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Source: Journal of Avian Medicine and Surgery, 35(1) : 68-74

Published By: Association of Avian Veterinarians

URL: https://doi.org/10.1647/1082-6742-35.1.68

Journal of Avian Medicine and Surgery 35(1):68–74, 2021

Research Brief

Transsinus Pinning to Correct Lateral Deviation of the Upper Beak in Juvenile Macaws

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Abstract: Lateral deviation of the upper beak ("scissor beak" or "wry beak") is a common malocclusion in many species of birds but appears to be a common presentation in macaws (*Ara* species). This article describes transsinus pinning, a procedure in which a pin is passed through the frontal sinuses, turned parallel to the upper beak, and attached to the tip of the beak with an orthodontic rubber band to provide constant tension on the beak as it grows. The tension of the rubber band is maintained until the beak is considered straight. The results of 16 cases in which this beak-straightening procedure was used are presented. The age of the chicks that had their beaks straightened ranged from 7 to 28 weeks, and they were placed into 2 groups: those younger than 12 weeks (12 chicks; 75%) and those older (4 chicks; 25%). Complete resolution was achieved in 87.5% (14 of 16) of the avian patients that were treated with this procedure. The 2 remaining cases (12.5%) failed to fully respond. The 12 younger birds (75%; age, 7–12 weeks; median, 10 weeks; range, 5 weeks) responded to treatment within 2 weeks (12–85 days; median, 14 days; range, 73 days); the remaining 4 older chicks (25%; age, 14–28 weeks; median, 17.5 weeks; range, 14 weeks) required a longer period (13–90 days; median, 25.5 days; range, 77 days) for the beak to straighten. Transsinus pinning is a simple, effective, and rapid technique for correcting this malocclusion in macaw chicks younger than 16 weeks old. With this approach, in most cases, excellent results can be expected in only 2–4 weeks.

Key words: scissor beak, transsinus pinning, maxilla, premaxilla, avian, macaw, *Ara* species

INTRODUCTION

Lateral deviation of the upper beak ("scissor beak" or "wry beak") is a common beak malocclusion in many species of birds but appears, for unknown reasons, to be most common in macaws (*Ara* species).[1–3] The upper beak is deviated laterally and, because the tomia of the rhinotheca and gnathotheca no longer maintain reference interval occlusion, keratin overgrowth of both beaks occurs (Figs 1 and 2). This exacerbates the malocclusion to a state in which the healthy prehension of food may no longer be possible.[2] The lateral beak malocclusion can be present from hatching or develop over a period up to 7 weeks after hatching.[4]

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The avian skull consists of the neurocranium (the braincase and the orbit) and the splanchnocranium (the viscerocranium).[5] The splanchnocranium is the skeleton of the face and consists of the mandible, maxilla, jugal bars, quadrate, palate, and hyoid apparatus. In large species of macaws, the splanchnocranium is loosely attached to the neurocranium at the craniofacial hinge and at the diarthroses of the quadrate and palate bones.[2] The upper jaw comprises the nasal, premaxillary, and maxillary bones.[5] Immediately caudal to the craniofacial hinge, between the nares and the medial canthus of the eye, is the lacrimal bone, which is fused to the frontal bone of the neurocranium (Fig 3).[6] The bones of the splanchnocranium are present at hatching but continue to grow via single ossification centers in the premaxilla and vomer bones and in the paired maxillary, palatine, nasal, jugal, quadratojugal, pterygoid, and quadrate bones.[7] The age at which growth ceases is also undetermined, but my clinical

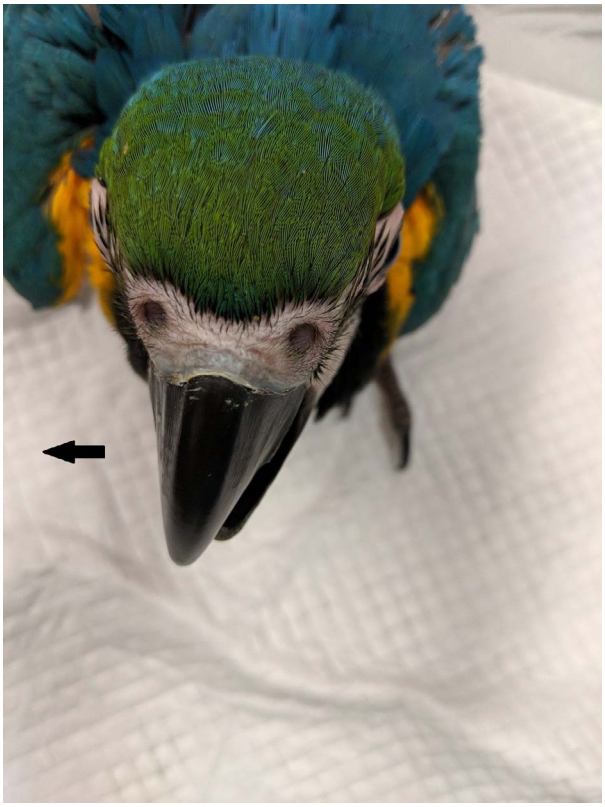

Figure 1. Scissor beak, on presentation of 12-week-old blue and gold macaw, dorsoventral view. The beak has a right deviation (arrow pointing in direction of the beak deviation).

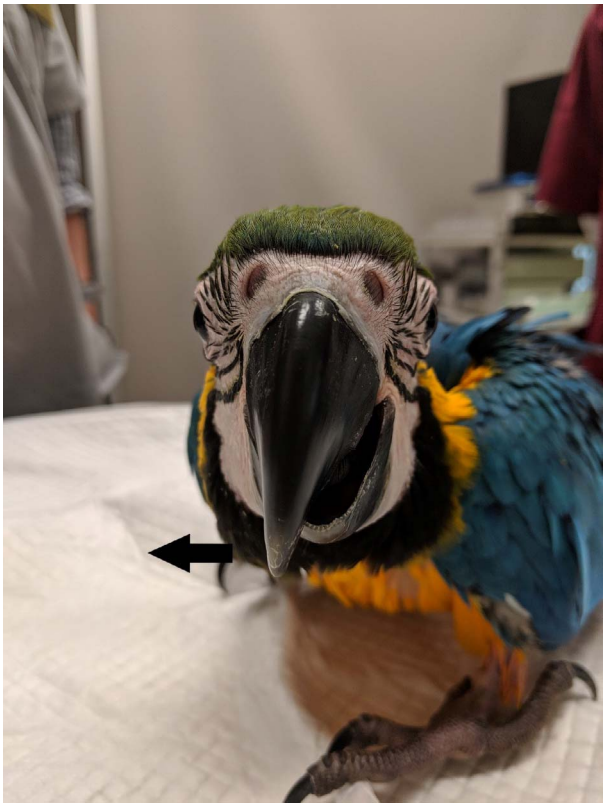

Figure 2. Scissor beak in a 12-week-old blue and gold macaw on presentation, rostral to caudal view. The maxilla deviates to the right (arrow pointing in direction of the beak deviation).

experience suggests that, in macaws, it may be between 14 and 18 weeks.

In my opinion, a lateral deviation of the premaxilla likely occurs in the activity of these ossification center (most likely in the maxilla or premaxilla), which must be unilaterally increased or reduced. The causes of this growth disturbance have not been determined but is considered to be the result of genetic, nutritional, or incubation factors or as the result of hand-feeding practices. Consequently, it has been suggested that feeding from 1 side of the beak only, compressive trauma to the rictus (the caudal oral opening between the angle of the jaw and the rhinotheca) during restraint of the bird's head during feeding, or direct trauma to the rictus and underlying tissues from a syringe tip may be causative factors.[1,2] The author is unaware of any reports of lateral deviation of the upper beak occurring in parent-reared birds.

A variety of corrective techniques for lateral deviation of the macaw upper beak have been described.[3,8,9] These include the application of gentle digital pressure to the upper beak in very young birds,[3] regular beak trimming aimed at restoring reference interval occlusion in mild cases,[3] and acrylic ramps or prostheses on the mandible in more-advanced cases.[3,8,9]

Figure 3. Blue and gold macaw skull showing the jugal (J), lacrimal (L), maxilla (M), and premaxilla (PM) bones.

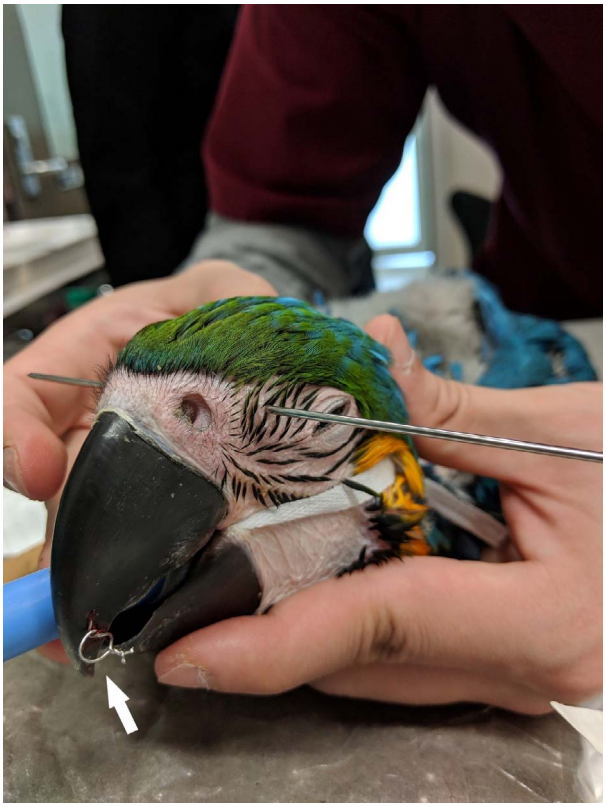

Figure 4. Placement of the transsinus pin through the lacrimal bones of a 12-week-old blue and gold macaw. Note the wire loop placed through the tip of the beak (arrow).

Transsinus pinning is a procedure designed to provide constant lateral tension on the deviated maxilla to guide it into a more-anatomically reference interval position as it grows.[2,3] The purpose of this article is to describe the transsinus pinning technique in detail and to, retrospectively, review treatment of patients and outcomes.

MATERIALS AND METHODS

Between 2013 and 2019, 16 macaw chicks (12 [75.0%] blue and gold macaws [*Ara ararauna*], 2 [12.5%] scarlet macaws [*Ara macao*], and 2 [12.5] green-winged macaws [*Ara chloropterus*]) were presented to the University of Queensland Veterinary Medical Centre for correction of scissor beak. The age of these chicks at presentation ranged from 7 to 28 weeks. The birds were divided into 2 groups: 12 (75%) younger birds (age, 7–12 weeks; median, 10 weeks; range, 5 weeks) and 4 (25%) older chicks (age, 14–28 weeks; median, 17.5 weeks; range, 14 weeks).

Each chick had a lateral deviation of the maxilla with no evidence of any other facial deformity. In all birds, the lateral beak deviation had been present for at least 2 weeks before presentation. One chick, a blue and gold macaw (*Ara ararauna*), also had scoliosis and kyphosis. Most chicks had mild overgrowth of the rostral tomia of both rhinotheca and gnathotheca because of the malocclusion.

Before the transsinus pinning procedure the birds were induced with 5% isoflurane in a 1.5-L flow of oxygen via face mask; then, they were intubated and maintained in a surgical plane of anesthesia with 2.5% isoflurane in a 1.5-L flow of oxygen. Anesthesia and recovery were uneventful in all cases. The procedures were performed under conditions of surgical sterility. (In some of the figures, the bare hands are those of a veterinary technician, holding the bird's head for photos. The surgeon's gloved hands are out of the picture.)

For the procedure, an appropriately sized Kirschner wire (1.1–1.2 mm × 125 mm) or intramedullary bone pin (1.5 mm × 300 mm, with three-sided trocar tips at each end; IMEX Veterinary Inc, Longview, TX, USA) was placed transversely through the frontal sinuses. The entry and exit points were the center of the lacrimal bones on each side of the skull, just caudal to the craniofacial hinge joint on a line drawn between the medial canthus of the eye and the nare (Fig 4). Care was taken to position that pin in exactly the correct location, not too far caudal or ventral. In all birds, the pin could be passed though the skull and sinus with minimal effort with a small handheld Jacobs chuck.

A loop of 22-gauge cerclage wire (IMEX) was created on the side of the beak tip opposite the direction of the deviation. The wire was passed through 2 holes drilled 5 mm apart through the keratin tip of the beak and twisted to form a loop (Fig 4). Dental acrylic (3M Protemp 4 Temporisation Material, 3M Australia, North Ryde, NSW, Australia) was used to secure and strengthen that wire's connection to the beak.

On the side of the beak opposite the direction of the deviation, the pin was bent 90° as it exited the skin, folded parallel to the face for the desired beak alignment, and cut so that it was 1–2 cm longer than the maxilla. That end of the pin was then folded back on itself twice to form a hook that was level with the beak tip, and a rubber cap (Pin caps, IMEX) was placed over the cut surface at the end of the pin to prevent iatrogenic trauma. Horizontal movement of the pin through the frontal sinuses was minimized with a rubber stopper (from a Vacutainer blood collection tube or a syringe plunger) placed over the other end of the pin and

Figure 5. Completed transsinus pinning procedure on a 12-week-old blue and gold macaw. The pin has been bent to run parallel to the left side of the maxilla, and a "hook" has been made at the end of the pin. An orthodontic rubber band connects the hook to the wire loop, and the loop is protected from the bird's attention by dental acrylic. On the right side of the transsinus pin, a rubber stopper has been placed, and the pin tip is bent to prevent the pin's lateral movement.

pushed flush against the skin; that end of the pin was then bent over so it could not be pulled through the skull, again, with a pin cap placed over the end of the pin.

The tip of the beak was then placed under tension by means of an orthodontic rubber band (3.16–6.15-mm orthodontic rubber bands, Ormco Zoo Pack, Henan, China) around the beak and the hook (Fig 5). Various means of securing the rubber band to the beak tip were used (ie, looping the band over the beak and securing with adhesive tape or dental acrylic), but a cerclage wire loop, as described above, appears to give the best results. Excessive tension on the beak can be seen by the bowing of the pin or the horizontal part of the pin pulling ventrally through the bone and skin. Insufficient tension results in loosening of the band or a failure to correct the beak alignment after 1 week. The tension on the beak tip was adjusted by loosening or tightening the rubber band as required. With practice, the transsinus pinning procedure took 10–15 minutes to complete. Weekly rechecks were recommended in all cases to assess treatment progress. The tension from the rubber band was maintained until the beak was straight with the pin and cerclage wire being removed when the beak was considered to be in reference interval alignment.

RESULTS

Four different aviculturists owned the birds described in this report; all were known to provide their breeding birds an excellent diet (60%–70% commercial formulated diets [eg, Nutriblend, Vetafarm, Wagga, NSW, Australia; Avian Breeder Diet, ZuPreem, Shawnee, KS, USA], 5%–10% seed, 30% vegetables, and 5%–10% fruit). It is unknown whether any of the parent birds were related. All chicks had been artificially incubated and hand reared from hatching with commercial hand-rearing formula (eg, Neocare, Vetafarm; Tropican Hand Rearing Formula, Hari, Burnaby, BC, Canada), with various-sized syringes appropriate to their age and size. Feeding frequency began at 2-hourly feeds in the first week; by the time of presentation, most chicks were being fed 3 to 4 times a day. All birds examined were in good body condition. The upper beak was deviated to the left in 6 cases (38%) and to the right in the remaining 10 chicks (62%).

Most of the chicks were still being hand-fed at the time of treatment, although some were starting to wean. Those still being hand fed could return to their usual feeding regime almost immediately after the procedure. Several birds were eating solid food at the time of presentation and were able to continue doing so without difficulty, after an adjustment period of 1–2 days, with the transsinus pin in place.

Complete resolution of the lateral beak deviation (Figs 6 and 7) was achieved in 14 of 16 (87.5%) of cases (in 2 cases [12.5%], the owner declined further treatment to fully resolve the beak abnormality), and no recurrence was noted in any chick. The median time to correction for the 12 younger birds (75%) was 14 days (12–85 days; range, 77 days); the 4 older chicks (25%) required a greater time for correction (13–90 days; median, 25.5 days; range 73 days; Tables 1, 2).

No postimplant infections were noted, but in some patients, it proved difficult to maintain the tension because they attempted to dislodge the rubber bands with their tongues or feet or by

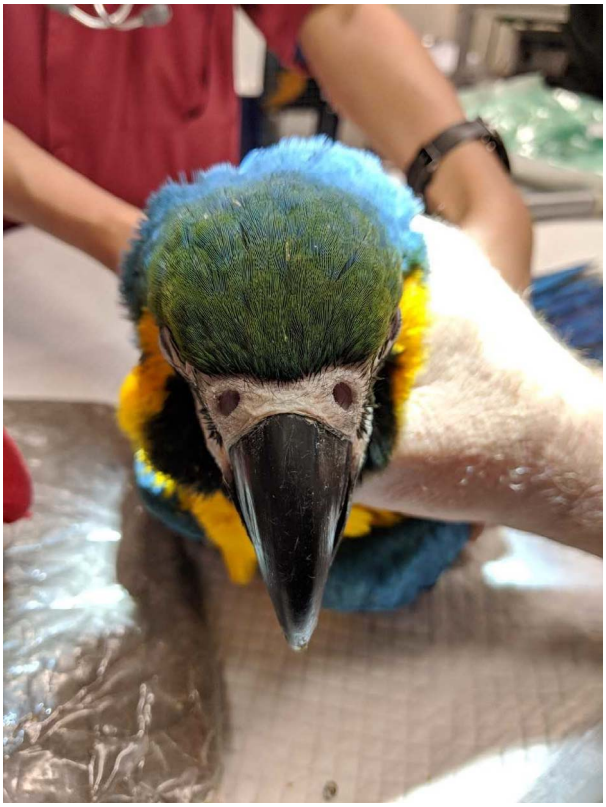

Figure 6. Three weeks after the transsinus pinning procedure on the 12-week-old blue and gold macaw shown in Figures 1, 2, 4, and 5, the device has been removed. Note that the beak is now in reference interval alignment on a dorsoventral view.

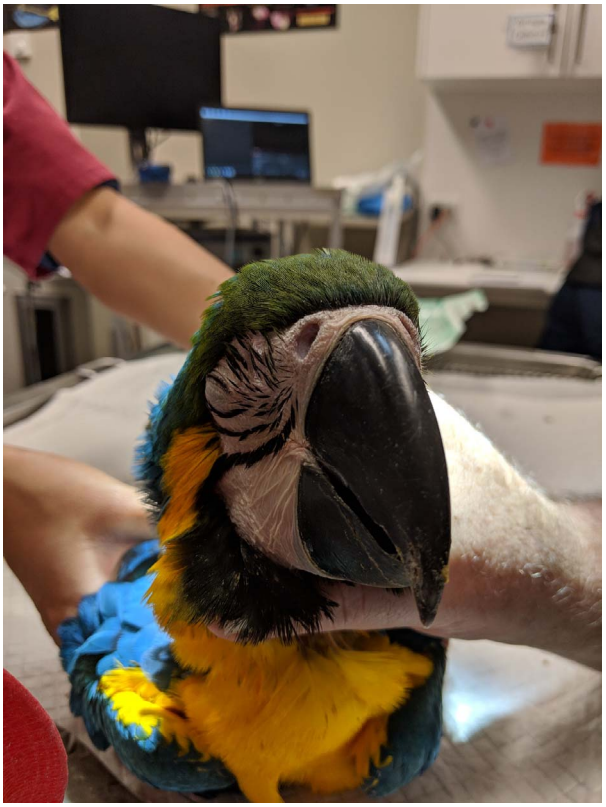

Figure 7. A lateral view of the 12-week-old blue and gold macaw shown in Figures 1, 2, 4–6 with the transsinus pin removed, 3 weeks after the pin was placed, showing the beak alignment at reference interval.

wiping their beaks on the sides of their enclosures. Vigilance on the part of the owner was required to prevent disturbance of the pin and to replace dislodged bands.

In 2 cases (12.5%), when the owners were unable to present the birds for weekly rechecks, the cerclage wire on the beak tip that attached the rubber band to the pin broke off. The owners attempted to correct the loss of the cerclage wire by taping the pin to the beak tip. In both cases, that home remedy failed to provide adequate tension to the beak, and it continued to deviate laterally. The taping of the pin to the beak pulled the horizontal portion of the pin cranioventrally through the lacrimal bone, toward the craniofacial hinge. In both cases, the pin was removed without adverse side effects; beak and sinus function were unaffected, but the lateral beak deviation remained, although improved. Both birds continue to require minor beak trimming to prevent keratin overgrowth.

DISCUSSION

Lateral deviation of the beak (scissor beak) remains a common problem in hand-reared macaw

Table 1. Species, age, and treatment duration of macaws (age, 7–12 weeks) with scissor beak.

Case No.	Species	Age, wk	Duration of treatment, d	Outcome, % improvement
1	Blue and gold	10	14	100
2	Scarlet	11	14	100
3	Blue and gold	12	14	100
4	Scarlet	8	14	100
5	Blue and gold	8	12	100
6	Blue and gold	9	13	100
7	Blue and gold	9	13	100
8	Green-winged	12	21	100
9	Blue and gold	12	25	100
10	Blue and gold[a]	10	31	100
11	Blue and gold	7	14	100
12	Blue and gold[b]	12	85	90

[a] Poor owner compliance in returning and maintaining tension.
[b] Poor owner compliance; this bird also had severe spinal deformities (scoliosis and kyphosis).

Table 2. Species, age, and treatment duration of macaws (age, older than 12 weeks) with scissor beak.

Case No.	Species	Age, wk	Duration of treatment, d	Outcome, % improvement
1	Blue and gold	16	19	100
2	Blue and gold	14	13	100
3	Green-winged[a]	28	32	100
4	Blue and gold[a]	19	90	80

[a] Poor owner compliance in returning and maintaining tension.

chicks.[1–3] It is unclear why this genus is overrepresented with this medical condition. Left untreated, the resulting malocclusion can lead to keratin overgrowth of the rhinotheca and gnathotheca, exacerbating the problem and affecting the bird's ability to normally prehend food.[3] Moreover, lateral deviation of the beak will result in a lifelong necessity for regular beak trimming and assisted or modified feeding. It is, therefore, important to perform a procedure to correct this malocclusion, preferably at an early age (younger than 16 weeks).

Scissor beak can be present from hatching or develop over a period of up to 7 weeks after hatching.[4] The causes of lateral beak deviation in macaw species have not been definitively determined but are thought to be the result of genetic, nutritional, or incubation factors or to be caused by hand-feeding practices (feeding from one side only, trauma to the rictus and restraint of the bird's head during feeding, or direct trauma from the syringe tip).[1–4]

In this case series, 3 different species of macaws, from 4 different breeders, were affected with scissor beak. Wolf and Clubb[4] reported lateral beak deviation in 11 macaw species from 1 aviary. Those findings would suggest that it is unlikely that there is an underlying genetic cause. The treated birds (and their parents) in this case series appeared to be fed an appropriate diet,[10] making malnutrition a less-likely cause. From the birds described in this study, some maxillary beaks deviated to the left and others to the right. Thus, it is unlikely that feeding from only one side was the reason for the beak deviation. Iatrogenic trauma to the rictus (and underlying maxilla and premaxilla bones) during hand feeding of the chick with a syringe or restraining the chick's head during that feeding is often suggested as a cause.[1,2] That theory is supported by the lack of reports of this problem in parent-reared aviary and wild birds. Conversely, because the malocclusion can be present at hatching,[4] it is, again, my opinion that hand feeding is unlikely to be the sole cause of lateral beak deviation. Unidentified incubation factors may contribute to a predisposition for malocclusion, perhaps through a minor malposition in the egg. More research is needed to elucidate the cause of lateral beak deviation, particularly in macaw species, and recommendations for its prevention need to be defined.

Different techniques have been proposed to treat lateral beak deviation with varying levels of difficulty and success. Physical therapy may be effective in very young chicks, when the abnormality is recognized early.[3] That technique, which attaches dental acrylic ramps to the lateral wall of the mandibular beak to "force" the upper beak into alignment may take several months to correct the lateral deviation and require regular replacement during that time. The size and bulk of the dental acrylic ramps required may necessitate modified feeding techniques, if the bird in not already being hand fed, until the implant is removed.[3,8,9] The transsinus pinning technique described in this article offers a simple, effective means of correcting the deviation and having minimal effect on the bird's quality of life. Weekly reassessment is essential to ensure that correct tension is been maintained on the growing beak. Owner compliance in monitoring the device is paramount to the success of the treatment.

Lateral deviation of the premaxilla (scissor beak) is a common problem in juvenile hand-reared macaws. Transsinus pinning is a simple, effective, and rapidly performed procedure for correcting this malocclusion in macaw chicks. This approach, in birds younger than 16 weeks, can result in excellent treatment response in as few as 2–4 weeks in most cases.

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