Functional result after extremity replantation

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Replantation of an amputated extremity is technically feasible in selected instances. The indications for replantation and its place in the surgical armamentarium depend upon the extent of functional recovery which can be expected. Experimental replantation has furnished much valuable information, but the problem of equating functional return in an animal leg with that in a human hand seems insoluble. Even in primate experiments difficulties in giving postoperative physiotherapy and in evaluating motivation are apparent. Accumulation of careful reports of experience with extremity replantation is essential. Although several reports are now available there is a paucity of information regarding long range return of function in these extremities 1,2,3. The purpose of this communication is to describe the functional recovery in a replanted upper extremity 29 months after amputation.

CASE REPORT.

The patient to be described has been reported previously 4,5. Since evaluation of recovery must be correlated with the nature of the injury and the choice of management, the case is again outlined briefly.

A 20 year old white male was admitted to the University of Oklahoma Medical Center on November 2, 1934, about two hours after sustaining amputation of the right arm. The injury occurred when the patient reached into a high-speed laundry water extractor. The arm was immediately wrapped in a cold wet towel and promptly transferred to a tub of ice water. The shoulder wound was dressed and the patient transferred 70 miles by ambulance, arriving at the University Hospital in excellent general condition. The amputation site was at the mid-humerus of the right arm. Both wounds were clean. Replantation was begun immediately. The shoulder wound was debrided while the extremity vasculature was perfused by gravity using normal saline con-
taining heparin and penicillin. The comminuted humerus was repaired with screws and plates. Anastomosis of the major veins was followed by arterial anastomosis and circulation was restored five hours after injury. The nerves, muscles and skin were repaired and the operation terminated.

Postoperative course.

Circulation in the arm appeared to be adequate immediately following the operation and remained so. Edema of the arm was noticeable within a few hours and began to subside after one week. Physiotherapy, consisting of passive motion of the joints of the extremity and galvanic stimulation of the denervated muscle groups, was begun on the second day and continued daily. The patient was discharged from the hospital after three weeks with the arm in a sling. Twelve weeks after injury (January 1965) the median nerve neuroma was resected and primary anastomosis performed. Resection of the ulnar nerve neuroma was resected and primary anastomosis performed. Resection of the ulnar nerve neuroma necessitated bridging the gap with a free graft of the medial antibrachial cutaneous nerve. Twelve weeks after this procedure (March 1965) radial nerve continuity was established by resection of the neuroma and insertion of free graft of sural nerve. Recovery from both nerve procedures was uneventful.

Return of function.

Physiotherapy was continued on a daily basis at the patient's school and he returned to the Medical Center at two to four weeks intervals. Biceps contractions below the level of transection were noted four months after the original injury. Motion in the long finger flexors was first detected ten months after injury. Extensors were first noted at 16 months. All muscle groups slowly gained strength with physiotherapy. Active intrinsic muscles of the hand were first detected 24 months after injury. Sensory return was patchy but progressive. The patient developed temperature sensation in the hand with withdrawal from painful stimuli 19 months after injury.

Current status.

The patient is currently in graduate school having completed college on schedule. He does not use a sling or brace on the right arm and carries it normally. On examination the shoulder muscles and contour are normal. There is virtually normal range of passive joint motion in the entire right upper extremity. There is normal range of active elbow motion with excellent strength. There is a good range of wrist motion with reasonably strong extension but definite weakness of the wrist flexors. Finger flexion is performed through nearly normal range of motion and there is fair strength in the long finger flexors. The finger extensors are present but weak. Activity can be detected in both thenar and hypothenar muscle groups, but there has been no return of opposition. The patient can adduct the thumb with some strength. Sensation in the distribution of the median nerve is reasonably good with return of pain and temperature sensation. Two point sensation is lacking. There is return in the ulnar distribution, but this is incomplete in the hand at this time. There is sensation on the dorsum of the hand.
The patient uses the hand in daily activity. He opens doors, carries a briefcase, etc. with right hand. He can grip a cup or glass and use a fork but does not eat with this hand regularly. He continues to gain strength and improve fine movements in the hand.

**Comment.**

This is an unusually well-motivated and intelligent patient. Nevertheless, the degree of return of function at 29 months is highly encouraging. The hand is currently far more useful than any prothetic device yet described, and further improvement is expected. The patient has been able to lead a normal life during the rehabilitative process. At the present time, it seems reasonable to recommend replanting amputated extremities under favorable circumstances.

**Bibliography.**


**Summary.**

Although successful replantation of amputated extremities has been reported several times, there is very little information regarding the long range functional result in such patients. Since the decision to attempt replantation depends upon the long range return of function which can be anticipated the accumulation of such information is important. The degree of functional recovery in a replanted right upper extremity 29 months after replantation is described. The patient uses the extremity in daily activities. There is a protective level of sensation in the hand and there is innervation of all muscle groups.

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Wenn auch wiederholt amputierte Extremitäten erfolgreich angeähnt werden konnten, so fehlt es doch an Mitteilungen über die Fernergebnisse bei diesen Patienten. Der Entschluss zum Versuch der Reimplantation hängt ab von der Funktionswiederaufnahme aber ebenso auch von wichtigen Mitteilungen über das Fernergebnis. Beschreibung der Funktion einer reimplantierten oberen Extremität 29 Monate...
A pesar de que se haya logrado un mejor resultado, todavía se encuentra problemas con respecto a las extremidades amputadas. En estos casos, como la prótesis del miembro inferior, se puede observar una recuperación funcional más rápida a lo largo del tiempo. Cuando se ha logrado un resultado funcional satisfactorio, los pacientes pueden regresar a sus actividades diarias. La sensibilidad en el nuevo miembro ya no es tan alta como en el miembro original.
Хотя об успешной реплантации ампутированных конечностей сообщали уже не раз, отдаленные функциональные результаты у таких больных исследовались очень мало. Поскольку решение, предпринять ли реплантацию, зависит от возвращения функции, которой можно ожидать в результате операции, наложение такой информации очень важно. Описана степень функционального выздоровления реплантованной правой верхней конечности через 29 месяцев после реплантации. Больной пользовался этой рукой в повседневной работе. В руке имеется защитный уровень чувствительности и иннервация всех мышечных групп.