Complete versus incomplete nonviable amputations of the thumb

Comparison of the survival rate and functional results

Panayotis N Soucacos, Alexandros E Beris, Alexandros S Touliatos, Anastasios B Korobilias, John Gelalis and George Sakas

81 patients with 84 complete (55) or incomplete (29) nonviable amputations of the thumb were studied to compare the survival rate and functional results between the two groups. 3 of these patients had bilateral thumb amputations. Of the 55 completely amputated thumbs, 43 survived (78 percent), while of the 29 incomplete nonviable amputations, 25 were salvaged (86 percent). Excluding patients with an amputation at the level of or distal to the interphalangeal (IP) joint, motion at the IP joint which did not exceed 40° flexion even when a secondary procedure was done, did not show a statistical difference between the 2 groups. Average two-point discrimination was 14 mm for patients with complete amputations and 11 mm for patients with incomplete nonviable amputations. We conclude that incomplete nonviable amputations of the thumb are associated with a higher survival rate and better sensibility than complete thumb amputations, while motion at the IP joint does not differ between the two groups of patients.

Correspondence: Panayotis N. Soucacos, MD, Professor and Chairman, Department of Orthopaedic Surgery, University of Ioannina, School of Medicine, Ioannina 451 10 Greece.
Tel +30-651-45 731. Fax +30-651-46 222

The first successful replantation of a completely amputated thumb was performed by Komatsu and Tamai in June 1965 and reported in 1968. 15 years later on September 15, 1980, the first successful replantation of a completely amputated thumb was done in Greece (Soucacos et al. 1993). Through out all these years a good number of reports have dealt with the various problems which may influence survival, such as avulsion, crush or guillotine type of injuries, as well as rare types of amputations involving both thumbs (Goldner et al. 1990, Soucacos et al. 1982, Soucacos et al. 1994, Urbaniak 1988). In addition, sophisticated techniques which may lead to a better result and observations as to whether and how much an amputation of the thumb may influence the function of the hand, even in highly specialized individuals such as surgeons, have been thoroughly discussed (Chow et al. 1979, Early and Watson 1984, Schlenker et al. 1980). In regards to the latter, however, the importance of the thumb in the overall function of the hand no longer appears to be in question. As so aptly stated by Sir Charles Bell (1833): "on the length, strength, free lateral motion and perfect mobility of the thumb, depends the power of the human hand."

The purpose of this study was to evaluate two groups of patients, one with complete and the other with incomplete nonviable amputations of the thumb, in order to relate the two types of amputations with both the rate of survival and the functional capacity of the replanted thumb.

Patients and methods

Two groups of patients were included. *Group A* included patients with *complete* amputations, while *Group B* consisted of patients with *incomplete nonviable* amputations. Complete amputations were defined as those where full detachment of the amputated part from the proximal stump was present. Incomplete nonviable amputation were considered as those where both the neurovascular bundles and all the dorsal veins were severed and the distal part was connected to the proximal stump with only an islet of skin, tendon or nerve. Incomplete, but viable, amputations which referred to those where either a digital artery and/or a dorsal vein remained intact were excluded from this study.

Of the 81 patients, 3 had bilateral thumb amputations. From the 84 thumbs, 55 were complete amputations (Group A) and 29 incomplete nonviable amputations (Group B). In 18 patients, the amputation level was at the metacarpal level, 54 at the prox-

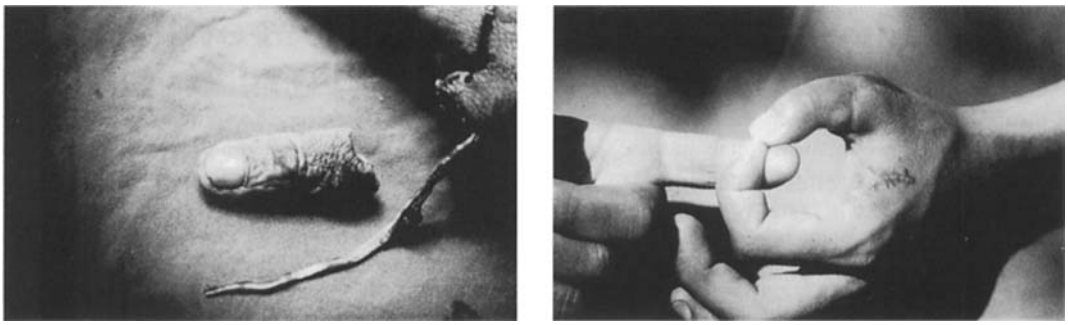

Figure 1. Avulsion injury at the base of the proximal phalanx of the right thumb (left). Appearance 4 months post-operatively showing successful replantation (right). Note the scar at the radial aspect of the second metacarpal where a vein graft was taken for to bridge the gap of princep policis artery. DIP joint was tenodesed at 15° of flexion.

Figure 2. Incomplete nonviable amputation of the thumb at the metacarpophalangeal joint on 26-year-old laborer (left). The distal amputated part was connected to the proximal stump with a digital nerve only. Appearance of the successful replantation 1 year post-operatively (right). The IP joint of the thumb remained stiff even though the flexor policis longus tendon was repaired.

imal phalanx and 12 at or distal to the IP joint. In 11 patients the thumb amputation was in conjunction with amputation of one or more of the digits. In 6 of these, transpositional microsurgery was performed because the distal part was either too small or severely crushed, thus not replantable. In all 6 cases, the least damaged digit was transposed to the place of the thumb.

Of the 84 amputations, 56 were clean-cut, guillotine type of injury (35 complete and 21 incomplete) and 28 were crush or avulsion injuries (20 complete and 8 incomplete).

The replantation procedure followed the routine technique including thorough debridement of both the amputated part and the proximal stump under magnification, bone shortening mainly from the proximal stump, suturing of the flexor and extensor tendons and of the nerves when the gap did not exceed 2 cm. An attempt to anastomose 2 arteries and 2 veins starting from the princeps policis was also made. Vein grafts were used in the majority of the crush-avulsion injuries (22 out of 28) and in cases were the amputation level was at the metacarpal region. The vein graft was anastomosed to the radial artery using an end-to-side anastomosis at the snuff-box anatomical area. By this technique strong inflow from the radial artery to the anastomosed digital artery was established.

Results

Out of 84 thumbs (81 patients), 55 had complete amputations (Group A) and 29 incomplete nonviable amputations. 12 of the complete amputations failed or the replantation procedure had to be abandoned in the operating room. 43 thumbs survived (Figure 1). In the group of incomplete nonviable amputations, 25 out of 29 survived and 4 failed (Figure 2). Overall, the success rate was 81 percent. No statistical difference was found between the two groups regarding motion at the IP joint which was found to be between 20°–40° of flexion. Key pinch strength and power grasp was almost the same in both groups, while sensibility was better in patients who had incomplete amputations which measured 11 mm two-point discrimination compared to 14 mm in the patients with complete amputations. The performance in other

tests, such as picking up small objects or performing daily activities, such as writing, eating, buttoning clothes or holding heavy material, also did not show distinct differences between the two groups. Cold intolerance, however, was more intense in the patients who had complete amputations and lasted longer (more than one year) compared to those who had incomplete amputations.

Discussion

Complete or incomplete nonviable amputations of the thumb prior to the microsurgical era were usually managed with the use of a prosthesis. This was one of most common alternatives at that time which was aimed at maintaining the length of the thumb. After the establishment of microsurgery and the refinement of replantation techniques, however, replantation of the thumb following either a complete or incomplete nonviable amputation has always been of first priority. In this regard, there is no thumb reconstructive procedure which can be compared with the result of a successfully replanted thumb, and thus, the significance of Buncke's statement that the thumb is a "must try" situation becomes clear for all types of thumb amputations and particularly, for bilateral thumb amputations (Buncke et al. 1981). Moreover, the strict indication to always replant an amputated thumb, no matter whether it is complete or incomplete, reflects the fact that it is the most important digit for replantation as 50 percent of the functional ability of the hand depends upon its presence. Furthermore, restoration of the function of the flexor policis longus does not appear to play a decisive role in the patient's ability to use the thumb, as was seen among the patients in whom the FPL was either reconstructed, was not functioning satisfactorily or was not repaired at all.

The survival rate between the 2 groups of patients did not seem to be influenced according to the mechanism of injury, type of amputation, age of the patient, and revascularization time. This observation is compatible with other reports (Stevanovic et al. 1991, Vlastou and Earle 1986). However, according to our observations a decisive role in affecting the difference seen between the patients with complete or incomplete amputations appears to be played by the islet of skin which connected the proximal stump to the distal amputated part in the complete nonviable amputations. Although this islet does not contribute to the arterial blood flow, it may have acted as an adjunct in the venous blood return along with the dorsal veins which were anastomosed at the time of replantation.

According to some, this small islet of skin should be cut since it is believed to prohibit proper debridement, vessel identification and arterial plus venous anastomoses. However, our findings suggest that the islet of skin not only may help in venous return and, thus, minimize the risk of venous congestion in the first critical post-operative days, but also in the case of occlusion of one of the anastomosed dorsal veins, it may along with the newly formed vessels be able to uphold venous return. The same islet of skin must also be attributed to the greater sensibility that was observed in the group of patients with incomplete nonviable amputations.

In conclusion, no distinct difference was found between patients with complete and incomplete nonviable amputations of the thumb regarding motion. The superiority of the survival rate in the incomplete group, as well as the greater sensibility and less cold intolerance must be attributed to the presence of the islet of skin which assisted in venous return.

References

Bell C. The hand, its mechanism and vital endowments at envincing design. Pickering, London 1833.

Chow J S A, Bilos Z J, Chunprapaph B. Thirty thumb replantations: indications and results Plast Reconstr Surg 1979; 64:626-630.

Early M J, Watson J S. Twenty four thumb replantations. J Hand Surg 1984; 9B: 98-102.

Goldner R D, Howson M P, Nunley J A, Fitch R D, Belding N R, Urbaniak J R. One hundred eleven thumb amputations: replantation vs revision. Microsugery 1990; 11(3): 243-250.

Komatsu S, Tamai S. Successful replantation of a completely cut-off thumb. Rlast Reconstr Surg 1968; 42: 374-377.

Schlenker J D, Kleinert H E, Tsai T. Methods and results of replantation following traumatic amputation of the thumb in sixty-four patients. J Hand Surg 1980; 5: 63-70.

Soucacos P N, Beris A E, Anastasiou E D. The first thumb... Orthopaedics 1993; 6(1): 13-15.

Soucacos P N, Beris A E, Malizos K N, Touliatos A S. Bilateral thumb amputation. Microsurgery 1994; 15(7): 454-458.

Soucacos P N, Touliatos A S, Anastasiou S, Daoutis N, Beris A E, Sourmelis S. Thumb replantation and revascularization. In: Proceedings of the 7th International Congress of Orthopaeidcs and Traumatology of the Mediterranean and Middle East Countries Society, Rome, Italy 1982: 331-334.

Stevanovic M V, Vucetic C, Bumbasirevic M, Vuckovic C. Avulsion injuries of the thumb. Plast Reconstr Surg 1991; 87(6): 1099-1104.

Vlastou C, Earle A S. Avulsion injuries of the thumb. J Hand Surg 1986; 11A(1): 51-56.