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Long-term functional, subjective and psychological results after single digit replantation

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ABSTRACT

Objective: The aim of this study was to analyse the long-term functional, subjective, and psychological results after single-digit replantation.

Methods: Thirty cases of digital replantation (14 thumbs, 12 index fingers, 2 middle fingers, 1 ring finger, and 1 little finger) in 30 patients (7 females and 23 males) with a mean age of 44.2 years (20–65 years) were evaluated at the end of a mean follow-up time of 36 months (19–50 months). The active range of motion of joints, grip and pinch strength, cutaneous sensibility, upper-extremity functioning, and subjective satisfaction were determined using the Disability of Arm, Shoulder, and Hand (DASH) questionnaire and the Michigan Hand Outcomes questionnaire (MHQ). Psychological sequelae, including depression, anxiety, and posttraumatic stress disorder (PTSD), were assessed. A correlation analysis among variables was also performed.

Results: The mean score for the DASH questionnaire was 6.6 (range: 0–39.2). The symptom of cold intolerance occurred in 53% of the patients. Two patients were diagnosed with depression, and only one patient exhibited PTSD. The DASH score had a good statistical correlation with total grip strength, pinch grip strength, and static two-point discrimination (S-2PD) ($P < 0.05$). Several aspects of the MHQ were also statistically relevant to some or all of the three objective results. Furthermore, the grip strength showed significant correlation with DASH and most aspects of the MHQ in multivariate logistic regression analysis ($P < 0.05$).

Conclusion: Total grip strength is the most important factor positively related to subjective outcomes. The incidence rates of psychological symptoms after digit replantation are very low at long-term follow-up. Level of evidence: Level IV, therapeutic study

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Introduction

The focus of replantation surgery is survival during the early period. The functional recovery of the hand after the replantation of one or more digits has seen increasing attention with the increase in survival rate.¹ However, several discrepancies can be observed between subjective satisfaction and objective results, including the

range of motion of digits, sense perception, and power of the hand. To date, a rigorous and comprehensive evaluation system of the functional outcomes of replantation has not been applied and accepted widely² because many confounding variables affect the comparison of functional outcomes, such as the mechanism of injury (guillotine, crush, and avulsion), types of amputation (total or partial), different injured digits or multiple-digit amputation (thumb or index, middle, ring, or little finger), different planes of amputation, and different evaluation methods.

Sebastin et al² summarised the challenges in assessing the outcomes of digital replantation and advised that the comprehensive evaluation of the hand function should include objective assessments, health-related quality of life, and psychological status. Truly successful replantation is achieved when the mind

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and body of the patient return to a functional state. Only a few studies comprehensively investigated long-term function recovery after digit replantation. Walaszek et al.³ assessed the long-term objective and subjective results of successfully replanted or revascularised digits. Unglaubt et al.,⁴ Haas et al.,⁵ and Ciclamini et al.⁶ reported the functional and subjective results of thumb replantations. These studies did not thoroughly analyse the relationship between objective and subjective outcomes and did not focus on the role of psychological factors. Previous studies assessed the short-term (1 year) post-operative psychological status of patients with hand injuries; they suggested that psychosocial factors correlate with pain and disability and that the psychological sequelae of hand trauma can persist long after the physical injury.^{7–10} Patients want additional information about their psychological status and aesthetic appearance after replantation.¹¹

Therefore, understanding the characteristics of long-term sequelae on the psychological status of patients after digit replantation is crucial. The aim of this study is to comprehensively present the long-term functional, subjective, and psychological outcomes after single-digit replantation and analyse the relationship among these results to understand the interrelationship among objective function, subjective satisfaction, and psychological symptoms.

Material and methods

Study design

We conducted a retrospective review of all patients who underwent successful replantation of a single digit from December 2011 to September 2014 in our department. To reduce the effect of other variables, the inclusion criteria were set as follows: (1) complete or incomplete amputations of a single digit, (2) digits surviving, (3) aged 18 years and above, (4) work-related trauma, and (5) the mechanism of injury is crush or avulsion. Patients were excluded when they had any of the following: (1) amputation involving multiple digits, (2) combination with other digit injuries, such as comminuted fracture, soft tissue defect, extensor or flexor tendon injuries, and (3) replantation of proximal to the metacarpophalangeal joint. The study was approved by the institutional review board.

Patients

In accordance with these criteria, 42 patients who underwent single-digit amputation were surgically treated with replantation in this study. Twelve patients could not be contacted because of a change in address or phone number, or a refusal to accept follow-up. The follow-up rate was 71.4%. Finally, a total of 30 digits (14 thumbs, 12 index fingers, 2 middle fingers, 1 ring finger, and 1 little finger) in 30 patients (7 females and 23 males) with complete (13 cases) or incomplete (type III 3 cases, type V 14 cases) amputation were considered. The mean patient age was 44.2 years (20–65 years). The mean follow-up time was 36 months (19–50 months) after the operation. The mean interval from injury to replantation was 3.5 h (2.5–7 h). The right hand was the dominant hand in all patients. Ten patients injured their right hand, whereas 20 patients injured their left hand.

Because of traditionally held concepts of the people in the East, the majority of patients demand replantation although the amputated plane of a single digit is proximal to the flexor digitorum superficialis tendon. In the current study, five fingers were amputated proximal to the flexor digitorum superficialis tendon, seven fingers were amputated between the proximal interphalangeal and distal interphalangeal joints (DIP), and four fingers were amputated

distal to the DIP. The number of cases for different amputated planes of thumbs was 4 (proximal phalanx), 7 (interphalangeal joint), and 3 (distal phalanx).

The classic method of surgical replantation was performed. The selected bone fixation was axial or cross K-wire. In several cases, vein grafts were required to detect artery defect. No patient underwent secondary corrective operations, such as tenolysis and secondary nerve repair.

Assessment of the objective outcome

The sensitivity of digit pulps was measured with Semmes–Weinstein (SW) monofilaments (Aesthesio Precision Sensory Evaluators, DanMic Global, Campbell, CA, USA). Static two-point discrimination (S-2PD) was measured in the centre of a pulp using the Disk-Criminator (North Coast Medical, Inc., Gilroy, CA, USA). The active ranges of motion (AROM) of the three joints of the injured fingers or two joints of injured thumbs were measured. Percentage ROM was defined as the ratio of the sum of ROM of injured digits over that of the contralateral hand. Total grip strength and pinch strength (lateral pinch) were measured with a Jamar manometer.

Assessment of the subjective outcome

The patients were asked to report on their satisfaction based on the appearance and function of the injured hand (5-point response scale) according to the Michigan Hand Outcomes Questionnaire (MHQ).^{12,13} The Disability of Arm, Shoulder, and Hand (DASH) questionnaire was also used as a subjective outcome measure. Cold intolerance of the injured digits was measured by the self-administered Cold Intolerance Severity Score questionnaire. The maximum score is 100. The scores were grouped into four grades (0–25 mild, 26–50 moderate, 51–75 severe, and 76–100 extremely severe).¹⁴

Assessment of the psychological outcome

The psychological outcomes, including symptoms of depression, anxiety, and posttraumatic stress disorder (PTSD), were assessed.

Anxiety and depression in the preceding week were assessed with the revised Self-Rating Anxiety Scale¹⁵ (SAS; Zung, 1971) and the Beck Depression Inventory¹⁶ (BDI), respectively. SAS consists of 15 items that assess increasing anxiety and five items that assess decreasing anxiety; a score greater than 50 is considered indicative of clinical anxiety. BDI includes 21 items designed to assess mood symptoms; scores greater than 5 are considered indicative of depression.

The symptoms of PTSD were measured with the Screen for Posttraumatic Stress Symptoms (SPTSS). SPTSS is a 17-item instrument.¹⁷ The content is brief and intelligible. It does not link symptoms to a single event and has been proved to have internal consistency and confirmed validity. A score of four or higher was adopted as the optimal cut-off score to classify participants as having PTSD.

Statistical analysis

The Pearson correlation coefficient was applied to compare the relationships among the objective data. The Spearman correlation coefficient was adopted to analyse the relations among subjective, objective, and psychological outcomes. The variables that independently influenced the subjective outcomes ($P < 0.05$ in univariate analysis) were entered into a multivariate logistic regression

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