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A MODIFIED BLOW-GUN SYRINGE FOR REMOTE INJECTION OF CAPTIVE WILDLIFE

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Abstract: A modified syringe capable of automatic injection and suitable for use with a blow-gun is described. The syringe has been used successfully with white-tailed deer (*Odocoileus virginianus*) under confined conditions. Desirable characteristics for blow-gun syringes are discussed.

INTRODUCTION

Experimentation with wild species under close confinement is increasing in wildlife research. Often it is desirable to administer drugs intramuscularly for immobilization or as medication. To minimize disturbance or trauma to experimental animals, a remote injection system that is efficient, versatile, and economical is needed. Described herein is a modified blow-gun syringe capable of automatic injection which should be useful in many research efforts on animals in close confinement. A brief review of the several designs available for remote injection of captive animals with blow-gun syringes is also presented.

MATERIALS AND METHODS

A completed syringe is shown in Fig. 1. The following materials or similar substitutes are required:

- (1) 10 ml plastic disposable syringes with Luer-lok tip (B-D No. 5640).[□]
- (2) 16 gauge disposable needles, 25 mm long (B-D No. 5197).
- (3) 20 gauge disposable needles, 38 mm long (B-D No. 5176).
- (4) Rubber stoppers from 15 ml evacuated blood tubes or other pliable rubber stoppers 15 mm in diameter and 10-15 mm long.

- (5) Size No. 5 cork stoppers (22 mm long, 17 mm top diameter 13 mm bottom diameter).
- (6) Rubber tubing with 4 mm wall thickness.
- (7) Size No. 4 cork borer (7 mm diameter).
- (8) Electric drill and size No. 54 (0.1397 mm or 0.0055 inch) drill bit.
- (9) Yarn and epoxy resin glue.

Construction of the Blow-Gun Syringe

Cut the plastic handle from the withdrawn syringe plunger, leaving the anterior plastic handle attachment. This plunger is the mobile plunger. Insert the pliable rubber stopper into the syringe behind the mobile plunger and force both down the tube of the syringe, leaving a 12 mm distance behind the rubber stopper. Secure the rubber stopper in place by driving a 20 gauge needle perpendicular through the syringe and stopper. Cut both ends of the needle flush with the outer body of the syringe and file smooth. Cut the plastic finger flanges from the syringe so that the back of the syringe is well-rounded.

Preparation of the needle has been described by Haigh and Hopf³ and is only summarized here. Drill a lateral hole about 13 mm (0.5 inch) from the

[□] Becton, Dickinson and Co., Rutherford, New Jersey 07070, USA.

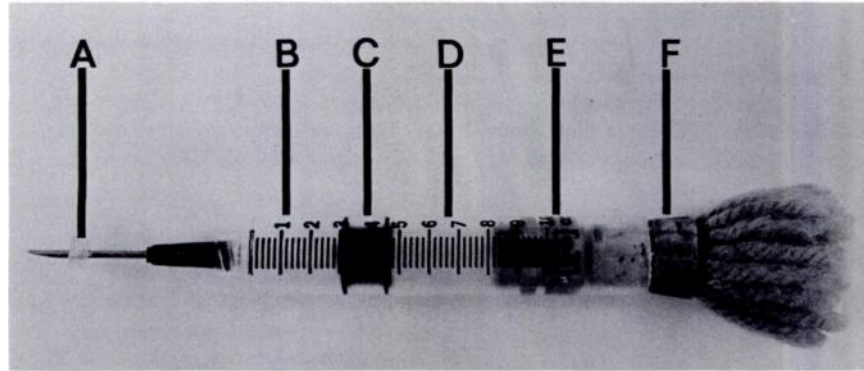


FIGURE 1. Syringe-dart. A - Rubber needle sleeve occluding lateral hole. B - Solution chamber. C - Mobile plunger. D - Pressurizing chamber. E - Fixed rubber stopper. F - Fletching cork.

needle tip. Fill the needle tip with epoxy glue, taking care not to occlude the lateral hole. Cut out a rubber circle from the wall of the rubber tubing with the No. 4 cork borer. This rubber circle is used as the needle sleeve.

Cut a hole approximately 6 mm (0.25 inch) deep in the top of a cork stopper to be used for the fletching cork. Glue 34-40 strands of yarn, each 25-38 mm (1-1.5 inch) long, inside the hole with epoxy.

Procedure for Loading and Pressurizing the Blow-Gun Syringe

Mount a prepared needle on a completed blow-gun syringe with the rubber sleeve pushed back to the base of the needle. Mount a 20 gauge needle, 38 mm long on a second ("pressurizing") syringe and insert the needle through the back of the fixed rubber stopper of the blow-gun syringe. The needle tip should be located inside the pressurizing chamber. Thus, when the needle of the blow-gun syringe is inserted in a drug or medication vial and the plunger of the pressurizing syringe is withdrawn, the solution chamber of the syringe will be filled directly. The amount of drug or medication in the solution chamber is adjusted by pushing or pulling the plunger of the

pressurizing syringe. The blow-gun syringe is now ready to be pressurized.

Slide the rubber needle sleeve forward to occlude the lateral hole of the needle. At this point, the 20 gauge needle is detached from the pressurizing syringe but left inside the fixed rubber stopper of the blow-gun syringe. Withdraw the plunger of the pressurizing syringe to its limit (filling it with 10-12 ml of air) and reattach it to the 20 gauge needle still inside the fixed rubber stopper. Depress and hold the plunger of the pressurizing syringe and then immediately pull the blow-gun syringe away from the pressurizing syringe and needle. Thus, the air in the middle chamber of the blow-gun syringe will be compressed. The pressurizing syringe's plunger must be kept completely depressed while removing the blow-gun syringe. Finally, attach the fletching cork.

The blow-gun syringe is now ready for use. A 1 m long piece of 19 mm diameter (0.75 inch) polyvinyl chloride water pipe is utilized as a blow-gun. A sleeve junction attached to one end of the pipe functions adequately as a mouth piece. A short, forceful breath is used to propel the syringe. Upon striking the animal, the rubber sleeve slides backwards, remov-

ing the occlusion over the lateral hole. The compressed air in the pressurizing chamber then forces the mobile rubber plunger forward, rapidly injecting the solution. The actual speed of injection depends on solution volume and viscosity as well as the volume of compressed air injected in the pressurizing chamber. The syringe hangs from the animal after injection and falls out due to its own weight within a few minutes.

DISCUSSION

Effective methods for remote injection of liquids are available commercially.^[2] However, the noise originating from the powder or CO₂ charge and the trauma that can be inflicted sometimes makes their use in controlled, experimental situations prohibitive. These characteristics are especially undesirable when repeated injection of individual animals over long periods of time is required. The blow-gun syringe is ideally suited for these situations.

Several variations of the basic blow-gun syringe described herein for remote injection at short distances (up to 20 m) have been reported. Brockelman and Kobayshi² developed a blow-gun syringe for immobilization of non-human primates. They utilized 1 ml tuberculin syringes with 15 gauge needles filed to 3 mm length. A movable brass weight drove the front plunger forward on impact, thereby forcing the liquid out. A second complete plunger was used to aid in propelling the syringe and to stabilize its flight. Disadvantages of this design include possible liquid loss from the needle tip, limited volumetric capacity, as well as repeated injections sometimes being necessary to deliver the desired dose.

A major recent development in the design of blow-gun syringes (i.e., the use of pressurized gas or air as the injecting

force) seems to have been developed simultaneously by several investigators. Haigh and Hopf³ utilized butane gas as the injecting force for their blow-gun syringe. Their design employed 3 ml disposable syringes and 16 gauge, 3.7 cm long needles with blocked tips and laterally drilled holes. A second, secured plunger base, to which were attached several strands of wool, served to contain the butane gas in the pressurizing chamber and to stabilize the syringe. Upon penetration, the occlusive tubing over the needle's lateral hole slid backwards and the expanding butane provided the injecting force for the liquid. Haigh and Hopf³ further considered that greater or lesser volume syringes and correspondingly different sized pipes could be used as needed.

Bubenik and Bubenik's¹ design employed compressed air as the injecting force for their blow-gun syringe. They utilized 3 ml Luer-lok tip syringes fitted with 18 gauge needles. Two lateral holes were drilled in the needle. The first, 7 mm from the tip, served to secure a strong nylon filament embedded in epoxy glue as a needle barb. The second, 12 mm from the tip, functioned as the lateral injection hole. Two thin layers of tubing inserted over each other were used as the needle sleeve. A plunger handle from a second syringe was inserted in a rubber stopper and secured (in an unspecified manner) to the rear of the syringe to act as a stabilizer during flight. They report having used barbed needles for remote injection of immobilizing drugs and plain needles for antibiotics, hormones or vaccines. Bubenik and Bubenik¹ also considered the use of larger and smaller syringes and pipes if necessary. Syringes were repeatedly used 10 to 20 times and needles for 10 to 15 injections.

Wentges,⁵ Wiesner,⁶ and Ruedi and Vollm⁴ all describe their use and experiences with the commercially-

[2] Paxarms syringes and projectors; Paxarms Ltd., P.O. Box 317, Timaru, New Zealand.

[3] Cap-Chur equipment; Palmer Chemical and Equipment Co., Inc., Box 867, Douglasville, Georgia 30134, USA.

available Telinject[®] blow-gun syringe. This design also employed compressed gas/air as the injecting force, Luer-lok syringe tips, and a terminally-sealed needle with occluded lateral hole. A tuft of wool was used for flight stabilization. Two blow-guns, 1.2 m and 2.0 m long, were provided for short or long-range administration. The Telinject[®] blow-gun syringe is described as having a maximum capacity of 2.7 ml. Ruedi and Vollm⁴ indicated, however, that 5 ml capacity syringes were being developed.

All previously discussed devices are filled by a separate syringe containing the desired dose. The blow-gun syringe needle is then attached before it is pressurized for use. The method of preparation described herein provides direct filling of the blow-gun syringe, thereby preventing the possibility of air embolism. Other characteristics deemed desirable for a blow-gun syringe based on the designs reviewed are:

- (1) For construction, disposable polypropylene syringes with Luer-lok tips are most desirable. These syringes are inexpensive, lightweight, and sturdy. They permit reuse, if desired, and the Luer-lok tips are less likely to break off during or after impact.
- (2) Pressurized air is the most desirable of those injecting forces available. It is less dangerous and less costly than butane gas and adds no weight compared to sliding brass weights. Greater volumes of air can be injected if more rapid injection is desired.
- (3) Large diameter rubber needle sleeves are more easily forced backwards upon impact than fine tubing, thereby perhaps permitting quicker, more efficient injection. Both still

effectively occlude the lateral hole, however.

- (4) Variability in size is a necessary characteristic for blow-gun syringes. Although some immobilizing drugs can be used effectively in small volumes, most medications must be used in larger volumes. In addition, smaller syringes are necessary so as to ensure minimal trauma to smaller mammals or birds.
- (5) Variability in needle size is also desirable. Larger gauge needles can be used to provide even faster injection or for animals with tough hides. Shorter, smaller gauge needles can be used for small or lean animals, whereas longer needles may be required for mammals with great amounts of subcutaneous fat. Shorter needles will fall out faster and risk incomplete injection, however. Barbed needles do not seem to be required, but can be used if identification of injected animals is necessary, although greater tissue damage will necessarily result from the needle. Needles can be reused less frequently than syringes as needle sharpness is imperative to achieve quick, efficient penetration and injection.
- (6) Either wool fletching or the plunger handle from a second syringe seem to function adequately for flight stability. However, wool fletching not only adds less weight than the plunger handle, but also does not necessitate that two syringes be used to construct one blow-gun syringe.

The blow-gun syringe described herein meets all of the above requirements and has been used successfully for remote injection of captive white-tailed deer with up to 5 ml of Combitic[®] or Diathal[®] at

[®] Telinject; L.C. Kullmann, D-6700 Ludwigshafen, West Germany.

[®] Pfizer, Co., New York, New York 10017, USA.

[®] Schering Corp., Kenilworth, New Jersey 07033, USA.

distances of up to 10 m. It was also employed for immobilization of 7 deer with Rompun[®] every 4 weeks during a 13-month long experiment. Injections were placed in the hind-quarter or rump region with misses accounting for approximately 10% of the shots taken. Greater range and accuracy can be achieved by use of a longer pipe. In addition, dilution of the liquid to be injected with physiological saline or other carrier to a standard volume will overcome weight and trajectory variations caused by different volumes and may provide greater accuracy.

The disadvantages to the blow-gun syringe system include its limited range and limited force of impact for injecting large animals with relatively thick skins. However, in a sense, it is these very disadvantages that make the blow-gun syringe ideally suited to controlled, experimental situations where minimal disturbance and trauma are required. The blow-gun syringe ensures safe, non-traumatic, remote injection under close, controlled conditions not necessarily afforded by powder or CO₂ charged devices. It also affords greater versatility and range than provided by pole-syringes.

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[®] Haver-Lockhart Laboratories, Shawnee, Kansas 66201, USA.