



## 20 Minutes with Kian Kun Yap and Manoj Murali

by Rachel Fowler, Publisher/Editor-in-Chief  
TLT - 20 Minutes July 2021



*Injuries from Continual Wearing of Facial PPE*

**Two doctorate students from Imperial College London discuss their research on PPE-induced skin injuries among healthcare workers.**

**TLT: How did you come across the PPE-induced skin injuries problem suffered by COVID-19 frontline medics?**

**Yap and Murali:** During the height of the COVID-19 pandemic in April 2020, the Biotribology team at Imperial College London, led by Dr. Marc Masen, noticed a huge number of media reports on healthcare workers suffering from awful facial injuries. This was caused by the need to wear PPE for extended hours beyond the recommended usage time. The skin injuries not only cause pain and discomfort among medics but may potentially provide a dermal pathway for bacterial and viral infection.

Due to our prior experience on pressure-induced skin injuries research, we immediately recognized this to be a skin tribology problem. The only advice available was to apply petroleum jelly at 30-minute intervals, which would not be possible whatsoever in a COVID-19 ward setting where you simply cannot remove PPE with any frequency. Having seen the problem, there was a need to improve the medical recommendations given to healthcare workers to avoid these injuries.

As tribologists, we wanted to make use of our expertise in solving this problem for healthcare workers who have been risking their lives to combat the pandemic. The Imperial College COVID-19 Response Fund allowed us to put money toward testing and other resources. From there, we gathered a team of around 30 engineers and clinicians to accelerate the research of possible solutions, which could alleviate PPE-related skin injuries.

**TLT: How are these PPE-induced skin injuries related to tribology?**

**Yap and Murali:** Prolonged use of tight-fitting PPE such as goggles, visors and respirator masks among COVID-19 frontline medics can cause various skin injuries (e.g., contact dermatitis, urticaria, skin tears, blisters and pressure ulcers). If we observe the facial skin injuries among medics closely, you will find that these injuries mainly develop at the nose bridge, cheek bones and forehead. This is

because shear stresses and strains tend to concentrate at bony prominences. Although wearing PPE can introduce both normal and shear loads on our skin, our skin is robust against normal loads but vulnerable to shear loads. The shear load is caused by the static friction that prevents the PPE from sliding against our skin. Excessive shear on the skin surface can cause significant tissue deformation and cellular distortion, leading to injuries. At the same time, shear loading reduces blood perfusion and the transcutaneous oxygen level in our skin. This weakens the integrity of the tissue, making our skin more prone to injury. Therefore, the key to alleviating PPE-induced skin injury is by minimizing the shear or friction at the skin-PPE interface.

#### **Main Project Contributors**

*Principal investigator: Dr. Marc Masen*

*Lubricant development team: Kian Kun Yap, Manoj Murali, Dr. Zhengchu Tan, Xue Zhou and Luli Li*

*Skin-PPE modeling team: Rikeen Jobanputra, Sravani Royyuru and Jack Hayes*

You can reach Kian Kun Yap at [kkyap@imperial.ac.uk](mailto:kkyap@imperial.ac.uk).

You can reach Manoj Murali at [manoj.murali15@imperial.ac.uk](mailto:manoj.murali15@imperial.ac.uk).

#### **Read the Full Article, reprinted at**

**<http://www.sait.org.za/conferences/newsletters>, with permission, from the July 2021 issue of TLT, the official monthly magazine of the Society of Tribologists and Lubrication Engineers, an international not-for-profit professional society headquartered in Park Ridge, Ill., [www.stle.org](http://www.stle.org)**