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Prevention of ear-looped face mask-induced pressure injury on ears: A Technical report with review of literature

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Abstract

In modern times, protective masks with flexible loops are commonly used to prevent the spread of microorganisms during surgical procedure the constant contact of the stretching bands caused by wearing a mask for several hours' daily causes pressure on this cartilage, leading to painful and erythematous lesions on the skin behind the auricles. Patients and the public now wear masks for extended periods of time. Over time, wearing this mask frequently can cause damage to the ear. Consequently, people regularly switch out their masks to alleviate pressure, increasing their chances of getting infected. Doctors and other healthcare professionals should be aware that continued use may cause damage to the ears and auricles. This article addresses a novel method to alleviate stress on the ear loops of surgical masks and examines the typical ear injuries or pressure injuries on the ear mentioned in literature regarding prolonged mask usage and ways to prevent them.



Introduction

Face masks offer protection from harmful microorganisms, so using them is crucial as seen during the recent pandemic. Healthcare was compelled to introduce a universal mask policy during the COVID-19 pandemic in 2020 [1]. Face mask usage was a key component of the WHO COVID-19 prevention measures [2]. The significant increase in the utilization of surgical masks and respirators, not only by healthcare professionals but also by the broader public as a form of personal protective equipment (PPE), brought about fresh obstacles [3]. Healthcare workers had to adjust to wearing face masks constantly, which led to health issues due to prolonged use, including skin problems like rash and acne, as well as headaches, breathing issues, and impaired cognitive function [4].

Currently used fluid resistant surgical masks (FRSM) include elastic (flexible) ties that go to the back of the ears the ears, and prolonged usage of these masks irritates and discomforts the area at the back of the ears. This holds especially true when they are used for an extended period of time [5]. The risk-benefit ratio favors the use of masks at all times because the prevalence of their harmful effects is thought to be extremely low. Nevertheless, continuous use can result in harm to the ear and pinna, a side effect that should be recognized by healthcare professionals and physicians. [6]

After wearing the masks for multiple hours each day, these flexible elastics continuously compress the skin and the cartilage of the auricle, as a result, causing erythematous and painful lesions of the retroauricular skin, contact dermatitis, typically behind the ears (from elastic straps). Any form of facemask can become moist under it, which increases the risk of skin deterioration and, possibly, superinfection [7].

Skin breakdown in specific areas like the bridge of the nose and behind the ears may be caused by masks that fit tightly and create pressure in those areas, which may result from frequent PPE and mask changes [8]. The ear's design renders it more vulnerable to pressure damage. The postauricular region is anatomically different because it covers the bone medially, muscle, tendon, and lateral cartilage. Additionally, due to its facial skin's thinness, it is vulnerable to pressure injuries. However, long-term use of an N95 mask with ear loops can lead to pressure damage to the ear's skin, which may force users to adjust the mask frequently and increase their risk of infection [9].

Through this technical report, we describe a simple and effective technique for securing the surgical mask's ties in place with a woolen band.

Methods

Literature Search and Selection Criteria

In order to gather relevant information, an extensive literature search was conducted using PubMed and Google Web Browser. Key terms such as "face mask", "surgical face mask", "elastic ear loops", "pressure injury", "ear injury", "pinna injury". The search results were thoroughly assessed to verify their pertinence to the subject. Literature was selected and analyzed from the initial pool of literature, a total of 34 peer-reviewed research articles were selected for inclusion in this study.

Discussion

Technique:

- A strip of wool can be knitted in a rectangular fashion and two big buttons can be sewn at either end of the woolen knitted piece (Fig 1).
- Place this woolen strip on the middle part of the occipital bone or on the back of neck (Fig 2).
- The buttons can be used to hook the elastic flexible bands of the face mask on either each side of the knitted woolen strip (Fig 3).
- Thus, by adjusting the elastic flexible bands of the face mask on the buttons, damage to the ear's skin caused by pressure can be avoided.



Figure 1: An illustration of a Rectangular woolen fabric strip.



Figure 2: The woolen fabric strip with flexible ear elastics fastens to the occipital bone.



Figure 3: Side view of the face mask fasten to the Rectangular woolen Strip.

Wearing facial masks has been taken as a worldwide method to safeguard oneself and others amid the COVID-19 outbreak. Many surgical masks have stretchy components that go around the ear and apply pressure to this sensitive region. The elastic and flexible parts of many surgical masks go around the ear, apply pressure on this vulnerable region. Skin injury caused by pressure may occur if the mask is overly tight or worn for an extended period of time [10-11]. Because the post-auricular region is concealed behind the ear and/or covered in hair, it is possible to overlook or delay the diagnosis of injuries and dermatological conditions there [12-13]. Long-term use may result in pressure damage to the skin caused by a medical device (MDRPI) [13]. Throughout the COVID-19 pandemic, post-auricular dermatitis and contact dermatitis have also been extensively documented in the literature [3]. A pressure injury is a confined injury to the skin and underlying structures caused by extended pressure. When wearing a face mask for an extended period of time, the pressure from the flexible elastic straps near the ears can cause indentations on the skin that may lead to irritation on the skin or pressure injuries [14].

The architecture of the ear makes it more susceptible to pressure injury [12]. Given that it covers the cartilage laterally, muscle, tendon, and bone medially, the post auricular region is anatomically distinct. Moreover, due to the fact that it possesses the thinnest skin on the facial area, it is susceptible to pressure injuries [12].

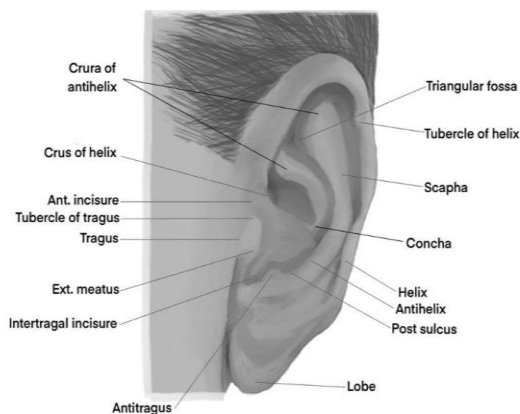


Figure 4: Anatomy of External Ear.

Dermatological complications can arise from extended face mask use. These skin injuries, ranging from lesions to open wounds are of great concern. Complications associated with disposable ear loop masks include contact dermatitis, psoriasis, and acute shear stress on the outer ear leading to ulceration [12, 15]. Individuals with preexisting skin conditions like psoriasis, who are at risk of experiencing the Koebner phenomenon (new psoriatic lesions appear in previously unaffected skin areas after injury or trauma in psoriasis patients) after wearing mouth mask for prolonged period.

Adhesives, rubber found in straps, free formaldehyde released from non-woven polypropylene, and metal in clips have the potential to result in contact dermatitis and contact urticaria. [16-17], some individuals may have a reaction to thiuram, a substance present in the ear loops of surgical masks [18].

Bothra et al., [3] reported preliminary data on patients with retro-auricular dermatitis from wearing ear loop face masks. Gyapong et al., [2] evaluated the adverse reactions of wearing masks for extended periods among regular and occasional face mask users worldwide using an online structured questionnaire cited 22% respondent the most common complaints of discomfort included experiencing pain in the ear area. Users frequently touch their face masks as a result of their extreme discomfort, which increases the risk of cross-contamination between the hands and the mask and further spreads diseases [19]. Rosner E[4] in their online survey to evaluate the adverse effects of continued mask wearing on healthcare workers amid the COVID-19 pandemic cited 32.1% of the respondents reported skin breakdown behind the ears. Also, Hu K et.al [20] reported the adverse skin reactions of health care workers using personal protective equipment for COVID-19 in their survey cited 11% of the respondents had indentation and ear pain while wearing masks. A similar study by Purushothaman PK [19] reported in their survey, 45.2% had experienced pain behind the ear, likely caused by masks that are too tight. Venecija et al., [21] in their Webropol® Online survey conducted in Finland among healthcare workers on their perspectives and experiences with using surgical masks. Many respondents reported (R26) as “*In some surgical masks, the rubber bands of ear loops are so thin that they abrade the skin, irritating the area behind the ears. The pain caused by the rubber bands reduces the concentration on work.*”

Damage to the pinna can range from mild skin erosion on the postauricular side to skin damage brought on by pressure from a medical device (MDRPI) [12]. Few cases have been reported in literature regarding injury to post-auricular area the external ear/pinna by the straps or ear loop of the surgical masks [6,

12, 14] to as severe as the pinna was torn off from the crus of the helix and the cartilage was revealed and broken into fragments [22] and a case where both ears are perforated from wearing a mask for too long in a patient with phobia to corona virus [23] Zanotti B et. al. [7] highlighted the auricular cartilage of pre-adolescent children who are still developing and less resistant to disfigurement; therefore, extended pressure from the flexible elastic bands of the mask on the antihelix level can affect the proper development and angulation of the external ear.

Preventive measures to avoid discomfort and damage to the pinna by fastening the mask ear straps behind the occiput, one can utilize a "ear saver" mask strap to prevent pressure or contact on pinnae [6]. Strap-secured masks should be taken into consideration as a different option to ear loop masks, adjustable straps provide comfort and reduce skin pressure for the user. Suggestions have been made to use hairpins to suspend elastic bands and other types of bands that go around the back of the neck, where the mask loops can be attached. [15]

Author/year	Technique used
Kainth GS / 2020 [24]	<ul style="list-style-type: none"> Securing the surgical mask in place with a regular hospital wristband. Using the different punched holes allows for adjusting the strip's length.
Mukhtar M / 2020 [25]	<ul style="list-style-type: none"> Instead of being looped around the ears, the mask's ear loops are wrapped around the handles of the glasses.
Mukhtar M/ 2020 [25]	<ul style="list-style-type: none"> The ear loop of the face mask is broadened with tape or gauze piece to reduce the pressure per unit area on the ear and increase the surface area in contact with the ear.
Jiang W / 2020 [26]	<ul style="list-style-type: none"> A plastic handle utilized with the ear loop-style N95 mask. Secure the plastic handle at the center of the occipital bone and attach elastic bands of the mask to both sides of the handle from the back.
Moody C / 2020 [27]	<ul style="list-style-type: none"> Place the ear saver at the back of the head and attach the elastic straps of the surgical mask onto it.
Levine, Jeffrey / 2021[12]	<ul style="list-style-type: none"> Utilizing an "ear saver" mask strap to prevent pressure and friction on the area behind the ear.

Table 1: Previous reports on modification / alterations with surgical mouth masks to prevent pressure injuries on the skin of the ears.

Many commercially available similar items are available which can be used along with the surgical masks to prevent pressure on the ears. We present a very simple solution by using a woolen strap with buttons. The advantage of this rectangular based woolen fabric with buttons is it can easily be knitted especially by females and it will avoid irritation and injury to the skin of the auricle by taking off the pressure of the elastics. Also, this woolen fabric can be disinfected and reused again. Traditionally, females have been knitting woolen fabrics for years. It can be

used whenever these commercial items are not available, especially in rural places.

Prevention strategy to prevent pressure injuries on the skin behind the ears

The National Pressure Injury Advisory Panel discussed a variety of ways to shield skin against friction caused by masks, such as the utilization of protective creams, moisturizers, skin sealants, and frequent PPE offloading [28]. In a study that was conducted recently, participants' skin-PPE shear stress was minimized by using a lubricant made of 20% beeswax, 40% mineral oil, and 40% olive oil [29].

The literature has previously discussed recommendations. The first is the inclusion of division of work schedule into shifts for more opportunities to wear masks for shorter periods of time [30-31]. Second recommendation is to take preventative actions such using barrier creams, emollients, and moisturizers to stop skin deterioration. It is important to take precautions to make sure that bandages, lotions do not impact the seal of the mask and decrease its effectiveness in protecting against infectious particles [4]. A third recommendation is to develop masks designed to prioritize comfort, safety, and tolerability [32].

When wearing a face mask for longer than four to six hours each day, there are significant risk factors associated with adverse skin reactions. It has been recommended to encourage people who wear masks for more than 4 hours to have breaks without wearing a mask and to change masks at least once a day [33].

Sr. No.	Recommendations
1.	Consider all patients who wear masks are at risk of developing ear breakdown.
2.	Ensure the mask is not excessively snug around the ear by testing the tension with your finger.
3.	Inspect the area around and under the mask at least twice a day, or more often if the patient is at high risk of skin breakdown. (Including the mask ear loops).
4.	Simply put on the mask when it is needed, and take it off as soon as it's safe to do so.
5.	To prevent rubbing and strain on the postauricular region, think about employing an "ear saver" mask strap.

Table 2: The prevention recommendations for face masks adapted from Medical Device-Related Pressure Injury (MDRPI) are listed [11].

Conclusion

The ear's particular architecture makes it more susceptible to damage from pressure, particularly for medical devices like masks when used for prolonged periods. The main measures to prevent skin damage behind the ears is to use "ear saver" masks that are held in place with straps behind the head should be chosen, as they enable the wearer to customize the fit for comfort and alleviate pressure on the skin. Woolen strap with buttons can be considered when

commercially available “ear saver” straps are not available, especially in rural places.

Author Contributions

Dr. Fareedi Mukram Ali, Dr. Abdullah Saeed Wasli, Dr. Abbas Hasan Hobani conceptualized and gathered the data about this technical report. Dr. Samira Hussain Al Faraj, Dr. Essa Hamoud Mashiakhy gave the necessary inputs and managed the literary searches. Dr. Ali Mohammed Alkhayrat, Reem Abdullah Khawaji provided valuable input on the manuscript.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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