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Auricular Protection after Ear Reconstruction Using an Antipressure Alarm

Di Liu, NB*
Xueshang Su, MM†
Jintian Hu, MD‡

Summary: Auricular protection is an important part of postoperative care for ear reconstruction and has an important impact on the expected outcome of the surgery. Therefore, we developed an antipressure alarm to protect the reconstructed ear in the supine position. The device consists of three components: an alarm, a pressure detector, and an adjustable elastic band. When the patient is in a supine position, the pressure sensor is located above the back of the reconstructed ear. When the head is rotated to the affected side, the pressure detector senses the pressure signal in advance compared with the reconstructed ear, and then triggers an alarm to remind the patient to adjust his position in time to avoid pressing the reconstructed ear. The device has been applied to more than 100 patients and has achieved satisfactory clinical results. *(Plast Reconstr Surg Glob Open 2023; 11:e5169; doi: 10.1097/GOX.0000000000005169; Published online 4 August 2023.)*

INTRODUCTION

Auricular reconstruction is the primary treatment for congenital microtia and acquired ear absence.[1,2] However, during the postoperative recovery period, the reconstructed ear may have poor pressure resistance. As most patients are children who lack self-protection ability, it is crucial to provide adequate protection for their reconstructed ears. Previous studies have developed various earmuffs that can effectively safeguard the reconstructed ear during daily activities. Nevertheless, ensuring both comfort and stability of these earmuffs remains a challenge. Therefore, we have developed an antipressure alarm to safeguard the reconstructed ear while the patient is in a supine position.

MECHANISM OF THE DEVICE

The device consists of three components: an alarm, a pressure detector, and an adjustable elastic band, as shown in Figure 1. The alarm and pressure detectors are mounted on elastic bands and connected by a circuit. The elastic band was worn on the head of the patient, the length of the elastic band was adjusted to the circumference of the head, and the pressure detector was positioned above the back of the reconstructed ear. When the patient is in a supine position, and after repeated testing to ensure that the pressure detector is in the optimal position, triggering an alarm before compression of the ear occurs while avoiding false alarms due to safe head movement during rest. Please refer to Figures 2–4 for schematic illustrations depicting a patient utilizing an antipressure alarm.

The device operates on the principle that, when patients are in a supine position and turn their head toward the affected side, pressure detected by the sensor triggers an alarm to alert both children and parents of potential risk to the reconstructed ear. This allows for timely adjustments to sleeping positions, thereby protecting against undue pressure.

CLINICAL USAGE AND RESULT

This device is recommended for use within 3 months after ear reconstruction, but caution should be exercised during the expander implantation period to prevent damage to the expanded skin. The antipressure alarm has been applied to over 100 patients, and based on feedback from patients and their families, it effectively protects the reconstructed ear by reducing nighttime pressure and alleviating parental night care burdens without any adverse events reported.

Disclosure statements are at the end of this article, following the correspondence information.

*From the *Outpatient Operation Room, Plastic Surgery Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, People's Republic of China; †Department of Cicatrix Minimally Invasive Treatment Center, Plastic Surgery Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College. Beijing, People's Republic of China; and ‡Department of Cosmetic Injection Center, Plastic Surgery Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, People's Republic of China.*

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Drs. Liu and Su contributed equally to this work.

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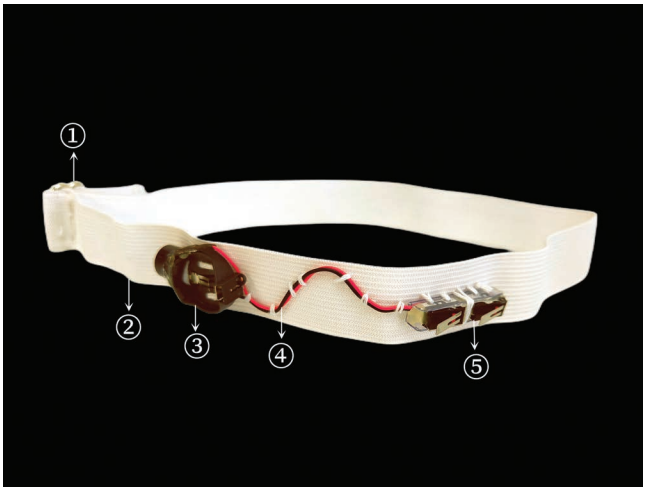

Fig. 1. Antipressure alarm: ①Length adjustment buckle of elastic band; ②Elastic band; ③Alarm; ④Circuit; ⑤Pressure detector.

Fig. 2. Schematic photograph of a patient using an antipressure alarm from a frontal perspective.

DISCUSSION

The reconstructed ear can achieve an appearance similar to that of a normal ear, but it lacks the flexibility, wear resistance, and ability to withstand external forces provided by natural cartilage. Additionally, due to its prominent position, the reconstructed ear is susceptible to compression when in a supine position, which may result in wound injury, framework exposure or helix flattening, significantly impacting surgical outcomes.[3,4] Therefore, postoperative protection is crucial for successful reconstruction. However, there are limited options for devices suitable for safeguarding the reconstructed ear while the patient is in a supine position.[4,5] Although

Takeaways

Question: Can an antipressure alarm protect a reconstructed ear in recumbent position after ear reconstruction?

Findings: This antipressure alarm can effectively protect the reconstructed ear. When the patient is in the supine position and the patient's head turns to the affected side, the pressure detector can feel the pressure in advance compared with the reconstructed ear, and then trigger the alarm to remind the patient to adjust the position in time.

Meaning: Antipressure alarm protects the reconstructed ear of the patient in the recumbent position.

Fig. 3. Schematic photograph of a patient using an antipressure alarm from a rear perspective.

Fig. 4. Schematic photograph depicting a patient using antipressure alarm in a horizontal position.

some reconstructed ear protective earmuffs can be worn during sleep, their comfort level is relatively poor. This is especially true for earmuffs with good airtightness, which may cause stuffiness and tinnitus when worn for extended periods of time.[6] Moreover, the strength of earmuff materials is limited and there remains a risk of external ear compression under high pressure. Additionally, due to the irregular anatomical structure surrounding the ear, ensuring earmuff stability in supine positions can be challenging. Moreover, there are variations in ear size and shape as well as the surrounding anatomical structure among patients, making it challenging to achieve consistent adherence to standardized specifications. However, individualized production incurs high costs, which impose a financial burden on patients. The antipressure alarm offers the following advantages over it: (1) It effectively protects the reconstructed ear from being compressed when the patient is in a supine or sleeping position, and the nonslip inner layer serves to further mitigate the risk of displacement. (2) The device features a simplistic structure and an adjustable elastic band, rendering it suitable for a diverse range of individuals. As such, the production cost is minimal and will not impose any financial burden upon patients or their families. (3) The elastic band boasts excellent air permeability and can be adjusted to fit the patient's head circumference, rendering it highly comfortable for prolonged nocturnal wear. (4) The method of donning is uncomplicated and facile to execute; even children can acquire the technique with ease. (5) The device serves to monitor the compression of the reconstructed ear in patients and alleviate the burden of nocturnal care for parents. In addition, our improvement plan includes the integration of a nonslip surface on the inner layer of the elastic belt to further mitigate displacement risks.

CONCLUSIONS

The antipressure alarm is an effective means of protecting the reconstructed ear in a recumbent position, with low production costs and user-friendly operation. It holds great potential for clinical application.

Jintian Hu, MD
33 Badachu Road
Shijingshan District, Beijing
People's Republic of China
E-mail: hujintian@vip.163.com

DISCLOSURES

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PATIENT CONSENT

The patient provided written consent for the use of her image.

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