonstration, 55.8% ($n = 24$) of hairdressers and apprentices had contaminated skin areas ($p < 0.001$).

In addition to the decrease in the number of participants with contaminated hands, we also saw a decrease in the sizes of the areas of contaminated skin. The intervention had a significant impact on the effectiveness of the use of gloves in this study. However, 24 of the participants were contaminated in the second round, possibly because the demonstration on how to use gloves correctly was relatively short. We would probably be able to obtain a better result if the participants were offered a longer training programme. The wearing of jewellery and long nails may also have affected the number of participants who did not manage to perform the second round of hair washing without having their hands contaminated.

This study shows that it is possible to decrease the amount of trace material on the skin resulting from the performance of one simple procedure. However, it does not show the possible effect on hairdressers who carry out many procedures during a working day, which will lead to the accumulation of chemicals on their skin.

The questionnaire contained questions concerning the number of gloves used by each participant during an ordinary working day. This gave the participants a hint about the theme of this trial, which might have made the result a little less significant than would have been possible if they did not have this information.

Previously, an intervention study on 502 Danish hairdressing apprentices showed that an educational programme on skin care had a significant effect on the prevalence of hand eczema (9). This intervention included education on when to use gloves. Significantly more apprentices used gloves after the intervention, and a significant decrease in the prevalence of hand eczema was observed; however, even in the intervention group, 19.4% had hand eczema at the 18-month follow-up. This means that there is room for improvement; one overlooked point to address may be how to remove gloves correctly.

In a Swedish study, dermal exposure to permanent hair dyes was assessed with a bag-rinsing method (8, 10), which showed significant amounts of hairdressing chemicals on hairdressers' hands despite the use of gloves (14 of 17 hairdressers). In our study, we showed that all participants had contaminated skin areas, with a median of 3.62 cm² but with a large range of 0.02–101.37 cm². Such unintended exposure is likely to cause an additional risk of contact allergy, for example to hair dye ingredients. A recent study in Swedish hairdressers has shown that levels of potentially carcinogenic aromatic amines in hairdressers' blood seem to be linked to how often they use permanent dyes and permanent wave treatments on clients' hair (11), which further emphasizes the need for adequate skin protection.

Our study indicates that hairdressers and apprentices are not, in practice, able to use gloves in a satisfactory way. Different studies have shown that they also lack knowledge on when and how to use gloves according to the recommendations (12). A Danish questionnaire administered to 2918 hairdressers showed that 20.2% used non-reusable gloves more than once, that the mean number of times that a pair of gloves was used was 3.46 (range 1–20), and that 8% turned the gloves inside out before reusing them (1). All together, these studies show that hairdressers and apprentices have an alarming lack of knowledge on how to protect themselves from occupational hand eczema.

As expected, we saw a positive effect of education. In a German study, it was shown that a significantly larger number of hairdressers could stay in the occupation and avoid skin diseases after receiving an educational training programme with a large number of teaching points (13). In Germany, the consequences of the high incidence of occupational skin diseases among hairdressers have been taken seriously, and two legislative regulations have been implemented, causing a 10-fold decline in the annual incidence between 1990 and 1999 (14). The two regulations were introduced as Technical Rules for Hazardous Substances 530 'hairdressing trade' and 531 'Endangerment of the skin by work in the wet environment'. In

Denmark, chemicals in hairdressing products are covered by EU regulations (15), and, since 2007, the use of gloves in cases of wet work has been recommended by the Labour Inspectorate, but there is no legal requirement, which would seem to be both useful and needed (14, 16).

In summary, education of hairdressers is needed, including education about the practical aspects of glove use. Education should be combined with regulations regarding the hairdressers' work environment, to

effectively reduce the major problems with hand eczema in the hairdressing trade.

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References

- 1 Lysdal S H, Johansen J D, Flyvholm M, Søsted H. A quantification of occupational skin exposures and the use of protective gloves among hairdressers in Denmark. *Contact Dermatitis* 2012; **66**: 323–334.
- 2 Pal T M, de Wilde N S, van Beurden M M, Coenraads P J, Bruynzeel P D. Notification of occupational skin diseases by dermatologists in The Netherlands. *Oxford J, Occup Med* 2009; **59**: 38–43.
- 3 Cherry N, Meyer J D, Adishes A, Brooke R, Owen-Smith V, Swales C, Beck M H. Surveillance of occupational skin disease: EPIDERM and OPRA. *Br J Dermatol* 2000; **142**: 1128–1134.
- 4 Lysdal S H, Søsted H, Andersen K L, Johansen J D. Hand eczema in hairdressers: a Danish register-based study of the prevalence of hand eczema and its career consequences. *Contact Dermatitis* 2011; **65**: 151–158.
- 5 Søsted H. Occupational contact dermatitis: hairdressers. In: *Contact Dermatitis*, 5th edition, Johansen J D, Frosch P J, Lepoittevin J (eds): Berlin, Heidelberg, Springer-Verlag, 2011: pp. 865–871.
- 6 Kirkeskov L. Reproductive hazard of working with hairdressing chemicals, 2013. Available at: http://www.bispebjerghospital.dk/NR/rdonlyres/B31EF7A6-6257-4F02-9992-B322B1C556FF/0/BBH_Rapport_Frisorkemikalier_print.pdf (last accessed 09 July 2014). Copenhagen, Denmark.
- 7 Lind M L, Johnsson S, Meding B, Boman A. Permeability of hair dye compounds p-phenylenediamine, toluene-2,5-diaminesulfate and resorcinol through protective gloves in hairdressing. *Oxford J Ann Occup Hyg* 2007; **51**: 479–485.
- 8 Lind M L, Boman A, Sollenberg J, Johnsson S, Hagelthorn G, Meding B. Occupational dermal exposure to permanent hair dyes among hairdressers. *Oxford J Ann Occup Hyg* 2005; **49**: 473–480.
- 9 Bregnhøj A, Menné T, Johansen J D, Søsted H. Prevention of hand eczema among Danish hairdressing apprentices: an intervention study. *Occup Environ Med* 2012; **69**: 310–316.
- 10 Lind M L, Boman A, Surakka J, Sollenberg J, Meding B. A method for assessing occupational dermal exposure to permanent hair dyes. *Oxford J Ann Occup Hyg* 2004; **48**: 533–539.
- 11 Johansson G M, Jönsson B A G, Axmon A et al. Exposure of hairdressers to ortho- and meta-toluidine in hair dyes. *Occup Environ Med* 2015; **72**: 57–63.
- 12 Knowledge Centre for Hairdressers. Recommendations concerning gloves, 2014. Videncenterforfriserer.dk. Available at: <http://www.xn--videncenterforfriserer-7fc.dk/> (last accessed 09 July 2014).
- 13 Wulfhorst B, Bock M, Gediga G, Skudlik C, Allmers H, John S M. Sustainability of an interdisciplinary secondary prevention program for hairdressers. *Int Arch Occup Environ Health* 2010; **83**: 165–171.
- 14 Dickel H, Kuss O, Schmidt A, Diepgen T L. Impact of preventive strategies on trend of occupational skin disease in hairdressers: population based register study. *Br Med J* 2002; **324**: 1422–1423.
- 15 Cosmetic Directive. European Commission. <http://ec.europa.eu/consumers/cosmetics/cosing/index.cfm?fuseaction=app.welcome> (last accessed 1 November 2014).
- 16 Nixon R, Roberts H, Frowen K, Sim M. Knowledge of skin hazards and the use of gloves by Australian hairdressing students and practising hairdressers. *Contact Dermatitis* 2006; **54**: 112–116.