

LETTER

Hydrogel patches alleviate skin injuries to the cheeks and nasal bridge caused by continuous N95 mask use

Dear Editor,

Masks are essential for healthcare workers (HCWs) safety during the current coronavirus disease-2019 (COVID-19) pandemic. Skin damage has been reported from the use of some masks however,¹ which has obvious health implications for HCWs. Mask-related skin damage to cheeks and nasal bridges has a reported incidence of over 70% among frontline HCWs combating the epidemic.^{2,3} Our preliminary short-term research⁴ revealed that a hydrogel patch can alleviate the skin damage from long hours of mask-wearing. Our analyses were limited however by the relatively short hydrogel intervention period and did not assess the effects of mask compression on the nasal bridge in any detail, which may be the most affected part of the skin. We thus conducted a relatively long-term, randomized, controlled study to explore whether hydrogel patches adequately protect the nasal bridge and cheeks from skin injury by an N95 mask during >7 days of continuous use over a 14 day period.

The study flowchart is shown in Figure 1. Twenty-six frontline HCWs were randomized into hydrogel and control groups that is, those operating with or without a W-shaped hydrogel patch (Figure 2) over their cheeks and nasal bridge while wearing an N95 mask for at least 7 full working days over 2 weeks. Mask sealing was ensured by proper adjustment and checking for leaks during deep breathing.⁵ Questionnaires were completed by the participating HCWs who provided subjective appraisals of their skin damage on days 0 and 14. Their responses were recorded on a numeric scale, with five indicating the most severe. This study was approved by the Medical Ethics Committee of HUST (No. [2020](0063)) and written informed consent was obtained. Statistical analysis was performed with SPSS using a paired *t* test and independent-sample *t* test ($P < .05$).

As illustrated in Figure 3A,D hydrogel use led to significant score reductions in pain, itching, and indentation. Burning on the nasal bridge, although not on the cheeks, also scored lower. The indentation scores on both cheeks (1.33; 95% CI, 0.18 to 2.47; $P = .03$) and nasal bridge (1.45; 95% CI, 0.36 to 2.54; $P = .01$) showed the most marked decrease on day 14 in the hydrogel subjects. Other skin injuries such as dryness, redness and swelling also got lower scores in the hydrogel group, but these were not significant reductions ($P > .05$).

In line with our previous preliminary findings,⁴ a hydrogel patch showed clear benefits in lowering the indentation, pain, and itching caused by N95 mask compression, as reflected by the lower total questionnaire scores in the hydrogel group (Figure 3B, E). This suggested a sustained protective effect of these patches against skin damage caused by an N95 mask. No differences appeared in the total scores of the control group on day 14 compared to day 0 (Figure 3C, F). The induced facial skin damage appeared therefore not to be cumulative and the skin could likely repair itself to some extent after mask removal.

People with thin facial fat layers, high cheekbones, and high nose bridges are more likely to undergo severe facial skin damage due to higher shear forces, pressure, and friction. Developing a novel N95 respirator with hydrogel patches fixed on the inner face may greatly reduce this damage and facilitate the application for HCWs, but its effectiveness and reliability would need careful validation. The relatively small sample size limits the general applicability of our current findings. Nonetheless, our present results provide further evidence of the effectiveness of hydrogel patches in preventing both nasal bridge and cheek skin injury from N95 mask use over a comparatively long working period.

ACKNOWLEDGMENTS

This study was supported by HUST COVID-19 Rapid Response Call Program (2020kfyXGYJ056) and Hubei Provincial Emergency Science and Technology Program for COVID-19 (2020FCA037).

CONFLICT OF INTEREST

The authors declare no conflict of interest.

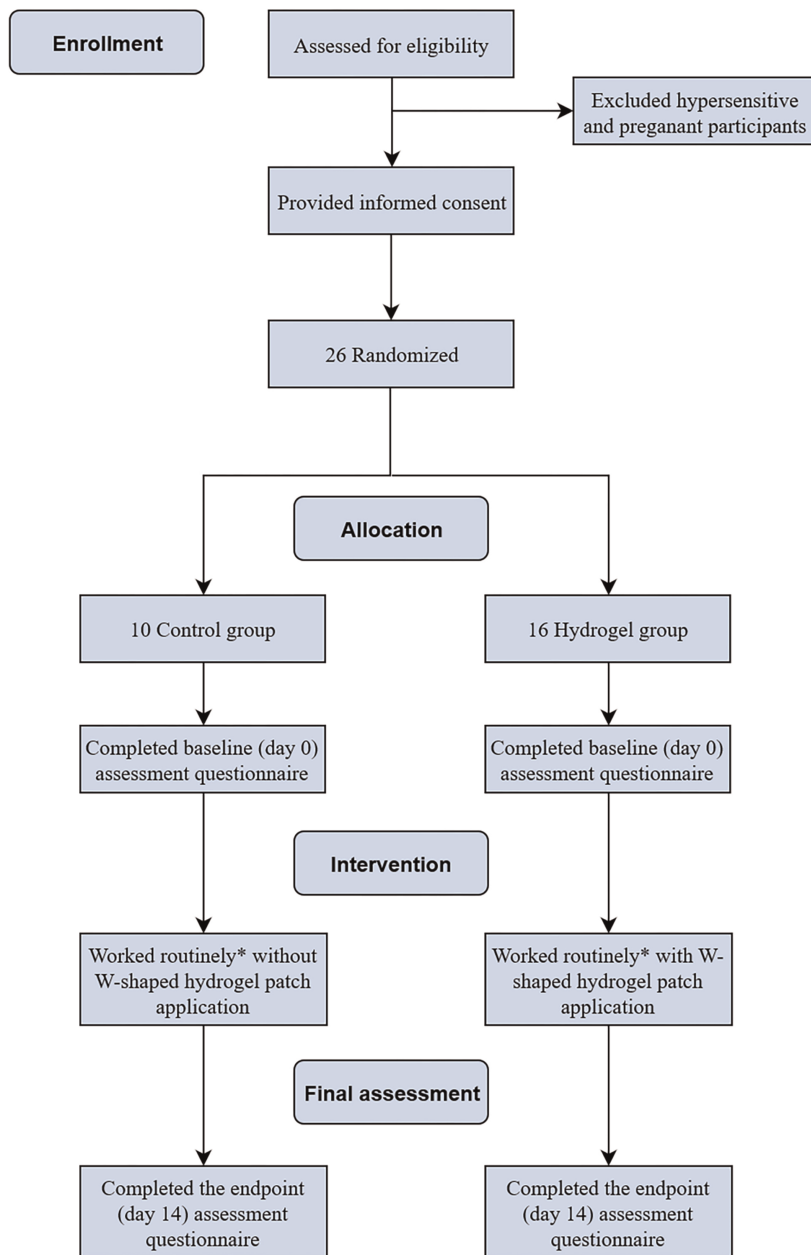
AUTHOR CONTRIBUTIONS

Study design: All authors. Data collection: Yan Li, Jing Yang, Liu Yang and Xiangjie An. Data analysis: Liu Yang, Yamin Zhang, Huinan Suo, and Hongyao Du. Drafting of the manuscript: Nuoya Zhou, Liu Yang, and Liyun Dong. Critical revision of the manuscript for important intellectual content: Juan Tao and Jintao Zhu. Administrative support: Juan Tao. Supervision: Juan Tao.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Nuoya Zhou and Liu Yang have contributed equally to this study.



* > 7 days out of 14 days, > 4 h per day

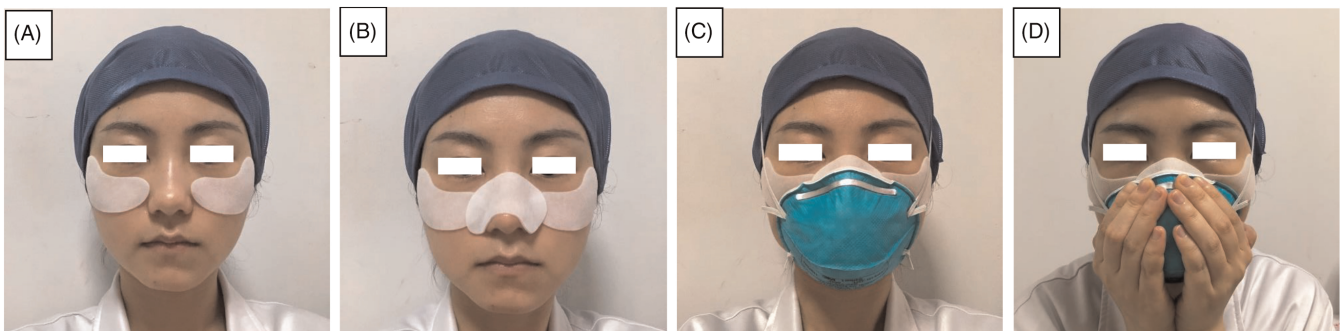


FIGURE 2 W-shaped hydrogel patch application with an N95 mask. A, Application of a hydrogel patch on both cheeks. B, Application of another patch to cover the nasal bridge. C, Wearing the N95 mask over the hydrogel patches. D, Checking the air tightness of the mask by feeling whether it is well deformed whilst taking deep breaths

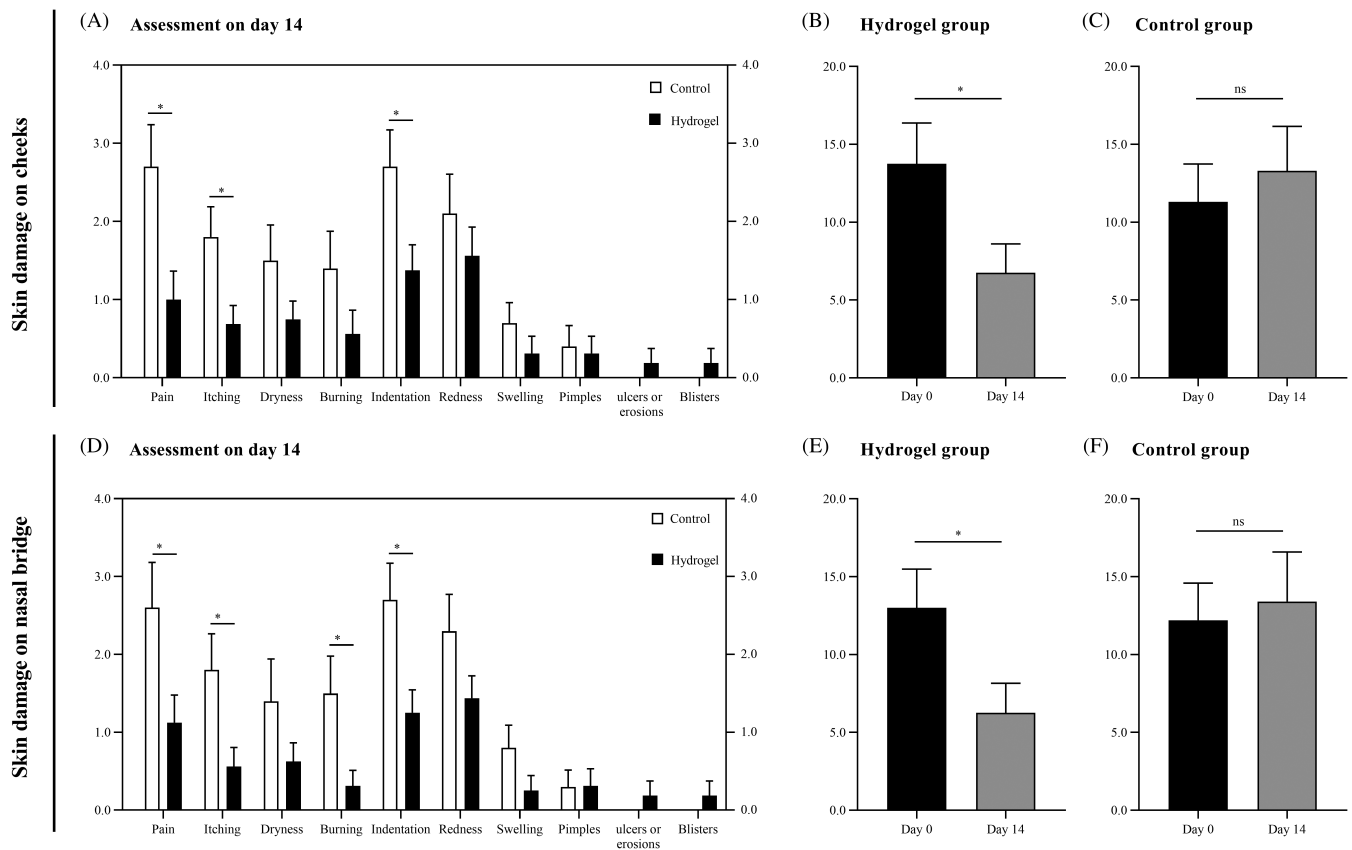


FIGURE 3 Comparison of skin damage to the cheeks and nasal bridge caused by N95 mask compression with and without hydrogel patches. Comparison of skin damage scores between the hydrogel and control groups on day 14 for the A, cheeks and D, nasal bridge. Comparison of the total skin damage scores in the hydrogel group on day 14 and day 0 for B, cheeks and E, nasal bridge. Comparison of the total skin damage scores in the control group on day 14 and day 0 for C, cheeks and F, nasal bridge. * $P < .05$ and ^{ns} $P > .05$; A, D by independent-sample t test and B, C, E, F by paired t test

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