Ankle Arthroscopy: Follow-up Study of 33 Ankles—Effect of Physical Therapy and Obesity

A retrospective analysis was conducted of 32 patients (33 ankles) who had undergone surgical ankle arthroscopy for chronic ankle pain that was recalcitrant to conservative treatment. All patients were examined clinically and completed a written questionnaire. Intraoperative ankle arthroscopy showed hypertrophic synovitis, adhesive bands, chondral bands with synovitis, osteophytes, and abnormalities in the talar dome. Results of treatment after an average follow-up time of 1.4 years (range: 0.33 to 12.5 years) showed ankle scores of 15 excellent, 11 good, 5 fair, and 2 poor.

Obesity was significantly related to the outcomes of arthroscopy procedures. Obese patients were more likely to be rated as fair or poor, while nonobese patients were significantly more likely to be rated excellent or good. Those patients who received physical therapy postoperatively for one or more months had significantly better ankle ratings than those who did not elect to have physical therapy. (The Journal of Foot and Ankle Surgery 35(3):199–209, 1996)

Key words: arthroscopy, ankle

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Surgical ankle arthroscopy has been successful in diagnosing and treating chronic ankle problems where other measures have failed (1–7). When a patient presents with chronic undiagnosed ankle pain that is recalcitrant to conservative treatment, arthroscopy should be considered. One of the chief advantages of arthroscopy is the ability to directly visualize the joint, thereby providing an accurate diagnosis. Plain radiographs often do not reflect joint pathology (8). Magnetic resonance imaging (MRI) of the ankle is only 30 to 40% positive for soft tissue lesions (1, 9). Even the addition of contrast dye to MRI only slightly improved the detection of chondral defects (10–12).

Results of follow-up studies tend to be positive with from 63 to 97% obtaining excellent and good results (Table 1). One hundred percent of patients treated with ankle arthroscopy returned to work within 5 to 6 weeks (2). Arthroscopy normalizes a joint by: 1) mechanically removing loose bodies in the joint; 2) abrading articular cartilage defects or tears; and 3) abrading exostosis and removing excessive dendritic synovitis or problematic soft tissue. Ultimately the goal is to provide a joint with decreased sources of inflammation so as to allow the ankle joint to anatomically function pain free.

History

According to Takagi, in 1918 the first documented intra-articular observation of a cadaveric knee was performed using a cystoscope (13). Arthroscopy came somewhat later in 1922 when Bercher described knee meniscal injury using the Jacobian Laproscope (14). On the basis of cadaver experiments, he believed that only the knee was suitable for examination because of its size. In 1931 Burman, utilizing an arthroscope, described the appearance of almost every major joint in the body (15). Interestingly, he noted that the ankle was difficult to evaluate because the joint space was too narrow and the talar dome too convex for viewing. In 1939, Takagi performed arthroscopy on joints including one flail ankle (15). In the 1960s and early 1970s, there was a renewal of interest in joint arthroscopy. Chen (16) was able to perform ankle arthroscopy on 67 patients with

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[5] Watanabe number 24 Selfoc Arthroscope, Needlescope, Nippon Sheet Glass Company, Tokyo, Japan.

TABLE 1 **Results of other ankle arthroscopy studies including current study**

Study	Ankles/Complications	Follow-up Time (years)	Condition At Follow-up			
			Excellent (N) %	Good (N) %	Fair (N) %	Poor (N) %
Current study	32/0	0.33–12.5	15 (45.0%)	11 (33.0%)	5 (15.0%)	2 (6.0%)
Martin (1989)	58/9	1–4.1	13 (22.4%)	24 (41.3%)	10 (17.3%)	11 (19.0%)
Feder (1992)	30/2	1–9	4 (13.4%)	18 (60.0%)	5 (16.6%)	3 (10.0%)
Parisen (1985)	15/0	0.5–5	10 (66.7%)	4 (26.7%)	1 (6.6%)	0 (0%)
Thein (1992)	9/1	2–3.6	8 (88.9%)	0 (0%)	1 (11.1%)	0 (0%)
Ogilvie-Harris (1993)	17/1	2–5.6	14 (87.1%)	2 (9.4%)	1 (3.5%)	0 (0%)
Ferkel (1991)	31/NP[a]	2	15 (48.4%)	11 (35.5%)	4 (12.9%)	1 (0.3%)

[a] NP, not published.

the development of the Watanabe[5] number 24 Selfoc arthroscope.

Currently, with state-of-the-art instrumentation, ankle arthroscopy has become an accepted procedure. Ankle joint arthroscopy has been shown to be highly accurate in diagnosing ankle lesions with 94% of arthroscopic diagnoses being confirmed by arthrotomy (17). The use of the Dyonetics[6] needle has been of additional value for the diagnosis of even smaller joints, including the ankle (18).

Methods and Materials

From 1983 to 1995, 60 patients had ankle joint arthroscopies at our institution performed by one of us (R.G.). Thirty-two patients (33 ankles) were available for follow-up evaluation (Table 2). Patients in this study were both from clinical and private practice. Average length of follow-up was 1.4 years (range: 3 months through 12.5 years). Of the 32 patients, 27 were female and 5 were male. Average age at the time of surgery was 42 years and ranged from 13 to 65 years. The right ankle was involved in 22 cases and the left ankle in 11 cases. One patient had bilateral involvement and had arthroscopy done on both the left and right ankle.

Patients were evaluated by clinical examination, and an ankle rating scale (Table 3). The rating scale has been modified from the Hospital for Special Surgery knee arthroscopy scale (19). The rating system is subdivided into six categories including: pain, function, range of motion, muscle strength, edema, and instability. The score range was from zero to 100, with 100 being the highest score and indicating an asymptomatic ankle. Points were subtracted for walking aids and ankle supports. Ankles were subsequently divided into four categories based on the rating score: Excellent: 85 or higher; Good: 70 to 84; Fair: 60 to 69; and Poor: less than 69.

The Body Mass Index (BMI) for each patient was calculated utilizing the patient's height and mass at the time of surgery (20). The calculation was based on the formula for BMI:

$$\text{BMI} = \frac{\text{kilograms}}{\text{square meters}}$$

The BMI was used to determine obesity as discussed in the Framingham study, Nurses Health Study and the Healthy People Report (Table 4) (20–22). Patients with a BMI of 27.8 or greater were considered obese.

Indications and Presentation

The indications for ankle arthroscopy included at least 6 months of unexplained, persistent ankle pain, mild to moderate degenerative joint disease, specific arthridity, *e.g.*, rheumatoid arthritis, and previous history of ankle sprains that failed to improve. The most common presenting clinical history was that of an adult female in her forties (45% were obese) with chronic persistent ankle pain present at rest and exacerbated during ambulation. Chronic edema was almost always present, and a vascular etiology had to be eliminated. The patient generally walked with a limp and many others used a cane. There was typically a history of chronic ankle sprains.

Physical examination revealed that the pain was diffuse and could not be localized to one area of the ankle. Ankle range of motion tended to be limited. Plain radiographs were uniformly negative for severe degenerative joint disease, fracture, widening of the ankle mortise, or other specific entities. All patients received conservative therapy in the past which consisted of rest, immobilization, injections, anti-inflammatory medications, various forms of physical therapy, and special shoes and orthoses.

Surgical Technique

The patient is positioned supine on the operating room table in anatomical position. The thigh is then placed in a well padded knee holder, and an ankle tourniquet is applied approximately 2 cm. proximal to

[6] Dyonetics needle: Smith and Nephew Dyonics, Inc. Danvers, MA 01923.

TABLE 2 **Patient data base**

Patient	Gender	Age At Time of Surgery (years)	Ankle (R/L)	Follow-up Times (yr)	Postoperative Rating (Improved, Same, or worse)	Postoperative Ankle Rating Score (0–100; 100 = Highest)	Physical Therapy Post Surgery (no. of Mos.)	Body Mass Index
KM	F[a]	46	L	1.50	Improved	100	17	24.82
HS	M	34	L	0.83	Improved	100	0	26.61
NM	M	31	L	1.50	Improved	99	0	27.45
DK	F	45	R	0.33	Improved	98	1	20.82
PR	F	40	L	1	Improved	95	6	35.16
OM	F	45	L,R	2	Improved	93	3	30.19
EB	F	62	R	1	Improved	92	2	26.10
MA	F	48	R	0.5	Improved	91	5	22.88
ER	M	44	L	0.25	Improved	90	0	28.24
SR	F	65	R	0.25	Improved	90	3	46.56
AR	F	30	R	0.92	Improved	89	4	33.33
PP	F	34	R	0.58	Improved	88	7	31.08
PW	F	40	R	2.33	Improved	88	7	25.33
KP	F	13	R	0.42	Improved	86	5	20.29
ER	F	36	R	0.33	Improved	84	4	24.89
LT	F	47	R	0.33	Improved	84	1	25.19
AB	F	57	L	12.50	Improved	84	2	25.04
CA	M	49	R	0.33	Improved	80	2	26.67
CM	F	29	R	0.33	Improved	79	1	30.06
BD	F	26	R	2.33	Improved	79	5	23.66
DJ	F	34	R	0.42	Improved	77	3	23.31
IL	F	47	L	0.33	Improved	77	2	37.40
JB	F	43	R	0.25	Improved	76	4	21.97
LG	F	47	L	2	Improved	73	8	33.67
RC	M	51	R	3	Improved	70	0	23.66
TR	F	59	R	2.35	Improved	68	0	18.97
SP	F	34	R	1	Improved	68	0	30.43
AP	F	45	R	0.25	Improved	67	3	33.02
VM	F	34	R	0.5	Improved	67	0	40.07
GN	F	53	L	4	Improved	60	6	31.17
SG	F	58	L	0.66	Improved	58	4	37.45
IR	F	56	R	2	Improved	52	0	36.40

[a] Abbreviations: R, right; L, left; M, male; F, female.

the affected ankle. Anesthesia consists of intravenous sedation, and an ankle block is performed at the operative site using approximately 20 cc. of lidocaine, 1% plain. General anesthesia alone may be used as an alternative means of sedation. The ankle is then prepared and draped in the usual sterile manner. Attention is directed to the affected ankle joint, which is anatomically marked and extra-articular structures are identified. Next, a 50-mL. syringe filled with normal saline and attached to an 18-gauge, 1.5-inch needle which is inserted at the lateral gutter of the ankle joint. The joint is distended and a stab incision is made over the portal of entry. The arthroscope cannula with sharp trochar is used to pierce the soft tissue and capsule. The sharp trochar is removed and replaced with an obturator which is used to penetrate the synovium and prevent intra-articular soft tissue damage. The obturator is then removed and a 2.7-mm. arthroscope with camera and light source is inserted to visualize the joint, utilizing an anterior central approach (23–26). While visualizing the joint, a second cannula is introduced, which can be used for outflow or insertion of other instruments, such as biopsy with accession forceps, probes, or power abraders. This method of joint visualization with accession is known as the triangulation technique. Next, the arthroscope is swept through the joint and a standard nine-point check is made which evaluates the deltoid ligament, medial gutter, medial talus, central talus, lateral talus, talofibular articulation, lateral gutter, anterior gutter, and the central tibiotalar articulation (Fig. 1). Then, utilizing the triangulation technique, the joint can be surgically managed.

The hypertrophic synovitis, or synovial accumulation in the medial and lateral gutters, is removed using a synovial abrader (Fig. 2). The ankle joint is irrigated with copious amounts of normal saline under pressure, and vacuuming of debris is then accomplished. Once the area is clear of debris, all lesions are lysed and abrasion chondroplasty is performed. Finally, the incision sites are closed with 4-0 nylon. A compressive bandage is applied to the operative site followed by a short leg nonweightbearing plaster of Paris cast. The cast is

TABLE 3 Ankle rating scale

I. Pain (30 points)	
a. no pain at any time	30
b. no pain on walking	15
c. mild pain on walking	10
d. moderate pain on walking	5
e. severe pain on walking	0
f. no pain at rest	15
g. mild pain at rest	10
h. moderate pain at rest	5
i. severe pain at rest	0
II. Function (22 points)	
a. walking and standing unlimited	12
b. walking a distance of 5–10 blocks and standing ability intermittently	10
c. walking 1–5 blocks and standing ability for up to 1/2 hr.	8
d. walk less than 1 block	4
e. can not walk	0
f. can climb stairs	5
g. climb stairs with support	2
h. transfer activity	5
i. transfer activity with support	2
III. Range of motion (15 points)[a]	
a. dorsiflexion	-
b. plantarflexion	-
IV. Instability (12 points)	
a. none	12
b. mild	8
c. moderate	4
d. severe	0
V. Edema (10 points)	
a. none	10
b. nonpitting	6
c. pitting + 1	6
d. pitting + 2	4
e. pitting > + 2	2
VI. Muscle Strength Plantarflexion/Dorsiflexion[a]	
a. excellent; both 5/5	11
b. good; one muscle group 4/5 and one muscle group 5/5	8
c. fair; both muscle groups 4/5	4
d. poor; both muscle groups < 4/5	2
VII. Subtraction[b]	
a. one ankle support	1
b. one cane	1
c. one crutch	2
d. two crutches	3
e. ankle support with cane or crutch	5
f. special shoe gear	3

[a] One point for each two degrees of motion on the sagittal plane.
[b] Subtract from total score the following points if any of the listed prosthetic devices are used.

TABLE 4 Obesity as measured by body mass index (BMI)

Study	Low Level BMI Obesity Cut Points	
	Males	Females
Healthy People 2000 Report (1990)	27.8	27.3
Framingham (1988)	24	—
Nurses Health Study (1990)	—	21

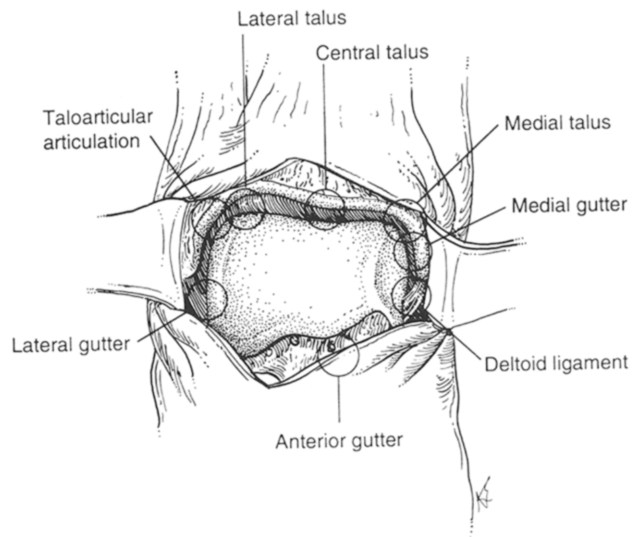

FIGURE 1 Ankle anatomy.

removed 7 to 10 days postoperatively. Sutures are removed and a compressive dressing is applied. During postoperative week 4, after the edema has reduced, physical therapy is started consisting of whirlpool, ultrasound, and progressive resistance exercises. Therapy is performed twice each week, ideally for 1 month or more as needed.

Results

Diagnoses and Intraoperative Findings

Patients presented with multiple intraoperative diagnoses and findings. The most common ankle diagnoses were chronic synovitis (54%) and traumatic arthritis (54%) (Table 5). Less frequent diagnoses included: acute synovitis (6%), lateral impingement syndrome (3%), and osteochondritis dissecans of the talus (6%) (Table 5). These diagnoses were consistent with intraoperative findings. All 33 ankles were found to have hypertrophic synovium, and 25 ankles (76%) were found to have various osteochondral defects at the time of surgery (Table 5). The arthroscopic intraoperative findings tended to reveal pathology that was not observed clinically or radiographically. For example, 11 of 18 patients with chronic nonspecific ambulatory pain and negative ankle x-rays were observed to have osteochondral defects during the arthroscopy procedure. Two patients were diagnosed with osteochondritis dissecans of the talus preoperatively,

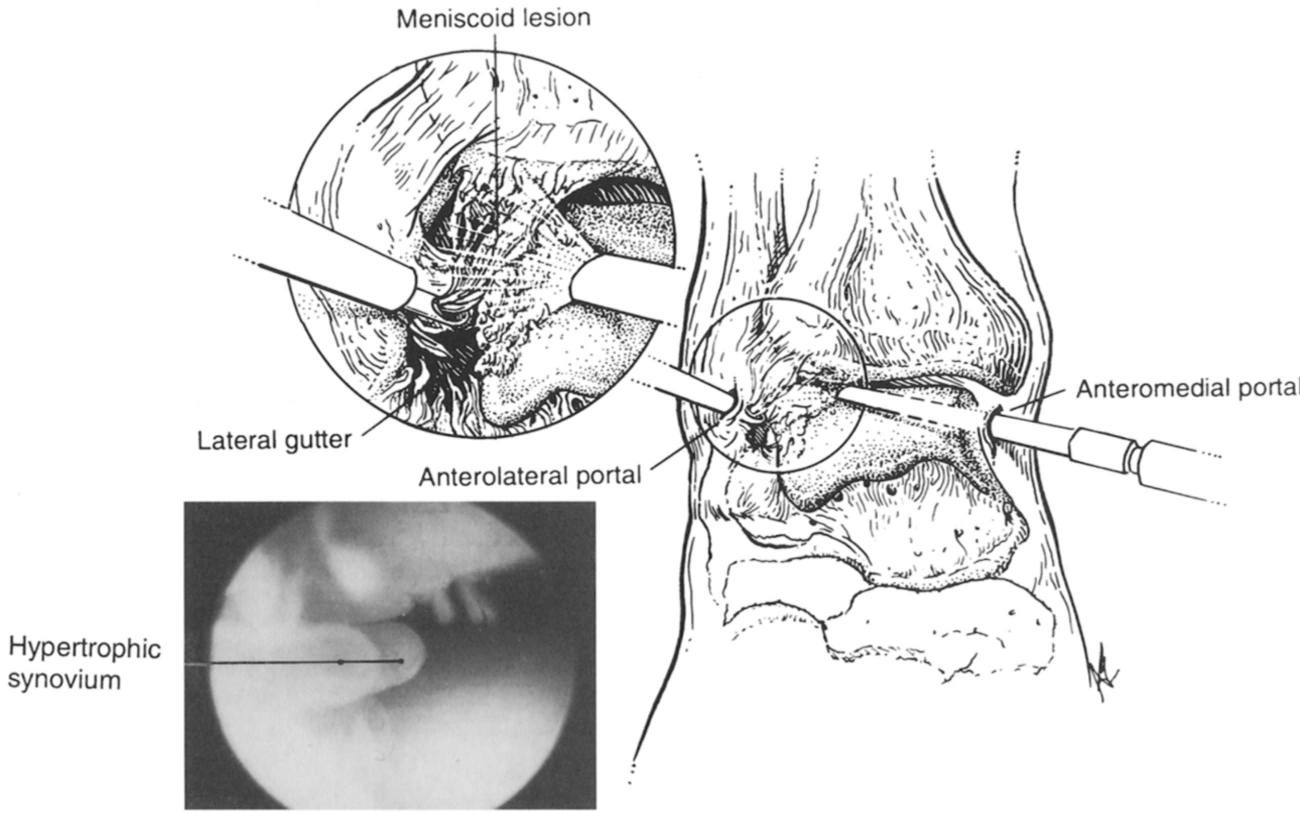

FIGURE 2 Synovial abrasion of the lateral gutter using anteromedial approach.

whereas six patients were found to have osteochondritis dissecans intraoperatively. Similarly, only one patient was diagnosed with microfracture of the talar dome preoperatively, while seven patients were observed to have this diagnosis intraoperatively (Table 5).

Ankle Rating Score

Postoperative follow-up of 32 patients with 33 ankles who completed the Ankle Rating System revealed 15 excellent (45%), 11 good (33%), 5 fair (15%), and 2 poor (6%) ankle rating scores (see Table 1). All patients had surgical ankle arthroscopy for the diagnosis and treatment of severe and chronic ankle pain. All patients reported that pain was reduced after the surgery. At the time of follow-up, all patients in the excellent and good categories had either no pain or mild pain when walking (Table 6). All patients in the fair and poor categories had either moderate or mild pain while walking. Twenty-three ankles (88%) in the excellent and good categories had no pain at rest. All patients in the fair and poor categories had mild pain at rest (Table 6).

Clinically, 52% of all ankles had no edema. Ninety-two percent had good or full muscle strength. Ninety-four percent had stable ankles or mild ankle instability (Table 7).

Concerning the functional profile, 46% of patients with ankles rated in the excellent and good categories were able to walk and stand in an unlimited capacity, whereas all patients with ankles rated in the fair/poor categories had some limitation in walking and standing (Table 8). Seventy-six percent of all patients were able to climb stairs with no support. Eighty-five percent of patients were able to perform transfer activities, and 15% required a cane to perform these activities (Table 8).

All patients were encouraged to have physical therapy for at least 1 month after surgery. The type of physical therapy included whirlpool, range of motion exercises, and progressive resistance exercises. Ankle scores were positively related to the length of time for which physical therapy was performed. Patients whose ankle rating scores were excellent, good, fair, and poor received physical therapy for periods of 4.20 months, 2.68 months, 1.80 months, and 1.00 month, respectively (Table 9). Patients receiving physical therapy for 1 month or more had a significantly greater amount of good and excellent ankle scores, while patients receiving less than 1 month of physical therapy had a significantly greater amount of poor and fair ankle scores ($p < 0.05$) (Table 9).

Forty-five percent of patients in this study were con-

TABLE 5 Diagnostic and intraoperative ankle arthroscopic findings

	Ankle Rating Category					
	Excellent (N = 15)	Good (N = 11)	Fair (N = 5)	Poor (N = 2)	Total (N = 33)	(%) (N = 33)
Diagnosis						
Acute synovitis	2				2	(6%)
Chronic synovitis	8	5	4	1	18	(54%)
Traumatic arthritis	9	7	1	1	18	(54%)
Lateral impingement syndrome	1				1	(3%)
Micro-fracture talar dome	1				1	(3%)
Osteochondritis dissecans, talus	2				2	(6%)
Talar exostosis	1				1	(3%)
Psoriatic arthritis	1				1	(3%)
Intraoperative findings						
Hypertrophic synovitis	16	11	5	1	33	(100%)
Chondral defect talus	3				3	(9%)
Chip fracture intraarticular, tibia		1			1	(3%)
Chondral defect tibial plafond		1			1	(3%)
Micro-fracture of talus	3	4			7	(21%)
Talar dome fracture	2	2			4	(12%)
Meniscoid body	4	3			7	(21%)
Adhesion bands	5	3			8	(24%)
Talar exostosis	3	1			4	(12%)
Blood clots	1				1	(3%)
Mild capsular tears	1				1	(3%)
Lateral gutter DJD		1			1	(3%)
Medial groove erosion	1				1	(3%)
Osteochondritis dissecans of talus	4	1	1		6	(18%)
Loose bodies	2	1			3	(9%)
Bone fragments	1				1	(3%)
Hemarthrosis		1			1	(3%)
Ankle deformity			1		1	(3%)
Torn lateral ligament		2			2	(6%)
Calcific ligaments		1			1	(3%)

TABLE 6 Pain profile of patients after ankle arthroscopy

Ankle Rating Category	Excellent % (N = 15)	Good % (N = 11)	Fair % (N = 5)	Poor % (N = 2)	Total % (N = 33)
Pain					
No pain anytime	47% (7)	-	-	-	21% (7)
Walking pain					
No pain	80% (12)	18% (2)	-	-	42% (14)
Mild pain	20% (3)	81% (9)	80% (4)	50% (1)	52% (17)
Moderate pain	-	-	20% (1)	50% (1)	6% (2)
Severe pain	-	-	-	-	-
Rest pain					
No pain	93% (14)	81% (9)	-	-	70% (23)
Mild pain	7% (1)	18% (2)	100% (5)	100% (2)	30% (10)
Moderate pain	-	-	-	-	-
Severe pain	-	-	-	-	-

sidered obese as determined by the Body Mass Index (BMI of greater than 27.8) (21–23). Patients with a BMI of less than 27.8 were significantly more likely to have good and excellent ankle scores, while patients with a BMI of greater than 27.8 were significantly more likely to have poor and fair ankle scores ($p < 0.05$) (Table 9). In addition, patients with better ankle scores tended to have a smaller percentage of obese individuals in each

TABLE 7 Clinical profile of patients after ankle arthroscopy

Ankle Rating Category	Excellent % (N = 15)	Good % (N = 11)	Fair % (N = 5)	Poor % (N = 2)	Total % (N = 33)
Edema					
None	73% (11)	27% (3)	20% (1)	100% (2)	52% (17)
Nonpitting	27% (4)	55% (6)	60% (3)	-	40% (13)
Pitting	-	18% (2)	20% (2)	-	8% (3)
Muscle strength					
Full	80% (12)	36% (4)	-	50% (1)	52% (17)
Good	20% (3)	55% (6)	60% (3)	50% (1)	40% (13)
Fair	-	9% (1)	40% (2)	-	8% (3)
Poor	-	-	-	-	-
Instability					
None	87% (13)	18% (2)	60% (3)	-	54% (18)
Mild	13% (2)	64% (7)	40% (2)	100% (2)	40% (13)
Moderate	-	18% (2)	-	-	6% (2)
Severe	-	-	-	-	-

TABLE 8 Functional profile of patients after ankle arthroscopy

Ankle Rating Category	Excellent % (N = 15)	Good % (N = 11)	Fair % (N = 5)	Poor % (N = 2)	Total % (N = 33)
Walking					
Unlimited walking and standing	67% (10)	18% (2)	-	-	36% (12)
Walking distances of 5–10 blocks	27% (4)	64% (7)	-	50% (1)	36% (12)
Walking 1–5 blocks	6% (1)	18% (2)	100% (5)	50% (1)	28% (9)
Walking < 1 block	-	-	-	-	-
Unable to walk	-	-	-	-	-
Stair climbing					
Independent stair climbing	87% (13)	18% (9)	40% (2)	50% (1)	76% (25)
Support with stair climbing	13% (2)	18% (2)	60% (3)	50% (1)	24% (8)
Transfer activity					
Independent	93% (14)	91% (10)	60% (3)	50% (1)	85% (28)
With support	7% (1)	9% (1)	40% (2)	50% (1)	15% (5)
Supportive devices					
None used	60% (9)	55% (6)	20% (1)	-	48% (16)
One ankle support	20% (3)	36% (4)	40% (2)	-	27% (9)
One cane or crutch(s)	-	9% (1)	40% (2)	100% (2)	15% (5)
Ankle support with cane or crutch	13% (2)	-	-	-	6% (2)
Special shoes	7% (1)	-	-	-	3% (1)

group. For example, 33% of patients receiving excellent ankle scores were obese as compared to 100% of patients receiving poor ankle scores being obese (Table 9).

Discussion

It is theorized that excessive stress applied to the ankle joint will irritate surrounding bone, synovium, cartilage, and capsule resulting in an inflammatory response which causes joint pain (27). The reaction of the synovium to these excessive stresses results in synovitis. All patients in this study were found intraoperatively to have chronic or acute synovitis.

Histologically cellular trauma initiates the release of interleukin I (IL-1), which stimulates fibroblastic synovitis (FLS). The FLS then proliferates and secretes metaloproteinases, prostaglandins, and cytokines (28, 29). These inflammatory effects are modified by interleukin-1 receptor antagonist (IL-1RA) of which two structural variants exist (30). The first type is produced by macrophages. The second type is produced by keratinocytes or epithelial cells. Both types may be produced simultaneously. In addition, transforming growth factor β (TGFB) has been shown to modify IL-1 (30).

Ferkel *et al.* describe lateral impingement syndrome pain (1). They believe that the hypertrophic synovium is

TABLE 9 Postoperative ankle rating category versus clinical profile and Chi square values after ankle arthroscopy

	Excellent (N = 15)	Good (N = 11)	Fair (N = 5)	Poor (N = 2)	Total (N = 33)	Chi Square Value[b]	Confidence Level[c]
Physical therapy (months)	4.20	2.68	1.80	1.00	3.27	5.2365	0.05
Body mass index	28.57	26.90	30.73	36.73	28.85	4.9302	0.05
Percent obese patients	33% (5)	36% (4)	50% (4)	100% (2)	45% (15)	-	-
Age	41.60	42.36	38.40	57.00	42.00	-	-

[a] Scores: excellent (100–85); good (84–70); fair (69–60); poor (59–0).
[b] Group ankle score: excellent/good; fair/poor.
[c] Body mass index: >27.8; <27.8.

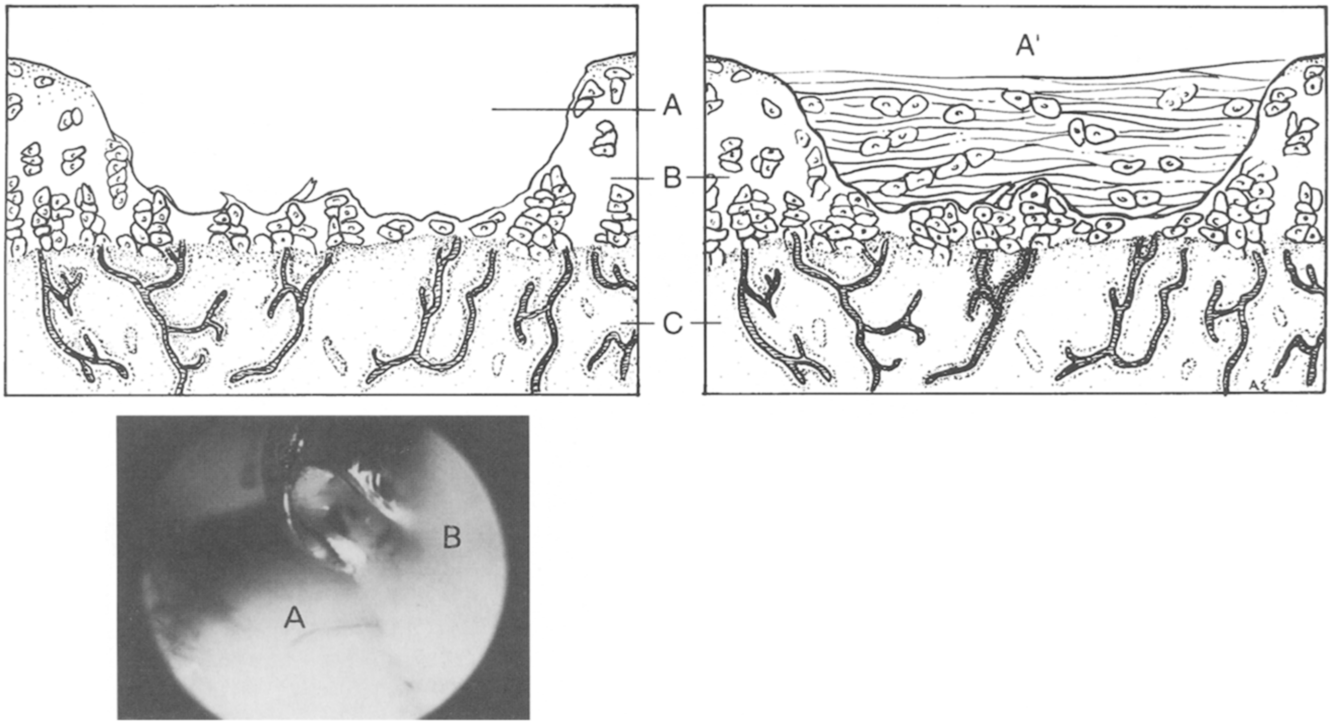

FIGURE 3 *Top left and right:* An articular cartilage defect with a small amount of hyaline cartilage covering the subchondral bone. Abrasion of the subchondral bone and blood vessels stimulates the formation of fibrocartilage in the defect. *A,* articular cartilage defect; *A',* fibrocartilage; *B,* hyaline cartilage; *C,* subchondral bone. *Bottom left photo:* Arthroscopic photograph; magnification depicts an osteochondral defect.

compressed by the talus, tibia, and fibula, causing increased irritation and inflammatory synovial tissue (1). The result is chronic lateral ankle pain. Guhl (26) suggested that excessive stresses or trauma cause intra-articular hematoma that is slowly reabsorbed, ultimately by macrophages, and causes a reactive synovitis. Meniscoid bodies as seen in some ankle joints (see Table 5) are composed of capsule, ligament, and synovial tissue (31). These bands are indicators of advanced anterolateral impingement (32) and represent a general advanced stage of ankle joint destruction.

Impact loading on bone with excessive pressure initiates an indirect inflammatory osteoarthritic response (24, 25). High internal stress creates microfractures of the bone trabaculae weakening the superstructure (Fig. 3) and creating cracks and fissures of the overlying cartilage (Fig. 4). In response to this osteochondral destruction, inflammation and pain begins (26). Twenty-five patients (78%) in this study were arthroscopically found to have chondral talar defects, various talar fractures, osteochondritis dissecans of the talar dome, and degenerative joint disease of the lateral gutter and medial groove erosions (see Table 5). These osteochondral defects can remain undetected by radiography. In this study there was a 61% rate of false-negative x-rays for painful ankles with osteochondral defects.

The diagnoses associated with chronically painful ankle include: chronic synovitis (54%); traumatic arthritis (54%); lateral impingement syndrome (3%); microfractures of the talar dome (3%); osteochrondritis dissecans of the talus (6%); and talar exostosis (3%) (see Table 5). These diagnoses were consistent with the

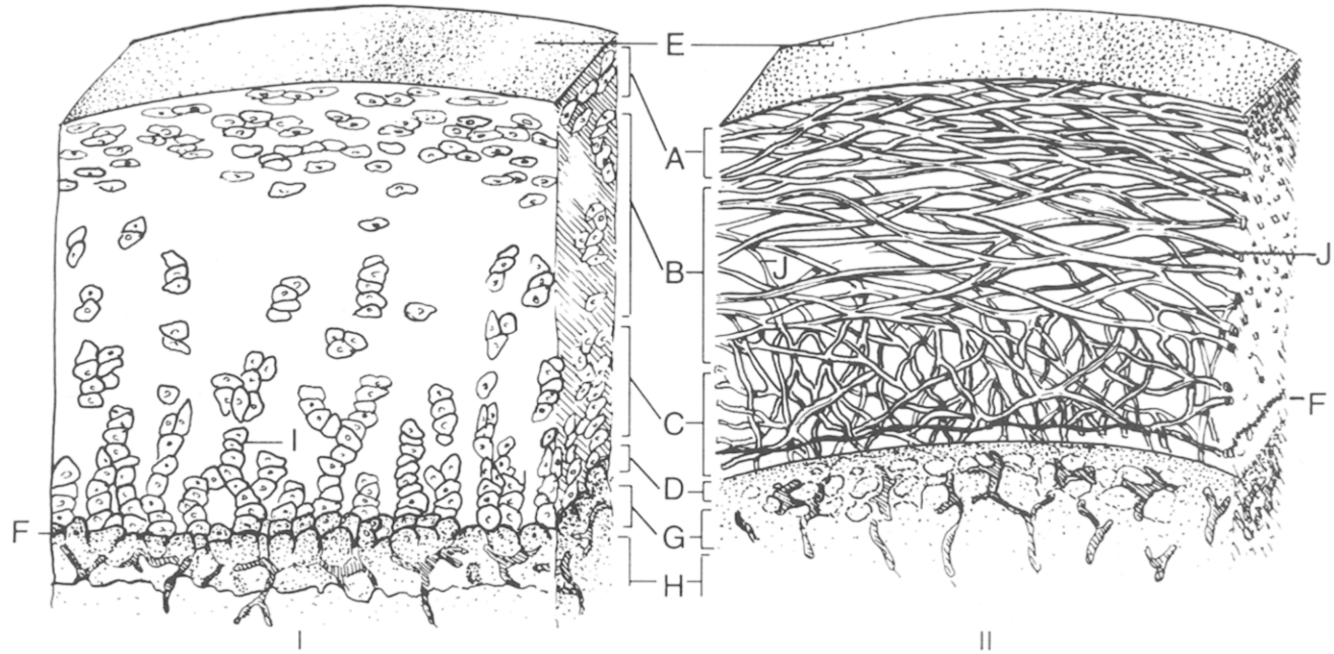

FIGURE 4 *Diagram I:* Zonal variation and arrangement of chondrocytes through the entire depth of cartilage. *Diagram II:* Zonal variation and arrangement of collagen fibers through the entire depth of cartilage. *A,* superficial tangential zone; *B,* middle zone; *C,* deep zone; *D,* calcified cartilage; *E,* articular surface; *F,* tidemark; *G,* subchondral bone; *H,* cancellous bone; *I,* chondrocytes; *J,* collagen fiber.

intraoperative findings which included: hypertrophic synovium, chondral defects of the talus, intra-articular chip fracture, chondral defects of the tibial plafond, microfractures of the talus, talar dome fractures, meniscoid body, adhesion bands, talar exostosis, blood clots, mild capsular tears, lateral gutter degenerative joint disease, medial groove erosion, osteochrondritis dissecans of the talus, loose bodies, hemarthrosis, marked ankle deformity, lateral ligament tears, and calcific ankle ligaments.

Arthroscopy is a less traumatic procedure when compared to open ankle arthrotomy, so it inherently produces less tissue inflammation to the surrounding joint apparatus. Arthroscopy reduces sources of inflammation by mechanically removing intra-articular cartilage, bone, and soft tissue. Ultimately, the goal is to allow the ankle joint to anatomically function pain free.

This study represents a retrospective analysis of 33 ankle arthroscopies completed on patients for persistent and/or undiagnosed ankle pain of 6 or more months duration. Overall, patients did better several months after arthroscopy having less pain. This study also demonstrates that obesity significantly impacts on the outcome of arthroscopic procedures. Obese patients were more likely to be rated with fair or poor outcomes, while nonobese patients were significantly more likely to be rated excellent or good (Table 9). The extra weight in the obese patient may increase stress on the ankle joint and exacerbate the inflammatory process affecting the arthroscopic treatment.

Patients in this study who received physical therapy postoperatively for 1 or more months after ankle arthroscopy had significantly better ankle rating scores than those who did not have physical therapy (Table 9). Physical therapy treatment for pain is designed to combat the physiologic aspects of pain such as tissue damage, inflammation, edema, ischemia, defects of reduced physical and metabolic activity, and trauma (33). Physical therapy received by the patients in the present study consisted of whirlpool, ultrasound, and ankle strengthening/progressive resistance exercises.

Saxena *et al.* report that the most efficaceous method of promoting an expedient and functional recovery is through physical therapy and structured exercises (34). Modalities such as moist heat, ultrasound, and parrafin wax offer temporary patient analgesia with increased range of motion. This increase in activity and exercise improves extrinsic muscle strength and prevents muscle atrophy (34).

O'Driscoll *et al.* studied the effects of continuous passive motion (CPM) in the clearance of joint hemarthrosis (35). They noted it to be effective in accelerating clearance of joint hemarthrosis, while hemarthrosis slowly cleared from immobilized joints resulting in synovial hypertrophy, intra-articular adhesions, and joint stiffness. It is believed that synovial hyperplasia results in the production of proteolytic enzymes and cartilage destruction (35). Evidence has been provided that physical therapy in the form of CPM promotes reorientation of blood vessels to a normal state and increases tendon sheath repair (36, 37).

The results of this study suggest that relief of ankle pain that has failed to respond to conservative measures can be successfully treated by arthroscopy. However, postoperative physical therapy and patient obesity will significantly temper the outcome.

Summary

Thirty-two patients with 33 painful ankles underwent ankle arthroscopy for treatment of recalcitrant ankle pain. Results of treatment after an average follow-up time of 1.4 years (range, 0.33 to 12.5 years) showed ankle scores of 15 excellent, 11 good, 5 fair, and 2 poor. Nonobese patients and patients receiving postoperative physical therapy had significantly better outcomes of arthroscopic treatment as compared to obese patients and patients who did not receive physical therapy postoperatively. An additional unexpected finding was that patients in the excellent and good categories had the most intraoperative findings indicating the effectiveness of arthroscopic removal of intra-articular debris in alleviating chronic severe ankle pain.

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