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Original Article

Swanson arthroplasty for replanted of severed metacarpophalangeal joints: a long-term follow up

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Abstract: To evaluate the clinical outcome of Swanson implant replacement for replantated of severed metacarpophalangeal (MCP) joints in a long term follow up. This was a retrospective study of 11 patients (3 women, 8 men) operated from July 2005 to May 2007. All patients were using Swanson joint implants for replanted of severed MCP joints. The average age at the time of the procedure was 58.45±3.4 years old (range 51-64). Functional assessment by grip strength and range of motion. Subjective assessment by the Michigan Hand Outcomes Questionnaire (MHQ) and Sollerman hand function test. The mean follow-up period was 8.9±0.7 years (range 8-10). The grip of strength improved significantly (preoperative 4.2±2.2 kg, postoperative 6.7±2.8 kg, P=0.027). The range of motion improved significantly (preoperative 24.6±9.0, postoperative 47.0±10.7, P<0.001). The Sollerman score showed no statistically difference before and after operation. The mean MHQ total score at 8 years improved significantly (preoperative 50±15, postoperative 57±15, P=0.002). The scores of domain of Function, activities of daily living (ADL), Aesthetics, and Satisfaction indicated significant improvement postoperatively. The postoperative score of work and pain did not improve significantly. Our study suggests that Swanson Implants for replantated of severed MCP Joints can improve the range function of the joints in long-term follow-up. Patients themselves felt their aesthetics have been improved. We recommend for Swanson arthroplasty for replanted of severed MCP Joints.

Keywords: Metacarpophalangeal joint, replantation, swanson implant, arthroplasty

Introduction

Swanson implant was originally designed in 1968 [1] and was commonly used for proximal interphalangeal and metacarpophalangeal (MCP) joints replacement. Former studies focused on the outcomes of Swanson implants for rheumatoid MCP joints [2-4]. There is less report about MCP joints after trauma. Considering the poor function of MCP joints after replantation, we chose to use Swanson implant replacement to solve this problem. All the patients would be followed up for 8~10 years to evaluate the outcomes. It is the first time reported replantated of severed MCP joints replacement with long term follow up. We discuss its functional and subjective assessment.

Patients and methods

Patients

A total of 11 patients underwent Swanson joints replacement (Wright Medical Technology, USA) from July 2005 to May 2007, patients with replantation of severed MCP joints were elected and operated. Its was 8 male and 3 female patients. The MCP joints of the index finger were involved in six cases, four cases involved the middle finger and one involved the ring finger. All the patients underwent the MCP joints replacement at least 6 months after the initial fingers replantation. Exclusion criteria included infection, health problems, serious flexor tendons injured, capsule injured and skin defects. All the patients had strong will to improve the motion of the joints. They were performed by the same surgeon. The ethical committees approved of the study design.

Surgical technique

A longitudinal incision was made across the dorsal aspect of the MCP joints. The extensor tendon and capsules were incised to expose the joint. For some serious contracture cases, collateral ligaments, flexor tendons and capsule might be released to achieve more motion.

Table 1. The result of grip strength, ROM and sollerman score

	Preoperative	8-Y Postoperative	*P* value
Grip strength (kg)	4.2±2.4	6.7±2.8	0.027
Range of motion	24.6±9.0	47.0±10.7	<0.001
Sollerman score	46±16	47±15	0.20

Table 2. The outcome of MHQ score

MHQ Scale	Preoperative	8-Y Postoperative	*P* value
Function	50±13	58±13	<0.001
ADL	46±21	55±17	0.002
Work	52±15	55±17	0.111
Pain	34±7	30±8	0.108
Aesthetics	36±28	44±31	0.011
Satisfaction	49±12	59±14	0.001
Overall Score	50±15	57±15	0.002

The metacarpal head and the base of phalanx were cut with an oscillating saw. The medullary canal were reamed, the trials were performed to fit the size of prosthesis. Removed the osteophytes in the canal, the joint was flexed to insert the prosthesis. The largest possible prosthesis was used. The dorsal capsule and ligament on both sides were sutured. The local soft tissue and skin were also sutured and reattached. For the serious cases of capsule defect, the capsule could not be closed with suture; we used part of dorsal metacarpal fascia to cover the prosthesis.

Postoperative protocol

Antibiotics were not used. The treated joints were fixed in dorsiflexion position with a resting splint in 3 days after the surgery. One week after surgery, we change a dynamic splint. Patients used a continuous passive motion device for one hour 3 times per day after the surgery.

Statistics

Data collection included preoperative and postoperative quantitative measures (grip of strength, range of motion, Sollerman hand function test) and a patient-reported measure (MHQ). Sollerman test includes subtests that represent common handgrips and activities. Scores range from 0 to 80 with higher scores reflecting a better performance. The MHQ Scores contains 6 domains: (1) overall hand function, (2) ADL, (3) pain, (4) work performance, (5) aesthetics, and (6) patient satisfaction. Scores range from 0 to 100, with higher scores indicating better performance, except for the pain scale. For the pain scale, a higher score indicates more pain. The length of follow-up was at lease 8 years. Statistical analysis was performed using the paired t-test (p values <0.05 were deemed statistically significant). The data analysis tool was SPSS 11.0.

Result

The average age of patients was 58.45±3.4 years old (range 51-64). The mean follow-up period was 8.9±0.7 years (range 8-10) years. No serious complications of infection, fracture and flap necrosis were found. None of implant had to be revised.

The result of functional assessment showed that the grip of strength had increased significantly (preoperative 4.2±2.2 kg, postoperative 6.7±2.8 kg, P=0.027). The range of motion had increased significantly (preoperative 24.6±9.0, postoperative 47.0±10.7, P<0.001). The Sollerman score showed no statistically significant difference before and after the operation (**Table 1**). The mean MHQ total score in the eighth year had increased significantly (preoperative 50±15, postoperative 57±15, P=0.002). The postoperative score of domain of Function, ADL, Aesthetics, and Satisfaction increased significantly as well. However, the postoperative score of work and pain did not improve (**Table 2**). Patients expressed satisfaction with the postoperative aesthetics.

Discussion

In our research patients refused to use joint replacement by the transplantation of metatarsophalangeal joints. They demanded to have a better range of motion but required for low-intensity physical activity. Recovery of function and relief of pain are the most recognized surgical indications for MCP joint replacement. Though replantated of severed MCP joint often accompanies with injures of extensor/flexor mechanism and defect of the capsule, we find that arthroplasty can achieve a good result (**Figures 1-3**). MHQ is a patient-reported measure of hand function. In the result of this study, postoperative domain of Function, ADL,

Figure 1. A 53-year-old patient was seriously injured by machine. The ring and little fingers had no indication for replantation. The index and middle fingers' were injured at the MCP joint level. The digital arteries and nerves were all torn. The extensor tendons and dorsal of the capsules were broken. The bone structures of the MCP joints were crushed. The flexor tendons were still complete. Both finger had vascular and nerve anastomosis.

Aesthetics, and Satisfaction indicated significantly improvement. These improvements had benefits from the motion of the joints. A recent study indicated that normal motion of the finger MCP joints ranged from 33 to 73 degrees, with an average of 61 degrees [5]. In our research, the preoperative ROM is about 25 degrees, and the postoperative ROM is 47 degrees. The ROM change is smaller than rheumatoid hand [2-4], but it still improved the activities of daily living. However, the score of work domain was not significantly changed, which was also found in rheumatoid joint replacement [6]. Most patients in our research had mild pain of posttraumatic hand. However, the score indicates that this operation has no significant effect on alleviating pain. This fact should been told to patients for reducing their expectations.

Figure 2. 6 months after the first replantation surgery, the second and third MCP joint still had flexion range of about 10 degree. The patient expected more range of motion by the surgery. X-ray showed MCP joint serious destruction.

Many different implants are available for MCP joint replacement, including Swanson, NeuFlex, Avanta, and the material of Pyrocarbon implants. No evidence has demonstrated whether there is clear superiority one over the other, the complication rates have no significant difference between different implants [7-9]. Our patients had deformity of posttraumatic fingers, the author believes there is more chance for posttraumatic patients to have complication, such as infection, fracture and broken implants, so these cases should be followed in future. The strength of extensor/flexor mechanism must be evaluated preoperatively. The tendon and ligament should be released to improve motion. For the serious capsule contracture, the capsule may not be closed with suture when the implant is inserted. The author uses a part of dorsal metacarpal fascia to cover the prosthesis. However, this method is possible to limit the range of motion.

The results presented in this paper include 8~10 years of follow-up remain good. We are

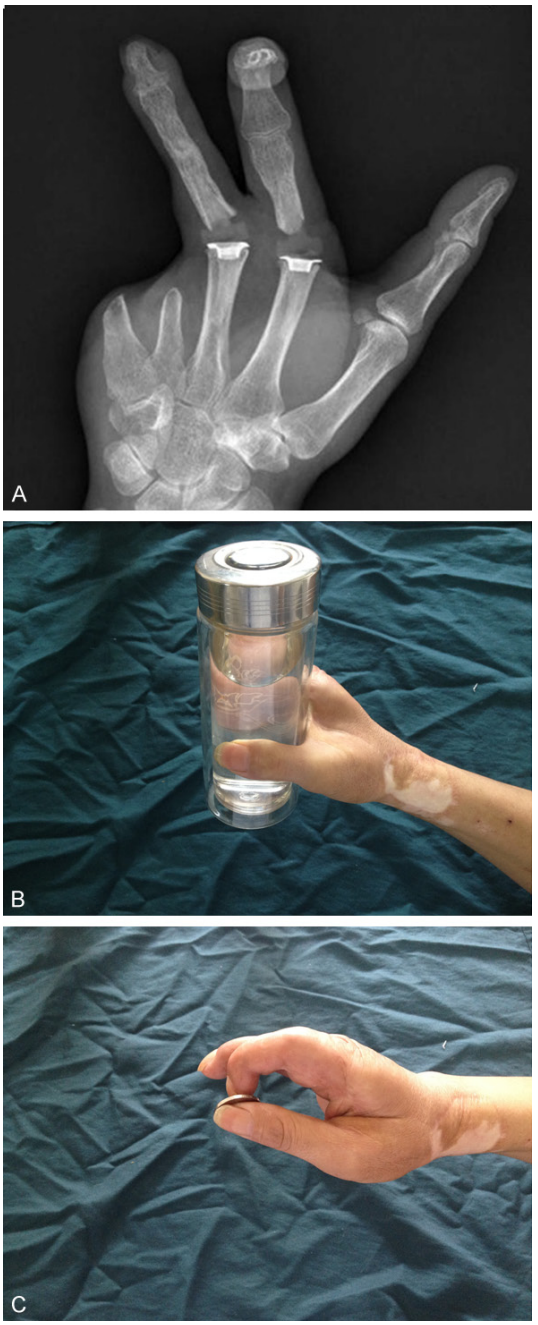

Figure 3. In the 10 years following up, the MOP is 35 degree in both fingers. He considered the function improved in daily work postoperatively. No complications of infection, fracture and flap necrosis were found.

continuing to follow the cases to determine whether improvements are maintained. And complications are still to be concerned.

Conclusion

Our study suggests that Swanson Implants for replantated of severed MCP Joints can improve the range of motion of the joint. Function and aesthetics of Patient have been improved. But Sollerman score indicates no significant change. The effect to release pain is not determined. Much longer-term follow up will help to better determine the efficacy of the method. We recommend for Swanson arthroplasty for replanted of severed MCP Joints.

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Disclosure of conflict of interest

None.

Authors' contribution

Hui Lu drafted the manuscript. Qiang Chen and Hui Shen participated in the design of the study and performed the statistical analysis. Hui Lu conceived of the study, and participated in its design and coordination and helped to draft the manuscript. All authors read and approved the final manuscript.

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