BUILDING THE BARRICADE – DIY SLIT LAMP BREATH SHIELD

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INTRODUCTION

Coronavirus disease 2019 (COVID-19) has rapidly become a global health threat[1]. It is caused by a novel virus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It is thought that the primary route of transmission of the virus is through respiratory droplets via sneezing, coughing or fomites. COVID-19 can manifest in many ways – ranging from no symptoms, mild flu-like symptoms (cough, fever, fatigue) to severe viral pneumonia requiring respiratory support. It was reported that the virus can affect the eyes in the form of viral conjunctivitis with symptoms of watery eyes, redness, swelling or discharge. Very rarely, conjunctivitis may manifest as the first sign of the disease[2].

Due to prolonged close contact with patients during slit lamp examinations and potential contamination of instruments, ophthalmic practitioners are at a higher risk of contracting the disease than other specialties[3].

PURPOSE

We aim to design a simple, low-cost, waterproof breath shield to minimise risk of infection.

DESIGN

Haag-Streit slit lamps (model BM 900) are used within Epsom and St Helier University Hospitals NHS Trust. The following design works in conjunction with the original breath shield and is suitable to use with BM 900 slit lamps. Materials needed are listed below:

- One A3 transparent laminator pouch (160 microns, 2x 80 microns)
- One A3 Laminator
- Two A4 pieces of paper
- A pair of scissors
- A hole punch
- A jar with a 6cm diameter
- A ruler

The final dimensions are shown in Figure 1. The method on how to mount the breath shield is shown in Figures 2A and 2B.

POST MEASUREMENT

Following four PDSA cycles, the percentage of confidence that the final design would be effective at preventing droplet transmission increased from 5.6% to 80%.

- A good barrier: when it is sprayed with a fluorescein infused spray (Figures 3A and 3B), the examiner's side of the slit lamp is spared from fluorescein. The breath shield allowed fluorescein to slide and drip down its surface.
- Waterproof: after washing the breath shield with soap and water for at least 20 seconds, the A4 paper inside the breath shield remained dry confirming the shield is waterproof.

ACT

Mass production of the breath shields for the rest of the department in both sites (Epsom General Hospital and St Helier Hospital) including ophthalmic theatres.

PLAN

Goal: Design and implement a simple and inexpensive barrier on the slit lamp between the patient and the clinician.

Data collection: Verbal and written feedback on design and accessibility.

DO

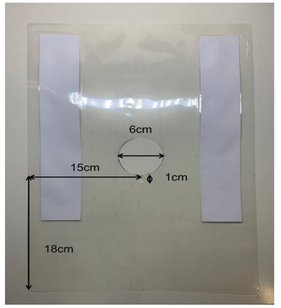


Figure 1. Breath shield measurements for Haag-Streit slit lamps (model BM 900).

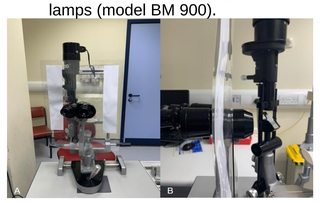


Figure 2A. Mount the DIY breath shield through the objective lens.
Figure 2B. Side view after the placement of breath shield and the tight seal it forms around the objective lens.

STUDY

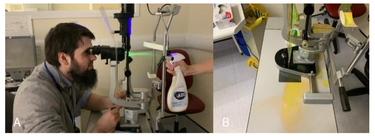


Figure 3A. Fluorescein-instilled water sprayed towards the clinician to simulate when patients cough or sneeze with the breath shield in place.
Figure 3B. After four consecutive sprays there is a clear demarcation where the breath shield is protective against droplets produced in close proximity.

	PDSA cycles 1-2	PDSA cycles 3-4
Size	A4	A3
Transparency	No	Yes
The breath shield is of sufficient size	11.1%	72.2%
The breath shield is easy to install	72.2%	77.8%
I am able to reach all the controls with ease	16.7%	61.1%
I am able to perform basic procedures such as IOP, corneal scrapes, suture and foreign body removal with this breath shield on	16.7%	55.6%
I am confident that this provides protection to droplet transmission	5.6%	80%

DISCUSSION

Although breath shields are already widely used in other countries, there were challenges and resistance in implementing this in our department initially because there was no existing trust guidance on this. However, it soon became clear that breath shields form part of the PPE and frontline staff should be adequately protected. Ahead of published guidance, the lesson highlighted here is the need for leadership, initiative and persistence in such unprecedented times. Since trialling them at St Helier Hospital, breath shields were made for all slit lamps for both sites of Epsom and St Helier University Hospitals NHS Trust including ophthalmic theatres within 24 hours.

Limitations and Solutions

- Access to the slit length and filter controls: this can be overcome by moving the microscope rotation arm to either side for easier access, adding additional openings or trimming the upper border of the breath shield to access controls. However, we do not recommend the latter two options due to the increased risk of droplet transmission.
- Size of the breath shield: some particles of fluorescein can be seen beyond the barrier. A solution to this could be having a wider shield or a different shape, however, a balance between adequate protection and ease of access to key slit lamp controls must be struck.
- There are many models and manufacturers of slit lamps. This particular breath shield we made is specific for models in our hospital. However, it is easily replicable and modified for other models using similar design process. We have now developed templates for Haag-Streit 900V, Tagaki and Topcon slit lamps, as well as laser machines, which we are happy to share.

CONCLUSION

Utilising existing and readily available resources minimises the financial burden in underfunded healthcare systems and developing countries. This is a sustainable product as it is easily replicable should future replacements be required. Addition of the breath shield does not replace the need for hand hygiene and the use of face masks for both the patient and clinician. Handwashing with soap and water as well as wearing face masks remain important methods to prevent infection.

In summary, we present a simple, tested, cost-effective, easily-reproducible design of slit lamp breath shield amenable to mass production to protect slit lamp users and patients alike during the current coronavirus pandemic.

REFERENCES

1. *WHO/Europe | Coronavirus disease (COVID-19) outbreak - WHO announces COVID-19 outbreak a pandemic [Internet]. [cited 2020 Apr 22]. Available from: http://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/news/news/2020/3/who-announces-covid-19-outbreak-a-pandemic*
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Please contact clarahoika.wu@gmail.com for templates for Haag-Streit 900V, Tagaki and Topcon slit lamps and laser machines.