

Comparison of Outcomes Following Syndactyly Release with Grafts and Without Grafts

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ABSTRACT

Objective: To compare the results of syndactyly release with or without graft in patients with simple syndactyly of hand.

Study Design: Prospective comparative study.

Place and Duration of Study: Department of Plastic Surgery, Combined Military Hospital Rawalpindi Pakistan, from Jul 2017 to Jun 2019

Methodology: Forty-five patients with simple syndactyly were included in this study. Group-1 had 20 patients whose syndactyly was released without using a skin graft. Group-2 had 25 patients whose soft tissue was covered with a full-thickness skin graft between the flaps post syndactyly release. Both groups were compared based on operative time, wound healing time, and when physiotherapy was started post operatively.

Results: The results of our study showed that the mean operative time for the first group was 47.1 ± 4.5 minutes (range 35-60 minutes) and for the second group 90.5 ± 10.0 minutes (range 72-108 minutes) with a p -value <0.001 . The wound healing time for the first group was 15.2 ± 1.3 days (12-18 days' range) and for the second group was 22.5 ± 5.1 days (range 14-30 days) with a p -value <0.001 . Post-operative physiotherapy was started earlier in the first group with an average of 20.6 ± 1.3 days (18-22 days' range) as compared to the second group whose average time of the start of physiotherapy was 27.7 ± 4.4 days (range 20-35 days) with p -value <0.001 .

Conclusion: Syndactyly release without a skin graft has a lesser operative time, early wound healing and an earlier start of physiotherapy than syndactyly release with a skin graft.

Keywords: Clover-leaf flap, Skin graft, Simple syndactyly, Syndactyly release.

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INTRODUCTION

Syndactyly is the fusion, or web-bing, of the digits¹. Among the congenital anomalies of the hand, syndactyly has the highest prevalence. From 2,000 to 3,000 children born alive,¹ presents with this anomaly 2.50% of the cases occur bilaterally.³ Embryonically, the developing mesenchymal structures fail to separate, resulting in fused digits.² Different classifications for syndactyly have been proposed. The most common of these classifies it as simple (skin and soft tissue syndactylized), complex (bone or joint along with soft tissue fused), complete (fingers are fused up to the tip), incomplete fingers are partially connected).^{4,5} When more than two digits & various elements are fused, as in Poland and Apert syndrome, it is classified as "complicated syndactyly".² When syndactyly is associated with some syndromelike Holt-Oram syndrome or ring constriction syndrome, it is syndromic syndactyly.³

According to some reports, 10 to 40 percent of cases are familial, with the most frequent involvement

of long-ring web.⁴ However, in patients with no family history, various factors like smoking, malnutrition, and other embryotoxic factors during pregnancy have been found to play a role.^{6,7}

In the last two centuries, many techniques for the release of syndactyly with adequate inter-digital space and adequate coverage for every aspect of the affected digit have been described⁶. In 1810, the dorsal "V" flap for the web-space creation was described by Zeller, then Differbach coined the quadrilateral flap in 1834⁷. In 1881 dorsal and palmar triangular flaps were introduced by Norton.⁸ Cronin illustrated zigzag incisions for dorsal and palmar surfaces. This technique of Cronin was modified in 1985 by Killiam *et al.*⁹ He placed the flap slightly ulnar and proximal to the volar flap. Authors have described various flap designs during the past few decades, including perforator flaps for neo web creation.

The creation of a hand that has maximum functionality with the least possible morbidity, in the long run, is the goal of treating syndactyly. To accomplish this goal, adequate webspace, distal phalanges, and fingertips must be formed with minimum procedures as possible.¹⁰

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Using skin graft to cover the raw area has the disadvantage of web creep, flexion contracture, patchy appearance of the grafted area due to colour mismatch, and the donor site morbidity. It also increases the operative time and the time it takes to be off the dressings and start using the hand. Different designs of dorsal flaps are emerging to overcome all these issues using skin grafts. In our study, we compared a full-thickness skin graft for the coverage of soft tissue on fingers after web creation with a dorsal rectangular flap and using a cloverleaf flap for webspace creation without using any skin graft for webspace or the fingers.

METHODOLOGY

After taking formal permission from Ethical Review Committee (ERC/IERB approval certificate number 44), a prospective comparative study was conducted at the Department of Plastic and Reconstructive Surgery, Combined Military Hospital Rawalpindi from July 2017 to June 2019. In addition, informed consent was taken from the parents/guardians of the patients.

Inclusion Criteria: The patients with simple complete syndactyly were included in the study.

Exclusion Criteria: Patients with complex syndactyly or other systemic conditions, including congenital syndromes, infections and skin diseases, were excluded from the study.

Sixty patients with congenital syndactyly were operated upon during our study through consecutive sampling. For sample size calculation, a reference prevalence of 1% in 10,000 live births from literature was taken using the WHO calculator.¹¹

The most common web involved was the third web. There were 20 patients whose web was created using a dorsal clover leaf flap in group one. The wings of this flap covered the radial and ulnar sides of fingers in the web. Extra fat projecting out was trimmed. Small areas that could not be closed primarily due to tension were left to heal by epithelialization. In group,² 25 patients underwent syndactyly release. A dorsal rectangular flap was used for neo-web creation and interdigitating triangular zig-zag flaps for fingers. Full-thickness skin grafts were used to cover the soft tissue between the flaps (Figure A, B, C). When comparing these two groups, we considered operative time, wound healing time, and the time when each group started physiotherapy.

All procedures were performed under general anaesthesia under tourniquet control. Flaps were

marked. Dorsal clover leaf flap for neo web creation was raised, and triangular flaps were raised to interdigitate on adjacent fingers while preserving the digital neuro-vascular bundles. The wings of the cloverleaf flap covered the radial and ulnar sides of fingers in the web. Extra fat projecting out between the zig-zag flaps was trimmed. Small areas that could not be closed primarily due to tension were left to heal by epithelialization. The flaps were sutured at their place with Polyglactin suture. Dressing in paraffin gauze, surgical gauze and crepe bandage were done. After marking the flap in the second group, the dorsal rectangular flap was raised for the new web and triangular flaps for the fingers. After dissecting the flaps taking care not to damage the digital neurovascular bundles, the flaps were stitched meticulously using Polyglactin 5/0. The space between the flaps was covered with a full-thickness skin graft. The graft was harvested from the non-hair bearing part of the groin. The donor site was closed primarily. After suturing, the graft at its place with Polyglactin 5/0 dressing was done in the same manner as for the other group.

Statistical Package for Social Sciences (SPSS) version 21.0 was used for the data analysis. Quantitative variables (wound healing time, start of physio-therapy and operation time) were summarized as mean \pm SD and t-test was used between the two groups for comparison. In contrast, qualitative variables (gender) were analyzed with frequency and percentages.

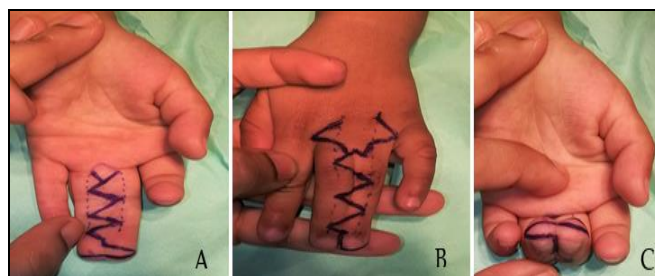


Figure (A, B, C): Marking of release with cloverleaf flap for dorsal web space.

RESULTS

Our study included Forty-five patients, 33 (73.3%) males and 12 (26.6%) females. The mean age of the patients was 3.5 ± 2.0 years, with a range of 1 year to 6.5 years. The most common web involved was the third web, and the least common was the first web. In addition, 45 syndactyly released (25 released using full-thickness skin grafts and 20 without any graft use) included in our study were assessed on three criteria, i.e., operative time of each group, time each group took

to heal and when each group was able to start physiotherapy.

Mean operative and tourniquet time for group 1 and group 2 was noted to be as in Table. The difference between the two groups was statistically significant, with a *p*-value <0.001. Operative time in the grafted group was increased due to the additional time required for harvesting the graft and its meticulous suturing at the recipient site and the closure of the donor site.

Wound healing time was defined by the time when the patient did not require any more dressings, and the graft was fully taken with all soft tissue fully covered.

Table showed the time patients in each group took to heal. The difference between the two groups was statistically significant, with a *p*-value of <0.001.

The partial or complete graft loss increased the time for healing the grafted group. There was a complete graft loss in 2 of our patients, and partial graft loss was seen in 5 of our patients.

The time the physiotherapy was started was directly proportional to the wound healing time. As the time for wound healing increased, so was the physiotherapy delayed. The difference between the two groups was statistically significant, with a *p*-value of <0.001 (Table).

Table: Comparison of mean duration of operation, wound healing time and start of physiotherapy between two groups

Parameters	Group-1 (n=20)	Group-2 (n=25)	<i>p</i> -value
Duration of Operation (Mean ± SD)	47.1 ± 4.5 Minutes (Range; 35-60 Minutes)	90.5 ± 10.0 Minutes (Range; 72-108 Minutes)	<0.001
Wound Healing Time (Mean ± SD)	15.2 ± 1.3 Days (Range; 12-18 Days)	22.5 ± 5.1 Days (Range; 14-30 Days)	<0.001
Start of Physiotherapy (Mean ± SD)	20.6 ± 1.3 Days (Range; 18-22 Days)	27.7 ± 4.4 Days (Range; 20-35 Days)	<0.001

DISCUSSION

Creating a hand with maximum function and minimum long-term complications is the main aim of syndactyly release. Therefore, a functional and aesthetically pleasing interdigital space must be created with as few procedures as possible.^{10,11} The optimum time for the release of syndactyly has been under debate for a long.

However, recently, more authors believe that patients with simple syndactyly involving only two fingers can be operated upon before the child is 18 months old.⁵ Surgeons have reached a consensus that they should be separated earlier in cases in which border digits are involved, i.e., by six months. However, the anaesthetic risks are inversely proportional to the age of the patient.¹² Another aspect of treatment that needs consideration is the increased incidence of angular deviation of fingers and the negative psychological impact if a release occurs after the age of five.¹³

The key point in treating syndactyly is perhaps the reconstruction of neo-web space. Tissue in the web area is always deficient, and the use of skin grafts for its coverage has high rates of contracture and web creep.¹⁴ To overcome these disadvantages of using skin grafts at the finger base after dorsal rectangular and triangular flaps, flaps of varying designs have gained popularity.¹⁵ Owing to its good elastic feature, the skin on the hand dorsum can be pulled freely to the webspace. Furthermore, its colour and texture are ideal. If the dorsal flap is designed properly, it can be used to separate the digits without using skin grafts for soft tissue coverage at the base. The shape and size of the flaps can be adjusted as per individual case requirements.¹⁶

It is a common belief that the defect that cannot be closed primarily should be covered with either a full-thickness or a split-thickness skin graft.¹⁷ A cellular dermal matrix with split-thickness skin graft for the coverage of skin defects after surgical treatment of congenital syndactyly has also been proposed.¹⁸

The most famously used technique for dividing the congenitally joined digits was first introduced by Cronin in mid of 20th century. This involved use of the zig-zag incision. In 2001, Withey *et al*, decreased the angle and increased the length of these flaps to cover the joints fully. Nevertheless, these changes made the tips of the flaps more prone to necrosis.² Modification of these incisions to S-shape to lessen the chance of necrosis has been suggested by surgeons. However, if the angle of these flaps is too obtuse, the scar may become a straight line with growth leading to flexion contractures.⁵ Furthermore, debulking of the flaps and subcutaneous tissue has been practised by some authors to cover the wound without skin grafts.¹⁹

Niranjan *et al*, used a dorsal trilobed flap to create a new web and used a zig-zag flap for the coverage of fingers, leaving the fat between the flaps to dry out

without using a skin graft for its coverage.²⁰ Wounds healed in 2 weeks, which is comparable to our study.

Sherif used a dorsal metacarpal island flap without using a skin graft for neo web creation, as well as debulking/defatting of the digits.²¹ Later in 2001, Greuse and Coessens also voted for defatting fingers for tension-free wound closure without grafts.¹⁹ Since then, many other techniques that did not need skin grafts have been proposed. Most of these vary in the way dorsal skin has been utilized.

In 2017, Wang *et al*, used hexagonal flaps for web creation and zig-zag flaps without skin graft for finger closure.³ His patients were also off the dressing after two weeks. They, however, did not compare their results with the skin graft technique.

Sharma *et al*, closed the fingers primarily, leaving the 3-4 mm raw areas to heal by epithelialization like in our study.⁷ Their wounds, however, showed much early healing, i.e. within five days. This difference may be due to the difference in criteria of wound healing we set, ours being the time when the patient was completely off dressing.

A study was conducted by Withey *et al*, They compared two groups of syndactyly release, without skin graft and with a skin graft, like our study.² They showed a statistically significant difference in mean operative time between the two groups, i.e. 55 minutes without a skin graft and 81 minutes with a skin graft. This is comparable to the difference we have shown in our results.

Wang and Hutchinson published a study in 2019 in which they showed the operative time for graft less technique was significantly less than the technique in which skin graft was used.²²

There is no consensus on any single dorsal flap for neo web creation. Many authors have shown different dorsal flaps showing promising results for web creation without using a skin graft. However, most authors have used zig-zag flaps to cover adjacent finger areas with the raw area between the flaps left to heal. To the author's knowledge, there has been no study that compares the time at which physiotherapy was started in each group.

Few studies compared different types of release. Sullivan and Adkinson used dorsal meta-carpal advancement flap and skin graft techniques and presented a systematic review of their studies.²³ They concluded that skin grafts, when used, had high complication rates. Complications such as web creep, scarring,

higher revision rates, and issues associated with grafts and flaps were reported.

Ferarri and Werker studied syndactyly release with and without skin graft in 29 patients with a median age of 7.4 years.²⁴ They included patients of simple, complex, complicated, and acrosyndactyly. Their study was a retro-spective review. They did not find any significant difference when comparing the complications rate and observer-rated scar scores. The number of surgeries performed in the skin-grafted group was more, but both groups had the same patient-rated satisfaction rate.

Our study did not include the long-term results of the two treatment methods. Instead, it focuses on the immediate outcomes. Our study favours the method in which there is no need for graft for syndactyly release considering it takes a lot less time to perform this procedure, which decreases the tourniquet time. Patients are off the dressings early and do not have to worry about the result of the graft or the chances of graft loss, nor do they have to worry about the additional scar on the donor site. They can start using their hand effectively and efficiently much earlier with an early start of physiotherapy.

Conflict of Interest: None.

Authors' Contribution

PM: & RSA: Research, data collection, article writing, SH: & MRA: Study design, proof reading, MWUB: & RK: Conception of research topic, data collection, proof reading.

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