Assessing the opinions of subjects with or without sustained hand injury about toe-to-thumb transfer

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ABSTRACT

Introduction: Traumatic finger amputations may lead to significant functional and aesthetic impairment yet when compared with the number of finger amputations, toe-to-hand transplantation numbers are very low.

Materials and Methods: In this study we aimed to assess the thoughts of healthy subjects, with or without previously sustained hand injury, about toe-to-hand transplantation and re-assess their thoughts following a brief informative description of the surgery.

Results: We found that after visual briefing, willingness to undergo toe-to-hand transplantation dramatically increased.

Conclusion: Visual briefings including video presentations have a great impact on eliminating negative prejudgement.

Key words: Toe-to-hand, toe-to-hand transplantation, finger amputation, hand surgery, microsurgery

Introduction

Serious aesthetic and functional deformities can occur after total thumb amputation. Although there are other treatment options to total thumb amputation, such as metacarpal lengthening [1], pollicisation [2] and on-top plasty [3], the most successful remains toe-to-hand transplantation based on aesthetic and functional outcomes [4,5]. Even with high success rates and positive surgical outcomes [4,6-8], toe-to-thumb transplantation numbers are still relatively low when compared to the rate of finger amputations.

The aim of this study is to assess the thoughts of healthy subjects, with or without previously sustained hand injuries, on toe-to-thumb transfer and to re-evaluate their opinions after a brief informative description of the surgery and the possible results.

Materials and Methods

A questionnaire was provided to 100 volunteer subjects with and without a history of previous hand surgery (50 from each) between January and March 2007. The questionnaire was comprised of four parts. In the first, demographic characteristic questions, such as regarding sex, age, education level and occupation, were asked. In the second part, the importance of the hand in social and work life was assessed. Then patients were asked whether or not they had information regarding toe-to-thumb transfers and if they would be willing to undergo a toe-to-thumb transfer if they had a
total thumb amputation. If they didn’t want the transfer, they were asked to provide the reason behind their decision. In the third part of the questionnaire, toe-to-hand transplantation was briefly summarized and then photos of examples of preoperative and postoperative conditions were shown. After these photographs, a short video of a successful transplant patient was shown to the subjects regarding foot function. Following the summary of the procedure, in the fourth part of the study, subjects were asked to reassess their opinions about the toe-to-thumb procedure.

Hand injuries were classified as major and minor hand injuries. Subjects with isolated tendon injuries and fingertip injuries were classified in the minor hand injury group, while subjects with combined tendon-nerve injuries or major finger amputations at a level at or proximal to the distal interphalangeal joint were assigned to the major hand injury group.

Statistical analysis was carried out using SPSS for Windows v.15 (IBM Corporation, New York, USA). The Pearson chi-square test was utilized to demonstrate any existing relationships and a p value <0.05 was considered to be statistically significant.

Results

65 of the subjects were male and 35 were female. All subjects were over 18 years of age and the average age was 33.5 years. Among the female subjects, 17 were housewives, 14 worked in governmental posts and four were student. Of the males, 29 were government workers, 25 worked in the private sector and 11 were students. Educational levels of the subjects were: a) university level - 22 females and 36 males; b) mid-high school - 9 females and 23 males; and c) primary school - 9 females and 23 females.

50 volunteer subjects were present in each group, with previously sustained hand injury in the first group and without hand injury in the second group. Demographic properties were similar between the two groups (p>0.05). When subjects were asked to grade the importance of their hand functions in their social and professional lives, all stated that it is either important or very important.

In the hand injury group, 20 subjects had isolated tendon injuries and 8 had fingertip injuries. These were classified in the minor hand injury group. Of the remaining 22 subjects, 12 had combined tendon and nerve injuries accompanied by simple soft tissue injuries, and 10 had amputated fingers at or proximal to the distal interphalangeal joint level. These patients were placed in the major hand injury group.

Patients were next asked if they knew about the toe-to-thumb transfer procedure - 12% (6/50) of the subjects in the non-injured group and 38% (19/50) of the injured group replied “yes”. This ratio was 90% (9/10) in subjects with amputated fingers. The difference between the two groups was found to be statisti-

| Table 1. Subject opinions on accepting a toe-to-thumb transfer (TTT) following finger amputation before and after a short briefing. Acceptance of TTT before and after briefing was statistically significant (p=0.001) in injured and in non-injured subjects (p=0.01). The difference in acceptance of TTT between injured and non-injured subjects before briefing was p=0.001 and after briefing was significant (p=0.0015). |
|---|---|---|---|---|
| | Injured 50 Subjects | Non-Injured 50 Subjects |
| | Accept TTT | Reject TTT | Accept THT | Reject THT |
| Before Briefing | 18 | 32 | 38 | 12 |
| After Briefing | 34 | 16 | 44 | 6 |

| Table 2. Subject opinions on accepting a toe-to-thumb transfer (TTT) following finger amputation before and after a short briefing in minor and major hand injury groups. Acceptance of TTT before and after briefing was statistically significant in minor hand injuries (p>0.05) and in major hand injury subjects (p = 0.006). The difference in acceptance of TTT between injured and non-injured subjects both before and after briefing is insignificant (p>0.05). |
|---|---|---|---|---|
| | Minor Hand Injuries (28 Subjects) | Major Hand Injuries (22 Subjects) |
| | Total 50 subjects | Accept TTT | Reject TTT | Accept TTT | Reject TTT |
| Before Briefing | 13 | 15 | 5 | 17 |
| After Briefing | 20 | 8 | 14 | 8 |
cally significant (p=0.002).

When subjects were asked if they would be willing to undergo a toe-to-thumb transfer after finger amputation, 36% (18/50) of the injured subjects and 76% (38/50) of the non-injured subjects replied that they would be willing to undertake the procedure. This difference was also significant (p=0.001) (Table 1). When further examining the answers of the subjects with hand injuries, unwillingness to undergo the toe-to-thumb transfer was 77% (17/22) in the major hand injury group and 53% (15/28) in minor hand injury group. This difference was statistically insignificant.

When the subjects were asked why they would not accept a toe-to-thumb transfer, 28 replied that they were concerned about impaired foot functioning, 8 responded that they were apprehensive about worsened hand functions, and 8 stated that they did not have enough knowledge. When the reasons for the negative answer were analyzed in the hand injury group, it appears to have been related with the fear of a foot injury in 18 subjects, worsened hand function in 4 subjects and the absence of knowledge in 4 subjects. These numbers in non-injured patients were 10 for the fear of foot function, and four for being afraid of worsened hand function and four for the the absence of knowledge. The major reason for a negative answer was the fear of impaired foot function in both groups and this difference among groups was not statistically significant (p>0.05).

After a short briefing about the general aspects of the procedure, subjects were asked again whether they would accept a toe-to-hand transplantation. Positive answers increased to 68% (34/50) in injured and 88% (38/50) in non-injured hand subjects. This increase was statistically significant in both injured (p=0.001) and non-injured (p=0.01) subjects. The negative answers decreased from 44 to 22 after the briefing and this drop was also statistically significant (p<0.001). Although willingness to undergo toe-to-hand transplantation in injured subjects rose after the brief informative description, this ratio was still significantly lower than the non-injured subjects (p=0.015). Also, when the minor and major hand injury groups were compared after the short briefing, the unwillingness ratio was diminished to 36% (8/22) in the major hand injury group and 28% (8/28) in the minor hand injury group. The decrease in the major injury group was found to be statistically significant. The types of hand injury and changes in opinion following the briefing are summarized in Table 2.

Among the subjects who were still unwilling to have the procedure even after the briefing, the number of subjects that feared impaired foot function was reduced from 28 to 8 subjects (p=0.013) and the number of subjects that were afraid of worsened hand functioning was slightly increased from 8 to 10 subjects. There were still 4 patients with negative answers because of the absence of sufficient knowledge (Graph 1).

**Discussion**

There are a number of treatment options for reconstruction of total amputated thumbs [1-4]. The best option is always replantation whenever possible [4]. If replantation is not possible or cannot be accomplished, then thumb reconstruction options are evaluated. The most commonly considered reconstruction options are metacarpal lengthening [1], pollicisation [2], on-top plasty [3] and toe-to-thumb transfer. [4] After total thumb amputation and metacarpal lengthening, an osteotomy is performed at the mid-metacarpal level and after a distraction period, bone grafting is applied to the gap. Although the thumb length can be increased with this technique, a fully functional thumb cannot be achieved. The on-top plasty technique is applied when there is a combined injury of the thumb and the index finger. In this technique, the residual index finger is raised on its neurovascular pedicle and then transferred to the thumb stump. Although favorable surgical
results have been described in previous studies [3,4], a surgical indication for this technique is still very limited. Pollizisation is the pedicled neurovascular transfer of an intact index finger into the thumb position where it is stabilized by skeletal fixation. Although in this technique, sensory neural thumb functions can be accomplished without microsurgical intervention, high secondary surgery rates [2,4] and sacrificing a hand finger are the main limitations.

When comparing toe-to-thumb transfer with other surgical techniques, it results in higher functional and aesthetic outcomes with acceptable donor site morbidities [4,5,9]. The first successful toe-to-hand transplantation was completed in 1966 by Buncke in monkeys [10]. The first successful toe-to-thumb transplantation in humans was by Cobbett in 1969 [11]. When reviewing a large case series, the overall success rate is shown to be over 95% [5,6,9]. In grasping tests 80-100% of functional abilities have been reported, while in pinch tests, 56-100% [7]. Foot function was generally not affected after the transfer [12] and patient satisfaction rates were as high as 83% [8].

Yet, even with these positive outcomes and the high priority of the hand in both social and work life, the number of toe-to-hand transplantations is still very low versus the number of finger amputations. In the present study, the reason for this discrepancy was independently assessed in subjects with or without previously sustained hand injury.

The knowledge of toe-to-thumb transfer was found to be higher in injured subjects. This was an expected result as people will likely be more open and eager to research their condition.

When willingness the transfer was assessed between injured and non-injured subjects, the acceptance rates were found to be higher in the non-injured subjects. As well, when willingness was reviewed between subjects with major and minor hand injuries, acceptance rates were also higher in the minor hand injury group. This may possibly be related to the difficulties of healing and the rehabilitation period that the injured subjects faced following trauma. Furthermore, as non-injured patients do not have any idea about the difficulties in healing or rehabilitation, they seemed more prone to toe-to-thumb transfer.

When the reasons of unwillingness were examined, the most common fear was impaired foot function after transplantation in both groups. The second biggest fear was worsening of hand function, and the third was lack of sufficient knowledge. These results were also expected as none of the subjects were health care providers and so they did not have any substantial knowledge about foot and hand functioning that would be present following the procedure.

After a visual briefing, willingness to undergo toe-to-thumb transfer significantly increased and the fear of foot impairment significantly decreased in both groups. The significant reduction in the fear of foot impairment could be related to the video that demonstrated foot function after transfer shown during the briefing. In contrast to the decrease in foot impairment fear, the fear of hand impairment slightly rose following the video. During the briefing, although foot functioning was shown in the video, hand function was only demonstrated by photos. This might possibly shed light on the effectiveness and importance of videos during patient briefings.

As a consequence of the questionnaire, the authors have changed their clinical strategy regarding patient education on toe-to-hand transplantation. New videos have been added demonstrating both hand and foot function during patient briefings, and there has also been receipt of positive feedback from two consecutive toe-to-thumb transplantation patients in which this new informative technique was utilized.

Ultimately, in patients with injuries where toe-to-thumb transfer is indicated, the most important consideration to make is to ensure that enough time is spared to properly education and inform patients. In addition, utilizing visual materials, especially videos, significantly helps to enhance patient motivation and reduce fear of both worsened hand and diminished foot functioning after a toe-to-thumb transfer.

Conflict of interest statement
The authors have no conflicts of interest to declare.

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