

## Pastern joint arthrodesis using two paraaxial and one axial crossed lag screws: a case report

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**ABSTRACT:** Arthrodesis was achieved in two foals through the placement of three 4.5 mm cortical lag screws. Two screws were placed in a standard transarticular fashion from the dorsal aspect of P1 (glide hole) to the palmar aspect of P2 (thread hole). A third transarticular lag screw was placed from the dorsal aspect of P2 (glide hole) to the palmar aspect of P1 (thread hole). Both foals were comfortable and considered suitable for light work. Crossed transarticular lag screw fixation of P1 and P2 in cases of PIPJ arthrodesis in foals is a simple and useful method offering good stability for fusion and future athletic soundness.

**Keywords:** foal; joint fusion; immaturity; osteochondrosis; osteosynthesis

Proximal interphalangeal joint (PIPJ) arthrodesis is a radical surgical procedure indicated in cases of osteoarthritis, subluxation or fractures in adult horses; it has a reported success rate of 83% in the hind limb and 46% in the front limb (Ruggles 2003). To date, there are four reports of PIPJ arthrodesis in foals, the first being undertaken for a proximal phalangeal fracture, the second for an unreported reason, and the third for a congenital malformation of the pastern joint (Steenhaut et al. 1985; Schneider et al. 1987; Caron et al. 1990, Watts et al. 2007). Surgery was performed in the youngest foal at one month of age for palmar subluxation of the PIPJ and disruption of the attachment of the distal sesamoidean ligaments and superficial flexor tendons (Watts et al. 2007).

The preferred method of pastern joint fusion is the application of two or three lag screws in a dorsoproximal-palmarodistal direction or the use of an axially located three-hole dynamic compression plate and two parallel transarticular lag screws (Auer 2006). In foals the usual method of arthrodesis is the placement of two transarticular lag screws (as above). In this paper we report two cases of successful PIPJ arthrodesis using a modified lag screw technique.

### Case description

#### Case 1

A seven month old Czech Warmblood colt was presented to the Equine clinic of the University of Veterinary and Pharmaceutical Sciences, Brno with a severe right forelimb lameness of three months duration. Severe osteochondrosis of the right fore PIPJ had been previously diagnosed by the referring veterinarian. Due to the severity of the lameness and limited response to conventional treatment, consent for surgical arthrodesis of the PIPJ was given by the owner.

The foal was anaesthetised in left lateral recumbency with the right forelimb positioned uppermost. An inverted “V” incision of the skin and common digital extensor tendon was performed (Figure 1), followed by transection of the collateral ligaments, removal of the articular cartilage and osteostixis of the subchondral bone plates of P1 and P2. Two paraaxial lag screws were introduced in a regular dorsoproximal-palmodistal slightly divergent direction. A third lag screw was applied closely perpendicular to the first two screws from the dorsal part of P2 (glide hole) into the palmar

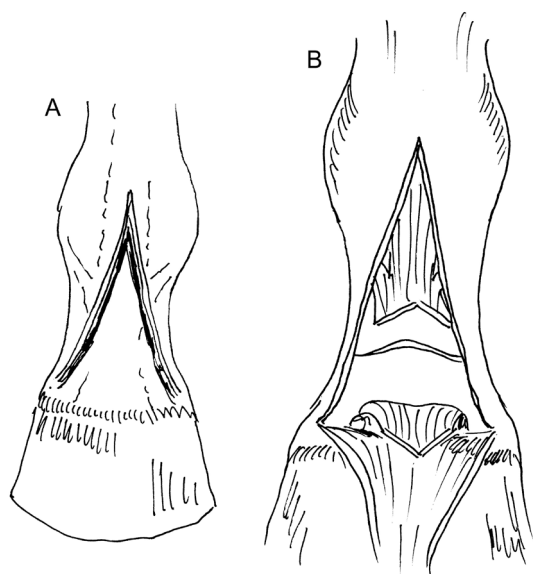


Figure 1. Skin incision in the shape of an inverted “V” (A); elevation of common digitor extensor tendon (B)

part of P1 (thread hole; Figure 2). The collateral ligaments and extensor tendon were sutured in a simple interrupted pattern. The subcutaneous tissue and skin were closed in a routine manner with simple vertical mattress sutures. A bandage cast was applied for anaesthetic recovery and was subsequently replaced on Day 2 with a three-layer bandage.

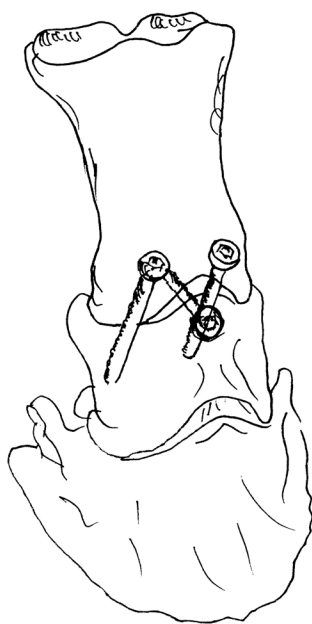


Figure 2. Two paraaxial and one axial lag screws applied in a crossed manner through the pastern joint

Pre- and post-operatively the foal received 10 days of parenteral antibiotics (intravenous gentamycin at 6.6 mg/kg SID; potassium penicillin at 10 000 IU/kg QID). Phenylbutazone was administered for three days post-surgery at 1 mg/kg SID. Complete fusion of the joint was observed three months post operatively (Figure 3 and 4). The surgical implants were not removed and no problems were encountered. Three years later the horse is competing regularly in regional show jumping events. The horse has reduced flexion of the distal right forelimb (making him unsuitable for dressage); however, no lameness is evident.

## Case 2

A Noriken filly was intensively managed at a hospital for six weeks as a premature neonate; with mal-development of the articular surfaces of the right forelimb PIPJ (Figure 4 and 5). The filly was initially managed in a cast; however, permanent irregularity of the distal aspect of P1 and the proximal articular surface of P2 were apparent. The filly developed an angular deviation of the digit, an irregularly shaped hoof and remained lame. Bony development of the left forelimb proceeded as normal post-partum (Figure 6 and 7). Arthrodesis of the proximal interphalangeal joint was considered



Figure 3. Dorsopalmar view of the pastern joint in Case 1 three months after the surgery



Figure 4. Lateromedial view of the same image as in Figure 3 (pastern joint in Case 1)



Figure 5. Lateromedial view of the pastern joint in Case 2 showing the remarkable underdevelopment of the joint structures

the only viable option for salvage of the animal for pasture or riding. The surgical procedure and post-operative management was the same as for

case one. Arthrodesis of the PIPJ was achieved by 10 weeks post-surgery. The surgical implants were not removed and there were no reported problems.



Figure 6. Dorsopalmar view of the pastern joint in Case 2 with distinct axial deformation of digital structures caused by underdevelopment of the joint structures apparent



Figure 7. Lateromedial view of the contralateral front limb in Case 2 at the same age as in Figure 5 for comparison



Figure 8. Dorsopalmar view of the same contralateral front limb shown in Figure 7

Eight months after surgery the filly was ambulating well in the pasture with only a mild conformational limb defect. The animal was checked at the age of three years for the surgical management of colic in the same clinic and the fusion of the joint was observed to be perfect (Figure 6). However, a certain deviation of the limb axis in the digit was seen.



Figure 10. Dorsopalmar view of the same pastern joint as in Figure 9



Figure 9. Lateromedial view of the pastern joint in Case 2 three months after surgery

## DISCUSSION AND CONCLUSIONS

Performing arthrodesis of the proximal interphalangeal joint in the young horse is questionable due to the unpredictable outcome for future soundness as an adult. There are only a few studies that evaluate the long term outcome of early PIPJ fusion and its effect on digit function in adult life. Case number one here shows a positive long-term outcome following PIPJ arthrodesis performed at an early age. The formation of the ring bone in young animals as an early PIPJ osteoarthritis is a not infrequent developmental problem in foals (Ruggles 2003). This type of ring bone could be a permanent source of pain and lameness reducing the use of the animal for athletic performance. Arthrodesis is a radical solution but in our hands in this case it resulted in an animal free of lameness and which could be used in show jumping competitions. However, it would be necessary to evaluate a greater number of cases before any conclusions could be made with regard to future athletic soundness.

The surgical approach through an inverted V-shaped skin and tendon incision (compared to the standard T-shaped skin incision; Auer 2006), in our opinion, facilitates better healing of the coronary band region. Incision of the collateral ligaments, removal of articular cartilage and manipulation of the distal limb for implant placement was successful. The authors would recommend this variation on the incision for future cases.



The application of the third axial lag screw in a dorsodistal-palmoproximal direction from dorsal part of P2 into the palmar/plantar part of P3 produced in our hands a stronger construct of arthrodesis PIPJ. This stability we explain as an effect similar to the use of a dorsal plate in the adult horse. The third screw applies fixation and compression effects on the joint line in the perpendicular direction to the effect of the traditionally applied dorsoproximal-palmodistal screws. The use of the plate in foals, particularly at very early ages is too robust in comparison with the simple third lag screw fixation which we apply here.

The use of the same method of arthrodesis of PIPJ in adult horses would seem to be feasible; however, the routine use of our method in older horses runs into problems with the proximal coronary border of the hoof. It would be interesting to find, experimentally or by measurement from radiograms, the age limitation for the application of this surgical procedure in older or even adult horses. The dorsal method of DIPJ arthrodesis (Lischer and Auer 2012), stipulates the placement of the most distal screw under the hoof capsule similarly to our method through the extensor process of the P3 into the palmar/plantar part of P2. It would be interesting to assess the limits of placement of the axial screw in the case of intended PIPJ arthrodesis in adults under the coronary tissue. It seems that the collision with the hoof tissue would be less pronounced than in the case of DIPJ arthrodesis. In our two foals we were successful with 4.5 mm cortical screws; in adults stronger stability might be achieved by the use of 5.5 screws.

These two successful cases of arthrodesis of PIPJ in foals demonstrate that a method consisting of

two abaxial and one crossed axial screw could be a promising simplification of the procedure for the treatment of different disorders of the pastern joint.

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