Contact Lens Update
CLINICAL INSIGHTS BASED IN CURRENT RESEARCH

Case Report: Novel use of Non-Invasive Tear Break Up Time (NITBUT) to Confirm Symptomatic Description of a Recently Described Phenomenon Related to COVID-19 Safety Measures: Mask-Associated Dry Eye (MADE)

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Introduction

Several strategies have been recommended to help mitigate the spread of COVID-19, including hand hygiene measures and limiting time spent in close proximity with others. [1-7] The wearing of face masks to help reduce the spread of the novel coronavirus from airborne droplet transmission between people forms one of those recommendations.[3-10] It has become common practice in many countries to wear a face mask in situations where physical distancing is not possible, and there is a growing body of evidence that such a strategy is effective in reducing the risk of infection. [1, 5, 8, 9, 11]

While it has been concluded, especially in areas of high cases numbers, that the benefits of face mask wearing outweigh the risks, [1, 5, 9, 11] it is also true that certain ocular side effects have been widely experienced. Most obvious is the immediate fogging of spectacle lenses with exhaled air escaping through the top of the mask that settles as condensation on the relatively cooler surface of the spectacles.[12-14] A related phenomenon, first reported in patients presenting to an Ophthalmology clinic with worsening dry eye symptoms, has been described as “Mask-Associated Dry Eye” (MADE). [15] Moshirfar and colleagues also reported seeing a marked increase in dry eye symptoms among patients, theorising that prolonged mask wearing increases air flow over the ocular surface, leading to increased tear film evaporation. [16] Subsequently, more has been published to bring the condition, and the simple steps that exist to help mitigate it, including the wearing of contact lenses,[14] to the attention of eye care practitioners and their patients. [17]

While awareness of MADE is increasing, the clinical impact, other than reports of increased symptoms, is thus far less well documented. This case report demonstrates the measurable impact of MADE on the stability of the tear film, and discusses the implications, not only for patient management of MADE in general, but in relation to the potential of MADE to impact accurate clinical diagnosis.

Case Report

A 25-year-old male attended the Optometry clinic, having previously been seen at the practice and diagnosed with early keratoconus. Whilst being monitored by Ophthalmology for consideration of a future corneal cross-linking procedure, he returned wishing to try contact lenses to help improve his vision. Best corrected visual acuity was 6/15 (20/50) OD (Plano/-1.50 x180) and 6/9.5 (20/30) OS (-0.25/-1.50 x180), with both eyes achieving 6/6 (20/20) with pin hole. Binocular vision and fundus examination were unremarkable.

The appointment took place in a UK Optometric practice during the continuing COVID-19 pandemic. Following an initial period of lockdown and administration of emergency-only care, routine clinical practice was subsequently permitted. That routine practice operated with a number of safety measures in place to maintain the safest possible environment for patients and staff, including remote consultations, limited time on site, spaced appointment times, Perspex barriers and full disinfection of high-touch and shared surfaces between each patient. [18] Personal protective equipment (PPE) including face masks and protective eye wear were worn by clinicians, and all patients wore face masks throughout their time in the building.

Examination of the anterior eye is required prior to a new contact lens fit. At the practice in question this encompasses a full dry eye examination to ensure the ocular surface and tear film condition is fully assessed and optimized to help maximize the chance of achieving a successful fit. This process includes baseline symptom assessment via a validated questionnaire. The Ocular Surface Disease Index (OSDI) symptom questionnaire [19] returned a score of 33, indicating the patient was on the borderline of moderate to severe dry eye. [20] According to the Tear Film and Ocular Surface Society's (TFOS) Dry Eye Workshop II (DEWS II) diagnostic criteria, such a score suggests that a further examination to determine the presence of various homeostasis markers was required. [21] Diagnosis of dry eye disease was confirmed by tear film osmolarity measure (TearLab, TearLab Corp, CA, USA): 318 mOsm/L OD and 306 mOsm/L OS. Other minimally invasive tests conducted early in the appointment established tear meniscus heights of 0.27mm OD and 0.32mm OS; with both eyes positive for the inflammatory marker MMP-9 (Inflammadry, Quidel Corp, CA, USA).

Non-invasive tear break up time (NITBUT) was conducted using the Oculus Keratograph 5M (Oculus, Optikgeräte GmbH, Germany). The initial results for the patient's right eye are shown in Figure 1, with a time to first break of 2.68 secs and average break of 5.63 secs.

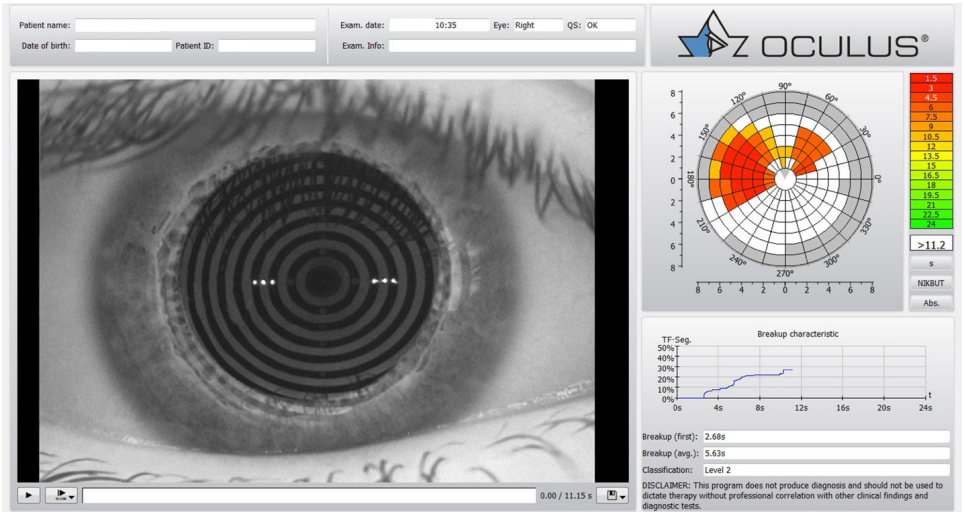

Figure 1: NITBUT while wearing a loose-fitting face mask, OD

While conducting the test the patient commented that although already aware of having dry-feeling eyes, his "eyes felt worse when wearing a mask." This prompted further questioning about his experience and mask-wearing habits. The patient routinely wore cloth masks when in enclosed public spaces, for example grocery shopping and health appointments, and often noticed a subtle increase in ocular discomfort after fifteen minutes of mask use. Closer inspection of the mask that the patient was wearing during the appointment revealed it was quite loose fitting, especially along the top edge. MADE was suspected as being present. Given the patient was in the process of having their dry eye disease quantified, the question arose as to whether a poorly fitting mask leading to MADE could possibly impact the diagnostic measurements being captured.

MADE has been described as the movement of exhaled air escaping from the top edge of the mask being repeatedly directed upwards over the ocular surface, leading to increased tear film evaporation and an increase in dry eye symptoms. [16, 17] Simple steps have been proposed to help alleviate MADE, the first of which is to reduce air flow out of the top of the mask. [17] This can be achieved with a more closely fitting mask that better follows the contours of the face, or by using surgical tape to gently secure the mask edge to the face on either side of the nose.

In this case, the patient continued wearing the same mask and agreed to tape the top edge. This was done during the appointment, and after a period of ten minutes to allow any effect of the tape to manifest, NITBUT measurements were repeated for the right eye. The results are shown in Figure 2, with time to first break of 5.74 sec and an average break of 9.80 sec. Following this, the remainder of the diagnostic and baseline measures required for the patient were captured, all with the mask in its taped position. NITBUT for the left eye was recorded as time to first break of 13.57 secs, and an average time of 20.65 secs. No ocular surface staining was present with either sodium fluorescein or lissamine green. Meibography revealed some gland loss in the lower lid of both eyes (OD: grade 0 (upper) and grade 2 (lower); OS: grade 0.8 (upper) and grade 1.5 (lower), Jenvis Grading Scale). [22]

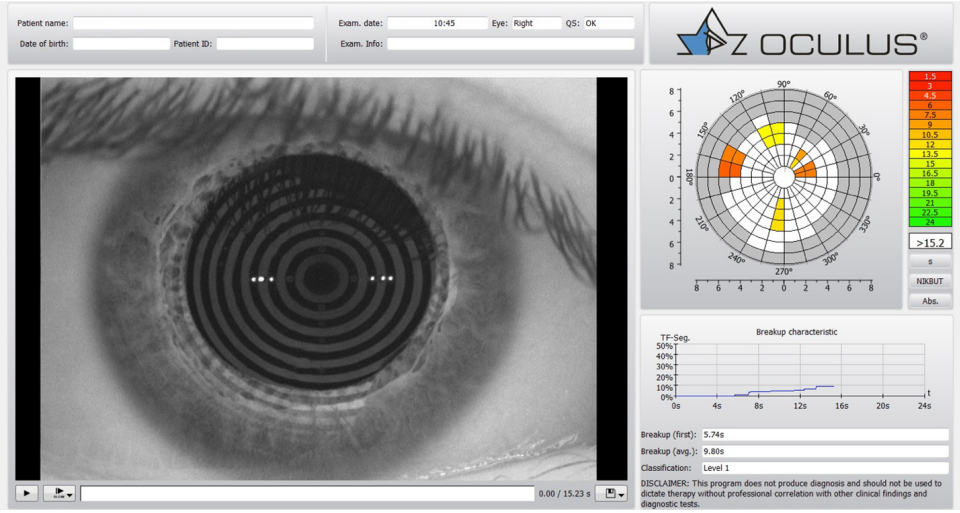

Figure 2: Repeated NITBUT while wearing a face mask with the top edge taped, OD

Using TFOS DEWS II diagnostic and subtype criteria, [21] the patient was diagnosed with evaporative dry eye disease. Management of the signs and symptoms of his dry eye disease was initiated ahead of proceeding with the contact lens fitting. The moderate to severe grade of his symptoms made it relevant to select management from both step one and two of the TFOS DEWS II management and therapy guidelines. [23] This involved patient education about the condition and providing advice on nutrition and environment. Use of warm compresses twice daily for one month was prescribed, along with recommendation of a lipid-containing artificial tear to help with symptom relief and tear film stabilisation. Given the aim was to reduce symptoms and inflammation in order to maximise the chances of achieving a successful contact lens fit, in this case a short course of topical steroid was also prescribed (Fluorometholone (FML) ophthalmic suspension, TID, OU). Follow up in four weeks was scheduled to reassess baseline measures, including symptomology and inflammatory markers, ahead of the contact trial.

Additionally, and based on the change in NITBUT revealed during the appointment, patient management also included a discussion about MADE, its causes and how to minimise its effect. The patient was informed about

reducing air flow from the top of the mask, use of artificial tears for symptom relief, and the importance of taking regular breaks from drying environments such as air-conditioned rooms and viewing digital devices when wearing the mask (Figure 3).

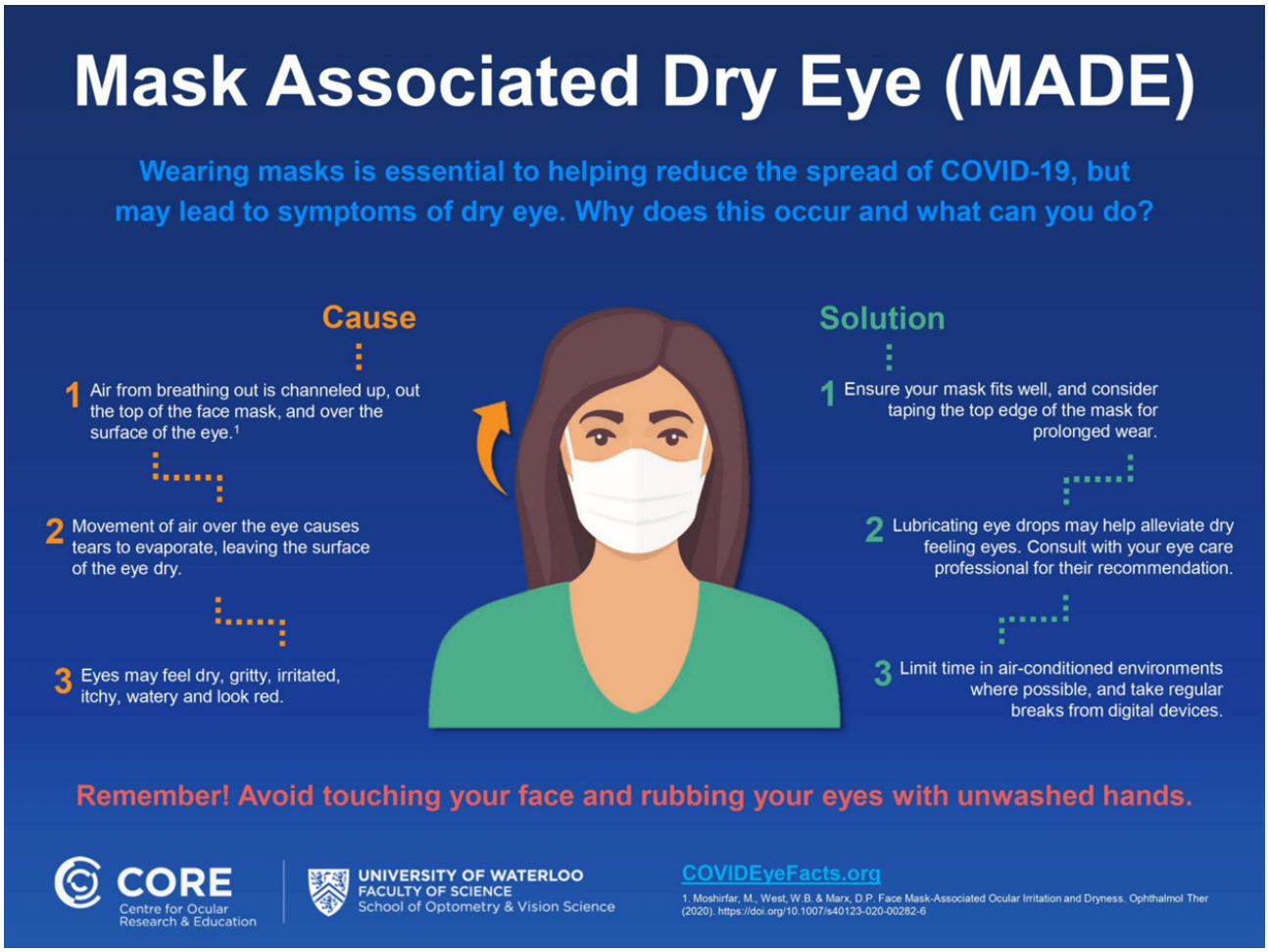

Figure 3: Mask-Associated Dry Eye Infographic, used with permission from COVIDEyeFacts.org

Discussion

While several reports exist of increased dry eye symptoms associated with wearing a face mask, this case history illustrates an example of the clinical effect of MADE. In the presence of a loose-fitting face mask, with air flow over the ocular surface, average NITBUT was reduced by nearly half (1.75x less) compared to the NITBUT present once the top edge of the mask had been taped.

There are two clinically relevant implications of this observation. First, that NITBUT measures can be used to confirm the presence of MADE. For patients reporting dry eye symptoms, either worse than normal, or for some, possibly for the first time, while wearing a mask, this simple and quick novel use of NITBUT provides an effective diagnostic tool. Baseline NITBUT wearing a face mask in its usual position can be compared to NITBUT following careful taping of the top edge. An increase in NITBUT in the second measurement suggests upward air flow from the mask may be contributing to reported dry eye symptoms. This procedure aids simple diagnosis that can be quantified clinically, allowing easy education for the patient, appropriate management and accurate follow up over

time.

The second implication of this case is the additional effect MADE may have on diagnostic measures being captured for dry eye disease. Many regions around the world continue to mandate face masks indoors and the effect of a patient wearing that mask throughout their eye examination should be borne in mind. While the fogging of phoropter eye pieces is perhaps the most obvious manifestation that both patients and eye care practitioners notice, this case serves as an important reminder of how other measures may also be impacted. In this particular example, the patient's diagnosis would not have changed based on the altered NITBUT score alone. However, for many other patients with mild dry eye symptoms, the effect of MADE could tip the balance between a true, or mask-only induced, diagnosis of dry eye disease.

This case illustrates the effect on tear break up time alone, but it is likely additional clinical sequelae may also be present in other patients. These could include increased ocular surface staining and increased tear film osmolarity. Mask wearing is set to continue for some time yet in many areas, and more reports of the clinical impact of MADE would be welcome. They would add to wider understanding of how to diagnose and manage the condition, along with helping to differentiate between true dry eye disease, and the exacerbating but albeit relatively temporary effect of MADE.

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