Autogenous Osteochondral Grafting for Treatment of Stifle Osteochondrosis in Dogs

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Objective—To develop and assess clinical outcomes for osteochondral autografting for treatment of stifle osteochondrosis (OC) in dogs.

Study Design—Retrospective case series.

Animals—Dogs with stifle OC (n = 10).

Methods—Osteochondral autografting was developed and optimized in canine cadavers and purpose-bred research dogs using the Osteochondral Autograft Transfer System (OATS). Dogs with stifle OC (n = 10 dogs, 12 stifles) were then treated using the OATS system. Outcomes were assessed by radiography (n = 12), magnetic resonance imaging (1), second-look arthroscopy (9), lameness scoring (12), and telephone survey of owners (10 clients, 12 stifles) 6–15 months after surgery.

Results—Complications were documented in 4 of the 12 stifles treated and included peri-incisional seromas (3) and marked stifle effusion (1). Subjective assessment of follow-up radiographs revealed evidence of integration of the grafts with maintenance of subchondral bone surface architecture. Subjective assessment of follow-up MRI in 1 stifle revealed evidence for incorporation of grafts with restoration of articular surface contour. Second-look arthroscopy 6–30 weeks after surgery revealed maintenance of articular cartilage at the graft site. Dogs were significantly (P < .001) less lame at follow-up compared with preoperative scores. Based on follow-up owner surveys, only 2 dogs had no pain or lameness; the other dogs were judged to have mild pain and/or lameness. All owners noticed improvement in the dogs' quality of life after surgery.

Conclusion—Osteochondral autografting deserves consideration and further evaluation as a primary treatment option for stifle OC in dogs.

Clinical Relevance—Osteochondral autografting for treatment of lateral femoral condylar OC lesions in dogs using OATS instrumentation is safe and results in improved function and quality of life based on owners' perception 6–15 months after treatment.

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INTRODUCTION

OSTEOCHONDROSIS (OC) is a developmental disease of articular cartilage most commonly affecting young, rapidly growing, large- to- giant breed dogs.1-4 The stifle joint is the fourth most common location affected by OC in dogs.5 Stifle OC most often affects the axial, weight-bearing portion of the lateral condyle of the femur, and may be unilateral or bilateral in occurrence. Male dogs are predisposed to stifle OC, and Great Danes, Labrador Retrievers, Golden Retrievers, Newfoundlands, Mastiffs, and German Shepherds are breeds reported to have greater risk for the disease.1-4 When clinically manifested, the condition typically results in pain, lameness, and progressive osteoarthritis (OA). Stifle joint effusion, crepitus, decreased range of motion,
and muscle atrophy are also commonly seen. Age at presentation may be as early as 5–7 months; however, diagnosis may be made at a much later time point as stifle OC may be missed in its early stages.

Classically, therapy for stifle OC has consisted of nonsurgical management, including exercise restriction with or without supportive bandaging and nonsteroidal anti-inflammatory medications, or palliative surgical treatment.\textsuperscript{1–4,6} Surgical therapy most often involves removal of pathologic articular cartilage and bone with subsequent curettage of the OC bed to bleeding subchondral bone to induce fibrocartilage proliferation in the defect.\textsuperscript{2–6} Surgical treatment may be performed by arthrotomy or arthroscopy. These techniques have met with limited success, although 1 report suggested that arthroscopic treatment resulted in good short-term outcomes when subjectively compared with cases treated by arthrotomy.\textsuperscript{6} Typically, a guarded-to-poor prognosis for high-level, pain-free function in the long term is communicated to clients before traditional treatment for stifle OC.\textsuperscript{1–4} Poor outcomes for stifle OC in dogs are generally attributed to loss of articular cartilage and subchondral bone architecture, incongruity, inferior biomechanics of reparative tissue, and/or pre-existing or subsequent secondary OA in this high-demand and complex joint.

In human orthopedic surgery, OC and other osteochondral lesions have been treated successfully with various osteochondral grafting techniques.\textsuperscript{7–18} Both autografts and allografts have been used to treat defects in weight-bearing portions of the knee in humans. Osteochondral autografting in the knee typically involves harvesting grafts of healthy articular cartilage and underlying subchondral bone from nonweight-bearing areas of the joint and then transferring these grafts into a prepared graft bed at the site of the cartilage defect. This technique has been reported to result in good to excellent outcomes in humans for daily, and even athletic, function for as long as 7 years postoperatively,\textsuperscript{5–18} and has been reported to result in bony incorporation and maintenance of articular cartilage composition and biomechanical properties in the normal stifles of research dogs.\textsuperscript{19} Additionally, osteochondral autografting has been reported to provide successful outcomes for treatment of subchondral cystic lesions in the equine stifle.\textsuperscript{20}

Based on the reported success of this technique, we sought to investigate the feasibility of using it for treatment of stifle OC in dogs and to determine if it would result in improved outcomes for these dogs based on historical data and our experience. This report details the preclinical data we obtained with respect to feasibility and subjective assessment of the clinical outcomes in 10 dogs with stifle OC treated with osteochondral autografts.

### In Vivo Research Study

With institutional animal care and use committee approval, 2 adult Labrador Retriever research dogs were anesthetized and prepared for aseptic surgery of the right stifle. Eight-millimeter-diameter osteochondral autografts were obtained from the sulcus terminalis of the medial femoral trochlear ridge of the right stifle. Grafts were transferred to the medial (n = 1) or lateral (1) femoral condyle of the same stifle using OATS instrumentation and manufacturer’s instructions with slight modifications for the dog as described later. Dogs were maintained for 2 weeks (n = 1) or 6 weeks (1) after surgery, and then humanely euthanatized by intravenous overdose of pentobarbital/phenytoin to allow for gross, histologic, and confocal microscopic assessment of graft appearance, integrity, morphology, integration, and viability. Assessment of this preclinical study showed that osteochondral autografting of the lateral femoral condyle could be successfully accomplished in vivo. Evaluation of the joints at 2 or 6 weeks after surgery revealed evidence for maintenance of articular cartilage at the graft site, integration of graft and host bone, and viability of grafted cells (Fig 1).

### Clinical Application and Assessment

Based on the success of the preclinical feasibility studies, clinical cases of OC of the lateral femoral condyle were treated with multiple osteochondral autografts using the OATS system. Informed owner consent to treatment based on discussion of available treatment options and associated prognoses, as well as experience and results with OATS treatment, was obtained and documented in the medical record for each dog.

### Surgical Technique

Dogs were premedicated, anesthetized, and positioned in dorsal recumbency to prepare them for aseptic surgery of one
or both stifles using a hanging limb technique. Protocols used for anesthesia and analgesia were those standard to our institution and included preoperative and postoperative analgesics. After preparation and appropriate draping, standard stifle arthroscopy using craniomedial and craniolateral portals was performed on the clinically affected stifle(s) to assess the location, severity and extent of OC lesions, thoroughly assess the joint for other pathology, and assess potential graft harvest sites for cartilage area and integrity.

After arthroscopic assessment and documentation, lateral parapatellar arthrotomy was performed. The stifle was hyperflexed to ensure complete evaluation and access to the OC lesion. Using the 6-, 8-, and 10-mm OATS sizing templates, the number and size of grafts needed to completely cover the OC lesion surface area were determined (Fig 2). Sizing templates were then used to assess potential sites for graft harvest on the medial sulcus terminalis and the medial and lateral trochlear ridges of the femur. Graft sites were chosen based on gross appearance of articular cartilage, surface area of articular cartilage, and surface contour of articular cartilage at the site. Sites that had healthy appearing articular cartilage of sufficient area with a surface contour most closely resembling that of the femoral condyle surrounding the OC lesion were chosen for donor osteochondral grafts. The location of the growth plate was also factored into the decision of donor graft site to avoid iatrogenic damage to the physis and the associated morbidity.

Once the donor sites and sizes were determined, the appropriate OATS Donor Harvester Trephine was used to obtain the osteochondral grafts for transplantation. The trephine was centered on the chosen site, and the axis of the trephine was maintained at an angle perpendicular to the tangent of curvature at the midpoint of the site (Fig 3). Maintenance of this angle was ensured by watching the calibrated depth lines on the trephine as the trephine was advanced to make sure each line fell below the cartilage surface symmetrically around its circumference. The trephine was advanced into the cartilage and subchondral bone by tapping the top of it with a mallet. The trephine was advanced to a minimum depth of 6 mm, while a depth of 8–15 mm was considered ideal and was reached for the majority of grafts. Once the trephine was advanced to the desired depth, it was rotated 90° clockwise and then gently rocked in the hole to dislodge the graft.

The graft was then extruded from the trephine into the sterile tray using the OATS Core Extruder Cap, assessed for any asymmetry and trimmed as necessary with a #10 scalpel.
blade to ensure its base was as flat as possible (Fig 4). The osteochondral graft was then remeasured using the OATS Recipient Site Drill Bit and Dilator–Tamp to determine the final graft depth.

The OATS Beath pin was then placed into the femoral condyle to a depth of at least 2 cm at the center of the most caudal recipient site. Care was taken to ensure that the pin was inserted perpendicular to the tangent of the desired femoral condyle contour in both planes. Once the pin was placed in the ideal location and orientation, the OATS Cannulated Recipient Site Drill Bit of appropriate diameter was placed over the pin and advanced into the femoral condyle to the predetermined depth for graft placement to restore femoral condylar surface height and contour using the calibrated depth lines on the bit (Fig 5). The drill bit and pin were removed and the graft depth was again compared with the drill bit and dilator–tamp to ensure accuracy before placement.

The dilator–tamp of appropriate diameter was inserted into the graft site and tapped with a mallet to dilate the site, tamp the recipient bed, and ensure accurate depth for graft placement. Using either the clear OATS Graft Delivery Tube or direct insertion, the osteochondral graft was inserted into the recipient bed (Fig 6). In most joints, the graft was completely inserted and firmly seated in the site by manual pressure with the surgeon’s thumb, which was considered ideal. In some cases, final seating of the graft to the desired depth had to be accomplished by tamping the graft into place using the blue OATS Concave Tamp and a mallet.

The procedure was then repeated for additional grafts as needed, working from caudal to cranial to resurface the entire OC defect in each joint (Fig 7). Donor sites were left untreated and allowed to fill in with endogenous blood clot. Routine closure of the surgical wounds was performed. Postoperative radiographs were obtained and a soft-padded bandage was placed on each hind limb treated and maintained for 48–72 hours postoperatively. Dogs were administered postoperative analgesic and nonsteroidal anti-inflammatory medications for a minimum of 10 days with type, dose, and frequency of medications chosen on an individual patient basis. Instructions to the owners were the same for each dog and included care of the incision with skin staple removal in 10–14 days.
strict cage rest with leash walking only to allow urination and defecation for 6 weeks after surgery, and re-examination 6–8 weeks postoperatively. After re-examination, owners were instructed to invoke a progressive return to full, unrestricted function over the subsequent 8 weeks. No specific rehabilitation strategies or techniques were provided to the owners.

Clinical Outcomes Assessments

Patients included in the study were those that had OATS treatment of lateral femoral condylar OC lesions with documented informed owner consent during the period from August 2004 through December 2006, and had sufficient medical record data to allow complete assessment. Complete assessment was defined as medical record data including signalment, date of surgery, details of surgery performed, and follow-up information, and completion of a survey (Appendix A) with respect to outcome completed by telephone conversation with the owner at least 6 months after OATS surgery.

RESULTS

Ten dogs met the inclusion criteria. Two dogs had OATS treatment of both stifles during the same anesthetic episode. Sites for graft harvest were on the medial sulcus terminalis (n = 12), medial trochlear ridge (10), and lateral trochlear ridge (1) of the femur. OATS treatment was feasible to perform in all joints attempted without unacceptable perioperative morbidity or complications. Data with respect to signalment, surgery details, and follow-up data from the medical records are summarized in Table 1.

Complications

Complications were documented in 4 of the 12 treated stifles and included peri-incisional seromas (3) and marked stifle effusion (1). One seroma resolved after treatment with open drainage for 1 week by the primary care veterinarian, and the other 2 seromas resolved within 2 weeks with treatment by warm packing. Marked stifle effusion was noted in the treated stifle of a 15-month-old Mastiff 8 weeks after surgery. Arthrocentesis was performed, and the synovial fluid analyzed to ensure septic arthritis was not present. Synovial fluid analysis
was consistent with OA with no evidence of sepsis, and the effusion subsided within 3 weeks of nonsteroidal anti-inflammatory medication and continued exercise restriction.

**Repeat Arthroscopy Findings**

Nine of the 12 affected stifles had second-look arthroscopy 6–30 weeks after OATS surgery. In all joints, subjective arthroscopic assessment revealed maintenance of articular cartilage at the graft site with variable degrees of integration and maintenance of surrounding articular cartilage. Based on observation and careful probing, mild fibrillation and/or malacia of a 0.5–1 mm rim of host cartilage around the graft was a common finding. Offset of the graft articular surface to host articular surface ranged from \( \frac{1}{2} \) mm recessed to \( \frac{1}{2} \) mm proud and was considered acceptable in all evaluated joints. Overall condylar contour was also considered acceptable in all evaluated joints (Fig 8). Fibrocartilaginous filling of donor sites with mild associated synovitis as well as mild generalized synovitis were noted in all joints (Fig 9). Lesions of opposing tibial articular cartilage were not seen, nor were any meniscal or cruciate ligament lesions noted. Mild medial and lateral trochlear ridge osteophytosis was noted in 7 of 9 cases evaluated.

**Lameness Scores**

All dogs went from a lameness score of 6–10 of 10 to a score of 1 or 2 within 6–8 weeks of OATS treatment (Table 1). Dogs were significantly \( P < 0.001 \) less lame at final follow-up evaluation (score = 2.3 ± 0.8) compared with preoperative lameness scores (score = 8.1 ± 1.0) from the medical records for the patients in this study.

**Imaging Findings**

Follow-up radiographic evaluation was performed for all stifles at 6–10 weeks postoperatively. Subjective

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**Table 1. Summary of Clinical Findings for Dogs with Stifle OC Treated with Osteochondral Grafting**

<table>
<thead>
<tr>
<th>Dog</th>
<th>Signalment</th>
<th>Intended Function</th>
<th>Affected Stifle(s)</th>
<th>Graft Sizes (mm) and Location</th>
<th>Pre Lameness</th>
<th>Post Lameness</th>
<th>Complications</th>
<th>Last Clinical Follow-up Time and Assessments</th>
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<tbody>
<tr>
<td>1</td>
<td>7 mo M Mastiff</td>
<td>Pet</td>
<td>R</td>
<td>8 Cd, 6 Cr</td>
<td>8</td>
<td>2</td>
<td>Seroma</td>
<td>7 mo, Rads, Scope</td>
</tr>
<tr>
<td>2</td>
<td>8 mo F Mastiff</td>
<td>Pet</td>
<td>L</td>
<td>8 Cd, 8 Cr</td>
<td>8</td>
<td>3</td>
<td>Seroma</td>
<td>4 mo, Rads</td>
</tr>
<tr>
<td>3</td>
<td>7 mo F Lab</td>
<td>Hunting</td>
<td>L</td>
<td>8 single</td>
<td>10</td>
<td>2</td>
<td>None</td>
<td>7 mo, Rads, Scope</td>
</tr>
<tr>
<td>4</td>
<td>8 mo FS Mix</td>
<td>Pet</td>
<td>R, L</td>
<td>R-8 Cd, 8 Cr, L-8 Cd, 6 Cr</td>
<td>R-8</td>
<td>R-3</td>
<td>None</td>
<td>9 mo, Rads, Scope</td>
</tr>
<tr>
<td>5</td>
<td>9 mo F Labrador</td>
<td>Hunting</td>
<td>R</td>
<td>8 Cd, 6 Cr</td>
<td>8</td>
<td>1</td>
<td>None</td>
<td>4 mo, Rads, Scope</td>
</tr>
<tr>
<td>6</td>
<td>15 mo FS Mastiff</td>
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<td>R</td>
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<td>3</td>
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<td>4 mo, Rads</td>
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<tr>
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<td>10 mo M Labrador</td>
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<td>8</td>
<td>2</td>
<td>None</td>
<td>4 mo, Rads, MRI, Scope</td>
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</tbody>
</table>

mo, months; M, male; F, female; FS, spayed female; R, right limb; L, left limb; Cd, caudal graft location; Cr, cranial graft location; Rads, orthogonal view radiographs obtained and evaluated; Scope, second-look arthroscopy performed for subjective assessment; MRI, magnetic resonance imaging performed and evaluated.

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Fig 8. Arthroscopic images showing the appearance of the lateral femoral condyles of 2 dogs treated with osteochondral autografts 2 months (A) or 4 months (B) previously. A blunt probe is shown palpating the graft in (A).

Fig 9. Arthroscopic image of an osteochondral autograft donor site on the medial trochlear ridge of the femur of a dog treated 2 months previously.
assessment of follow-up radiographs revealed evidence of integration of the grafts with maintenance of subchondral bone surface architecture in all cases (Fig 10). No radiographic progression of OA was noted within this short period of evaluation. One dog was evaluated by magnetic resonance imaging (MRI) of the treated stifle 4 months after surgery. Subjective assessment of follow-up MRI of this dog’s stifle revealed evidence of bony incorporation of the grafts with maintenance of restoration of articular surface contour and architecture of the femoral condyle (Fig 11). Graft donor sites were still distinguishable at this time point.

**Outcome (Table 2)**

Dogs were evaluated 6–15 months postoperatively by asking the owners a standard set of questions after contacting them via telephone. Only 2 dogs were judged by the owners to have no perceivable pain or lameness. The other dogs were judged to have mild pain and/or lameness by their owners. Half of the dogs were receiving intermittent or consistent nonsteroidal anti-inflammatory drugs and/or nutraceuticals at the time of final follow-up. All owners stated that they noticed a definite improvement in the dogs’ quality of life after surgery compared with before surgery. Owners were somewhat (3) or very (7) satisfied with the outcome of OATS surgery in their dogs.

**DISCUSSION**

Our results suggest that osteochondral autografting for treatment of lateral condylar OC lesions of the stifle of dogs is feasible, and that 6–15 months outcomes as assessed by subjective clinical evaluation, imaging, and owner assessments of pain, function, and quality of life compare favorably with those previously reported2–4,6 and those observed in the authors’ previous experiences. Osteochondral autografts showed evidence for bony integration, maintenance of articular cartilage composition and architecture, and restoration of articular surface contour and congruity. Complications were minimal and considered minor, and no evidence for persistent morbidity associated with the procedure was noted. However, only 2 dogs were completely free of pain or lameness based on their owners’ observations and perception at the final follow-up assessments performed in this study.

Using the OATS system as optimized for treatment of canine stifle OC, the procedure for osteochondral autografting described in this study was felt to be precise, reproducible, and technically feasible for experienced surgeons to perform after training and practice on cadavers. In our experience, the 2 critical aspects of the procedure involve careful harvest of grafts from optimal donor sites and accurate recipient bed preparation for implantation. Donor site choice is primarily based on availability of nonarticulating, nonweight-bearing hyaline cartilage with adequate thickness and surface contour, which allows for harvest at required diameters such that adequate subchondral bone can be included for stable implantation without causing undue morbidity.7–11,21–30

Of the commonly used donor sites in the human knee, including the proximal medial trochlea, distal medial trochlea, lateral trochlea, and intercondylar notch, the only site reported to have no appositional articular cartilage contact during the full range of weight-bearing
functions was the distal medial trochlea. Based on these data and our feasibility studies, we chose the distal medial trochlea at the sulcus terminalis as the preferred site for donor graft harvest. When this site does not provide appropriate or adequate graft material, the lateral or medial trochlear ridges can be used based on our results.

A major concern that must be considered when using the OATS technique is donor site morbidity. Whereas most studies in human patients suggest that donor site morbidity is not a concern, recent work suggests that significant morbidity can be associated with osteochondral graft harvest from asymptomatic knees, including knee pain, patellar instability, persistent effusion, and loss of function. Although no morbidity in our study could be directly attributed to donor site complications, donor sites were not completely remodeled or healed for up to 7 months postoperatively, and localized synovitis was associated with those evaluated arthroscopically. It is also possible that donor site morbidity could have contributed to the residual pain and lameness noticed in most dogs in our study. We suggest that this must be taken into account when performing osteochondral autografting and suggest that graft harvest from a joint without evidence of clinical signs for treatment of another joint should be considered only when no other equivalent options for treatment are available.

Accurate recipient bed preparation for implantation determines the precision of articular surface contour and congruity restoration, which significantly influence graft function and patient outcomes. To address this factor for treatment of stifle OC in dogs, careful attention to graft and recipient bed depth matching is crucial. To aid in this process, the OATS instrumentation for dogs has a canine-specific recipient bed drill bit with calibrated depth markings based on typical graft sizes used in dogs. In addition, we strongly recommend checking depth match of the graft to the drill bit before drilling and to use the dilator-tamp before final bed preparation and graft implantation.

Other factors that may determine indications and affect outcomes for osteochondral autografting in humans include cartilage defect number, size, and location, orthopedic comorbidities, and postoperative management. We cannot directly compare our results to those in the human literature with respect to these factors and can make only very limited statements with respect to treatment of canine patients. We treated only single defects of the lateral femoral condyle with a maximal surface area that could be completely resurfaced using two 10-mm-diameter grafts or less. We did not recognize any orthopedic comorbidities affecting the stifles of dogs included in our study.

As is typical for clinical studies involving client-owned dogs, we can only realistically attempt to “standardize” postoperative management by providing instructions for activity restriction and undoubtedly this varied widely among patients. An advantage of osteochondral autografting over other techniques which do not involve the use of mature tissue (e.g., microfracture, subchondral drilling, cell-based therapies) is the ability to allow early motion and controlled load-bearing of the affected joint. This was one of the motivating factors in our exploration of this cartilage resurfacing technique for use in dogs. Our outcomes suggest that “routine postoperative management” after OATS treatment allows for graft integration and function even when grafting was performed bilaterally at the same surgical setting. However, evaluation of rehabilitation strategies and techniques designed to optimize joint health and function should be pursued as we move forward in developing and critically assessing cartilage treatment strategies for dogs.

Whereas it is not appropriate to directly compare outcomes in our study to the little historical data available regarding outcomes of other treatments for stifle OC in dogs, the evidence provided by this case series

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<th>Patient No.</th>
<th>Time Point of Survey (months)</th>
<th>Time to WB (days)</th>
<th>Activity Level</th>
<th>Lameness</th>
<th>Pain</th>
<th>Improvement in Quality of Life</th>
<th>Continued Meds</th>
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<td>Glu-Chon, NSAID prn</td>
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WB, weightbearing; NSAID, nonsteroidal anti-inflammatory drug; prn, as needed (based on owner perception); Glu-Chon, glucosamine chondroitin combination nutraceutical.
suggests that osteochondral autografting deserves consideration as a primary treatment option for stifle OC in dogs. While one study suggests that outcome was improved with arthroscopic treatment of stifle OC based on subjective results in 6 cases, no treatment technique has been documented to significantly ameliorate pain, lameness, or development and progression of OA associated with this problem in dogs. Similarly, our data do not allow us to conclude that osteochondral grafting is superior to any other technique in the long term. Our purposes were to describe a technique for osteochondral autografting in dogs’ stifles, and to report the subjective clinical outcomes in a series of dogs to demonstrate safety and initial efficacy of the technique. These data provide impetus for prospective comparison of techniques for treatment of stifle OC in dogs.

There are multiple limitations to our study, which should be considered when interpreting the data. As mentioned above, this study was retrospective with limited subjective outcome measures used to assess a small series of cases. No controls or cohorts were available for this clinical study. The primary outcome measure used was a subjective questionnaire to survey owners by telephone contact at variable times postoperatively. This questionnaire is neither standardized nor validated, but was chosen based on previous experience and ongoing research in the investigators’ laboratory and clinical practice. Therefore, this study can be considered to provide level 4 evidence, documenting feasibility and safety so as to promote inclusion of this technique in prospective, controlled clinical trials focused on determining optimal treatment for stifle OC in dogs.

In summary, osteochondral autografting for treatment of femoral OC lesions in dogs using OATS instrumentation is safe and results in improved function and quality of life based on owners’ perception 6–15 months after surgery. From our data, we can only propose that young dogs with focal OC of the lateral femoral condyle without clinical evidence for diffuse joint disease or comorbidities (e.g., cranial cruciate ligament pathology, angular limb deformity, meniscal pathology) are indicated for this type of surgical intervention. We cannot comment on relative contraindications in dogs. Complications noted in our study did not appear to negatively affect outcome or require further surgery, and may be further minimized with longer term bandaging and strict client compliance to activity restriction. Careful attention to the critical technical aspects of the procedure appears to allow for consistent and accurate graft placement and result in graft integration, maintenance of articular cartilage composition and architecture, and restoration of condylar contour and congruity. Donor site morbidity was not recognized but deserves attention in future work. These data allow us to conclude that osteochondral autografting deserves consideration and further evaluation as a primary treatment option for stifle OC in dogs.

REFERENCES


APPENDIX A

Phone Survey

Questions regarding Pre-Surgical Period:
1. Did _______ (pet’s name) have the OATS procedure performed at the REDACTED on ____________ (date)?

2. Is _______ (pet’s name) ____ years old?
   Yes  No

3. Was _______ (pet’s name) in pain or showing signs of lameness prior to surgery?
   Yes  No

4. Was the pain/lameness associated with a traumatic injury?
   Yes  No

5. Please rank the lameness prior to surgery on a scale of 1–10
   1  2  3  4  5  6  7  8  9  10
   (owners told to rank on “whole number” scale of 1 to 10 with 1 being no lameness and 10 being severe, non-weightbearing lameness)

6. How would you describe _______ (pet’s name) activity level prior to surgery? Minimal Moderate High Extreme
   (Minimal—Pet only moves to food and to potty; Moderate: Pet plays with owner and goes outside several times daily; High: Pet routinely plays/runs for much of the day; Extreme: Pet is a professional athlete)

7. What was the length of time from when you first noted signs of lameness until the OATS procedure was performed?

8. Had _______ (pet’s name) been on any medications prior to surgery? If so please list medications, amount of time pet was on each medication and dosage if known.

9. Had any medical/surgical treatments been performed prior to the OATS procedure? If yes, please describe procedure including approximate date, location where performed, and who performed it.

   Dates: Procedure: Location: Surgeon:

Questions regarding Post-Surgical Period:

1. Characterize _______ (pet’s name) post operative pain in the first week after surgery
   1  2  3  4  5  6  7  8  9  10
   (owners told to rank on “whole number” scale of 1 to 10 with 1 being no pain and 10 being severe, unbearable pain)

2. How long was _______ (pet’s name) non-weight bearing period

3. How long did you perform assisted walking with _______ (pet’s name) after surgery and how long was activity restricted overall? Please describe _______ (pet’s name) return to function period.

4. How long after surgery was it until _______ (pet’s name) resumed normal activity and how long was activity restricted overall? Please describe _______ (pet’s name) return to function period.

5. Did you perform physical therapy after surgery? If yes then what did you do, when did you start, how often did you do it, how long, when did you stop?
Physical Manipulation (ROM): Swimming: Other:
6. Have you had follow up radiographs or checkups with your local veterinarian since your most recent visit here? If yes then what were the relevant findings?
7. Is _________ (pet’s name) on pain medications/NSAIDS/joint supplements currently? If yes please list drugs, dosages, etc.
   
   **Drug:**   **Dosage:**   **Drug:**   **Dosage:**
8. What is _________ (pet’s name) current level of use of the affected limb?
   
   1  2  3  4  5  6  7  8  9  10
   (owners told to rank on “whole number” scale of 1 to 10 with 1 being no lameness and 10 being severe, non-weightbearing lameness)
9. Does _________ (pet’s name) seem to favor the affected limb over the other limbs?
   Yes  No
10. Please describe any pain in the affected limb at present.
    1  2  3  4  5  6  7  8  9  10
   (owners told to rank on “whole number” scale of 1 to 10 with 1 being no pain and 10 being severe, unbearable pain)
11. What is _________ (pet’s name) current activity level?
    Minimal:  Moderate:  High:  Extreme:
12. Do you think that _________ (pet’s name) has a higher, lower, or equivalent quality of life than before surgery?
    Higher  Lower  Equal
13. What is your level of satisfaction with the OATS procedure (give a ranking system of some sort?)
14. If you could go back in time, would you choose to have the OATS procedure performed again?
    Yes  No
15. Would you recommend this procedure for your friends’ pets?
    Yes  No