Hallux Rigidus: Treatment by Cheilectomy*

BY ROGER A. MANN, M.D.†, OAKLAND, CALIFORNIA, AND THOMAS O. CLANTON, M.D.‡, HOUSTON, TEXAS

ABSTRACT: **Cheilectomy, the excision of an irregular osseous rim that interferes with motion of a joint, was performed on the distal part of the first metatarsal of twenty-five patients who had hallux rigidus. Relief of pain was achieved in all but three patients, whose cases were considered as failures. Joint motion improved by an average of 20 degrees, and it was in an acceptable range in twenty-three patients. There were no complications other than persistence of swelling in six patients. No patient required additional operative intervention during an average follow-up of fifty-six months. We concluded that cheilectomy is a better method of treatment for hallux rigidus than arthrodesis, resection arthroplasty, or arthroplasty with the use of a flexible implant.**

Hallux rigidus is a painful affliction of the first metatarsophalangeal joint that is associated with limitation of motion, especially dorsiflexion. The original description of this condition has been attributed to Davies-Colley[8], who called it hallux flexus, in a paper that was read before the Clinical Society of London in 1887. The name hallux rigidus was proposed four months later by Cotterill[6], and it remains the most common designation despite the advocacy of other names such as hallux limitus, hallux dolorosus, metatarsus non-extensus, dorsal bunion, winkle-picker disease, and metatarsus primus elevatus. The history of the terminology was well summarized by Kelikian[30].

The general approach to treatment has not varied greatly since Davies-Colley suggested resecting the base of the proximal phalanx of the great toe[8]. Most authors[3,9,11-13,20,27,29,32,34,36,40,43,44,46,54,55] have recommended that form of resection arthroplasty or arthrodesis of the first metatarsophalangeal joint. Wedge osteotomy of the proximal phalanx or of the neck of the metatarsal has been advocated for young patients[18-20,31,32,41]. Resection of the head of the first metatarsal was widely advocated in the early literature on hallux rigidus[5,6,23,26], but this procedure has since fallen into disrepute[3]. More recently attention has been focused on various implants that have been used in the treatment of pathological conditions of the great toe[7,15,24,42,45,50,51,53]. While cheilectomy is routinely included in some arthroplasty procedures for hallux rigidus, it has received scant attention as an isolated procedure[15,39], and the purpose of this paper is to report on a group of patients who were treated with this procedure.

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† 3300 Webster Street, Suite 1200, Oakland, California 94609.

‡ University of Texas Health Science Center at Houston, 6410 Fannin, Suite 310, Houston, Texas 77030. Please address requests for reprints to Dr. Clanton.

Materials and Methods

Between January 1976 and December 1981, we treated twenty-eight patients with thirty-four cheilectomies. Only two other patients who had hallux rigidus were treated operatively during this period of time. Those two patients had an arthrodesis because they had extensive degenerative changes and desired a single definitive procedure. Many more patients who had hallux rigidus were seen during the six-year period, but they either improved with non-operative treatment or went elsewhere for treatment.

The diagnosis of hallux rigidus was based on a complaint of pain in the first metatarsophalangeal joint and these physical findings: increased bulk of the joint, especially dorsally; not infrequently, an associated synovitis; and marked restriction of dorsiflexion. Plantar flexion also caused some pain. We attributed that to stretching of the capsule of the joint and of the tendon of the extensor hallucis longus over the osteophyte on the dorsal rim of the metatarsal head. Radiographs always revealed degenerative arthritis of the first metatarsophalangeal joint, and an osteophyte was always present on the dorsal aspect of the metatarsal. No patient had evidence of rheumatoid arthritis, gout, or seronegative spondyloarthropathy.

Twenty-five of the twenty-eight patients were examined at follow-up by one of us (R. A. M.) (Table I). Three patients were lost to follow-up. The average length of follow-up was fifty-six months (range, thirty to 100 months). There were five men and twenty women, and the average age was fifty-six years (range, thirty to eighty years). Six patients had the lesion bilaterally. Ten patients had a history of injury to the great toe, but in only five could the injury be directly related to the onset of the symptoms. Only one patient had an occupation that might have contributed to the development of the symptoms. Ten patients related the symptoms predominantly to recreational activities.

The pain was severe enough to interfere with the lifestyle of all of the patients. Discomfort that was produced by pressure of the shoe on the osteophyte caused all patients to alter their footwear. Eight patients complained of the cosmetic deformity of the dorsal bunion, and four had an ulceration of the skin over the bunion.

The preoperative arc of motion of the first metatarsophalangeal joint averaged 29 degrees (range, 5 to 65 degrees). There is some disagreement about what constitutes

TABLE I

DATA ON PATIENTS

Case	Age (Yrs.)	Side	Motion in Degrees: Preop. Arc	Preop. Dorsiflexion	Preop. Plantar Flexion	Postop. Arc	Postop. Dorsiflexion	Postop. Plantar Flexion	Relief of Pain	Level of Satisfaction with Result	Length of Follow-up (Mos.)
1	56	R	25	10	15	70	60	10	Complete	Satisfied	71
		L	25	10	15	50	40	10	Partial	Satisfied*	71
2	51	R	5	15	−10	45	25	20	Complete	Satisfied	96
3	50	R	30	10	20	10	35	−25	Unchanged	Dissatisfied	48
4	49	R	30	15	15	55	50	5	Complete	Satisfied	36
		L	30	15	15	60	50	10	Complete	Satisfied	36
5	61	L	25	10	15	65	50	15	Complete	Satisfied	37
6	64	L	25	15	10	45	30	15	Complete	Satisfied	56
7	71	L	25	15	10	5	15	−10	Worse	Dissatisfied	55
8	58	R	45	30	15	80	60	20	Complete	Satisfied	36
9	30	R	35	20	15	60	40	20	Complete	Satisfied	30
10	45	R	55	40	15	80	70	10	Complete	Satisfied	54
		L	15	5	10	80	70	10	Complete	Satisfied	54
11	51	R	45	45	0	30	40	−10	Complete	Satisfied	39
		L	40	40	0	40	45	−5	Complete	Satisfied	39
12	60	L	20	5	15	30	30	0	Complete	Satisfied	30
13	54	R	25	10	15	65	60	5	Complete	Satisfied	46
		L	35	20	15	75	60	15	Complete	Satisfied	46
14	45	R	30	25	5	35	25	10	Partial	Satisfied*	42
		L	65	30	35	65	45	20	Complete	Satisfied	42
15	64	L	15	10	5	25	40	−15	Complete	Satisfied	96
16	39	R	15	15	0	40	30	10	Partial	Satisfied	100
17	69	L	10	10	0	30	15	15	Partial	Satisfied	73
18	74	R	30	30	0	65	60	5	Complete	Satisfied	66
19	53	R	30	10	20	25	30	−5	Complete	Satisfied*	41
20	53	R	30	10	20	50	45	5	Complete	Satisfied	51
21	40	R	30	20	10	50	45	5	Partial	Satisfied*	72
22	80	R	20	25	−5	30	30	0	Complete	Satisfied	66
23	63	L	15	5	10	15	30	−15	Unchanged	Dissatisfied	59
24	59	R	20	5	15	80	65	15	Partial	Satisfied*	34
25	69	R	30	10	20	30	35	−5	Complete	Satisfied*	60

* The patient was satisfied but had reservations.

a normal arc of motion in this joint[1,17,24,25,28]. We have considered 100 degrees as the normal arc, which is composed of 70 degrees of dorsiflexion and 30 degrees of plantar flexion. Dorsiflexion was limited to 30 degrees or less in all but two patients (Cases 10 and 11). No patient had any important coexisting lesions, such as hallux valgus, on the affected foot.

On the radiographs that were made preoperatively, the dorsal osteophyte had produced squaring and enlargement of the dorsal aspect of the metatarsal head (Figs. 1-A and 1-B). There also was formation of osteophytes that involved the lateral and occasionally the medial aspect of the metatarsal head and the base of the proximal phalanx in twenty-four of the thirty-one affected joints. The first metatarsophalangeal joint space measured one millimeter or less in twenty-four joints, and there was no measurable space in six. An identifiable loose body was evident in two joints. No major abnormalities were noted in the first intermetatarsal angle or in the hallux valgus angle, nor was there any dorsiflexion deformity of the first metatarsal.

Symptoms had been present preoperatively for an average of 8.8 years (range, two weeks to forty years). The period of non-operative treatment from the initial office visit to the day of operation ranged from seven days to three years. Our conservative methods consisted of using extra-depth shoes that had soft uppers and rocker-bottom soles and administering anti-inflammatory medications. If conservative management failed, cheilectomy was suggested, but all patients were advised of the possible need for another operation should the cheilectomy fail.

Surgical Technique

The cheilectomies were performed under general or spinal anesthesia, and a thigh tourniquet was used. Through a dorsal midline incision that was centered over the first metatarsophalangeal joint, the extensor hallucis longus tendon was retracted medially or laterally. The joint was opened longitudinally, any proliferative synovial tissue was excised, and the debris and loose bodies about the joint were removed. Frequently the articular surface of the first meta-

FIG. 1-A FIG. 1-B

Figs. 1-A and 1-B: Case 6.
Fig. 1-A: Anteroposterior radiograph of the first metatarsophalangeal joint in a patient who had hallux rigidus, demonstrating squaring of the joint and loss of the normal joint space.
Fig. 1-B: Lateral radiograph demonstrating a large dorsal osteophyte.

tarsal head was found to be eroded to subchondral bone on its dorsal half, and at times there was involvement of the articular surface of the proximal phalanx as well, but these abnormalities did not lead to any alteration in the surgical technique. In addition to the large dorsal osteophyte on the metatarsal head, occasionally we found a spur on the dorsal aspect of the base of the proximal phalanx. They were removed, along with the dorsal one-quarter to one-third of the metatarsal head (Figs. 2-A and 2-B); if large lateral or medial osteophytes were present, they were removed also. The incision for the cheilectomy was made from distal to proximal with a six-millimeter straight osteotome to prevent fragmentation of the articular surface. This left the remaining dorsum of the metatarsal head at a level that was somewhat plantar to the level of the metatarsal shaft but flush with the metatarsal both medially and laterally (Fig. 3). The joint could then be passively dorsiflexed to approximately 70 degrees without impingement (Fig. 4). We no longer inject a steroid into the joint, as previously described[10,39]. The capsule was sutured loosely, and a compressive dressing was applied before the tourniquet was released.

Postoperatively, the dressing was changed at eighteen to twenty-four hours and then a new, snug dressing was applied. The patient was allowed to walk using a wooden-soled shoe and no support. The sutures and the dressing were removed ten to fourteen days after the operation, and active and passive range-of-motion exercises were started. The wooden-soled shoe was soon discarded and any comfortable, flexible footwear was permitted.

Results

Maximum improvement usually was evident in our patients within two to three months and they returned to normal activities quickly, but some patients continued to show improvement for twelve months after the operation. In the final assessment, we rated patients on relief of pain and improvement in range of motion.

Complete relief of preoperative pain was obtained in twenty-two of the thirty-one affected joints. In six there was considerable relief that was characterized by only occasional episodes of non-disabling discomfort. There was no relief in two joints (Cases 3 and 23) and increased pain in one (Case 7). In Case 23 an associated post-traumatic arthritis of the ankle required an arthrodesis, and the increased stress across the first metatarsophalangeal joint that resulted from the arthrodesis may have played a role in this poor result. In Case 3 there was only slight discomfort, but the patient complained of limited motion and difficulty in wearing shoes with any heel. In Case 7 the patient felt that the toe was worse because of pain, stiffness, and problems with shoes. She was offered an arthrodesis, but she refused.

The range of motion of the first metatarsophalangeal joint improved after cheilectomy in twenty-three of the thirty-one feet. The average postoperative arc of motion was 48 degrees (range, 5 to 80 degrees), which was approximately 20 degrees of improvement. There were more than 30 degrees of dorsiflexion in twenty-one feet. Five joints (Cases 11, 14, 19, 23, and 25) had a negligible change in range of motion and three (Cases 3, 7, and 11) lost 15 to 20 degrees. One of these three patients who had decreased motion (Case 11) was still pleased with the result because she had relief of pain and the motion was in a functional range, but the results in the other two were rated as poor.

One patient had a small recurrence of the dorsal osteophyte. There was little correlation between the clinical rating of results and the radiographic appearance of the affected joints. Many patients who had severe degenerative changes as assessed radiographically had an excellent result. The four patients who had had an ulceration over the dorsal bunion had no further problems with the skin. No sensitivity

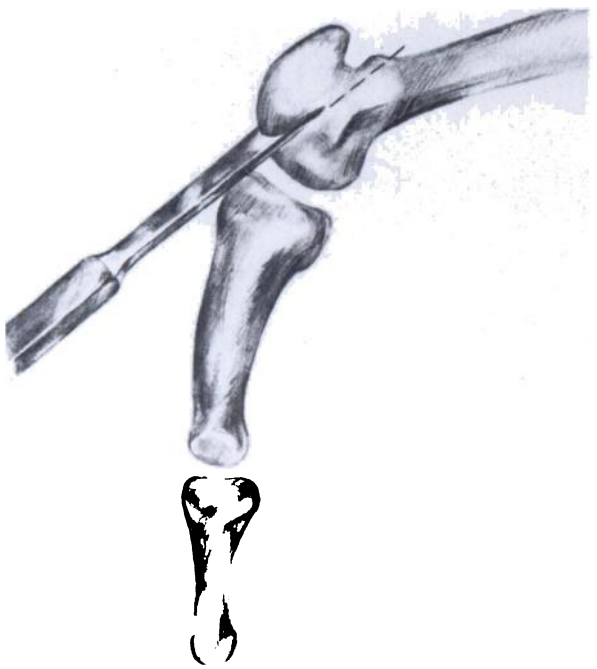

FIG. 2-A

Figs. 2-A and 2-B: Illustrations depicting bone that was removed from the first metatarsal during the cheilectomy.
Fig. 2-A: Preoperative lateral view of the dorsal osteophyte.

was noted at the site of the incision. Problems with shoes persisted in four patients, but the remaining twenty-one patients were able to wear ordinary shoes; however, most of the women avoided heels that were higher than five centimeters.

There were no serious complications. Swelling about the first metatarsophalangeal joint without evidence of infection persisted for one year in one patient, for four months in one, and for six weeks in four, but this complication did not compromise the result in terms of pain or function. At the time of writing, no patient in this series had had any additional related surgical procedure.

Discussion

Hallux rigidus is a common and disabling affliction of the great toe and it occurs in about one in forty-five individuals who are more than fifty years old[16]. A predisposition to development of the lesion has been suggested in people who have a long, slender foot[2]; a pronated foot[2,23,44]; a long great toe[4,8,9,44,48,52]; pes planus[4,9,22], particularly when the person habitually wears stiff boots[6]; congenital flattening of the first metatarsal head[10]; metatarsus primus elevatus[33]; and osteochondritis dissecans of the first metatarsal head[14,35,52]. Each of these conditions allegedly increases the stress across the first metatarsophalangeal joint and results in damage to the articular surface. Then there is reflex spasm in the surrounding musculature and subsequent production of osteophytic bone[9,26]. Although some patients in our series manifested one or more of these alleged predispositions, none seemed to be a common predisposing factor for hallux rigidus.

Hallux rigidus has been described in two age-groups: adolescent patients, who have localized changes in the articular cartilage; and adult patients, who have more generalized degenerative arthritis of the joint[44]. Kessel and Bonney[31] implicated osteochondritis dissecans as a cause of hallux rigidus in young patients. This idea was substantiated by Goodfellow[14], who proposed that trauma to a vulnerable epiphysis could result in osteochondritis dissecans of the first metatarsal head. No patient in our series was an adolescent. The only salient pathological variation in our patients was an increase in the degree of osteoarthritic involvement with age. We did not alter our approach on the basis of age or degree of involvement, although others have suggested that this should be done[15,32].

The technique of cheilectomy that we are reporting is essentially unchanged from the procedure that was described originally by DuVries[10] in 1959 and was reported by Mann et al.[39] in 1979. Authors of previous articles on hallux rigidus that mentioned exostectomy conveyed little enthusiasm for the procedure[2,3,44], but perhaps the unsatisfactory results were related to removal of less bone than the amount that we have advocated.

Cheilectomy was recently advocated by Gould[15] for the treatment of hallux rigidus in young patients, and that series included twelve patients. He thought that toe power and stability were better in the patients who were treated by cheilectomy than in a simultaneously reported group of patients who were treated with an implant. Our previous series of twenty patients who were treated by cheilectomy included

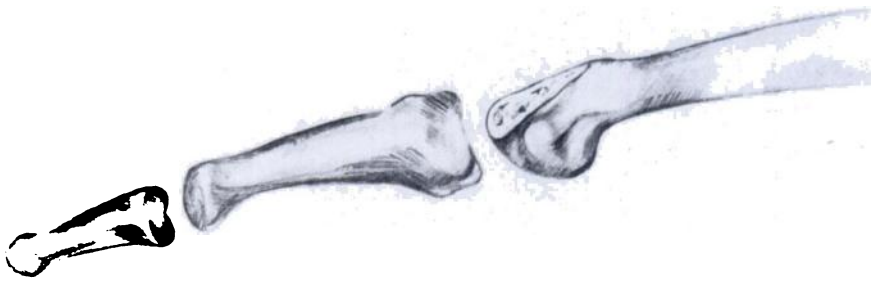

FIG. 2-B

Removal of the osteophyte and a portion of the normal articular surface of the dorsal aspect of the first metatarsal.

FIG. 3

Lateral radiograph of the first metatarsophalangeal joint after cheilectomy, demonstrating the amount of bone that was removed. (Reproduced by permission from Surgery of the Foot, edited by Roger A. Mann. Ed. 5, p. 165, Fig. 6-9 C. St. Louis, C. V. Mosby, 1986.)

four who are in the present series (Cases 2, 13, 15, and 16)[39]. All patients in that series had relief of pain and were satisfied with the result, even though hallux valgus subsequently developed in one patient and another had a recurrent osteophyte. The results in the current series compare favorably with those of other series in terms of both relief of pain and improvement in motion. Comparison of the results that were obtained with various other procedures for the treatment of hallux rigidus is difficult, because many authors have not documented the results in detail.

We believe that the critical elements in an analysis of results should be long-term relief of pain, improvement in joint motion, and avoidance of complications. In our series, twenty-two of twenty-five patients (twenty-eight of thirty-one joints) who were treated by cheilectomy had adequate or complete relief of pain. These results compare favorably with those of other reports, whether they described treatment by resection arthroplasty (the Keller procedure), prosthetic replacement, arthrodesis, or osteotomy. Combining the patients of Severin[46] and Wrighton[55], who were treated by using the Keller procedure, forty-four of fifty painful joints were improved. Eighteen of twenty-one patients who had

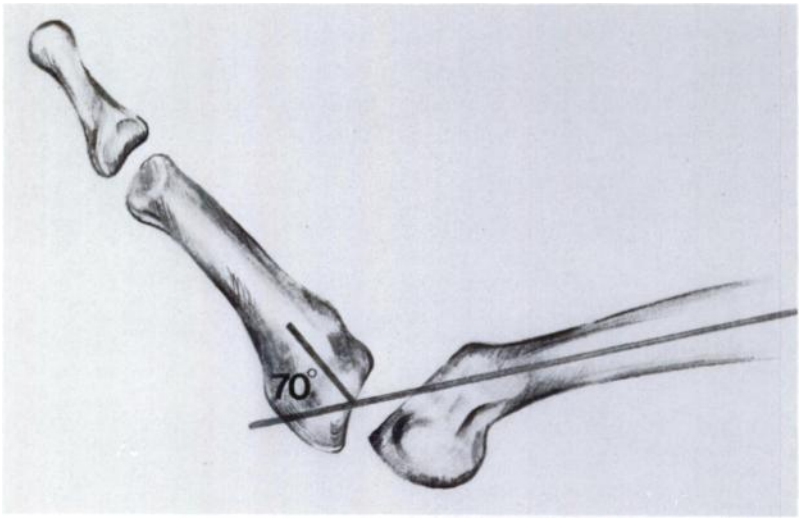

FIG. 4

Illustration depicting the postoperative appearance of a great toe that is capable of 70 degrees of dorsiflexion.

hallux rigidus and were treated by arthrodesis had relief of pain[12,43,48]. The use of implant arthroplasty relieved pain in seventy-six of eighty-five patients[7,24,42,45,47,51], and the use of osteotomy relieved pain in nine of ten joints[31]. This comparison of results suggests that relief of pain is remarkably similar for the several operations, but joint motion and stability are retained with cheilectomy, and no foreign material is inserted.

Decreased dorsiflexion of the first metatarsophalangeal joint is a characteristic disability in patients who have hallux rigidus, and although there is disagreement on the minimum arc of motion, and specifically of dorsiflexion, that is required for comfortable walking on level terrain[1,17,24,25,28], we think that at least 15 degrees of dorsiflexion is needed. In our series, twenty-nine of the thirty-one affected joints had at least that amount of dorsiflexion and twenty-three had 30 degrees or more. Only two patients had less than 15 degrees of dorsiflexion. This degree of motion is considerably better than that obtained by the Keller procedure[3,46,55]. The average arc of motion that has been reported in patients who were treated with silicone implants was 47 degrees in twenty-seven patients[24,25], which is about the same as our average of 48 degrees. The tendency of the implant to fracture on repeated bending, which is an important disadvantage, must be considered. However, no series of patients who were treated with implants with a comparable length of follow-up to our series (average follow-up, fifty-six months) has been reported, to show how frequently that complication arises.

A major cause of loss of motion as well as of pain in patients who have hallux rigidus is impingement of the proximal phalanx against the large dorsal osteophyte on the metatarsal head. Cheilectomy eliminates the impingement and permits additional dorsiflexion. While the procedure does not eliminate or retard the ongoing degenerative process within the joint, little deterioration of the result of the operation seems to occur with time. Even if there is deterioration of the joint, cheilectomy permits the later use of any other procedure. That advantage does not apply for the other procedures that have been mentioned.

All procedures that have been used for the treatment of hallux rigidus have satisfied more than 80 per cent of patients, but the operation that is selected by the surgeon should offer as many advantages as possible as well as the fewest potential complications. The Keller procedure often is not followed by acceptable cosmetic and functional results, especially in terms of weakness in plantar flexion. It shortens the great toe, and it often causes a hyperextension deformity and altered weight-bearing[21,27,46,49,50,55]. While the use of implant arthroplasty proposes to eliminate the cosmetic disadvantages, prosthetic wear, adverse reactions to Silastic, and fragmentation and breakage of implants have been reported[42,47]. Although an arthrodesis is a good procedure theoretically and in practice, malposition or non-union may develop, and arthritis of the interphalangeal joint is often an unwelcome sequela[12,38,43]. Osteotomy also may be followed by malunion or non-union, and it requires considerable technical expertise if the desired range of motion is to be achieved. Cheilectomy introduces none of these additional risks. For that reason it is, for us, the treatment of choice for hallux rigidus when symptoms warrant surgical intervention.

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