TECHNICAL NOTE

A MODIFIED SHOCK-DELIVERY SYSTEM FOR QUAIL

Research with pigeons has been extended to quail (e.g., Cloar and Melvin, 1968; Gardner, 1969; Stettner, 1967). However, investigations of shock punishment on the quail's operant or species-typical behavior are absent from the literature, partly because it is difficult to administer faradic shock. With the following modifications, however, Azrin's (1959) technique is applicable to bobwhite quail (*Colinus virginianus*).

Azrin (1959) recommended looping a 5-cm strand of 20-gauge wire around each pubis bone of the pigeon. Since quail are smaller than pigeons, their pubis bones are more flexible and less protruding. Our efforts to secure a wire loop around the quail's pubis bones failed. Consequently, a 30-gauge stainless steel wire was threaded on a 2.0-cm circular cutting needle (Anchor Brand, size 1830-1), and pushed through the bone. Anesthetization with methoxyflurane inhalation following Gandal's (1969) procedure eliminated subject movement during the implantation. After anesthetization, the pubic protuberances and the pubic arch between the two bones were plucked of feathers. During the development of this procedure we experienced the problem of some electrodes dislodging weekly. We found these electrodes had been implanted through the caudal end of the pubis, which is composed of cartilage. To hit the pubis bone properly, the needle was inserted 5 to 7 mm from the caudal end of the bone. At this location, the bone is 3 to 4 mm wide and firmly anchors the wire electrode. Four quail have been implanted for as long as three months with only two electrodes requiring re-implantation. Since birds have light, hollow bones, only moderate pressure on the needle was used to penetrate the pubis bone. Once the needle was through, it was removed, and the two ends of wire were tied and twisted together, leaving a 3-cm double strand of wire. This operating procedure is illustrated in Figure 1. The pubis bone was moved less in pushing a needle through it than with looping a subcutaneous wire around the bone. Also, the surgical exposure of the bone required for the subcutaneous loop, reduces the structural support provided by the connecting tissues. With the needle implant technique, the supportive structures were left intact.

Mean time for anesthetic induction and electrode implantation for 32 quail was 12 min. Some bleeding occurred with five quail but was effectively cauterized with the tip of a hot soldering iron. This method did not require sterile operating procedures because of the resistance to infection provided by the quail's high body temperature.

As in Azrin's (1959) technique, each quail was fitted to a heart-shaped suede leather jacket with two wing holes. On the dorsal midline portion of the

jacket, between the wing holes, two stainless steel 5-mm bolts and nuts served as anchoring posts for the shock-source cable. Two Nu-way snap leads, 4 cm apart, were sewn to the outside caudal edge of the jacket, and a 6-cm piece of 22-gauge insulated wire was soldered to each snap. When the jacket was placed on the quail, each snap lead wire was attached to one of the implanted electrode wires by twisting them together. Upon recovery from anesthetization, each quail wore a jacket connected to the implanted electrodes for the three-month duration of the experiment.

Cloar and Melvin (1968) reported bobwhite quail "reacted violently to handling" and were "wary of strange environments". We have observed quail to remain motionless for up to an hour at a time when placed in a novel environment. To prevent this "freezing" during experimental sessions, a wire simulating a shock-source cable was suspended from the roof of each quail's home cage, and implanted quail were allowed to wear their jackets for a week before the experiment. During experimental sessions, metal washers on the shock-source cable were bolted to the jacket, and snaps on the cable were attached to the snaps on the jacket. The electrode implants and jacket did not alter the quails' bodily movements.

The wire electrode was secure, and the quail required no special handling after implantation. To obtain a quantifiable indication of the amount of stress the implanted electrodes would tolerate before dislodging, 12 quail were sacrificed and increasing gradations of weight were attached to the two electrodes. The mean weight at which one or both of the electrodes were dislodged was 1955 g. The average free-feeding weight of the bobwhite quail we have studied was 207 g.

We have not attempted the needle implantation technique with *Coturnix coturnix*, the species of quail discussed by Reese and Reese (1962). The description of *Colinus virginianus* provided by Stoddard (1946) is similar to that of *coturnix* by Fitzgerald (1969), and the gross skeletal anatomy of the pubis bone appears to be comparable for all avian species (e.g., Bradley and Grahame, 1950; McLeod, Trotter, and Lumb, 1964).

The apparatus used for shock delivery passed 115 V ac through a 16-V step-down transformer and into an autotransformer, variable from 0 to 16 V. Shock from the autotransformer was delivered through a 10-K ohm series resistor at durations of 0.50 sec. The mean interelectrode impedance for 18 quail was 1028 ohms, and ranged from 863 ohms to 1158 ohms. With the 10-K ohm series resistor, changes in impedance within sessions varied less than 5%, and impedance across 15 daily sessions varied up to 9%. After seven to 10 daily sessions there was a gradual build up of an encrustation

Fig. 1. (A) Skeletal structure of the pubis bone. (B) Needle is pushed into and pulled out of the bone. (C) Location of implantation on the pubis bone.

Fig. 2. Effect of electric shock on autoshaped key pecking of two quail.

around some electrodes. Whenever the encrustation became visible, Dermassage lotion was applied to the area, and after 3 to 4 hr the lotion was removed with a cotton swab. The donut shape of the encrusted area was bisected with the superficial cut of a pair of Mayo scissors, and the encrusted tissue was carefully torn from the electrode.

Figure 2 shows the effect of shock-punishment on autoshaped key pecking of two quail. Consecutive daily sessions consisted of 30 trials each. The mean inter-trial interval was 120 sec and ranged from 30 to 180 sec. The intertrial interval was signalled by a white key (S^A), and the discriminative stimulus (S^D) was the same key transilluminated for 8 sec by a green light. Simultaneous with termination of the S^D , food reinforcement was presented for 4 sec. Session 1 began when the quail had ceased making any responses during the S^A . In the punishment condition, only the first key peck to the S^D was followed by shock. Shock intensities below 0.80 mA produced no response suppression. During all four punishment sessions, Quail 1 (0.85 mA) made a total of 57 key pecks, 31 of which were punished. Quail

2 (1.7 mA) responded 37 times, 27 of which were punished. In four subsequent autoshaping sessions without shock, the rate of responding for Quail 1 returned to the prepunishment level. Quail 2 ceased responding after the eighth trial in the last punishment session and did not respond again during the 120 trials of autoshaping without shock.

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