

## Management of skin damage of health workers' face: the role of plastic surgery in the time of Pandemic

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**Abstract.** *Background and aim:* The Sars-Cov-2 virus is characterized by a being highly contagiousness, and this is the reason why massive use of personal protective equipment is required by medical and paramedical staff of the COVID-19 dedicated departments. The aim of this manuscript is to describe and share our experience in the prevention and treatment of the personal protective equipment related pressure sores and other skin alterations in the medical and paramedical staff. *Methods:* All healthcare workers with PPE-related skin damages were registered at time 0. Age, sex, profession, type of skin damage, diseases and possible drugs were registered. *Results:* Two strategies were employed: the first strategy was to immediately treat the skin and the second one was to prevent pressure wounds formation both in already affected healthcare workers and the recurrence in healed staff. Three weeks after the two strategies were used, the incidence rate PPE-related skin damage was reduced in a statistically significant way. *Conclusions:* Proper management helps in reducing the incidence of pressure ulcers related to personal protective devices in Covid-19 Units. Skin prevention and hydration, have been obtained achieved by using products applied at home, autonomously.

**Key words:** COVID-19, Nasal bridge ulcer, wound care, wounds

### Introduction

Sars-Cov-2 epidemic changed the world and healthcare workers lives (1).

At present, the evidence suggests the Sars-Cov-2 is transmitted by Flugge's droplets, thus people with the higher risk of infection are those in close contact. The infection leads in acute respiratory distress syndrome. Recently a new pathogenetic mechanism has been described; new evidences suggest an involvement of immune dysregulation, vasculitis, vessel thrombosis and hypercoagulable status of these patients, as recorded by an increased risk of

pulmonary embolism although the exact pathophysiology is still unclear (2,3).

Due to its easy spread and difficult treatment, healthcare workers must wear individual protection devices in order to prevent transmission in the healthcare setting (1).

The virus has high contagiousness, so massive use of personal protective equipment is mandatory for the medical and paramedical staff of the COVID-19 dedicated departments.

Healthcare workers are forced to total isolation by wearing proper suits, gloves, shoes, filtering masks, glasses, visors and helmets for many hours, in order to

minimize the risk of infection during the dressing and undressing processes. The currently available protective masks are defined N95/FFP2 (or FFP3) and they have a metal strip to effectively adapt to the nasal pyramid, to achieve good respiratory protection and perfect adhesion to the skin. Some types of mask are equipped with a strip of polyurethane sponge or other soft materials (4). Long-term use (usually 4-6 hours) frequently results in mechanic damage that may lead to pressure ulcers.

This was underlined by other authors and usually the use of hydrocolloid dressing to cover the skin has been proposed (4,5).

In our Hospital, the COVID-19 area has been opened on March 23rd and 206 healthcare worked there. The staff was composed by 46 medical doctors, 112 nurses and other 48 workers. The Operative Unit of Plastic Surgery was involved for the treatment of PPE-related skin diseases (especially pressure sores of nasal bridge and forehead) of healthcare workers at nine days from the opening of COVID-19 Pavillion.

A protocol for prevention and treatment was proposed according with a Chinese University and adopted to reduce the incidence of skin alterations, and an observational study was carried out.

The aim of this manuscript is to describe and share our experience in prevention and treatment of the PPE-related pressure sores and other skin injuries in the medical and paramedical staff of our Hospital.

## Materials and methods

Committee of Publication Ethics (COPE) and Declaration of Helsinki were duly followed.

All healthcare workers with PPE-related skin injuries were registered at time 0 according to NPUAP scale (6).

Age, sex, profession, type of skin damage, diseases and possible drugs were registered.

Two protocols were proposed to both treat the traumatic injuries than to prevent either pressure wounds.

### *Wounds treatment*

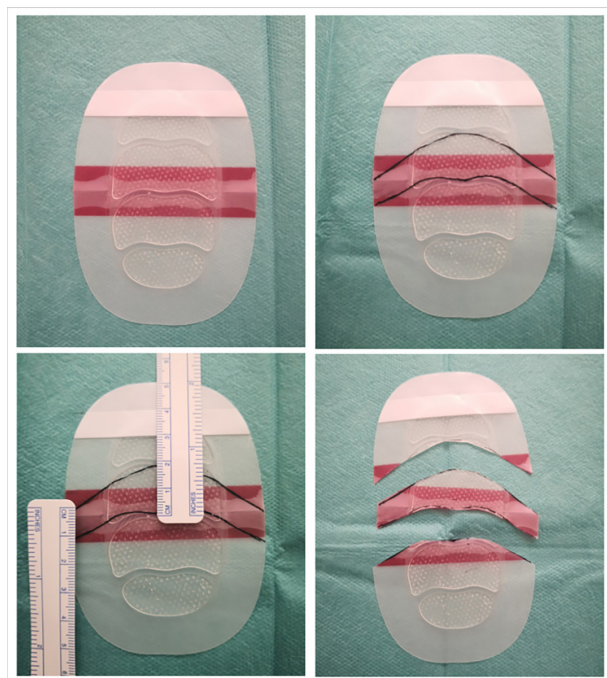
Healthcare workers affected by nasal bridge or forehead sores have been registered and treated based on skin damage (see table 1):

1. erythema without skin interruption has been treated with Collagen Veil masks and hyaluronic acid creams to increase hydration and soothing effect.
2. ulceration of the skin has been treated by disinfection with sodium hypochlorite and application of three gels applied as follow:
  - a. carbomer based gel plus carnosine and sodium benzoate applied in the morning
  - b. an hydroxycellulose hydrogel /poliesanide based gel applied in the afternoon
  - c. chlorhexidine/Ethylenediaminetetraacetic acid plus hyaluronic acid and imidazolidinil urea gel base applied in the evening until eschar formation.

Healthcare workers affected by ulcers continued to work by using an hydropolymer plus transparent film, water and virus proof dressing, that was cut as shown in the figure 1 and figure 2.

**Table 1.** Wound treatments

Erythema without skin interruption (NPUAP scale grade 1)	Collagen Veil masks and hyaluronic acid creams once a day
Ulceration of the skin (NPUAP scale grade 2 or more)	Morning: carbomer based gel plus carnosine and sodium benzoate
	Afternoon hydroxycellulose hydrogel plus poliesanide based gel
	Evening chlorhexidine/Ethylenediaminetetraacetic acid plus hyaluronic acid and imidazolidinil urea gel base



**Figure 1.** Transparent reinforced dressing modulation for nasal bridge

### *Wounds prevention*

We considered the use of transparent membrane, polyurethane foam or hydrocolloid dressing to protect the skin according to literature data (7-12).

Polyurethane foam was cut and attached on the metal strip region of the mask with a transparent film

(see figure 3), and around the glasses, to prevent its contact with the skin. This allows a quick removal of the mask during the undressing procedure to reduce the risk of infection.

Chi-squared test and Fisher exact test were performed for the analysis of incidence of grade 2 pressure ulcers between day 0 and day 21, using IBM SPSS ver.25.

### **Results**

The data and the demographic characteristics of healthcare workers are shown in table 2.

A total of 206 subjects were considered for this study. Nasal bridge and/or forehead ulcers involved 25,7% of healthcare workers at time 0, nine days after Covid-19 Building was activated. Forty-two subjects, both medical and paramedical staff, had developed grade 2 pressure ulcers, and 11 subjects had developed grade 1 pressure ulcers.

Swabs for microorganisms tests were not performed because unnecessary (no clinical signs of infection were found) as were baseline serum proteins and/or fasting blood sugar.

Three weeks after the use of this two proposed strategies, only one healthcare worker developed a grade 2 pressure ulcer and 7 workers developed grade 1 ulcers (3,9%, see table 3).



**Figure 2.** Transparent reinforced dressing on nasal bridge to cover grade 1 and grade 2 ulcers



**Figure 3.** Polyurethane foam modulation for masks

**Table 2.** Healthworkers' data at time 0 (NPUAP scale)

n.	Sex	Age	Profession	Other diseases and or drugs assumed	Skin lesion grade	Affected area
1	Male	30	Nurse	none	Grade 2	Nasal bridge
2	Female	42	Nurse	none	Grade 2	Nasal bridge
3	Female	27	Nurse	none	Grade 1	Nasal bridge
4	Female	29	Nurse	none	Grade 2	Nasal bridge
5	Female	31	Physician	none	Grade 2	Forehead and nasal bridge
6	Male	28	Physician	none	Grade 2	Nasal bridge
7	Male	25	Nurse	none	Grade 2	Forehead and nasal bridge



8	Female	38	Physician	none	Grade 1	Forehead and nasal bridge
9	Female	27	Nurse	asthma/ corticosteroids	Grade 1	Forehead and nasal bridge
10	Female	43	Physician	none	Grade 2	Forehead and nasal bridge
11	Male	40	Nurse	none	Grade 1	Nasal bridge
12	Male	38	Nurse	none	Grade 2	Nasal bridge
13	Male	30	Physician	none	Grade 2	Nasal bridge
14	Female	30	Other	none	Grade 2	Forehead and nasal bridge
15	Male	49	Physician	none	Grade 1	Forehead and nasal bridge
16	Female	39	Other	none	Grade 1	Forehead and nasal bridge
17	Male	50	Nurse	epilepsy/phenobarbital	Grade 1	Nasal bridge
18	Female	43	Physician	none	Grade 2	Forehead and nasal bridge
19	Male	34	Other	none	Grade 1	Nasal bridge
20	Female	34	Nurse	none	Grade 1	Nasal bridge
21	Female	24	Nurse	none	Grade 2	Nasal bridge
22	Female	25	Nurse	none	Grade 2	Forehead and nasal bridge
23	Female	47	Other	none	Grade 2	Forehead and nasal bridge
24	Male	30	Nurse	none	Grade 1	Nasal bridge
25	Male	41	Other	none	Grade 2	Forehead and nasal bridge
26	Female	45	Other	none	Grade 2	Nasal bridge
27	Female	50	Nurse	none	Grade 1	Nasal bridge
28	Male	37	Other	none	Grade 2	Nasal bridge
29	Female	36	Other	none	Grade 1	Nasal bridge
30	Female	33	Nurse	none	Grade 2	Forehead and nasal bridge
31	Female	43	Physician	none	Grade 2	Nasal bridge
32	Male	25	Nurse	none	Grade 1	Nasal bridge
33	Male	43	Physician	none	Grade 2	Forehead and nasal bridge
34	Female	48	Physician	none	Grade 1	Forehead and nasal bridge
35	Male	31	Nurse	none	Grade 2	Nasal bridge
36	Male	33	Nurse	none	Grade 2	Forehead and nasal bridge
37	Female	41	Nurse	none	Grade 2	Nasal bridge
38	Male	40	Nurse	anxiety/benzodiazepines	Grade 2	Nasal bridge
39	Male	43	Physician	none	Grade 2	Nasal bridge
40	Female	32	Nurse	none	Grade 2	Forehead and nasal bridge
41	Male	25	Nurse	none	Grade 2	Forehead and nasal bridge

Grade 1: Intact skin with area of nonblanchable erythema or changes in sensation, temperature, or firmness.

Grade 2: Partial-thickness loss of skin with exposed dermis.

Grade 3: Full-thickness skin loss.

Grade 4: exposition of deep structures (fascia, muscle, cartilage, bone, etc).

**Table 3.** Healthworkers' data at three weeks (NPUAP Scale)

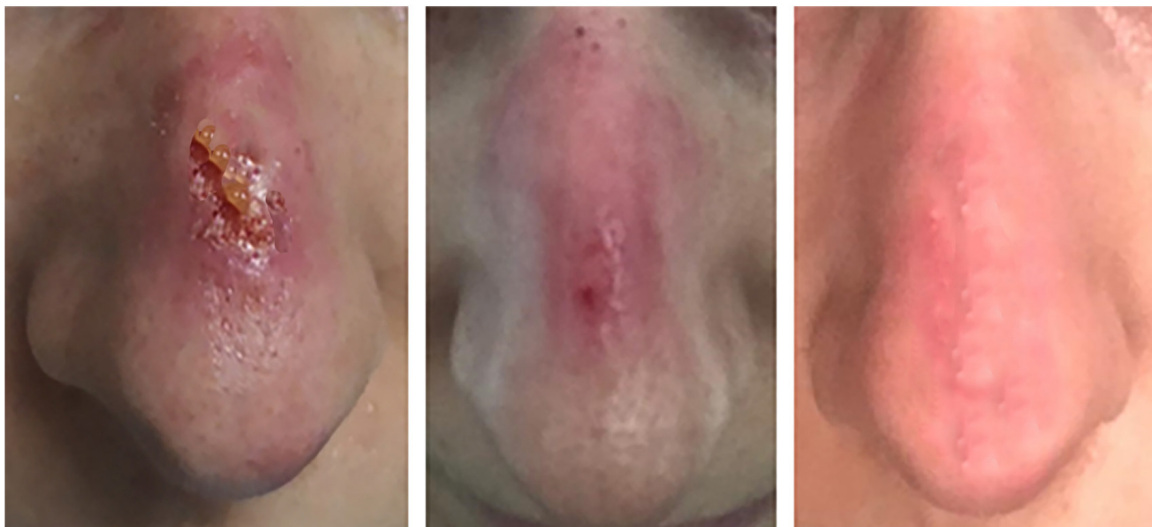
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**Figure 4.** Evolution of grade 2 nasal bridge ulcer. From the left: time 0, one week, two weeks.

No healthcare worker stopped to work, and the evolution of skin ulcers is illustrated in figure 5 and figure 6.

Chi Square and Fisher exact tests revealed statistical significance with p value less than 0,05.

**Figure 5.** Evolution of grade 2 forehead ulcer. From the left: time 0, one week, two weeks.

## Discussion

The infection due to COVID-19 is causing a public worldwide health emergency, characterized by a high impact on national health systems and especially on intensive care units, as shown in Italy by hospitalization data with approximately 10% occupancy of ICU beds. This infection can in fact result in a vasculitis with involvement of the microcirculation with respiratory failure, which requires assisted and mechanical ventilation.

The sudden outbreak of this global epidemic has led to a massive use of personal protection devices. The departments dedicated to the treatment of positive Sars-Cov-2 patients needs of isolation suits, masks and glasses to protect health workers. These are forced to wear protection devices for many hours and the impact on the skin is often devastating.

The use of prophylactic hydrocolloid or polyurethane foam over the bridge of the nose has been proposed by many authors. Previous studies describe the reduction of incidence between 5-20% of nasal bridge damage even in patients needing non-invasive-ventilation (10, 13-21).

Weng et al proposed the use of Tegaserb® and Tegaderm® dressing to reduce grade 1 nasal bridge pressure ulcers. These products showed a significative reduction in incidence between treated and control groups (9).

Similar results were shown by many authors, using foam film, silicone, thin sponge and hydrocolloid on nasal bridge. Although film does not completely prevent the ulcer, it can help to prevent friction, shearing forces and consequent damage. Silicone, polyurethane sponge and hydrocolloid are more effective (9, 22-25) but:

- they show an increased risk of creating a space between the mask and the skin, allowing the virus to infect the worker
- they can be uncomfortable using the glasses.

Previous studies were conducted on bedridden with non-invasive ventilation patients, and no study was performed on workers who must often carry out invasive manoeuvres (like intubating a patient) wearing masks and glasses. Often, in addition to masks

and goggles, health workers also need to wear protective visors that contribute to the pressure on the nasal bridge.

## Conclusions

This observational study shows that applying a small strip of polyurethane foam or a reinforced transparent film to the nasal bridge is effective in reducing the incidence of pressure ulcers. The use of collagen veil and creams can help to mitigate symptoms and can bring faster healing.

What keep in mind?

- these devices must be applied correctly
- the mask must adhere firmly to the skin, to not leave unprotected areas where the virus may pass.

Proper management helps in reducing the incidence of pressure ulcers. Our choice, especially for prevention and hydration phase, relies on products that are simple to apply, even for an autonomous use: in fact many workers were isolated from their house and the were alone for dress change.

**Conflict of Interest:** Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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Received: 1 November 2020

Accepted: 30 November 2020

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