Negative pressure manoeuvre in microtia reconstruction with autologous rib cartilage

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Summary In microtia reconstruction, maintaining a healthy contact between the skin and the fabricated cartilage framework is essential to attaining a smooth and accentuated contour of the reconstructed auricle. Conventional means to achieve this include bolster sutures and continuous suction drains, both of which have associated shortcomings. A new dressing method was developed and applied in 10 consecutive patients who underwent the first of a two-stage microtia reconstruction using the Nagata technique. A small catheter was introduced into the space between the skin and the cartilage framework. Negative pressure was applied through the catheter, drawing the skin onto the cartilage framework. This evens out the skin, accentuates the contour of the framework and concurrently eliminates potential dead space. Skin contact on the framework is maintained whilst the catheter is removed and an occlusive transparent dressing is applied to the ear. Of the 10 cases in which this manoeuvre was performed, one had to be converted to the bolster suture technique due to a persistent air leak from the wound. Overall results of the nine cases in which this technique was carried out successfully demonstrate smooth skin contour and excellent definition of the fabricated framework. This negative pressure manoeuvre provides a simple, safe and consistent approach to achieving a smooth and accentuated contour in auricular reconstruction.

The detailed three-dimensional (3-D) morphology of the external auricle demands an intricate approach to its reconstruction. Current debate surrounds the optimal dressing method after wound closure to achieve smooth draping of skin over the complex 3-D cartilage framework.1 We introduce a new technique in which a negative pressure manoeuvre is used to evenly drape the skin over the 3-D cartilage framework and to facilitate postoperative wound care without drains or bolster sutures.
Ten consecutive microtia patients underwent the first of the two-stage auricular reconstruction using the technique described by Nagata. During the first stage, the fabricated 3-D cartilage framework was inserted into the skin pocket.

The Nagata technique uniquely enables creation of an ample skin pocket, and ensuring minimal skin tension is a prerequisite to effectively performing the negative pressure manoeuvre. After wound closure, a 16-gauge...
Angiocatheter (BD Angiocath Plus TM Ref591845, 3M company, USA) was introduced either through a small opening in the wound or through a small incision in the lobule into the space between the skin flap and the cartilage framework. The catheter was then connected to a suction device delivering 100 mmHg of negative pressure, which drew the skin onto the cartilage framework, defining the morphology of the reconstructed auricle.

Fine adjustments were made to even out the skin over the cartilaginous convolutions and meticulous wound

Figure 2  Same patient as in Figure 1, six month after the second stage (projection) surgery. (a) The reconstructed auricle shows smooth contour and good definition of the complex 3-D morphology of the framework. (b) A well-projected auricle can be observed from the frontal view. (c) Close up view of the contour of the auricle. (d) Vertex view showing a well-constructed auriculocephalic sulcus.
closure was performed. The catheter was then gently withdrawn, and finger pressure applied at the insertion site as the catheter was removed. In the presence of minimal skin tension, an airtight seal was usually achieved and maintained after removal of finger pressure; however, if air manages to seep into the skin pocket, the manoeuvre can be repeated until airtight conditions are achieved (see Video, Supplemental Digital Content 1). Rolled gauze was gently fitted into the indentations formed in the helix, concha and scapha to help maintain definition of the reconstructed auricle. The wound was then sealed with Tegaderm (3M, USA). This method of dressing provides gentle compression to minimise seroma formation. The dressing can be left intact until suture removal 10 days after surgery. Postoperative care is easy and comfortable for both the patient and carer.

Nine cases were lobule-type and one was a concha-type microtia, according to Nagata’s classification.2 One patient, who had reconstruction for a chocha-type microtia, developed a persistent air leak through the wound and had to be converted to the bolster suture technique. One patient developed a seroma in the scapha area 2 days after surgery. This was caused by improper adherence of the dressing on the scalp due to loose hair and subsequent prevention of an airtight seal. The seroma was evacuated by the bedside using the same negative pressure manoeuvre, and the wound healed uneventfully. It is extremely important to shave the hair in the application area of Tegaderm so intimate contact can be retained for more than 10 days. No other complications were noted. In the nine cases where the negative pressure manoeuvre was carried out successfully, all reconstructed auricles showed smooth skin contour and good definition of the 3-D cartilage framework (Figure 1a–d).

In microtia reconstruction, maintaining tight contact between the skin flap and the implanted cartilage framework is critical to attaining a smooth and accentuated outline of the fabricated framework. This also minimises potential dead space where haematoma or seroma may form.3–5 Bolster sutures make postoperative wound care convenient and negate the use of drains.2 However, pressure from compression sutures may risk vascular compromise to the underlying skin flap, resulting in necrosis. Trans-cartilage sutures may result in weakening or fracturing the cartilage framework, and in rare cases, may even be difficult to perform due to severe calcification within the framework. The use of drains is that they can be somewhat inconvenient and uncomfortable, often requiring frequent changing during the immediate postoperative period. Furthermore, they can easily occlude due to the small calibre of the drain tubes.

The negative pressure manoeuvre enables an evenly distributed negative pressure that pulls the skin snugly over the many convolutions of the cartilage framework. The skin remains tightly adhered to the cartilage once an airtight seal is attained. The key to effectively performing the procedure lies in the condition of the skin envelope. In order to have a good seal and intimate adhesion of the skin to the framework, there must be minimal tension on the skin envelope. The first stage of the Nagata technique is unique, in that it enables insertion of the cartilage framework with little skin tension. The absence of skin tension and elasticity reduces the tendency for air leaks. If skin tension is present, it tends to promote tenting of the skin over the framework, and increases the risk of destroying the negative seal and allowing air to enter the skin pocket.

In the second stage of the Nagata technique, we attempt to leave the anterior skin–cartilage contact area untouched as the reconstructed ear is elevated off the skull. The morphologic details of the anterior (visible) portion of the reconstructed ear therefore remains unchanged from the results gained after the first stage (Figure 2a–d). In summary, the negative pressure manoeuvre provides an alternative, simple and consistent approach to achieving a smooth and accentuated contour in auricular reconstruction, whilst negating the potential shortcomings of bolster sutures or drains.

Conflict of interest statement

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Appendix

Supplementary data

Supplementary data associated with this article can be found in the online version, at doi:10.1016/j.bjps.2009.07.007.

References