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PATELLAR LUXATION – HOW TO GET YOUR GROOVE BACK
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Very little is actually new in the world of patellar luxation- but this condition certainly warrants review and discussion due to its high prevalence and the common occurrence of complications following surgical repair. Patellar luxation is a frequent presenting complaint of small dogs and cats, and is occasionally seen in large dogs. Medial patellar luxation predominates in both small and large breeds, although past literature suggests lateral luxation is much more common in large breeds. Patellar luxation is generally graded from 1-4 based on increasing severity. Grade 1 patellar luxations are generally not repaired, but surgical repair is recommended for grades 2-4. Surgical options include trochleoplasty, trochlear wedge recession, trochlear block recession, tibial tuberosity transposition, rectus femoris transposition, retinacular imbrication, derotational suture, retinacular releasing incision and corrective osteotomy in cases of femoral or tibial deformity. In severe cases that do not respond to the above treatments, patellectomy and stiffe arthrodesis are a possibility; these techniques are fortunately rarely needed.

DECISION-MAKING FOR PATELLAR LUXATION REPAIR
Many surgical options are available when considering repair of the luxating patella. It is important to consider the underlying problems associated with the particular luxation when choosing a surgical plan. Factors to consider include, depth of the trochlear groove, alignment of the quadriceps mechanism (quadriceps, patella, patellar tendon), and the presence of excessive laxity or tension of the joint capsule and retinacular tissues medially and laterally. The surgical options chosen should alleviate the underlying factor contributing to the luxation. For example, if a dog has good alignment of the quadriceps mechanism, but a shallow trochlear groove- the surgical plan should include a technique to deepen the femoral trochlea, but not a tibial tuberosity transposition.

METHODS TO DEEPEN THE TROCHLEA
Three methods are commonly used to deepen a shallow trochlear groove. These methods are described below. A head-to-head comparison as not been performed to document superior efficacy of one technique compared to the others. Usually trochleoplasty is reserved for toy-breed dogs and cats. Trochlear wedge recession and trochlear block recession are preferred for small, medium and large breed dogs, but also can be performed effectively in toy-breed dogs and cats with a slight increase in technical difficulty.

Trochleoplasty - Trochleoplasty is a traditional technique that involves removal of articular cartilage and subchondral bone from the trochlear sulcus, thereby deepening the sulcus. Fibrocartilage repair is generally seen. This technique is considered less desirable to cartilage-sparing techniques described below, although it is sometimes used in toy breeds very successfully. Trochleoplasty is technically easy to perform. A deepened groove can be quickly formed using appropriate sized rongeurs. Attention should be paid to ensuring adequate depth of the groove proximally.

Trochlear Wedge Recession - Trochlear wedge recession provides a means of adequately deepening the trochlear sulcus, while preserving most of the articular cartilage. This technique is described elsewhere, but basically involves removal of a V-shaped wedge of bone and cartilage from the trochlear sulcus, removal of underlying bone, followed by replacement of the original wedge in a recessed position. This is an excellent technique, but technically more demanding than trochleoplasty.

The technique is performed using a fine-tooth hand saw-blade. Care should be taken when beginning the saw cut, not to excoriate the adjacent cartilage due to slippage. The cut is initiated perpendicular to the cartilage surface adjacent to the peak of the trochlear ridge. Once the saw blade has engaged the subchondral bone, the blade is gradually redirected in the proper direction, parallel to the V-shaped trochlear groove. A cut is made from the lateral and medial ridge, meeting deep to the central sulcus of the groove. The wedge is removed and carefully stored to avoid accidental discard. The groove is further deepened by removing a block of bone from one side of the groove by making a parallel cut with the handsaw. A modification of this technique is to broaden and deepen the proximal aspect of the new, deepened groove by performing a partial trochleoplasty in the proximal aspect of the groove only, as described above using rongeurs. A portion of bone can also be removed from the underside of the trochlear wedge to further deepen the groove. The wedge is replaced and the adequate depth of the groove is documented. Fixation of the wedge is not needed due to pressure applied from the patella lying above and the congruency between the groove and wedge geometry.

Figure 1- trochlear wedge or block recession is indicated for this shallow trochlear groove
Trochlear Block Recession - Trochlear block recession is similar to trochlear wedge recession except that a block-shaped wedge is removed from the trochlear sulcus rather than a v-shaped wedge. This technique allows a deeper sulcus proximally, which may provide better biomechanical stability of the patella when the stifle is in an extended position. This is an excellent technique, but technically more demanding than trochleoplasty. The technique is performed using a fine-tooth hand saw-blade, a small osteotome and mallet. Care should be taken when beginning the saw cut, not to excoriate the adjacent cartilage due to slippage. The cut is initiated perpendicular to the cartilage surface adjacent to the peak of the trochlear ridge. Once the saw blade has engaged the subchondral bone, the blade is gradually redirected in the proper direction, perpendicular to the long axis of the bone. A cut is made from the lateral and medial ridge and each cut is carried to an adequate depth deep to the central sulcus of the groove. The block of cartilage and bone is removed gently using an osteotome and mallet. The osteotome is positioned just proximal to the intercondylar notch beginning at the depth of the trochlear cuts. The osteotome is directed towards the proximal extent to the trochlear groove. Gentle raps with the mallet will advance the osteotome, dislodging the trochlear block. The trochlear block is removed and carefully stored to avoid accidental discard. The groove is further deepened by removing a complimentary block of bone from the deep portion of the groove by making a parallel cut with the osteotome or by deepening with a rongeur. A portion of bone can also be removed from the underside of the trochlear block to further deepen the groove. The block is replaced and the adequate depth of the groove is documented. Fixation of the block is not needed due to pressure applied from the patella lying above and the congruency between the groove and block geometry.

ALIGNMENT OF THE QUADRICEPS MECHANISM

Tibial Tuberosity Transposition - Tibial tuberosity transposition is an excellent method of improving alignment of the patellar mechanism in patients having an abaxially displaced tibial tuberosity. If the tuberosity is displaced medially, luxation occurs medially; therefore, the tuberosity must be transposed laterally and secured. Lateral luxations require medial tibial tuberosity transposition. An osteotomy is performed as previously described; the tuberosity is transposed then secured with a single or multiple k-wires. An attempt is made when performing the osteotomy to leave the distal cortical bone intact to act as a tension band against the pull of the quadriceps mechanism. If the tuberosity is freed completely, it is prudent to secure the transposed bone with either a pin and tension band or a lag screw. The tuberosity should be transposed to a position that restores axial alignment to the quadriceps mechanism.
**Rectus Femoris Transposition** - This is a technique described by Dr. Barclay Slocum for use in bow-legged dogs having medial patellar luxation. This technique is done in combination with a medial releasing incision. A trochlear deepening technique should also be performed as needed. The rectus femoris is transected from its pelvic origin with a small piece of attached bone, then laterally transposed by tunneling under the vastus lateralis and reattaching it to the cervical tubercle or third trochanter of the proximal femur with wire or heavy suture. This realigns the quadriceps mechanism, restoring a straight-line pull.

**RETINACULAR IMBRICATION**

Lateral imbrication is usually performed with correction of a medial patellar luxation as a means of creating lateral restraint. The stretching of the lateral joint capsule and retinaculum occurs chronically with longstanding patellar luxation. Occasionally a traumatic luxation may result in rupture of these tissues; imbrication is also a good technique for repair in this case. Imbrication is usually performed using heavy, absorbable, monofilament suture placed in a vest-over-pants- or horizontal mattress pattern. Care must be taken not to tighten the retinaculum excessively (especially if a retinacular releasing incision has been performed on the opposite side), because it is possible to create an iatrogenic luxation in the opposite direction. An alternative method of supplying lateral restraint is placement of a lateral derotational suture from the lateral fabella to a bone tunnel in the tibial tuberosity.

**RETINACULAR RELEASING INCISION**

A medial releasing incision is performed if fibrous hyperplasia has occurred medially following prolonged or severe medial patellar luxation. An incision is made through the retinacular tissues in a medial parapatellar location. The incision should extend proximally beside the medial edge of the quadriceps tendon. Placement of the incision in this location will release the insertion of the sartorius muscle, decreasing pull on the patella. The incision occasionally has to be carried deeper to include the joint capsule if marked joint capsular fibrosis has occurred creating excessive medial restraint. The incision is left open and not sutured.

**CORRECTIVE OSTEOTOMY**

Occasionally grade 3 or 4 luxations are associated with severe deformity of the distal femur and/or proximal tibia. This is primarily a problem in pets that develop medial patellar luxation at a very young age while the physes are actively growing. The medial position of the patella results in placement of a tensile force on the medial aspect of the proximal tibial and the lateral aspect of the distal femoral physes. A compressive force on the lateral aspect of the proximal tibial and medial aspect of the distal femoral physes also occurs. The end result is a sigmoid deformity of the stifle and concomitant torsional deformity of the femur and tibia due to asynchronous growth of the physes as a result of the unequal forces placed on the physes. Derotational and wedge osteotomies may be required of the femur and or tibia in severe cases. Theses procedures are rarely needed and are technically very demanding. A good functional result can be obtained if the surgery is properly performed, however.