

# Capsulectomy of the metacarpophalangeal and proximal interphalangeal joints

*From July 1975, through March, 1978, 105 metacarpophalangeal joint capsulectomies in 37 patients, 47 dorsal proximal interphalangeal (PIP) capsulectomies in 26 patients, and 65 volar PIP capsulectomies in 41 patients were performed. The procedures were done after conservative methods had failed, and the results were tabulated in each area by diagnostic category. In the major group in which stiffness resulted from fracture and crushing injuries, average gains of 13° to 18° of active motion were achieved, with a change in arc of motion, while nerve paralysis patients did substantially better. The study should clarify expectations from the procedure; functional gains may still be significant.*

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Capsulectomy of the metacarpophalangeal and the proximal interphalangeal joints has become a standard procedure for improving function in these joints when normal articular surfaces exist, and conservative measures, such as dynamic splinting, have failed to produce satisfactory motion. Although Curtis<sup>1</sup> has pointed out that, as more supplementary procedures are added to the capsulectomy, poorer results may be anticipated; few authors, due to the multiple variables involved, have attempted to compare the results of the different groups. Fowler<sup>2</sup> described his technique for the metacarpophalangeal joint in 1946. He stated that he had performed over 100 capsulectomies with this method, but declined a detailed analysis of results due to the variables. Buch<sup>3</sup> described the anatomical characteristics of the joint and the anatomy of the ligaments in 1974, emphasizing the importance of immobilization of the joint in 70° of flexion to prevent contracture. Young, Wray, and Weeks,<sup>4</sup> in 1978, described their results, noted the use of Kirschner-wire fixation of the joint in the corrected position for 2 weeks following operation, reported the gains in passive range of motion as representative of joint mobility alone, and achieved significant improvement in 119 of 135 stiff joints. Curtis described his technique for the proximal interphalangeal joint in 1954. At that time he emphasized

retraction of the retinacular ligament and maintenance of its continuity for lateral stability after complete resection of the collateral ligament. Rhode and Jennings<sup>5</sup> contributed their experience with the proximal interphalangeal joint in 1971, providing details of the anatomy and their results in 23 joints. Sprague,<sup>6</sup> in 1976, pointed out the temporary nature of the initial release with 50% to 60% of the initial surgical improvement lost during the ensuing 6 months after operation. He obtained poorer results in the volar capsulectomy at the proximal interphalangeal joint than in the dorsal capsulectomy at this level. Harrison,<sup>7</sup> in 1977, revived Kaplan's<sup>8</sup> approach, utilizing an incision through the retinaculum just volar to the lateral bands for the dorsal capsulectomy, excising only the upper cord portion of the collateral ligament, and resuturing the retinaculum. He proposed that the Curtis technique had several disadvantages, including the risk of lateral instability, potential subluxation in flexion, and poor access to the joint. He also suggested that the failure of good results for the volar capsulectomy might be attributed to the failure of the extensor tendon to compensate. Our study is a quantitative evaluation of the results obtained by diagnostic category using our current surgical technique and post operative management.

## Clinical approach

Initially we try to decrease edema utilizing exercises and elevation. Tight, well-powdered surgical gloves with small holes in the webs for ventilation and the intermittent compression apparatus are utilized to decrease edema. When pain is a factor, the transcutaneous nerve stimulator and heat or cold applications are used during exercises. If there is a suspicion that sympathetic reflex dystrophy may have existed or exists at

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present, an attempt is made to eliminate this before surgical treatments are given. The measures utilized are stellate ganglion sympathetic blockade, elimination of the trigger mechanism and intravenous reserpine blocks. Dorsal sympathectomy is done if the nonoperative treatments provide only temporary improvement. Dynamic splinting is utilized in the form of elastic dor-siflexor assist splints, elastic flexion splints, as well as adjustable static devices, along with active range-of-motion exercises with proximal blocking. These measures continue until a plateau is reached. If the motion is still considered to be unsatisfactory for good function, the patient is considered a candidate for capsulectomy.

### Surgical techniques

When the metacarpophalangeal joint is contracted in extension, a dorsal curvilinear incision is made through the skin, the retinaculum is incised perpendicularly to the long axis of the common extensor in the direction of the fibers at the joint margin, the retinaculum is freed from the underlying collateral ligament, the collateral ligament is excised and the dorsal capsule is incised. The volar recess then is reestablished with a Penfield elevator, and the joint is pinned in 75° to 90° of flexion.<sup>9</sup> When a snapping sensation occurs as the joint is brought from extension to flexion, it is thought that an excess of collateral ligament remains which is riding over the volar expanse of the metacarpal condyle. Additional ligament then is excised. If necessary, extensor tenolysis is carried out. If a skin graft or flap is anticipated, as in burn patients, a transverse incision is utilized and grafting is carried out following the release.

When the metacarpophalangeal joint is contracted in flexion, a zigzag incision is made in the palm with consideration given to Z-plasties and free grafting when the skin is involved, as in burns or in Dupuytren's contracture. Subcutaneous fibrous tissue, as in burns or fascial bands in Dupuytren's, are excised. The neurovascular bundles are identified and protected. Fibrous thickening of the flexor sheath-pulley mechanism may require excision, preserving the pulley in the proximal half of the proximal phalanx area. The lower portion of the collateral ligament with the overlying retinaculum is then excised, and the volar plate is released proximally. If necessary, this incision is extended proximally and distally for flexor tenolysis.

For the dorsal capsulectomy at the proximal interphalangeal joint level, a dorsal curvilinear incision is made through the skin. Cleland's ligaments are divided on either side; and the retinaculum is divided just volar to the lateral bands. About 50% of the cord portion of

**Table I.** Metacarpophalangeal joint series (July, 1975 to March, 1978)

	Patients	Joints
Total	37 (22 male, 15 female)	105
Dorsal	35 (20 male, 15 female)	100
Volar	2 (2 male)	5
Follow-up: 3 mo to 32 yr		
Age range: (10 to 70 yr)		
0-10	2	
11-20	2	
21-50	25	
51-70	8	
Digital distribution		
Index 28		
Long 24		
Ring 26		
Little 27		
Diagnosis		
Fractures and crush	21	52
Nerve paralysis	8	25
Burns	5	10
Stroke	1	4
Rheumatoid arthritis	1	2
Mucopolysaccharidosis	1	4
(Sympathetic dystrophy)*	4	13

\*Within the fracture and crush injury group.

the collateral ligament is excised. The collateral ligament is also freed sagittally from the edge of the condyle of the proximal phalanx distal to its origin. The dorsal capsule is incised, preserving the central slip of the extensor mechanism. The volar recess is reestablished and the retinaculum is repaired. The joint is then pinned in 90° of flexion. A Littler intrinsic release is carried out, if necessary, along with extensor tenolysis, when indicated. The use of silicone sheeting as an interposition membrane as an adjunct to tenolysis has not been effective.

For the proximal interphalangeal joint contracted in flexion, the volar capsulectomy is carried out through mid-lateral incisions on either side of the digit. Through these, the volar retinaculum is excised, along with its attachment to the flexor sheath. The lower portion of the accessory collateral ligament is excised. The proximal fibrous portion of the volar plate is incised and the frequently thickened flexor sheath is then divided dorsal and, if necessary, volar to the tendons. The joint is then pinned in full extension. If, after the tourniquet is released, there appears to be inadequate

**Table II.** Results in the metacarpophalangeal joint capsulectomy series

Diagnosis	Preoperative average range		End result		Gain	
	Active	Passive	Active	Passive	Active	Passive
Total series	36°	44°	57°	73°	21°	29°
Fracture and crush	35°	42°	53°	62°	18°	20°
Nerve paralysis	28°	40°	63°	77°	35°	37°
Burns	28°	37°	64°	79°	36°	42°
Stroke		36°		87.5°		51.5°
Sympathetic dystrophy	18°	27°	21°	55°	3°	28°
11 to 20 age group	19°	30°	68°	88°	49°	58°
Mucopolysaccharidosis*						
Index	0°	0°	60°	60°		
Long	0°	0°	90°	90°		
Ring	0°	0°	90°	90°		
Little	0°	0°	90°	90°		

\*Hurlers-Scheie disease.

**Table III.** Proximal interphalangeal joint dorsal series (March, 1976 to March, 1978)

Diagnosis	Joints	Patients
Fracture and crush	31	19
Burns	8	2
Rheumatoid arthritis	4	4
Nerve paralysis	4	1
Sympathetic dystrophy*	4	1
Total	47	26 (17 male, 9 female)

Age range: 17 to 72 yr  
Joint distribution: Even  
Follow-up: 3 to 24 mo

\* Within the fracture and crush injury group.

circulation distal to the joint, the pin is removed and replaced with the joint in a slightly flexed position. Accessory procedures may include a tenotomy of the flexor digitorum superficialis, or a lengthening at the wrist, or a Z-plasty of the volar skin or skin grafting.

In all of the capsulectomies, the pin is removed after 10 to 14 days.

### Metacarpophalangeal joint series

From July, 1975, to March, 1978, metacarpophalangeal joint capsulectomies were performed on 105 joints in 37 patients (Table I). Follow-up time ranged from 3 months to 32 months. One hundred capsulectomies involved dorsal structures and five joints were operated for volar contractures. Patients ranged in age from 10 to 70 years, with the majority between 21 and 50 years. Diagnoses included fracture and crush injuries, nerve paralysis, burns, stroke, rheumatoid arthritis, and mucopolysaccharidosis. Thirteen joints were operated on in four patients with a diagnosis of reflex sympathetic dystrophy, now quiescent. Two pa-

tients had volar contractures secondary to thermal burns and Dupuytren's contracture.

### Results

In the dorsal capsulectomy series (Table II), an average gain of 21° of active motion was achieved with 29° gained passively. Each diagnostic category was evaluated. Nerve injury patients averaged 37° of gain passively before transfers and 35° actively after. The fracture and crush patients gained 20° passively and 18° actively. Four joints operated in a stroke patient averaged a 51.5° gain passively before transfer. Burn patients gained 42° passively and 36° actively. Most of the patients with quiescent reflex sympathetic dystrophy had some exacerbation of symptoms, despite the operation being done under brachial block and post operative stellate blocks; and gained 28° passively and only 3° actively, with increased pain. A small group of patients in the fracture and crush group between the ages of 11 and 20 gained 58° passively and 49° actively. A patient with mucopolysaccharidosis with the Hurlers-Scheie diagnosis initially had 0° of flexion in four joints and gained 60° of active and passive motion in the index finger and 90° of active and passive motion in the long, ring, and little fingers. We found no significant variation in the results among the digits. Patients in all categories tended to improve, once mobilization was initiated, up to the 3 month postoperative interval, with small gains up to 5 months, but none thereafter. Although almost all of the patients had joints that could be flexed 90° at operation, this was rarely obtained ultimately except in the nerve paralysis patients. In almost all cases, patients tended to gain in flexion very satisfactorily, with a lag in extension, consequently developing a more functional flexion arc.

**Table IV.** Results in the proximal interphalangeal joint dorsal capsulectomy series

Diagnosis	Preoperative average range		End result		Gain	
	Active	Passive	Active	Passive	Active	Passive
Total series	27°	40°	41°	61°	14°	21°
Fracture and crush	17°	31°	32°	46°	15°	15°
Nerve paralysis	5°	8°	78°	98°	73°	90°
Burns	46°	56°	50°	75°	4°	19°
Rheumatoid arthritis	3°	25°	25°	25°	22°	0°

Since the completion of this study, patients protected with sympathectomies who had quiescent sympathetic reflex dystrophy had results similar to those in the fracture and crush groups when the digits were so involved, or to the nerve paralysis patients when there had been no local damage to the digits. Two patients who flared despite presumed protective sympathectomies had the dystrophy aborted after operation with intravenous reserpine blocks. We are now investigating the use of intravenous regional anesthesia with reserpine added to the lidocaine in patients with a quiescent dystrophy or suggestive history.

The volar capsulectomy series was too small to allow a statistical conclusion. Both patients, however, achieved full extension following the procedures. In our experience the flexion contracture at the metacarpophalangeal joint level in burn and Dupuytren's contracture patients is frequently relieved with the skin and subcutaneous release. In these cases the joint capsule at this level is not involved. In many of the fracture and crush patients with contractures, the articular surfaces are abnormal, with arthroplasty rather than capsulectomy indicated.

### Proximal interphalangeal joint

**Dorsal-capsulectomy series.** From March, 1976, to March, 1978, with a follow-up of 3 months to 2 years, 47 dorsal capsulectomies of the proximal interphalangeal joints in 26 patients with even joint distribution were performed (Table III). Ages ranged from 17 to 72 years. Diagnoses included fracture and crush, burns, rheumatoid arthritis, nerve paralysis, and quiescent reflex sympathetic dystrophy.

The results (Table IV) in the overall group demonstrated a 21° gain passively and a 14° gain actively. Improvement ceased after 3 to 5 months in the fracture and crush group, but continued for 6 to 8 months in the nerve injury and burn groups. Fracture and crush patients gained only 15° actively and passively. The nerve paralysis patient gained 90° passively and 73° actively in four joints. Burn patients gained only 19° passively

**Table V.** Proximal interphalangeal joint volar series (July, 1975 to March, 1978)

Diagnosis	Joints	Patients
Fracture and crush	44	33
Nerve paralysis	16	4
Rheumatoid arthritis	3	2
Burns	1	1
Charcot-Marie-Tooth	1	1
Sympathetic dystrophy*	8	3
Total	65	41 (22 male, 19 female)

Age range: 17 to 67 yr  
Joint distribution: Even  
Follow-up: 3 to 32 mo

\*Within the fracture and crush group.

and 4° actively. Tenolysis of burned extensor mechanisms is obviously unproductive. Three rheumatoid patients made no ultimate gains passively in four joints, but did gain 22° actively, presumably from the accompanying tenosynovectomy.

**Volar capsulectomy series.** From July, 1975, to March, 1978, with 3 to 32 months of follow-up, 65 volar capsulectomies at the proximal interphalangeal joints in 41 patients with even digital distribution and an age range from 17 to 67 years were performed (Table V). The diagnoses included fracture and crush, nerve paralysis, rheumatoid arthritis, burns, and Charcot-Marie-Tooth disease. There were three patients in the quiescent reflex sympathetic dystrophy category. In the entire group, there was a 24° gain passively and 13° gain actively (Table VI). The fracture and crush group failed to gain after 3 to 5 months, and averaged a 16° gain actively and passively, a similar result to that obtained in the dorsal series at this level. The nerve paralysis group gained only 10° passively prior to tendon transfer and did not improve after 5 months. Three rheumatoid patients gained 37° passively and 22° actively. One burn patient gained 45° passively, but only 5° actively. In patients with quiescent reflex sympathetic dystrophy (Table VII), in the dorsal series, one patient gained 28° passively in four

**Table VI.** Results in the proximal interphalangeal joint volar capsulectomy series

Diagnosis	Preoperative average range		End result		Gain	
	Active	Passive	Active	Passive	Active	Passive
Total series	28°	38°	41°	62°	13°	24°
Fracture and crush	28°	40°	44°	56°	16°	16°
Nerve paralysis	28°	40°	28°	50°	0°	10°
Rheumatoid arthritis	38°	38°	60°	75°	22°	37°
Burns	20°	20°	25°	65°	5°	45°
Charcot-Marie-Tooth	25°	32°	30°	55°	5°	23°

**Table VII.** Results of proximal interphalangeal joint capsulectomy in quiescent reflex sympathetic dystrophy

Site	Joints	Patients	Gain	
			Passive	Active
Dorsal	4	1	28°	18°
Volar*	8	3	31°	12°

\*Two patients had no change or decreased motion; one had a large gain.

joints and 18° actively. In the volar series in eight joints of three patients, 31° were gained passively and 12° actively. These averages in the volar group, however, do not reflect the finding that two patients had no gain or a slight decrease, and only one had significantly large gains. Again, in proximal interphalangeal joint capsulectomies, a more functional arc was usually achieved, with greater flexion accompanied by a lag in extension when attempting to achieve flexion. Unfortunately, gains in extension were also met in some cases with the loss of flexion.

### Conclusions

Our findings confirm Curtis' opinion that optimal results are obtained when only capsular contracture has occurred. As additional steps are needed, the gains in both flexion and extension in the proximal interphalangeal joints and flexion in the metacarpophalangeal joints are modest, at best. From the initiation of mobilization, most patients reach a limit in their postoperative gains at 3 to 5 months. Those requiring fewer surgical maneuvers, however, may gain up to 6 to 8 months. Quiescent reflex sympathetic dystrophy patients tend to have ultimately poor results, despite sym-

pathetic blockade during and after operation. We would agree with Sprague concerning the temporary nature of the initial release; however, it should be noted that patients tend to gain from their initial attempts at mobilization 2 weeks after operation. We would agree with Harrison that the approach through the retinaculum in the proximal interphalangeal dorsal capsulectomy provides excellent exposure and prevents postoperative instability. We feel that the findings of the study have clarified the anticipated results in various diagnostic categories. They have tended to modify expectations, but not to discourage the use of capsulectomies, as the functional gains, allowing better prehension, have still been found to be significant.

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