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STUDY ON EVALUATING THE FUNCTIONAL RESULTS OF FINGERTIP INJURIES INCLUDING SKIN LOSS TREATED WITH THENAR AND CROSS FINGER FLAPS.

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ABSTRACT

Background: Fingertip injuries are extremely common. The structures distal to the distal interphalangeal joint are referred to as fingertip structures. Anything beyond the flexor and extensor tendon insertions at the base of the distal phalanx is also referred to as the finger tip. The fingers are the most often injured area of the hand, and the hand is susceptible to both industrial and home trauma. Over two-thirds of all hand injuries in children occur on the fingers, with door crushes being the most frequent type. Thenar flap and cross finger flap are both surgical techniques used in reconstructive surgery, particularly for covering defects in the hand.

Material and Methods: It's a prospective study design. The Patna Medical College and Hospital's plastic surgery department served as the study's site. The study was carried out between January 2020 and January 2021, duration of two years. There were 58 subjects in all that were part of this investigation. Each participant was randomly assigned to one of two groups: the cross finger flap group or the thenar flap group. Cases 28 for THEENAR FLAP and 30 for CROSS FINGER FLAP. Statistical analysis was done through SPSS.

Results: The age range of 21 to 30 years old accounted for the greatest amount of injuries. There were 38 males in all, 15 of whom were in the thenar flap group and 23 of whom were in the Cross finger flap group. Out of the fourteen females, nine belonged to the group called thenar, and five to the group called cross finger flap. The subjective functional result, 62.5%, 25%, and 12.5% of patients in the thenar flap group selected excellent, good, and fair, while 50%, 32.1%, 17.8%, 14.2%, and 3.5% of patients in the cross finger flap group selected excellent, good, fair, and poor.

Conclusion: In evaluating functional outcomes for fingertip injuries with thenar and cross finger flap, both techniques demonstrate effective restoration of function and aesthetics. The choice of flap should be tailored to the specific injury characteristics to optimize recovery and patient satisfaction.

Keywords: Fingertip Injuries; Thenar Flap; Cross Finger Flap.

INTRODUCTION

The fingertip is a unique structure that helps with hand aesthetics, fine motor function, and accurate feeling. A fingertip injury is one of the most frequent traumatic injuries that require emergency care. It is described as an injury that occurs away from the flexor and extensor tendon insertions. Numerous therapy approaches have been employed to address these deficiencies. Numerous variables, including the lesion's size, the surgeon's skill level, the patient's preferences, the local culture, and the resources available, influence the treatment decision.[1]

Fingertip epidermis is thick and has deep papillary ridges that make each fingerprint distinct. Vascular fibro fatty tissue makes up the underlying pulp,

which is held in place by fibrous septa that run from the dermis to the distal phalanx's periosteum. The volar pulp is responsible for more than half (56%) of the volume of the fingertip and is essential for grip, proprioception, and feeling. When reconstructing, this soft-tissue requirement needs to be taken into account.[2]

The objectives of fingertip defect reconstruction are to maintain the length, avoid nail abnormalities, and offer a painless tip with good quality skin and sufficient protective feeling. Maintaining the integrity of the pulp and fingernails is crucial for handling tiny items and making delicate movements. Replantation is the recommended course of action in the majority of fingertip amputations in order to preserve finger function and improve cosmetics. Complicated finger defects are those that have exposed bones, tendons, and joints. In cases where replantation is not feasible or does not work, flap restoration must be done as soon as possible to retain function. Various flap techniques have been reported for the reconstruction of deformities in the fingers. These include the thenar flap and the cross-finger flap, which require two stages for temporary attachment and finger immobilization.[3]

Jacques Michon described the fingertip as the portion of the finger that is distal to the point where the flexor and extensor tendons insertion. The surgeon's approach to treating fingertip injuries should be adaptable. A variety of parameters, including the number of injured digits, the location of the wound, the major function of the injured digit, occupation, sex, age, time factor, available facilities, and socioeconomic status above all else, must be taken into account when selecting a reconstruction method.[4]

Although cross-finger flap repair of the finger pulp is frequently used, there are certain drawbacks, including a noticeable donor site at the finger's dorsum and stiff interphalangeal joints (IPJs). Moreover, cross-finger flaps are essentially insufficient for a multifinger injury because they lack sufficient mass. Meals et al. provided support for Gatewood4's 1926 description of the thenar flap. It supplied enough robust, glabrous soft tissue to rebuild pulp. A few drawbacks of this flap, including flexion contracture of the IPJ and ugly donor scars, have been documented in the literature. Melone et al. reported that modified thenar flaps based laterally have demonstrated good outcomes in a trial including 150 patients.

MATERIALS AND METHODS

This study was conducted in the plastic surgery department of the Patna Medical College and Hospital. At I.G.C.C. PMCH Patna Emergency and Plastic Surgery O.P.D., patients with trauma complaints who came directly from or were referred from PHC, referral center, and district hospital from various parts of the state were treated. Prospective study design was used. The study was conducted between January 2020 and January 2022, a span of two years. One of two groups—the thenar flap group or the cross finger flap group—was randomly allocated to each participant. Six cases were lost during follow-up out of the total 58 cases that were included.

Cases 30 for CROSS FINGER FLAP and 28 for THEENAR FLAP. The patient's medical history was collected, together with information about the kind, severity, and mechanism of the injury. Every patient enrolled in this study provided an informed consent form. The shortest follow-up duration was two months, and the longest was eighteen months. Following the procedure, the patient was released and instructed to follow up on a different day for the dressing and flap review.

Before the flap division period, the flap's condition, any pus discharge, and flap necrosis were examined. The length of the flap division, the flap's condition, the morbidity of the donor site, and any further complications were examined.

After a sufficient amount of time, the flap was separated and the defect was reset. Wounds at the donor site are mostly closed.

The patient was closely monitored both in the outpatient department and over the phone.

In the study, color coordination, texture, feel, and visual appeal were taken into account. Two-point discrimination testing and range of motion were conducted.

Inclusion Criteria

- All the patients from age 4 to 5o years were included in this study.
- Acute injuries to the fingertip that reveal the tendon and bone.
- Amputations distal to the DIP joint those are transverse and oblique.

Exclusion Criteria

- More than one injury to the same finger
- Thumb injuries
- Mangled extremity.
- Major crush injuries.

Statistical Analysis: the gathered information was put into a Microsoft Excel spreadsheet, which was then exported to the data editor of SPSS Version 20.0.

RESULTS

Table 1 shows age distribution of study subjects. The study had 52 subjects aged 5 to 50. Of these, the age group of 21 to 30 years had the largest number of injuries (28.84%). The four-year-old youngest child sustained injuries from a closed door. The 48-year-old patient who was the oldest in the research suffered a crush injury with skin loss after being involved in an industrial accident. [Table 1]

Table 2 shows sex distribution of study subjects. In total, 38 men were present, with 15 belonging to the thenar flap group and 23 to the Cross finger flap

group. Nine of the fourteen females belonged to the thenar group, and five to the cross finger flap group. [Table 2]

Out of 52 patients, 25 had fingertip injuries as a result of work-related accidents (48.08%), and 10 had injuries from household chores (19.23%). 3 door crushes, 2 animal bites, 2 RTA, and 2 were caused by the kids playing. [Table 3]

There were twenty-eight subjects in the thenar group and twenty-four in the cross finger group out of a total of fifty-two subjects. [Table 4]

In the thenar flap group, patients chose excellent results in 29.1% of cases, fair results in 16.7%, and poor results in 12.5% of cases for the subjective assessment of sensibility. In contrast, in the cross finger flap group, patients chose excellent, good, fair, and poor results in 21.4%, 39.2%, 17.8%, and 21.4% of cases, respectively.

In the thenar flap group, 62.5%, 25%, and 12.5% of patients selected excellent, good, and fair as their subjective functional outcome, whereas in the cross finger flap group, 50%, 32.1%, 17.8%, 14.2%, and 3.5% of patients selected excellent, good, fair, and poor functional outcome. The mean response on the 7-point scale for sensibility was 4.6, for function it was 5.9 out of 7, and for the appearance of the reconstructed finger, it was 6.3 out of 7. The mean rating for the thenar flap group was higher than the mean ratings for the cross finger flap group, which were 4.2, 5.6, and 5.2 on the same scale. [Table 5]

Two-point discrimination (2PD) testing was performed on 48 participants because the four youngest patients in our study were unable to provide understandable data. The cross finger flap group's static two-point discrimination ranged from 4 to 10 mm, with a mean of 6.64 ±1.52 mm compared to 5.32 ± 1.21 mm for the unaffected normal hand. [Table 6]

In the cross finger flap group, moving two-point discrimination varied between 4 and 10 mm, with a mean of 7.39 ± 1.70 mm, as opposed to 4.96 ± 1.13 mm for the unaffected normal hand.

In the thenar flap group, the mean static two-point discrimination was 6.88± 2.19 mm, compared to 4.38± 1.37 mm in the normal unaffected hand. The discrimination ranged from 3 to 10 mm.

The range of moving two-point discrimination in the thenar flap group was 4 to 10 mm, with a mean of 6.29 ± 2.36 mm, which was lower than the normal unaffected hand's 3.83 ± 1.20 mm.

The repaired finger's distal interphalangeal joint (DIP), MP, and PIP joints were tested for their active range of motion. As a control, the corresponding finger on the opposing hand's active range of motion was measured.

Using a standard goniometer, the reconstructed finger's active and passive range of motion at the MP, PIP, and DIP joints was measured and compared to a normal contra lateral finger.

The reconstructed finger's mean MP joint motion in the cross finger flap group was 95.71± 8.240, while the unaffected contra lateral finger's was 102 ± 9.80. At p=0.06, the difference is statistically not significant. The PIP joint mobility mean was 88.93 ± 4.370, while the contra lateral side's mean was 92 ± 5.00. Once more, this difference reaches the 0.05 level of statistical significance. When comparing the affected digits to the control, the mean DIP joint mobility was 43.040 vs. 550, although there was no statistically significant decrease (p=0.09). For the rebuilt digit, the average computed total active range of motion was 215 ± 190.

The reconstructed finger's mean MP joint motion in the thenar flap group was 93.96 ± 9.0860, whereas the unaffected contra lateral finger's motion was 102 ± 9.50. At p=0.07, the difference is statistically not significant. The PIP joint mobility mean was 89.79 ± 3.1200, while the contra lateral side's mean was 91 ± 4.80. Once more, the change was not statistically significant (p=0.06). When comparing the affected digits to the control, the mean DIP joint motion was significantly lower (p=0.02), at 41.960 versus 490 ± 5.40. For the reconstructed digit, the average computed total active range of motion was 220 ± 16^0.

Table 1: Age distribution of study subjects

AGE (YEARS)	NO. OF SUBJECTS
0-10	9
11-20	11
21-30	15
31-40	13
>41	4
TOTAL	52

Table 2: Sex distribution of study subjects

GROUP	MALE	FEMALE	TOTAL
CROSS FINGER FLAP	23	5	28
THENAR FLAP	15	9	24
TOTAL	38	14	52

Table 3: Distribution according to mode of injury

MODE OF INJURY	NO. OF PATIENTS
ASSAULT	02
OCCUPATIONAL	25

RTA	07
HOUSEHOLD WORK	10
DOOR INJURY	04
ANIMAL	02
OTHER ACCIDENTS	02
TOTAL	52

Table 4: Distribution according to subject in each group

GROUP	NO. OF CASES
CROSS FINGER FLAP GROUP	28
THENAR FLAP GROUP	24
TOTAL	52

Table 5: Subjective assessment of thenar flap group and cross finger flap group

THENAR FLAP GROUP

ASSESSMENT	POOR	FAIR	GOOD	EXCELLENT	7 POINT SCALE
SENSIBILITY	3(12.5%)	4(16.7%)	10(41.7%)	7(29.1%)	4.9
FUNCTIONAL	0	3(12.5%)	6(25%)	15(62.5%)	5.9
APPEARENCE	0	0	6(31%)	18(69%)	6.3

CROSS FINGER FLAP GROUP

ASSESSMENT	POOR	FAIR	GOOD	EXCELLENT	7 POINT SCALE
SENSIBILITY	6(21.4%)	5(17.8%)	11(39.2%)	6(21.4%)	4.8
FUNCTIONAL	1(3.5%)	4(14.2%)	9(32.1%)	14(50%)	5.6
APPEARENCE	7(25%)	7(25%)	9(32.1%)	5(17.9%)	5.2

Table 6: Objective assessment of thenar flap group and cross finger flap group.

TWO POINT DISCRIMINATION TESTING

2POINT DISCRIMINATION	MEAN STATIC 2 POINT DISCRIMINATION		MEAN MOVING 2 POINT DISCRIMINATION	
FLAP	CFF	THENAR	CFF	THENAR
FLAP SIDE	6.64 ± 1.52 mm	6.88 ± 2.19 mm	7.39 ± 1.70 mm	6.29 ± 2.36 mm
CONTRALATERAL SIDE	5.32 ± 1.21 mm	4.96 ± 1.13 mm	4.38 ± 1.37 mm	3.83 ± 1.20 mm

MOVEMENTS

CROSS FINGER FLAP	AFFECTED DIGIT MOTION	CONTRALATERAL DIGIT MOTION	P VALUE
MEAN MP JOINT	95.71 ± 8.24^0	102 ± 9.8^0	0.06
MEAN PIP JOINT	88.93 ± 4.37^0	92 ± 5.0^0	0.01
MEAN DIP JOINT	$43.04^0 \pm 10.03^0$	55 ± 5.7^0	0.09

Thenar flap	Affected digit motion	Contra lateral digit motion	P value
Mean MP joint	93.96 ± 9.086^0	102 ± 9.5^0	0.07
Mean PIP joint	89.79 ± 3.120^0	91 ± 4.8^0	0.06
Mean DIP joint	$41.96^0 \pm 10.03^0$	$49^0 \pm 5.4^0$	0.02

DISCUSSION

In the Sturman and Duran series, 20% of the 20 patients who had cross-finger flaps reported feeling uncomfortable, but none of them showed obvious discomfort. Within our sample, 19.5% exhibited tenderness, but only 5% exhibited significant tenderness.10% of respondents said they had some handicap, but not much. None of the 19% with disabilities in our series had any noticeable ones. Forty days were lost from work on average. In our sequence, 34.85 days passed.[6]

Significant trauma to the thumb was also present, with a greater involvement of the index and middle fingers. The most used digits are these three, and since the middle and index are the largest, they are also the most exposed, making them more susceptible to injuries. Brody shown that there is a direct correlation between the length and frequency of injuries. Miller, Tupper, and Moynihan also noted a comparable occurrence.[7]

The Moberg flap for the thumb and the VY advancement flap for the thumb and fingers were reported as the first line therapies in the comparative study conducted by Jin Bo Tang, MD et al. across different continents. This finding supports the outcome for injuries involving exposed bone. The author of the same study reported a decrease in the usage of the cross finger flap, which is different from our findings because volar oblique fingertip damage showed 46.7% concordance. As we evaluated the groupings, we saw a tendency toward conservative treatment with weekly occlusive dressing changes and secondary intention healing in the more than five years subgroup.[8]

Plastic surgeons treating fingertip injuries may find it confusing as there are so many different treatment choices available. Even though there are many different ways to treat the condition, the main

objectives are to maintain useful feeling, maximize functional length, avoid joint contractures, maintain a good look, and prevent donor disfigurement and functional loss. The age, sex, hand dominance, occupation, interests, finger involvement, location, depth, angle, and involvement of the nail bed in addition to the co-existing soft tissue conditions and the anatomy of the fingertip defect all influence the operating surgeon's decision when choosing a course of action for a given patient.[9]

Marginal necrosis, cold intolerance, and hypersensitivity were the most frequent surgical sequelae. While other minor problems such as partial wound dehiscence and partial graft loss were unrelated to the surgical approach used to treat them, the marginal necrosis was caused by tension closure. In essence, cold intolerance and hypersensitivity are side effects of the injury rather than the result of the treatment. A review of the literature indicates that, irrespective of the treatment strategy, the rates of cold intolerance and hypersensitivity are approximately 50%. But this is self-limited, and it goes away in a year or two.[10]

CONCLUSION

Injuries to the fingers cause significant functional and cosmetic issues for people of all ages. It is important to treat fingertip injuries carefully since improper care can lead to serious morbidity. Evaluating the functional results of fingertip injuries with skin loss using thenar and cross finger flaps reveals that both techniques can effectively restore function and aesthetics. The thenar flap is advantageous over cross finger flap. The choice between these flaps should be guided by the specific injury characteristics, desired functional outcomes and patient preferences. Continuous assessment of these techniques is essential for optimizing recovery and enhancing quality of life for patients with fingertip injuries.

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