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Time of return back to work and complications following cross-finger flaps in industrial workers: Comparison between immediate post operative mobilization versus immobilization until flap division

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ABSTRACT

INTRODUCTION: Previous authors have immobilized the injured hand or digits following cross finger flaps.
PATIENTS AND METHODS: About 3 years ago, the author adopted a protocol of immediate postoperative active and passive mobilization (without a splint) following cross finger flap surgery in industrial workers. The current study is a retrospective audit comparing postoperative complications and time of return back to work following cross-finger flaps in two groups of injured industrial workers: Group I (n = 12) had immediate postoperative mobilization; and Group II (n = 12) had immobilization till the time of flap division.
RESULTS: The complication rate was similar in both groups. However, patients in Group I returned to work earlier than those in group II and the difference was statistically significant.
CONCLUSION: Immediate postoperative mobilization following cross-finger flaps in industrial workers does not increase the risk of complications and has the advantage of early return to work.

1. Introduction

Cross-finger flaps are commonly used for reconstruction of complex finger defects. There are three main types of cross-finger flaps. The "classic" flap is harvested from the dorsal aspect of the donor finger to cover a volar defect in the recipient finger [1,2]. In "de-epithelialized" flaps, a flap from the dorsal aspect of the donor finger is de-epithelialized first and is then turned over to cover a dorsal defect in an adjacent finger [3,4]. Cross-finger flaps can also be raised as "adipo-fascial" flaps to cover dorsal or volar defects of adjacent fingers [5]. Regardless of the technique, all previous authors immobilized the hand or the operated digits until flap division. Complete immobilization was employed for 10 days [6,7], 14 days [1,2,8,9] 18 days [10,11], and 21 days [12–17]. One series employed early partial mobilization (the exact details of this partial mobilization were not stated) until flap division at 24 days, at which time full mobilization was started [18].

The author has been the main hand surgeon at an industrial hospital for many years. About 3 years ago, the author adopted a protocol of immediate postoperative active and passive mobilization (without a splint) following cross-finger flap surgery. The following retrospective study compares postoperative complications, the need to refer to physiotherapy, and time of return back to work following cross-finger flaps in workers who had immediate postoperative mobilization versus those who had immobilization until the time of flap division. The case series is compliant with the PROCESS Guidelines [19].

2. Patients and methods

Over the last 3 years, (June 2014–May 2017), twelve consecutive industrial workers (Group I, n = 12) with complex finger defects were treated with cross-finger flaps and immediate postoperative active and passive mobilization (without any splints). One patient had concurrent extensor tendon loss over the middle phalanx and required a tendon graft and k-wire joint fixation across the distal interphalangeal joint. The dressing for this group was a single layer of gauze (applied over the wound only and not circumferentially around the fingers) and loose tape to allow immediate postoperative mobilization (Fig. 1).

We then matched this group with another twelve patients (Group II, n = 12) who had cross-finger flaps and postoperative immobilization until flap division. Matching was done with regards to the site of defect and the donor finger. We also included one matched patient who required extensor tendon reconstruction and k-wire fixation across the distal interphalangeal joint. Matched patients of Group II were operated upon between January 2006 and May 2014.

Systemic co-morbidities were diabetes mellitus (one patient in each group) and hypertension (one patient in each group). These co-morbidities were seen in patients over 50 years of age. In all

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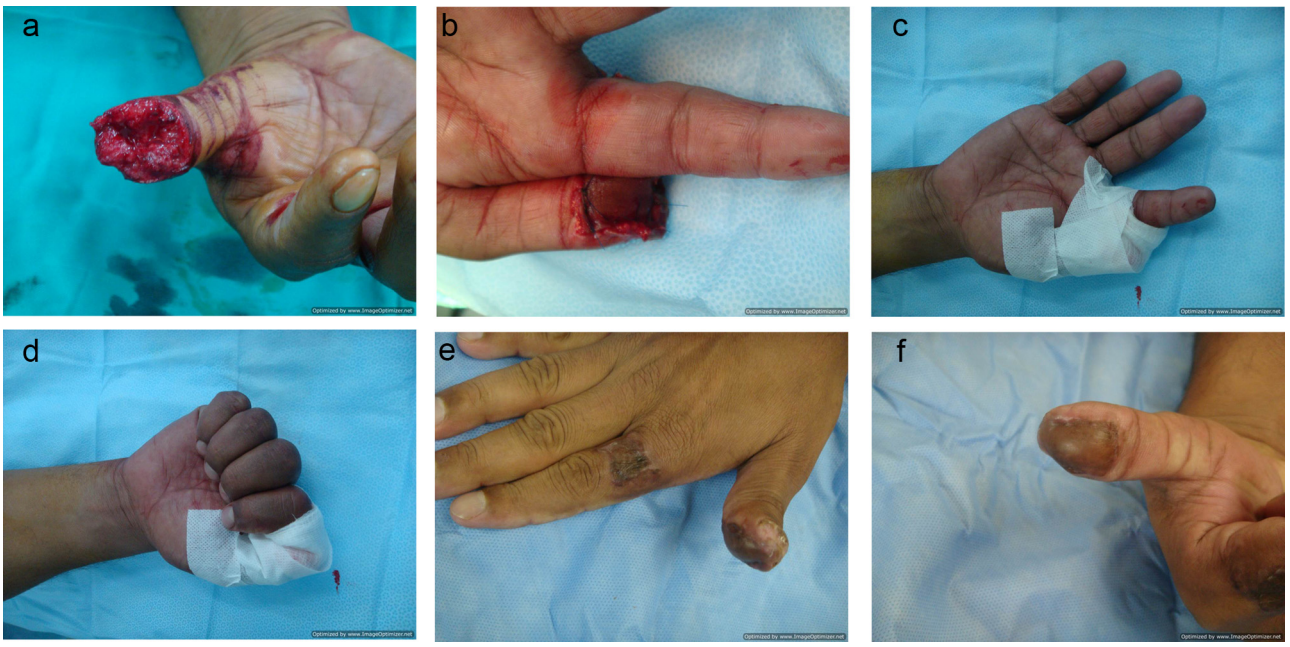

Fig. 1. Immediate postoperative mobilization following a classic flap from the index finger to a thumb pulp defect.
a) The defect
b) The flap
c&d) Mobilization at the first postoperative day. Note the simple dressing without any splints
e&f) The healed wounds

patient, the blood sugar and blood pressure were well-controlled on medications.

In both groups, surgery was performed by the author under local anesthesia or brachial plexus block within 24 h of the injury. Suturing of the flaps was done using 3/0 sutures. Grafting of the donor site was done in classic and de-epithelialized flaps; and grafting of the flap was also required in de-epithelialized flaps. All patients had split-thickness skin grafts. Flap division was done between 17 and 19 days under local anesthesia. The k-wire was removed at 5 weeks in the two patients with extensor tendon reconstruction.

All patients received prophylactic antibiotics: a cephalosporin, one dose before surgery and two doses after surgery. Intravenous paracetamol was used for pain control after surgery; and the use of narcotics was not required in any of the patients. All patients had weekly follow-up in the clinic after the discharge from the hospital.

One of the main determinants of time of return to work is the advice that is given to the patient by the surgeon. The same advice was given to both patient groups. Patients were encouraged to go back to work as soon as they felt they were ready to do so. All patients in our series were covered by compensation. The compensation file was closed by the surgeon and the patient returned to work once full or near-full range of motion was reached. As per the regulations of the "occupational Hazard Group" in our city, "file closure" means that the management of the industrial injury is completed; and the surgeon writes a final medical report detailing any permanent disability and the ability to go back to work. If any injury-related problems arise after returning to work, the worker is allowed to re-open his compensation file for re-assessment and treatment. It is also important to note that regulations and compensations of work-related hand injuries in our country did not change over the years of our study.

The following data were collected retrospectively for both groups: age, sex, site of defect, donor finger, concurrent injuries, type of flap used, time of flap division, postoperative complications (bleeding, infection, flap dehiscence, percentage of skin graft loss, complex regional pain syndrome), and the need for referring the patient to the physiotherapy department. Furthermore, the time of return back to work and the range of motion of the donor and recipient fingers at final follow-up were recorded.

Data was analyzed by using Statistical Package for Social Studies (SPSS 22; IBM Corp., New York, NY, USA). Continuous variables were expressed as mean ± standard deviation and categorical variables

Table 1
Data of the two groups of patients in the current study. Group 1 (n = 12) underwent a cross finger flap followed by immediate postoperative mobilization. Group II (n = 12) underwent a cross finger flap followed by postoperative immobilization until flap division.

Parameter	Group I (n = 12)	Group II (n = 12)
Age	21–60 years (mean, 42 years; median, 43 years)	20–58 years (mean, 41 years; median, 42 years)
Sex	All males	All males
Site of defect/donor finger	4 thumb defects (index finger as the donor finger) 2 index finger defects (middle finger as the donor finger) 2 middle finger defects (index finger as the donor finger) 2 ring finger defects (middle finger as the donor finger) 2 little finger defect (ring finger as the donor finger)	Defects/donor fingers were matched to Group I.
Concurrent injuries	One patient with a little finger defect had concurrent loss of the extensor tendon in Zone 2	One matched patient was included in Group II with a little finger defect and concurrent loss of the extensor tendon in zone 2
Type of flap	6 classic flaps, 6 de-epithelialized flaps	6 classic flaps, 6 de-epithelialized flaps

Table 2
Postoperative complications in both study groups.

Complication	Group I (n = 12)	Group II (n = 12)
Bleeding	0	0
Infection	0	1 (superficial pin tract infection)
Flap dehiscence	0	0
Skin graft loss		
a) Excellent graft-take defined as patients not requiring re-grafting	12	12
b) significant graft loss requiring re-grafting	0	0
Complex regional pain syndrome	0	0

Table 3
Referral to physiotherapy, time of return to work and range of motion in both study groups.

Parameter	Group I (n = 12)	Group II (n = 12)	P value
Number of patients referred to physiotherapy	3	12	P < 0.001
Time of return back to work	4 patients at 4 weeks 7 patients at 5 weeks 1 patient at 6 weeks For the entire group: 4.75 weeks ± 0.62	1 patient at 4 weeks 3 patients at 5 weeks 3 patients at 6 weeks 5 patients at 7 weeks For the entire group: 6.00 weeks ± 1.04	P = 0.002
Range of motion of the donor and recipient digits at final follow-up	10 patients: full range of motion 1 patient had minor (10°) flexion contracture of the PIP joint of the recipient finger[a] 1 patient had significant stiffness of the DIP joint of the recipient little finger (0–30° of motion). The same patient had extensor tendon reconstruction with K-wire fixation of the DIP joint.	9 patients: full range of motion 2 patients had minor (10° and 15°) flexion contracture of the PIP joint of the recipient fingers[a] 1 patient had significant stiffness of the DIP joint of the recipient little finger (0–20° of motion). The same patient had extensor tendon reconstruction with K-wire fixation of the DIP joint.	P > 0.05

[a] All flexion contractures were due to flap surgery since contractures were not present prior to injury.

were expressed as percentages. The *t*-test was used for continuous variables and fisher's exact test was used for categorical variables. A p-value <0.05 was considered statistically significant.

3. Results

The demographic data of the two groups are shown in Table 1. Age, sex, site of defects, donor fingers, concurrent injuries, type of flap, and time of flap division were similar in both groups. This was expected because of the matching done prior to data collection.

Postoperative complications are shown in Table 2. The patient in Group II with the k-wire had a superficial pin-tract infection which responded to oral antibiotics. All patients in both groups had excellent skin graft take and non-required re-grafting. None of the patient had bleeding or flap dehiscence.

The mobilization regimen prior to flap division in Group I was done at home and instructions were given by the surgeon. Patients were instructed to perform active mobilization and then complete the range of motion passively using the contralateral hand. Following flap division, only 25% of patients of group I were referred to physiotherapy because of significant residual stiffness. In contrast, all patients in Group II were noted to have significant stiffness after flap division and hence 100% of patients in this group were referred to physiotherapy. The difference between the two groups regarding the need to refer to physiotherapy was statistically significant (P < 0.001) (Table 3). Furthermore, Group I patients went back to work earlier than patients of group II; and the difference between the two group was also significant (P = 0.002) (Table 3). It is important to note that all patients returned back to their original jobs with complete independence and no job modifications. Most patients in both groups obtained full range of motion of the donor and recipient fingers with no significant difference between the two groups (P > 0.05) (Table 3).

Two illustrative examples from Group I are shown in Figs. 1 and 2; and a video of the same patient in Fig. 2 is also provided to show the range of motion of the fingers just prior to flap division.

4. Discussion

Our results demonstrate that immediate postoperative mobilization following cross-finger flaps in industrial workers is safe and has the advantage of early return back to work. The main reason for that is probably the early regain of range of motion with immediate postoperative mobilization (see video).

Cross-finger flap dehiscence is very rare, although it has been reported in children [3]. Note should be given that all of our patients were adults and no dehiscence was seen despite the early mobilization. Skin graft take was also excellent in our series despite the immediate mobilization. There was no significant difference in the final range of motion between the two groups in our series (see Table 3). However, immobilization following cross-finger flaps in the elderly may be associated with permanent stiffness of the proximal interphalangeal joint [3].

The complications of cross-finger flap surgery were reported by Koch et al. [20] in a series of 23 patients. The mobilization protocol was not mentioned in the Methods, but the authors mentioned in their Discussion that the lack of immediate postoperative mobilization was the main reason for the high rate of mild stiffness (seen in 68% of patients) in their series. In another series of 23 patients with job-related injuries, Kappel and Burech [21] immobilized the hand postoperatively for 11–14 days at which time the flap was divided. The authors sent patients to the physiotherapy department after flap division. At final follow-up, mild stiffness was noted in only 17% of patients (all those with permanent stiffness were older than 50 years); and the low rate of stiffness was attributed to early flap division. Lost work time in that series averaged 67 days [21]. In a third series, Kleinert et al. [22] reported on 56 patients who underwent cross-finger flap surgery with early flap division (12-14 days) and mobilization following flap division. The authors divided their patients into three groups according to age: Group I, 1–12 years; Group II, 13–39 years; ang Group III, 40–67 years of age. The authors did not provide the exact ranges of motion but stated that "satisfactory" range of motion was obtained in 100% of patients in Group I, 88% in Group II. And 90% in Group III [22]. In our series, all three

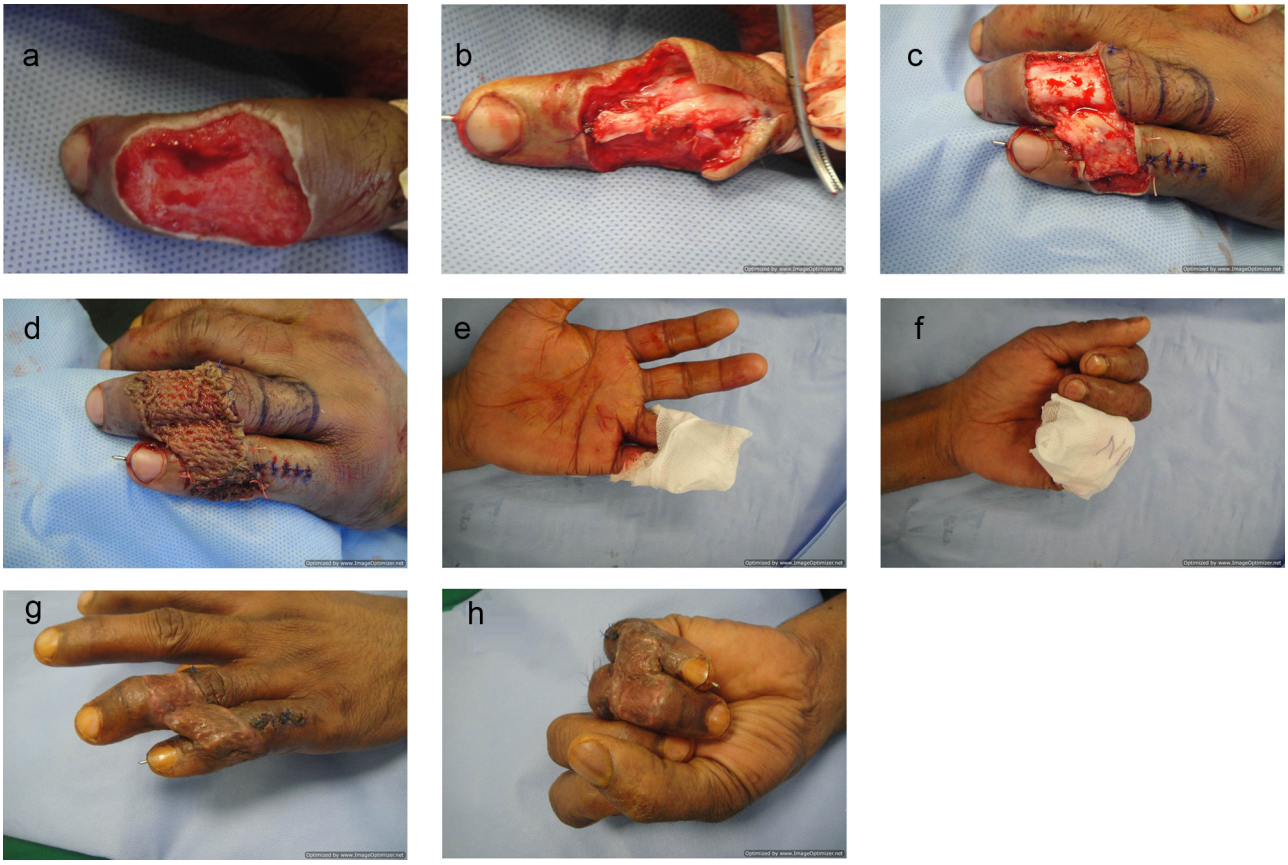

Fig. 2. Immediate postoperative mobilization following a de-epithelialized flap in a patient. who also required primary extensor tendon reconstruction.
a) The defect. Note the lost extensor tendon over zone 2.
b) Palmaris longus tendon graft.
c) The flap in place.
d) The skin graft in place.
e & f) Mobilization at the first postoperative day. Note the light dressing.
g & h) Range of motion at 17 days just prior to flap division. The mallet deformity in the donor ring finger is an old untreated injury.
Video: Range of motion at 17 days just prior to flap division.

patients who had permanent flexion contractures of the proximal interphalangeal joints were older than 50 years of age.

Several authors recommended the use of full-thickness skin grafts to cover the donor finger defect in order to obtain a good cosmetic result [21,22]. Koch et al. [20] used both split- and full-thickness skin grafts in their series and documented better cosmetic results in the group of patients who had full-thickness grafts. In our series, split-thickness grafts were used in all patients. The rationale for using split-thickness rather than full-thickness grafts was the expected higher graft- take in the former. Our chart review had no data on the cosmetic outcome or patient satisfaction scores.

The main weakness of our study is the small number of subjects. Despite the small number, statistical significance was reached between the two groups with regard to the need to refer to physiotherapy and the time to return back to work (Table 3). Strengths of the study included the matching between the two groups and the fact that all patients were operated upon by the same surgeon at a single industrial hospital setting.

5. Conclusion

Immediate postoperative mobilization following cross-finger flaps in industrial workers does not increase the risk of complications and has the advantage of early return to work.

Conflict of interest

There is no conflict of interest.

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Ethical approval

The study was approved by the Research Committee of National Hospital (Riyadh Care) Riyadh, Saudi Arabia.

Consent

Written informed consent was obtained from the patients for publication. A copy of the written consent is available for review by the Editor-In-Chief of this journal on request.

Author's contributions

The author performed the surgery, collected the data, did the literature review, and wrote the manuscript.

Guarantor

M M Al-Qattan.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.ijscr.2017.11.048.

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