

Original Article

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## Assessment of Flap Viability and Post-operative Hand Function After Resurfacing of Acute Soft Tissue Injury on the Palm of Hand by Groin Flap and Reverse Pedicled Radial Forearm Flap.

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### Abstract:

**Background:** Many flaps have been described and used for coverage of various soft tissue defects of hand, which can be regional or distant.

**Objective:** In this study main goal is to evaluate the assessment of flap viability and post-operative hand function by Total Active Motion (TAM) and Hand grip strength.

**Method:** This was a comparative observational study, conducted at department of Orthopaedic Surgery and Burn and Plastic surgery in Sylhet MAG Osmani Medical College Hospital (SOMCH) from January 2018 to October, 2019. A total of 16 patients with acute hand injury or pathology in the palm which may create surgical wound, admitted in the study place during the study period were the study population. Where those who had Acute wound in palm with exposed tendon, nerve and bones or degloving hand injury were included in the study. Patient were divided into two group namely Group-A and Group-B. Patient chosen for groin flap were allocated in group-A and for reverse pedicled radial forearm flap were in group-B.

**Results:** During the study, complete flap survival was 100% in both group A and B. At all the follow-ups hand grip strength was more in group B and the difference was statistically significant ( $p < 0.05$ , obtained by unpaired t-test). At final follow-up (12 weeks) hand grip strength was 22.38 (SD±5.26) kg in Group A and 30.13 (SD±10.15) kg in Group B. There is no (0.0%) excellent result of index and middle finger in group A patient compared to 3 (37.5%) and 6 (75.0%) patients respectively in group B. In group A 3 patient had excellent outcome in ring finger compared to 7 (87.5%) patients in group B. Majority (87.5%) patient's little finger was excellent in group A and 8 (100.0%) in group B. The difference of index finger and middle finger were statistically significant between groups ( $p < 0.05$  obtained by Fisher Exact test).

**Conclusion:** From this study we can say that, both the handgrip strength and TAM score was better in patients who underwent radial forearm flap and the difference was statistically significant ( $p < 0.05$ ). It is concluded that reverse pedicled radial forearm flap has better outcome regarding flap viability and post-operative hand function than groin flap.

**Keywords:** hand injury, Groin Flap, Distally Based Radial Forearm Flap, hand function, Total active motion, flap viability

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### Introduction

Upper extremity soft tissue reconstruction is a broad topic since there are several solutions for various soft tissue abnormalities including the shoulder, arm, elbow, forearm, wrist, and hand.<sup>1-2</sup>

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Flap cover is frequently required for resurfacing exposed important structures such as tendons, neurovascular structures, bone, to provide supple tissue over joints, preserve hand functions and to allow for early rehabilitation. Local, regional, distant, and free flaps are available.<sup>3-4</sup> Regional forearm flaps are: reverse pedicled radial forearm flap, ulnar artery flap and the posterior interosseous artery flap. Distant flap may be pedicled or free flap. The standard pedicled distant flaps used in the reconstruction of hand are the groin flap and the abdominal flap.<sup>4</sup> The

free flap option is widely recognized as a flexible one stage surgery that allows for the simultaneous repair of other essential structures. It also enables for early discharge and return to work following surgery. On the other side, it necessitates extra resources, a larger staff, a longer operating period, and the possibility of catastrophic flap failure.<sup>5</sup>So, reverse pedicled radial forearm flap and the groin flap is commonly done for resurfacing of soft tissue defect of hand<sup>6</sup>.

In this study our main goal is to evaluate the assessment of flap viability and post-operative hand function by Total Active Motion (TAM) and hand grip strength, after resurfacing of acute soft tissue injury on the palm of hand by Groin Flap and reverse pedicled Radial Forearm Flap.

### Objective

To evaluate the assessment of flap viability and post-operative hand function by total active motion (TAM) and hand grip strength.

### Methodology

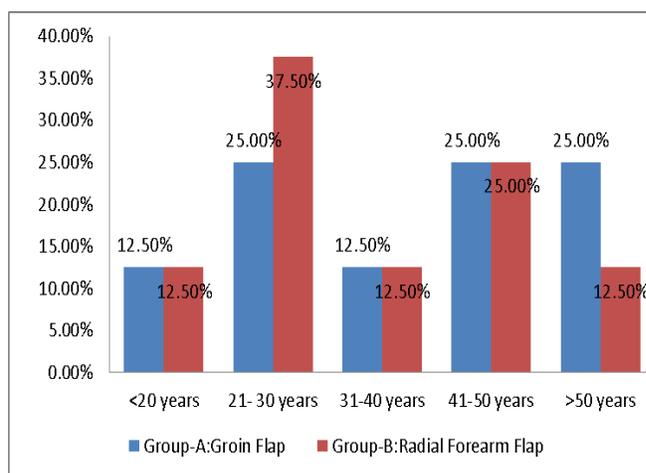
This was a comparative observational study, conducted at department of Orthopedic Surgery and Burn and Plastic surgery Sylhet MAG Osmani Medical College Hospital from January 2018 to October, 2019. A total of 16 patients with acute hand injury or pathology in the palm of hand which may create surgical wound, admitted in the study place during the study period were the study population. Where those who had Acute wound in palm of hand with exposed tendon, nerve and bones or degloving hand injury were included in the study. Patients in whom Allen's test was negative in case of radial forearm flap, infected wound at donor and recipient site, poly trauma patient with life threatening injury, scar at donor site, prior operation at donor site, partial hand or finger amputation were excluded from the study.

Patient were divided into two group namely Group-A and Group-B. For the 1<sup>st</sup> patient, flap technique was chosen by lottery and from 2<sup>nd</sup> patient onward flap technique was chosen alternatively between groin flap and distally based radial forearm flap. Patient chosen for groin flap were allocated in group-A and for reverse pedicled radial forearm flap were in group-B.

A pre-designed questionnaire, designed for the study was used to collect data. The questionnaire was prepared by reviewing literature and consulting with experts. Hand grip strength was measured with a hand dynamometer and the range of motion of fingers was assessed by Total Active Motion (TAM) evaluation system proposed by the American Society for Surgery of the Hand (ASSH), measured by the goniometer. After admission of patient with palmar surface of hand injury, history was taken and clinical examination was done. Selection criteria were applied. The patients were informed in details regarding the procedure and purpose of the study and written consent were obtained. Data were collected on admission and at follow up visits at 1st, 6th, 9th & 12th week postoperatively.

### Results

In Figure-1 shows distribution of the study patients by age. It was observed that the age of the patients ranged from 16 to 55 years. In group A 25% cases belong to 21-30 years, 41-50 years and >50 years age group. Whereas in group-B majority belong to 21-30 years age group, 37.50%. The following figure is given below in detail:



**Figure-1: Age distribution**

**Table-1 Distribution of the study patients by sex (n=16)**

Gender distribution	Group A (n=8) n %	Group B (n=8) n %
Male	7 87%	7 87%
Female	1 13%	1 13%

In table-1 shows gender distribution of study group where 7 (87%) patients were male and 1 (13%) patient were female in both group A and group B.

**Table-2: Distribution of the study patients by flap survival (n=16)**

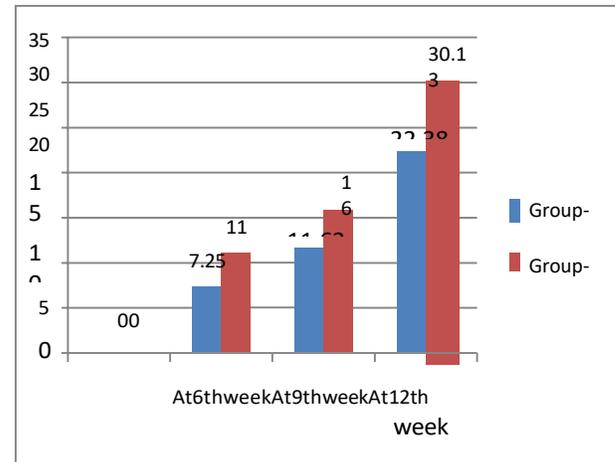
Flapsurvival	GroupA(n=8)	GroupB(n=8)
Completesurvival	8 (100%)	8 (100%)

GroupA:GroinFlap;GroupB:Reverse pedicled radial forearm flap

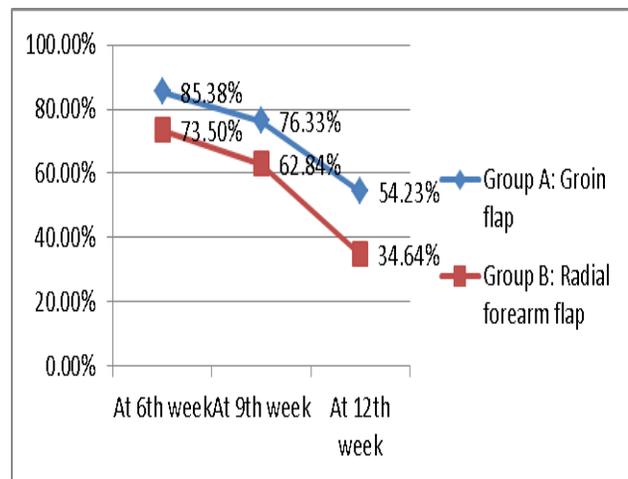
Table-2 shows distribution of the study patients by flap survival. Complete flap survival was 100% in both group A and group B.

In Figure-2 Shows distribution of the study patients by postoperative hand grip strength of injured hand and decrease of grip strength of injured hand compared to contralateral normal hand in different follow up between two groups. At all the follow-ups hand grip strength in injured hand was more in group B and the difference was statistically significant( $p < 0.05$ , obtained by unpaired t-test;  $t = 0.046$ ). At final follow-up (12 weeks) hand grip strength was 22.38 (SD±5.26) kg in Group A and 30.13 (SD±10.15) kg in Group B. The decrease in the hand grip strength in injured hand compared to contralateral normal hand is less in in group B in all follow up and the difference was statistically significant ( $p < 0.05$ ; obtained by unpaired t-test;  $t = 0.0003$ ). The mean decrease was 54.23 (SD±7.77) % in group A and 34.64 (SD±13.57) % in group B.

Patient with reverse radial forearm flap regain more grip strength in injured hand than patient with groin flap. The following figure is given below in detail:



(i)



(ii)

**Figure 4.4: Distribution of the study patients by (i) hand grip strength of injured hand in kg & (ii) percentage of decrease in grip strength in injured hand; compared to contralateral hand in different follow up between two groups (n=16)**

**Table-3: Distribution of the study patients by TAM score outcome in final follow up (At 12 weeks) (n=16)**

TAMscore outcome	GroupA(n=8)	GroupB (n=8)	p
	n(%)	n(%)	
<b>Indexfinger</b>			
Excellent	0 (00.00)	3 (37.50)	0.034
Good	2 (25.00)	4 (50.00)	
Fair	5(62.50)	0 (00.00)	
Poor	1 (12.50)	1 (12.50)	
<b>Middlefinger</b>			
Excellent	0 (0.00)	6 (75.00)	0.019
Good	5 (62.50)	1 (12.50)	
Fair	2 (25.00)	1 (12.50)	
Poor	1 (12.50)	0 (00.00)	
<b>Ringfinger</b>			
Excellent	3 (37.50)	7 (87.3)	0.111
Good	4 (50.00)	1 (12.5)	
Fair	1 (12.50)	0 (00.00)	
<b>Littlefinger</b>			
Excellent	7 (87.50)	8 (100.0)	1.000
Good	1 (12.50)	0 (0.00)	

Statistical analysis done by Fisher Exact test

Table-3 shows distribution of the study patients by TAM score outcome. It was observed that there is no (0.0%) excellent result of index and middle finger in group A patient compared to 3 (37.5%) and 6 (75.0%) patients respectively in group B. In group A 3 patient had excellent outcome in ring finger compared to 7 (87.5%) patients in group B. Majority (87.5%) patients little finger were excellent in group A and 8(100.0%) in group B. The difference of index finger and middle finger were statistically significant between groups ( $p < 0.05$  obtained by Fisher Exact test).

### Discussion

In this study complete flap survival was 100% in both groin flap groups and radial forearm flap treated group. One study found that one (2%)

flap loss occurred out of 49 patients and other study showed out of 5 patient 1 patient developed flap necrosis (20%) treated by groin flap.<sup>7-8</sup> Whereas other study recorded Complete (100%) survival of flap in all 13 patients in radial forearm flap treated patient. So, there is no significant difference between these two flaps in term of flap survival.<sup>9</sup>

At all the follow-ups hand grip strength in injured hand was more in radial forearm flap treated group and the difference was statistically significant ( $p < 0.05$ ). At final follow-up (12 weeks) hand grip strength was 22.38 (SD±5.26) kg in groin flap group and 30.13 (SD±10.15) kg in radial forearm flap treated group ( $P = 0.046$ ). The decrease in the grip strength in injured hand compared to contralateral normal hand is less in radial forearm flap treated group in all follow up

and the difference was statistically significant ( $p < 0.05$ ). The mean decrease was 54.23 (SD±7.77) % in groin flap group and 34.64 (SD±13.57) % in radial forearm flap treated group. Patient with radial forearm flap regain more grip strength in injured hand than patient with groin flap. One study showed that hand grip strength was regained fully in 100% of patient treated by Groin flap. Whereas one study showed that the grip strength of the hand was weaker by 11.9% (86.5 compared with 72.2 Kg) in radial flap treated patients and one study showed a decrease in the strength of the hand in five of the 15 patients who had radial forearm flaps and on average, 72% of the grip power of the contralateral hand.<sup>10-12</sup>

Less grip strength in this study may be due to inadequate hand physiotherapy of the patient.

TAM score outcome of this study showed that there was no (0.0%) excellent result of index and middle finger in groin flap group patient compared to 3 (37.5%) and 6 (75.0%) patients respectively in radial forearm flap treated group. In ring finger 3 patients had excellent outcome in groin flap group compared to 7 (87.5%) patients in radial forearm flap treated group. Majority (87.5%) patients little finger were excellent in groin flap group and 8(100.0%) in radial forearm flap treated group. The difference of index finger and middle finger were statistically significant ( $p < 0.05$ ) between groups. In Groin flap patients one study showed that all patient regained full range of movement except one patient. TAM score is excellent in 96.42 % and good in 3.58% of patient with fair and poor 00%.<sup>10</sup> Whereas in radial forearm treated patients one study showed that all patients regained full flexion and extension of their fingers and another study showed that functional outcomes of the finger were excellent and good in 11(84.61%) and 2(15.38%) patients, respectively, according to the TAM criteria.<sup>13,2</sup> Less TAM score in our study was probably due to lack of post-operative rehabilitation protocol and inadequate hand physiotherapy.

### Conclusion

From this study we can say that, both the handgrip strength and TAM score was better in patients who underwent reverse radial forearm flap and the difference was also statistically

significant ( $p < 0.05$ ). It is concluded that radial forearm flap has better outcome than groin flap.

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