

## THE MOST CHALLENGING RECONSTRUCTIVE PROCEDURE FOR GOD: FINGERTIP RECONSTRUCTION

MEHMET O. YENIDUNYA\*

*SUMMARY: We presented 59 fingertip injury cases that we treated and followed up. Among the 59 patients, 50 were male and 9 were female. The methods we chose for reconstruction were as follows: repairing by a skin graft (n:3), a V-Y advancement flap (n:17), a cross-finger flap (n:19), a thenar flap (n:5), an abdominal interpolation flap (n:8) and infraclavicular flap (n:2). We performed 35 operations under local anesthesia and 24 under general anesthesia. The waiting time for the second séance of the interpolation flaps was not longer than 12 days for all cases, and we performed the shortest flap separating operation at the end of the seventh day. Since their fingers healed, the patients had no complaints about the donor area. In this study, we did not evaluate the two-point discrimination. Flap-thinning operations were required later, for the abdominal interpolation performed cases. None of the patients had hypersensitivity against touching or cold. From this study it is concluded that regardless of the preferred fingertip repairing method, the evaluation of the finger profile view should not be neglected. It is important to obtain a profile view of repaired fingers similar to that of healthy fingers, and we believe that the pulp softness should be maintained. Although there is a continuous tendency to describe technically complicated and detailed reconstruction methods in literature, we feel the need to emphasize that the classical methods have not lost the value if they are carried out properly.*

*Key words: Fingertip, reconstruction, flap, graft.*

### INTRODUCTION

Whenever we face an illness, the aching part of our body reminds and warns us. A healthy person would not really remember and feel his back, unlike a person with a herniated disk pain in the area, can barely stand up. With this approach, we realize that every organ in our body is valuable and important; trying to prove one is above the others would be absurd. Having said that,

\*From Department of Plastic and Reconstructive Surgery, Şişli Etfal Education and Research Hospital Istanbul, Turkey.

we could think of hands as of those organs that distinguish humans from other livings. Healthy hands are necessary for our daily lives. Hands are important with all their veins, nerves, tendons, joints, skin and subcutaneous fatty tissues. But for the interaction of our hands and fingers with each other, the most important movement is opposition. Healthy pulps are very important not only for the transaction of fingers with each other, but also for the transaction with objects all around

us. Thus, when there is a fingertip injury, it is mostly occult pulp injury. All fingertip injuries other than pulp injuries could easily heal, either by themselves or with our help.

### MATERIALS AND METHOD

This study was formed by retrospective evaluation of the operations we performed in the past and also with the addition of more recent cases. We evaluated a total of 59 patients whose ages ranged from 5 to 75. Of these, 50 patients were male and 9 were female. Etiologically, the study showed that 50 cases were caused by work accidents and 9 were caused by domestic accidents. The methods we chose for reconstruction were as follows: repairing by a skin graft (n:3) a V-Y advancement flap (n:17), a cross-finger flap (n:19), a thenar flap (n:5), an abdominal interpolation flap (n:8), and an infraclavicular flap (n:2). We performed 35 of the operations under local anesthesia and 24 under general anesthesia. The waiting time for the second séance of the interpolation flaps was not longer than 12 days for all cases and we performed the shortest flap separating operation at the end of the seventh day. The second séance of all the interpolation flaps were performed under local anesthesia. The defects for the cases that we treated by skin graft were outside the pulps and were areas such as nail fold, finger lateral, or proximal nail fold. We did not test two-point discrimination after evaluating our patients post operation. We examined if they had hot or cold sensitivity, if they could feel area when touched and if there was any pain on their fingertips after daily activities.

### FINDINGS

None of the patients treated by interpolation flaps complained about the donor area, after seeing their fingertips healed. The flap thinning operations were required later for the abdominal interpolation performed cases. None of the patients had hypersensitivity against touching or cold. Almost-perfect color matches were obtained with the cross-finger flap cases; however we noticed relatively bold color differences with our abdominal interpolation cases. When asked if they could sense with the repaired area, all patients said they could. The fingertips of the patients who we treated by applying a volar V-Y advancement flap had sense on the first day of the operation. The sense on the fingertips got better by time for the patients we treated by a cross-finger flap, an abdominal interpolation flap, groin flap and an infraclavicular flap. Cold sensitivity was detected in all patients except for

those we treated by applying a V-Y advancement flap. In 3 months post-operation, we saw that cold sensitivity disappeared completely. There were no cases of sense loss resulting in burn injury or wound opening following the reconstructive procedures in any of our patients presented. The follow-ups for our patients lasted from 4 months to 20 years. In six patients we treated by applying an abdominal interpolation flap, a flap thinning operation was required later.

### DISCUSSION

It is pointless to argue whether an organ is more or less valuable than the other. However, this does not prevent us from saying that our hands make our daily lives easier if not possible. Hands are important all around but the fingertips and pulps are worth emphasizing. It has been said that *"pulp is an extension to the brain"* (1). We cannot argue this is wrong. Indeed, studying the cortex of the human brain shows that fingertips take up the largest space in cortical homunculus. Having *some* skills depends solely on having healthy fingertips. There are many examples to such skills, but being able to use cell phones and computer keyboards are among the first to remember, as they are important parts of our daily lives. When we use using these devices, mainly our pulps remain in contact with them.

Fingertip injuries often cause pulp defects. A healthy pulp means a healthy fingertip. There are various methods to chose from when treating an injured fingertip, and the V-Y advancement flap heads the list. However, the figures in some pretentious journals could be far from being realistic. In my opinion, the reader deserves actual case pictures rather than the unrealistically drawn figures. But why not present pictures? Although there are many possible answers to this, it is obvious that someone who has treated a case successfully and has good pictures to document the procedure would present them. They would want to present them. Thus, sometimes it is assumed that doctors who have no decent pictures of the cases they present, have good cases. This kind of doctors actually exists. On a different note, fingertip injuries are mostly treated by young surgeons, especially by assistants on their shifts. As very well stated by Goldwyn, *"The younger surgeons, the more emergency cases; the older surgeons, the more effective cases"* (3).

There is a verse in the Quran, the holy book of Muslims: **“Yes, we are able to rebuild even their fingertips”** (4). What comes right before this verse is a story of a couple who do not believe in the resurrection day. **“We are going to resurrect? Our decayed bones will come to life once again? Who could make that possible?”** they say. God answers this and says: **“Yes, we are able to rebuild even their fingertips.”** Quoting a holy book in an academic paper could have a lot of purposes, including missionary intentions. However, our goal here is to simply add spice to our article. Because, as we mentioned in a previous article (5), we would prefer saying **“yes, we are able to rebuild even their brains”**. Instead, God said fingertips, not brains in the Quran. We think this is a remarkable issue. Having this information, we think any plastic surgeon, whether believes in God or not should view fingertip injuries differently. In a study analyzing the operations of 4 child and 4 adult patients whose finger amputations covered the nail bed; surgeons repaired the main defects either by cross-finger flap, thenar flap or V-Y advancement flap. They also published the results they obtained by demonstrating the adaptation the nailbeds of the amputated pieces with the flaps they grafted. The pictures presented with the study also support that the method showed good results (6).

There are studies claiming to have successful results of only one digital artery repair together with thenar flap covering de-epithelised amputated part in 12 of the 14 patients of distal phalanx amputation (7).

A study presented with a single subtotal amputation case captured our attention in which the patient was a 2.5 years-old and the surgeons preserved the tendons of the distal phalanx on the left index finger. The authors mentioned that they could not obtain revascularization in the injured finger, therefore they revascularized with the adjacent finger and separated the pedicles 3 weeks later (8). In this particular study, the method was performed on two different fingers; whereas we performed a similar but an experimental operation earlier on two different animals, which we named *initially alloperfused autograft* (9). Our results showed that we were able to carry out the separation procedure after 140 hours, while the authors of this study waited for 3 weeks under the light of traditional approaches.

In another article the authors described how they

performed homodigital flaps based on terminal branches of the digital artery at the level of the distal interphalangeal joints. The method was performed on nine cases; however, two of these were excluded from the study due to disappointing results. Although the authors did not point out themselves, a close analysis of the figures and pictures presented with the study, showed the method used could be preferable for fingertip and finger-side defects that do not reach the pulp and expose the bone. The flap was planned transversely as a rectangle on the distal interphalangeal joint level and transferred by rotating 90 degrees. The donor area was also covered by a skin graft (10). In a study, a thenar flap was used for the reconstruction of index, middle, ring and little finger's tip defects in 8 patients and the time for pedicle division has been presented between 12 and 17 days. In this paper the width of the flap was larger than the designs can be seen in classical textbooks, yet no problem has been encountered on the donor area. To close the donor area defects, even skin grafts from the amputated parts have been used (11).

In another study, a dorsally located bipedicular flap was employed to reconstruct, especially defects located proximal to the nail bed in eight patients. They said that it was necessary for a secondary revisional operation to correct some dog ear deformities existed and they closed the donor defects with skin grafts. The flap was named as visor flap resembling head protector with a window on the eye level used in old wars (12).

In some cases, even an amputated part can be wounded. In such two cases from Japan, amputated part was de-epithelialized and covered with thenar flap by division of its pedicle on the sixteenth day (13).

Another very rare type treatment can be seen in an article from Spain presenting a microvascular transfer of the amputated second finger pulp to the third finger pulp after a multiple fingertip amputation in a 55 year old patient (14).

As last rare example from the related literature I would like to mention the Sakai's work on a 18 year old boy suffering from injuries on second, third, fourth fingers. He replanted second finger, did a V-Y advancement flap on the fourth finger and prefabricated free flap of the amputated fingertip including the nail-bed (15).

A well known subdermal pocket application under

abdominal wall was employed in 16 patients. They divided the abdominal flap pedicle between 7 and 15 days. They did not take any coverage tissue together with subdermal revascularized tissue. They left the new fingertip surface for secondary healing. Although some problems existed in 3 cases, 13 patients healed well, as they stated (16).

A strange critic from Italia appeared in the literature about V-Y advancement flaps. Ghrab et al argued that these flaps were described by Tranquilli and Leali for fingertip injuries (17). The only thing that can be considered seriously from their article is that some periosteal vascular connections may support the finger pulp blood supply. That is all. The technique described by Atasoy is certainly a new technique including modern plastic surgical information, although we can not be sure whether Atasoy himself had the knowledge of the so called Tranquilli Lealli method. The Atasoy flap does not cut the terminal digital nerves and arteries. It cuts only the skin, subcutaneous tissue and septal tissues to move the left pulp. By doing so, it gives a guarantee for flap viability and that it has sensation on it. When it comes to how much sensation is necessary on the pulp of fingers, we do not have a right to say 99%; if possible it should be 100%. In fact I think it is better to call such tissue transfers by their contents and type of movements instead of the author's name. If we start from the beginning I can describe the Tranquilli-Leali flap as "a nonsensorial V-Y advancement flap based on periosteal connections for fingertip defects". It is something like that for Atasoy's flap: "A sensorial V-Y advancement flap for fingertip injuries based on terminal branches of the digital artery and nerve". The main aim in medicine and surgery is to improve patients' conditions and the knowledge in these two areas is universal. It is immaterial from which nation the knowledge is acquired. Furthermore the methods described by Tranquilli-Lealli and Atasoy are totally different from each other as I explained above by their movements and contents. At least there are 35 years between the two reports. I think Ghrab et al tried to proudly announce that he was from the nation of Tranquilli-Lealli. They tried to show us a new reconstruction technique for fingertip injuries by underestimating the other author's work (especially the Atasoy's work). Unfortunately the techniques of these two were not the

same and furthermore the second one was more attached to the basic plastic surgical skill and knowledge (17). I, for my self, never imagine cutting from the skin to the periosteum by disturbing terminal branches of the digital nerve. It is not our job and responsibility to cut nerves, but to repair.

The profile view of the finger should be kept in mind, both during and after the operation when treating a fingertip injury. If the profile view of the finger is close to normal, the operation could be considered successful. Some fingertip amputation cases treated in emergency services by primary closure of the stump may fail to show this beauty. In such cases oversensitive fingertips may disturb a patient's daily life.

Last but not least, I would like to make some comments on the usage of techniques employing digital arteries. I think it is certainly a fault to use any intact digital artery to elevate any flap. If I were someone's patient, I would not have given permission to cut my digital arteries. I think I need them. All of these things including two operations, 10 days between them, scars after the operation on the donor area for a an abdominal flap are the things acceptable. However, the importance of the digital artery as an end artery should not be underestimated. I strongly advise questioned minds to read Yildirim and et al.'s article entitled "Complications of the Reverse Homodigital Island Flap in Fingertip Reconstruction" (18).

No two points discrimination test was done in this study to evaluate the fingertips. Only cold and warm intolerance were assessed by questioning. In no cases treated in this series reconstructed with any flap, cold and warm intolerance were observed. On the lateral view, tummy appearance of the finger pulp should be obtained and touch sensation must be associated with it. As per my knowledge the V-Y advancement flap described by Atasoy only can produce such results.

I would like to make some emphasis on the following points: (Figures- 1-12):

1. A dorsal oblique amputation can be treated best with a volar V-Y advancement flap.
2. The volar V-Y advancement flap can also be chosen in the cases of guillotine amputations including less than one third of the distal phalanx mass. To advance the flap only the skin should be cut by a surgi-



Figure 1: The most suitable cases for volar V-Y advancement techniques is dorsal oblique amputations.



Figure 6: Transferred thenar flap.



Figure 2: Length of middle leg of the Y can not be long as much as expected, yet it will give enough movements the flap that can cover the defect.



Figure 7: Late result with thenar flap, lateral view.



Figure 3: Late result, lateral aspect.



Figure 8: Postoperative appearance of donor area associated with thenar flap at 4th month.



Figure 4: Concomitant nail bed injury can be repaired by skin grafting.



Figure 9: A composite grafting that ended with failure on the third finger tip. On the same hand, a V-Y advancement flap was done to close fingertip defects located on the 4th finger.



Figure 5: A guillotine amputation located on the index finger.



Figure 10: For third finger, a cross finger flap was prepared.



Figure 11: Division of the flap pedicle was done at 8th day.



Figure 12: Lateral view of the 3rd and 4th finger following cross finger flap and V-Y advancement, respectively.

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## Correspondence

Mehmet Oğuz Yenidünya  
 Şişli Etfal Eğitim ve Araştırma Hastanesi  
 Plastik Cerrahi Klinik Şefi  
 Şişli/İstanbul/TURKIYE  
 e-mail: meogyeg@hotmail.com