

A Comparative Study of EFMT and Sublimis Transfer Operations in the Claw Hand¹

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Ever since Sir Harold Stiles and Forrester-Browne described the sublimis transfer operation for the correction of claw hand deformity in 1922, various surgical procedures have been devised to correct the claw hand deformity. Bunnell in 1942 modified this procedure and used both slips of all sublimi for transfer. In 1949 Littler modified this procedure further. Fowler's procedure was described in 1946, and Brand described the extensor extensor many tailed transfer extensor carpi radialis brevis—motor palmaris longus tendon—graft (EEMT) in 1954 and the extensor flexor many tailed transfer extensor carpi radialis longus—motor palmaris longus tendon—graft (EFMT) in 1956. In the Department of Orthopedics and Leprosy Reconstructive Surgery, Christian Medical College and Hospital, Vellore, India, these operations have been done routinely since 1951. Looking back over the years, various operative procedures have been popular with operating surgeons during different periods of time. The earliest favored operation was the sublimis transfer which was followed by the EEMT operation. In the middle 1960s and early 1970s the EFMT operation was commonly performed. Of late, we have reverted to the sublimis transfer (Fig. 1).

Operative techniques

Stiles used one slip of each sublimis tendon to replace the intrinsic of the corresponding finger. Bunnell used both slips of

all four sublimi. As a result each finger received two slips of its own sublimi for intrinsic replacement. The technique we follow is similar to Littler's modification. We use both slips of the sublimis to one finger, commonly the long or ring finger. The detached slips are pulled out through a mid-palmar incision, and each slip is divided into two, giving a total of four slips. Each slip is rerouted through the lumbrical canal volar to the deep transverse metacarpal ligament and brought to the lateral band. Each slip is attached to the dorsal surface of the lateral band of the corresponding finger just distal to the metacarpophalangeal (MP) joint which is scraped to receive the tendon. This insertion is placed on the ulnar side for the index finger and on the radial side for the long, ring, and little fingers.

In Brand's EFMT operation, the extensor carpi radialis longus tendon is disinserted at its insertion and rerouted on the volar side under the flexor retinaculum into the palm after anastomosing a graft to its end. (The graft is usually the tendon of the palmaris longus or a strip of the fascia lata.) This graft is split into four, and one slip is used for intrinsic replacement of each finger. The route and site of attachment is the same as for the sublimis transfer.

In Brand's EEMT the extensor carpi radialis brevis is disinserted and extended using a graft which is subsequently split into four. The slips for the index and long fingers are rerouted through the second intermetacarpal space through the lumbrical canal volar to the deep transverse metacarpal ligaments and inserted in the manner described earlier into the ulnar and radial aspects of the index and long fingers, respectively. The slips for the ring and little fingers are routed through the third and fourth intermetacarpal spaces, respectively, along a similar route and inserted onto the corresponding lateral bands on their radial aspects.

¹ Received for publication on 13 August 1982; accepted for publication in revised form on 13 December 1982.

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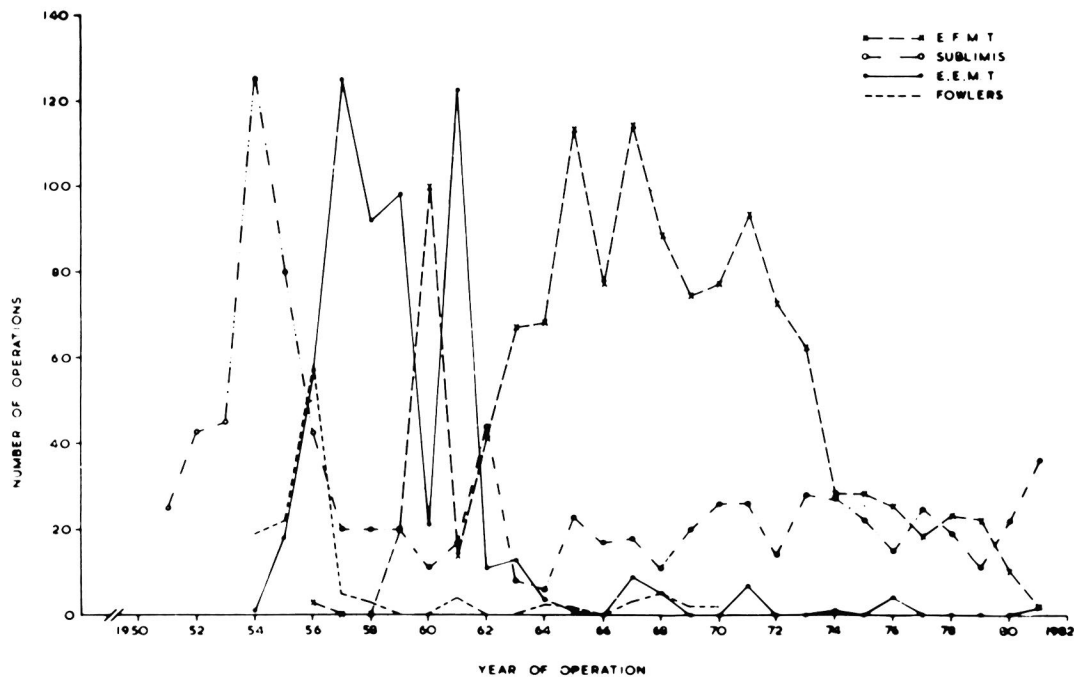


FIG. 1. Number of tendon operations on hands from 1951-1981.

In the Fowler's transfer two motor tendons are used—the extensor indicis proprius and the extensor digiti minimi quinti. Each of these, following its disinsertion at the MP joint level, is split into two. The extensor indicis proprius slips are used for the index and long fingers, and the extensor digiti minimi quinti slips are used for the ring and little fingers. Their routes and sites of insertion are identical to that of Brand's EEMT.

MATERIALS AND METHODS

The aim of this study was to assess the results of 200 cases each of EFMT and sublimis transfer operations performed on leprosy hands for claw hand correction. These cases have been selected by systematic sampling from the operative index cards which were available with all up-to-date data. As a routine, the first, second, and third follow ups were made six months, one year and two years postoperatively. Every sixth operated hand was selected from a total of 1237 EFMT operations, and every fourth case was selected from a total of 829 sublimis transfer operations performed in the years 1951 to 1980. Since these operations had been performed over a period of three

decades, surgeons of varying experience had been involved. The criteria used by different surgeons for their choices of operative procedures used have sometimes been unclear. A finger with very obviously hypermobile joints is generally not selected for a sublimis transfer. Although a high proportion of patients with fingers that were still in the clawed position were selected for sublimis transfer, all hands selected for sublimis transfer have not been stiff hands with proximal interphalangeal joint (PIP) contracture. Slightly over 50% of the cases selected for sublimis transfer have been in supple hands with no PIP contracture.

The incidences of preoperative and postoperative contractures of the PIP joints, reclawing of the fingers, postoperative intrinsic plus deformity and functional improvement of the hands have been studied and compared. The occurrence of sublimis minus deformity in fingers following removal of the sublimis tendon for transfer has been noted in postoperative cases.

RESULTS AND DISCUSSION

Contractures

As a routine, three angles are measured at the PIP joint:

TABLE 1. Number of hands showing contracture of fingers, preoperative and postoperative. $N = 200$ in each group.

Procedure	Preoperative				Postoperative			
	Index	Long	Ring	Little	Index	Long	Ring	Little
EFMT	18	15	14	29	8	8	10	17
Sublimis	41	38	54	63	26	21	33	38

1. Unassisted angle — the angle at the PIP joint when the patient with a claw hand attempts to straighten the fingers. Normally, in this position the MP and the PIP joints go into hyperextension and flexion deformities, respectively.
2. Assisted angle — the angle measured at the PIP joint as the patient attempts to straighten the fingers of the claw hand, MP hyperextension being passively limited by the examiner's finger.
3. Contracture angle — this denotes the contracture at the PIP joint. Contracture of the PIP joint is caused by contracture of various structures such as the capsule, sublimis tendon, subcutaneous tissue, and skin. Such contractures are seen in cases of long-standing deformity.

This contracture angle must be differentiated from adaptive shortening of the sublimis tendons which results in a flexion deformity at the PIP joint. This occurs following constant use of the hands with the wrist in flexion as happens in a claw hand deformity. Flexion of the wrist produces a tenodesis effect on the finger extensors, thereby opening the fingers by extension at the interphalangeal joints. In such a case, there exists no contracture at the joint and the deformity is produced by the shortened sublimis tendons.

Contractures at the PIP joint are graded in the following manner:

- 0–9° = minimal
- 10–20° = mild
- 21–40° = moderate
- Over 40° = severe

Only moderate and severe degrees of contracture are of functional significance and only these are accounted for as contractures.

Few hands selected for EFMT operations had residual preoperative contracture. Sublimis transfer, however, is the operation of choice for stiff hands with contracture; hence the incidence of preoperative contracture of the PIP joint in the sublimis series was high. The incidence of postoperative contracture was significantly less in both series (Table 1). An interesting observation in the sublimis series is that the incidence and degree of PIP contracture decreased with every subsequent follow up. It is suggested that the transferred tendon acts as a dynamic corrective force which continues to act favorably over a prolonged period of time to correct the PIP contracture.

Reclawing

Reclawing is manifested by reappearance of MP joint hyperextension postoperatively. Reclawing is graded as follows:

- 0–10° = minimal
- 11–40° = mild
- 41–90° = moderate
- Over 90° = severe

All degrees of reclawing have been considered and accounted for.

The incidence of reclawing was highest in the little and ring fingers. On comparing the incidence of reclawing in the individual fingers, the incidence in the EFMT series was appreciably more than in the sublimis series. The differences in the incidences of reclawing in these two series in the index, long, and ring fingers were found to be statistically significant (Table 2, Fig. 2).

Intrinsic plus deformity

The intrinsic plus deformity presents with hyperextension at the PIP joint and flexion at the DIP joint. This is seen following the use of high tension to suture the graft (or transferred tendon) onto the dorsal expan-

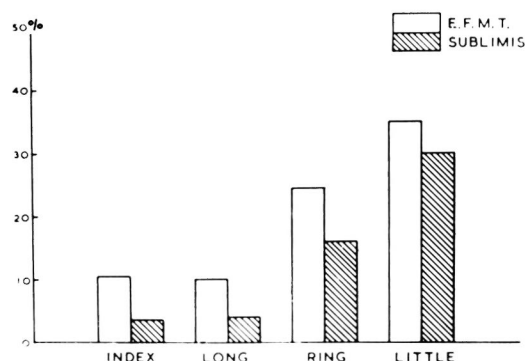


FIG. 2. Percentage of reclawing of fingers after operation.

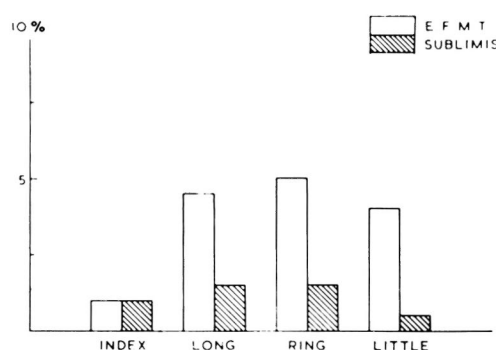


FIG. 3. Percentage of intrinsic plus deformity of fingers.

sion. It is also seen following fibrosis and subsequent shortening of the graft.

In the intrinsic plus deformity, the MP joint cannot be fully extended while the PIP joint is flexed or vice versa. This is the Bunnell test which should be performed with the proximal phalanx in line with the metacarpal without permitting any radial or ulnar deviation.

The incidence of intrinsic plus deformity was low in both series (less than 5% for any individual finger). However, its incidence in the EFMT series was higher than in the sublimis series. The differences in the incidences of intrinsic plus deformity in the ring and little fingers were found to be statistically significant (Table 3, Fig. 3). This is contrary to expectation, since the transferred sublimis tendon is believed to overact after transfer to produce a high incidence of intrinsic plus deformity.

Sublimis minus deformity

The sublimis minus deformity also results in hyperextension of the PIP and flexion of the DIP joints and hence could be mistaken for the intrinsic plus deformity if

the Bunnell test is not performed. Here the Bunnell test is negative and the finger joints have no restriction of movement. The sublimis minus deformity, being a mobile deformity, is of little functional disability and the power of the finger does not apparently differ from that of another finger without its sublimis tendon. It is, however, a cosmetic disability. Occasionally intrinsic plus deformity might occur in a finger whose sublimis tendon has been removed, in which case it ceases to be a sublimis minus deformity. Since the Bunnell test would then be positive in this finger, it would be purely an intrinsic plus deformity.

This deformity was seen more often in the sublimis series, more so in the long finger since the long finger sublimis tendon was commonly used for intrinsic replacement. Its occurrence in the EFMT series is following the removal of the sublimis tendon for opponens replacement (Table 4).

RESULTS

The functional results have been graded as good, fair, and poor. This is based on the surgeon's, occupational therapist's, and

TABLE 2. Number of hands showing reclawing of fingers. $N = 200$ in each group.

Procedure	Index	Long	Ring	Little
EFMT	21	20	49	70
Sublimis	7 ^a	8 ^b	32 ^c	60

^a Significantly less than EFMT, $p < 0.01$, chi square.

^b Significantly less than EFMT, $p < 0.02$, chi square.

^c Significantly less than EFMT, $p < 0.05$, chi square.

TABLE 3. Number of hands showing post-operative intrinsic plus deformity of fingers. $N = 200$ in each group.

Procedure	Index	Long	Ring	Little
EFMT	2	9	10	9
Sublimis	2	3	3 ^a	1 ^b

^a Significantly less than EFMT, $p < 0.05$, chi square.

^b Significantly less than EFMT, $p < 0.02$, chi square.

TABLE 4. Number of hands showing post-operative sublimis minus deformity of fingers. $N = 200$ in each group.

Procedure	Long	Ring
EFMT	14	16
Sublimis	29	17

physiotherapist's assessment of the post-operative hand. The surgeon assesses the appearance of the hand and complications such as contracture, re-clawing, and intrinsic plus deformity, and the tension and function of the transferred tendon or graft. The occupational therapist's assessment consists of various tests for precision, pinch, grip, and general performance.

Over 95% of the hands had good or fair results with significant improvement in the function of the hand and an effective motor transfer (Table 5). The good results in this study must be attributed to the operative technique using a standard frame for positioning and proper tension adjustment and good physiotherapy.

CONCLUSION

1. The incidence of re-clawing and intrinsic plus deformity, although low, was higher in the EFMT series. This is probably due to the slightly complicated operative technique of the EFMT operation.
2. The overall percentage of satisfactory results (good and fair) was about the same in both series—95%.
3. There seems to be a place for performing either of these two common operative procedures in selected cases provided the preoperative and postoperative managements are carefully supervised. Technical errors and postoperative complications were seen more often in the EFMT operation than in the sublimis procedure.

TABLE 5. Results.

Procedure	Good	Fair	Poor	Total
EFMT	129	65	6	200
Sublimis	126	67	7	200

SUMMARY

Two hundred cases each of EFMT and sublimis transfer operations performed for correction of claw hand deformity following Hansen's disease were studied and the results compared. The cases were selected by systematic sampling. The incidences of re-clawing in the index, long, and ring fingers were found to be more in the EFMT series. Also the postoperative intrinsic plus deformity was seen more often in the ring and little fingers in the EFMT series. The occurrence of a sublimis minus deformity following removal of the sublimis tendon is recognized and described. Both operative procedures produced 95% satisfactory results.

RESUMEN

Se compararon los resultados de 200 operaciones EFMT y 200 'elevaciones' efectuadas para corregir la mano en garra resultante de la enfermedad de Hansen. Los casos se seleccionaron por muestreo sistemático. La incidencia de re-engarramiento en los dedos índice, medio y anular fue mayor en las operaciones EFMT que en las 'elevaciones'. La deformidad intrínseca "plus" en los dedos anular y meñique también fue más frecuente en las operaciones EFMT. Se observó y se describe la aparición de una deformidad "minus" subsiguiente a la remoción del tendón elevador. Ambos procedimientos operativos produjeron un 95% de resultados satisfactorios.

RÉSUMÉ

On a étudié deux cents cas d'intervention chirurgicale EFMT et transfert du sublimis, pratiqués pour corriger la main en griffe causée par la maladie de Hansen. Les résultats ont été comparés. Les cas ont été choisis par échantillonnage systématique. L'incidence de la correction de la griffe dans l'index, dans le médian et dans l'annulaire, était plus prononcée que dans la série EFMT. On a également constaté les difformités intrinsèques postopératoires plus fréquemment dans l'annulaire et dans l'auriculaire dans la série EFMT. L'apparition d'une difformité du sublimis minus à la suite de la résection du tendon du sublimis est décrite. Dans les deux cas, les interventions chirurgicales ont entraîné 95% de résultats satisfaisants.

Acknowledgments. The authors wish to thank Mr. Sam Henry, Chief Assessor, and Mr. V. N. Radhakrishnan for his secretarial help.

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