



# Venous Flaps for Revascularization and Soft-Tissue Coverage in Traumatic Hand Injuries

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## Introduction

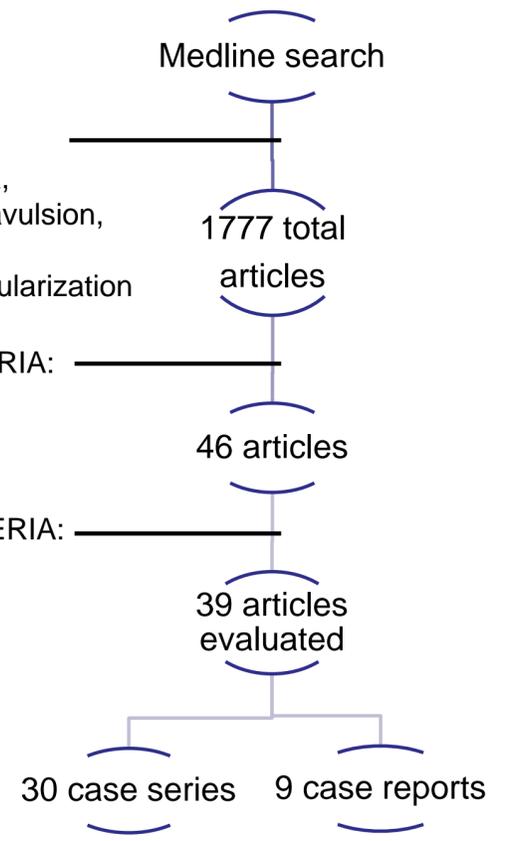
- In 1981, Nakayama performed the first documented venous flap experiments on mice transferring skin, and soft tissue with an artery connected to the venous system.<sup>1</sup>
- Honda et al. subsequently used venous flaps to provide soft tissue coverage and flow-through revascularization to amputated fingers.<sup>2</sup>
- The purpose of this study is to perform a comprehensive review of outcomes associated with the use of venous flaps in hand trauma.

## Methods

**KEYWORDS:**  
Venous flap, trauma, injury, amputation, avulsion, finger, hand, thumb, replantation, revascularization

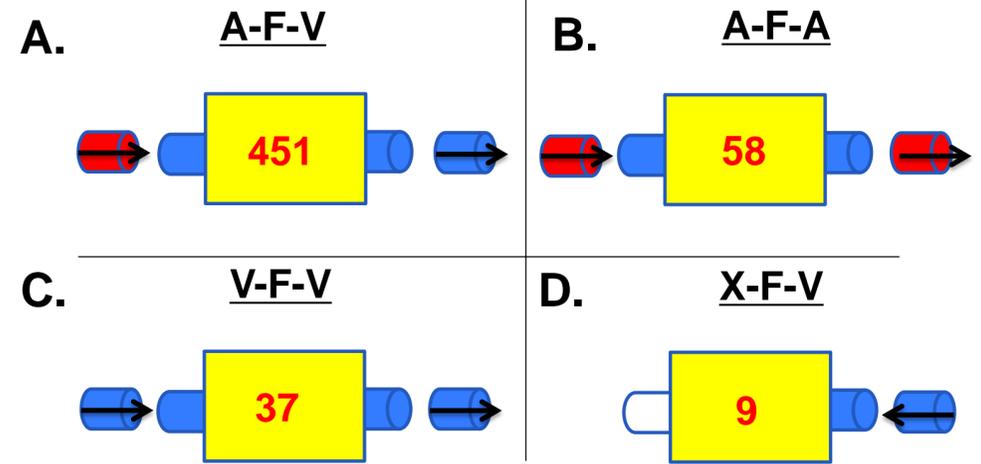
**INCLUSION CRITERIA:**  
1. Venous flap  
2. Hand Trauma  
3. Primary Data

**EXCLUSION CRITERIA:**  
1. Duplicate data  
2. Review article



## Results

- 557 flaps were identified with 77.1% male, mean age of 36.7 years, right hand injured in 52% and an average of 2.34 anastomosis completed.
- Complete healing was defined as no loss of flap tissue.
- Partial necrosis was defined as loss of any amount of tissue except complete loss.



**Figure 1:** Type and number of flaps. The box represents the flap. **A.** A-F-V: (451 flaps) arterialized venous flap, **B.** A-F-A: (58 flaps) arteriovenous anastomosis for both inflow and outflow. **C.** V-F-V: (37 flaps) Dual veno-venous anastomosis. **D.** X-F-V: (9 flaps) single venous inflow. Do not total 557 as 2 flaps did not fit these categories.

Donor site	Total # of flaps	Complete healing (%)	Partial necrosis (%)	Total flap loss (%)
<b>All flaps</b>	<b>557</b>	<b>448 (80.4)</b>	<b>80 (14.3)</b>	<b>29 (5.2)</b>
Multiple	283	232 (82.0)	35 (12.4)	16 (5.6)
Forearm	162	133 (82.1)	23 (14.2)	6 (3.7)
Palmar hand	15	13 (86.7)	1 (6.7)	1 (6.7)
Dorsal foot	9	7 (77.8)	2 (22.2)	0 (0.0)
Saphenous	11	<b>10 (90.9)*</b>	0 (25.0)	1 (9.1)
Finger	7	<b>4 (57.1)*</b>	3 (42.9)	0 (0.0)
Dorsal hand	15	13 (86.7)	1 (7.7)	1 (7.7)

**Table 1:** Outcomes based on donor sites. \* Donor site with most and least complete healing. Do not total 557 as not all papers identified donor site.

Size (in cm <sup>2</sup> )	Total # of flaps	Complete healing (%)	Partial necrosis (%)	Total flap loss (%)
<b>Small (0-10)</b>	<b>178</b>	<b>137 (77.0)</b>	<b>17 (9.6)</b>	<b>24 (13.5)</b>
Medium (10.1-25)	152	<b>136 (89.5)*</b>	7 (4.6)	9 (5.9)
Large (>25)	80	68 (85)	7 (8.8)	5 (6.3)

**Table 2:** Outcomes based on size. \* Flap size with most complete healing. Do not total 557 as not all papers identified size.

Flap design	Total # of flaps	Complete healing (%)	Partial necrosis (%)	Total flap loss (%)
A-F-V	451	369(81.9)	59 (13.0)	23 (2.9)
A-F-A	58	44 (77.8)	12 (19.0)	2 (3.2)
V-F-V	37	<b>25 (67.6)*</b>	<b>8 (21.6)*</b>	<b>4 (10.8)*</b>
X-F-V	9	8 (88.8)	1 (11.1)	0 (0.0)

**Table 3:** Outcomes based on type. \* Dual veno-venous flaps illustrated the worst outcomes with statistically significant increase in total flap loss (p=0.015). Do not total 557 as 2 flaps did not fit these categories.

## Conclusions

- All venous flaps demonstrate 80.4% complete healing and only 5.2% rate of total loss.
- 95.1% of flaps with arterial inflow at least partially survived.
- Increasing patient age was associated with higher rates of partial necrosis (p= 0.018).
- The saphenous donor site yielded the greatest rate of complete healing (90.9%).
- Medium sized flaps have the highest rate of complete healing (89.5%) and small flaps were more likely to have total loss (p=0.015)(Table 2).
- Dual veno-venous anastomosis are associated the highest rate of total flap loss (10.8%).
- Venous flaps can be used in soft tissue reconstruction of the hand after traumatic injuries with medium size and A-X-V flaps showing the greatest reliability.

## References

- Nakayama Y, Soeda S, Kasai Y. Flaps nourished by arterial inflow through the venous system: an experimental investigation. *Plast Reconstr Surg*. 1981 Mar;67(3):328-34.
- Honda T, Nomura S, et al. The possible applications of a composite skin and subcutaneous vein graft in the replantation of amputated digits. *Br J Plast Surg*. 1984Oct;37(4):607-12.