

COMPARISON OF TROCHLEAR BLOCK RECESSION AND TROCHLEAR WEDGE RECESSION IN FOUR DOGS WITH BILATERAL PATELLAR LUXATION

CONFRONTO FRA “SOLCOPLASTICA A CUNEO” E “SOLCOPLASTICA EN
BLOCK” IN QUATTRO CANI CON LUSSAZIONE ROTULEA BILATERALE

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SUMMARY

Patellar luxation is the result of progressive structural abnormalities in the soft and/or skeletal tissues of the dog's pelvic limbs. There is an alteration of the patella-trochlear groove interaction with negative effects on the stifle stability and extensor mechanism integrity, on the trochlear articular cartilage nutrition and the adequate trochlear depth and length development and maintenance. This is the reason for which there is a progressive trochlear groove levelling in the cases of severe patellar luxation; therefore, it is necessary to correct the trochlear depth abnormality to make patellar sliding action into the trochlear recess easier and to achieve consistent success with surgical treatment. Traditional methods to improve trochlear depth include the chondroplasty in the very young dogs, and the wedge recession trochleoplasty or TWR (trochlear wedge recession) in adult subjects. A modification of the technique called “trochlear block recession” (TBR) has recently been described from Talcott et al. in 2000. Block recession is identical in principle to wedge recession, except that a rectangular piece of cartilage and bone, rather than a wedge, is removed. The TBR seems to guarantee an adequate trochlear depth and width, the maximal preservation of hyaline articular cartilage and the secure implantation of the osteochondral autograft. The Authors report their clinical experience about four dogs affected by bilateral patellar luxation, treated with the TWR at one stifle and the TBR at the controlateral one in the same surgical session. In our study, we compared the trochleoplasty techniques, evaluating both the recuperated function of the limb, and the anatomic correction obtained, through clinical and computer tomography examinations. Both the trochleoplasty techniques proved clinical efficiency; at the postoperative examinations, all the articulations were adequately stabilised and there were no complications or relapses in any of the cases; also the return to complete function of limb was rather rapid. The TBR, notwithstanding the modest executive difficulties and the slower recovery caused by a more invasive procedure, assures the best anatomical correction of the trochlear defect and increases the patellar stability in extended stifle position; it assent to obtain an adequate trochlear depth without weakening either the trochlear ridges or femoral distal epiphysis, not even in small dogs.

Key words: dog; patellar luxation; trochleoplasty.

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RIASSUNTO

La lussazione rotulea rappresenta l'esito di progressive deformazioni strutturali dei tessuti molli e/o scheletrici dell'arto pelvico del cane, che alterano la stretta interazione fra rotula e solco trocleare, con ripercussioni negative sulla stabilità del ginocchio e sull'integrità del meccanismo estensorio di tutto l'arto, sul nutrimento della cartilagine articolare, nonché sullo sviluppo e sul mantenimento di una profondità trocleare idonea. Per questo motivo, nelle lussazioni rotulee gravi, si assiste ad un progressivo appiattimento del solco stesso, che non è più in grado di alloggiare e contenere in sede la rotula; è quindi necessario intervenire chirurgicamente per aumentare la profondità del recesso e mantenere la rotula nei confini definiti dai labbri trocleari laterale e mediale. Le opzioni chirurgiche più diffuse sono la condroplastica in soggetti molto giovani e la "solcoplastica a cuneo o a V" o TWR (troclear wedge recession) in cani adulti. Più recentemente, nel 2000, Talcott e coll. hanno proposto una variante alla tecnica, definita "solcoplastica rettangolare" o TBR (troclear block recession), che differisce dalla precedente per la formazione di un blocco osteocartilagineo di forma rettangolare, e che sembra garantire un'adeguata profondità trocleare, la massima conservazione della cartilagine articolare e un impianto dell'innesto più sicuro. Gli Autori descrivono l'esperienza personale in quattro pazienti affetti da lussazione rotulea bilaterale e trattati con TBR ad un arto e TWR al controlaterale nella medesima seduta operatoria. Entrambe le tecniche di solcoplastica si sono rivelate idonee allo scopo, garantendo un completo recupero dell'arto senza recidive a breve e lungo periodo. La TBR, nonostante alcune modeste difficoltà esecutive correlate alla tecnica e una ripresa funzionale più lenta imputabile ad una procedura chirurgica leggermente più invasiva, consente di ottenere una migliore correzione anatomica del difetto trocleare rispetto alla TWR e conferisce una maggiore stabilità patellare quando l'arto è in posizione estesa; permette inoltre un approfondimento importante del solco trocleare, senza per questo indebolire i margini trocleari o la troclea femorale stessa, anche nei pazienti di piccola taglia.

Parole chiave: cane; lussazione rotulea; solcoplastica.

INTRODUCTION

Patellar luxation is the result of progressive structural abnormalities in the soft and/or skeletal tissues of the dog's pelvic limbs. In skeletally immature animals, the displaced quadriceps muscle group create a "bowstring effect", causing abnormal angular and torsional femoral growth; therefore, the patella-trochlear groove interaction is altered, with negative effects on the stifle stability and extensor mechanism integrity (Palmer, 2002). The patellofemoral articulation function is important for the rotational and anterior stability of the entire joint; moreover, the patellar sliding within the trochlear groove warrants the proper patellar and trochlear articular cartilage nutrition and the adequate trochlear depth and length development and maintenance. For this reason the patellar luxation and the lack of patellar physiological pressure can result in the development of degenerative articular cartilage alterations and the progressive levelling of the trochlear groove, which no longer is able to contain the patella in place; it creates a vicious cycle and the patella, which remains in the trochlear proximal position when the limb is extended, isn't adequately directed

and contained between the medial and lateral trochlear ridges during limb flexion.

The shallow trochlea is frequently caused by severe patellar luxations, especially in grade III and IV, because patellar action on the trochlear groove is short or absent; therefore, it is necessary to correct the trochlear depth abnormality to make patellar sliding action into the trochlear recess easier and to achieve consistent success with surgical treatment (Hulse & Shire, 1990).

Traditional methods to improve trochlear depth include chondroplasty, limited to very young dogs (usually less than five-six months of age), and wedge recession trochleoplasty or TWR (trochlear wedge recession), which has the potential to preserve hyaline articular cartilage within the trochlea, also in adult dogs.

With this method a V-shaped cut is made into the trochlea, beginning on the ridges and then meeting within the depths of the bone, to form an angle of 30-40°; the slanting osteotomies extend from the midpoint between the trochlear ridges at the dorsal margin of the articular cartilage within the suprapatellar pouch proximally, to a similar point at the cranial edge of the intercondylar notch, within the caudal cruciate ligament insertion. The autograft raised; the amount of bone removed as swath material is just enough to allow the trochlea to settle into a deeper position, producing a good trochlear groove. The depth of the recession is controlled by the amount of bone removed in the saw cut. Removal of an additional wafer of the apex of the wedge are occasionally indicated, before being replaced it.

A modification of the technique called “trochlear block recession” (TBR) has recently been described from Talcott et al. in 2000. Block recession is identical in principle to wedge recession, except that a rectangular piece of cartilage and bone, rather than a wedge, is removed. TBR technique involves two abaxial cuts angled approximately 10° axially toward the sagittal plane of the femur. These cuts are positioned wide enough apart to accommodate the patellar articular surface while maintaining the medial and lateral trochlear ridges, and extend from the proximal trans-trochlear margin in the suprapatellar region to the distal trans-trochlear margin approaching the intercondylar fossa. To complete the rectangular autograft, a straight basilar cut connecting the proximal and distal trans-trochlear margins using an osteotome or a saw is performed (Fig. 1); after the release of the osteochondral autograft, additional trochlear depth can be achieved by further resectioning of the recipient bed; the graft is positioned and firmly pressed in place. The TBR seems to guarantee an adequate trochlear depth and width, the maximal preservation of hyaline articular cartilage and the secure implantation of the osteochondral autograft (Talcott et al., 2000).

Johnson et al., in 2001, performed a comparison of these trochlear recession techniques using a canine cadaver model. Bilateral pelvic limb specimens were mounted on a positioning device and TBR or TWR was performed. Computer Tomography (CT) scan and biomechanical evaluations were performed pre and postoperatively in both extended and flexed stifle position; biomechanical testing consisted of applying 40° of internal tibial rotation and documenting resistance to patellar luxation.

The Authors assert that TBR increases proximal patellar depth, increases patel-



Fig. 1. Rectangular osteochondral autograft resection with osteotome.

lar articular contact, recesses a larger percentage of trochlear surface area, and results in a greater resistance to patellar luxation in an extended position, compared with TWR (Johnson et al., 2001).

In our study, we compared the trochleoplasty techniques, evaluating both the recuperated function of the limb, and the anatomical correction obtained, through clinical and computer tomographic examinations.

MATERIALS AND METHODS

In this study, 4 dogs were selected between the cases brought to our Department with a complaint of secondary lameness caused by patellar luxation, between the years of 2002-2004.

Pre-operative assessment of the patient with suspected patellar luxation included collection of anamnesis and physical examination. Orthopedic examination was performed initially to assess the severity of lameness, the positioning of the patella in the standing position, the range of motion and the pain associated with manipulation of the knee. To classify the severity of pathology, a grading system from grade I-V, provided from Koch in 2003, was used.

Radiographic examination under sedation has been necessary to establish the articular status and the degree of osteoarthritis and to exclude any severe malformation of the femur and tibia.

Surgical treatment planning was achieved, based on clinical and radiographical data. Trochlear sulcus evaluation was performed during surgery and the choice of trochleoplasty technique to apply in each cases has been casual and not bounded by any selective standard.

TWR was performed according to the principles reported in the main small animal orthopedic handbooks; the block recession technique was in conformity with the described procedure by Talcott et al. in 2000.

At the end of surgery, all the operated joints were evaluated by CT scan, in ventrodorsal view with semi-flexed pelvic limbs. The CT images were used to estimate trochlear depth and patellar depth: the first measure corresponded to the distance from a straight line across the top of the trochlear ridges to the center of the trochlear surface; the patellar depth is the percentage of the entire patellar volume positioned under the trochlear ridges (Johnson et al., 2001). The obtained data were compared in relation to trochleoplasty techniques used.

Postoperative care included 10-15 days of rest with a Robert-Jones bandage. After this period, we removed the dressing and a clinical articular evaluation was assessed; if the postoperative course was regular, the patients had a period of physiotherapy with gradual return to normal activity in about 2 months.

The dogs were seen 2 to 3 months after surgery. In one case only, a second tomographic control was performed after 12 months.

RISULTS

Four cases of patellar luxation, in which a trochleoplasty was performed, were investigated. The dogs belonged to different breed, sex and weight, ranging from 5 months to 7 years old.

All the patients were symptomatic and they presented various degrees of bilateral lameness, sometimes difficulty and reluctance to walk, to jump and to go upstairs (Tab. I). During an orthopedic examination the dogs showed capsular ectasia from moderate to severe, limb musculature hypotrophy and pain during passive knee manipulations.

The pathology were presented bilaterally with grade from 1° to 4°. In all the subjects, the standard techniques at one stifle and the block recession at the contralateral one were performed in the same surgical session.

There weren't complications during surgery, but we found greater difficulties in TBR compared to TWR technique, especially at the moment of autograft complete release with osteotome or saw.

In the postoperative period, there were no complications or relapses in any of the cases. Fifteen days after surgery, the patients showed a fairly good ability to distribute weight on both operated limbs, even if they still presented stiffness during gait; moreover, there was more lameness and pain in articulations with TBR. After 2 months all the patients presented an important improvement, with good tolerance during activity, muscular growth, patellar stability and no articular pain.

The clinical picture was similar in both joints subjected to surgery, with the difference that the kneecup was stable in the flexed position, but when the limb is in the extended position, we observed more lateromedial patellar instability in stifle treated with wedge trochlear recession.

Tab. I. Clinical cases.					
Case	Breed	Sex	Age	Diagnosis	Surgery
1	New Foudland	F	5 m	Lateral patellar luxation 3° bilateral	TBR dx TWR sx
2	Pinscher	M	18 m	Medial patellar luxation 1° dx and 4° sx	TBR dx TWR sx Tibial tubercle trasposition
3	Segugio Italiano	F	14 m	Lateral patellar luxation 3° bilateral	TWR dx TBR sx Sartorius Muscle trasposition
4	Springer Spaniel	M	7 yrs	Medial patellar luxation 3° dx and 2° sx	TBR dx TWR sx Tibial tubercle trasposition

The TC images showed the correct autograft positioning and an adequate patellar lodging into the trochlear groove in all the cases, independently of surgical technique used.

Concerning the central trochlea, both TBR and TWR allowed the achievement of a good and similar trochlear depth, but the patellar depth was greater in the knee with rectangular recession. Considerable differences were noted in the evaluation of the proximal trochlea, because the proximal trochlear sulcus was wider and deeper with TBR than with TWR.

Therefore, the tomographic examination showed that the subchondral wedge apex in standard techniques reaches deeper within the caudal portion of the femoral trochlea; on the contrary, the rectangular autograft in TBR is entirely excavated in the cranial portion of the trochlea.

The CT images performed 12 months after surgery showed complete consolidation of the autograft, both wedge and block, confirming the previous datas concerning patellar and trochlear depth.

DISCUSSION

Congenital patellar luxation is not considered as an isolated disease of the knee, but rather as a component/consequence of a complex of skeletal abnormalities affecting the overall alignment of the limb. Therefore, restoration of anatomy and

function in the treatment of patellar luxation requires accurate detection and treatment of all skeletal and soft tissues pathology. Systematic identification and correction of primary and secondary bony and/or soft tissues abnormalities associated with patellar luxation is needed in achieving consistent success with surgical treatment.

For the reasons given above, the techniques proposed to deepen a shallow trochlea must be taken into consideration everytime we come across an abnormally developed trochlear groove, even though an invasive process (Pucheu et al., 2004).

The correction of trochlear depth abnormality is often essential to improve patellar sliding within the trochlear recess and to guarantee joint stability, especially in severe patellar luxations.

In our study, the trochleoplasty is used, individually or in combination of others techniques, in 4 subjects for a total of 8 operated joints.

More difficulties were noticed during the execution of the TBR, especially at the moment of autograft complete release with osteotome or saw; however, in our opinion, this is not the real difficulty, but rather than a short familiarity of surgeon with a new surgical techniques. Therefore, this difficulty can be surmounted with the experience.

The achieved data show that both of the trochleoplasty techniques gave clinical efficiency; at the postoperative examinations, all the articulations were adequately stable and there were no complications or relapses in any of the cases. Also, the return to complete function of limb was rather rapid, likely thanks to maintenance of hyaline cartilage on entire articular surface, except for osteotomy margins, which are rapidly covered with fibrocartilage.

The postoperative examinations showed an important difference between the trochleoplasty techniques, all the more evident because they have been applied on the same patient; although the state of articulations was similar into the stifles, all the patients leaned later the limb treated by TBR, and they limped more on it 2-3 weeks after surgery. The following examinations showed a complete recovery in these limbs too. This difference is perhaps attributable to the presence of three surfaces of osteotomy and to the less congruency obtained between the autograft surfaces and the subchondral bone. The CT images evidenced that the wedge and the trochlear recess are complementary, whereas the block autograft doesn't tally perfectly with the recipient bed; there are some areas with slight cohesion between the cut surfaces, which can slow down the osteointegration process.

CT measurements performed on the central trochlea showed that no significant difference existed in the depth of trochlear recession between the joints submitted to TBR and TWR surgical procedures; the patellar depth is similar in the TBR group compared with the TWR group in large breed dogs, but greater in small breed dogs. This is expected because, with equal depth of recession, the TBR allows to achieve a wider trochlear groove in these patients too, without an excessive weakening of trochlear ridges because the abaxial osteotomies are the least inclination toward the sagittal plane of the femur; this entails an increase of patellar articular contact.

Concerning the proximal trochlea, we noted considerable differences, because the proximal trochlear sulcus resulted significantly wider and deeper with block recession than wedge recession in all the cases. This difference is a result of the

geometry of the block and wedge. The articular surface width of the block and wedge are similar in the center of the trochlea, but the block maintains the articular surface width for the entire length of the trochlea, instead of the osteochondral wedge, which tapers to a point proximally and distally (Fig. 2); this precludes adequate recession of the proximal trochlea, which is essential in the clinical treatment of patellar luxation. After TBR, as the stifle is extended and the patella moves proximally in the position of outmost instability, the patella may articulate and ride up on the recessed portion of the trochlea. Therefore, TBR resulted in increased patellar depth and increased patellar articular contact with the recessed trochlea proximally as compared with TWR. Adequate recession of the proximal trochlea helps to stabilize the patella: this observation was evidenced during the orthopedic examination, when we observed a greater patellar stability in extended limb position.

The tomographic examination showed also the different involvement of central portion of distal femoral epiphysis; the osteochondral wedge apex become deeper within the caudal portion of the femoral trochlea; on the contrary, the rectangular autograft in TBR is entirely excavated in the cranial portion of the epiphysis. Therefore, we can obtain the equal trochlear depth with the minimum skeletal weakening; this is one potential advantage of TBR compared with TWR, especially in smaller patients.

Based on our clinical experience, the trochleoplasty must be applied everytime we come across a shallow trochlear groove; TWR and TBR are the only techniques currently available to recess the femoral trochlea while preserving hyaline articular cartilage in adult dogs. The rectangular recession trochleoplasty is an effective and improved method for treatment of inadequate trochlear depth associated with patellar luxation in the dog. The TBR assures the best anatomical correction of the trochlear defect and increases the patellar stability in extended stifle position; it assent to obtain an adequate trochlear depth without weakening either the trochlear ridges or femoral distal epiphysis, not even in small dogs.

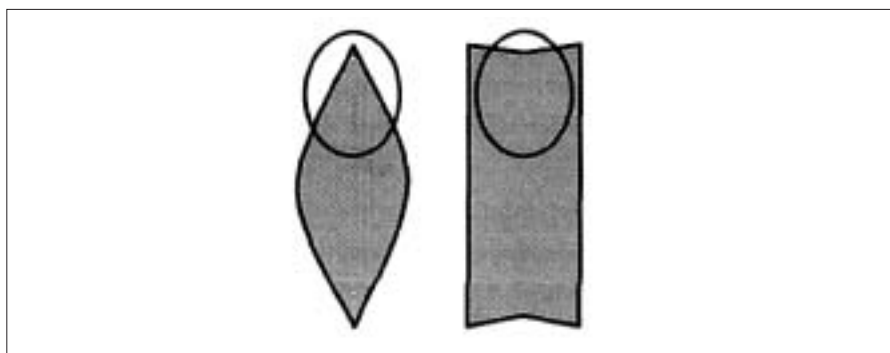


Fig. 2. Schematic representation of the articular surface shape of the block and wedge. The patella has been drawn in the proximal trochlea (Johnson A.L. e coll., 2001).

Therefore, notwithstanding the modest executive difficulties and the slower recovery caused by a more invasive procedure, the trochlear block recession guarantees the best results concerning patellar stability and may help to limit the development of degenerative joint disease in dogs treated for canine patellar luxation.

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