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IDEAS AND INNOVATIONS

Breast

Nipple Shield Made from a Thermoplastic with Aluminum Properties

Haruka Soyano, MD
Hajime Matsumine, MD, PhD

Summary: Here, we report the preparation of a nipple shield from an inexpensive and re-formable thermoplastic with metallic properties as well as its favorable outcomes when used for patients who had undergone nipple reconstruction. The nipple shield was prepared from a material made of a mixture of a thermoplastic resin and special aluminum pellets (aluminum content, 70%). Each patient wore the nipple shield for 3 months after nipple reconstruction. The material was re-softened for re-forming into an adequate shape as required during this 3-month period. All reconstructed nipples were securely protected, with no complications (eg, ulceration, wound dehiscence, and wound infections) during the 3-month period. Also, there were no skin complications such as contact dermatitis or cellulitis in the area where the nipple shield was in contact with the skin. None of the patients stopped using the nipple shield because it came off frequently, or was uncomfortable or painful to wear, and there were no cases in which the nipple shield had to be remade due to damage. The thermoplastic material used in this study appeared to be extremely useful as a nipple protection material because of its good breathability, attributed to its nonwoven form, its low thermal conductivity and resulting cooling effect attributed to its aluminum content, its suitability for rapid re-forming, and its washability. *(Plast Reconstr Surg Glob Open 2023; 11:e4855; doi: 10.1097/GOX.0000000000004855; Published online 8 March 2023.)*

INTRODUCTION

After nipple-areola complex reconstruction and inverted nipple correction, use of a nipple shield is recommended for a few months to protect against external stimuli and stress.[1] Ideally, materials for nipple shields should be lightweight, easy to form into the desired shape, comfortable to wear, highly breathable, highly durable, easy to attach and detach, inexpensive, and washable. Many objects have been used as nipple shields, including syringes,[2] the caps of saline bottles,[3] nipple pads,[4] sponge hair rollers,[5] eye protectors,[6] and silicone shields.[7] A previous report has concluded that nipple projection cannot be maintained without the use of a nipple shield.[1] We believe that a nipple shield is necessary to maintain nipple projection and protect nipples from surrounding external forces. Here, we report the development of a nipple shield made from an inexpensive and re-formable thermoplastic sheet with aluminum properties that showed favorable outcomes in patients who used this nipple shield.

Department of Plastic and Reconstructive Surgery, Tokyo Women's Medical University, Tokyo, Japan.

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MATERIALS AND METHODS

We prepared a nipple shield from THERMAL GIPS (Toyo Aluminium, Osaka, Japan), which is a 3-mm-thick thermoplastic sheet with aluminum properties. THERMAL GIPS has a three-dimensional mesh structure created by extruding a mixture of thermoplastic resin and special aluminum pellets (aluminum content, 70%) using nozzles with a diameter of 1 mm in order to achieve a uniform density (Fig. 1). This specially processed sheet softens at 60 °C or more and hardens again at 35 °C or more. To make a nipple shield, a piece of THERMAL GIPS was immersed in hot water (≥60 °C) for a few dozen seconds, the excess water was removed using a towel, and the top of a drink bottle or the like was pressed into the softened piece of THERMAL GIPS to make a dome-like shape (Fig. 2). Before the piece hardened, the dome-shaped piece was placed over the nipple with the patient in the sitting position, and the skin-contacting part was shaped to achieve a good fit with the skin around the nipple (Fig. 3). Then, to prevent the breast skin from being damaged, the corner of the sheet was rounded using a pair of scissors.

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Fig. 1. Using a pair of scissors, a sheet of THERMAL GIPS was cut to a size slightly larger than that of the nipple shield to be prepared.

Fig. 2. The cap of a saline bottle was pushed into a piece of THERMAL GIPS to make a dome that covers the nipple.

The resulting nipple shield was cooled in flowing water until it hardened, to avoid disturbing the shape.

The position of the nipple shield was adjusted so that the wall of the dome-shaped part was not in contact with the reconstructed nipple, and then the nipple shield was fixed to the breast using micropore tape (3M, St. Paul, Minn.) with moderate pressure to achieve close adherence to the skin (Fig. 4).

Takeaways

Question: Development of new nipple protection material.

Findings: We report the preparation of a nipple shield from an inexpensive and re-formable thermoplastic with metallic properties as well as its favorable outcomes when used for patients who had undergone nipple reconstruction. The nipple shield was prepared from a material made of a mixture of a thermoplastic resin and special aluminum pellets (aluminum content, 70%).

Meaning: We report the development of a nipple shield made from an inexpensive and re-formable thermoplastic sheet with aluminum properties that showed favorable outcomes in patients who used this nipple shield.

Fig. 3. The patient was asked to assume a sitting position. Before the sheet hardened, the dome-shaped piece was placed over the nipple, and the skin-contacting part around the dome-shaped part was formed into the shape to achieve a good fit with the skin around the nipple.

PATIENTS

Participants were seven patients with breast cancer who had undergone autologous breast reconstruction followed by local flap nipple reconstruction. All nipple reconstructions were performed using the arrow flap technique. The mean age was 49 years (range, 37–58 years), and the mean BMI was 23 (range, 18.9–32.5). The nipple shield was placed as described above and used for 3 months after nipple reconstruction. Complications related to the reconstructed nipple and skin complications in the area where the nipple shield was attached were recorded.

RESULTS

In all patients, the reconstructed nipple was securely protected and there were no complications (eg, ulceration, wound dehiscence, and wound infection) during the 3-month period. Also, there were no skin complications (eg, contact dermatitis and cellulitis) in the area where the nipple shield was attached. None of the patients

Fig. 4. The position of the nipple shield was adjusted so that the wall of the dome-shaped part was not in contact with the reconstructed nipple, and then the nipple shield was fixed to the breast using micropore tape with moderate pressure to achieve close adherence to the skin.

stopped using the nipple shield because it came off frequently, or was uncomfortable or painful to wear. Also, there were no cases in which the nipple shield had to be re-made due to damage.

DISCUSSION

The nipple shield made from THERMAL GIPS securely protected the nipple without causing complications. No defects were found, and the patients were able to wear the nipple shield comfortably for 3 months. The reasons for the observed favorable outcomes are considered to be the following.

First, the material is nonwoven. It has adequate durability to protect the nipple from external impact, as well as adequate porosity, which provides favorable breathability and prevents accumulation of excessive moisture in the wound area. Also, it is more lightweight compared with solid materials and, thus, less prone to spontaneous detachment due to gravity while being worn. The nonwoven material has a smaller contact area with the skin compared with woven materials, and therefore causes less irritation.

Second, the material contains aluminum and, thus, has high thermal conductivity. It has been reported that the THERMAL GIPS has thermal conductivity of 0.255 W/m K, which is much higher than the value for general heat-modifiable external fixation materials, meaning that it has excellent heat dissipation.[8] Iuchi et al examined an external splint for nasal fractures made from THERMAL GIPS and reported that postoperative edema healed quickly as a result of the cooling effect of the material.[8] Our results suggest that moderate cooling of the wound might have occurred and contributed to the soothing of postoperative inflammation in the present study as well.

Third, thermoplastic resins have favorable characteristics. They adhere well to tapes, facilitating their easy attachment to the skin. Also, because they can easily be formed into a desired shape by heating, they can be reformed in a short time. They are washable and, thus, very hygienic. The 3-mm-thick THERMAL GIPS used in this study is a prototype, and is expected to be marketed outside Japan in the future.

Hajime Matsumine, MD, PhD
Department of Plastic and Reconstructive Surgery
Tokyo Women's Medical University
8-1 Kawada-cho, Shinjuku-ku
Tokyo 162-8666,
Japan
E-mail: matsumine.hajime@twmu.ac.jp

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