Skin Tears, Medical Face Masks, and Coronavirus

Professor Amit Gefen, PhD

The International Consensus Document on Device-related Pressure Injuries[1] (DRPIs), developed over a year of intense work by a global multidisciplinary expert group (of which I was chair), is a comprehensive synthesis of contemporary scientific and clinical knowledge regarding tissue damage that can be caused by medical devices. This document focuses on evidence-based medical practice and covers the pathophysiological and etiological aspects of DRPIs, safe use of devices, risk factors and risk assessment, how to avoid tissue damage, and guidelines for regulators, policymakers, and industry. Its publisher made the document available for free download to assist in our struggle against these predominantly avoidable injuries (https://doi.org/10.12968/jowc.2020.29.Sup2a.S1).[1]

The document was published just a few weeks before the coronavirus outbreak. Learning of this valuable publication, the Editors of *Wound Management & Prevention* asked me to summarize its contents. Because circumstances have changed so dramatically over the days and weeks following its publication as this pandemic spreads and impacts life globally, I will instead extrapolate some of the fundamental topics specific to a type of DRPI associated with a medical device that is the most commonly used and highly relevant, not only among patients but especially among the clinicians in hospitals where the battles to defeat coronavirus have begun. What is the DRPI that incurs these injuries to staff? The simple, basic medical face mask.[2]

The international consensus document[1] discusses the role of frictional forces in DRPIs in detail. Generally, frictional forces caused by medical devices (or other objects in contact with skin) distort cells and tissues, resulting in sustained shear that leads to skin and subdermal tissue damage. The document describes the damage cascade in cells and tissues, particularly in the context of ventilation masks,[3] tissue damage similar to that caused by prolonged use of medical face masks. The damage often manifests in the form of skin tears (friction lesions),[2] a form of avulsion that occurs as a result of static or dynamic frictional forces acting on the skin.

The clinical teams engaged in all types of the coronavirus care settings are consistently reporting facial skin tears and lesions caused by prolonged use of their protective face masks.[2] Loss of facial skin integrity creates a portal for penetration of pathogens, including the coronavirus itself, as well as other hospital-acquired bacterial, viral, or fungal infections. Thus, skin damage can facilitate penetration of coronavirus and other pathogens into the blood circulation directly.

The mask materials mechanically indent and damage facial skin, an effect that is further compromised by perspiration (sweat) and moisture due to the mental stress and work load care teams are experiencing.[2] Specifically, the cause for these widely reported skin tears is that the materials of the mask, which already have a substantial friction coefficient with the skin, do not release the moisture (sweat) that is captured at the mask-skin contact sites, subsequently increasing the friction coefficient even more and elevating the static frictional forces that eventually tear the skin.[4] The moisture also compromises the mechanical strength of skin[4]; as such, the increased frictional forces and the reduced tissue strength synergistically contribute to the skin tears (ie, friction lesions), which are becoming increasingly common among the care teams.

Given that masks are now being used throughout the day and under extreme workload conditions, along with the fact that perspiration is profuse due to the mental and physical stress, a practical solution for clinicians is to use a skin barrier under the contact sites between the face and the mask. Petroleum jelly (PJ), also known as white petrolatum or soft paraffin, is approved by the United States Food and Drug Administration as an over-the-counter skin protectant and is widely used in cosmetic skin care. Applying PJ at the contours of facial skin that are in contact with the mask can serve as an effective barrier, considering the etiological factors and bioengineering damage theory described in the consensus doument[1] — namely, mitigation of both the friction and the compromising effect of perspiration on skin structure and function. Friction is mitigated by the lubricating effect of PJ, which will temporarily reduce the friction coefficient of the skin with the mask materials, and moisture issues are addressed in that PJ is highly occlusive on skin (ie, it forms a film on the skin and prevents loss of water

Dr. Gefen is The Herbert J. Berman Chair in Vascular Bioengineering, Department of Biomedical Engineering, Faculty of Engineering, Tel Aviv University, Tel Aviv, Israel. Please address correspondence to: gefen@tauex.tau.ac.il. *The opinions and statements expressed herein are specific to the respective authors and not necessarily those of Wound Management & Prevention or HMP. This article was not subject to the Wound Management & Prevention peer-review process.*

that may accumulate under the contact regions with the mask). Experimental biotribology work[5] has confirmed that PJ decreases the friction coefficient at the skin interface by approximately 25% immediately post-application; however, the friction coefficient will gradually and monotonically return to baseline after about an hour. This demands frequent PJ reapplication under the mask, a questionable practice in light of the fact that touching the face increases the risk for viral infection. Also relevant is the strong correlation between the perception of greasiness on the face and the actual mechanical reduction in the coefficient of friction,[5] leaving the user to determine whether the self-application of PJ reduces the friction of facial skin under the mask. Considering all of these factors together from a bioengineering perspective, applying a thick layer of PJ once every 30 minutes to facial skin under the mask, after a very thorough wash and disinfection of the hands with a hospital-quality sanitary gel product (obviously following removal of the used gloves), and using a new mask each time, should considerably reduce the risk for facial skin tears.

Heavy mineral oil (paraffin) can achieve similar but slightly less optimal results compared to PJ,[5] which is solid at room temperature and is easier to apply. Fatty acids, such as vegetable oils (eg, olive oil, that likewise is commonly used in cosmetics) are also occlusive and can lower the friction coefficient similar to mineral oil and can be used as a substitute for PJ for health care workers who are allergic to petroleum-derived products.

To summarize, skin failure under a medical face mask will be a portal for the coronavirus to penetrate the body and also will allow other hospital-acquired bacterial, viral, or fungal infections access to the circulatory system. Therefore, it is highly important for health care professionals to apply a skin barrier under the face mask after thoroughly washing and sanitizing their hands. Application of a thick layer of PJ once every 30 minutes on the face under the contours of a fresh mask using sterile hands should lessen the biomechanical risk of skin tears. This is a critical step in minimizing further spread of the coronavirus among caregivers and hospital teams and their families and also should reduce the likelihood of infecting other (non-coronavirus) patients.

The present information is a timely codicil to the international consensus document It was written to address the radical change in global circumstances since its publication to adapt the observations and conclusions contained therein to facial skin tears due to use of medical face masks, a pivotal aspect in the fight against the coronavirus. ■

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