

Tube Realignment for Patellar Luxation Repair in Dogs

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Abstract

Grade II patellar luxations in dogs were repaired by trochlear wedge recession in 5 stifles (group 1) and by proximal tube realignment in 5 stifles (group 2). A combination of the two techniques was used to correct grade II luxation in 10 stifles (group 3) and grade III luxation in 5 stifles (group 4). The position of the patella, weight bearing, and animal gait were postoperatively examined for 12 weeks. Satisfactory results were observed in 1(20%), 3(60%), and 9(90%) stifles with grade II luxation in groups 1, 2, and 3, respectively. Good recovery from grade III luxation was observed in 2(40%) stifles from group 4. The luxations recurred in 4(80%), 2(40%), and 2(40%) stifles from groups 1, 2, and 4, respectively. Overcorrection was observed in 1(10%) and 1(20%) stifles from groups 3 and 4, respectively. In conclusion, tube realignment, when used solely, is not able to correct grades II and III luxations of the patella but it can correct the grade II luxation when combined with the trochlear wedge recession. For the grade III luxation, other reconstruction techniques are additionally required.

Keywords : tube realignment, patellar luxation, dog

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บทคัดย่อ

การทำท่อปรับแนวเอ็นส่วนต้นเพื่อแก้ไขสะบ้าเคลื่อนในสุนัข

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สะบ้าเคลื่อนระดับ 2 ในสุนัขได้รับการแก้ไขโดยการตกแต่งร่องที่ปลายกระดูกต้นขาหลัง 5 ข้อ (กลุ่มที่ 1) และโดยการทำท่อปรับแนวเอ็น 5 ข้อ (กลุ่มที่ 2) และใช้ทั้งสองวิธีร่วมกันในการแก้ไขสะบ้าเคลื่อนระดับ 2 10 ข้อ (กลุ่มที่ 3) และระดับ 3 5 ข้อ (กลุ่มที่ 4) ติดตามผลการรักษา 12 สัปดาห์ โดยการตรวจคลำตำแหน่งของสะบ้า การใช้ขารับน้ำหนักและการก้าวเดินของสุนัข พบว่าการรักษาให้ผลเป็นที่น่าพอใจในข้อเข่าที่สะบ้าเคลื่อนระดับ 2 1(20%), 3(60%) และ 9(90%) ข้อ ในกลุ่มที่ 1, 2 และ 3 ตามลำดับ ข้อเข่าในกลุ่มที่ 4 2(40%) ข้อหายจากสะบ้าเคลื่อนระดับ 3 พบสะบ้าเคลื่อนกลับไปข้างเดิม 4(80%), 2(40%) และ 2(40%) ข้อ ในกลุ่มที่ 1, 2 และ 4 ตามลำดับ และพบการแก้ไขที่มากเกินไปทำให้สะบ้าเคลื่อนไปด้านตรงกันข้ามกับด้านเดิมในกลุ่มที่ 3 1(10%) ข้อ และในกลุ่มที่ 4 1(20%) ข้อ สรุปได้ว่าการทำท่อปรับแนวเอ็นเพียงวิธีเดียวไม่สามารถแก้ไขสะบ้าเคลื่อนระดับ 2 และ 3 ในสุนัขได้ แต่สามารถใช้แก้ไขสะบ้าเคลื่อนระดับ 2 เมื่อใช้ร่วมกับการตกแต่งร่องที่ปลายกระดูกต้นขาหลัง สำหรับสะบ้าเคลื่อนระดับ 3 จะต้องใช้วิธีแก้ไขวิธีอื่นร่วมด้วย

คำสำคัญ: การทำท่อปรับแนวเอ็น สะบ้าเคลื่อน สุนัข

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Introduction

The patella is a sesamoid bone embedded in the tendon of the quadriceps muscle which converges on the patella and continues distally as the straight patellar tendon which inserts on the tibial tuberosity. In a normal stifle, the patella localizes and glides within the femoral trochlear sulcus or groove bounded medially and laterally by prominent trochlear ridges that aid in maintaining stability of the patella. The alignment of the quadriceps, patella, trochlear sulcus, patellar tendon, and tibial tuberosity must be normal for the stability and proper function of the stifle. Malalignment of one or more of these structures may lead to luxation of the patella (Hulse, 1995). A shallow trochlear sulcus and displacement of the quadriceps are usually seen in patients with patellar luxation.

Patellar luxations occur frequently in dogs and occasionally in cats and are commonly seen in most small animal practices. The patella can be displaced medially or laterally. Medial luxation is more common than lateral luxation in all breeds and is found most frequently in small and toy breeds of dogs (Hayes et al., 1994; Piermattei and Flo, 1997). Lateral luxation is

most often diagnosed in larger breeds of dogs. Patellar luxation is classified as developmental or congenital luxation and acquired traumatic luxation (Hulse, 1995). Congenital luxation is more common and mostly inherited. Therefore, affected animals should not be bred. Acquired traumatic patellar luxation is uncommon but can be seen in any breed of dog subjected to trauma.

Based on variable degrees of clinical and pathological changes, patellar luxation is classified into 4 grades (Hulse, 1995; Piermattei and Flo, 1997). The patella in grade I luxation is still in the trochlear sulcus but it may intermittently luxate. It is easily luxated manually at full extension of the stifle joint, but returns to the sulcus when released. In grade II luxation, the patella luxates more frequently than in grade I and may be manually displaced while the foot is rotated (internally for medial luxation and externally for lateral luxation). When it is pushed. The patella remains luxated until it is reduced by the examiner or by extension and derotation of the tibia by the patient. The patella in grade III luxation is permanently luxated but may be manually reduced with the stifle in extension. However, after manual reduction, flexion and extension of the stifle result in relaxation of

the patella. The quadriceps muscle group is displaced along with the luxated patella. The trochlear sulcus is very shallow or even flattened. Torsion of the tibia and deviation of the tibial crest from the cranial/caudal plane develop. In grade IV luxation, the patella is permanently luxated and cannot be manually repositioned. The trochlear sulcus is shallow, absent, or even convex. The quadriceps muscle group is displaced along with the luxated patella. The tibia is twisted and the tibial crest deviates from the cranial/caudal plane.

Luxation of the patella may be treated nonsurgically or surgically. Deciding which method is applicable for a patient depends on clinical history, physical findings, and age. Surgery is indicated in any aged patient exhibiting lameness and is strongly advised in one with active growth plates because skeletal deformity may worsen rapidly (Hulse, 1995). The goals of surgery for patellar luxations are stabilization of the patella in the trochlear sulcus and realignment of the quadriceps. Numerous surgical techniques have been proposed for the correction of this abnormality and are categorized as soft tissue and bone reconstructions (Piermattei and Flo, 1997). Soft tissue reconstruction includes the overlap of the lateral or medial retinaculum, fascia lata overlap, patellar and tibial antirotational suture ligaments, desmotomy and capsulectomy, and quadriceps release. Bone reconstruction includes trochleoplasty, transposition of the tibial tuberosity, tibial derotation, osteotomy and patellectomy (Johnston, 1996). The decision as to which techniques to use is a judgement based primarily on the severity of the luxation. Reconstruction of the soft tissue may be adequate for a less severely luxated patella. Luxation with a shallow trochlea or/and deviated tibial tuberosity requires bone reconstruction. Generally, a combination of techniques is required (Hulse, 1995).

Proximal tube realignment is one of the surgical procedures for correction of recurrent patellar dislocation and chondromalacia patellae in human patients (Crosby and Insall, 1976; Insall et al., 1976). Satisfactory to excellent results in 11 of 12 knees (92%) have been

noted for recurrent patellar dislocation (Abraham et al., 1989). The technique has the same principle as that of soft tissue reconstruction techniques for canine patellar luxation in increasing tension on the side opposite to the luxating side in order to pull the patella and quadriceps tendon back into normal alignment. The purpose of this study was to evaluate the efficiency of this technique in repairing patellar luxations in dogs.

Materials and Method

The dogs included in this study were 12 females and 12 males, 6 to 108 months old and weighing 1.95 to 19.55 kg. They were 11 Poodles, 4 Pomeranians, 4 mongrels, 2 Miniature Pinschers, 1 Chihuahua, 1 Cocker Spaniel, and 1 Yorkshire Terrier. 21 unilaterally medial, 2 unilaterally lateral, and 1 bilaterally lateral patellar luxations were involved. 20 stifles with grade II patellar luxations in 19 dogs and 5 stifles with grade III patellar luxations in 5 dogs were divided into 4 groups. 5, 5, and 10 stifles with grade II luxations were corrected by modified trochlear wedge recession (Slocum and Slocum, 1993) (Fig. 1) (group 1), proximal tube realignment (Insall et al., 1976) (Fig. 2) (group 2), and a combination of the two techniques (group 3), respectively. 5 stifles with grade III luxations (group 4) were corrected by the combined procedure used in group 3. Dogs in groups 1, 2, 3, and 4 had age ranges of 9-48, 8-30, 6-108, and 7-108 months, respectively and weight ranges of 1.95-6.05, 2-9.70, 2.95-11.90, and 2.45-19.55 kg, respectively.

Cranio-lateral skin and subcutaneous tissue incisions were made at 4 cm proximal to the patella and continued distally to 2 cm below the tibial tuberosity. The lateral retinaculum (femoropatellar fascia) was incised 3 to 5 mm from and parallel to the patella. A modified trochlear wedge recession technique of Slocum and Slocum (1993) was made on all stifles in groups 1, 3 and 4 (Fig. 1). For the medial luxation, modified proximal tube realignment of Insall et al. (1976) was performed after the joint capsule had been closed.

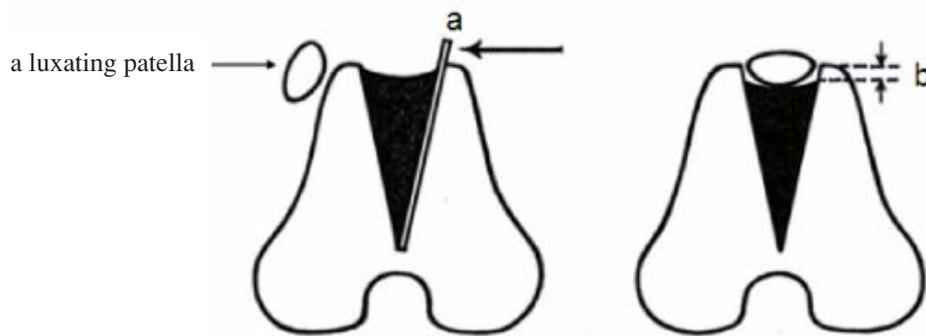


Figure 1. Modified trochlear wedge recession procedure. A V-shaped wedge is cut from the sulcus. The two cuts are slightly wider apart than the width of the patella. Then, a piece of bone less than 1.5 mm wide (a) is cut and discarded from the trochlear ridge to allow the trochlear sulcus to be recessed by half the thickness of the patella (b). The original wedge is taken back to its place to form a new sulcus in which the patella is stabilized.

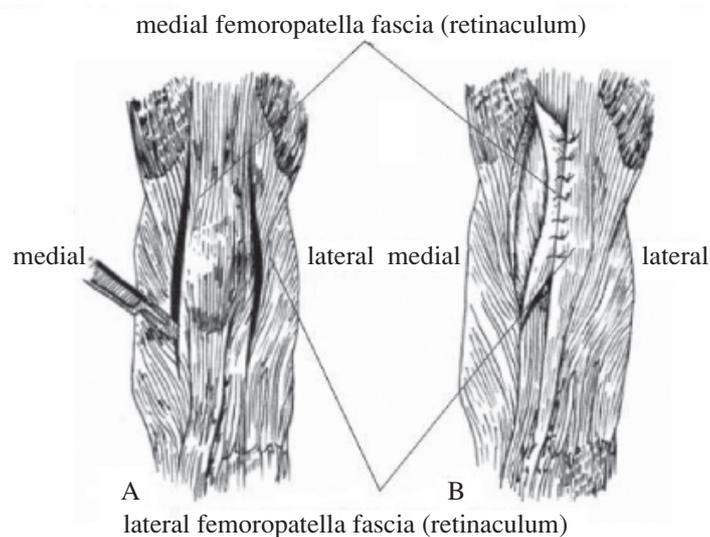


Figure 2. Tube realignment procedure for correction of medial patellar luxation. A, incisions on the medial and lateral retinacula 3 to 5 mm from and parallel to the patella. B, the caudal flap of the lateral retinaculum is sutured to the cranial flap of the medial retinaculum adjacent to the patella.

Subcutaneous tissue anterior, lateral, and medial to the patella was dissected to visualize the medial and lateral retinacula which were incised 3 to 5 mm from and parallel to the patella (Fig. 2A). The caudal flap of the medial retinaculum was undermined to relieve tension on the medial side of the patella luxated medially. The caudal flap of the lateral retinaculum was sutured, with absorbable suture (polyglactin) and simple interrupted pattern, to the cranial flap of the medial retinaculum adjacent to the patella (Fig. 2B). Tube realignment for lateral patellar luxation (Insall et al., 1976) was made after undermining the caudal flap of the lateral retinaculum to relieve tension on the lateral side of the patella. Then, the caudal flap of the medial retinaculum

was sutured to the cranial flap of the lateral retinaculum adjacent to the patella.

Postoperatively, the leg was placed in a soft padded bandage for 3 weeks to protect the wound, prevent swelling, and limit free movement of the stifle joint. All dogs received cephalexin for 7 days and aspirin for 3 weeks. Animal gait and patellar position were postoperatively examined at 10, 28, 56, and 84 days and graded as follows: fail-recurrence or overcorrection; fair-patella remains in the trochlear sulcus and weight-bearing with moderate gait abnormality; good-patella remains in the trochlear sulcus and full weight-bearing with minimal gait abnormality; and very good-patella remains in the trochlear sulcus and full weight-bearing without gait abnormality.

Results

From 20 stifles with grade II patellar luxations, trochlear wedge recession gave good result only in 1(20%) of 5 stifles (group 1) (Table 1) while tube realignment provided good to very good recovery in 3(60%) of 5 stifles (group 2). Luxations recurred in 4(80%) and 2(40%) stifles in groups 1 and 2, respectively. When the two procedures were concurrently performed on 10 stifles in group 3, good to very good results were observed in 9(90%) stifles while overcorrection was found in 1(10%) stifle. For grade III luxation (group 4), the combined procedure gave good to very good results in only 2(40%) of 5 stifles while overcorrection and recurrence of the luxations were observed in 1(20%) and 2(40%) stifles, respectively.

Discussion

Our findings are consistent with others in which medial patellar luxation has been found more often than lateral patellar luxation (Hayes et al., 1994; Piermattei and Flo, 1997). This might be because of the most dogs in this study were small and toy breeds which are prone to develop medial luxation of the patella (Hulse, 1995). All dogs had shallow trochlear sulci and medial or lateral displacement of the quadriceps. Overlap of the lateral or medial retinaculum, fascia lata overlap, patellar and tibial antirotational suture ligaments, desmotomy, capsulectomy, quadriceps release, trochleoplasty, transposition of the tibial tuberosity, tibial derotation, osteotomy and patellectomy have all been advocated for surgical correction of patellar luxations (Johnston, 1996). These techniques aim to realign the displaced quadriceps and to restrain the patella within the trochlear sulcus. Trochlear wedge recession, a technique of trochleoplasty, was conducted in this study to deepen the trochlear sulcus for restraining the patella and to preserve the articular cartilage of the trochlear sulcus for articulating with the patella. Tube realignment was performed to pull the patella and quadriceps tendon back into normal alignment. However, when solely

applied to dogs in this study, neither trochlear wedge recession nor tube realignment could restrain the patella within the sulcus. Our finding is in contrast to the satisfactory to excellent results of using proximal tube realignment in 11 of 12 human knees (92%) with recurrent patellar dislocation. However, a better result was observed when tube realignment and trochlear wedge recession were concurrently used for grade II luxations in group 3. 9(90%) stifles had good to very good recovery at 84 postoperative days while 1 stifle (10%) was overcorrected. Good results were observed in only 2 of 5 stifles with grade III luxation using the combined technique. This indicates that tube realignment can not be used solely for the correction of grade II and III patellar luxations. The technique must be used in combination with the trochlear wedge recession and other reconstruction techniques. The recurrence of the luxations observed in groups 1, 2, and 4 might have been the result of inadequately relieved tension on the luxating side and inadequate recession of the trochlear sulci. Dehiscence of the aligning tube might have been another cause of the recurrence of the luxations in group 2 and 4. The dehiscence resulted from the insufficient strength of a normally thin medial retinaculum to withstand the tension on the aligning tube during joint movement. Moreover, marked rotation of the tibial crests in grade III luxation (group 4) added more tension on the tube and made realigning the quadriceps more difficult. More invasive techniques of bone reconstruction such as transposition of the tibial tuberosity and tibial derotation are additionally required in these cases. Recurrence of luxation may occur because of unrestricted activity of the operated joint during few weeks postoperation. Overtension on the side opposite to the luxating side might have been the cause of overcorrection observed in groups 3 and 4.

The ranges of age and weight of dogs in this study were quite wide. However, it appeared from our study that both age and weight were less important than the severity of the luxation and the corrective procedures

Table 1. The results of trochlear wedge recession (group 1), tube realignment (group 2), and a combination of the two techniques (groups 3 and 4) in dogs with grade II (group 1-3) and grade III (group 4) patellar luxations.

Group	Days	Fail	Fair	Good	Very good
1	10	60(3/5)*	40(2/5)	0	0
	28	60(3/5)	40(2/5)	0	0
	56	80(4/5)	0	20(1/5)	0
	84	80(4/5)	0	20(1/5)	0
2	10	20(1/5)	20(1/5)	60(3/5)	0
	28	20(1/5)	0	60(3/5)	20(1/5)
	56	20(1/5)	0	60(3/5)	20(1/5)
	84	40(2/5)	0	40(2/5)	20(1/5)
3	10	10(1/10)	80(8/10)	10(1/10)	0
	28	10(1/10)	50(5/10)	40(4/10)	0
	56	10(1/10)	10(1/10)	60(6/10)	20(2/10)
	84	10(1/10)	0	60(6/10)	30(3/10)
4	10	20(1/5)	20(1/5)	60(3/5)	0
	28	40(2/5)	20(1/5)	0	40(2/5)
	56	60(3/5)	20(1/5)	0	20(1/5)
	84	60(3/5)	0	20(1/5)	20(1/5)

*Percentage (number of incidences/total operated stifles)

used. Dogs of groups 3 and 4 had comparable age and weight ranges but different grades of the luxations. Though both groups received the same methods of treatment, a better result was observed in group 3 which had less severity of the luxation. Dogs in groups 1 and 2 were younger and weighed less than those of group 3. Though the dogs in these three groups suffered from the same grade of luxation, the best result was found in group 3 which received a combination of the two treatment procedures used separately in group 1 and 2.

Conclusion

Tube realignment, when used solely, is not able to correct grades II and III of patellar luxation but it can correct grade II luxation when combined with trochlear wedge recession. For the grade III luxation, more reconstruction techniques are additionally required.

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