

condition that may alter performance of tests to be done for hand function assessment. 6) Patients cooperative & willing for surgery. 7) Full ROM of proximal joints (wrist and elbow).

Exclusion criteria for study groups:

- 1) Less than 5 years of age.
- 2) Thumb amputations
- 3) Inability to understand commands.
- 4) Presence of pain, any neurological deficit or any musculoskeletal conditions (cicatrization, nerve involvement, other deformities, other joint problems,) that impairs hand function.
- 5) Unwilling to take part in study
- 6) Restriction of ROM of proximal joints.

After taking the relevant history, all patients fulfilling inclusion criteria for study were examined clinically at pretreatment, 30 days post intervention and 90 days post intervention with special emphasis on Length of finger Grip strengths Pinch strengths Minnesota manual dexterity test for Turning Minnesota manual dexterity test for Placing. **METHODOLOGY** A total selected sample size of 7 patients based on their baseline characteristics (age, hand anthropometry, tip pinch , gross grip, Minnesota manual dexterity) were operated cases for digital lengthening were performed.

The following parameters were calculated: Range of Motion: Measured using a goniometer. Isometric Finger Pinch: Performed using the B & L Pinch Gauge . **TIP PINCH STRENGTH (PINCH METER)** Isometric Power Grip: Performed using the JAMAR Hand Dynamometer. **GROSS GRIP STRENGTH (JAMAR DYNAMOMETER)**

A more general classification, with the following categories: three pinch grips (tip pinch, lateral or key pinch, and tripod or chuck pinch) and three modes of gripping: (power grip, spherical or flexion grip, and extension grip in intrinsic plus position). Minnesota Turning Time for 3 Trials. Minnesota Placing Time for 3 Trials

Surgical Management :preoperative Evaluation And Planning -

The patients who are willing for surgery were evaluated for it with complete haemogram, erythrocyte sedimentation rate (ESR), Urine routine & microscopic, bleeding time (BT), clotting time (CT), HIV, HBsAg, Digital X ray, and any special investigation deemed necessary by the anaesthetist.

Preoperative counselling (the children and their parents were given detailed information about the procedure) and occupational therapy had been given as appropriate. Planning of surgery, type and size of distractor to be applied, the length to be achieved, etc. was decided after consultation with the surgeons.

INTRAOPERATIVE PRE OP PHOTO AND X RAY OF SYNDACTYLY



Figure 5.8 Intra Op Photo Of Digital Lengthening

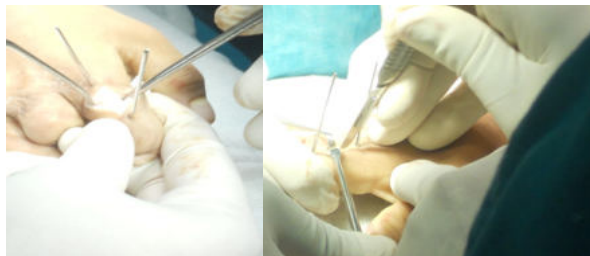


Figure 5.9 Post Op Photo & X Ray

During surgery, general anaesthesia with a pneumatic tourniquet was used.

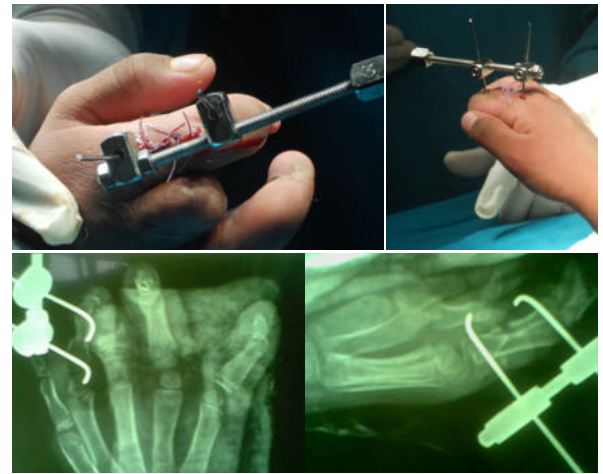
Surgical technique. The operation is performed through a longitudinal dorsoradial skin incision over the metacarpal. The periosteum is incised longitudinally and carefully elevated. Care was taken not to injure the periosteum.

Two pairs of threaded 2.5 mm pins are inserted at right angles to the bone. If the base of the phalanx is present when the most distal pin is placed in it to prevent flexion of the metacarpophalangeal joint during distraction. When the metacarpal is short, the most proximal pin is placed in the trapezium. An osteotomy is performed, using an oscillating saw, and a unilateral distractor is mounted on the pins. The osteotomy is immediately distracted by 0.5 cm to ensure proper movement of the bone fragments and then closed again to bring the bone ends back into contact . Despite the simplicity of the concept, successful distraction-lengthening of digital rays depends on careful attention to several details^(29,30,31,32,33).

One is adequate stabilisation of the bone fragments to be distracted. The distal fragment is the main problem because it always tends to be unstable.

Adequate stabilisation of the distal fragment may have to be accomplished by introduction of two parallel Kirschner wires, to transmit the pulling forces to the rigid distraction apparatus and to prevent any rotational deformity. The proximal fragment usually is stable when a metacarpal is undergoing distraction, because of the adjacent supporting bones and the limited mobility of the carpometacarpal joint. Adequate fixation of the proximal fragment can be accomplished in most cases by use of a single Kirschner wire, engaging the surrounding bones as needed. If a proximal phalanx is to be lengthened, its proximal fragment is best stabilised by two Kirschner wires.

A precise axial line of distraction is achieved by using one or two transverse connecting plates to the distraction rods. The apparatus is less constrained, however, if the connecting plates are not used and then increased distraction on one of the two rods can divert the distal fragment, if needed, to one side; the manoeuvre may be useful in transposition of a distracted distal fragment to the adjacent metacarpal or phalanx. If distraction is being applied to a very small fragment, one should not hesitate to stabilise it by temporary transfixion of the neighbouring joint, metacarpal , or phalanx. After application of the external fixator, the periosteum and skin were closed.



RESULTS

A total of 7 partial hand amputees who attended the AIIPMR OPD were evaluated for their residual hand functions like sensation, cylindrical grasp, gross grasp strength, pinch strength and minnesota manual dexterity tests of turning and placing. All patients had complete follow up upto 3 months In the study sample it was found that traumatic amputation due to crush injury was the most common cause of partial hand amputation with more prevalence in adult males aged more than 17 years . The most common cause for crush injury was heavy machinery at work sites apart from road traffic accidents cases. The most common hand injured was the dominant right hand.

Congenital causes were the 2nd most common causes for partial hands . Cases studied included congenital right hand hypoplasia with thumb sparing , congenital right hand syndactyly with thumb sparing.

A total of 7 patients had been operated for digital lengthening with a total of 12 digits.

At day 1 presentation the patients had impaired sensations, loss of digits, swelling, pain and stiffness due to associated fractures, deformity and contractures which combinedly accounted for the loss of hand functions at presentation. Pain relief medications and intensive occupational therapy in the form of desensitisation, massaging, fluidotherapy and gentle ROM mobilisation exercises were started. After swelling subsides, measurements of residual hand anthropometry were taken and cosmetic gloves with fillers were prescribed. Residual hand functions were tested.

After 30 days when therapy helped them regain their residual hand functions with the relief of swelling, pain and stiffness again, hand functions were tested. Follow up was done till 90 days.

RESULTS FOR DIGITAL DISTRACTION LENGTHENING HAND FUNCTIONS

A total selected sample size of 7 patients based on their baseline characteristics (age, hand anthropometry, tip pinch, gross grip, Minnesota manual dexterity)

HAND FUNCTION	NORMATIVE	DAY 1	DAY 30	DAY 90
Gross Grip(kg)	54.794	10	18	27
Tip Pinch(kg)	8.3	5.5714	7.5	9.142857
MMDT Minnesota Turning Time (seconds)	146	222.7143	211.857	211.857
MMDT Minnesota Placing Time (seconds)	146	276	266	256.576

The procedure was performed on those patients who had partially preserved proximal or middle or distal phalanx of sufficient length that would allow the fixation of distractor and osteotomy.

A total of 7 patients underwent digital lengthening of 12 digits in total. Each patient underwent single stage surgery involving one or two or three digits at one time only.

Index 2nd finger lengthening:
 Number of index finger lengthened: 6
 Bone lengthened: proximal phalanx
 Mean length achieved: 2 cm
 3rd finger lengthening:
 Number of 3rd finger lengthened: 5
 Bone lengthened: proximal phalanx
 Mean length achieved: 1.5 cm
 Ring 4th finger lengthening:
 Number of ring finger lengthened: 1
 Bone lengthened: proximal phalanx
 Mean length achieved: 2 cm

COMPLICATIONS-

No pin-tract infections.
 In one of these patients, a new cosmetic complaint developed due to the scar tissue forming at the pin site.
 No delayed union, nonunion or infection occurred in any of the patients.
 No distraction-related sensory defects or joint contractures were noted.
 No fixator problems occurred, other than the bending of the Kirshner wires in one patient,
 No instances of failure.

CONCLUSION

A total of 7 patients had been operated for digital distraction lengthening with a total of 12 digits. Each patient underwent single stage surgery involving one or two or three digits at one time only. All showed improvement in hand functions initially till 90 days of follow up. New bone formation in patients is excellent.

No significant complications were noted.

- Digital lengthening significantly improved gross grip strength.
- Digital lengthening significantly improved tip pinch (thumb & index) strength.
- Digital lengthening nonsignificantly improved Minnesota turning time.
- Digital lengthening nonsignificantly improved Minnesota placing time.
- Digital lengthening improves cylindrical grasp span.

OBSERVATIONS IN THE STUDY:

- Multiple digit amputees who were moderate to severely disabled who had undergone surgical digital lengthening improved their gross grip strength and tip pinch strength and non significantly improved their Minnesota turning and placing time and this improvement is much more than the patients in the group of prescribed cosmetic gloves with fillers and non interventional group. New bone formation in patients is excellent, and therefore single-stage metacarpal lengthening by distraction osteogenesis is a good method of digit reconstruction in digit loss amputees. Hence digital lengthening is a safe and effective treatment option for patients with multiple digital amputees who have lost significant hand functions.
- Single digit amputees usually adapted themselves to their mild to moderate disability and were more interested in conservative (cosmetic gloves, gloves with fillers) or non-interventional management rather than surgical management. The hand functions of patients who underwent conservative line of management improved much more compared to no interventions.
- Partial hand amputation is more prevalent in adult males due to traumatic crush injury to the dominant right hand in heavy machinery at work site, apart from road traffic accidents the 2nd leading cause of traumatic hand amputation

LIMITATIONS OF STUDY:

- Small sample size of 7 patients.
- Limited literature on the Indian population.

RECOMMENDATIONS

- 11.1) Digital amputations should not be left unattended.
- 11.2) Single or multi digit amputees with moderate to severely affected hand functions will benefit with reconstructive digital lengthening procedure.
- 11.3) Joshi's external stabilisation system is a safe and effective method for digital lengthening by slow distraction for achieving 2 cm phalangeal bone length.

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