

Safety of Goggles vs. Face Shields in the COVID-19 Era

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Introduction:

Both the Occupational Safety and Health Administration (OSHA) and Centers for Disease Control (CDC) recommend the use of eye protection to prevent the transmission of infectious diseases. Goggles are the preferred method of protection. However, there is currently a shortage of goggles in hospitals.

Case Report:

A young male presented to the emergency department with presumed COVID-19 and was treated with high flow nasal cannula (HFNC). The HFNC caused nasal irritation and a nurse from the emergency department assisted the patient and repositioned the HFNC. While doing this, respiratory droplets entered under her mask and face shield and entered her eyes. The nurse followed hospital protocols and reported to employee health where her eyes were irrigated. The nurse has been continuously monitored for symptoms of COVID-19 since the incident.

Discussion:

OSHA recommends goggles as primary protectors because they form a protective seal around the eyes and prevent objects or droplets from entering under or around them. Face shields are recommended as secondary protectors to use in combination with goggles to provide additional protection to the whole face. [4] COVID-19 spreads through droplets. If droplets from patients infected with COVID-19 enter the conjunctivae, there is a chance of disease transmission. Currently, the CDC recommends the use of Standard Precautions and use of a respirator/face mask, gown, gloves and eye protection when caring for patients with COVID-19 [3]. The recommendations do not distinguish between primary and secondary eye protection, and there are currently shortages of goggles in hospitals. This increases the risk of exposure for healthcare workers, especially when there is the possibility of rapid droplet dispersion such as when patients are actively coughing, being intubated or are on HFNC. Therefore, we recommend that goggles should be preferentially used by all healthcare workers when caring for patients with COVID-19 particularly when devices like HFNC (which have the potential of rapid droplet dispersion) are used.

Eye Protection	Advantages	Disadvantages
Goggles [2]	<ul style="list-style-type: none"> - Appropriately fitted, indirectly-vented goggles with a manufacturer's anti-fog coating provide the most reliable eye protection from splashes, sprays, and respiratory droplets [1] 	<ul style="list-style-type: none"> - Goggles do not provide splash or spray protection to other parts of the face - Increased tendency to fog - Uncomfortable with prolonged use
Face Shields [9]	<ul style="list-style-type: none"> - Provide a barrier to acutely-expelled aerosols of body fluid [7] - Comfortable - Protect a large portion of the face - Easy to don and doff - Inexpensive 	<ul style="list-style-type: none"> - Lack of good peripheral facial seal - Little is known about the effectiveness of face shields in preventing the transmission of viral respiratory diseases

Evidence to Date:

Healthcare workers are at risk for infection when droplets from infected patients are exposed to their mucus membranes. Coughing is one of the major symptoms of COVID-19 and leads to rapid droplet dispersion. Lindsley et al. used a coughing aerosol simulator loaded with influenza virus and a breathing worker stimulator to investigate the efficacy of face shields in reducing droplet exposure. With the droplet diameter set to 8.5 μm , they found that the face shield reduced the inhalation exposure by 96% at 18in distance from the coughing simulator. Decreasing the aerosol size to 3.4 μm resulted in the face shield blocking 68% of the exposure at 18in immediately after the cough. After waiting for a period of 1-30 minutes post cough, the face shield was only 23% effective in reducing exposure, likely due to aerosol dispersing throughout the room. These findings suggest that face shields are mostly effective at reducing short-term exposure to large aerosolized particles. They show weakness when the aerosolized particles are small, and when the healthcare worker is exposed to the particles for long periods of time. [7]

Goggles are recommended as primary eye protection because they have been shown to significantly reduce transmission of infectious diseases. Respiratory syncytial virus (RSV) is another highly contagious respiratory virus that spreads via droplets. Gala et al. explored the effectiveness of goggles in preventing nosocomial transmission of RSV in patients and staff on an infant ward. Of those who wore goggles, 5% of adults and 6% of infants acquired nosocomial transmission of RSV. When goggles were not used, 34% of adults and 43% of the infants became infected. Thus, the use of goggles is associated with significant decrease in nosocomial RSV infection. [5] Agah et al. also looked at the effectiveness of both mask and goggle use in preventing nosocomial transmission of RSV. They found that RSV illness rate in healthcare workers wearing masks and goggles was 5%, while the rate for those not wearing masks and goggles was 61%. This study did not isolate goggles as a variable, but supports the use of proper PPE when caring for patients with a highly contagious virus. [1] A study from China evaluated the effectiveness of personal protective equipment (PPE) in preventing the nosocomial transmission of SARS. When specifically looking at goggles, they showed a significant protective factor in reducing infection rates of SARS. [10] These findings align with the recommendation to use goggles as primary eye protection.

High Flow Nasal Cannula (HFNC) is a common form of oxygen supplementation used to treat patients with COVID-19. HFNC uses high speed (60L/min), humidified, warmed air to create continuous positive airway pressure. While patients are instructed to keep their mouth closed during treatment, it is common for patients to cough or talk, leading to the risk of forced air exiting the patient's mouth. When the device is repositioned by a healthcare worker, there is also a greater risk of exposure. Kotodo et al. explored the risk of pathogen dispersal with HFNC. The design used a mannequin being treated with HFNC, and they collected water and yeast droplets surrounding the mannequin to identify how far droplets traveled at rest. The minimum liquid droplet size detectable was 50 μ m. Their results found no water or yeast droplets in areas >60cm away from the mannequin's face. This study was limited because it used a mannequin and hence did not imitate any human movements, talking, or coughing that would lead to increased droplet dispersion. Additionally, the study only detected liquid droplets >50 μ m, and did not account for any small, aerosolized particles generated by HFNC. [4] Given

these findings, if possible, healthcare workers should maintain at least a 60cm distance when caring for patients on HFNC if not using goggles with a face shield.

Limitations to Recommendations:

There is a lack of research on the effectiveness of different forms of eye protection. A preprinted article on MedRx posted on March 30th, 2020 looked to explore the use of eye protection as a physical intervention to reduce the spread of respiratory viruses and found no randomized trials testing eye protection. [8]

Conclusion:

If available, goggles should be used as primary eye protection with a face shield to protect the rest of the face when caring for patients with COVID-19. Face shields should not be used as primary face/eye protection due to the lack of a peripheral facial seal and decreased efficacy with small aerosolized particles. If goggles are not available, healthcare workers should use a face shield with respiratory personal protective equipment and limit the duration of the exposure.

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