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Late results of replantations in tip amputations of the thumb

Başparmak distal uç amputasyonlarında replantasyon uygulamalarının geç dönem sonuçları

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Amaç: Başparmak Tamai tip 1 amputasyonlarda uygulanan replantasyonlar geriye dönük olarak değerlendirildi.

Çalışma planı: Çalışmaya, başparmak tırnak yatağı distalinde meydana gelen Tamai tip 1 amputasyonlar nedeniyle replantasyon uygulanan ve tedavi sonrasında dolaşım devamı sağlanan 14 hasta (12 erkek, 2 kadın; ort. yaş 28; dağılım 14-40) alındı. Tüm hastalarda santral digital arter anastomozu yapıldı. Anastomoza uygun ven bulunabilen dört hastada birer adet volar ven anastomozu yapıldı. Sinir tamiri sadece üç hastada yapılabildi. Duyu değerlendirmesi Semmes-Weinstein testi, iki nokta ayrım testi, hareketli iki nokta ayrım testi ve vibrasyon testi ile yapıldı; ayrıca, hastalar parmak atrofisi, soğuk intoleransı ve tırnak yatağı deformiteleri açısından incelendi. Ortalama takip süresi 11 ay (dağılım 6-48) idi.

Sonuçlar: Semmes-Weinstein testi beş parmakta (%35.7) yeşil (dağılım 2.83-3.22), sekiz parmakta (%57.1) mavi (dağılım 3.22-3.61), bir parmakta (%7.1) mor (dağılım 3.84-4.31) idi. İki nokta ayrım testi ortalama skoru 6.9 mm (dağılım 3-11 mm), hareketli iki nokta ayrım testi ortalama skoru 4.5 mm (dağılım 3-6 mm) bulundu. Aynı elin sağlıklı parmaklarıyla karşılaştırıldığında, vibrasyon altı başparmakta (%42.9) artmış, altı başparmakta azalmış bulunurken, iki başparmağın (%14.3) vibrasyonu diğer parmaklarla eşit idi. Beş parmağın (%35.7) replante edilen kısmında atrofi; üçer hastada (%21.4) ise soğuk intoleransı ve tırnak deformitesi görüldü. Hastaların işe dönüş süreleri ortalaması 3.2 aydı (dağılım 2-6 ay).

Çıkarımlar: Başparmak distal uç replantasyonları, teknik zorluklara rağmen, görünüm açısından ve fonksiyonel açıdan iyi sonuçlar vermektedir. Sinir tamiri yapılamayan olgularda da yeterli duysal iyileşme sağlanmaktadır.

Anahtar sözcükler: Amputasyon, travmatik/cerrahi; anastomoz, cerrahi; parmak yaralanması; replantasyon; başparmak/cerrahi.

Objectives: We retrospectively evaluated replantations performed for Tamai type 1 thumb amputations.

Methods: The study included 14 patients (12 males, 2 females; mean age 28 years; range 14 to 40 years) whose replanted thumbs survived following replantation for Tamai type 1 amputations in the distal nail fold of the thumb. Central digital artery anastomosis was performed in all the cases. Four patients with an appropriate vein had a single volar vein anastomosis. Nerve repair could be possible in only three patients. Sensory evaluations were made with the Semmes-Weinstein monofilament test, static and moving two-point discrimination tests, and vibration test. In addition, patients were evaluated with respect to atrophy in the replanted part, nail-bed deformities, and cold intolerance. The mean follow-up period was 11 months (range 6 to 48 months).

Results: The Semmes-Weinstein test was green (range 2.83 to 3.22) in five patients (35.7%), blue (range 3.22 to 3.61) in eight patients (57.1%), and purple (range 3.84 to 4.31) in one patient (7.1%). The mean static and moving two-point discrimination test results were 6.9 mm (range 3 to 10 mm) and 4.5 mm (range 3 to 6 mm), respectively. Compared to the intact fingers, vibration was increased in six thumbs (42.9%), decreased in six thumbs, and the same in two thumbs (14.3%). Atrophy of the replanted parts was observed in five patients (35.7%). Three patients (21.4%) complained about cold intolerance, and three patients had nail-bed deformities. The mean time to return to work was 3.2 months (range 2 to 6 months).

Conclusion: Despite technical difficulties, thumb replantations yield good functional and aesthetic results. Sensory recovery is sufficient even after tip replantations without nerve repair.

Key words: Amputation, traumatic/surgery; anastomosis, surgical; finger injuries; replantation; thumb/surgery.

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Preservation of thumb length along with adequate functionality and sensory activity is considered as a crucial factor for hand functions. Replantations of amputations at the level of distal nail bed presents technical difficulties due to narrow arterial diameter and venous problems.

Various treatment modalities exist for distal tip amputations: Repairing primary amputated part with or without bone shortening, local flaps, regional flaps, free flaps, neurovascular island flap, composite grafts and skin grafts etc. However, various complications such as aesthetic deformation, shortening of the thumb, reccurent pain, hypersensitivity, cold intolerance, sensory diminution (or hypoesthesia), hyperesthesia, paresthesia, soft tissue athrophy, loss of nail, nail deformity, joint dysfunction, decreased grasping power and subjective complaints are observed after treatment. Some treatments require re-operation and donor site conditions and malformations might occur in donor-finger.[4-5] Thumb and distal tip amputations were found to yield poor prognosis in a meta-analysis study[6]. Sharma et al [7] recommended the employment of the replantation operation independently of trauma mechanism and injury level and reported high success rate (91.3%) in their cases. Anastomosis yields obstacle due to distally decreasing arterial diameter.[1-3, 5,8] Replantation is recommended whenever possible in distal tip amputations of the thumb despite technical difficulties.

This study aims to evaluate the late results of replantation cases with intact circulation in distal nail bed amputations.

Patients and methods

In this study, replantations employed in thumb distal nail bed amputations (8 right and 12 left hands) were retrospectively evaluated in 20 patients (16 males, 4 females, mean age of 26 years old, range 6-40 years) treated between 2000 and 2006. Tamai 1 thumb amputation cases were included in the study (9), subtotal amputations were excluded. Replantation was employed in patients with vascular compromise based on the evaluation of amputated part and the finger.

Sensorial and functional evaluations of 14 patients (70%) (12 males, 2 females, mean age of 28 years old, range 14?-40 years) whose circulations were maintained were performed (Fig. 1 and 2). The mean duration of follow-up period of evaluable patients was 11 months (range 6-48 months). While sensory examination was performed via Semmes-Weinstein test, two-point discrimination test, moving two-point discrimination test and vibration test, atrophic changes in the finger, cold intolerance and nail bed deformities were also examined.

Replantation

During operation patients received 500 ml dextran 40 (rheomacrodex ®, over 24 hours), low molecular weight heparine and cephazoline sodium as prophylactic antiboitic therapy and analgesics.

Minimal osteosynthesis with K-wire was employed as an operation procedure. Nail bed deformities were repaired. Anastomosis was employed with 10/0 suture in arterial structures considered as appropriate for proximal and distal anastomosis after suturing the part of the skin. Since arterial diameter was too narrow, multiple sutures could not be employed as in classical anastomosis; anastomosis was completed usually by three to five sutures.

Volar veins were selected for anastomosis since they were wider than dorsal veins in the distal part of the nail bed. Single vein anastomosis was performed in four patients. Nail beds were humidified with heparinized gauze every two hours through pin holes opened in the nail bed in patients who could not received vein anastomosis or had a venous drainage defect after anastomosis. Nerve repair was possible only in three patients while it was not possible in most cases due to nerve terminal branching in the operation site.

Patients were hospitalized for an average of seven days.

Results

Semmes-Weinstein test was green (range 2,83-3,22) in five fingers out of 14 (35.7), blue (range 3,22-3,61) in in eight fingers (51.7) and violet (range 3,84-4,31) in one finger (7.1%).

Mean score for two-point discrimination test was 6.9 mm (range 3-11 mm) while it was 4.5 mm (range 3-6 mm) in moving two-point discrimination test.

Vibration increased in six thumbs (42.9%) while it decreased also in six thumbs and it was at the same level with other fingers in two thumbs (14.3%). An atrophy was observed in the replanted part of the six

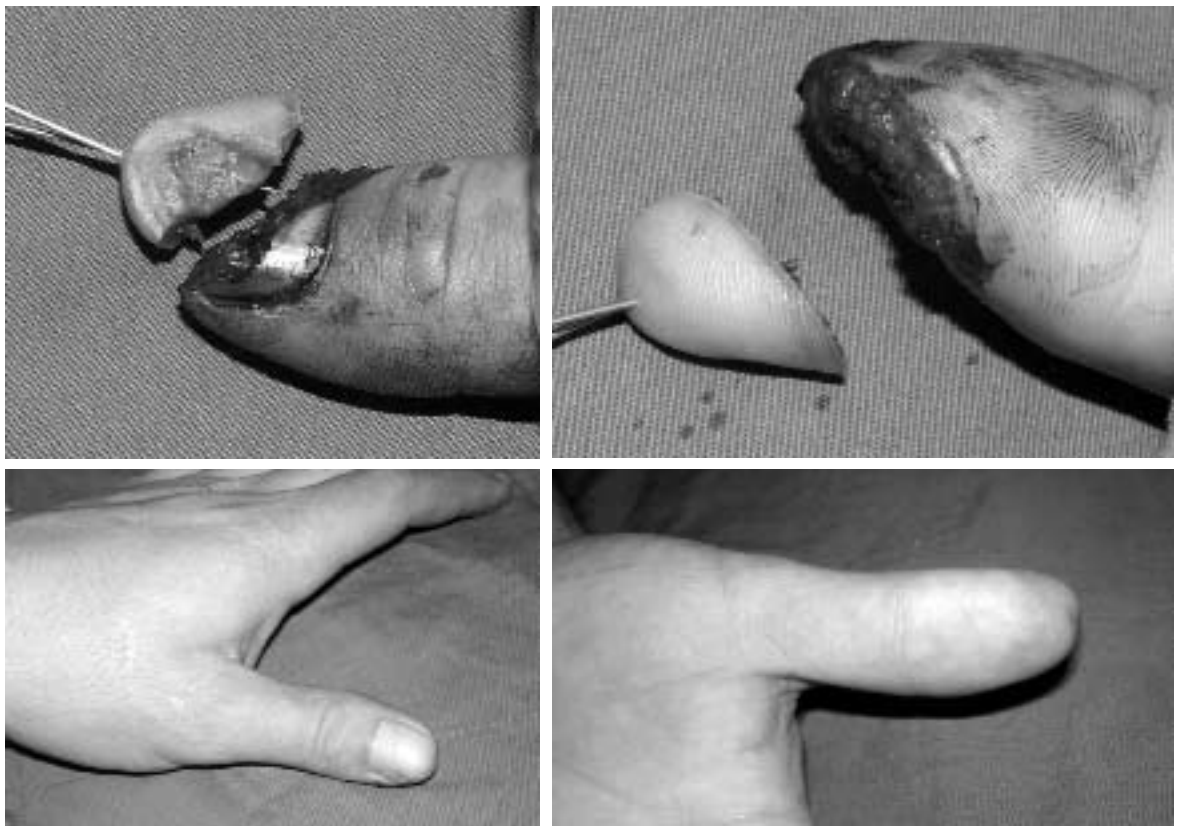

Figure 1. The photos of a 37-years old patient with thumb distal tip amputation due to cutting-machine injury before operation and 22 months after operation.

thumbs (35.7). Three patients (21.4%) complained of cold intolerance and presented nail deformities. Mean time for returning to work was 3.2 months (range 2-6 months).

Discussion

Advancements in the microvascular surgery techniques increased the performance rate of distal tip replantations.[1,8] Aesthetic appearance was better provided and satisfactory results were obtained in terms of function by preserving the nail and the length of the thumb in distal tip replantations[5,10].

Tamai classification was the most frequently used classification system in distal phalanx amputations. [9] Zone 1 was the site between the nail bed and the fingertip. [2,3,8,9,11] Digital artery diameter was in the range of 0.4-0.7 mm at the base of distal phalanx. Terminal branches were in the range of 0.3-0.7 mm [12]. Distal central artery at the level of pulp is the most suitable one in terms of diameter for microvascular surgery[3,4]. Volar veins were wider than dorsal veins [13].

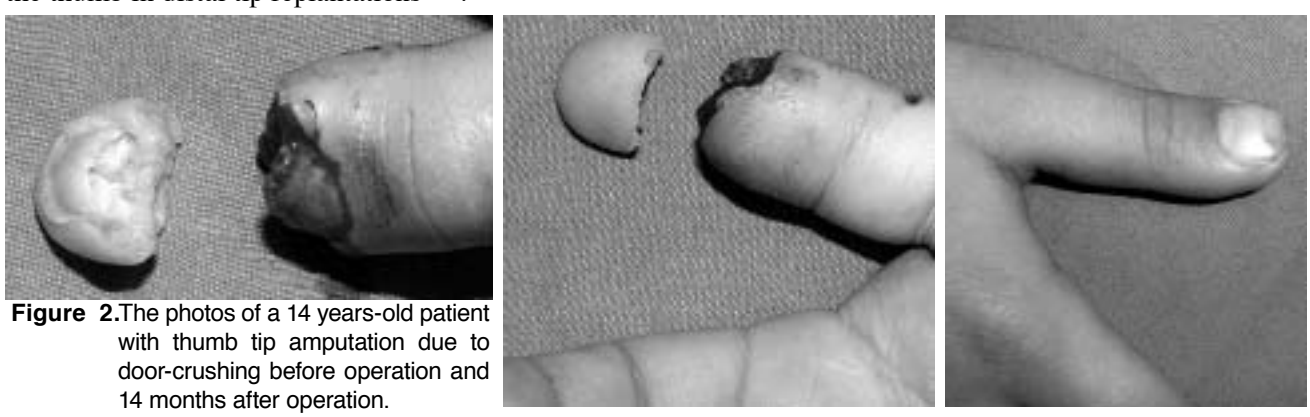

Figure 2. The photos of a 14 years-old patient with thumb tip amputation due to door-crushing before operation and 14 months after operation.

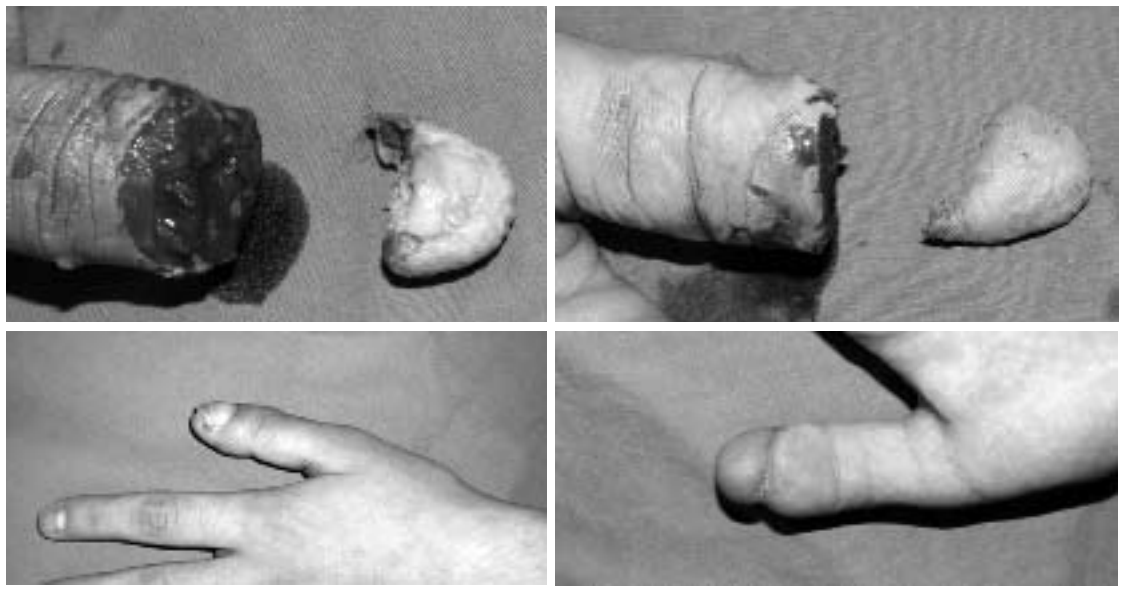

Figure 3. Pre-op photos of a 31 years old patient with thumb tip amputation due to work machine crushing injury. Nail bed deformity and atrophy are observed nine months after operation.

Hattori et al.[14] reported that anastomosis were difficult to be employed in tip amputations due to the position of the thumb; therefore they applied vein grafts to arteries and veins targeted for anastomosis before osteosynthesis and they established anastomosis between arteries and veins in the proximal part via vein grafts after osteosynthesis. We think that primary anastomosis is possible if arterial defect is not present though position is difficult.

Hirase[1] classified the distal tip amputations, described the treatment regimens and divided the level of nail bed in three parts. The first part was the fingertip where digital artery terminates in branches. A composite graft was recommended for amputation of this region. The second part (2/a) is composed of distal palmar arch of the digital artery. For the treatment of amputation in this region, bone fixation was not recommended for not obstructing the venous drainage from medullar cavity but central digital artery anastomosis was recommended and no intervention was employed for venous return. Heparinized gauze and/or leech application were recommended.[15]

Koshima et al [16] employed arteriovenous anastomosis technique to eliminate venous drainage problem while repairing artery in distal phalangeal amputation. Yamano [8] reported that patients received urokinase for the first seven days and heparine between 7th and 10th days and heparine and serum physiologic were continuously dropped on fish mouth-like opening in the pulp. Akyürek et al [3] reported that venous anastomosis and nerve repair were not applied in 21 patients with distal nail bed amputation for which a single arterial anastomosis was employed but venous drainage was maintained via external bleeding technique and replantation was successfull in 76 % of cases.

The secondary intraluminal thrombosis was possible in artery in contusion type injuries. The scar that may develop around pedicule increase the obstruction risk [17]. Lee et al. [17] reported that neurovascularization was achieved within an average of 7.6 days in 144 replantation cases where external bleeding was provided. It was also reported that adequate arterial nutrition via neurovascularization was achieved within five to seven days after operation in replanted fingers and the safety state was reached within 14-21 days; during this process if an obstruction in the digital artery with anastomosis and inadequate neurovascularization in the distal part occurred, a total or partial necrosis was observed in the finger [17]. In the same study, some fingers were lost after 10 days; it was postulated that distal amputation caused by contusion injuries increased the late loses. At this level, dorsal veins were too thin, volar veins were inadequate. Hahn and Jung [5] reported that success rate was increased in proportion to number of veins used in anastomosis in 450 patients treated for distal tip amputation and that operati-

on failed only in one case out of 130 where more than one vein was used in anastomosis. In our study, volar vein anastomosis was preferred in four patients (20%) out of 20 replantation cases. At this level, microvascular repair is technically difficult to achieve since vein diameter is too narrow and the nail bed and the skin in the dorsal part are not flexible enough. Therefore, a heparinized gauze was placed over pin holes in the nail bed and heparine was administered every two hours to provide venous drainage.[18,19]

The nail development is achievable in distal lunular amputation if germinal matrix injury originating from blunt trauma or punch press. The nail development problem is most frequently observed in proximal lunular amputation and nail deformities such as hook, fissure, elevated types might occur [11]. In our study, nail deformity was observed in three patients (21.4%). Since nail deformities did not deteriorate the working and functional conditions, no additional intervention was employed in any case.

Cold intolerance after replantation and various atrophic changes in the replantation site might be observed [19]. In our study, an atrophy affecting the aesthetic appearance was observed in five patients (35.7%) and cold intolerance developed in three patients (21.4%). Patients reported that they suffered from cold intolerance mainly in winter , therefore they continously wore gloves.

Wiberg et al. [20] compared the sensory recovery after replantation in patients with and without sensory reeducation for one year. It has been reported that patients of sensory reeducation group had a better score in two-point discrimination test but no significant difference was observed between groups in Semmes-Weinstein test. Shich et al. [21] also emphasized the importance of long term sensory reeducation . In accordance with these studies, we consider that post-replantation rehabilitation necessitates experience and special interest and the rehabilitation and sensory reeducation have an important influence on the functional and sensorial recovery [22].

A significant rate of sensory recovery could be achieved in distal tip amputation where no nerve repair could be employed [3,5,23,24]. Dubert et al. [4] reported that no significant sensory lost could occur in distal tip amputation without nerve repair.

In sum, thumb amputation is a significant indication for replantation. Distal tip replantations yield very good aesthetic and functional results despite technical dificulties. Relevant studies show that adequate sensory recovery could be achieved in thumb distal tip replantations without nerve repair.

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