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Equine Orthodontics

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Take Home Message

The principles of orthodontic tooth movement and manipulation of jaw growth and development can be utilized in equine dental practice. A technique to improve or even correct the serious malocclusion of parrot mouth (overjet and possibly overbite) in foals utilizing maxillary retention wires combined with a fixed acrylic and aluminum bite plane, has been used for over ten years by the author with good results. A description of the corrective procedure and short- and long-term case follow-ups are presented.

Introduction

Orthodontics is the field of dentistry that deals with the prevention and treatment of dental malocclusions. The objective of equine orthodontics is to correct or prevent dental or dentofacial malocclusions or malalignments through surgery, dental crown equilibration and/or the use of functional dental appliances.[1] Through the use of corrective orthodontics, the oral dental function and periodontal health of the horse are improved. This article concentrates on the use of orthodontic treatment to improve or correct parrot mouth in the young horse.

The term "parrot mouth" has been used to describe a horse with rostral malocclusion of the upper incisor teeth in relation to the lower incisor teeth. The condition is seen in horses that have a very long maxilla or a very short mandible. Often, the upper lip overlaps the lower and on profile can resemble a bird's beak. The condition should more accurately be termed retrognathism if the mandible is of normal length but positioned caudal to its normal position in relation to a long maxilla. The term brachygnathism is used to describe a receding or short mandible. The degree of incisor overjet (measured as the distance the upper incisor teeth protrude labial or rostral to the lower incisors) is quite variable in horses with this condition. Foals born with incisor overjet may range from having upper and lower incisor occlusal contact with a slight labial malalignment to having no incisor occlusion with up to 4 cm of distance between the labial surface of the upper and lower incisor arcades (Fig. 1). The premolar arcades of horses with incisor overjet are usually malaligned but often to a lessor degree than are the incisors.[2] Parrot mouth has been described as a Class 2 malocclusion because the mandibular teeth occlude distally (caudally) in relation to the maxillary teeth.[3]

The occlusal surfaces of the upper and lower incisors of a young horse with parrot mouth are initially level, but as the foal grows, the incisive bones or premaxillae, drift ventrally causing an overbite. The degree of incisor overbite is measured as the distance the

Figure 1. 5 day-old Thoroughbred filly with a 1 cm overjet and no overbite. Only the central incisors have erupted and they are not yet in wear. The premaxilla (incisive bone) is level with no ventral curvature.

occlusal surface of the upper incisors overhangs that of and the lower incisors when the mouth is completely closed and the cheek teeth in full occlusal contact (Fig. 2). Full occlusion of cheek teeth is not possible in horses that have proper incisor occlusal contact. As the upper and lower incisors continue to erupt unopposed, the exposed crowns of the incisors are not worn by normal attrition, causing the lower incisors to become trapped behind the upper incisors. The upper incisors often contact the hard palate and at this point, a distinct bend or downward curvature of the roof of the mouth often develops. Entrapment of the lower incisors behind the upper incisors places caudal pressure on the lower jaw, further retarding rostral mandibular growth and development. The cheek teeth malocclusion leads to the formation of a rostral focal overgrowths (hooks) on the upper 2nd premolars (506, 606) and at times, lower sloping (ramps) or focal overgrowths (hooks) on the last lower premolars (708 and 808). In older foals and yearlings, these overgrowths worsen the condition by limiting rostral mandibular growth.

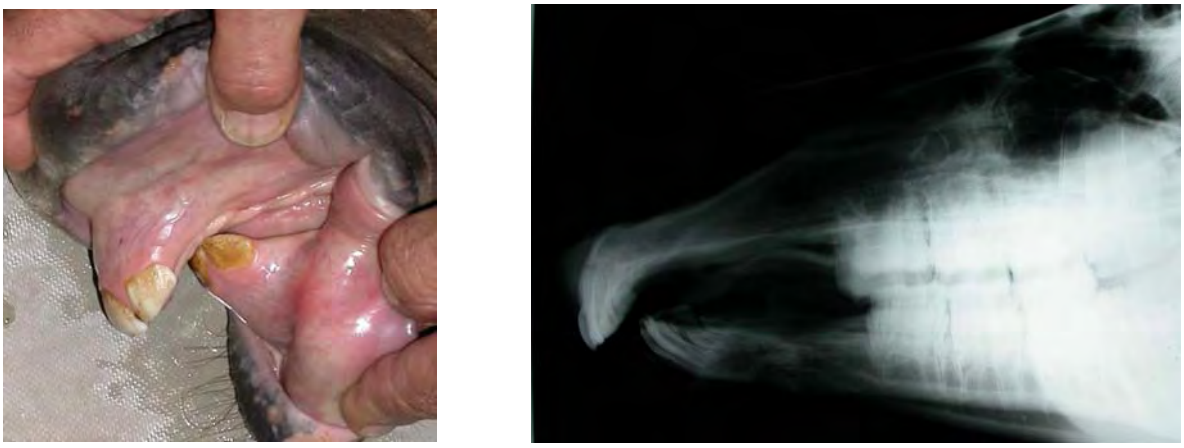

Figure 2. Lateral skull radiographs of a 5-month-old foal with parrot mouth. Notice the ventral curvature and downward drift of the premaxilla. The lower incisor teeth are trapped behind the upper incisors. The rostral hooks on the upper 2nd premolars (506 and 606) and tall transverse ridges on the cheek teeth further restrict rostral mandibular growth.

A technique developed to help correct the occlusal abnormality in young horses involves placing a tension band wire on the upper jaw to retard rostral maxillary and premaxillary growth. A fixed acrylic platform with a metal incline plane is also used to place dorsal pressure on the upper incisors, thus preventing or correcting the overbite. Contact of the lower incisors with the incline plane during normal mastication tends to pull the lower jaw rostrally, promoting its rostral growth. Additionally, the thickness of the acrylic platform and bite plate contacting the lower incisors, separates the premolars which decreases the lock on the cheek teeth. This allows the lower jaw to move forward independently of the upper jaw.

Surgical Technique

Preoperative Care

Foals with parrot mouth should be carefully examined for other congenital or developmental abnormalities. The owner/trainer should be advised about breed registry requirements, the possible genetic origin of the parrot mouth condition, the likely success of surgery, the risks and benefits as well as costs of orthodontic treatment. Using parrot mouth horses for breeding should be discouraged.

The earlier treatment is initiated, the greater is the correction that can be expected. Young foals in the rapid stages of growth respond faster and more completely to treatment, but to avoid interference with the eruption of the intermediate incisors (02s), treatment should be postponed until these teeth are in wear (6-12 weeks). Foals that are candidates for orthodontic correction should have a full set of skull radiographs and occlusive measurements taken prior to proceeding with correction. The cheek teeth should be gently floated to slightly round tall transverse ridges and to reduce rostral or caudal hooks. The incisor plate brings the cheek teeth slightly out of full occlusal contact. “Over-floating” of the cheek teeth occlusal surfaces is discouraged as this prohibits cheek tooth contact during mastication. Foals need not be weaned prior to surgery but should be on a diet consisting of pelleted feed and good pasture or chopped hay.

Surgical Procedure

An IV catheter is placed and the foal is premedicated with broad spectrum antibiotics and a nonsteroidal anti-inflammatory drug. The mouth is thoroughly rinsed with a dilute chlorhexidine solution. The foal is sedated with xylazine HCl, 1.1 mg/Kg, IV and general anesthesia is induced with ketamine HCl 2.2 mg/Kg, IV. Anesthesia is maintained with a solution consisting of xylazine HCl (500 mgs), ketamine HCl (1000 mgs) and guaifenesin (1 liter, 5% solution) (i.e., triple drip), given slowly, intravenously, to effect.

The foal is positioned in lateral recumbency. During the procedure, oxygen is delivered at 10 liters/minute through a nasotracheal tube. The exposed crowns of the incisor teeth are reduced and leveled with a rasp or power grinder until only 2-4 mm of crown protrudes above the gum line, taking care not to damage the gingiva or expose the incisor pulp horn. A small area just ventral to the rostral aspect of the facial crest is clipped and

surgically prepped. With one hand in the mouth, the interdental space between PM3 and PM4 on the uppermost arcade, is identified. A small, stab skin incision is made just below the facial crest between PM3 and PM4 taking care to avoid branches of the dorsal buccal nerve. A 3.2 mm diameter Steinmann pin is introduced through the skin incision and directed between the reserve crowns of PM3 and PM4 in a slightly dorsal ventral direction just above the buccal gum line, exiting in the mouth 2-3 mm above the palatal gingiva. Care should be taken to avoid the palatine artery which lies about 3 mms medial to the palatine surface of the teeth. Intra-operative radiographic and fluoroscopic examinations are helpful and necessary at times to properly position the pin between the teeth without damaging the cheek teeth roots. The pin is removed and a 14 gauge, 3.8 cm long, hypodermic needle is placed in the created hole to act as a wire guide. A section of 18 gauge, 316 stainless steel, orthopedic wire is cut to a length at least three times the distance from PM4 to the central incisor teeth (i.e., about 36 cm). One end of the wire is placed through the hub of the needle to enter the oral cavity at the gingival margin. The needle is removed over the free end of the wire. The free end of the wire is then doubled back and passed through the skin incision and pushed through the buccal mucosa into the buccal space on the lateral aspect of the cheek teeth. Care should be taken to avoid catching soft tissue of the cheek or damaging a branch of the facial nerve during the process. The ends of the wire are grasped with a forceps and pulled rostrally out of the mouth to form a loop around the distal aspect of the reserve crown of PM3. Kinking the wire should be avoided because this may cause the wires to break from fatigue. The small skin incision is left open to heal by second intention. The foal is repositioned in lateral recumbency on the opposite side and the procedure for wire placement is repeated on the opposite arcade.

With both wire loops protruding from the oral cavity, the foal is positioned in dorsal recumbency with a pad placed caudal to the poll to hyperextend the neck, leaving the roof of the mouth parallel to the ground. The wire loop on each side is pulled tight and twisted several times on itself in the interdental space. The loop should be twisted by directing the buccal portion of the loop ventrally and the palatal portion of the loop dorsally. While twisting, the loop should be positioned close to the hard palate to avoid any of the wire contacting the occlusal surface of the cheek teeth. The twisted loops from each side are pulled forward and brought around the labial edge of the incisor arcade and twisted together. The wires should lie across the labial surface of the incisors at the gum level. The end of the wires is cut and bent ventrally so it lies tucked in the groove between the two incisors. A 3.2 mm thick plate of perforated aluminum is sized to fit over the occlusal surface of the upper incisors and extend caudally over the hard palate, 1 cm caudal to the contact point of the lower incisor arcade on the hard palate. Paraffin rope is placed at gum level around the upper incisors, pulled under the wires on each side, and extended several centimeters caudally on the roof of the mouth to form a dental “dam” for acrylic administration. Hard-setting dental acrylic[a] is mixed and placed within the boundary of the paraffin rope. After the acrylic begins to set, the paraffin rope is removed and the acrylic is molded by hand in the roof of the mouth and is then extended laterally and rostrally to incorporate the wires and labial surface of the upper incisor arcade into the acrylic mass. The acrylic is formed with the curved rostral edge of the metal plate resting on the

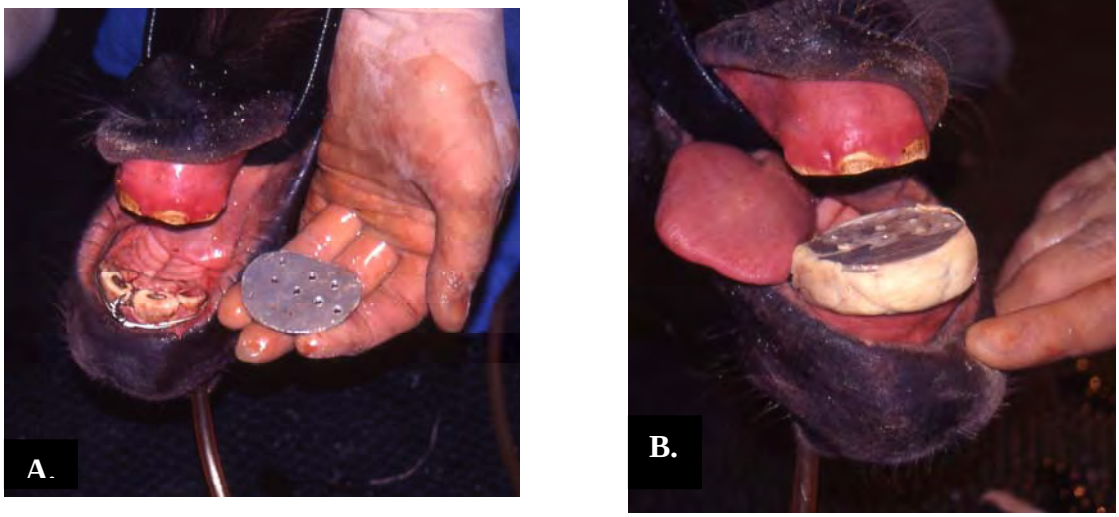

Figure 3a. Parrot mouth foal in dorsal recumbency with orthodontic wires in place. Paraffin rope has been placed to act as a dam for acrylic. A 3.2 mm thick aluminum plate has been fitted on the occlusal surface of the upper incisors and projects caudal enough to make contact with the lower incisors when the mouth is closed. Figure 3b. Parrot mouth foal with orthodontic wires and acrylic appliance with a metal incline plane in place

occlusal surface of the upper incisors and the caudal edge of the plate level with or slightly more dorsal than the rostral aspect. This creates a flat or inclined surface for the lower incisors to contact, freeing the mandible from caudal force and creating a slight rostral pull as the incisor teeth slide over the plate during mastication. As the foal chews, dorsal pressure is also applied to the upper incisors and premaxillae, eventually lifting them into a more normal position.

The acrylic should cover the twisted ends of the wire, the wire loops and the gingivae to prevent the wire from irritating the soft tissue. Splinting the upper incisor arcade with acrylic is important to stabilize the teeth so the force of the orthodontic wires is prevented from spreading or twisting the incisors. The band of acrylic around the upper incisor teeth and orthodontic wires, holds the acrylic incline plate firmly in the roof of the mouth (Figs. 3a and 3b).

After the acrylic sets, the foal is allowed to recover from anesthesia and is placed back with the dam. Most foals quickly learn to nurse with the appliance in place. Foals that do not nurse well are supplemented with a complete foal ration.

Postoperative Care

Postoperative care consists of keeping the skin wounds clean until they are healed. While adjusting to the orthodontic appliance, most foals are kept on oral omeprazole for 4-5 days to help prevent gastric ulcers. Postoperatively, foals usually eat and nurse well after 1-2 days of adjustment. The plate and wires are checked daily to detect loose or broken wires or loose acrylic. The patient also needs to be examined by a veterinarian on a

Figure 4. Lateral radiograph of a 10-month-old foal with retention wires, acrylic plate and aluminum incline plane attached to upper jaw. The foal had a 1.4 cm overjet and a 6 mm overbite when first evaluated and treated at 4 months of age. The overbite has been completely corrected with the upper and lower incisor teeth in occlusal contact with just a 3 mm overjet remaining.

monthly basis to ensure that the appliance is secure and not causing any problems intraorally (Fig. 4). During these follow-up visits, the cheek teeth are also inspected and any abnormal wear patterns are corrected with floating.

The bite plate wears thin over time from lower incisor contact and typically after 3-6 months, the appliance and/or wires must be removed. If correction is not complete at that time, the surgical procedure is repeated until the desirable results are achieved. The overbite of most foals correct approximately 5 mm every 3-6 months. The most rapid correction is noticed between 2-8 months after which improvement continues slowly until the horse is approximately 19 months old.

Results

Twenty-eight foals with incisor overjet greater than 4 mm, were examined and treated by the author between January 2000 and December 2003. Medical records were reviewed and follow-up telephone questionnaires carried out in 2006.

The group consisted of 16 Thoroughbreds, 6 American Quarter horses, 3 American Saddlebreds, 1 Warmblood out of a Thoroughbred mare, 1 Arabian and 1 Morgan. The sexes were nearly equally distributed (15 fillies and 13 colts). The dams of 2 thoroughbred foals were noted to have an incisor overjet. None of the sires of the affected foals were known to have a parrot mouth condition but these sires were not examined by the author. At the time of initial surgery, the foals ranged in age from 11 weeks to 9 months of age with a mean of 4.5 months of age. The incisor overjet at the time of initial surgery, ranged from 4 mms to 3 cms. The incisor overbite ranged from 0 to 2.5 cms. The foals underwent 1-4 surgeries over a 4-14 month period. The foals had a mean of 2.5 surgeries over an average period of 9.4 months.

Orthodontic appliances were removed or replaced when they showed signs of wear (e.g., broken wires, worn aluminum plates, or loose or broken acrylic). One or a combination of these problems occurred between 2 weeks and 6 months after application of the orthodontic device. Most foals developed some degree of transient gingivitis beneath the acrylic appliance, most notably on the labial aspect above the upper incisors. Dark staining of the deciduous upper incisor crown cementum was common. The wires grooved the exposed dental crowns of the upper incisors of most foals. During the course of treatment, a small valve diastema was observed between upper deciduous PM3 and PM4 on all foals.

Complications at the time of surgery were minimal. One foal experienced transient hemorrhage following puncture of the palatine artery. No anesthetic-associated problems were encountered. Transient postoperative facial swelling which slowly resolved in 5-6 days was noted around the skin incisions in 6 foals. Transient, unilateral facial nerve paralysis (neuropraxia) was observed in 1 foal but this spontaneously resolved in 2-3 weeks. Young nursing foals were supported nutritionally for 12-24 hours post surgery until they were able to manage nursing with the orthodontic appliance in place. Feed tended to pack around the wires and buccal pouches of most foals but this was easily managed by daily oral lavage administered by caretakers.

A follow-up study in 28 horses, 1-5 years post treatment showed that all cases improved. Correction of overjet ranged from .4 to 2.4 cms in overjet (corrected). Average improvement with the first appliance and wire application was 4 mm in overbite and 5 mm in overjet. Average additional improvement with the second application of appliance and wires was 6 mms in overjet and complete correction of overbite. Four horses experienced crowding of permanent incisors or retention of deciduous incisor teeth. Two horses at 2-3 years of age, had retained deciduous central upper incisors with the permanents erupting rostral to the deciduous teeth. One yearling lost a 103 (central deciduous incisor) when the acrylic loosened and a permanent replacement tooth did not erupt in this horse. Cheek tooth malocclusions were not accurately measured and documented. Abnormal wear patterns (06 upper hooks, caudal lower last cheek teeth hooks, and exaggerated transverse ridges) recurred and had to be repeatedly corrected during the time the appliance and wires were in place and also during the period between removal of the acrylic appliance and long term follow-up.

Discussion

Several different approaches have been taken in the management and/or correction of parrot mouth in the horse.[1,4,5] The condition is not life threatening and many horses with proper dental care and feeding management, have had productive performance careers despite this malocclusion. Orthodontic correction during the first 6 to 18 months of life when the equine skull is in a rapid phase of growth and development, does improve the horse's occlusion. Most owners of horses that have received orthodontic correction have reported improvement in quality of life for the horse after treatment.

Other orthodontic techniques including the use of retention wires on the upper jaw with no incline plane, have been successfully used in foals with incisor overjet but no overbite.[3] Over a period of 18 months, a fixed acrylic incline plane without the use of retention wires was used to correct a young horse suffering from parrot mouth.[5] Surgical distraction osteogenesis has been used to correct maxillary deviation in the foal and has been used by this author (with limited results) to lengthen the lower jaw.[6] It appears that the combined approach with retention wires on the upper jaw combined with a fixed acrylic and aluminum incline plane, has advantages over other techniques. Correction of the malocclusion is more rapid with minimal complications when using the combined approach.

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References and Footnote

1. Easley J. Basic equine orthodontics. In: Baker GJ and Easley J ed. *Equine Dentistry*, 2nd ed. London: Elsevier Saunders, 2005; 249-266.
2. DeBowes RM, Gaughn EM. Congenital dental diseases of horses. In: Gaughn EM and DeBowes RM, ed. *Vet Clin North Am Equine Pract*, Vol 14, No 2, Philadelphia: WB Saunders, 1998; 275-281.
3. Wiggs RB and Lobprise HB. Basics of orthodontics. In: Wiggs, RB and Lobprise HB eds, *Veterinary Dentistry, Principles and Practice*, Philadelphia:Lippincott, 1997:438-441.
4. Gift L, DeBowes R, Clem M, et al: Brachygnathism in horses: 20 cases (1979-1989). *J Am Vet Med Assoc*, 1992; 200-715.
5. Klugh DO. Acrylic bite plane for treatment of malocclusion in a young horse. *J Vet Dent*, 2004, 21(2), 84-87.
6. Puchol JL, Herran R, Durral I, et al. Use of distraction osteogenesis for the correction of deviated nasal septum and premaxilla in a horse. *J Am Vet Med Assoc*, 2004; 224-226.

a. Lange's Dental Acrylic.

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