Chapter

26 Degenerative Arthritis of the Knee

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An increased life expectancy and heightened awareness of the importance of maintaining physical fitness throughout adulthood equal more miles on knees.[1–5] There are variations in the patient population with articular surface changes: age, physical demands, goals, and expectations. In the active individual, how do we keep these knees natural, painless, and moving? The wand of the arthroscope does not magically remove the pain from an arthritic, malaligned knee.

The decision to intervene arthroscopically should be based on symptoms of mechanical locking, effusion, and localized painful popping. The light for the future of arthroscopy burns brightly; however, make sure the choice of procedure and equipment is indicated for the patient's problem. Multiple clinical examinations and histories to document symptoms are necessary. Biomechanical assessment of gait, radiographs of the weight-bearing patient, and technetium-99m bone scan are performed.[6–8] In this era of "outcomes review" and close scrutiny of health-care expenditures, the arthroscopist should proceed with caution.[9] Many patients with arthritic knees may not benefit dramatically from arthroscopic intervention.[10] Complications from arthroscopy do occur.[11–13] The superiority of arthroscopy to plain radiography of chondral changes is well recognized.[13–16] The focus of this chapter is degenerative arthritis: its nature and pathophysiology, analysis of the published literature regarding arthroscopic treatment, and areas that warrant further investigation.

RANGE OF CAUSES

There are many causes of arthrosis, not all of which are truly "degenerative."[17] The categories are primary, secondary, and nontraumatic; they are listed in Table 26–1. The order of importance of contributing factors should be ranked. Factors contributing to abnormal joint loading include obesity, congenital or developmental, pathologic, and varus and valgus alignment.[18–20]

The causes of primary osteoarthritis are well recognized. There seems to be a familial component.[21, 22] DNA analysis may predict a predisposition to degenerative joint disease (DJD). Enzymes are released into joint fluid after knee injury.[23] A single-base mutation in the gene coding for type II collagen was identified in a family with chondrodysplasia and osteoarthritis.[24, 25] This enzyme environment from injury or inheritance creates a milieu for destruction of cartilage.

Look for the primary causative factor in the degenerative knee. Is it vascular? Is it ligament instability? Beware of avascular necrosis of the femoral condyles[26] (Table 26–2). Early ligament reconstruction to correct instability and osteotomy to correct malalignment are preventive measures.[27] Longitudinal retrospective studies have illustrated an unfavorable natural history for the anterior cruciate ligament (ACL)–deficient knee.[28–32] Other studies do not support ACL reconstruction to prevent DJD.[33] With mild to moderate DJD with malalignment, ACL reconstruction can be successful.[34] Chronic posterior cruciate ligament instability increases wear and contact forces in the patellofemoral and medial compartments.[35, 36]

Patellar instability with osteochondral fractures and abnormal, excessive patellar loading contribute to localized patellofemoral DJD. The role of patellar instability in the development of patellofemoral arthritis is more debatable.[37] Open patellar realignment procedures must unload the abnormal cartilage to be successful.[38]

The meniscus protects the chondral surfaces of the knee by evening the load distribution, improving joint stability, and assisting in cartilage nutrition.[39] Elegant studies in meniscal biology have been coupled with a clinical understanding of the deleterious results of meniscectomy[26, 40, 41] to create a campaign for meniscal preservation. Allograft meniscal transplantation remains in the investigative stages owing to mixed clinical results.[42–47] Noyes and Barber-Westin[47] reported a 58% failure rate; only 10% of transplants were believed to be "fully healed and functional" after 2–3 years. Experimental synthetic

Table 26–1 Various Forms of Arthrosis

I. Primary degenerative arthritis
  A. Osteoarthritis: compartments involved
    1. Angular deformity
      a. Varus: medial compartment
      b. Valgus: lateral compartment
    2. "Isolated" patellofemoral
    3. Tricompartmental
II. Secondary degeneration
  A. Post-traumatic arthritis
    1. Osteochondral fracture (localized lesion)
      a. Loose body
      b. Surface disruption or defect
    2. Osteochondritis dissecans
    3. Intra-articular fracture
      a. Joint surface incongruity
    4. Alteration of force distribution across joint
      a. Femur fracture
      b. Tibia fracture
      c. Leg length inequality
    5. Previous meniscectomy
      a. Medial
      b. Lateral
    6. Post-ligament reconstruction
      a. Posterior cruciate ligament
      b. Anterior cruciate ligament
      c. Medial cruciate ligament
      d. Combined
      e. Patellofemoral
  B. Arthritis associated with instability
    1. Anterior cruciate ligament
    2. Posterior cruciate ligament
    3. Patellofemoral
    4. Combined instabilities
    5. Reconstruction or realignment procedure
III. "Non-traumatic" conditions causing chondral injury and degeneration
  A. Postinfectious
    1. Septic
    2. Tuberculosis, syphilis
    3. Lyme arthritis
  B. Vascular
    1. Avascular necrosis
    2. Osteochondritis dissecans
  C. Inflammatory, crystalline, metabolic
    1. Cartilage matrix deposition
      a. Gout, hemochromatosis, ochronosis, Wilson's disease
    2. Pseudogout (calcium-pyrophosphate deposition)
      a. Calcium-hydroxyapatite crystal deposits
    3. Rheumatoid arthritis
    4. Nonrheumatoid systemic inflammatory conditions
      a. e.g., psoriasis, lupus, ankylosing spondylitis
    5. Other synovial processes
      a. Pigmented villonodular synovitis
      b. Hemophilic arthropathy
  D. Obesity
  E. Genetic

Table 26–2 Factors Leading to the Development of Joint Degeneration

I. Direct destruction of cartilage
  A. Infection
  B. Pannus
II. Joint incongruity
  A. "Macroscopic": intra-articular fracture, osteochondritis
  B. "Microscopic": early joint wear, particulate debris
III. Abnormal joint loading
  A. Obesity
  B. Alignment abnormalities
  C. Length discrepancy
  D. Gait abnormalities
IV. Instability
V. Iatrogenic
  A. Meniscectomy
  B. "Over-constraint"
VI. Genetic factors
VII. Activity level

meniscal scaffolds and substitutes are also being developed.[48, 49] Cartilage transplantation is being performed.[50] For localized femoral condyle lesions in a small population, results are encouraging.[50] However, for the truly degenerative knee this highly publicized procedure is not indicated.

Research is being done on the basic science models of chondrocyte transplantation with protective transduced chondrocytes from interleukin-1–induced extracellular matrix degradation.[51] When modified chondrocytes were transplanted into the articular surface of osteoarthritic mice, integration to the articular cartilage occurred. Research is under way in the work-up of deficiencies in cartilage collagens and models for gene therapy.[52]

However—promise of the future notwithstanding—the result remains much the same as in the words of Hunter.[53] In 1743 Hunter wrote "ulcerated cartilage is a troublesome thing . . . once destroyed it is not repaired."[54]

BASIC SCIENCE OF CARTILAGE INJURY

Hyaline cartilage is avascular and aneural. Isolated chondral injury or wear does not generate pain or a significant healing response.[55] The structure of cartilage is predominantly that of an extracellular matrix containing 70–80% water in terms of total weight. Scattered cells in the matrix synthesize the structural macromolecules that comprise this unique composite. The fibrillar components of cartilage are 50% collagen (predominantly type II), 35% proteoglycans, and 15% noncollagenous proteins and glycoproteins. With their low metabolic level, chondrocytes can obtain sufficient nutrition by a process of diffusion through the matrix.[56, 57] The cartilage-bone interface occurs deep to the tidemark with the formation of calcified cartilage, eventually giving way to subchondral bone.[58–60]

Nerve endings and specialized neurosensory organs in the subchondral bone sense pressure changes and, hence, pain. Intraosseous pressure measurements greater than 40 mm Hg and elevation on the femoral side were found in patients with a painful osteoarthritic knee.[61]

The viscoelastic properties from the composite fluid/macromolecular structure and lubrication allow the hyaline cartilage to resist the types of forces seen in joints: shear, tension, and compression. Weeping lubrication occurs on the cartilage surface as water molecules are forced from the extracellular matrix owing to compressive and shearing forces.[62, 63] The coefficient of friction of a Teflon-polyethylene interface is an order of magnitude higher than that of opposing surfaces of hyaline cartilage lubricated by synovial fluid.

Wear occurs from fatigue, impact loading, and interfacial surfaces. Fatigue wear causes intrinsic damage to the molecular structure of collagen. Impact-loading wear results when axial forces do not allow time for stress relaxation of the matrix, again resulting in loss of structural integrity. Interfacial wear, caused by direct contact of irregular surfaces, includes the processes of abrasion and adhesion.[55] Histologic and biochemical evaluation of cartilage in osteoarthritis shows striking changes.[64] Damaged cartilage becomes hyperhydrated,[65] and hydraulic permeability increases, altering the mechanical properties of the tissue.[66, 67]

The three traditional phases of injury response (necrosis, inflammation, and repair) are not always seen following chondral injury.[68–72] In partial-thickness injury, early fibrillation and fissuring occur and are associated with mild hypercellularity and loss of mucopolysaccharides in the superficial and transitional zones.[73] This increase in cellularity appears to result in increased proteoglycan and collagen synthesis.[74, 75] These new cells do not migrate through the matrix toward the site of injury and lack the ability to organize the matrix, resulting in a tissue with inferior mechanical properties.[76, 77] The degradative enzymes produce increased chondral surface damage.[78] As arthritic changes progress, structural clefts extend into the deeper layers, and the hypercellular areas disappear, leaving a hypocellular matrix with marked diminution of proteoglycans. Microfractures in the subchondral bone lead to increased stiffness,[79] and a resulting increase in the peak stresses and impulse loads to articular cartilage accelerates the degenerative process.

After débridement of partial cartilage injuries, ultrastructural studies using electron microscopy show an increase in local fibrillation, degradation, and cell death.[80] After a full-thickness chondral injury, a fibrin clot forms in the defect and develops into granulation tissue with eventual metaplasia on the ingrowth of vascular tufts. The foundation of "abrasion chondroplasty" is based on stimulating the reparative healing of larger chondral defects by creating perforations into the subchondral bone and allowing fibrin clot formation.

Joint motion stimulates increased differentiation of pluripotential cells into chondroblasts.[81] Unfortunately, the fibrocartilaginous repair tissue is inferior to native hyaline cartilage.[82] This repair tissue is higher in concentration of type I collagen and has "inferior" proteoglycan composites. The long-term fate of repair cartilage seems to be fibrillation, degeneration, and deterioration.[83, 84]

NONOPERATIVE TREATMENT

The course of osteoarthritis is insidiously progressive, but the rate of deterioration varies.[85] Some patients improve, others remain unchanged, but most gradually worsen.[86]

It is clear that long-term studies are necessary to evaluate patients undergoing treatment for knee arthritis.[87–91]

In the presence of degenerative wear, the treatment regimen—both nonoperative and operative—must be discussed in detail with the patient.[92] In patients with degenerative wear, postoperative arthroscopy complications and patient dissatisfaction are common. Continued pain, limited motion, popping, and vascular complications can occur. The duration of nonoperative treatment should be long enough that the patient has continued symptoms and localized mechanical signs and is truly convinced an arthroscopy will help. Know your patient. Operate for mechanical signs, not pain.

SURGICAL TREATMENT AND LITERATURE REVIEW OF CARTILAGE LESIONS

Degenerative joint disease of the knee has been treated with arthroscopic lavage during the last 65 years.[93–97] Open débridement has been touted as causing significant improvement in patient comfort level.[98–104]

Washout Procedures

Several investigations have focused on more invasive office procedures for the treatment of degenerative knee conditions, including an office "washout"—closed, flow-through irrigation—with promising and surprising early follow-up. The impetus for this procedure comes from a belief that the benefits of minimal arthroscopic evaluation of a degenerative joint stem from the fluid irrigation of the procedure.[95, 105–107] Eriksson and Haggmark[107] performed needle lavage periodically in follow-up to arthroscopy in a series of avid joggers and found significant, sustained relief. Experimental evidence of joint irritation due to the byproducts of cartilage wear and particulate debris[108] may substantiate the reason for these successes in washing out the "evil humors" of the knee—proteases, hydrolases, and proteoglycans. In a controlled study, Livesley and colleagues[109] found better relief from lavage and physical therapy than from physical therapy alone. Whereas inflammation recurred within 3 months, some relief persisted up to 1 year. Ike et al.[110] prospectively evaluated the results of "tidal irrigation" versus those of medical management, and Edelson, Burks, and Bloebaum[111] reported striking results of irrigation at 2-year follow-up (17/21 good to excellent knees). No additional benefit was gained from the injection of hyaluronate, a substance known to be decreased in osteoarthritic knees.[112] However, not all studies have confirmed this benefit. Dawes, Kirlew, and

Haslock[113] found no evidence that a saline washout provided any more relief than a simple injection of 10 mL of sterile saline in a group of 20 patients studied in a single-blind, random fashion.[111]

Cartilage Débridement Without Abrasion

Aichroth, Patel, and Moyes[114] prospectively studied 254 patients undergoing arthroscopic débridement for pain due to degenerative disease. The average patient age was 49 years, with follow-up being nearly 4 years. Nearly half of the patients had only mild to moderate (Outerbridge grades I and II) changes. Localized abrasion procedures on eburnated tibial bone were utilized in 28% of patients. Reoperation rate was only 14%, and patient satisfaction rate (85%) was high. Younger patients fared significantly better than older patients, and results correlated with the degree of preoperative radiographic degeneration. These authors stated that drilling or abrading small (1–1.5 cm) areas of bone produced satisfactory results with no evidence of harm.

Bonamo, Kessler, and Noah[115] undertook débridement and partial meniscectomy alone in 118 patients older than 40 years of age, all with Outerbridge grades III and IV changes. No abrasion or drilling was performed. After mean follow-up of 3.3 years, this group was compared with a group of 63 patients who had no advanced articular surface changes but who underwent similar meniscal procedures. Whereas the group with degenerative changes fared worse overall, results were gratifying, with an 83% patient satisfaction rate and 75% resumption of recreational athletic activities. In contrast to previous findings by McBride and colleagues,[116] these authors did not find a significant difference in the clinical results between patients with tears classified as degenerative (complex, horizontal, cleavage tears) and those with more nondegenerative (flap, radial, oblique, and bucket-handle) patterns.

Baumgaertner et al.[117] evaluated 49 degenerative knees of 44 patients who underwent arthroscopic cartilage débridement without abrasion chondroplasty or meniscal work. About 67% had "severe" radiographic changes. The procedure involved osteophyte removal and limited débridement. At 33-month average follow-up, 52% of the patients had good or excellent results, and two-thirds of the patients had no visible deterioration. Thirty-nine percent had no improvement, and 9% had only temporary relief. Postoperatively, symptoms of swelling and giving way and walking endurance were markedly improved. Long duration of symptoms, malalignment, and advanced radiographic changes were associated with poorer results. Eight patients with chondrocalcinosis did better as a group. Despite the high percentage (39%) of early failures, the few good results were worth the failures as "no bridges were burned."

Similarly, Timoney et al.[118] reviewed the results of débridement without abrasion in 125 patients, obtaining mean follow-up of 50 months in 92% of the involved knees. Nearly two-thirds of the patients obtained measurable relief for a significant length of time and three-fourths of the patients believed the procedure was beneficial. However, a 27% failure rate at 6 months was found with most of these patients undergoing total knee replacement during the course of the study. Long duration of symptoms, malalignment, radiographic narrowing down to 1–3 mm joint space, and the presence of eburnated bone at arthroscopy correlated with a poor result. Results deteriorated, averaging nearly 2 years until worsening. Overall, 45% of the knees were rated as good at 50 months. Because of the low complication rate and general satisfaction of the patients, arthroscopic débridement was thought to be a reasonable alternative in selected patients.

Débridement Versus Abrasion Chondroplasty

However, there are no control (nonsurgical) groups in these studies,[117, 118] adding to the difficulty in comparing results. Merchan and Galindo[86] randomized 80 patients older than 50 years of age into one of two treatment groups: arthroscopic limited débridement (no abrasion) and nonoperative treatment. Patients were relatively sedentary, had brief (fewer than 6 months') duration of symptoms, and minimal joint space narrowing and osteophyte formation. Significant angular malalignment and patellofemoral degeneration resulted in exclusion from the study. Both groups underwent similar physical therapy regimens. A greater percentage of the operative group improved subjectively at the mean follow-up time of 25 months. The difference in knee scores (37 for the operative group and 32.76 for the nonoperative group) had a p value of .02. Although deterioration occurred, the authors concluded that meniscal and limited chondral débridement was beneficial in this group of patients.

In surveying the literature, Rand[16] and Bert[119] concurred that abrasion offers little benefit versus débridement and management of degenerative menisci, although both procedures remain unpredictable. Rand's study population demonstrated a 67% rate of continued relief from débridement alone at 5-year follow-up. In contrast, nearly 50% of patients undergoing abrasion required conversion to total knee replacement at 3 years. As such, a trend toward minimal perforation of the subchondral bone (so-called microfracture technique using picks or smaller drills and flexible K-wires) is being seen.[120]

Prior to advancements in arthroscopic techniques, patients were relatively satisfied with short-term follow-up after an arthrotomy and open osteophyte removal and drilling of cancellous bone to improve blood supply. In the early 1970s, diagnostic arthroscopy became more popular for débridement.[105, 121, 122] Subchondral drilling and débridement resulted in 80% subjective good results in 22 patients.[123] Other studies showed overall satisfactory results with drilling.[124, 125] Ficat's original open "spongialization" principles were popularized arthroscopically by Johnson in the form of an abrasion arthroplasty.[126] Intracortical vessel bleeding after motorized débridement of the area resulted in fibrin clot, inflammatory response, and promotion of repair of fibrocartilage. In 95 patients, 75% improved subjectively, and only 7 patients required further surgical intervention at 3-year follow-up. Biopsy samples showed no normal type II collagen fibers, but in some samples the tidemark had reformed. Hjertquist and Lemperg[127] suggested that cortical subchondral bone must be preserved. Hence, the débridement should not go into the cancellous bone. This concern has also been an issue in newer chondrocyte transplantation techniques, in which it is believed to be important not to violate the cancellous base so that the cartilage cells have a tidemark off which to work.[50] In rabbits, if the subchondral plate is violated even with curettage at the base, the defect does not heal spontaneously.[128] The abrasion technique attempts not to violate the cortical layer, avoiding exposure of raw red and cancellous trabeculae.[129]

Abrasion Chondroplasty

Abrasion chondroplasty became very popular; later it was scrutinized.[106] Johnson's strict selection and rehabilitation criteria were believed to select for highly motivated patients who would do well after any procedure.[126] Later authors were unable to duplicate the successes reported earlier. Promising results from procedures, including limited chondral débridement, osteophyte removal, and formal abrasion arthroplasty—such as the favorable report by Chandler[130]—often had less than 2-year average follow-up. Singh, Lee, and Tay[131] reported 50% "improvement" using crude pain and range-of-motion scores in 44 patients with only 3–27-month follow-up; nine patients required further operation during this limited period, and 25% were rated "worse" after surgery. Many surgeons reported abrading large areas of the joint (e.g., the majority of the trochlear surface), contradictory to the recommendations made by Johnson.[126]

In an effort to evaluate the abrasion technique more objectively, studies were attempted[132, 133] comparing two similar groups—débridement and abrasion, and débridement alone. A substantial number of patients in both groups worsened symptomatically following surgery. Joint-space widening on postoperative radiographs did not correlate with reduction in symptoms. At 5-year follow-up, 15 of 59 patients with abrasion and débridement had been converted to total knee replacement. The conclusions were that abrasion was unpredictable and offered no long-term benefit for actual joint resurfacing. Friedman et al.[134] had slightly better results using abrasion techniques when compared with débridement alone, although follow-up was short (12 months), and 83% of patients still had pain, with 63% still taking nonsteroidal anti-inflammatory drugs and 24% using ambulatory aids. Nearly 60% of patients were "unchanged" by the results of surgery.

"Limited" abrasion techniques have been investigated as well. Reports by Jackson, Silver, and Marans[135] and Ogilvie-Harris and Fitsialos[136] showed similar improvement following arthroscopic débridement at 3–4-year follow-up. In the later group[136] of 441 procedures (average patient age was 58 years), 68% of patients obtained at least 2 years of pain relief, 53% remained good at 4.1 years. Mild to moderate (Outerbridge grades I and II) disease was treated with local chondral débridement; limited abrasions were performed when full-thickness defects involving up to one-half of one condyle were present. All knees were thoroughly lavaged; when no significant meniscal disease was present in the presence of extensive chondral destruction, lavage alone was performed. Immediate weight-bearing was allowed, but reduced impact-loading for at least 6 months was prescribed. Patients with unstable meniscal flap tears fared best, whereas those with bicondylar disease showed the worst results. The extent of patellofemoral degeneration did not seem to affect results; rather, patients with a significant patellofemoral component also had more advanced bicondylar disease, which did correlate with inferior results. Patients with isolated lateral arthrosis fared somewhat better than those with medial side degeneration. Lavage alone failed to provide improvement. Only five patients subjectively worsened, four of whom were in the group with severe degeneration. Patients undergoing abrasion fared slightly worse, but this could have been due to selection bias, as they tended to have more significant lesions.

SURGICAL INTERVENTION AND LITERATURE REVIEW OF MENISCAL TEARS

Radiographically and clinically,[40, 41] total meniscectomy has been shown to lead to progressive arthrosis. Emphasis on leaving stable meniscal rims is based on sound biomechanical principles. When more meniscus is removed, the articular surface is under significantly greater and asymmetric force distribution.[39, 137] Patients with normal preoperative radiographs undergoing medial meniscectomy had a 90% chance of having a good or excellent result, whereas patients with radiographic changes had a 20% chance of a good or excellent result.[26] Careful assessment of standing radiographs and changes for osteonecrosis should be done. Other studies showed joint degeneration in 60% of patients following partial meniscectomy.[138, 139]

In the degenerative knee, medial meniscus tears outnumber lateral meniscus tears by 9:1, and posterior third location occurred in 84% of knees.[140] There are numerous tear patterns in the degenerative knee.[115, 141] It has been suggested to leave stable meniscal tissue alone[9, 142] because such tissue provides a space and scaffold. The most important indicator of successful arthroscopic meniscectomy is preoperative status of severity of degenerative joint disease.[26, 115, 116, 141, 143–145] Lateral meniscus tears in the degenerative knee appeared to do better than medial meniscal tears associated with chondral wear.[42, 136, 139] Many series have evaluated the results of arthroscopic partial and subtotal excisions.[116, 143–146] Patients who cite a specific traumatic event as the cause of symptoms, especially if they are short-term, fare remarkably well, even if the patients have had previous surgery and have suffered reinjury.[146] Chronic symptoms, when associated with significant radiographic changes, tend to lessen overall results. Even in the presence of joint degeneration, though, the results of arthroscopic meniscal resection are promising.[109, 140] In one series, 72% of patients maintained good results at 4.7-year follow-up from partial menisectomy in the presence of advanced degenerative changes.[136]

Patellofemoral Changes

Limited success in patients with significant patellofemoral degenerative changes has been reported.[147, 148] If these changes are localized arthritic defects, procedures to relieve the pressure and transfer it to normal articular surface should be done. Open distal realignments include the Maquet procedure[149–151] and Fulkerson anteromedial tubercle elevation.[38] In patients with patellofemoral arthritis, tibial tubercle advance resulted in 65% excellent or good results at 3-year follow-up.

Spongialization of the patella to the cancellous bone resulted in 79% good or excellent results.[152] The patellofemoral articulation undergoes different forces than do the weight-bearing medial and lateral compartments. In patellar degeneration, resection arthroplasty resulted in 60% of patients being pain-free.[153] Partial cartilage débridement and drilling resulted in 22 of 25 good or excellent results, with patients younger than 30 years of age faring better.

Association with High Tibial Osteotomy

Although MacIntosh[154] routinely performed open joint débridement before high tibial osteotomy with good results, there is controversy whether to do arthroscopy before either high tibial[28, 155–158] or distal femoral osteotomy. With significant angular deformity, the results of valgus tibial osteotomy correlate with the degree of angular correction, not with the involvement of the lateral compartment or patellofemoral joint.[155] There is no clinical evidence to support arthroscopy as a preoperative adjunct to decision-making with respect to unicompartmental versus tricompartmental arthroplasty.[159]

Surgical Indications

However, simple "diagnostic" arthroscopy should not routinely be performed. In-office diagnostic arthroscopy with the patient under local anesthesia is not appropriate for patients undergoing high tibial osteotomies. Failure of conservative treatment constitutes a reasonable indication for arthroscopy in these patients. Clinical signs of a meniscal tear with localized symptoms is the number one indication for arthroscopy.

Radiographic Work-Up

Radiographic work-up includes a standing posteroanterior 30 degree flexed radiograph. Other studies are technetium-99m bone scan and magnetic resonance imaging (MRI).[7] Can MRI effectively replace arthroscopy? The authors think not.[160, 161]

Numerous studies have shown an abnormal MRI signal in menisci that are causing patients no symptoms.[160–162] MRI is gradually evolving in the assessment of articular cartilage injuries; however, at this time, it is not as sensitive and specific as for documentation of meniscal disorders and tear patterns.[162–165] Articles written on correlation of MRI with arthroscopy provide ground for questions as radiologists and orthopaedists protect their diagnostic tools.[160, 161, 163–166]

If the MRI scan is normal, a treatment regimen of time and exercise and no arthroscopy should be suggested.[166] However, the question occurs for a not-too-symptomatic knee patient with mild mechanical signs: should an arthroscopy be done if there is a grade II signal documented by MRI? Often, MRI forces one to proceed with surgery, and questions of trephination and what to do about the grades I and II signals remain. Therapeutic arthroscopy should be done in the degenerative knee for specific mechanical signs and symptoms.

Mechanical limits of extension due to femoral notch and tibial eminence, impingement, and patellofemoral osteophytes can be improved with aggressive arthroscopic débridement.[130] Excision of meniscal flaps and removal of loose bodies, along with resection of notch and tibial spine osteophytes, can improve range of motion in appropriate patients. Improvement of extension range of motion improves gait, lessens hamstring force, and reduces patellofemoral articular pressure. Severe arthrosis and limited range of motion are rarely helped arthroscopically.

It is the knee with more severe chondral damage that poses the greatest dilemma: Can this patient be helped by arthroscopy? What guidelines are there for the treatment of chondral lesions? In fact, even in the knee with severe degenerative changes, the risk-benefit ratio of arthroscopy is relatively favorable when compared with that of more invasive procedures, and for the properly educated patient, arthroscopic evaluation can be considered as a temporizing procedure. It is this class of patients, however, that exhibits the least predictable response to arthroscopic débridement.

INDICATIONS FOR ARTHROSCOPY IN THE DEGENERATIVE KNEE

A review of the literature is appropriate in order to develop a treatment philosophy. The prospective correlation of pre- and postoperative knee-rating questionnaires and evaluating relative improvement and deterioration using combined subjective and objective parameters would help interpret these results, but few such studies have been attempted.[86]

Predictive factors for the success of arthroscopic intervention remain elusive. Gross et al.[167] found that a higher number of significant findings (meniscal tears, osteophytes, chondral lesions) seemed to best predict a negative outcome, as opposed to any particular single pathologic entity. These authors reported high overall success rates in patients with normal limb alignment in whom débridement without formal abrasion was performed. Indeed, the most important negative predictor seems to be significant malalignment (especially valgus).[136] Salisbury, Nottage, and Gardner[168] specifically evaluated the effects of limb alignment on the results of arthroscopic débridement in a series of 52 patients with minimum 2-year follow-up; the researchers showed correlation of poorer results with malalignment (normal being 1–7 degrees valgus), and even the fair results in some of the patients with relative varus tended to deteriorate with

Table 26–3 **Grading of Chondral Surface Lesions**

I. Outerbridge System
   A. Grade I: Softening and swelling of cartilage
   B. Grade II: Fragmentation and fissuring, less than 0.5 inch diameter
   C. Grade III: Fragmentation and fissuring, greater than 0.5 inch diameter
   D. Grade IV: Erosion of cartilage down to exposed subchondral bone
II. Noyes System
   A. Grade 1: Cartilage surface intact (1A = some remaining resilience; 1B = deformation)
   B. Grade 2A: Cartilage surface damaged (cracks, fibrillation, fissuring or fragmentation); with less than one-half of cartilage thickness involved
   C. Grade 2B: Depth of involvement greater than one-half of cartilage thickness but without exposed bone
   D. Grade 3: Bone exposed (3A = surface intact; 3B = surface cavitation)
III. Additional parameters
   A. Measure diameter of lesion(s) in millimeters
   B. Describe the location of lesion(s): which surface and where (patellar facet or anterior, middle, or posterior portions of condylar or plateau surface)
   C. Describe the degree (range) of knee flexion where the lesion is in weight-bearing contact

time. Other negative predictors include prior meniscectomy, additional arthroscopic surgery, tibial surface eburnation, and bilaterality.[136] Age alone does not appear to be a contributory factor in most series, when groups are corrected for amount of degeneration present.[169] The presence of chondrocalcinosis is of unclear significance.[117, 136] In the series by Ogilvie-Harris,[136] worker compensation patients fared the same as other patients when considered as a group, whereas those with pending litigation fared poorly in the Duke study.[169] Collective review of the literature suggests shorter duration of symptoms, mild to moderate radiographic degeneration, and the presence of mechanical symptoms that are associated with better results.

In light of evidence that hyaline-like repair tissue can be seen following corrective osteotomy alone,[170, 171] strong consideration should be given to such a procedure when indicated. Certainly, arthroscopy with removal of loose bodies and limited débridement can be performed in conjunction with an osteotomy. However, there is no firm evidence to support concomitant high tibial osteotomy and arthroscopic débridement and cartilage "stimulation"—abrasion appears to add only morbidity to the postoperative results.[157] Furthermore, Rand and Ritts[170] showed that abrasion arthroplasty is not an effective salvage for failed high tibial osteotomy.

Documentation of the patterns of wear on the patella is necessary to plan any patellar realignment procedures.[172–174] Successful patellofemoral realignment is predictable when the area of overloaded cartilage can be stress-shielded by a realignment.

GRADING OF CARTILAGE LESIONS

Several classification schemes (Table 26–3) for articular lesions have been proposed.[175–177] Previous classifications were based on radiographic findings and did not take into account localized or partial-thickness lesions.[178] The width, depth, and location of the cartilage injury should be documented during arthroscopy.

The Outerbridge classification is based on the following four grades: grade I is softening and swelling of cartilage; grades II and III are fragmentation and fissuring of cartilage (diameter less than 0.5 inch, grade II; greater than 0.5 inch, grade III); grade IV is erosion of cartilage down to exposed subchondral bone. (Fig. 26–1). The Noyes classification is based on three grades, with letters assigned to classification of cartilage resiliency, with the

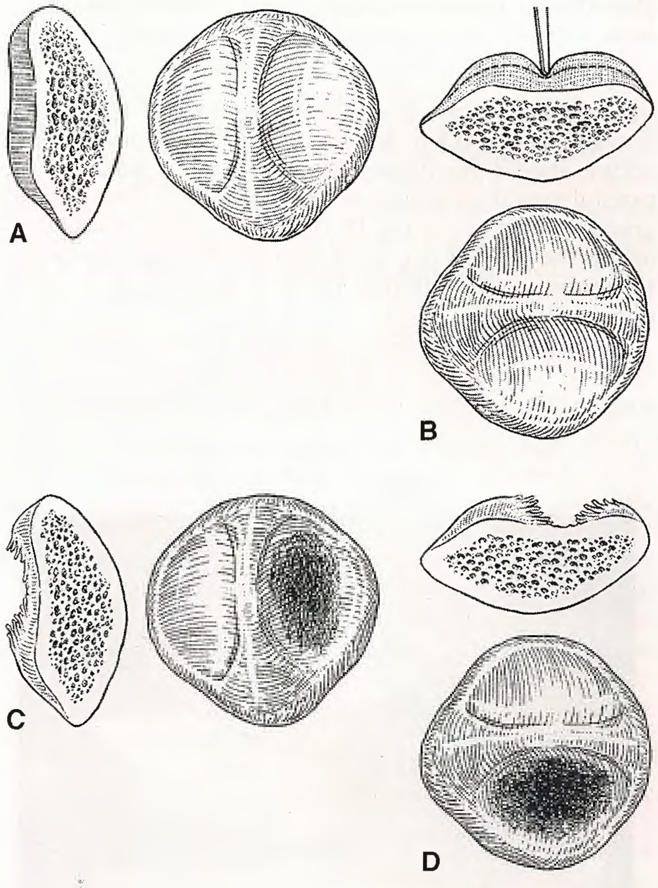

Figure 26–1 • The Outerbridge classification of chondromalacic change is shown diagrammatically. *A*, Normal articular cartilage of the patella is depicted. *B*, Grade I is softening only, without fragmentation or fissuring. *C*, Grades II and III are fissuring and fragmentation, with II being less than 1 inch and III being more than 1 inch. There is no exposed subchondral bone. *D*, Grade IV is down to subchondral bone. Documentation of the grade and size of the arthritic change is helpful, particularly in the patellofemoral articulation, in predicting success and outlining a rehabilitation program.

Figure 26–2 • Chondromalacia grade II of the odd patella facet.

surface intact or cavitated. The diameter of the lesion location and degree at which contact of the abnormal cartilage occurs should be documented. Isolated lesions of the patellofemoral articulation are shown of Outerbridge grades II (Fig. 26–2) and III (Fig. 26–3). One should document the grade I degree of flexion when contact occurs to design a rehabilitation program limiting that arc of motion.

Arthroscopic classifications such as that by Bauer and Jackson[179] attempted to describe lesions based on appearance: crack, stellate fracture, flap, crater, and fibrillation. A more comprehensive, specific scheme was developed by Noyes and Stabler[176] that relies on more descriptive data to clarify the size, depth, and relative location of chondral defects. With the addition of minimal descriptive data—measuring the true size of lesions by referencing against the tip of the arthroscopic probe, describing the actual location of the defect with respect to the arc-of-motion angle at which it demonstrates contact with an opposing surface, and differentiating between partial- and full-thickness erosions—more accurate long-term assessment of the results of surgical intervention can be accomplished.

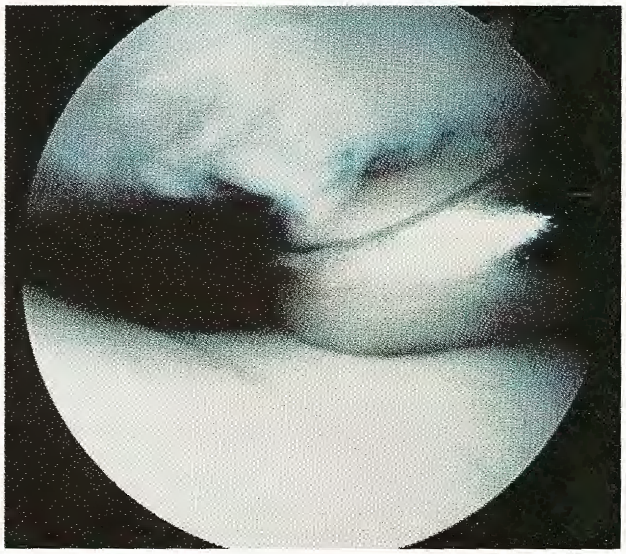

Figure 26–3 • Grade III chondromalacia odd patellar facet without trochlear groove involvement. Saucerization and débridement with motorized resector is being performed.

OPERATIVE TECHNIQUES

Principles

The basic principles of arthroscopy for the degenerative knee are to improve biomechanical function. There are many options. The categories are diagnostic, therapeutic, and new technology (Table 26–4). Removal of loose bodies and of free or synovialized osteophytes in the gutters, notch, or tibial eminence; meniscal resection; and addressing chondral lesions are procedures commonly performed in the degenerative knee. A systematic approach must be used. Prioritizing the factors causing the patient's symptoms should be done preoperatively to minimize operating and tourniquet time. Loose bodies should be looked for in the popliteal hiatus and suprapatellar pouch, but when they are located in the Baker cyst they are usually not findable and do not require removal. Synovectomy and plical resection are indicated when there is a true mechanical component or the effusion has created continued loss-of-motion and enzymatic symptoms. Chondrocalcinosis with its punctate calcifications free, imbedded in meniscus and articular cartilage, is commonly seen in the degenerative knee. Radiographic calcifications in the menisci and arthroscopic salt calcifications everywhere are shown in Figure 26–4. Arthroscopic washout and resection of meniscus is usually successful in reducing local symptoms.

Table 26–4 **Arthroscopic Options with Degenerative Joint Disease**

I. Diagnostic
   A. Evaluation
   B. Washout
II. Therapeutic
   A. Débridement
   B. Chondral flap saucerization, débridement
   C. Loose bodies
   D. Meniscectomy, medial or lateral
   E. Abrasion chondroplasty
   F. Removal of osteophytes
   G. Notchplasty
III. New technology: experimental
   A. Laser
   B. Cartilage transplantation

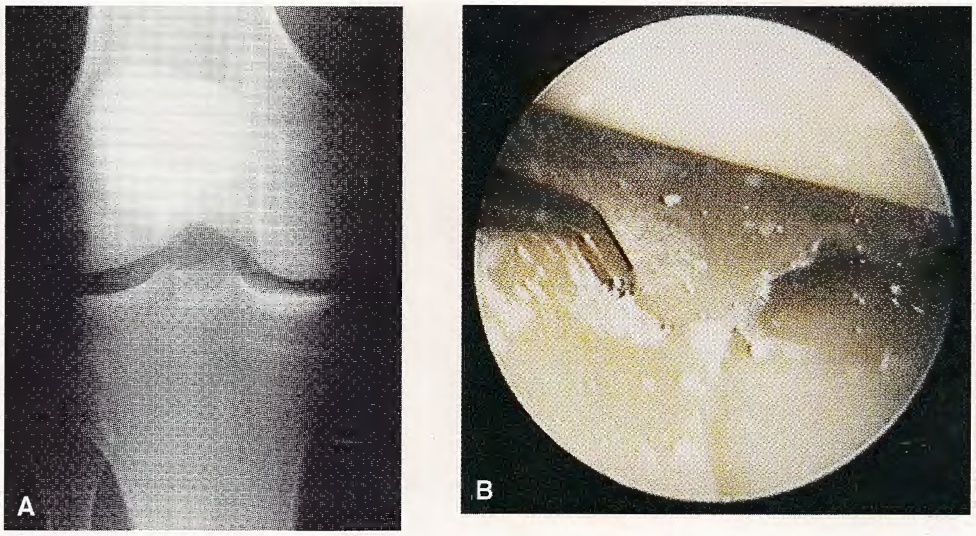

Figure 26–4 • Anteroposterior radiograph of knee showing chondrocalcinosis with calcifications in the meniscus. *A*, Arthroscopic view shows punctate calcification in the articular cartilage, meniscus, and floating free intra-articularly. *B*, Chondrocalcinosis is seen in pseudogout, gout, degenerative joint disease, and following multiple steroid injections.

The methods for changing articular surface defects include removal of loose flaps and saucerization and irrigation to remove cartilaginous loose bodies. Methods for improving blood supply at the base of the grade IV chondromalacic lesion include abrasion chondroplasty, subchondral drilling, and microfracture pick techniques. In the degenerative knee, it is less likely that periosteal grafting, perichondral grafting, and chondrocyte transplantation techniques will be helpful, particularly in femoral and tibial matching lesions. Because of the unique biomechanical aspects of the patellofemoral articulation, débridement of loose cartilage, saucerized, osteophyte removal is done. Abrasion chondroplasty is not suggested as forces are not conducive to better collagen tissue. Reduction of excessive pressure and reduction of cartilaginous free or potentially loose fragment is accomplished by débridement. Use of equipment with which the surgeon is familiar, including graspers, motorized instruments, and curved hand-held instruments, makes this demanding multiple-procedure surgery easier, faster, and more efficient.

Managing Chondral Lesions

In general, the adherence to certain principles will help guide the arthroscopist in the decision-making process. Most significant chondral lesions appear on the surfaces of the femoral condyles and trochlea; patellar defects are also common.

Functional areas of joint cartilage should be preserved at all costs. Occasionally, loose regions of cartilage seem to grow as portions are resected, nearly peeling the entire chondral surface away. Such delamination presents a significant problem, and careful probing of the chondral surface and flap should be performed before beginning removal. The role of transchondral drilling in such circumstances is unclear. Areas of fibrillation and fissuring should not be aggressively débrided; rather, gentle surface resection using a protected ("whisker") shaver should, at most, be performed. Such limited débridement may be beneficial in reducing the total surface area of exposed, damaged cartilage in the joint, thereby reducing the overall inflammatory reaction.

Larger areas of full-thickness cartilage loss and areas of patchy, near–full-thickness erosion where all that remains is a thin layer of fibrillated, degenerative cartilage present the greatest challenge. If the lesions are still well defined (that is, the entire condyle is not involved), then an attempt at cartilage stimulation is reasonable. The first step is to remove loose chondral flaps and create sharp margins of the lesion as outlined previously. This should be followed by débridement or perforation of the subchondral bone to stimulate blood flow into the area. This may be accomplished by abrasion using a bur or perforation using picks or a drill. Abrasion should be performed gently to avoid creating an overly deep crater; edges of the lesion should not be violated. Perforations should be made to an adequate depth to access vascular channels (generally 1–2 mm). Drilling or using a pick to perforate subchondral bone can often be done with precision, avoiding the creation of large, overly deep erosions. Blood flow can often be confirmed by visualization of vascular tufts, not of cancellous trabeculae. Alternatively, stopping arthroscopic inflow can document bleeding. A grade IV multi fragmented flap of medial femoral condyle is shown in Figure 26–5*A*. Débridement of the loose cartilage was performed with a full-radius resector and hand-held duckbill punch (Fig. 26–5*B*), and stimulation of the vascular channel was done by drilling (Fig. 26–5*C*).

Isolated femoral and tibial defects seem best suited to procedures that promote stimulation of fibrocartilage ingrowth. A grade IV isolated femoral lesion, measuring 1.5 × 1 cm, is shown in Figure 26–6*A*. Following abrasion chondroplasty with a motorized bur, the lesion is seen bleeding in Figure 26–6*B*. Follow-up arthroscopy was performed 8 months after the abrasion chondroplasty, with excellent filling-in of the defect (Fig. 26–6*C*). The patient was non–weight-bearing for 8 weeks; immediate motion was started. Although no biopsy was done, the resiliency and appearance of this lesion leads one to question the need for cartilage transplantation.

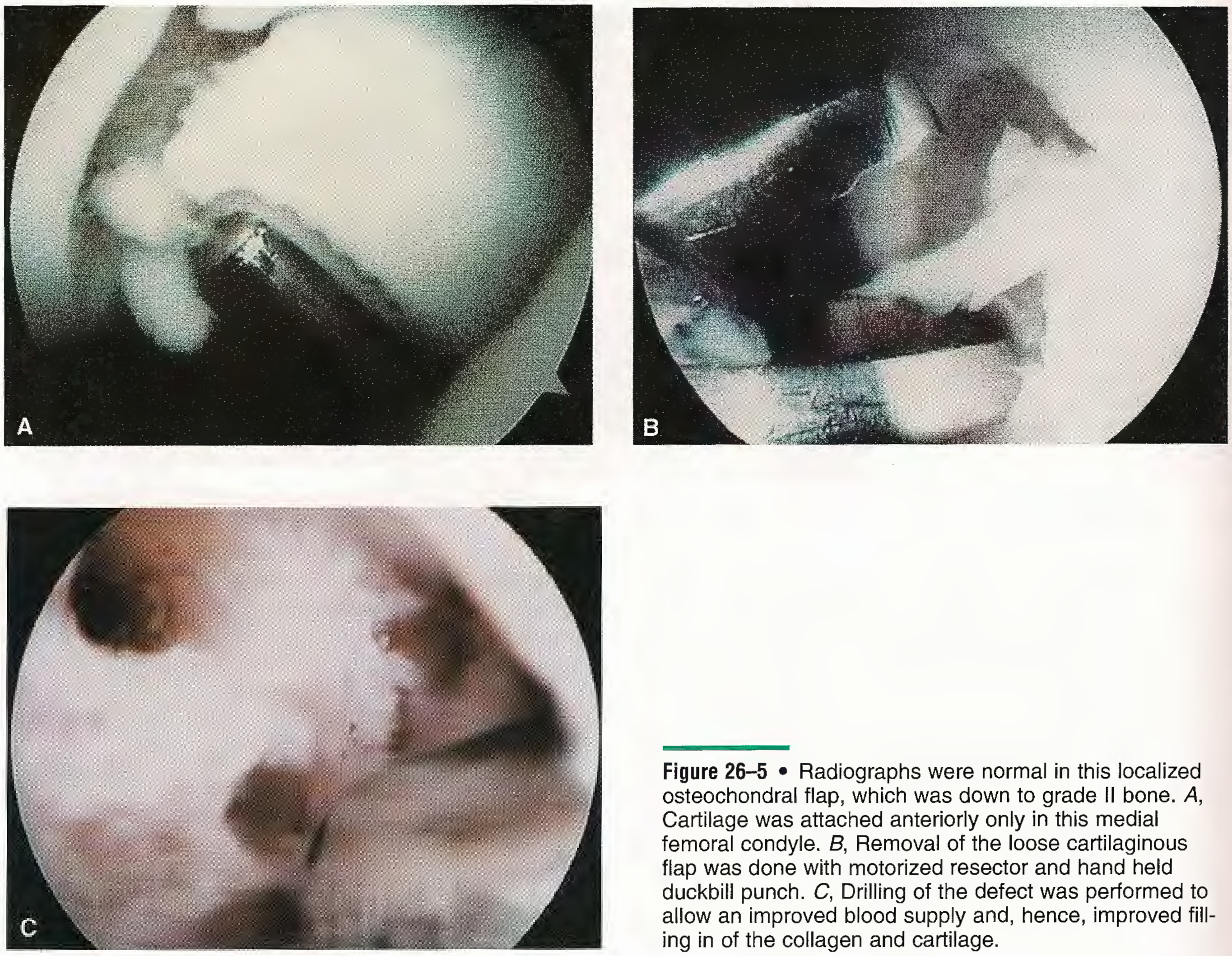

Figure 26–5 • Radiographs were normal in this localized osteochondral flap, which was down to grade II bone. *A*, Cartilage was attached anteriorly only in this medial femoral condyle. *B*, Removal of the loose cartilaginous flap was done with motorized resector and hand held duckbill punch. *C*, Drilling of the defect was performed to allow an improved blood supply and, hence, improved filling in of the collagen and cartilage.

The loss of joint space and the kissing osteophyte lesions from medial gonarthrosis are longitudinal railroad-tie configurations shown diagrammatically in Figure 26–7*A* and *B* and in radiographs in Figure 26–7*D* and *E*. Standing posteroanterior views of both knees show the loss of joint space and varus alignment on the left (Fig. 26–7*C*). A localized tibial lesion was treated with abrasion chondroplasty; this lesion was located just medial to the meniscus, which also had a tear (see Fig. 26–7*B*). Follow-up arthroscopy and x-ray 2 years after tibial abrasion chondroplasty show essentially no change in joint space medially (Fig. 26–7*F*). The abraded area filled in centrally with fibrocartilage at 2-year arthroscopic follow-up (Fig. 26–7*D*). There are reports of actual reconstitution of the joint space following abrasion chondroplasty.[126] If there are matching femoral and tibial grade IV chondromalacic defects, abrasion chondroplasty is not predictably successful. Patients with such advanced surface loss are best treated by minimal débridement, perhaps isolated drilling or picking, and postoperative counseling regarding activity restrictions.

Meniscal Tears

Unstable meniscal tears in the presence of mild or moderate arthrosis without significant malalignment do well with aggressive débridement of the unstable fragments. Using a two-portal technique and gradually allowing access into the difficult posterior medial compartments, partial resection of the meniscus, and saucerization, removal of loose cartilaginous fragments should be performed. Often, once the partial meniscectomy has been started, there is yellowish discoloration of the meniscal fragment and need for further resection, particularly around the tibial side. Most meniscal tears in the degenerative knee are complex. Mechanical symptoms can be relieved by arthroscopic meniscal resection. The lateral meniscal tear in Figure 26–8*A* was causing unpredictable locking and pain localized over the lateral compartment. Subtotal partial lateral meniscectomy was performed. The complex nature of the tear is seen. Arthroscopic resection (Fig. 26–8*B*) shows the exposed popliteal hiatus without lateral meniscus and grade IV tibial articular surface changes. Other meniscal

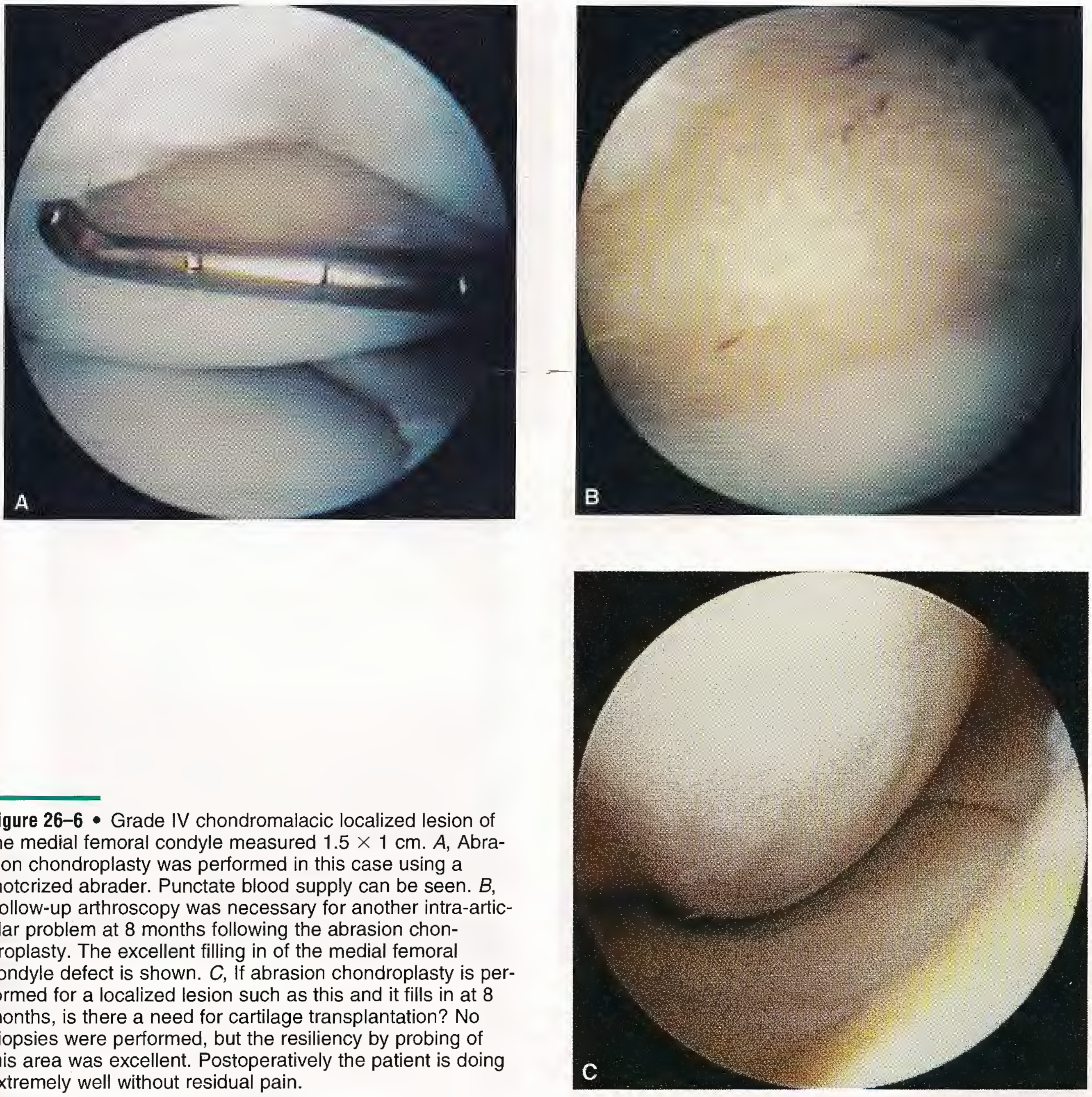

Figure 26–6 • Grade IV chondromalacic localized lesion of the medial femoral condyle measured 1.5 × 1 cm. *A*, Abrasion chondroplasty was performed in this case using a motorized abrader. Punctate blood supply can be seen. *B*, Follow-up arthroscopy was necessary for another intra-articular problem at 8 months following the abrasion chondroplasty. The excellent filling in of the medial femoral condyle defect is shown. *C*, If abrasion chondroplasty is performed for a localized lesion such as this and it fills in at 8 months, is there a need for cartilage transplantation? No biopsies were performed, but the resiliency by probing of this area was excellent. Postoperatively the patient is doing extremely well without residual pain.

tears show yellowish degeneration, and an adequate resection of the unstable meniscal rim, which is usually the tibial side, should be done. A complex tear of the medial meniscus is shown in Figure 26–9*A*. Aggressive resection of the unstable tibial surface was performed (Fig. 26–9*B* and *C*). Trephination is more successful in the younger patients.[180] Trephination to improve blood supply in the degenerative meniscus is not realistic. Outside-to-inside cyst decompression is done for localized cyst formation from degenerative meniscal tear.

Excision of the meniscus to the periphery essentially eliminates the hoop stress capacity of the meniscus.[181] If the posterior horn cleavage tear of the medial meniscus is removed, there is a two-thirds reduction in energy absorption.[182]

Specific meniscal work should be directed toward the patient's symptoms. Unstable flaps and cartilage fragments should be removed. Horizontal flap meniscal tears require resection on the tibial side. Small superficial stable fissures and chondral lesions should be left alone.

Resection osteophytes and loose bodies, which cause locking, can be treated successfully by removal. Notch osteophytes and the anterior aspect of tibial osteophytes, as well as patellar medial compartment osteophytes, can be removed with osteotome and motorized bur. Limited extension in the knee of this person who had a previous total medial meniscectomy and a symptomatic loose body was treated by arthroscopic notchplasty and removal of the loose body. The standing posteroanterior radiograph (Fig. 26–10*A*) and notch view (Fig. 26–10*B*) show no joint space

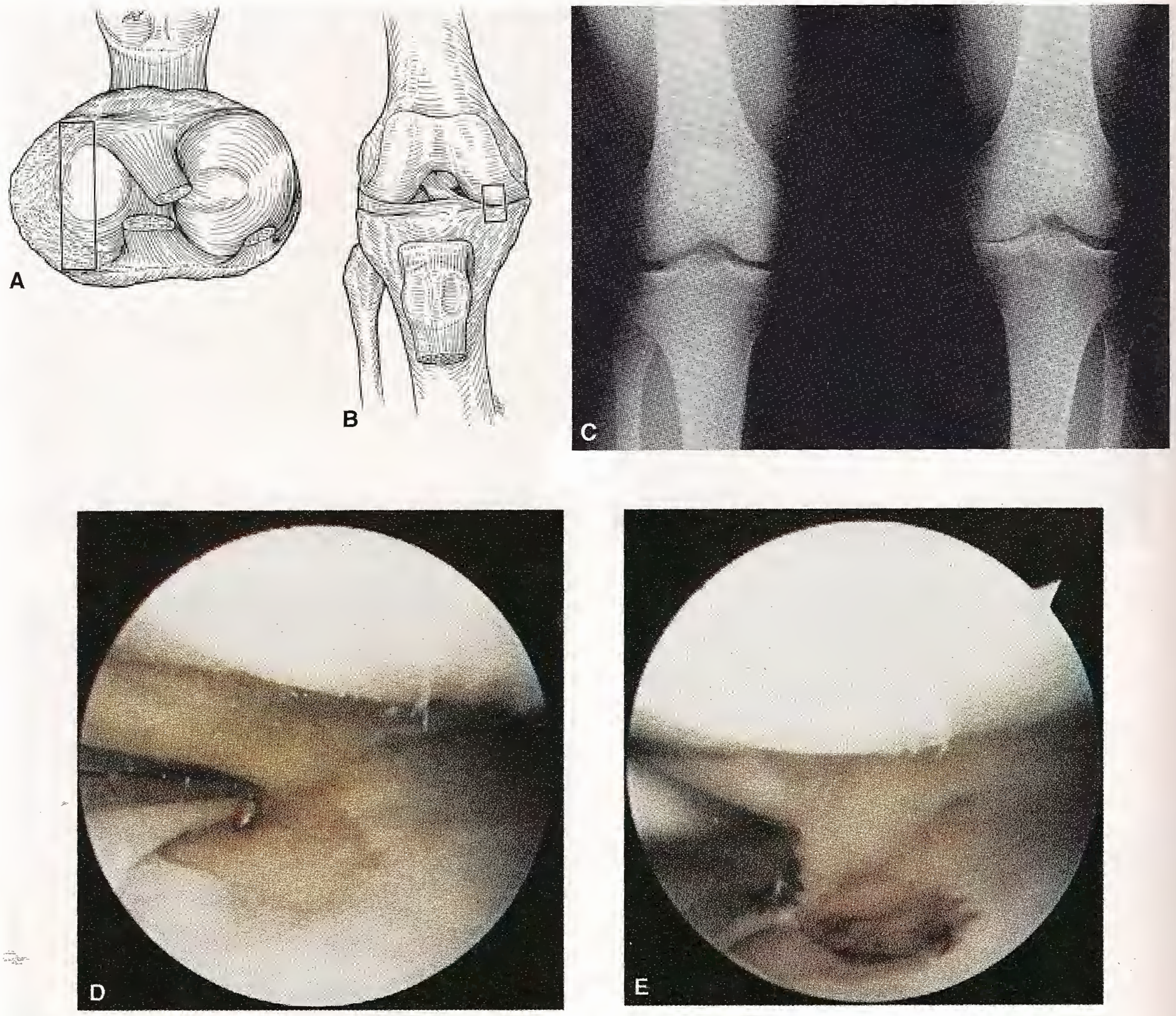

Figure 26–7 • *A*, A varus knee with medial compartment gonarthrosis has a typical rectangular railroad-type longitudinal wear pattern with localized matching lesions on the tibia and femur. *B*, Weight-bearing posteroanterior view is shown diagrammatically, with loss of medial joint space (often after a meniscectomy has been performed). *C*, Patient had left-knee complaints of painful popping and locking for which he underwent arthroscopy. Radiographs showed genu varum loss of joint space. *C*, This film correlates with the diagram. Diagnostic arthroscopy showed localized defect in the medial tibial plateau as shown with probe. *D*, Patient also had medial meniscus tear for which he underwent arthroscopic partial medial meniscectomy. *E*, Localized abrasion chondroplasty of the defect was done.

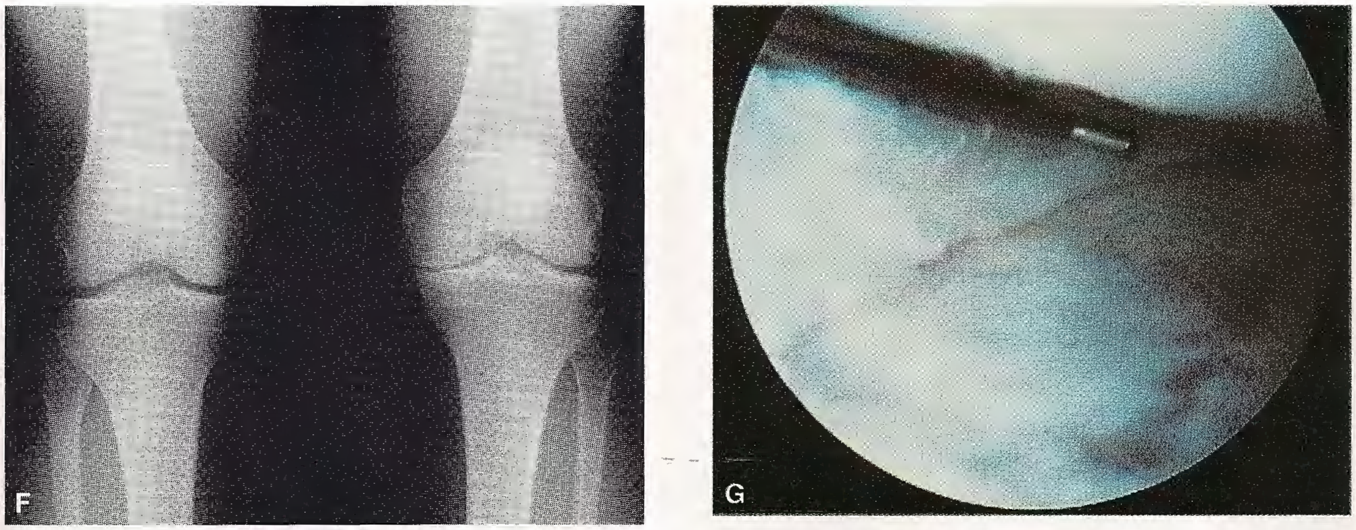

Figure 26–7 • *Continued F*, Two years postoperatively the patient had lateral meniscal complaints. Standing 30 degrees posteroanterior flexed radiographs show no significant progression of the medial gonarthrosis 2 years following his arthroscopic abrasion and chondroplasty of the medial tibial plateau. *G*, Two years postoperatively the central area of the abrasion is well healed. There is some more peripheral articular surface involvement. Partial lateral meniscectomy was performed, and no specific work was done on the articular cartilage in this later arthroscopy. In addition, notch osteophytes and medial osteophytes (not pictured) were removed to reduce pain and improve extension range of motion.

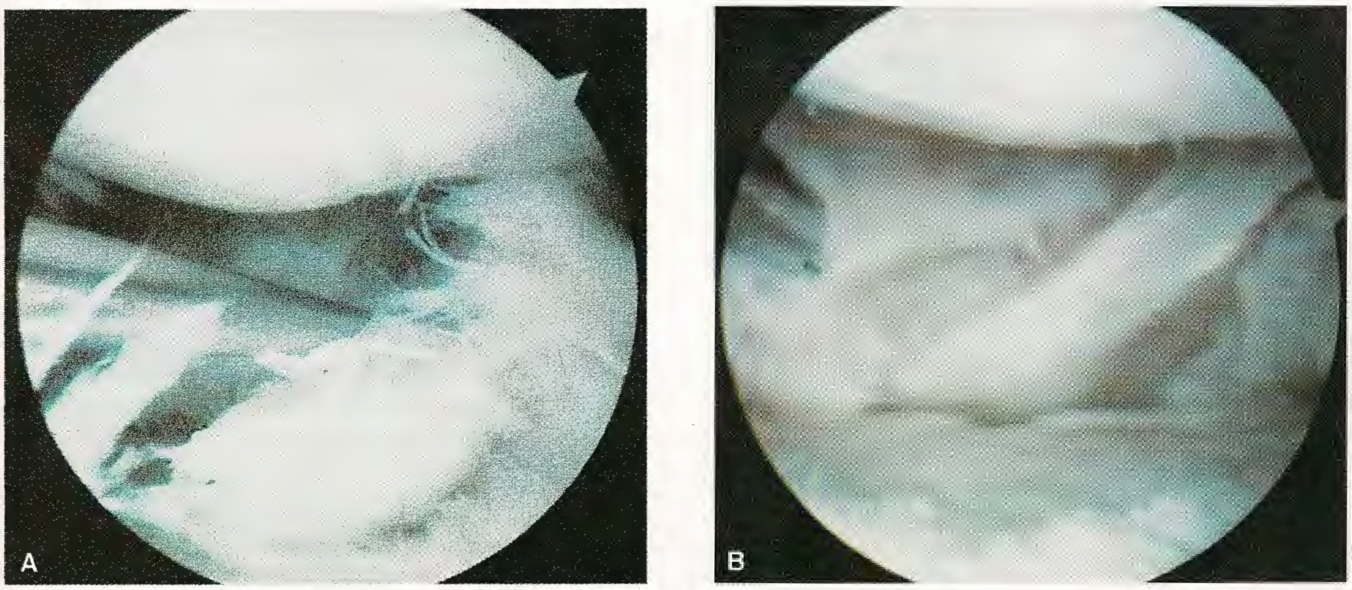

Figure 26–8 • *A*, Complex tear of the lateral meniscus in this left knee was symptomatic in this active farmer. He had localized joint line tenderness. The complex multiple-direction lateral meniscal tear can be seen. *B*, Arthroscopic subtotal lateral meniscectomy was performed, with exposure of grade III chondromalacic changes of the tibial plateau and popliteal hiatus now visible. Postoperatively the patient's symptoms have significantly improved.

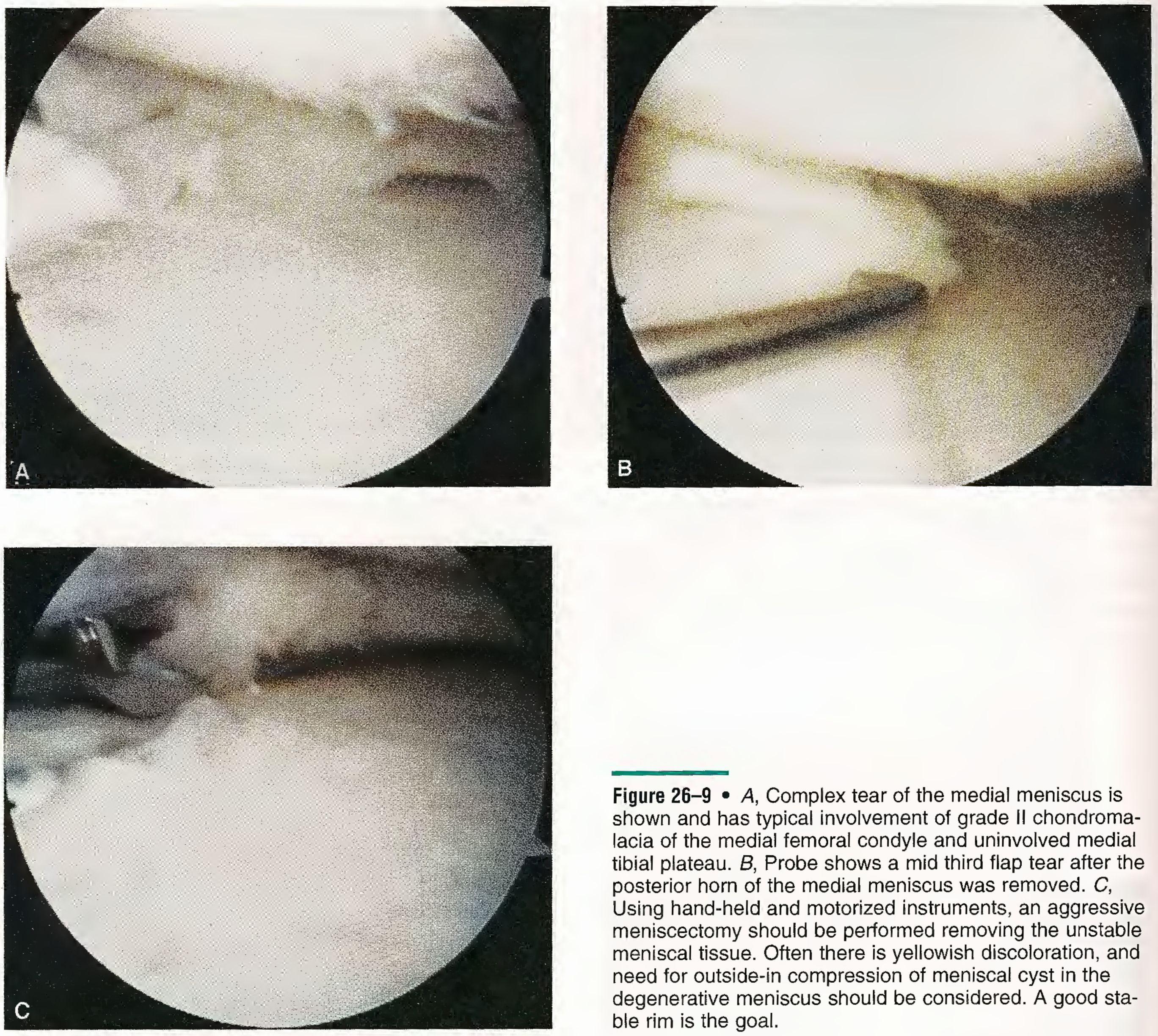

Figure 26–9 • *A*, Complex tear of the medial meniscus is shown and has typical involvement of grade II chondromalacia of the medial femoral condyle and uninvolved medial tibial plateau. *B*, Probe shows a mid third flap tear after the posterior horn of the medial meniscus was removed. *C*, Using hand-held and motorized instruments, an aggressive meniscectomy should be performed removing the unstable meniscal tissue. Often there is yellowish discoloration, and need for outside-in compression of meniscal cyst in the degenerative meniscus should be considered. A good stable rim is the goal.

in this chronic anterior cruciate ligament–insufficient patient who had previous arthrotomy and meniscectomy. The patient had a severe loose body causing locking. Arthroscopic débridement and notchplasty were done (Fig. 26–10*C*). The loose body was removed, and aggressive notchplasty and tibial eminence débridement improved range of motion (Fig. 26–10*D*). Vigorous physical therapy to push range of motion and regain quadriceps strength should be done postoperatively. Counseling and detailed discussion of arthritis severity should be done with a patient like this.

SPECIAL CONSIDERATIONS

Laser Therapy

Laser is an acronym for Light Amplification by the Stimulated Emission of Radiation.[183] One must be cautious in regard to the indication for laser use.[7] The American Academy of Orthopaedic Surgeons (AAOS) position statement is: "Clinical studies reported in orthopaedic literature have not established the benefit provided by lasers when compared to other systems now in use. As further clinical research in laster application becomes available, the Academy encourages investigators to pay attention to these areas where the techniques can be shown to be effective additions to orthopaedic care."[184, 185]

Laser use in arthroscopy is evolving. The ability to deliver focused energy to areas of the knee may prove beneficial as an adjunct to meniscal and chondral healing. Complications of laser use have been cited, including osteonecrosis of the condyle.[186]

Use of lasers for meniscal articular surface problems has been reviewed.[86, 185–187, 190] Use of laser is becoming more widespread with numerous laser tools available in the categories of CO_2, holmium:YAG, neodymium (Nd), and Excimer.[121, 182, 188, 190, 191]

Cases of aseptic necrosis of the femoral condyle following use of a holmium YAG laser have been de-

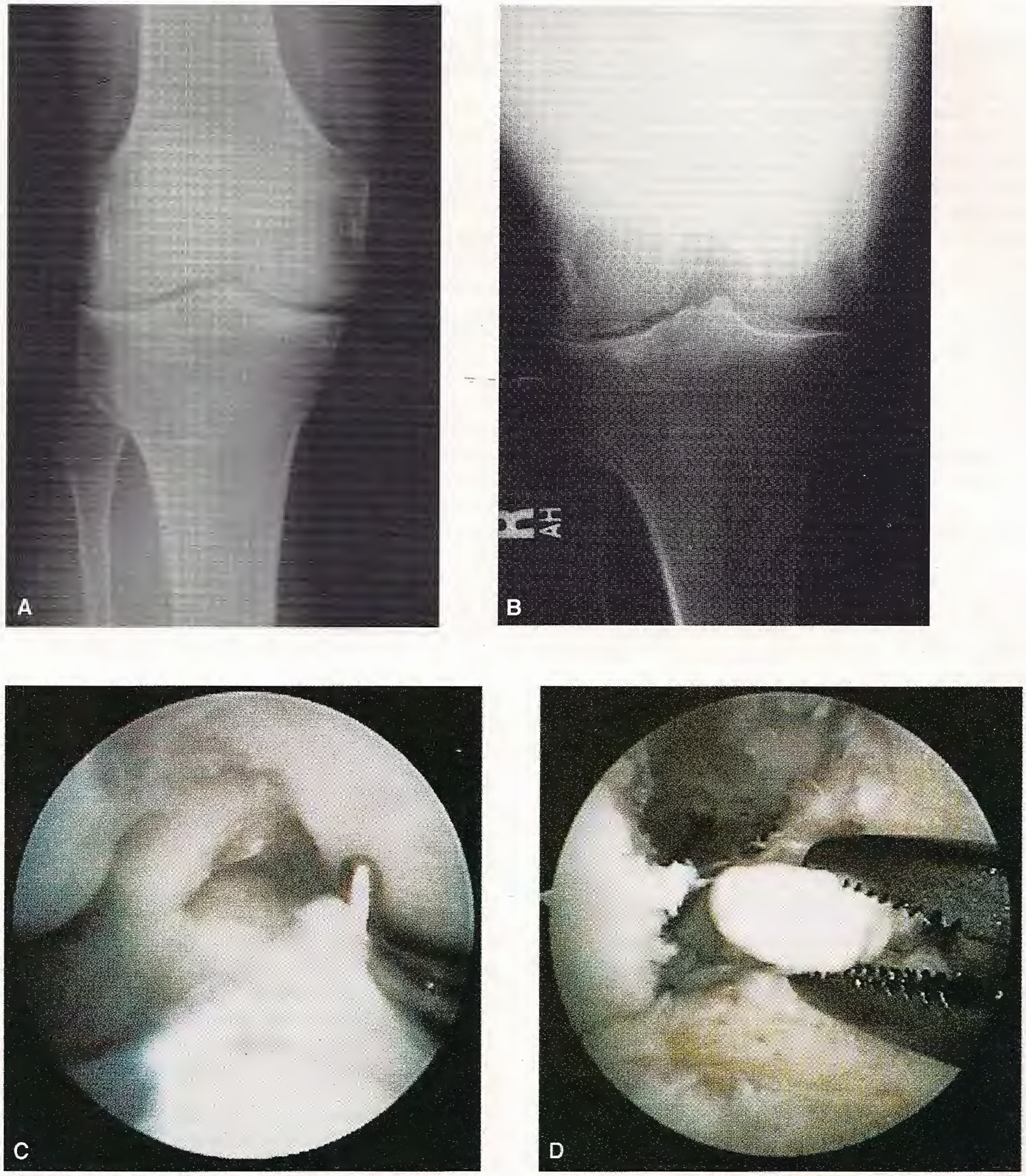

Figure 26–10 • *A*, Previous medial and lateral meniscectomies result in no joint space seen in this radiographic standing posteroanterior 30 degree flexed view. *B*, Patient had an old anterior cruciate ligament injury, and the notch osteophytes are well seen in this notch view. The patient had mechanical symptoms and a palpable loose body. *C*, Arthroscopically shown are the notch osteophytes with kissing lesion of the tibial eminence and medial femoral condyle before notchplasty. There was some tissue in the notch; however, it was not truly that of the anterior cruciate ligament but only scar tissue. *D*, Vigorous notchplasty removal of tibial eminence and notch osteophytes was performed. Loose body removal is shown with Schlissinger clamp. Postoperatively the patient has some improvement of range of motion and no further mechanical signs.

scribed.[188, 191] Inability to regulate depth of thermal energy associated with the CO_2 laser has led to reduced use; the Excimer laser, emitting light energy in the ultraviolet range, is recommended and appears to be superior with fewer thermal complications.[186] The holmium:YAG laser can be used on meniscal tissue with a rate of penetration not dependent on the laser's pulse width.[183] In describing potential risks to patients, one must include thermal energy risks.

In the canine Nd YAG laser, exposure of articular cartilage in low levels stimulates cartilage matrix synthesis, but single exposure may not be sufficient to up-regulate.[192] Similar results have been cited for human cartilage explants exposed to holmium:YAG beams.[193] Limited clinical case reports have shown fibrocartilaginous repair in vivo following laser stimulation.[194–196] However, much of the "praise" for laser technology remains anecdotal, and the AAOS urged caution in an advisory statement: further research is needed before adopting lasers for widespread use. Practice marketing strategies emphasizing such "advances," with implicit suggestions that they are superior to current techniques, should be critically evaluated before lasers are used in the degenerative knee.

Work in chondrocyte transplantation is currently in the early stage. The surgeon needs to beware of patient selection and expectation. Ongoing research into the stimulation of cartilage growth and repair has generated some promising early results with repopulation of damaged surfaces by cultured autogenous chondroblasts, placed back into the defect and covered with a periosteal flap.[51, 197] Work with chondrocyte growth factors,[198–200] direct progenitor cell and matrix composite implantation,[201, 202] artificial scaffolds,[203] periosteal and perichondrial grafts,[204–206] and allograft transplantation[207–209] is now being done.

COMPLICATIONS

In a patient with degenerative joint disease, given the circumstances of multiple procedures, complexity of the arthroscopy, and advanced patient age, complications are more commonly seen. These patients require closer postoperative monitoring if significant pain, calf tightness or calf swelling develops. Historically, the issue of deep venous thrombosis (DVT) prophylaxis has been neglected for arthroscopic procedures. In a series of complications following arthroscopy, Small[12] reported 12 cases of DVT in over 10,000 surgical cases; 8 of the 12 cases involved use of a tourniquet, with an average time of 50 minutes, and 350 mm Hg pressure. Four cases went on to pulmonary embolism, none of which was fatal. This small but significant number of cases may represent the tip of the iceberg in this older population. If there is a history of deep vein thrombosis, there should be preoperative measures of vascular function and avoidance of the use of the tourniquet intraoperatively. Prospective evaluations using Doppler analysis have shown significant levels of DVT following various orthopaedic procedures other than joint replacements, including a 4.4% rate of thrombus formation following arthroscopy in a prospective study of 45 patients screened both pre- and postoperatively with duplex ultrasound.[210] However, at least one study has argued against the need for screening ultrasound following arthroscopy, unless perhaps the patient has a known DVT risk.[211]

A survey done through the Arthroscopy Association of North America and published in 1985[212] revealed the order and frequency of complications. Of all the complications, the order and type are as follows: postoperative hemarthrosis 24%, broken instruments 17%, thrombophlebitis 15%, postoperative infection 10%, neurologic injury 7%, other 6%, anesthesia 5%, reflex sympathetic dystrophy 4.7%, knee ligament injury, 4.4%, and pulmonary embolus 3.4%. As advances in arthroscopy and arthroscopic techniques have occurred, the broken instrument and hemarthrosis complications appear to have been reduced in frequency. Use of a drain, if bony work is done, and compressive devices including the thromboembolic disease hose reduces venostasis. A vigorous postoperative rehabilitation program with early range-of-motion and elevation exercises should be instituted. In the patient with degenerative joint disease of the knee, the age is usually greater, and there is some venous insufficiency. Because of this, venous complications are probably the most common. At the Kentucky Sports Medicine Clinic during the last 7 years, out of 1394 knee arthroscopies, there have been seven deep vein thromboses, for an incidence of .005 (Ireland, unpublished data, 1995). The deep vein thromboses were in older patients who underwent work in the posteromedial compartment. There were no deep vein thromboses associated with anterior cruciate ligament reconstructions.

CONCLUSION

Objective clinical investigations will continue to refine the indications for arthroscopy for the patient with significant degenerative knee problems. Biology and transplantation research in the fields of human genetics, cartilage in animals and humans, and biomedical engineering will result in arthroscopic advancements. The future is bright for treating arthritis arthroscopically.

Patients should be carefully selected for arthroscopy. Decision is based on persistent symptoms despite rehabilitation, unwillingness to undergo a replacement, and a thorough understanding that the arthroscopy is to be a temporizing treatment. The ideal candidate for an arthroscopy has mechanical symptoms, such as locking, catching, or feelings of instability, in the presence of mild to moderate degenerative changes radiographically. If there is significant angular deformity, a corrective osteotomy or a unicompartmental or total knee arthroplasty should be strongly recommended.[213] The following question should be posed to the patient: Is a fair result from a minor operation better than a good result from a major operation?[159]

Above all, however, one must bear in mind that "newer" is not necessarily "better." "Cutting-edge" technological breakthroughs such as laser and cartilage transplantation should be proved successful and cost-effective before use. The orthopaedist should strive to use the tools that work best for the patient in the hands of the individual surgeon.

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