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BRIEF COMMUNICATION

An Economically Constructed and Durable Intracerebral Cannula System for Small Rodents[1]

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PATTERSON, T. A., M. C. ALVARADO, D. H. SAKAI, M. R. ROSENZWEIG AND E. L. BENNETT. *An economically constructed and durable intracerebral cannula system for small rodents.* PHARMACOL BIOCHEM BEHAV 25(2) 487–489, 1986.—An easily constructed cannula system is described for applying experimental substances to the brain of freely moving mice. Stainless steel tubing surrounded by a nylon insulator cap glued to the skull provides an economical and durable system which requires little preparation.

Intracerebral cannula Small rodents Intraventricular injections Unrestrained animals

A dependable and economical system for intracerebral cannulation is a necessary requirement for successful research involving intracerebral administration of experimental substances in unrestrained, freely moving animals. However, implantation of intracerebral cannulae in small rodents is a difficult task. The thin, curved skull and small cranial area of the mouse restricts the use of anchoring screws, which often results in the loss of skull caps before successful intracerebral injection can take place. A number of cannula systems have been proposed by various authors (e.g., [1–3]), but few are designed for the small skull of the mouse, and they can be quite complex and time consuming to prepare. The present report describes the preparation of a chronic intracerebral cannula system that is economical, easy to contruct and very reliable to use.

DESIGN AND CONSTRUCTION

The cannula system is basically an inner cannula constructed from 23 ga stainless steel tubing (although other gauges may be used) and an outer anchoring shell consisting of a small nylon screw insulator, 1.9 mm in diameter. The tubing is cut into 13 mm lengths by nicking the tubing with a rotary file, then snapping the tubing at the site of the nick. The nylon screw insulators (Small Parts, Inc., item IN 2/2) do not require any preparation, although the bottom can be lightly sanded for better adhesion. After placement of the cannula, the screw insulator is glued to the skull surrounding the cannula, while the space between the cannula and screw insulator is filled with dental acrylic (see Fig. 1).

Because the cannulation procedure takes only five to seven minutes, mice can be anesthetized using methoxyfluorane (Metofane), which is a fast and effective inhalant anesthetic. Metofane (0.5–1.0 ml) on cotton placed under a watch glass at the bottom of a small jar is an efficient anesthetic dose. Mice become deeply anesthetized after about three minutes exposure to the Metofane and can be kept anesthetized for the duration of the surgery by application of very small quantities of Metofane to a cotton ball in a nose cone around the mouse's nose. Mice usually recover completely from the Metofane anesthesia by 15 minutes post surgery.

Once anesthetized, the mouse is placed in a small rodent stereotaxic instrument. During surgery, the eyes and skin of the mouse should be protected by a plastic or parafilm screen. Using sterile surgical equipment, the scalp is deflected and a small hole is drilled in the skull over the cannulation site. The cannula is held in position by a guide needle fastened to the electrode holder attached to the stereotaxic instrument. The screw insulator should be placed around the cannula and guide needle before they are fastened to the electrode holder and should be held up out of the way with a small amount of clay or similar substance (see Fig. 2).

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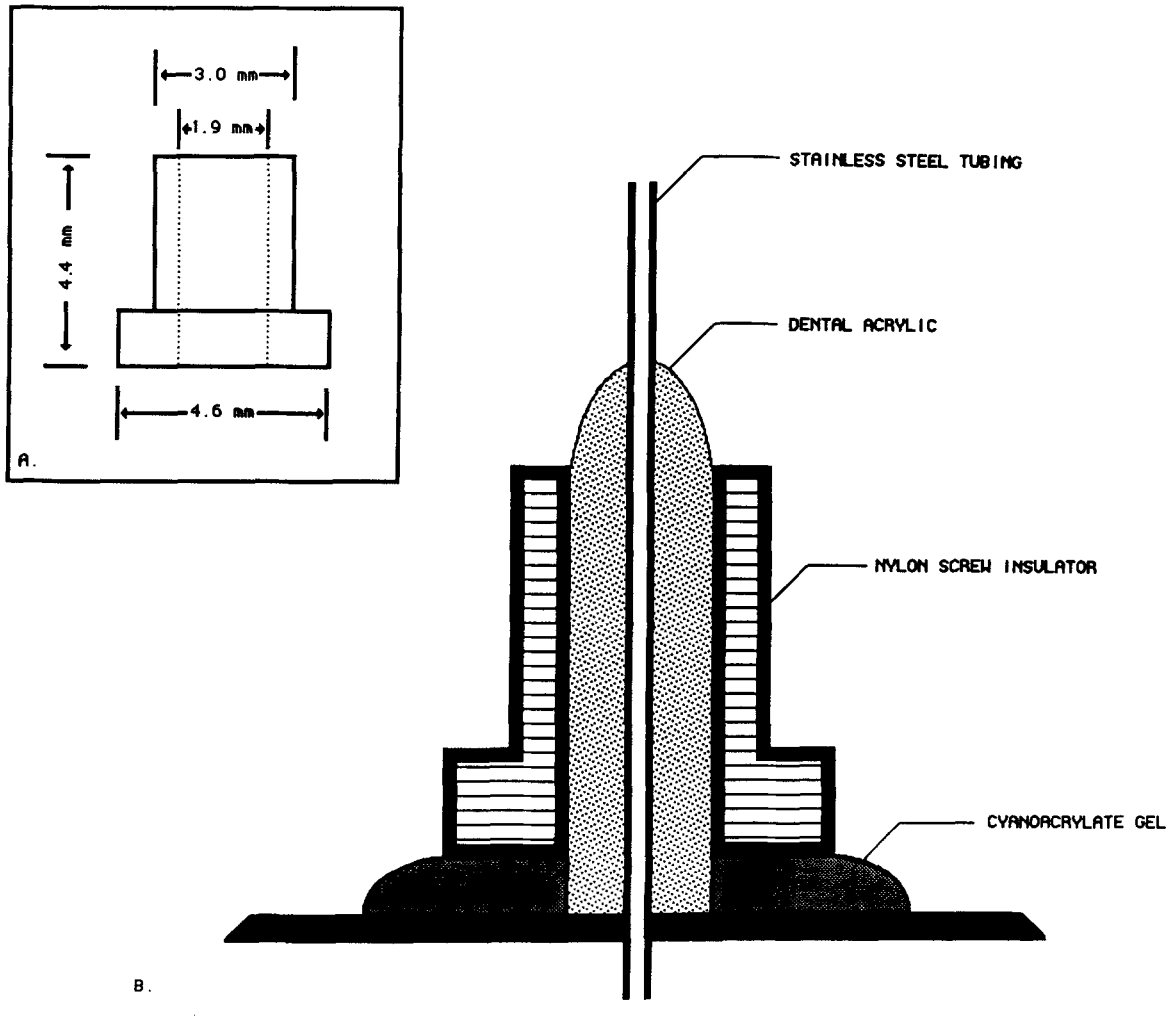

FIG. 1. (A) Appearance and dimensions of screw insulator. (B) Cross section of cannula assembly. For details see text.

At this step it is important that the skull surface surrounding the drill site be dry. A cotton tipped applicator frequently wiped around the drill site will keep the skull dry. After placement of the cannula, the screw insulator is dropped down around the cannula and glued to the skull surface with cyanoacrylate adhesive gel (e.g., Krazy Glue gel). This secures the screw insulator to the skull. Dental acrylic is then placed between the cannula and the screw insulator, securing the cannula to both the screw insulator and the skull. The surrounding skin can be brought up over the base of the screw insulator and sutured if necessary.

Once the acrylic has set, an insect pin (31 gauge) is placed inside the cannula to prevent blockage during the recovery phase after surgery. Mice are quite adept at removing insect pins from the cannula, so for added security, a small amount of paraffin can be melted around the head of the insect pin where it meets the cannula.

The cannula system described above is primarily for intracerebroventricular or unilateral injections. By using a larger screw insulator (larger sizes are available) and modifying the placement procedure slightly, bilateral cannulations can be made. If widely placed injection sites are used, it is possible to use two small screw insulators, although the small skull size of the mouse would prohibit placement of two screw insulators side by side.

Intracranial injection of unrestrained miee can be achieved in the standard manner. After removal of the insect pin, a 31 ga needle is placed into the cannula. A plastic stop on the needle can ensure accurate delivery of the needle tip to the appropriate location in the brain. The length of the injection needle is determined by the length of the cannula and the distance of the projected site of injection from the tip of the cannula. Before placement, the length of the cannula should be measured to ensure that the injection needle will have the correct depth during injection. If the mouse is to be reinjected at a later date, the insect pin should be placed back into the cannula between injections.

This system has many advantages, especially when a large number of mice must be cannulated. The cannula system takes little time to prepare and the necessary items are inexpensive. Anesthesia time is kept to a minimum and mice tolerate the surgery and cannula system remarkably well. If care is taken when the glue and dental acrylic are applied, few cannulae will be lost following surgery. Post mortem examination shows no infection due to the cannula assembly and no damage to the skull or tissue near the cannulation

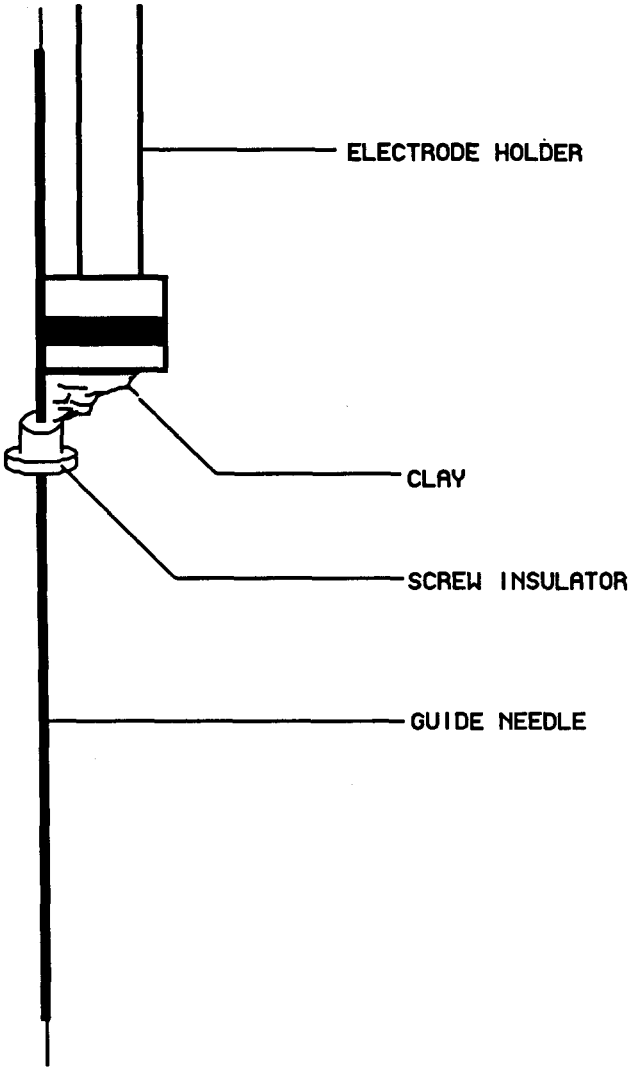

FIG. 2. Attachment of screw insulator to electrode holder and needle guide.

site. Although the maximum durability of the cannula system has not been measured, the cannulae have lasted for the maximum duration of experiments performed in this laboratory, which is four weeks. This system is durable enough to withstand any tension produced during injection of unrestrained, freely moving animals.

NOTE ADDED IN PROOF

We have recently used this cannula system to implant bilateral intrahippocampal cannulae in mice. Removal of one side of the bottom edge of each screw insulator allows placement of each cannula assembly side by side.

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