A REVIEW OF THE CROSS-FINGER FLAP HISTORY

KYŽMINIO PIRŠTO ODOS LOPO RAIDOS ISTORIJOS APŽVALGA

Saulius Špokevičius
Baltic American Clinics
JSC SK Impeks Medical Diagnostic Centre
Skin and Laser Surgery Center
University of Louisville (USA)
Baltijos ir Amerikos terapijos ir chirurgijos klinika
UAB „SK Impeks Medicinos diagnostikos centras”
Odos ir lazerinės chirurgijos centras
University of Louisville (USA)

ABSTRACT
Key words: cross- finger flap, finger tip injuries, skin island flaps, hand surgery.
The article reviews the publications on the development of the cross-finger flap and its modifications depicted in publications over the last 50 years. This well established and versatile procedure is one of the most popular and best methods for reconstructing finger soft tissue defects. The method underwent modifications, several useful alterations of the cross-finger flap being designed for the facilitation of the coverage of different finger parts and tissue loss. The aim of this article is to summarize and carry out a survey of the history of this procedure as well as to give the author’s summary and show the procedures in the schematic one-shape pictures in accordance with their original drawings.

The idea of the distant transposition of the flaps reaches the ancient and medieval times. The “Indian” method of nose reconstruction is associated with the name of Susruta [1]. The “Italian” method of nose reconstruction by Branca becomes widely used after elaboration and publication by Gasparo Tagliacozzi [1,2]. The method is also analogous to the cross leg flap and to those for the cross-tissue repair [3,4] known as the “Italian” method.

The first article which dealt with the cross-finger flap was published by Michael Gurdin and John W. Pangman in 1950 [5]. The authors named the procedure as the “transdigital flap” (Fig.1).

The difference from the “classic” cross-finger flap was that the transdigital flap was carved more on the lateral and volar surface of the donor digit.

At the same time T.D.Cronin stated that he had used the same method in February 1945 and presented the materials in November 1949 naming the procedure as the “cross-finger flap”. The authors mentioned used flaps of almost the same design and T.D. Cronin also showed the use of the flap to cover a thumb tip defect. He published the article a few years later in the “The American surgeon”, 1951.

Besides, he also dissected an obliquely harvested cross-finger flap to cover the dorsal skin defect of the finger (Fig 2).

Almost ten years later after the first publication D.H. Hoskins published his article [6] devoted to the versatile cross-finger flap. He was the first to design the flap as it is used now - a “classic” one (Fig. 3).

In the article of August 1963, J.Holevich [7] described the transfer of the subcuticular tissues of the dorsum of the index finger encompassing the terminal branches of the radial nerve. The idea came from Littler’s neurovascular skin island flaps, Mobergs’ “Transfer of Sensation” and Tubiana and Durpac’s published methods how to restore the finger sensation [29,30,31]. Subsequently this method enabled several modifications of the cross-finger flap from the index finger to restore thumb skin defects together with sensation.

In 1969 the first two articles dealing with the innervated cross finger flap for thumb innervation appeared in “The American Surgeon” by S.J. Gaul naming the flap as a “radial-innervated cross-finger flap from index” (four clinical cases) and by F.Bralliar and R.L. Horner (14 clinical cases)[8,9]. (Fig. 4).

In 1976 B.B. Joshi [10] described the “classic” cross-finger flap encompassing the dorsal sensory branch in the reconstruction of the index finger pulp using the long fingers donor sites. Later, after the division of the flap he dissected that branch out from the digital nerve, isolated it and transposed it onto the index finger. (Fig. 5).

The next chronological cross-finger flap modification
appeared in 1980 by E. Atasoy [11] – he published the use of the cross-thumb flap to cover a pulp loss of an index finger. (Fig. 6).

The use of the micro-neurorrhaphic method made it possible to facilitate utilizing the innervated conventional cross-finger flap, which enabled to improve the restoration of the better two point discrimination test – by B.E. Cohen and E.D. Cronin [12]. The authors combined B.B. Joshi’s idea used the microneurorrhaphy to connect the dorsal branch of the cross-finger flap to the stump of the damaged digital nerve of the volar pulp (Fig. 7).

The article on the next modification of the cross-finger flap was published and the de-epithelialized cross-finger flap for dorsal finger defects was introduced in 1985 by T.H. Robbins [13]. Prior to raising the flap, the author marked and deepithelialized the skin of the flap and then performed the procedure. (Fig. 8). Both donor and recipient places were covered with the skin graft.

In the same year, F. Grotvelt and R. Schroll [14] published their article in which they described the use of the flap from scarred skin of a burned hand and stated that the mature scar could be utilized for the cross-finger flap to correct proximal interphalangeal joint contractures caused by as a result of burns.

The idea of the innervated cross-finger flap using microneurorrhapy gave an idea to H. Hastings to use the dual innervated index for the thumb cross-finger flap reconstruction in 1987 [15]. (Fig. 9).

In order to restore the amount of the lost soft tissues of the fingertip T.H. Robbins developed a “jam roll” cross-finger flap and published his innovation in 1988 [16]. (Fig. 10). The author deepithelialized the cross-finger flap,
rolled it, made a cylinder-like soft tissue mass and used it to replace the lost distal finger part covering the donor area and the flap with the skin graft.

A year later E. Atasoy presented a modification of the reversed cross-finger subcutaneous flap to cover nail bed, nail fold and dorsal tissue defects [17]. (Fig. 11). In order to fully reconstruct the nail fold he encompassed a small strip of the skin to form the volar aspect of the nail fold. Then the de-fatted skin of the donor finger is sutured back and the cross-finger-subcuticular flap is covered with the full-thickness skin graft.

In 1993 M. Mutaf and coauthors designed a C-ring flap to cover amputated stumps and larger digital defects [18]. (Fig. 12). Both flaps received a blood supply as axial flaps from ante- or retrogradic blood supply from the digital arteries and concomitant veins.

In 1997 the modification included the innervated “classic” cross-finger flap together with the portion of subcuticular tissues from the distal, or, if needed, from proximal finger areas in order to enhance the amount of subcutaneous tissues in finger pulp reconstruction, or to use these extra tissues to cover the nail bed defects was carried out and published by S. Špokevičius and A. Gupta [19]. (Fig. 13).

DISCUSSION

We have reviewed the medical publications devoted to the cross-finger flap history and found 13 main modifications to the original design of the flap. All the methods mentioned above are versatile and have been used in the everyday surgery to reconstruct different digital part defects – both volar and dorsal, as well as to reconstruct nail fold and nail bed defects. Over the last 50 years the cross-finger flap underwent not only the modifications but also were made as a “one stage” procedure [20] and applied to treat or reconstruct finger tips or correct “hook-nail” deformity [21], and also has been used as a multiple cross-finger flaps [32].

Several articles were devoted to the studies of the recovery of sensation, donor site morbidity and the function after the procedure using innervated and non-innervated cross-finger flaps [22, 23, 24, 25, 26, 27, 28]. The literature shows that there is no doubt that although re-innervation is different in a non-innervated and innervated cross-finger flaps, the recovery of sensation (innervation) is advanced comparing with that of a skin grafting. Personal experience and literature show that using innervated cross-finger flaps the two point discrimination in inner-
vated flaps in general is 1.5 –2 times greater than in non-innervated ones.

In conclusion, we believe that this overview might be of interest to hand surgeons and residents and may also inspire some new ideas.

REFERENCES
2. Szimanowski J. Atlas k sochineniju operacii na poverchnosti cheloviecheskago tela. Kiev, 1865:

Gautas 2007 m. gegužės 12 d; aprobuotas 2008 m. vasario 25 d.
Submitted May 12, 2007; accepted Feb. 25, 2008