Trans-sinus fixation for correction of deviation of the gnathotheca in a hawk (Caracara plancus)

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Introduction: For birds of prey, the integrity of the beak is extremely important for defence, hygiene, socialization and especially, feeding. This paper describes successful trans-sinus fixation of a lateral deviation of the mandible in a hawk (Caracara plancus).

Case report: The patient was presented with malnutrition and dehydration due to severe left lateral deviation of gnathotheca, with significant malocclusion. Fixation was performed with a 1.0-mm pin and 0.4-mm cerclage, applying contralateral traction to the deviation. The placement of the cerclage enabled full opening of the beak to allow feeding in the postoperative period. At 21 days after surgery, occlusion was perfect and the patient had recovered normal beak function. When clinical follow-up indicated that the bird would be able to survive in the wild, it was released.

Conclusion: Trans-sinus fixation was effective in correcting lateral deviation of the gnathotheca in a hawk (C. plancus).

KEYWORDS
beak, gnathotheca, hawk, trans-sinus fixation

1 | INTRODUCTION

Birds of prey are dependent on the integrity of the beak, which is essential for defence, socialization and feeding (Tully et al., 2005). There is little published information on the stomatognathic system of these animals, which brings great challenges for veterinarians who need knowledge of specific orthopaedics and odontology for treatment of birds with beak abnormalities (Valdebenito et al., 2018; Wirthlin et al., 2018).

Scissor beak is a common anomaly in birds, where the maxilla or mandible is deviated laterally from the level of the tip of the beak (Valdebenito et al., 2018; Wheler, 2002). The lateral portion of the lower beak (gnathotheca) does not wear normally due to the malocclusion and the excessive growth causes discomfort, difficulty feeding normally and/or reduced locomotion and defence function (Prazeres et al., 2013). This condition is more common in young birds, up to 2 months old, but can be acquired at any age (Doneley, 2016).

Conservative treatment can be effective when the animal is young and is based on the application of digital pressure to the deviated mandible and subsequent regular beak trimming (Schnellbacher et al., 2010). However, the treatment of complex cases or in adult birds is more complex (Tully et al., 2005). This paper reports the correction of scissor beak in a hawk (Caracara plancus) using a trans-sinus pin.

2 | CASE REPORT

A young, female hawk (C. plancus), weighing 856 g and 56-cm tall, was presented with dehydration, malnutrition and malocclusion in the opening and closing of the beak. The bird had been found in an urban area with apparent difficulty in prehending food. On physical examination, a left lateral deviation of the beak (scissor beak) was observed (Figure 1), which caused difficulty eating and drinking, resulting in dehydration and malnutrition. Emergency fluid therapy and gavage...
tube feeding were performed for stabilization. Surgical treatment was performed the day after presentation.

Pre-anaesthetic medication comprised ketamine (20 mg/kg, intramuscular (IM); Syntec, Santana de Parnaíba, SP, Brazil), midazolam (1 mg/kg, IM; Hipolabor, Sabará, MG, Brazil) and butorphanol (1 mg/kg, IM; Zoetis, São Paulo, SP, Brazil). Cannulation of the basilic vein was performed to provide a route for administration of emergency medications if necessary. Anaesthesia was induced with sevoflurane (Cristália, Itapira, SP, Brazil, dose–effect) and oxygenation was performed using a mask coupled to the Baraka circuit, providing 100% oxygen (1 L/min). The animal was placed in the supine position, with the thoracic limbs fixed to the table with tape to prevent movement during the procedure. The rhamphotheca was cleaned with 2% aqueous chlorhexidine (2% Riohex; Rioquímica, São José do Rio Preto, SP, Brazil) and the oral cavity with 0.9% saline solution (Cristália, Itapira, SP, Brazil).

A 1-mm Steinmann pin was introduced through the frontal sinuses perpendicular to the skull (Figure 2) with the aid of an electric drill. The pin was introduced with great care in the most proximal portion of the frontal bone, ensuring placement was within the boundary of the medial corner of the orbits. The diameter of the pin was selected based on the size of the bird’s skull, taking into account the degree of tension needed and minimizing the weight of the device.

The use of a trans-sinus pin for correction of gnathotheca has not been previously described, so a modified form of the technique described by Doneley (2016) for the correction of maxillary deviation was used. After pin insertion, the side contralateral to the direction of the deviation (right) was bent at 90° and cut, leaving it about 1 cm longer than the mandible. The distal end of the pin on the left side was folded over to form a hook and a rubber sleeve (dental anaesthetic tube cover) was inserted to prevent the pin from sliding through the created hole. A tunnel was drilled through the gnathotheca to pass the 0.4 mm cerclage wire, which was connected to the pin putting tension on the deviated gnathotheca (Figure 2). The connection of the pin with the cerclage wire was made without a locking knot, to allow the wire to slide, ensuring a range of movement for the beak to allow feeding (Figure 2).

Surgical recovery was uneventful and the bird was confined throughout the treatment period and fed with minced raw meat. Immediately after the procedure, the bird was able to seize and ingest food, thanks to the amplitude of the nozzle provided by the sliding of the cerclage wire. The implant was removed 21 days after surgery by cutting the pin and the cerclage wire, under physical restraint. Beak occlusion was perfect with no apparent deviation (Figure 1). Immediately after removal of the device, the bird fed and used its beak, demonstrating recovery of all functions inherent to the beak. The patient was observed for 7 days and released after careful evaluation.

3 DISCUSSION

The treatment of beak abnormalities should permit a bird to survive in the wild and thus requires return of all essential functions such as feeding, social interaction and hygiene. Treatment must be evaluated on a case-by-case basis, since some birds will be very sensitive to stressful factors and may not tolerate external devices (Prazeres et al., 2013). This is the first report of correction of mandibular deviation in a bird of prey. This report demonstrates that deviations of rhamphotheca can be successfully treated in wild birds. In this case, the patient was able to use the beak with adequate occlusion 21 days after treatment.

During treatment planning, priority was given to the total correction of the lateral deviation of the gnathotheca, to achieve as near perfect occlusion as possible. This was important to allow recovery of food ingestion, water intake and swallowing (Doneley, 2016).
The aetiology of scissor beak is multifactorial, including malnutrition, genetics, poor positioning within the egg, difficulties in incubation, infectious or parasitic disease and trauma (Schnellbacher et al., 2010). Another cause, more common in parrots, is an anatomical alteration in the frontal bone, causing torsion in the rhinotheca (Tully et al., 2005; Speer, 2013). In this case, we believe that malnutrition may have been the primary problem and nutrient deficiencies resulted in abnormal beak development. The abnormal position of the beak caused constant pressure during growth, leading to malocclusion and significant misalignment.

The study of the skull anatomy and the biomechanics of rhamphotheca contributes to the success of the treatment. The pin must be placed through the frontal sinuses with care to avoid the bird’s brain. The pin must run perpendicular to the skull so as not to cause rotational deviation (Doneley, 2016). This requires careful selection of the wire diameter, since an excessively thin wire can bend to the deviated side, while thicker wires make the device heavy and uncomfortable. The 1-mm Kirschner wire was appropriate in the present case (bird of 856 g), and provided the necessary tension to achieve beak traction.

A cerclage wire was used to create the tension band connecting the pin to the bird’s mandible. This provided sufficient stability for constant tensioning of the gnathotheca and at the same time cranio-caudal mobility of the wire, allowing beak opening to facilitate feeding. Use of a tension band in the gnathotheca has not been previously described. Doneley (2016) described the use of an elastic band as the tension band to treat deviation of the rhinotheca in macaw hatchlings, and reported that some animals tried to remove the elastic with their tongue or feet. For this reason, supervision was required throughout the treatment, since the moving or loosening the elastic can decrease the corrective tension. In the case reported here, we did not consider the use of elastic or other malleable material, since the priority was to maintain tension without compromising the opening of the beak.

Rhamphotheca deviations can also be treated with the placement of prostheses, such as acrylic ramps, moulded and fixed in the gnathotheca on the same side as the maxillary deviation, forcing the rhinotheca to its anatomical position. This technique has been described in macaws, cockatiels and cockatoos (Schnellbacher et al., 2010), being easy to apply and not requiring extensive species-specific anatomical knowledge. However, frequent failures are reported due to damage to the gnathotheca during fixation and loosening of the prosthesis (Tully et al., 2005). The trans-sinus pin is a more robust device, felt to be more appropriate when taking into account the behaviour and size of a bird of prey. It also allowed mobility of the bird’s beak during feeding without any complications.

Younger birds usually respond more rapidly to treatment, within about 13 days. In animals over 4 months of age, correction can take 3 weeks (Worell, 2012), as reported here. Complications such as fractures of the beak due to excessive tension in the tension band are reported, as well as permanent changes in the vascularization of the affected region (Schnellbacher et al., 2010). With the application of appropriate tension in the rhinotheca and regular monitoring of the patient, such complications did not occur in this case.

Total correction of the beak occlusion was observed on the day of removal of the implant. There was no visible deviation, allowing the patient to perform all the beak functions inherent to the species.

## 4 | CONCLUSION

The trans-sinus pin with controlled tension was effective in treating scissor beak in a hawk (C. planus) allowing perfect postoperative occlusion. Controlled studies with a larger number of individuals are needed to validate our findings.

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## AUTHOR CONTRIBUTIONS

MAPM conducted the described technique; TVM, BWM and LGGGD performed the analysis and scientific writing. All authors read and approved the final manuscript.

## ETHICS STATEMENT

The authors confirm that the ethical policies of the journal, as noted on the journal’s authors guidelines page, have been adhered to. No ethical approval was required as this is a case report with no original research data.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## PEER REVIEW

The peer review history for this article is available at https://publons.com/publon/10.1002/vms3.838.

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