Surgical correction of ear curling caused by scar tissue formation in a horse

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EQUINE

- Ear injuries are uncommon in horses.
- Correction of an ear deformity secondary to contracture of a wound can be achieved with good cosmetic result through use of appropriate surgical technique and materials.

An 18-month-old Belgian Warmblood mare was evaluated at the Large Animal Surgery Department of the Veterinary Faculty of Ghent University because of a cosmetic problem in the left ear. Three weeks earlier, the horse had injured the outer convex aspect of the left auricle, which resulted in a 4-cm-diameter skin defect. Tissue contracture associated with second intention healing had subsequently caused the tip of the ear to curl backwards (**Figure 1**).

On examination of the left ear, there was a triangular-shaped skin defect on the distal third of the outer convex aspect of the auricle; the base of the triangle was parallel to the tip of the auricle, and the apex was oriented toward the base of the auricle. The defect was filled with healthy granulation tissue and surrounded by epithelizing and contracting wound margins. The tip of the left ear curled backward at an angle of approximately 50° to 60°, and the typical semilunar shape of the inner concave aspect of the ear was flattened. The cartilage of the ear was markedly thickened at the level of the distal border of the wound (the margin nearest the ear tip). Two main tension lines responsible for the abnormal ear shape were identified. One tension line exerted traction on the tip of the ear parallel with the long axis of the ear and induced the curling effect; the other tension line was aligned perpendicularly to the former and was responsible for the flattening of the ear. The main goal of reconstructive surgery was to release these tension lines and restore the normal appearance of the ear. By use of a skin graft to cover the existing skin defect, it was anticipated that wound healing would be accelerated, thereby avoiding adverse effects associated with second intention healing.

Twelve hours before surgery, antimicrobial agents were administered IM and tetanus antitoxin (3,000 units) was administered SC. After premedication with romifidine (0.1 mg/kg [0.05 mg/lb], IV), general anesthesia was induced with midazolam (0.06 mg/kg [0.03 mg/lb], IV) and ketamine (2.2 mg/kg [1.0 mg/lb], IV). Anesthesia was maintained with isoflurane in oxygen. The horse was positioned in right lateral recumbency. The ear and the site from which the skin graft would be harvested were clipped and prepared for surgery; the ear canal was packed with a cotton plug.

First, a 5-cm-long horizontal skin incision was made along the horizontal border of the triangular wound nearest the ear tip from the medial to the lateral edge of the ear. At the midpoint of this incision, a second incision was then started perpendicular to the first and oriented toward the base of the ear. This second incision was 6 cm long; it extended through the granulation tissue and the wound area and ended 5 mm proximal to the apex of the triangle-shaped wound (ie, 5 mm nearer the base of the ear). Both intact skin and a flap of granulation tissue on the medial aspect of the wound area were undermined and detached from the ear's cartilage. This reduced the backward curling of the ear by 5° to 10°. A thick plaque of fibrous scar tissue was identified that covered the entire auricular cartilage surface at the level of the original wound bed. This tissue was sharply resected. Restoration of the abnormal shape of the ear was not further influenced by this procedure. To correct the curling and remodel the auricle into its typical semilunar shape, the auricular cartilage was incised. One hor-

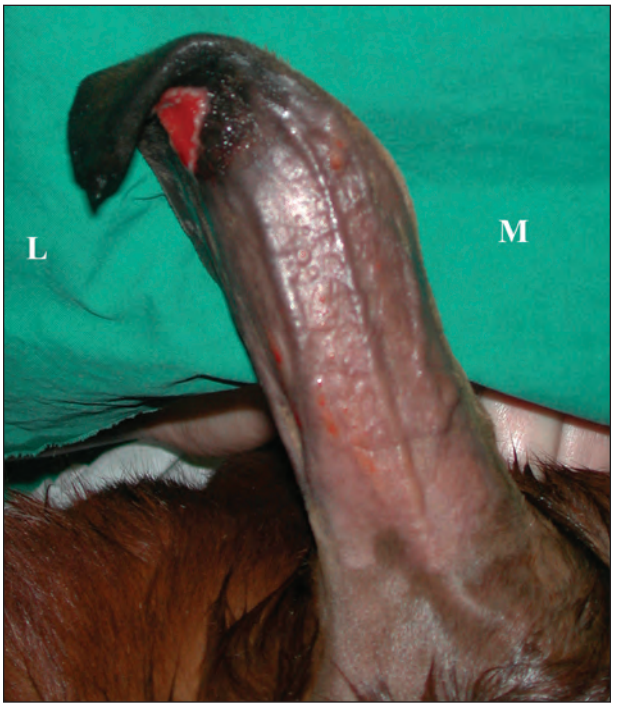

Figure 1—Photograph obtained during surgery of the left ear of a horse with an ear deformity resulting from trauma. Notice that the tip of the left ear curls backward at an angle of approximately 50° to 60°. A triangular-shaped skin defect is visible on the distal third of the outer convex aspect of the auricle; during healing of the wound, 2 main tension lines induced curling and flattening of the ear. L = Lateral. M = Medial.

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izontal full-thickness incision was made at the same level as the first skin incision; however, this incision did not extend to the lateral and medial edges of the ear. Four vertical full-thickness incisions (3 to 4 cm long) were made perpendicular to and centered over this initial cartilage incision; these 4 incisions were approximately 6 to 7 mm apart along the length of the initial cartilage incision. These 4 incisions further relieved the curling of the ear by 20° to 30° and allowed the ear to take a more normal shape (**Figure 2**). The medial granulation tissue flap was advanced distally to the medial rim of the ear and sutured to the skin with simple interrupted sutures (5-0 nylon suture).

A full-thickness skin graft was harvested from the pectoral region. The hypodermal layers were sharply dissected while the graft was kept in a polyionic solution.[a] The graft was then applied to the defect to cover both cartilage and granulation tissue areas. To obliterate dead space, 2 mattress sutures (2-0 polyglactin 910 suture) were placed through the ear parallel to each other. The graft edges were sutured to intact skin or to the epithelizing borders adjacent to the granulation tissue by use of an interrupted suture pattern (4-0 polyglyconate suture; **Figure 3**).

Thermoplastic material[b] was contoured to fit the inner concave surface of the ear while the ear was pulled forward in a normal position. This material was used to make a splint on the inner aspect of the ear for immobilization and fixation of the ear in its final shape after surgery. The splint was fixed to the ear with several cartilage-perforating sutures (2-0 polyglactin 910 suture; **Figure 4**). The skin graft was covered with a nitrofuran-impregnated sterile dressing, and an elastic self-adhesive bandage[c] was used to protect the ear.

Ten days after surgery, the bandage was changed for the first time. Graft color and temperature (assessed via touch) were considered normal. The central part of the graft was still slightly mobile in relation to the auricle. A skin-nourishing ointment was applied to the skin graft,[d] and a new bandage was applied. Twenty days after surgery, the entire graft area had adhered firmly to the application site. The bandage, thermoplastic splint, and sutures were removed 30 days postoperatively. The graft had healed completely, and the ear had a normal conformation. Six months after surgery, the shape of the ear remained normal; hairs were regrowing over the surgery site, although diffuse alopecia and several white hairs were apparent on the graft area (**Figure 5**). However, the owners were completely satisfied with the cosmetic result obtained.

Injuries to the ears are uncommon in horses. They can result from freezing, bite injury, and laceration.[1] In humans, auricular reconstruction is a unique area of facial plastic surgery for which a wide array of reconstructive options can be considered.[2] There is little information in the veterinary literature regarding the management of ear injuries in horses. The main indication for cosmetic surgery of ears is reconstruction of ear tips that have been damaged as a result of frostbite.[1]

In the horse of this report, surgical correction of an acquired ear deformity caused by scar tissue formation in a granulating wound bed was achieved. Ear lacerations in

Figure 2—Photograph of the left ear of the horse in Figure 1 illustrating the maximum correction of the ear curling that was achieved after undermining the skin and incising the cartilage associated with the wound area.

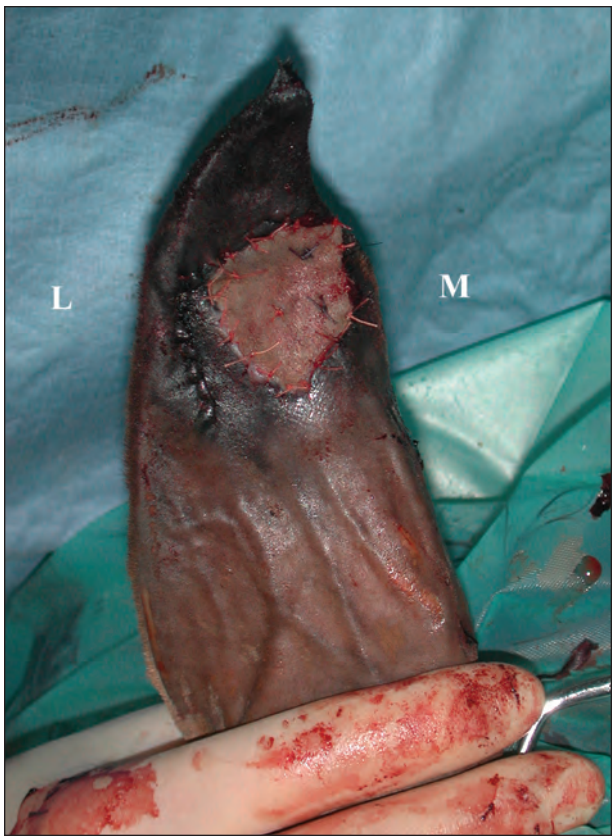

Figure 3—Photograph of the left ear of the horse in Figure 1 after application of a full-thickness skin graft over the defect on the outer convex aspect of the auricle. *See* Figure 1 for key.

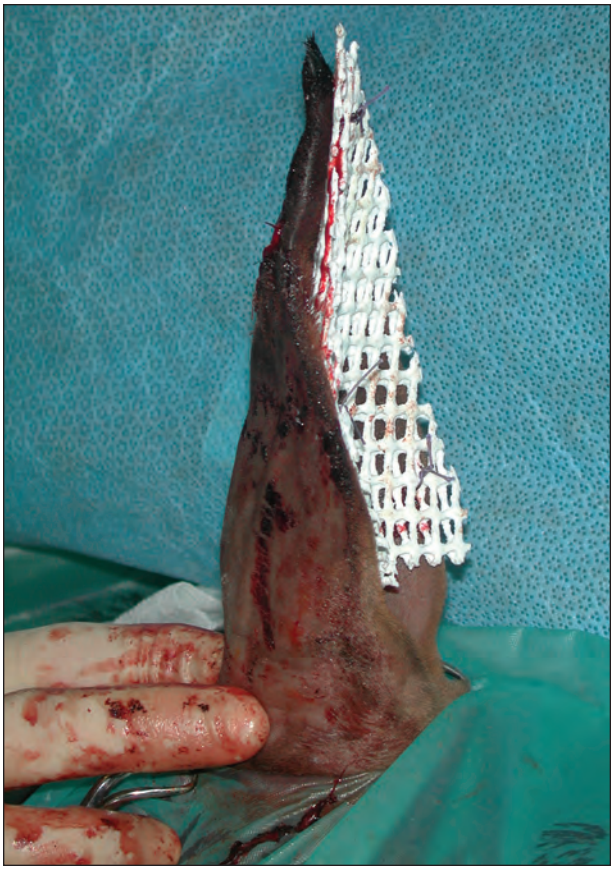

Figure 4—Photograph of the left ear of the horse in Figure 1 with a thermoplastic splint contoured to the inner concave aspect of the auricle and sutured in place to support the ear in its final corrected shape.

horses are usually a result of injury with sharp protruding objects that create full-thickness lesions, most commonly at the tip of the ear.[1,3] Loss of the ear tip has also been reported[1,4] as a result of bite injury or frostbite.

To the authors' knowledge, reconstruction of normal ear shape has not been reported in horses except for treatment of a drooping ear that was the result of muscle injury. In that horse, surgical treatment involved repairing the damaged extrinsic muscles.[3] In the horse of this report, release of the wound-induced tension at the level of the skin and subcutaneous tissue was not sufficient to allow the ear to return to its normal shape because of scar tissue formation at the level of the cartilage. Definitive cartilage modelling was possible via resection of fibrous tissue and through application of several full-thickness incisions. Surgical correction of prominent ears in humans is done through a combination of cartilage scoring and excision because the superficial layer of the cartilage controls the tendency of the main tissue mass to expand; when this outer layer is incised, tension release and reverse bending are easily achieved.[5-7] On the basis of these cartilage properties, restoration of the semilunar ear shape in the horse of this report may also have been achieved through use of partial-thickness instead of full-thickness longitudinal incisions in the cartilage. In dogs,[8] the use of mattress sutures has been described for correction of postoperative lateral ear deviation that may develop after ear cropping surgery; this requires placement of nonabsorbable sutures through the auricular cartilage to the temporal muscle fascia at the base of the ear in a horizontal mattress suture pattern.

Figure 5—Photograph of a portion of the head of the horse in Figure 1 six months after surgery to correct curling of the left ear.

In the horse of this report, full-thickness skin grafting was performed for cosmetic reasons and to avoid the deleterious effects of second intention wound healing. In plastic surgery procedures performed in humans, superficial defects on the lateral surface of the ear are most often reconstructed with a full-thickness skin graft.[2] This technique produces the best preservation of height, contour, and definition of the skin. The graft is aggressively thinned and secured with numerous central tacking sutures. In plastic surgery procedures involving human ears, split-thickness skin grafts are less widely used than full-thickness grafts because they inhibit secondary graft contraction less and are more susceptible to tissue mismatch.[2,9] Although these effects have not been detected in horses,[10] full-thickness grafts have been recommended when optimal cosmetic appearance and hair growth are important.[11] Such grafts can be harvested more easily, compared with split-thickness grafts that require specialized equipment (eg, a dermatome) for collection. An important factor in the acceptance of the graft at the application site is the presence of adequately vascularized underlying tissue.[12] However, a highly vascularized granulation tissue bed can decrease the chances of graft acceptance because of blood accumulation beneath the grafted area and the presence of some bacteria.[13] Despite large areas of healthy granulation tissue at the graft application site in the horse of this report, healing was uncomplicated. Cartilage is known to be a less favorable environment for graft attachment and revascularization.[12] This might explain why the central portion of the graft, which covered bare cartilage, was still not firmly attached to the auricle 10 days after surgery. Nevertheless, the graft had adhered to the entire surface of the recipient site 20 days after surgery. The cosmetic result obtained 6 months after surgery was good except for the presence of some diffuse alopecia and a few white hairs in the area of the graft. This could have been caused by excessive preparation of the graft during removal of the

hypodermic layer[11,12]; the quality of hair growth on split-thickness graft sites varies from none to fair depending on the thickness of the graft and the number of hair follicles transported and surviving with it.[13]

For the horse of this report, external fixation of the ear was necessary to maintain a normal ear shape after surgery. In horses, the use of a support stent (such as radiographic film) affixed by full-thickness sutures on the inner concave aspect of the auricle has been described[1,3]; the remaining abnormal tension forces associated with the ear wound in the horse of this report necessitated the use of a stronger fixation device. Several materials have been used in humans for surgical molding of ears, including bone wax, microfoam rolls, and copper or steel armatures padded with silicone tubing[14]; silicone foam dressing,[15,16] silicone rubber stents,[17] and thermoplastic splints[18] have also been devised to help maintain the ear detail after ear reconstruction. The lightweight thermoplastic material used in the horse of this report was contoured to take on the shape of the inner aspect of the auricle. This material supported the concave aspect of the auricle perfectly and was well accepted by the horse. Bandaging the ear in an upright position is often unrewarding because horses commonly flap and rub their ears.[1] Overall, the outcome of treatment reported here suggests that correction of an ear deformity secondary to scar tissue formation by use of an adapted surgical technique and appropriate materials can be achieved with good cosmetic results in horses.

a. Baxter Hartmann, Baxter SA, Lessines, Belgium.
b. Vet-Lite (100 mm), Runlite SA, Micheroux, Belgium.
c. Tensoplast, BSN Medical, Brierfield, England.
d. Newderm, Wolfs NV, Zwijndrecht, Belgium.

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