Our Excel formula has several advantages including:

1. Conversion directly from one cell of Snellen fraction into another cell without manipulation or re-formatting of the original Snellen fraction (Fig. 1) hence reducing risk of transcription errors.

2. Allows conversion of CF, HM, LP and NLP into LogMAR. Reference values for these are customizable and can be left as CF, HM, LP and NLP (Appendix S1).

3. This formula can be copied pasted to other cells and can utilize Excel’s drag manipulation or re-formatting of the original Snellen fraction hence reducing risk of transcription errors.

4. Works for both imperial and metric systems.

A downloadable Excel Sheet (Appendix S1) will enable customization of the formula in terms of reference LogMAR for CF, HM, LP and NLP. It allows re-labeling, for example LP to PL, as well as editing the starting reference cell (currently A2). By default, the formula utilizes the United Kingdom NOD values (Table 1; Day et al. 2015). Figure 1 outlines more detailed instructions and illustrates use.

We exercise caution in performing statistical analysis particularly with VA < HM. As no author has reliably and reproducibly converted LP and NLP, these are numerical imputations to aid quantification in database analysis. Consequently, we recommend avoiding parametric analysis and utilizing non-parametric analyses to interpret values as ordinal data if converting to LogMAR for statistical analysis.

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Supporting Information

Additional Supporting Information may be found in the online version of this article:

Appendix S1 Supplementary Excel Sheet to allow formula customization.

Quantification of aerosol production during phacoemulsification and pars plana vitrectomy

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Editor.

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the pathogen responsible for the 2019–2020 COVID-19 pandemic. The virus has the potential to be transmissible via aerosols (World Health Organization, 2020), which are tiny particles (≤5 μm in diameter) suspended in air that are invisible to the human eye (World Health Organization, 2014). Phacoemulsification and pars plana vitrectomy (PPV) are common intracocular surgical procedures which utilize high-speed devices. High-speed devices have the potential to generate aerosols across an air-fluid interface yet to date there has been no study quantifying whether these procedures generate aerosols. We used an experimental setup, involving model eyes and an optical particle counter, to quantify the degree of aerosol production that occurs during phacoemulsification and PPV.

For phacoemulsification, we used an advanced cataract model eye (Phillips Studio, Bristol, UK). A divide and conquer technique through a 2.2 mm
corneal wound and side paracentesis was performed with the CENTURION System (Alcon, Geneva, Switzerland). Aerosol production was measured during sculpting and quadrant removal. For PPV, a vitreoretinal model eye was used (GWB International, Marshfield Hills, MA, USA). The PPV was performed through three 25G valved port cannulas, using the CONSTELLA-TION System (Alcon) at a cut-rate of 4000 cpm. All experiments were performed in an operating room with a ventilation rate of 25 air changes per hour. A Met One A2400 optical particle counter (Hach Co, Loveland, CO, USA) sampling at a rate of one cubic foot per minute was used to measure particle concentration (Fig. 1A). The use of optical particle counters is an established method for the quantitative measurement of aerosols (Pazienza et al. 2014). For each of the three procedures, the particle count was measured at baseline with the handpiece or vitrector deactivated, and then during the procedure with the instrument activated. This was repeated five separate times.

The mean concentration of particles sized 1–5 μm was compared with the corresponding baseline for each procedure using the Welch’s t-test. Statistical significance was defined as p < 0.05. Mean particle concentrations for each procedure and the preceding baseline are presented in Fig. 1. During sculpting (Fig. 1B), there was a 193% increase [mean change 1932 counts/ft³, standard deviation (SD) 1451] in the mean particle concentration from the baseline, which was statistically significant (p = 0.04). For quadrant removal (Fig. 1C), there was an 83% increase (mean change 817 counts/ft³, SD 697) in the mean particle concentration from the baseline, which was statistically significant (p = 0.04). There was no statistically significant change (p = 0.14) in the mean particle concentration during PPV compared to baseline (mean change −129 counts/ft³, SD 174; Fig. 1D).

**Figure 1.** (A) The MET ONE A2400 optical particle counter probe (black arrow) was positioned 16 cm above the model eye to measure particle concentration during each procedure (B) Mean particle concentration during phacoemulsification - sculpting (C) Mean particle concentration during phacoemulsification – quadrant removal (D) Mean particle concentration during pars plana vitrectomy. n = 5. Error bars are the standard error of the mean.
The findings from our study suggest that aerosols may be produced during phacoemulsification but not during PPV. Although phacoemulsification may generate aerosols, currently there is no evidence showing the presence of SARS-CoV-2 in aqueous humour. Even if the virus was present, the aqueous is first replaced with viscoelastic and then with balanced salt solution (BSS) at the start of phacoemulsification. Consequently, by the time sculpting commences, it is BSS that is aerosolized rather than aqueous. We therefore support the rationale behind national (Royal College of Ophthalmologists, 2020) and international guidance (American Academy of Ophthalmology, 2020) on intraocular surgery during the COVID-19 pandemic, which suggests that the risk of aerosolized virus during phacoemulsification is likely to be very low. We did not measure a significant rise in particle concentration during PPV. This could be explained by virtue of this procedure being performed through valved port canulas, within a closed system, such that any aerosol generated is contained within the eye.

A limitation of our approach is the use of model eyes, which do not possess the same biomechanical properties as human eyes. Additionally, we used an optical particle counter which does not distinguish between infectious and noninfectious particles. Nevertheless, our study yields the first quantitative data on aerosol generation during intraocular surgery. Further research to confirm our model eye findings in a human eye is warranted.

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In keratoconic eyes, corneal hydrops may occur despite an intact Descemet membrane

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Editor,

Classical corneal hydrops is a disorder in which massive fluid-filled clefts appear suddenly within the stroma of keratoconic corneas (Feder et al. 1998), especially in patients with advanced stromal disease and a history of eye rubbing. These clefts are typically accompanied by obvious breaks in the Descemet membrane (DM) which have been presumed to be the cause of the condition (Chi et al. 1956).

Recently, however, we have shown experimentally that corneal hydrops cannot be explained by DM breaks alone. In a cohort of 21 eyes with keratoconus undergoing DMEK for comorbid Fuchs endothelial dystrophy, no eye developed acute hydrops, although all underwent complete descemetorhexis, and four developed large or total graft detachments postoperatively (Parker et al. 2019).

Now, we have encountered new evidence that a version of corneal hydrops may occur despite an intact DM. During both manual deep anterior lamellar keratoplasty (DALK) and Bowman layer (BL) transplantation for keratoconus, a deep stromal dissection is made which may be guided by use of intraoperative optical coherence tomography (iOCT; Tong et al. 2019). Recently, in two eyes (one undergoing DALK, another BL transplantation) following completion of stromal dissection, iOCT revealed the presence of large intrastromal clefts, but no disruption of the posterior corneal surface (Fig. 1).

In both eyes, the operations could be completed, and the subsequent postoperative course was uneventful. However, these intra-operative clefts appear to be the result of the cornea separating laterally under tension subsequent to stromal dissection, not (as previously believed) the result of an inrush of aqueous humour. If so, then the key insult in corneal hydrops may not be disruption of the corneal DM, but rather, the mid- to deep stromal layers, which may provide crucial structural support.

Interestingly, a general tendency for keratoconic corneas to separate laterally during stromal dissection could also explain the relatively high rate of presumed ‘accidental perforations’ during manual dissection, even by experienced surgeons with few complications otherwise (van Dijk et al. 2015).

While limited to only two cases, these observations strongly suggest that DM breaks are neither necessary nor sufficient for corneal hydrops to occur. As a result, some new theory accounting for the structural