Image Cover Sheet

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TITLE

Protective Clear Shield for Dorsal Surgical Wound Sites in the Rat

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Ideas and Innovations

Protective Clear Shield for Dorsal Surgical Wound Sites in the Rat

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In our studies investigating the usefulness of various artificial materials as skin substitutes, we require daily observation of the graft sites in conscious, unrestrained rats. Furthermore, a major challenge remains the protection of the surgical sites from environmental contamination and self-mutilation. Several techniques have been described to alleviate these latter drawbacks, including the use of an Orthoplast split saddle[1] and protective rat vests fashioned from a piece of x-ray film[2,3] or rubber sheet.[4] Under our experimental conditions, these postoperative wound-protection techniques were unsuitable because they involve substantial handling of the animal to access and visualize the surgical site, and, thus, may impair wound healing. We have recently designed a clear wound shield to protect dorsal experimental wounds and to allow frequent examination of grafted surgical sites in unrestrained rats (Figs. 1 and 2).

A piece of Lexan (9 × 10 cm; GE Structured Products, Cobourg, Ontario, Canada) was folded inside two juxtaposed 100-ml beakers and heated to 121°C for 15 minutes. The dome thus formed (Fig. 1, *a*) should only be removed from the beakers after thorough cooling has occurred. A small window (1 × 6 cm) was then made on top of the dome by using a rotary tool (Dremel MultiPro Rotary Tool, Model 395, Racine, Wis.), and covered with a piece of nonadherent dressing (Telfa, Kendall Healthcare Products Co., Mansfield, Mass.) (Fig. 1, *b*). This window allowed moisture release if the surgical site was large. In our five-wound rat model, omission of the covered window caused marked condensation on the walls of the dome for up to 24 hours.

The corners of the dome were smoothed to eliminate any sharp edges. A band of surgical tape (Microfoam, 3M Health Care, St. Paul, Minn.) was placed along the two bottom edges of the dome to provide padding to the edges of the dome in contact with the back of the animal (Fig. 1, *c*). The surgical tape was then secured in place by using self-adhesive fabric (Mefix, MoInlincke Clinical Products AB, Sweden). This procedure was necessary because Microfoam surgical tape does not adhere to Lexan for prolonged periods of time. Two small strips of surgical tape were used to join the two closest corners of the dome (Fig. 1); this latter procedure allowed retention of the shape of the dome. The anterior and posterior openings of the dome were covered with a piece of self-adherent, semipermeable membrane (Tegaderm, 3M Health Care) (Fig. 1, *d*). Strips of dental rubber dam (VWR Canlab, Mississauga, Ontario, Canada) were then attached to the lower edges of the dome by using self-adhesive fabric (Fig. 1, *e*); this procedure prevented contamination of the sterile surgical site by environmental matters (e.g., feces, wood chips).

Four 3.5-cm disks of self-adherent Velcro (hooks and pile; Velcro Canada, Brampton, Ontario, Canada) were cut in half. Two half-moons of Velcro (hooks) were applied firmly to the posterior portions of the dome, with the cut edge oriented toward the anterior of the dome (Fig. 1, *f*); this was used to secure the hindleg strap. Two half-moons of Velcro (pile portion) were attached to a precut hindleg neoprene strap (3 mm thick, 931-Skin, stock G-231; Rubatex, Roanoke, Va.) (Fig. 2, *a*). One narrow strip of Velcro (pile) was then applied

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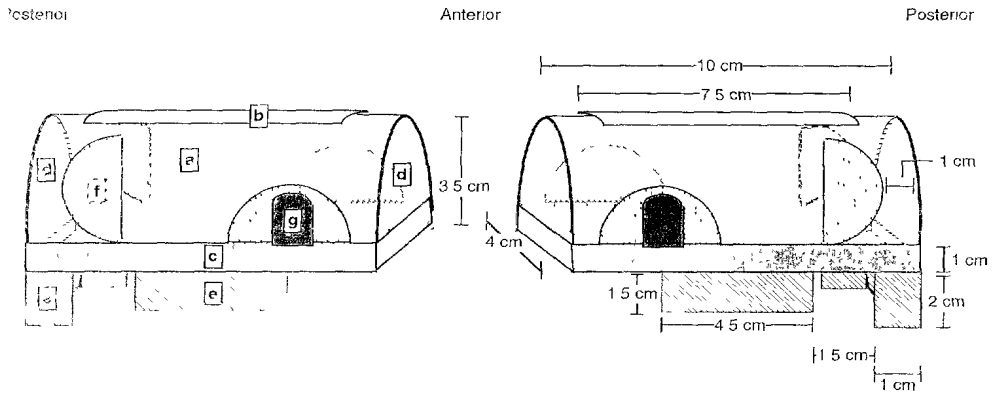

FIG. 1 Design and specifications for clear wound shield. (*a*) Lexan dome, (*b*) nonadherent dressing covering the top window, (*c*) surgical tape providing padding to the edge of the dome, (*d*) transparent dressing to close off the posterior and anterior portions of the dome, (*e*) rubber dam skirt, (*f*) self-adhesive Velcro to secure the hindleg strap, (*g*) adjustable self-adhesive Velcro fastener to secure the chest strap

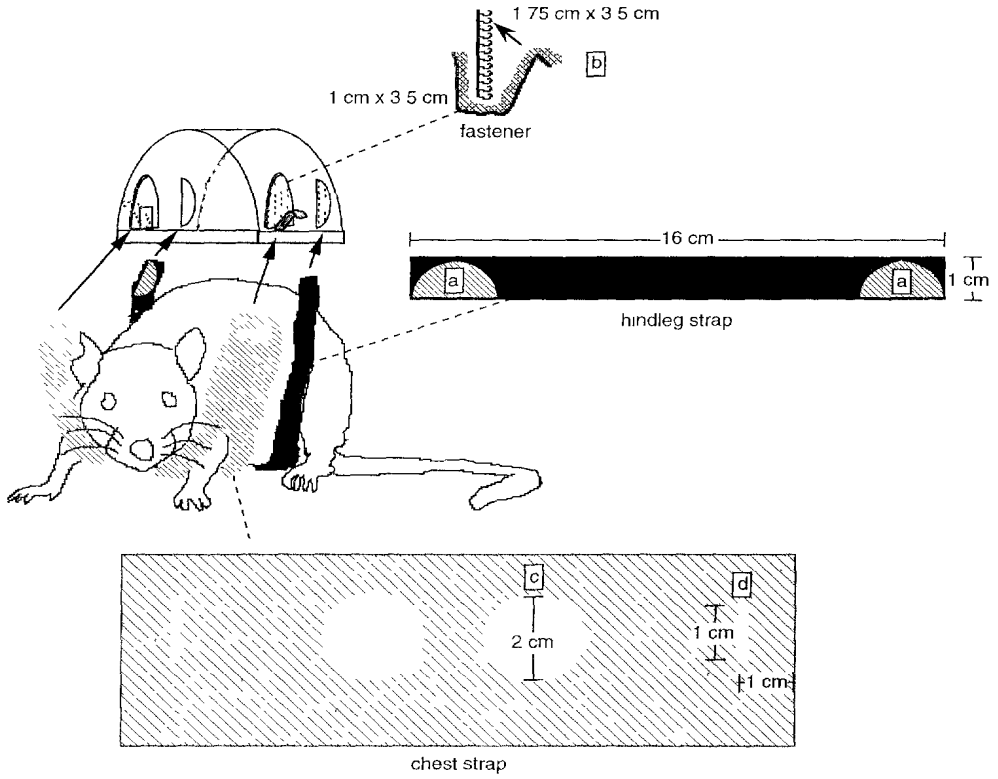

FIG. 2 Location of the dome on the experimental animal. For the sake of clarity, the rubber dam skirt was removed from the lower edge of the dome. (*a*) Self-adhesive Velcro to secure the hindleg strap to the posterior portion of the dome, (*b*) adjustable self-adhesive Velcro fastener to secure the chest strap, (*c*) stretchable openings for the forelimbs, (*d*) slits for inserting the fastener of the dome and securing the chest strap

to each of two half-moons of Velcro (hooks), forming a fastener used to secure the chest strap (Fig. 2, *b*). The fasteners were applied firmly to the proximal ends of the dome, with the cut edge oriented toward the bottom of the dome (Fig. 1, *g*). A chest strap was made of self-adherent bandage (Coban, 3M Health Care). Slits were made in the chest strap and rolled out to accommodate the rat's forelimbs (Fig. 2, *c*); another slit was made to secure the chest strap to the fasteners (Fig. 2, *d*).

Each dome could be assembled in 25 min-

utes (excluding heating and cooling periods), weighed approximately 16 g, and cost approximately US$0.90/unit. Its use enabled us to keep large surgical sites (e.g., 15 to 20 percent total body surface area skin defect) sterile for at least 28 days. The rats were mobile and did not seem otherwise stressed. However, there may have been some reduction in feeding activity, as suggested by a 3 percent reduction in body weight in three healthy, dome-wearing rats after 7 days compared with free-ranging animals (unpublished data). Although this dome was used in large rats (400 to 475 g), it could be easily modified to accommodate smaller rodents.

In summary, we believe that this easily built and inexpensive wound shield is easy to use, allows a clear view of the healing surgical site, and may be useful in those experimental designs precluding the use of wound shields in direct contact with the dorsal surgical site.

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