GLABROUS & NON-GLABROUS SPLIT SKIN GRAFT IN THE RECONSTRUCTION OF FLEXION CONTRACTURE OF FINGERS – AN OBSERVATIONAL AND COMPARATIVE STUDY.

Plastic Surgery

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ABSTRACT

Background: Flexion contractures of the fingers cause functional and aesthetic problems to a burn patient. Various methods of reconstruction have been described in the literature. These include release and split thickness grafting, release and full thickness grafting. Among those incision or excision of the contracture band and split skin grafting were the simplest and commonest techniques. In this study, we aim to compare functional & aesthetic outcomes of glabrous & non glabrous split skin graft in flexion contracture of fingers.

Methods: A total of 60 fingers of patients of post burn finger contractures were undertaken for the study. Patients were evaluated preoperatively on duration of contracture, extent of involvement, type of scar, range of movements using goniometer and degree of fixed flexion deformity. Finger contractures were released and resurfacing done with glabrous & non-glabrous split thickness skin grafts. Postoperative evaluation was done by measuring range of movements of Proximal Interphalangeal (PIP) and Distal interphalangeal (DIP) joints, flexion deformity, donor site morbidity, number of visits to the hospital, colour match of graft to adjacent skin.

Results: Functional outcome in terms of active range of motion combined at DIP joint, PIP joint & metacarpophalangeal joint were similar in both glabrous split thickness skin graft & non glabrous split thickness skin graft at the end of six months. As compared with non-glabrous split thickness skin grafts, glabrous split thickness grafts provided superior colour & texture match to surround tissue. There was no significant donor site morbidity in plantar in-step area & patients were able to walk from third to fourth post operative day. There was minimal hypertrophy of plantar donor site, owing to persistent pressure in standing posture.

Conclusion: Patient's satisfaction was greater in glabrous split skin graft.

KEYWORDS

Glabrous, Non-glabrous, Split skin graft, Reconstruction, Flexion contracture.

INTRODUCTION

Thermal injuries are characterized by varying degrees of damage to the skin and underlying structures. The commonest sequel of burns to the fingers is the volar flexion contracture, preventing full finger motions. A number of methods have been described for the treatment of finger contractures. These include release and split thickness grafting, release and full thickness grafting, Z - Y advancement flaps, cross finger flaps and dorsolateral flaps.^[1]

About 75% of burn patients sustain burns of the hands and 80% of these are bilateral.^[2] Often due to other more extensive injuries the hand injuries get neglected resulting in an enormous spectrum of deformities ranging from the unaesthetic to the complete loss of the part.

Prolonged wound healing with its attendant edema, infection, fibrosis and immobilization can lead to secondary joint contractures.^[3-5]

According to some studies, plantar skin of the instep area is the best replacement of palmar skin of the digits & hand because of the similarities in their characteristics.^[6] Other studies presented split thickness graft as better option.^[7]

Flexion contractures of the fingers cause functional and aesthetic problems to a burn patient. Various methods of reconstruction have been described in the literature. These include release and split thickness grafting, release and full thickness grafting. Among those incision or excision of the contracture band and split skin grafting were the simplest and commonest techniques.^[8-10]

There is currently very few studies to compare the outcomes of conventional split thickness skin graft & glabrous split skin graft in the reconstruction of flexion contracture of fingers in Indian population. As the skin characteristics of Indian population varies with that of others, results shall be varying. This study has been designed to assess the result of these techniques and compare the outcomes in Indian population.

MATERIALS AND METHODS

This prospective study was conducted in Department of Surgery of Muzaffarnagar Medical College & Hospital in 18 months from July 2017 to December 2018. Total of 60 fingers were taken and each group were assigned 30 fingers. In future reference each finger is referred as a case.

In this study, patients with flexion contracture of long fingers due to

volar skin burns were taken. These fingers were divided into two study groups. Release of finger contracture and resurfacing was done with glabrous & non-glabrous split thickness skin grafts. The results of these two techniques and there outcomes were compared.

Patients were evaluated preoperatively on duration of contracture, extent of involvement, type of scar, range of movements using goniometer and degree of fixed flexion deformity.

Finger contractures were released and resurfacing done with glabrous & non-glabrous split thickness skin grafts.

Postoperative evaluation was done by measuring range of movements of Proximal Interphalangeal (PIP) and Distal interphalangeal (DIP) joints, flexion deformity, donor site morbidity, number of visits to the hospital.

Patients were administered spinal anaesthesia using 0.25 % Bupivacaine Hydrochloride for graft harvest & for the wrist block, 0.5 % Bupivacaine & 2% Lignocaine in equal proportions were used.

RESULTS

Demography:

There were 30 cases in each group with age ranging from 12 years to 30 years (mean 16.9) in Group I, 12 years to 26 years (mean 14.7) in Group II. Distribution of age in both groups was comparable (p value - 0.06) [Table 1, Figure 1].

Table 1: Age Distribution.

GROUP	N	Range (Years)	Mean (Years)	p value
Group I	30	12-30	16.9	0.06
Group II	30	12-26	14.7

Figure 1: Graphical Representation.

Distribution of sex in both groups is as shown in table 2. There were 30% female and 70% male in group I, 20 % female and 80% male in group II. Gender specific distribution is comparable between the two groups (p-0.240) [Table 2, Figure 2].

Table 2: Sex Distribution.

	Female (%)	Male (%)	p value
Group I	8 (26.6%)	22 (73.3%)	0.240
Group II	7 (23.3%)	23 (76.6%)

Figure 2: Graphical Representation.

Digital Distribution of Flexion Contracture:

Digital distribution of flexion contracture were 40% index finger, 16.7% middle finger, 43.3% ring finger in GROUP I, 33.3% index finger, 36.7% middle finger and 30% ring finger in GROUP II [Table – 3, Figure 3].

Table 3: Digital Distribution Of Flexion Contracture.

	GROUP I N(%)	GROUP II N(%)	
PBC Index Finger	3 (10.0%)	6 (20.0%)	9 (15.0%)
PBC Middle Finger	9 (30.0%)	8 (26.6%)	17 (28.3%)
PBC Ring Finger	11 (36.6%)	8 (26.6%)	19 (31.6%)
PBC Little Finger	7 (23.3%)	8 (26.6%)	15 (25.0%)

Figure 3: Graphical Representation.

Extent Of Contracture In Relation To Interphalangeal Joint:

Distribution of extent of contracture upto distal interphalangeal joint (DIP) and proximal interphalangeal joint (PIP) in GROUP I & GROUP II is shown in table – 4. Distal interphalangeal joints were involved in 34.4% of cases and proximal interphalangeal joints were involved in 65.6% of cases.

Table 4: Extent Of Contracture In Relation To Inter-phalangeal Joint.

Extent	GROUP I n(%)	GROUP II n(%)
Distal interphalangeal joint	11 (36.6%)	9 (30.0%)
Proximal interphalangeal joint	19 (63.3%)	21 (70.0%)
Total	30	30

Flexion Deformity At Interphalangeal Joints:

Distribution of degrees of flexion deformity at proximal interphalangeal joints in GROUP I & GROUP II are shown in table – 5. Majority of the cases had fixed flexion deformities within 80 – 120 degrees. On student t test there were no significant difference in severity of contracture in GROUP I & GROUP II (P value - 0.421).

Table 5: Pre-operative Flexion Deformity At Proximal Interphalangeal Joint.

Degrees Of Fixed Flexion Deformity	Group I N(%)	GROUP II N(%)	p- value
1 - 20	1 (3.3%)	0 (0.0%)	0.421
21-40	2 (6.6%)	0 (0.0%)	
41-60	2 (6.6%)	3 (10.0%)	
61-80	3 (10.0%)	4 (13.3%)	
81-100	8 (26.6%)	7 (23.3%)	
101-120	3 (10.0%)	7 (23.3%)	

Fixed flexion deformities at distal interphalangeal joints were within the range of 1-40 degrees in majority of the cases (table – 6). P - value was analysed between the groups using student t test and was found to be statistically comparable.

Table 6: Pre Operative Flexion Deformity At Distal Interphalangeal Joint.

Fixed flexion deformity	Group I	GROUP II	P value
1-20	5 (16.6%)	3 (10.0%)	0.376
21-40	4 (13.3.0%)	5 (16.6%)	
41-60	1 (3.3%)	1 (3.3%)	
61-80	1 (3.3%)	0 (0.0%)	

Operative Observation:

The average postoperative active range of motion of digits after six months in Group-I was 223.5 degree & in Group-II was 232.3 degree. On statistical analysis, the active range of motion at the end of six months was comparable & there was no significant difference between the two groups (p value – 0.09) [Figure 4].

Figure 4: Active Range Of Movement At 6 Months.

The average postoperative passive range of motion of digits after six months in Group-I was 242.3 degree & in Group-II was 240.1 degree. On statistical analysis, the active range of motion at the end of six months was comparable & there was no significant difference between the two groups (p value – 0.38) [Figure 5].

Figure 5: Passive Range Of Movement At 6 Months.

There were total 12 (20%) cases of recurrence of contracture out of 60 cases. Of all these cases, 8 recurrences was due to non compliance of patient with physiotherapy advice & rest 4 due to partial graft loss. All these recurrences were in the range of 0-40 degree & involved both proximal as well as distal interphalangeal joint. In Group-I, proximal interphalangeal joint involvement in recurrence was in 3 cases, while in Group-II it was in 5 cases. On statistical analysis, there was no significance difference between the two groups (p value – 0.295) [Table 7].

Table 7: Flexion Deformity At Proximal Interphalangeal Joint At Six Months.

Fixed flexion deformity(Degrees)	GROUP I n(%)	GROUP II n(%)	P value
1-20	2 (6.6%)	4 (13.3%)	0.295
21-40	1 (3.3%)	1(3.3%)	

In Group-I, distal interphalangeal joint involvement in recurrence was in 2 cases, while in Group-II it was in 1 case. On statistical analysis, there was no significance difference between the two group (p value – 0.349) [Table 8].

Table 8: Flexion Deformity At Distal Interphalangeal Joint At Six Month.

Fixed flexion deformity (Degrees)	GROUP I n(%)	GROUP II n(%)	P value
1-20	2 (6.6%)	1 (3.3%)	0.349
21-40	0 (0.0%)	0 (0.0%)	

DISCUSSION

In present study release of post burn flexion contracture of fingers were done by incising the contracture band in both groups without excising the scarred volar skin. This method leaves the maximum residual volar skin to utilize its characteristic advantages. Our observations were consistent with Salisbury RE. Dingeldein GP⁸ who preferred the release of post burn flexion contracture of fingers by incision and grafting rather than excision.

Pensler J. M. et al² compared the results of full thickness skin grafts and split thickness skin grafts following release of flexion contractures. They concluded that type of graft utilized does not influence the final functional results. Our study contradicts their findings as better functional results were found in using full thickness skin grafts. Split skin grafted cases had 16.6% recurrence while glabrous skin grafted cases had 10.0% recurrence.

Pensler J. M. et al² reported fewer tendencies of hyperpigmentation and superior cosmesis in the use of split thickness skin grafts. Our results contradict these findings. Our study had found more hyperpigmentation in split thickness skin grafted area. Full thickness skin graft had shown less hyperpigmentation and superior cosmesis than split skin grafted cases. This difference might be due to Caucasian population. In Caucasians incident of hyperpigmentation is less.

Richard et al¹¹, concluded that harvesting split thickness glabrous graft from sole instep area is painful to patients with hypertrophic tendency of donor site & associated with prolonged healing of donor site with hyperpigmentation & significant donor site morbidity. However in our study, donor site morbidity was minimum with harvesting of split thickness glabrous graft. Most of our patients were able to walk from fourth post operative day & only single patient out of 30 required dressing change of donor site before 3 weeks.

Smith et al¹², concluded in his study of 64 patients out of which he was able to follow up 41 patients that result from split thickness glabrous skin grafts were quite satisfactory with no incidence of hyperpigmentation, good color & texture match with surrounding skin & good functional outcomes, especially in dark colored individuals. Donor site morbidity was also minimal. In our study results are consistent with this study. He also concluded good donor site healing with excellent color & texture match. He harvested split thickness glabrous skin graft leaving part of reticular dermis behind, similar method has been employed in our study with similar results. In his study, out of 41 patients, 16 patients required secondary reconstruction like Z plasty & additional skin grafting. None of such procedures were required in our study.

Tannabe HY et.al⁷ described covering of palmar & plantar defects using pinch grafts harvested from in-step area of sole. He described in his study this method of pinch plantar skin graft to be reliable with least morbidity & advocated the use of glabrous pinch grafts. In his study he described his results with excellent color & texture match with no recurrence of contractures.

Tannabe et.al⁷ concluded in his study using dermal glabrous split skin grafting. After harvesting split thickness glabrous graft from sole instep, superficial layer is re-positioned over donor site. In this series, he stated no noticeable marginal hypertrophic scarring in any patient. This is inconsistent with our study as we found marginal hypertrophy in 5 (16.6%) patients of group-I & 4 (13.3%) patients in group-II. This is due to difference in harvesting technique.

In study by Bunyan et.al¹³, he used medium thickness split skin graft, the donor area did not heal in 3 patients and had to be covered with the skin graft. Pensler JM et al² harvested full thickness skin graft from lateral great toe skin but this was associated with the additional split thickness skin graft placed on the donor site. In our study, there was no donor site healing problem in our cases and the donor area was well healed within 3 weeks.

Jackson et.al.³ concluded that about 88% of patients grafted with plantar split skin graft developed re-contracture. This is not consistent with our study, where recurrence rate in group-I with plantar glabrous graft was among 5 (16.6%) patients. This is possible because author included young pediatric population in which patient compliance is hard to maintain & recurrence occurred as result of lack of proper splinting & post operative physiotherapy.

Limitations of our study was non inclusion of pediatric population & assessment of pain & sensations was subjective. There was no precise scale of sensation & pain assessment.

CONCLUSION

After reviewing the results of glabrous split thickness grafts and non glabrous split thickness grafts in post burn contractures of fingers, following conclusions were drawn from the study.

Functional outcome in terms of active range of motion combined at DIP joint, PIP joint & MP joint were similar in both glabrous split thickness skin graft & non glabrous split thickness skin graft at the end of six months. As compared with non-glabrous split thickness skin grafts, glabrous split thickness grafts provided superior color & texture match to surround tissue. There was no significant donor site morbidity in plantar in-step area & patients were able to walk from third to fourth post operative day. There was minimal hypertrophy of plantar donor site, owing to persistent pressure in standing posture. Patient's satisfaction was greater in glabrous split skin graft.

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