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How to Remove an Over-Countersunk or Buried Single Transphyseal Screw

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1. Introduction
Angular limb disease is a common limb deformity in young horses resulting from an incongruity in growth between the medial and lateral sides of the bone. These deformities can be congenital or developmental. They are named using both the location of the origination of the deformity and the direction of the limb from that point distal (either valgus or varus). A valgus deformity is defined as a deformity in which the leg distal to the point of interest is abaxial to a line bisecting the bone proximal to the site of interest. For example, a carpal valgus is a deformity in which the leg distal to the carpus is abaxial from a line bisecting the radius. In comparison, a varus deformity is one in which the limb distal to the point of interest is axial to a line drawn through the bone proximal to the site of interest. For example, a fetlock varus is a deformity in which the pastern is axial to a line drawn through the metacarpus/metatarsus. The most common angular limb deformities are carpal valgus and fetlock varus.

In the past, multiple procedures have been performed to correct these angular limb deformities, including hoof trimming and the use of hoof extensions. Growth acceleration procedures such as periosteal stripping and the use of iodine injected periosteally have also been used. Growth retardation surgeries such as the use of screws and wires, screws and plates, and, most recently, the use of a single transphyseal screw have also been used. The placement of a single transphyseal screw has been shown to be as effective as a screw-and-wire technique. This procedure has a more cosmetic result and has therefore become more commonly performed.

The single transphyseal screw technique involves placing a screw obliquely across the physis. This involves placing the screw at an angle into the bone. In placing a 4.5-mm transphyseal screw, the first step is to drill a bed for the screw head with a 4.5-mm drill bit. Then, using a drill guide, the operator drills across the physis with a 3.2-mm drill. A 4.5-mm screw is placed, engaging 50% to 75% of the epiphysis.

2. Methods
As with any other screw removal, both anteroposterior and lateral radiographs should be taken before surgery to assess the location of the screw head. A single skin staple can be placed in the skin in the suspected position to use as a marker to aid in lo-
cating the initial skin incision. Evaluation of these radiographs may reveal overgrowth of bone over the screw head and a lack of the screw profile protruding from the bone. In these cases, the operator should be prepared to use this technique to extract the screw (Figs. 1–5).

The foal is treated with broad-spectrum antibiotics and anesthetized for surgery. The foal is placed in lateral recumbence with the affected leg placed on a Mayo stand or a table leg extension with the screw head positioned upward. The sensory plate for a DR digital radiograph system is placed under the leg so that intra-operative radiographs may be taken easily. The leg is clipped, scrubbed for aseptic surgery, and draped.

A 2-cm skin incision is made in the approximate location of the screw head, based on the previously taken preoperative radiographs. The incision is continued through the subcutaneous tissue to expose the bone. A self-retaining retractor (Weitlander) is placed in the incision. If the screw is

![Image](image1.png)

Fig. 1. Radiograph of a 3.5-mm transphyseal screw that has been over-countersunk and left in place too long. The screw head is completely overgrown with cortical bone.

![Image](image2.png)

Fig. 2. Intra-operative radiograph of the same limb as in Figure 1. Four 18-g (1.5-inch) needles have been placed in a cross-hatched pattern to determine the location of the screw head.

![Image](image3.png)

Fig. 3. Intra-operative photograph of an osteotome being used to shave the cortical bone. The lateral side of the screw head is now exposed.

![Image](image4.png)

Fig. 4. Intra-operative photograph of the trough created with a bone gouge to allow the screw a free path for extraction.
seen and can be extracted, it is removed in a routine manner. If the screw is not seen, then four 18-g (1.5-inch) needles are placed through the skin in a cross-hatched “tic-tac-toe” orientation, and a lateral radiograph is taken. The location of the screw head can then be determined, based on the quadrants formed by the needles. An osteotome and a mallet are used to shave 1 to 2 mm of the bone. The bone is repeatedly shaved in this manner until the screw head is visualized. Because the original placement of the screw is at an oblique angle, the side of the screw head is seen first. Once the screw head is seen, a curved bone gouge is used to create a trough from which the screw can be removed without the screw head coming into contact with the cortical bone. This prevents application of undue torque to the screw, which would cause the screw to break at the screw head / shaft interface. The recess in the screw head should be evacuated of bone and tissue before inserting the screwdriver, thus preventing the screw head from stripping. The subcutaneous tissue and skin is closed in a routine manner, and the leg is bandaged for recovery.

Using this technique, an over-countersunk screw can be removed without breaking the screw. In the event that the screw does break, then the standard principles of extracting a broken screw should be used.

3. Results
This technique was used during 2010 in three cases. All three cases were Thoroughbred foals, ranging in age from 3 to 6 months. In all three cases, the screws were left in place for more than 60 days. In each case, the screw head was overgrown with bone and was successfully removed.

The mean surgery time for the extraction was 30 minutes. Immediate postoperative complications included a mild degree of swelling at the surgery site. This swelling resolved during the immediate postoperative period. All incisions healed by primary intention. There was minimal callus formation, and all limbs were deemed cosmetically acceptable in these cases of yearlings going to sale.

4. Discussion
As single transphyseal screw placement becomes more common, complications are being encountered more often. As with any surgery, resolution of complications is easier with proper recognition and preparation. With this condition, proper recognition will not only alert the surgeon to the problem but will also allow for proper preparation of patient and placement of radiology equipment. The placement of the radiograph plate before draping will expedite the surgical procedure.

There are two factors to consider to prevent overgrowth of bone over the screw head of transphyseal screws. The first issue is that because the screw is being placed obliquely through the bone and therefore a seat must be created for the screw head, care should be taken not to over-drill when creating this seat. The second is that these screws should not be left in place for more than 60 days. If after 60 days it is deemed that more correction is needed, the screw can be removed and replaced.