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### DEGENERATIVE DISEASE OF THE PROXIMAL INTERPHALANGEAL JOINT TREATED WITH ARTHRODESIS USING PARALLEL CORTICAL SCREWS IN A HORSE: A CASE REPORT

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**Abstract :** We report the clinical case of a nine-year-old quarter horse, used for charreña activities, that presented with progressive lameness of the right forelimb with a twelve-month history. Orthopedic examination revealed dorsal swelling in the pastern region and pain on digital flexion. Perineural blocks allowed the lesion to be localized in the proximal interphalangeal joint. Radiographic examination showed loss of joint space, subchondral sclerosis, and osteophyte formation, findings consistent with advanced degenerative joint disease. Given the limited response to conservative medical treatment and the chronic nature of the condition, surgical arthrodesis was performed by placing three parallel cortical compression screws following destruction of the articular cartilage. The postoperative course was satisfactory, with no complications and no lameness at the three-month follow-up. This report highlights the importance of accurate clinical and imaging diagnosis and supports arthrodesis as a viable therapeutic alternative in horses with advanced degenerative joint disease of the proximal interphalangeal joint.

**Keywords:** arthrodesis, horse, degenerative joint disease, proximal interphalangeal joint, lameness.

## Introduction

Degenerative joint disease (DJD), also known as osteoarthritis or osteoarthrosis, is a chronic process characterized by progressive degeneration of articular cartilage and remodeling of the subchondral bone, leading to joint deformity secondary to bone loss and formation (Stashak, 2011; Zubrod and Schneider, 2005). This condition is a common cause of lameness in sport and

working horses, significantly affecting the animal's functional performance (Stashak, 2002).

Osteoarthritis (OA) of the proximal interphalangeal joint (PIP) is associated with progressive degenerative processes that cause chronic pain and mechanical limitation. In early stages, medical management may include nonsteroidal anti-inflammatory drugs, chondroprotectives, supplements, and exercise control, with variable results depending on the degree of joint involvement (Auer and Stick, 2012; Kenneth and Raymond, 2004). However, as the disease progresses, conservative treatment loses effectiveness, and the therapeutic goal shifts toward pain relief through the induction of joint ankylosis (Steenhaut et al., 1985; Schneider et al., 1978).

Various alternatives have been described to promote ankylosis of the AIP, including chemical methods such as intra-articular ethanol injection, as well as surgical techniques that employ different fixation systems (Caston, 2012; Zamos and Honnas, 1993). However, non-surgical procedures often require prolonged recovery periods and may yield inconsistent results in horses intended for athletic activities (Swanson, 1989).

In advanced cases of degenerative joint disease or joint fractures in the pastern region, surgical arthrodesis is a therapeutic alternative indicated for definitive pain control. Multiple techniques have been described, including the use of parallel or crossed compression screws, plate-screw combinations, and other stabilization methods, with varying reported functional outcomes (Knox and Watkins, 2003; Genetzky et al., 1981; Auer and Stick, 2012). Clinical studies have indicated that return

to zootechnical function may vary depending on the affected limb and the technique used, with better results observed in hind limbs compared to forelimbs (Steenhaut et al., 1985).

This report describes the diagnostic and surgical management of a horse with advanced degenerative joint disease of the proximal interphalangeal joint treated by arthrodesis using three parallel cortical compression screws, a technique selected based on biomechanical stability and clinical experience described in the literature.

## Method

### Case Description

A nine-year-old, uncastrated, chestnut-colored, Quarter Horse weighing approximately 460 kg and intended for rodeo activities was evaluated. The patient was admitted to the DITEQ Hospital for evaluation due to mild, progressive lameness of the right forelimb that had been present for twelve months.

On general physical examination, the physiological parameters were within the normal ranges for the species. During the static orthopedic evaluation, a hard, swollen mass was observed on the dorsal aspect of the pastern of the right forelimb, accompanied by pain on digital flexion. During dynamic evaluation, the lameness was classified as grade 4/5.

Based on the clinical findings, the primary problems were identified as lameness of the right forelimb, pain on digital flexion, and the mass in the dorsal region of the pastern. The diagnostic plan included perfor-

ming perineural blocks and a radiographic study of the affected region.

A lower palmar digital perineural block was performed using 4 ml of 2% lidocaine, yielding a negative result. Subsequently, an abaxial perineural block with 6 ml of 2% lidocaine produced approximately an 80% improvement in lameness, allowing the lesion to be localized at the level of the proximal interphalangeal joint.

Differential diagnoses included osteoarthritis of the proximal interphalangeal joint, fracture of the pyramidal process of the third phalanx, trauma to the common digital extensor tendon in the metacarpal region, subluxation of the distal interphalangeal joint, fractures of the first or second phalanx, subluxation of the proximal interphalangeal joint due to ligament damage, and osteoarthritis of the distal interphalangeal joint.

The radiographic study included lateromedial, dorsopalmar, oblique dorsolateral-palmaromedial, and oblique dorsomedial-palmarolateral views. Lytic changes, subchondral sclerosis, and loss of joint space were evident in the proximal interphalangeal joint. Additionally, new bone formation with osteophytes was observed on the dorsodistal aspect of the first phalanx and the dorsoproximal aspect of the second phalanx. The findings were consistent with degenerative joint disease of the proximal interphalangeal joint, also known as high-joint annular exostosis.



**Figure 1.** Lateral-medial and dorsopalmar radiographic views of the proximal interphalangeal joint showing joint space narrowing, subchondral sclerosis, and osteophyte formation. Source: Prepared by the authors

Based on the chronic course of the condition, the limited response to previous medical treatment, and the clinical and radiographic findings, a diagnosis of degenerative joint disease of the proximal interphalangeal joint was established, and it was decided to perform surgical treatment via arthrodesis.

For the procedure, the affected limb was shaved circumferentially from the crown to the proximal aspect of the metacarpus and prepared under aseptic technique with povidone-iodine. The patient was placed under general inhalation anesthesia and positioned in the left lateral decubitus position, with the affected limb elevated.

The joint location was confirmed using 18-gauge guide needles and intraoperative radiographic guidance. The articular cartilage was destroyed by making dorso-palmar drill holes using a 3.5-mm drill bit. Subsequently, the first and second phalanges were drilled using 5.5-mm and 4.5-mm drill bits, respectively, while irrigating with Hartmann's solution to prevent thermal necrosis. Three 4.5-mm self-tapping cortical screws were placed in a dorsoproximal-palmarodistal direction, with lengths of 36 mm for the central and lateral screws and 32 mm for the medial screw, achieving adequate fixation and interfragmentary compression confirmed radiographically.



**Figure 2.** Intraoperative lateromedial radiographic view showing the placement of three parallel cortical screws in the proximal interphalangeal joint.

Source: Prepared by the authors

Skin closure was performed with stainless steel staples, and external coaptation was applied using padded material and fiberglass bandages from the hoof to the proximal metacarpus. Anesthetic recovery occurred approximately 40 minutes later, without complications.

In the postoperative period, a continuous infusion of 300 mg of xylazine and 10 mg of butorphanol diluted in 1 L of Hartmann's solution was administered for six hours, as well as phenylbutazone at a dose of 4.4 mg/kg intravenously every 12 hours for eight days, ceftiofur sodium at 4.0 mg/kg intravenously every 12 hours for five days, and gentamicin at 6.6 mg/kg intravenously every 24 hours for five days.

No complications arose during the two-week hospitalization. At 40 days, the external fixation and staples were removed; radiographic examination revealed bone callus formation, loss of joint space, and proper positioning of the implants with no evidence of infection. Three months after the procedure, there was no evidence of lameness on walking, pain, or increased temperature on palpation.

## Results

The surgical procedure was performed under inhalation general anesthesia without intraoperative complications. The placement of the three cortical screws was performed without incident, with adequate alignment of the proximal interphalangeal joint observed and confirmed by intraoperative radiographic control.

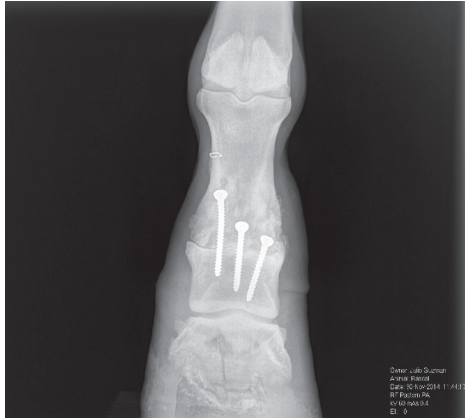
The surgical procedure was performed under general inhalation anesthesia without intraoperative complications. The place-

ment of the three cortical screws allowed for adequate stability and alignment of the proximal interphalangeal joint, which was confirmed by intraoperative radiographic control. Anesthetic recovery occurred approximately 40 minutes later and proceeded without incident.

During the two-week hospital stay, the patient progressed favorably. No systemic or local complications occurred, such as surgical wound infection, suture dehiscence, excessive inflammation, or signs consistent with rejection or loosening of the implants. The surgical wound showed adequate healing, and the dressing remained in good condition until its removal.

Forty days after the procedure, the external fixation and skin staples were removed. The clinical evaluation performed at that time revealed adequate stability of the operated segment. The follow-up radiographic study showed bone callus formation, loss of joint space, and proper positioning of the cortical screws, with no signs of migration, implant fracture, or radiographic evidence of infection. The findings were consistent with progression toward ankylosis of the proximal interphalangeal joint.





**Figure 3.** Follow-up radiographic views 40 days after the procedure. (A) Dorsopalmar. (B) Lateromedial. Bone callus formation and proper screw positioning are observed, with no evidence of complications.

Source: Prepared by the authors

At the evaluation performed three months after the procedure, the patient did not present with gait claudication. Palpation of the operated region revealed no pain, increased temperature, or abnormal inflammation. The clinical course was considered satisfactory within the established follow-up period.

## Discussion

Degenerative joint disease of the proximal interphalangeal joint is a common cause of chronic lameness in sport and working horses, particularly when it progresses to annular joint exostosis (Stashak, 2011; Zubrod and Schneider, 2005). In advanced stages, medical treatment is often insufficient to restore function, so surgical arthrodesis is considered an appropriate therapeutic alternative for definitive pain control (Auer and Stick, 2012).

Various techniques have been described for AIP arthrodesis, including the placement of parallel or crossed compression screws, as well as plate-screw combinations (Genetzky et al., 1981; Knox and Watkins, 2003). Schneider et al. (1978) described arthrodesis as an effective option in cases of “high ringbone,” emphasizing the importance of adequate preparation of the articular cartilage and interfragmentary stability to promote ankylosis. In the present case, cartilage destruction via multiple perforations and the placement of three parallel cortical screws allowed for adequate compression and stable joint alignment.

Steenhaut et al. (1985) reported variable rates of return to function depending on the affected limb, with better results observed in hind limbs compared to forelimbs. In this report, despite the case involving a forelimb—which biomechanically bears a greater load—the clinical outcome was favorable during the follow-up period, with no evidence of lameness at three months. This result can be attributed to the adequate stability achieved through internal fixation and proper external coaptation in the postoperative period.

From a biomechanical standpoint, the use of parallel cortical screws allows for the generation of direct interfragmentary compression, favoring the reduction of joint micromovement and promoting the formation of bone bridges (Auer and Stick, 2012). Furthermore, continuous irrigation during drilling, as performed in this case, helps minimize the risk of thermal necrosis, which can positively influence the healing process.

Compared to chemical methods of inducing ankylosis, such as the intra-articular injection of ethanol described by Caston (2012), surgical arthrodesis offers greater

control over immediate mechanical stability, although it is more invasive. However, in horses intended for sporting activities, structural stability can be a determining factor in the functional prognosis (Swanson, 1989).

A limitation of the present study is that it involves a single clinical case, which prevents the drawing of generalizable conclusions regarding the superiority of the technique used. Follow-up was limited to three months; therefore, studies with a longer observation period would allow for the evaluation of long-term functional outcomes and a possible full return to athletic activity.

## Conclusions

Degenerative joint disease of the proximal interphalangeal joint is a major cause of chronic lameness in sport horses, especially when it progresses to advanced stages characterized by bone remodeling, loss of joint space, and osteophyte formation. In these cases, conservative treatment is often insufficient to restore functionality, so arthrodesis represents a therapeutic alternative aimed at definitive pain control through joint ankylosis.

In the present case, surgical treatment via arthrodesis of the proximal interphalangeal joint using three parallel cortical screws allowed progression toward ankylosis and resolution of gait lameness during the three-month follow-up period. The absence of postoperative complications, the correct positioning of the implants, and radiographic findings consistent with bone union support the viability of this therapeutic approach in advanced cases of degenerative joint disease.

Although this is a single-case report and does not allow for generalizable con-

clusions, the results suggest that arthrodesis constitutes an effective therapeutic alternative for the management of advanced degenerative joint disease of the proximal interphalangeal joint, particularly when medical treatment does not produce clinical improvement. Studies with larger sample sizes and long-term follow-up will help strengthen the evidence regarding functional prognosis and return to sports activity.

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