

WHITE PAPER

PRPPE GUIDELINE | COVID 19

PRevention of skin lesions caused by **PR**esonal **PR**otective **PR**equipment
(Face masks, respirators, visors and protection glasses)

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PRvention of skin lesions caused by Personal Protective Equipment
(Face masks, respirators, visors and protection glasses)

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Within the scope of the infection caused by the new Coronavirus (SARS-CoV-2), in the Fight against Pandemic COVID19, the Portuguese Wound Management Association (APTFeridas) tried to respond to the calls of health professionals in order to issue recommendations for the prevention of injuries such as breaks skin, pressure ulcers, friction injuries and contact eczema related to frequent and continuous use for long periods of personal protective equipment (PPE), such as face masks, respirators, visors / goggles and gloves that are widely used in providing care to patients and which have been widely expressed at international and national level by personal reports and images that underlie this problem (1).

This recommendation was understood to be fundamental and of extraordinary importance for the days approaching the peak of the outbreak where its use will be even greater and by a higher number of health professionals. Although, as there is no published evidence on these interventions, APTFeridas used the experiences of professionals who also fight this battle, such as colleagues from China, Italy, Australia and the United States, as well as scientific evidence to support the recommendations issued, providing the professionals with easy access to information that allows them to weigh their use early, based on clinical and scientific evidence for this purpose.

These recommendations are only for skin care before and after the use of PPE without putting health professionals or patients cared for at risk. The use of PPE equipment is of essential importance and APTFeridas recommends that the use of PPE equipment must respect the recommendations of the General Health Directorate (DGS), European Center for Disease Prevention and Control (ECDC) and the Center for Disease Control and Prevention (CDC) and the World Health Organization (WHO).

WARNING: The recommendations are a general guideline for clinical practice, to be implemented by qualified health professionals, according to their clinical judgment, assessing each case individually and considering their preferences, patient needs and available resources. They must be implemented in a culturally conscious and respectful manner, in accordance with the principles of protection, participation and collaboration.

INTRODUCTION

THEORETICAL FOUNDATION

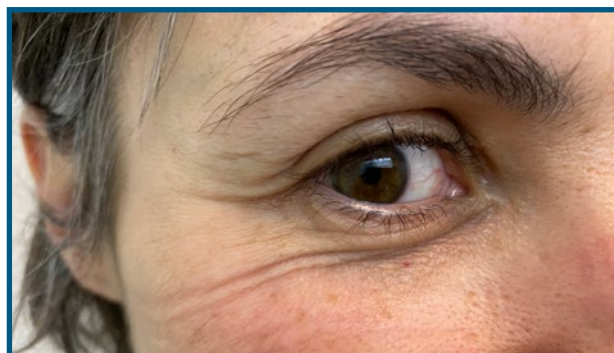
The skin is the first line of defense against the environment and is repeatedly subjected to mechanical and chemical forces (2), so its protective characteristics are altered when constantly attacked, as is the case with the continuous use of medical devices / PPE. These are physical factors such as sustained pressure, tension, friction and friction forces, as well as moist/humidity and temperature, which are directly associated with the development of Pressure Ulcers (PU), friction injuries and skin breakdowns (3).

Usual publications aimed preventing and treating these injuries, are mostly associated with injuries caused to patients and not in the health professionals. The medical devices most referred to in the literature are endotracheal tubes, nasogastric tubes, oxygen tubes, ventilation masks, urinary catheters and cervical collars. These injuries can increase the risk of infection and death; cause pain and scarring, which can be visible and cause distress; result in permanent hair loss, altered body image and / or reduced quality of life, as well as, increasing the length of hospital stay and consuming additional resources (time and materials) (4).

Personal protective equipment (PPE) must be in accordance with the level of care provided, respecting Guidelines No. 002/2020 of 25/01/2020 (5) and No. 003/2020 of 30/01/2020 (6). However, the prolonged and continuous use of face masks, respirators and goggles / visors leave to a constant friction and pressure forces on tissues causing skin lesions. Epidemiological data reveal that the injuries associated with the use of N95 masks most frequently reported by professionals are acne (59.6%), facial pruritus (51.4%) and rash (35.8%) (7).

If we manage to reduce these physical forces, without changing the safety capacity of PPE, we can reduce the impact on tissues and improve the skin's ability to respond to constant aggressions. We know that the friction of the skin is determined by the properties of its surface (roughness, hydration status, among others), the properties of the materials in contact (rigid, soft, fibrous, etc.), as well as the influence of possible intermediate layers (creams, lotions, pastes, among others), combined with sweat and sebum, which are naturally excreted at the skin outlayer (8-10).

As the skin itself is a surface, it is very important to analyze it in order to understand the impact of these physical factors on the alteration of its properties. In the specific case of the various materials / fabrics in contact with the skin, frictional and pressure forces develop at that interface, which strongly depend on the moist level. and are a necessary combination to break the adhesion bonds between the 2



surfaces and the forces that cause deformations in the contact area (11).

Friction is usually measured by the friction coefficient (CF), which is calculated when one surface is brought into contact with another and dragged towards it. The CF between the skin and the external materials is influenced by the nature of the textile materials, the contact pressure, the mechanical properties of the skin, the type of movement, the humidity of the environment and the humidity of the skin itself (12,13). This may explain the injuries that are being observed clinically in Portugal and in other countries. Since the mask materials, which already have a substantial FC with the skin and do not release moisture (sweat) captured at the contact sites (further increasing the FC), cause high static frictional forces that damage the skin (8). Since the resistance of the skin decreases with humidity, it appears that the increased frictional forces, synergistically with the low resistance of wet skin, contribute to the appearance of pressure injuries, friction and skin breaks.

Since masks are being used, they will be used throughout the day and under extreme conditions, associated with sweating is high due to the increased workload and also mental stress, a practical solution is to use a barrier over the contact places of PPE.

The first aspect we want to protect is any damage to the skin of healthcare professionals, as the skin lesion under the mask will be a gateway for the coronavirus, as well as for other bacterial, viral or fungal infections acquired in hospitals, hence the importance of skin care and preventive measures.

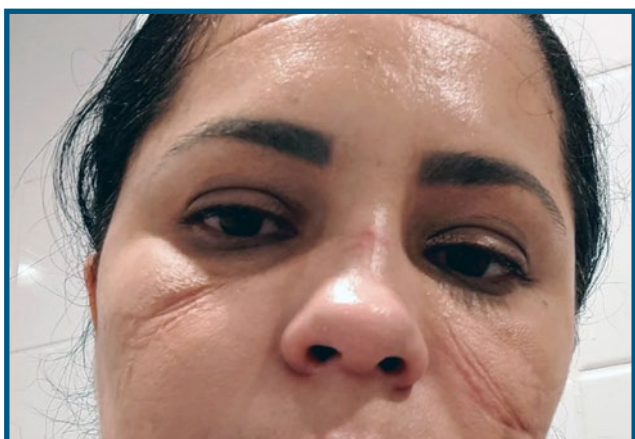
From the review and the consultation of international experts, two major recommendations emerge:

1. Adequate skin care before and after the use of PPE (hyperoxygenated fatty acids (AGH), barrier protectors and moisturizing creams)

The creams and barrier protectors in particular are occlusive, and could be a solution, as they slow down perspiration and simultaneously reduce the coefficient of friction on the skin due to its greasy nature. There is also scientific evidence that documents the effectiveness of AGH in preventing UP (14, 15).

2. Use of dressing material as an interface between the PPE and the skin in the areas of adhesion / pressure / friction

The use of dressing material in the prevention of pressure ulcers is recurrent in clinical practice and has a level of evidence B (3, 16). It should be taken into account that not all dressing materials have the same characteristics and present different/ diverse results. The interface material must be thin, non-traumatic when removed, absorb moisture, adapt to the contour of the face structures, always guaranteeing the correct sealing of the mask, without causing risk to the user.



GUIDELINE

A. SKIN PROTECTION

After daily hygiene, apply to the face and regions of greater contact (ears, forehead, nose and malar area) with PPE, moisturizing cream and/or skin protector. Consider using AGH, or a cream based on acrylate polymer and /or dimethicone (longer durability).

NOTE: It must be applied 1 hour before the use of PPE, so that the fat from the cream / protector does not interfere with the sealing of the mask, nor increase the friction, especially on the nose.



TABLE 1. Cutting molds and adaptation to the areas of greatest pressure

	Forehead	
	Nose and face	
	Ears	
	Thickness	

B. USE THE PPE APPROPRIATE TO THE LEVEL OF CARE TO BE PROVIDED AND YOUR ANATOMY

Select the PPE compatible with the level of risk and care you will provide.

Avoid exaggerated force in the fixation sites, with the objective of guaranteeing optimal sealing, since it will increase the pressure and friction forces in these places, resulting in discomfort and the high probability of injury. Adjust the device to the shape of your nose/face before definitively applying PPE. Confirm that you do not feel discomfort at any specific point of contact between the skin and the device.

VERY IMPORTANT: IN ADDITION TO THE REASONS MENTIONED ABOVE, SKIN LESIONS CAN ALSO BE CAUSED BY THE MISUSE/ INAPPROPRIATE USE OF PPE.

C. USE OF DRESSING MATERIAL / INTERFACE BETWEEN SKIN AND PPE

Assess all contact areas between PPE and the skin. The nose, the cheeks, the forehead and the posterior region of the ear are pressure / friction zones (Table 1).

1. Wash and dry the face, specifically in the places where the dressing material will be applied.

2. Cut and adjust the material to the application site. The proposed materials are thin foams with silicone (preferably), in the absence of these, the alternative will be films and hydrocolloids under the risk of not performing the best management of humidity or temperature, as they are occlusive.

3. The use of an interface (whichever one is chosen) must be continuously evaluated, monitored and reviewed by users in order to find the solution that best suits each professional.

4. Apply gently to the respective areas, stretched without too much tension but avoiding wrinkles or folds.

5. After applying PPE, confirm the correct application of it on the interface material, without increasing unnecessary pressure / tension in the contact areas.

6. Check the sealing of the PPE, with the interface and with the skin.

In these images provided by Hongyang Hu (China) from HEBEI Nursing Association, can be verified the correct application of the interface materials in regions of friction, humidity and pressure is verified.



Font: HEBEI Nursing Association - China

Dry the face well and then apply moisturizers on the skin (Moisturizing cream, hyperoxygenated fatty acids, and / or dressing material - the latter, if there is a continuity solution.

Skin care, with daily applications of hydration and protection, will reinforce areas that were at risk and provide greater protection for the next shifts where tensions will remain in the same places.

NOTE: The main hydration of the skin is not topically, but systemically. Health professionals should optimize their hydration and nutrition so that they maintain a balanced physiological response.

D. PRESSURE RELIEF

During each shift, the health professional must respect the institutional guidelines for changing shifts in the risk area and replacing PPE. At that time, the pressure / tension in the respective areas must be relieved, which must be carried out within a maximum interval of 4 hours.

NOTE: If the interface material or PPE is wet or damaged, it must be changed immediately.

E. SKIN CLEANSING AND HYDRATION

At the end of your shift, you must remove all PPE and interface material, respecting institutional safety recommendations.

After washing your hands, you should clean your face and neck properly.

Use a physiological saline solution or soap and water to wash the skin, paying particular attention to areas that have been under pressure, removing fat and flaking residues that may enhance maceration.

REFERENCES

1. <https://www.dailymail.co.uk/news/article-8108215/Nurses-bruises-marks-suffered-wearing-coronavirus-masks-South-Korea.html>
2. Sivamani, R.; Goodman, J.; Gitis, N.; Maibach, H. Coefficient of friction: tribological studies in man - an overview. *Skin Research and Technology* 2003; 9: 227-234. ISSN 0909-752X.
3. Schwartz D, Magen YK, Levy A, Gefen A. Effects of humidity on skin friction against medical textiles as related to prevention of pressure injuries. *Int Wound J*. 2018;1-9. <https://doi.org/10.1111/iwj.12937>.
4. Gefen A, Alves P, Ciprandi G et al. Device related pressure ulcers: SECURE prevention. *J Wound Care* 2020; 29(Sup2a): S1-S52. <https://doi.org/10.12968/jowc.2020.29.Sup2a.S1>.
5. Direção Geral de Saúde, Orientação No 002/2020 de 25/01/2020.
6. Direção Geral de Saúde, Orientação No 003/2020 de 30/01/2020.
7. Foo CCI, Goon ATJ, Leow YH, Goh CL. Adverse skin reactions to personal protective equipment against severe acute respiratory syndrome - A descriptive study in Singapore. *Contact Dermatitis*. 2006;55(5):291-4.
8. Gerhardt LC, Lenz A, Spencer ND, Münzer T, Derler S. Skin-textile friction and skin elasticity in young and aged persons. *Skin Res Technol*. 2009; 15(3):288-298.
9. Derler S, Gerhardt LC. Tribology of skin: review and analysis of experimental results for the friction coefficient of human skin. *Tribol Lett*. 2012; 45(1):1-27.
10. Gefen A. How do microclimate factors affect the risk for superficial pressure ulcers: a mathematical modeling study. *J Tissue Viability*. 2011;20(3):81-88.
11. Adams MJ, Briscoe BJ, Johnson SA. Friction and lubrication of human skin. *Tribol Lett*. 2007;26(3):239-253.
12. Meyers MA, Chen PY, Lin AYM, Seki Y. Biological materials: structure and mechanical properties. *Progr Mater Sci*. 2008;53(1):1-206.
13. Gerhardt LC, Mattle N, Schrade GU, Spencer ND, Derler S. Study of skin-fabric interactions of relevance to decubitus: friction and contact-pressure measurements. *Skin Res Technol*. 2008;14(1):77-88.
14. Gómez, T.S., Martínez, M.B., Molina Silva, R. et al. Cuidado de la piel y úlceras por presión. *Revista Rol de Enfermería* 2001; 24: 9, 578-582.
15. Meaume, S.; Colin, D.; Barrois, B.; Bohbot, S.; Allaert, FA. Preventing the occurrence of pressure ulceration in hospitalised elderly patients. *J Wound Care*. 2005 Feb;14(2):78-82. DOI: 10.12968/jowc.2005.14.2.26741.
16. European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel and Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers/Injuries: Quick Reference Guide. Emily Haesler (Ed.). EPUAP/NPIAP/PPPIA: 2019.



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