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BRIEF COMMUNICATION

Simple Flow-Thru Swivel for Infusions into Unrestrained Animals

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BROWN, Z. W., Z. AMIT AND J. R. WEEKS. *Simple flow-thru swivel for infusions into unrestrained animals.* PHARMAC. BIOCHEM. BEHAV. 5(3) 363–365, 1976. – Infusion of fluids into unrestrained animals requires the use of a flow-thru swivel. A method is described for the construction of a simple efficient swivel assembled from disposable plastic syringes and needles.

Swivel Flow-thru Infusions Unrestrained animals

EXPERIMENTS dealing with administration or infusion of fluids into relatively unrestrained animals require the use of a water-tight flow-thru swivel. A swivel designed specifically for this purpose (No. 191-03, BRS/LVE, Beltsville, Maryland 20705) functions well but is very expensive. Smith and Davis [2] describe modification of other commercial swivels to suit this purpose as well as construction of a relatively inexpensive swivel designed by W. F. Crowder. Pickens and Thompson [1] describe construction of an inexpensive swivel. These swivels, although they can be constructed without services of a machinist, require purchase of special parts and some tool fabrication.

We describe here the construction of a simple, efficient swivel which can be assembled by hand from materials commonly available in any laboratory at a negligible cost. Several of these swivels have been tested in drug self-administration experiments with rats and after more than 3,500 hr of use all have continued to function without leakage under pressure and continue to rotate freely.

GENERAL

The swivel is illustrated in Fig. 1. A 3 ml disposable syringe is the body of the swivel and a 22 ga hypodermic needle rotates and forms the bearing. The rubber tip from the plunger of a 1 ml disposable syringe serves as a rotating shaft seal. Fluid is carried through the seal on 24 ga hypodermic tubing which is held in place using the rubber tip from the plunger of the 3 ml syringe. Connections to the swivel may be conveniently made using size PE 20 polyetheylene tubing with the ends reinforced by shrinkable tubing [3].

The completed swivel may be conveniently mounted using a thermometer clamp (Fisher Scientific Co. 5-809) or something comparable (Fig. 2).

Materials

Materials and dimensions will be described for those used in our laboratory. Similar materials may be used although dimensions may have to be altered slightly. The parts needed are one each of the following, all from Becton, Dickinson Co., Rutherford, New Jersey 07070: 3 ml Plastipak disposable syringe (5585 or 5586), 1 ml Plastipak disposable syringe (5602), 22 ga Yale disposable needle 25 mm (5155), 24 ga hypodermic needle minimum 30 mm (1036 or 1037) and 13 ga hypodermic needle (1110). Epoxy adhesive (any brand) and Dow-Corning silicone stopcock grease (optional) are also needed.

Assembly

Cut off the point of the 22 ga needle and taper the end by twirling against the side of a cutting wheel, then slightly flatten the end to remove sharp edges by holding the needle vertically and rubbing against a fine grinding stone (see Weeks [3], Fig. 2-F).

Remove any debris or inside burrs with a stylet cleaning wire and flush with water. Cut the tubing from the hub of the 24 ga hypodermic needle and similarly taper and flatten

both ends. Remove the plunger from the 1 ml syringe and cut the barrel 1.8 cm from the tip (at the 0.15 ml graduation). Clean any debris from the cut edges. Remove the rubber tip from the plunger and insert it into the barrel backwards. Fill a 3 ml disposable syringe with Dow-Corning stopcock grease, attach a 22 ga needle (prepared as above), insert the tip of the needle into the space between the two ridges and fill it with stopcock grease, making certain there are no air spaces left. Wipe off excess grease. (The grease prevents compression of air trapped in this space should there be resistance to flow of solution through the swivel. If very accurate delivery is not required, stopcock grease may be eliminated). Rotate the cut end of the 1 ml syringe barrel near a small gas flame or soldering iron until the plastic has melted evenly back to the plunger tip, remove from the heat and roll between one's finger and the bench top to crimp the plastic and lock the rubber tip in place. The center of the rubber tip must remain exposed.

Grasp the 24 ga tubing piece with hemostatic forceps, insert it through the Luer tip of the 1 ml cut syringe and, keeping it centered both in the rubber tip and syringe tip, force through the rubber. Pass a stylet wire through the needle tubing, and remove the tubing leaving the stylet wire in the tip. (If the swivel is to rotate freely, the 24 ga tubing must pass precisely through the center of the rubber plunger tips. The wire will serve as a guide for later passing the 24 ga tubing from the other side). Connect the cut 22 ga needle to the cut 1 ml syringe barrel and seal the joint with a small bead of epoxy glue. (Application of the epoxy glue can be facilitated by using a 5 ml disposable syringe with a 20 ga rounded hypodermic needle). Allow the glue to harden.

In a manner similar to that described for the 1 ml syringe, remove the plunger tip from the 3 ml syringe, and cut the barrel 4.7 cm from the tip (at the 2.2 ml graduation). Drill a hole about 4 mm in dia. in the wall of the 3 ml syringe barrel approximately 3.7 cm from the tip (at the 1.55 ml graduation). This hole will allow viewing of the internal components of the swivel to check for leakage. The hole should be covered with tape to keep out dirt and spilled fluids.

Using a hemostatic forceps, grasp the 24 ga needle tubing, insert into the inside of the rubber tip from the plunger of the 3 ml syringe, and force it precisely through the center. Between 4.5 and 5 mm of tubing should project from the rubber tip. Slide the 24 ga tubing over the wire protruding from the 1 ml plunger tip and force the tubing through the tip. Carefully insert the assembly into the cut barrel of the 3 ml syringe and push down the rubber plunger into the 3 ml syringe barrel until the hub of the 22 ga needle rests against the inner end of the 3 ml syringe barrel. Pass a stiff wire or needle through the hole in the barrel and adjust position of the 3 ml plunger tip so that there is about 0.5 mm clearance between the rubber tips. Check that the 24 ga tubing is still properly placed and readjust if necessary. The tip of the 24 ga tubing will lie just within the 1 ml syringe tip and the air entrapped can then be flushed out readily. Remove stylet guide wire.

The cut end of the 3 ml syringe barrel should now be about 2 mm beyond the end of the rubber plunger. Fill the lumen of the plunger tip and the space above it with epoxy glue, thus cementing together the 24 ga needle tubing, the rubber plunger and the inner wall of the cut barrel of the 3 ml syringe. Allow the epoxy glue to harden.

Using the plastic tip protector supplied with the 1 ml syringe, a torque arm can be constructed. As close as possible to the closed end of the tip protector drill a hole that will accommodate a 13 ga needle. Cut a 2.5 cm length of the 13 ga hypodermic needle with one end on about a 45°

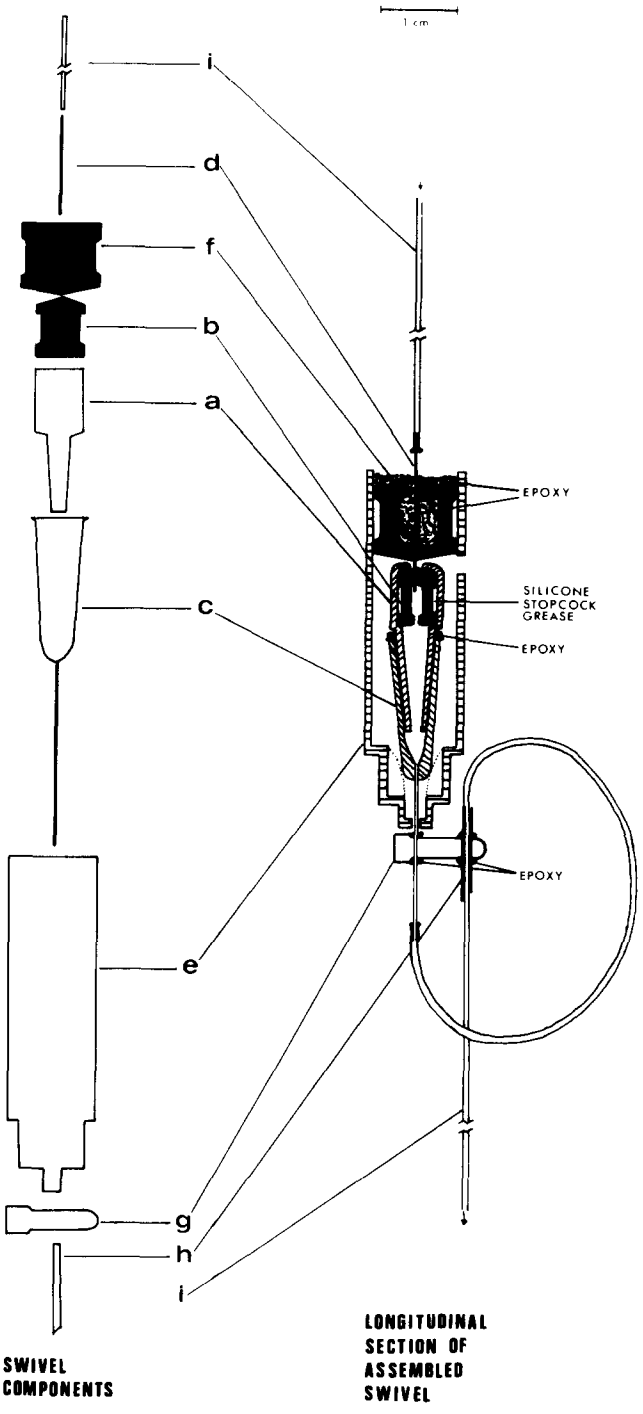

FIG. 1. Construction of a flow-thru swivel. (a) Cut barrel of a 1 ml disposable syringe. (b) Rubber plunger tip from the 1 ml syringe. (c) 22 ga disposable needle. (d) 24 ga hypodermic tubing. (e) Cut barrel of a 3 ml disposable syringe. (f) Rubber plunger tip from the 3 ml syringe. (g) Plastic protector tip from the 1 ml syringe. (h) 13 ga hypodermic tubing. (i) Polyethylene connecting tubing.

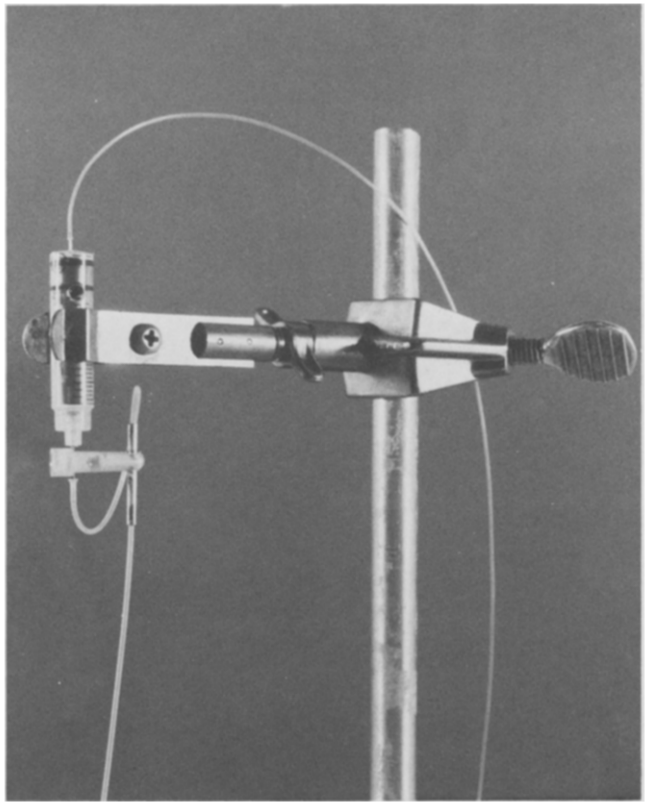

FIG. 2. An assembled swivel mounted and ready to use.

bevel, grind the ends smooth and force it halfway into the hole drilled in the tip protector. At the opposite end of the tip protector drill two small holes to accommodate a 22 ga needle. Using hemostatic forceps, grasp the 22 ga needle protruding from the assembled swivel and force it through these latter holes. Slide the tip protector up the shaft of the 22 ga needle of the swivel to a point approximately 2 mm from the tip of the 3 ml syringe barrel. A small amount of epoxy may be used to secure the 13 ga and the 22 ga needle tubing to the plastic torque arm. Allow epoxy glue to harden.

Optional Connector

If the swivel is to be used with rat saddles having a 1/4 in. set-screw collar for mounting (as No. 191-10 BRS/LVE, 5301 Holland Drive, Beltsville, MD 20705), make an adapter from 1/4 in. brass rod. Cut 11 mm long, drill a hole 0.8 mm (No. 69 drill) length-wise through the center, enlarge the hole to 1.1 mm (No. 57 twist drill) and 4 mm deep, then drill another hole on the side at the enlarged end and tap for a 4-40 (or 3 mm) set-screw. Cut an 11 mm length of 19 ga thin wall hypodermic tubing, insert into the adapter, and slide over the 22 ga needle until there is only minimal clearance between the adapter and the tip of the syringe. Tighten the set-screw until the 19 ga tubing is squeezed firmly against the 22 ga tubing, but not so that it is crushed. The 19 ga tubing prevents excessive flexing of the 22 ga tubing with movement of the rat. Additional materials may be obtained from Small Parts, Inc., 6901 NE Third Ave., Miami, FL 33138: No. ZRB-4 brass rod, No. SSX-440-2 stainless steel set-screw, and HTX-19TW hypodermic tubing 19 ga thin wall.

INSTRUCTIONS FOR USE

When filling the swivel with fluid or when solutions are being changed, air bubbles or residues of previous solutions may be eliminated by holding the swivel upside down and tapping it during filling. If there is difficulty in removing any air trapped in the 1 ml syringe rubber tip, attach a disposable syringe to the 24 ga needle inlet with a length of polyethylene tubing, flush with water, put the 22 ga needle outlet under water, occlude with a finger, pull a vacuum on the syringe (which will expand and dislodge small bubbles), release the occlusion and again flush.

When attaching connecting tubing to the inlet and outlet tubing of the swivel, grasp the needle tubing with hemostatic forceps so as not to exert force on the internal components of the swivel. The polyethylene tubing attached to the outlet needle of the swivel is looped and threaded through the 13 ga hypodermic tubing of the torque arm. A coil spring (Part No. 23217, Kalart, Victor Corp., Hultenius St., Plainville, Connecticut 06062) or other shielding material around the outlet tubing may be attached to the 13 ga tubing on the torque arm.

Although these swivels should continue to function properly for long periods of time, they should be checked periodically for leakage and friction that may develop with extensive use.

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