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Comparative evaluation of immobilization techniques after achilles tenorrhaphy in bovines

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A complete apposition of the tendon ends and immobilization are the 2 important factors in the process of healing (Mbiuki 1981). Modified transarticular external skeletal fixation (Hann *et al.* 1995) and cortical screw fixation (Saini *et al.* 2000) were used for immobilization of tibio-tarsal joint after achilles tendon repair in dogs. The present investigation was carried out to develop an immobilization technique, which could provide satisfactory immobilization after achilles tendon tenorrhaphy in bovines.

The study was conducted on 15 clinically healthy male crossbred cow calves 1-2 years old and weighing 80-90 kg. Left achilles tendon was chosen for the study. The animals were randomly divided into 3 groups, 1 (n=8), 2 (n=4) and 3 (n=3). Haloperidol-diazepam-thiopentone combination was used for general anaesthesia. After severing of achilles tendon, the tenorrhaphy was performed using 4, single locking loop sutures with polyamide No. 2 (Saini and Mirakhur 2000). Immobilization of tibiotarsal joint was performed as follows:

In group 1, immobilization of tibiotarsal joint was performed by transfixation of tibia with the calcaneal bone. Two 6 mm Steinmann's pins were inserted transversely in the tibia and two 5 mm Steinmann's pins in the calcaneus (Fig.1). Rest of the procedure of plaster application was performed in routine manner. In group 2, immobilization was performed by oblique insertion of 2 modified threaded Steinmann's pins from calcaneus to tibia no plaster was applied (Fig. 2). In group 3, external unilateral skeletal fixation with transverse insertion of 2 threaded Steinmann's pins into calcaneal bone and 2 in the tibia from the lateral side of operated limb and connected by aluminum splints enclosed in plaster of Paris (Fig. 3). Wound dressing with povidine-iodine solution was done on alternate days up to 10th postoperative day. Animals were kept in a enclosure (7m×5m) to restrict their movements.

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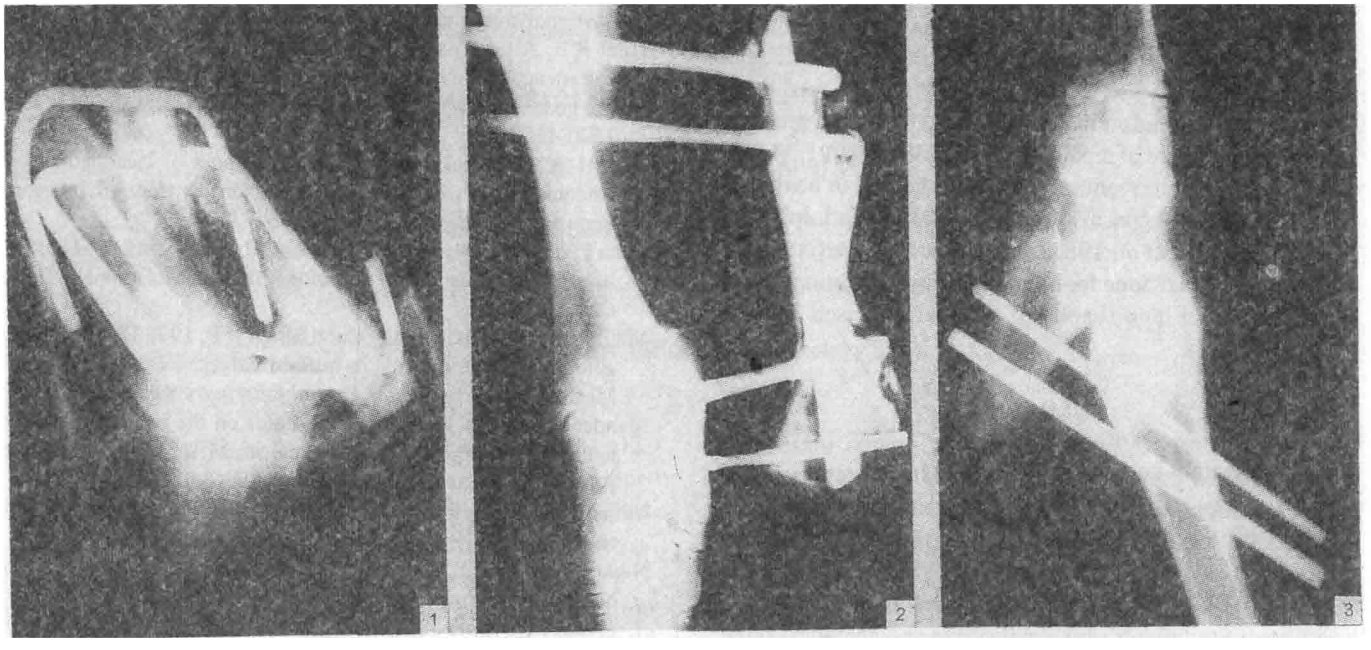
Postoperative radiographs were taken in all the groups to ascertain the proper application of various immobilization techniques. Postoperatively, all the animals were observed clinically for wound and tendon healing, weight bearing at rest and walk. Weight bearing at rest was graded as: mild (toe touching the ground), moderate (hoof touching the ground but limb is relaxed) and full weight bearing and lameness at walk was graded as: mild (animal supports the limb on ground but less weight bearing), moderate (supports the limb comfortably on ground but apparently lame) and bearing full weight and not lame. After removal of immobilization in group 1 on day 28, the extension and flexion of joint was monitored on days 30 (n=8), 60 (n=6), 90 (n=4) and 120 (n=2). Biopsy from the articular surface of tibiotarsal joint was taken in 2 animals of group 1 on day120, postoperatively. Biopsy samples were fixed in 10% buffered formalin and processed for paraffin block sectioning by cidar wood oil schedule (Luna 1968). Sections were stained with Hematoxylin & Eosin and Masson's trichrome stains.

Postoperative radiographs showed proper application of immobilization techniques in groups 1 (Fig.1), 2 (Fig. 2) and 3 (Fig. 3). Skin wounds and achilles tendon healed satisfactorily without any postoperative complication in group 1. However, tendon got torn in groups 2 and 3 due to immobilization failure. Mild to moderate weight bearing at rest was observed on first and second postoperative day in group 1. Moderate weight bearing was seen on day 7 and onwards. In group 2, mild and in group 3 only mild to moderate weight bearing was observed at rest. At walk, mild weight bearing was observed in group 1 on days 1 and 2 which improved to moderate on day 3 onwards. Full weight bearing was observed 2 weeks after tenorrhaphy and immobilization in group 1. Whereas in groups 2 and 3, mild to moderate weight bearing was seen at walk till immobilization failure. No weight bearing was observed at rest and walk in any of the animals of groups 2 and 3 on last day of study period i.e. 3-5 days postoperatively. Lameness and reduced weight bearing on the operated limbs seemed to be associated with



Figs 1-3. **1.** Lateromedial radiograph showing transfixation of tibiotarsal joint using 4 Steinmann's pins, 2 in the tibia and 2 in calcaneal bone (group 1). **2.** Lateromedial radiograph showing proper placement of Steinmann's pins and aluminium splints after transfixation of tibiotarsal joint (group 2). **3.** Anteroposterior radiograph showing external unilateral fixation device for immobilization of tibiotarsal joint (group 3).

postoperative pain and inflammation (Saini *et al.* 1996, 1998, Saini and Mirakhur 2000). Other workers have also reported normal weight bearing in 3 weeks after tenorrhaphy (Nigam *et al.* 1975) and tendon grafting (Verma *et al.* 1983) in bovines.

Transfixation (Fig. 1) of hock joint in group 1 checked undesired extension and flexion of tibiotarsal joint for 4 weeks, thus prevented undue tension on the operated tendons. No stiffness and any other abnormality in the joint movements was observed on extension and flexion of joint throughout observation period in group 1. In this group articular cartilage did not show any degenerative change on day 120. There were no surface erosions and ground substance appeared normal (Fig. 4). However, in 1 animal of group 1, tibia got fractured at 4 weeks as the involved limb was trapped in the manger. But achilles tendon remained intact in this animal till last observation on day 30. In group 2, immobilization did not succeed and resulted in dislodgment and bending of pins. Tibia fracture and achilles tendon tear were observed on days 3 (3 animals) and 5 (1 animal). In group 3 also, immobilization failed and resulted in over flexion of hock joint which led to tearing of achilles tendon and fracture of tibia by day 3 in all the animals. Calcaneal bone also got fractured in 1 animal in group 3.

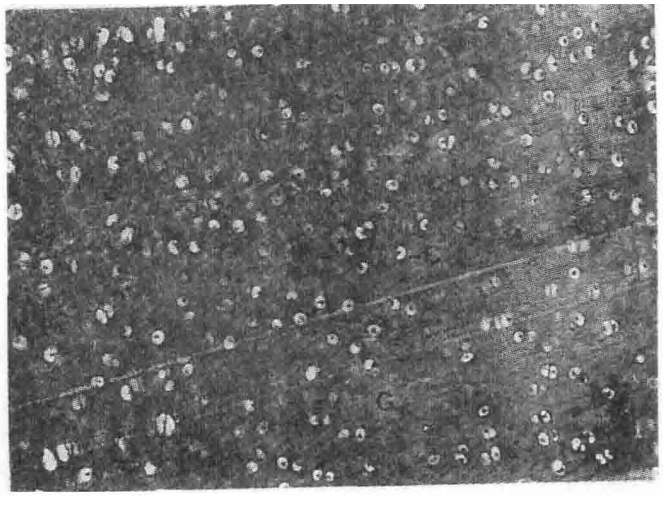


Fig. 4. Section of articular cartilage from hock joint of cow calf collected at 120 days postoperatively showing normal chondrocyte (C) and ground substance (G) in articular cartilage (group 1). Masson's trichrome × 280.

Immobilization in group 1 for 4 weeks was satisfactory for clinical union of repaired achilles tendon. Immobilization for 4-6 weeks has been recommended after tendon surgery (Nixon *et al.* 1984, Bertone *et al.* 1990, Taylor *et al.* 1995, Mbiuki 1981 and Hunt *et al.* 1991) recommended immobi*lization after repair of severed achilles tendon in a calf and a* goat respectively. Immobilization was useful in the treatment of flexor traumatic injuries in 27 cattle (Anderson *et al.* 1996). Little extended position of hock during immobilization helped in reducing the stress on the repaired tendons in all the animals. *Extended heel shoe immobilization successfully managed* lacerated tendons in a dairy cow (Jann and Steckel 1989). Extended fetlocks in the plaster cast after experimental superficial digital flexor tenoplasty in calves (Malik *et al*

1998) and equine (Saini *et al.* 1996 and 1998, Saini and Mirakhur 2000) was also used successfully. Immobilization technique using raised heel shoe for 6 weeks was found advantageous in tendon healing and also helped in reducing the tension at the site of repair (Singh and Bhatia 1991, Mander 1999). Restricted movements of animal helped in healing of the repaired tendons as also reported earlier (Radolph *et al.* 1980, Gelberman *et al.* 1983). To conclude, transfixation of tibia with calcaneal bone for tibiotarsal immobilization proved satisfactory after tenorrhaphy of surgically incised Achilles tendon in calves.

SUMMARY

In crossbred cow calves the surgical transection of left achilles tendon was done under general anaesthesia, the tenorrhaply was performed using 4, single-locking-loop sutures with polyamide. In group 1 (n=8), transfixation of tibia with the calcaneal bone was done using transverse insertion of Steinmann's pins in the tibia and calcaneal bone. In group 2 (n=4), immobilization was performed by oblique insertion of two modified threaded Steinmann's pins from calcaneal bone to tibia. In group 3 (n=3), external unilateral skeletal fixation with transverse insertion of 2 threaded Steinmann's pins into calcaneal bone and two in the tibia from the lateral side of operated limb was done. Wounds and achilles tendon healed satisfactory in group I and wound gaping, suture breakage, mutilation and achilles tendon tear had occurred in groups 2 and 3. Full weight bearing at rest was seen 2 weeks after tenorrhaphy and immobilization in group 1. Immobilization failure had occurred in groups 2 and 3. Transfixation (group 1) of tibia and calcaneal bone provided good immobilization after achilles tenorrhaphy.

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