



The long-term patient reported-outcomes of elbow, wrist, and hand surgery for rheumatoid arthritis

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Abstract

Aim. A retrospective questionnaire survey was conducted to investigate the long-term outcomes of elbow, wrist, and hand surgery for rheumatoid arthritis (RA).

Methods. One hundred thirteen RA patients underwent primary elective elbow, wrist, or hand surgery at our hospital between January 2002 and December 2003. To evaluate the outcomes at 10 years after surgery, the patient-reported outcomes were assessed using an original questionnaire that inquired about the site of treatment; the modified Stanford Health Assessment Questionnaire (mHAQ) was also used.

Results. Responses were obtained from 67 patients (98 sites). In the 10 years after surgery, the disease activity score 28-erythrocyte sedimentation rate (4) (DAS28-ESR (4)), and the mHAQ scores of the patients showed significant improvement. Nearly 85% of patients were satisfied with the outcome at the surgical site. The most frequent reason for perceived improvement was “pain relief” (all surgical sites). An “improved appearance” was frequently reported after finger surgery and “increased power” was frequently reported after wrist and thumb surgeries. With regard to elbow surgery, 30%

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6 of the patients were satisfied with the increase in motion and power. In contrast,
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9 approximately 20% of the patients complained of decreased power around the surgical
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12 site after elbow and thumb surgeries.
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15 Conclusions. Our original patient-reported outcome assessment tool revealed that
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18 elbow, wrist and hand surgery provided long-lasting benefits in RA patients. While the
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21 efficacy differed in some of the surgical sites, pain relief was the most favorable effect.
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24 Altered medical therapy may also have impacted the patient perceived outcomes of
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28 surgery at 10 years.
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Introduction

The patient's assessment of the effects of surgery for rheumatoid arthritis (RA) is useful in clinical practice as it offers a patient-friendly method of assessing the effects of surgery. Various surgical procedures are available for the treatment of the elbow, wrist, and hand in RA patients. Several patient-reported outcome measures can be used to assess the disease activity of RA¹. However, few studies have assessed the efficacy of surgical intervention based on the patient-reported outcomes². Previous studies have assessed postoperative outcomes based on objective clinical and radiological measures. Several reports have investigated the long-term postoperative outcomes of elbow,³⁻⁵ wrist⁶⁻⁹, and hand^{10,11} surgery for RA with a minimum follow-up period of 10 years. However, with the exception of pain, most of these reports only mentioned the objective outcomes and did not describe the subjective outcomes. Thus, in the present study, a retrospective questionnaire survey was conducted to assess the changes in the subjective findings, and to investigate the differences in the long-term effects of surgery for RA according to the site of the procedure.

Patients and methods

One-hundred thirteen RA patients underwent primary elective surgery of the elbow, wrist, thumb or fingers at our hospital between January 2002 and December 2003. Each patient was diagnosed with RA according to the 1987 revised American College of Rheumatology (ACR) criteria for RA.¹²

After the exclusion of 25 patients who were deceased or unable to reply because they were staying in a nursing home or due to severe dementia, our original questionnaire sheet was mailed to 88 RA patients. This questionnaire was used to assess the patient-reported outcomes of upper extremity surgery.

- Questionnaire (Original)

Our original questionnaire was created based on the satisfaction questionnaire described by Riches et al.² It was composed of 7 questions that each included 3 to 6 possible answers, as follows:

Q1: "Do you remember the type of surgery that you received 10 years previously?"

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6 1: Remember very well. 2: Remember well. 3: Remember partially. 4: Slightly
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9 remember. 5: Do not remember.

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12 Q2: "What is the present condition of the surgically-treated site in comparison to the
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15 preoperative condition?"

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18 1: Much better. 2: Better. 3: Unchanged. 4: Worse. 5: Much worse.

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21 Q3: "What improvement(s) have you noticed in comparison to the preoperative
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24 condition?" (Multiple answers were allowed)

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28 1: Pain relief. 2: Improved appearance. 3: Increase in power. 4: Easy to grasp. 5:
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31 Increase in motion. 6: Other.

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34 Q4: "What aspect(s) do you consider to have declined in comparison to the preoperative
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37 condition?" (Multiple answers were allowed)

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41 1: Increased or unchanged pain. 2: Worsened or unchanged appearance. 3: Decrease in
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44 power. 4: Difficulty in grasping. 5: Decrease in motion. 6: Other.

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47 Q5: "How is the usability of the hand at the surgically-treated site in comparison to
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50 before surgery?"

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53 1: Good. 2: Relatively good. 3: Neither good nor poor. 4: Relatively poor. 5: Poor.

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6 Q6: "Are you satisfied with the results of the surgical treatment?"
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9 1: Highly satisfied. 2: Satisfied. 3: Neither satisfied nor dissatisfied. 4: Somewhat
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12 dissatisfied. 5: Dissatisfied.
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15 Q7: "Would you recommend the same surgery for patients such as yourself?"
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18 1: Yes. 2: Uncertain. 3: No.
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21 The patient background information and the answers to the questionnaire were
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24 carefully reviewed. The background information from just before surgery was compared
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27 with that at 10 years after surgery.
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34 • Statistical analysis
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37 The overall cohort was divided into subgroups according to the site of surgical
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40 treatment and the results of the subgroups were compared. The mean and standard
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43 deviation (SD) values were determined for each group. All of the statistical analyses
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46 were performed using the IBM SPSS Statistics 21 software program (International Business
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49 Machines Corp., New York, US). The paired *t*-test was used for parametric data and the
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52 Wilcoxon signed-rank test was used for nonparametric data. P values of <0.05 were
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6 considered to indicate statistical significance.
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12 • Ethics
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15 This study was approved by the Institutional Review Board of our hospital.
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21 **Results**
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24 Among the 88 patients (77.8%) to whom the questionnaire was sent, 3 patients were
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28 deceased and 18 were unable to reply; thus responses were obtained from 67 patients
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31 (98 sites), which represented 59.3% of the original cohort (Figure 1). After excluding
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34 the patients who indicated that they were unable to recall (or only slightly able to recall)
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37 the surgery in Q1, 63 patients (93 sites) remained. The responses to the subsequent
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40 questions (Q2 to Q7) were analyzed for these patients.
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44 Surgery was performed to treat structural joint damage due to RA, which caused
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47 disability in the patient's daily life due to functional loss. The sites of surgery included
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50 the elbow (n=20), wrist (n=42), thumb (n=15), and finger (n=16) (Table 1). The
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53 common procedures were total elbow arthroplasty (n=13), wrist synovectomy and the
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6 Darrach procedure (n=31); radiolunate arthrodesis (n=17), the Sauvé-Kapandji
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9 operation (n=6), extensor tendon reconstruction (n=38); arthroplasty at the
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12 metacarpophalangeal (MP) joint of the thumb (Swanson) (n=8), and arthroplasty at the
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15 MP joint of the fingers (Swanson) (n=26). The sites of additional surgical procedures
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18 that were performed during the 10-year period (after the primary surgery) included the
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21 elbow (n=2), wrist (n=11), thumb (n=5), and finger (n=2). The additional procedures
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24 performed for the lower extremities included THA (n=1), TKA (n=4), and forefoot
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27 reconstruction, n=6.

31 **The background characteristics of the study population**

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34 At surgery, the mean age (range) of the 63 patients was 57.5 (21-78) years, the
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37 male/female ratio was 14/53, and the mean disease duration (range) was 12.3 (0.6-39)
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40 years (Table 2). The drugs administered just before surgery included prednisolone (PSL)
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43 (54.4%), methotrexate (MTX) (23.5%), and conventional synthetic disease-modifying
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46 anti-rheumatic drugs (csDMARDs) other than MTX (89.7%). No bDMARDs were used
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49 at the time of surgery. The mean disease activity score 28-erythrocyte sedimentation
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52 rate (4) (DAS28-ESR(4))¹³ was 4.51, the mean modified Stanford Health Assessment
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6 Questionnaire (mHAQ) score¹⁴ was 0.73.
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9 At 10 years after surgery, the drugs administered to the patients included PSL (54.4%),
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11 MTX (52.9%), csDMARDs other than MTX (70.6%), and bDMARDs (19.1%). In
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13 comparison to the distribution just before surgery, a similar number of patients were
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15 treated with PSL, the number of patients treated with MTX had increased, and
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17 bDMARDs were newly used by approximately 20% of the patients. The mean
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19 DAS28-ESR(4) value decreased significantly from 4.51 (moderate disease activity
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21 [MDA]) to 2.89 (low disease activity [LDA]) ($p < 0.001$). Thus, a large number of
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23 patients shifted from MDA to LDA. The disease activity decreased in all of the surgical
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25 site subgroups ($p < 0.001$). In the whole cohort, the mean mHAQ score decreased
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27 significantly from 0.73 to 0.60 ($p = 0.045$); there were no significant changes in the
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29 comparisons among the surgical site subgroups. The mean item scores that were mainly
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31 associated with the upper extremity function (items 1, 3, 5, and 7) decreased
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33 significantly from 0.86 to 0.64 ($p = 0.016$). At 10 years after surgery, a significant
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35 improvement was noted in items 3 (“Lift a full cup or glass to your mouth”; $p = 0.004$)
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37 and 8 (“Get in and out of a bus, car, train, or airplane”; $p = 0.042$).
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6 There were no superficial or deep wound infections at the surgical sites in this study
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9 group.

12 **The patient-reported clinical outcomes**

15 A1: Most patients indicated that they remembered the type of surgery that they received
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18 “well” (28.6%) or “very well” (63.3%) (Fig. 2).

21 A2: Over 85% of the patients answered “much better” (35.9%) or “better” (50.0%).

24 Among the surgical site subgroups, finger surgery was associated with the highest
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26
27 percentage of favorable responses (93.8%) (Table 3-a).

31 A3: The most frequent reason for improvement was “pain relief” at all surgical sites
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34 More than 70% of the patients who received elbow and wrist surgery indicated that they
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37 were satisfied with their level of pain relief. An “improved appearance” was frequently
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40 noted after finger surgery and “Increased power” was frequently noted after wrist and
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43 finger surgeries. Thirty percent of the patients who received elbow surgery indicated
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46 that they were satisfied with their increased motion and power (Table 3-b).

49 A4: Approximately 20% of the patients who underwent elbow and thumb surgeries
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52 complained of a decrease in power around the surgical site, while 18% of the patients
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6 who underwent wrist surgery complained of a decrease in motion (i.e., flexion and
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9 extension). These patients had undergone radiolunate arthrodesis or total wrist
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12 arthrodesis (Table 3-b).

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15 A5: Overall, 38.5% of the patients answered “good usability” and 50.5% answered
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18 “relatively good usability”. Regarding the outcomes of surgery in the surgical site
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21 subgroups, finger joint surgery was associated with highest percentage of favorable
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24 outcomes (93.8%) (Table 3-c).

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27 A6: Overall, 36.2% of the patients were highly satisfied and 48.4% were satisfied.

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30 The level of satisfaction with the surgery was highest in the following order: finger
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33 (93.8%), wrist (87.1%), thumb (80.0%) and elbow (73.7%) (Table 3-d).

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37 A7: More than 60% of the patients would recommend the same surgery (63.3%). This
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40 was lower than the rate of satisfaction. The number of patients who answered
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43 “Uncertain” was 32.2%, while 4.5% answered “No” (Table 3-e).

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46 The number of respondents to each questionnaire is indicated by the “n” number at the
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49 top-right of the table. The numbers of missing responses for each question were as
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52 follows: Q1, Q3, Q4 (n=0, 0%), Q2 (n=1, 1.1%), Q5 and 6 (n=2, 2.2%), and Q7 (n=3,

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6 3.2%).
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9 **Discussion**

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12 To date, several patient-reported outcome instruments, such as the mHAQ, have been
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14 used to assess the physical function and quality of life (QOL) of RA patients¹⁴. These
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16 instruments deal with the general status of the patients, but they are not sufficient for
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18 assessing the status of surgically-treated patients because the responses do not directly
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20 reflect the status of the surgical site. Thus, we created an original questionnaire about
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22 the surgical site and the degree of patient satisfaction based on the study by Riches et
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24 al.². The questionnaire asked about the present condition, improvements, aspects of
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26 decline, usability, satisfaction, and whether they recommended that other patients
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28 undergo the same treatment. In addition, each question had a practical rating system that
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30 was directly connected to the surgical effect.
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43 Several studies have investigated the long-term outcomes of elbow, wrist, and hand
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45 surgery in patients with RA. Although the surgical outcomes after a minimum follow-up
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47 period of 10 years have been reported for total elbow arthroplasty³⁻⁵, radiocarpal
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49 arthrodesis⁶, total wrist arthroplasty⁷⁻⁸, wrist synovectomy and the Darrach procedure⁹,
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6 and metacarpophalangeal joint arthroplasty¹⁰⁻¹¹, most of these studies investigated the
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9 postoperative changes in the objective findings other than pain. Riches et al. evaluated
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12 the usefulness of surgical treatment of the hand and wrist in RA patients using a
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15 validated modified score for the assessment and quantification of chronic rheumatoid
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18 affections of the hand (M-SACRAH)¹⁵ and the original satisfaction was assessed with a
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21 questionnaire, with a 3-year postoperative follow-up period². Among the studies that
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24 investigated the patient-reported outcomes, our study, which had a follow-up period of
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28 10 years (using similar questionnaires), had the longest follow-up period.

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31 It has been reported that a favorable subjective outcome after rheumatoid upper
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34 extremity surgery can be anticipated if disease activity is well-controlled¹⁶. The
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37 favorable responses to our questionnaire might reflect that the disease activity was
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40 suppressed by advanced pharmacotherapy during this 10-year period. Ishikawa et al.
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43 reported that the postoperative serum C-reactive protein level affected the level of
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46 postoperative pain¹⁷. Thus, there seems to be a relationship between the intensity of
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49 inflammation and the patient's satisfaction with a pain-free condition at the site of
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52 surgery. Some previous reports demonstrated that surgical intervention, especially
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6 synovectomy and arthroplasty, enhances the amelioration of systemic disease activity as
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9 well as the joint function¹⁸⁻²³. In this study, the elbow, wrist and hand surgeries might
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12 have enhanced the amelioration of the disease activity to some extent.
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15 Our results showed a significant improvement in the DAS28-ESR(4) and the mHAQ
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18 score at 10 years after surgery. It is generally said that lower extremity surgery might
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21 contribute to the improvement of disease activity and the mHAQ score. However, a
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24 relatively small number of patients in our cohort underwent lower extremity surgery,
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27 and the items of the mHAQ that reflected the upper limb function showed greater
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30 improvement. This indicated that the disease activity, physical function, and QOL of the
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33 patients improved after elbow, wrist and hand surgery and that—on the whole—the
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36 effect was maintained for 10 years. Durmus et al. investigated the relationship between
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39 patient-reported outcome instruments and disease activity, and concluded that the HAQ
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42 could determine the disease activity in RA patients better than other patient-reported
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45 outcome measures²⁴. Surgical intervention was recommended to some patients, in whom
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48 clinical remission or LDA was considered to be difficult to maintain with
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51 pharmacotherapy due to structural joint damage, and who did not show a low mHAQ
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6 score (i.e., ≤ 0.5 or functional remission). In this study, surgical intervention seemed to
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9 be associated with a favorable response to our questionnaire as well as improved
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12 mHAQ and DAS28 scores.
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15 In the present study, 84.6% of the patients answered that they were satisfied with the
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17 surgically-treated site at 10 years after surgery, and 63.3% of the patients indicated that
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19 they recommended the same surgery. The difference in the two rates was based on the
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21 patients' opinions about the changes in their situation and differences in their
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23 background characteristics. On the whole, it appeared that the patients were satisfied
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25 with their surgery, and that their satisfaction level remained high for 10 years.
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34 The present study is associated with several limitations, which should be considered
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36 when interpreting the results. Firstly, there was some bias when assessing the
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38 patient-reported outcomes. The responses were not available for all of the
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40 surgically-treated patients at 10 years after surgery. Thus, the 46 patients (40%) who
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42 were excluded from the analysis might have had worse background factors and a lower
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44 satisfaction level. Second, 20 patients (30% of the responders) received additional
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46 elbow or hand surgery in the 10 years after the primary surgery. No cases required
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6 revision surgery at the primary site. Third, several different surgical procedures were
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9 sometimes performed at one surgical site. Fourth, no non-surgical control group was
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12 established in this study. Withholding surgery from a disabled patient might pose ethical
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15 problems. Finally, the favorable outcomes in the present study might have also been
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18 associated with pharmacotherapy. It is difficult to clearly determine the extent to which
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21 surgery or pharmacotherapy contributed to these outcomes.
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24 Long-lasting benefits were confirmed in RA patients who underwent upper extremity
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27 surgery. If no severe comorbidities were observed and the disease activity could be
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30 controlled, then a favorable effect could be maintained at the surgically-treated site
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33 throughout the 10-year study period. The combination of pharmacotherapy and surgery
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36 for disabled patients with damaged joints was important for improving the QOL and
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39 maintaining high-level QOL in RA patients.
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Conflict of Interest Statement

The authors declare no conflicts of interest in association with the present study.

References

1. Hendrix J, de Jonge MJ, Fransen J, Kievit W, van Riel PL (2016) Systematic review of patient-reported outcome measures (PROMs) for assessing disease activity in rheumatoid arthritis. *RMD Open* 18;2 (2): e000202.
2. Riches PL, Elherik FK, Dolan S, Unglaub F, Breusch SJ (2016) Patient rated outcomes study into the surgical interventions available for the rheumatoid hand and wrist. *Arch Orthop Trauma Surg* 136 (4),563-70.
3. Bigsby E, Kemp M, Siddiqui N, Blewitt N (2016) The long-term outcome of the Gschwend-Scheier-Bähler III elbow replacement. *J Shoulder Elbow Surg* 25 (3),362-8.
4. Qureshi F, Draviraj KP, Stanley D (2010) The Kudo 5 total elbow replacement in the treatment of the rheumatoid elbow: results at a minimum of ten years. *J Bone Joint Surg Br* 92,1416-21.
5. Tanaka N, Kudo H, Iwano K, Sakahashi H, Sato E, Ishii S (2001) Kudo total elbow

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2
3
4
5
6 arthroplasty in patients with rheumatoid arthritis: a long-term follow-up study. J
7
8
9 Bone Joint Surg Am 83,1506-13.
10
11
12 6. Ishikawa H, Murasawa A, Nakazono K (2005) Long-term follow-up study of
13
14 radiocarpal arthrodesis for the rheumatoid wrist. J Hand Surg Am 30,658-66.
15
16
17
18 7. Papp M, Papp L, Lenkei B, Károlyi Z (2013) Long-term results of the
19
20
21 Sauvé-Kapandji procedure in the rheumatoid wrist. Acta Orthop Belg 79,655-9.
22
23
24
25 8. Kastler U, Weiss AP, Simmen BR, Herren DB (2005) Long-term results of silicone
26
27
28 wrist arthroplasty in patients with rheumatoid arthritis. J Hand Surg Am 30,1282-7.
29
30
31
32 9. Ishikawa H, Hanyu T, Tajima T (1992) Rheumatoid wrists treated with synovectomy
33
34 of the extensor tendons and the wrist joint combined with a Darrach procedure. J
35
36
37 Hand Surg Am 17,1109-17.
38
39
40
41 10. Goldfarb CA, Stern PJ (2003) Metacarpophalangeal joint arthroplasty in rheumatoid
42
43
44 arthritis. A long-term assessment. J Bone Joint Surg Am 85,1869-78.
45
46
47
48
49 11. Cook SD, Beckenbaugh RD, Redondo J, Popich LS, Klawitter JJ, Linscheid
50
51
52 RL(1999) Long-term follow-up of pyrolytic carbon metacarpophalangeal implants.
53
54
55
56
57
58
59
60

- 1
2
3
4
5
6 12. Arnett FC, Edworthy SM, Bloch DA, et al. (1988) The American Rheumatism
7
8
9 Association 1987 revised criteria for the classification of rheumatoid arthritis.
10
11
12 Arthritis Rheum 31,315-24.
13
- 14
15 13. Van Gestel AM, Prevoe ML, van't Hof MA, van Rijswijk MH, van de Putte LB,
16
17
18 van Riel PL (1996) Development and validation of the European League Against
19
20
21 Rheumatism response criteria for rheumatoid arthritis. Comparison with the
22
23
24 preliminary American College of Rheumatology and the World Health
25
26
27 Organization/International League Against Rheumatism Criteria. Arthritis Rheum
28
29
30 39,34-40.
31
32
- 33
34 14. Fries JF, Spitz P, Kraines RG, Holman HR (1980) Measurement of patient outcome
35
36
37 in arthritis. Arthritis Rheum 23,137-45.
38
39
- 40
41 15. Sautner J, Andel I, Rintelen B, Leeb BF (2004) Development of the M-SACRAH, a
42
43
44 modified, shortened version of SACRAH (score for the assessment and
45
46
47 quantification of chronic rheumatoid affections of the hand). Rheumatology
48
49
50 (Oxford) 43,1409-13.
51
52
- 53 16. Ishikawa H, Murasawa A, Nakazono K, et al. (2008) The patient-based outcome of
54
55
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2
3
4
5
6 upper extremity surgeries using the DASH questionnaire and the effect of disease
7
8
9 activity of the patients with rheumatoid arthritis. *Clin Rheumatol* 27,967-73.
10
11
12 17. Ishikawa H, Murasawa A, Hanyu T (2002) The effect of activity and type of
13
14
15 rheumatoid arthritis on the flexible implant arthroplasty of the metacarpophalangeal
16
17
18 joint. *J Hand Surg Br* 27,180-3.
19
20
21 18. Yonemoto Y, Okamura K, Kaneko T, et al. (2016) Effect of total knee arthroplasty
22
23
24 on other joints in patients with rheumatoid arthritis evaluated by 18-FDG-PET. *Int J*
25
26
27 *Rheum Dis* 20 (6),702-7.
28
29
30
31 19. Momohara S, Inoue E, Ikari K, et al (2011) Effect of total joint arthroplasty in
32
33
34 patients with established rheumatoid arthritis: improved longitudinal effects on
35
36
37 disease activity but not on health-related quality of life. *Mod Rheumatol* 21,476-81.
38
39
40 20. Oh K, Ishikawa H, Abe A, Otani H, Nakazono K, Murasawa A (2014) Effects of
41
42
43 surgical intervention on disease activity of rheumatoid arthritis: cases of surgery for
44
45
46 rheumatoid arthritis of the lower limbs treated with biologics. *Mod Rheumatol*
47
48
49 24,606-11.
50
51
52
53 21. Kanbe K, Inoue K (2006) Efficacy of arthroscopic synovectomy for the effect
54
55
56
57
58
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2
3
4
5
6 attenuation cases of infliximab in rheumatoid arthritis. Clin Rheumatol 25,877-81.
7
8
9 22. Yano K, Ikari K, Inoue E, et al. (2010) Effect of total knee arthroplasty on disease
10
11 activity in patients with established rheumatoid arthritis: 3-year follow-up results of
12
13 combined medical therapy and surgical intervention. Mod Rheumatol 20,452-7.
14
15
16 23. Hayashi M, Kojima T, Funahashi K, et al. (2012) Effect of total arthroplasty
17
18 combined with anti-tumor necrosis factor agents in attenuating systemic disease
19
20 activity in patients with rheumatoid arthritis. Mod Rheumatol 22,363-9.
21
22
23 24. Durmus B, Altay Z, Baysal O, et al. (2011) Can the patient-reported outcome
24
25 instruments determine disease activity in rheumatoid arthritis? Bratisl Lek Listy
26
27 112,555-61.
28
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41 **Figure legends**

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43 **Fig. 1** This chart shows the target patients who sent our original questionnaires and their
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45 response rates.
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49 **Fig. 2** Response to Question 1: "Do you remember the type of surgery that you received
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For Peer Review Only

Table 1 Surgical site and procedures

Surgical site	Procedures	Primary surgery		Additional surgery	
		n (joints)		n (joints)	
Elbow	Synovectomy	5		1	
	TEA	13	20	1	2
	Bursectomy	1		0	
	Ulnar neurolysis for	1		0	
Wrist	Synovectomy and Darrach procedure	31		3	
	Radio lunate arthrodesis	17		2	
	Total wrist arthrodesis	5		1	
	Clayton's tendon transfer	5		2	
	Capitate head replacement	2	42	1	11
	Sauvé-Kapandji operation	6		0	
	Reconstruction of the extensor tendon	38‡		2‡	
	Reconstruction of the flexor tendon	3‡		3‡	
Thumb	Neurolysis (carpaltunnel syndrome)	1		1	
	Arthroplasty at the CMJ (Suspensionplasty)	3		2	
	Synovectomy at the MPJ	2		1	
	Arthroplasty at the MPJ (Swanson)	8	15†	2	5†
	Arthrodesis at the MPJ	2		0	
Finger	Arthrodesis at the IPJ	4		1	
	Synovectomy at the MPJ	2		0	
	Arthroplasty at the MPJ (Swanson)	26		0	
	Synovectomy at the PIPJ	4	16†	1	2†
	Flexor tenosynovectomy	6‡		0	
	Fusion at the DIP joint	1		1	
Hip	THA			1	11
Knee	TKA			4	
Foot	Forefoot reconstruction			6	

†: number of hands

‡: number of digits

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7 TEA: total elbow arthroplasty

8 CM: carpometacarpal

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10 MP: metacarpophalangeal

11 IP: interphalangeal

12 PIP: proximal interphalangeal

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THA: total hip arthroplasty

BHA: bipolar hip arthroplasty

TKA: total knee arthroplasty

Table 2 Patient background

	At the time of surgery	Ten years after surgery	
Age (years)	57.5 (21~78)	68.1 (31~89)	
Gender (male/female)	14/54	14/54	
Disease duration (years)	12.3(0.6~39)	22.5 (11~50)	
PSL usage (%)	54.4	54.4	
MTX usage (%)	23.5	52.9	
Other csDMARDs usage (%)	89.7	70.6	
bDMARDs usage (%)	0	19.1	
DAS28-ESR(4)	4.51	2.89	* p<0.001
mHAQ	0.73	0.6	* p=0.045
mHAQ of upper extremity function(items 1,3,5 and 7)	0.86	0.64	* p=0.016
	[mean (range)]	[mean (range)]	

* significant difference by Wilcoxon signed-rank test.

PSL : Prednisolone

MTX : Methotrexate

csDMARDs : conventional synthetic Disease Modified Anti-rheumatic-drugs

bDMARDs : biological Disease Modified Anti-rheumatic-drugs

DAS28-ESR(4) : Disease activity score 28-erythrocyte sedimentation rate (4)

mHAQ : modified Stanford Health Assessment Questionnaire

Table 3-a Response to Question 2: “What is the present condition at the surgically-treated site in comparison to the preoperative condition?”

	Elbow (n=20)	Wrist (n=41)	Thumb (n=15)	Finger (n=16)	Total n=92)
Much better	8	15	5	5	33 (35.9%)
Better	9	20	7	10	46 (50.0%)
Unchanged	0	0	0	0	0 (0%)
Worse	2	4	1	0	7(7.6%)
Much worse	1	2	2	1	6 (6.5%)
Much better and better	85.0%	85.4%	80.0%	93.8%	79 (85.9%)

Table 3-b Response to Question 3 and Question 4

	Elbow (n=20)	Wrist (n=42)	Thumb (n=15)	Finger (n=16)	Total (n=93)
Pain relief (%)	75.0	73.8	46.7	50.0	65.6
Improved appearance (%)	20.0	7.1	33.3	50.0	21.5
Increase in power (%)	30.0	42.9	33.3	37.5	37.6
Easy to grasp (%)	15.0	23.8	26.7	31.3	23.7
Increase in motion (%)	39.0	26.2	13.3	12.5	22.6
Others (%)	0.0	0.0	0.0	12.5	2.2
Increased or unchanged pain (%)	5.0	6.7	6.3	0.0	5.4
Worsened or unchanged appearance (%)	10.0	0.0	0.0	0.0	2.2
Decrease in power (%)	20.0	8.9	18.8	12.5	14.0
Difficult to grasp (%)	0.0	2.2	12.5	12.5	5.4
Decrease in motion (%)	10.0	17.8	12.5	12.5	15.1
Others (%)	0.0	0.0	6.3	0.0	1.1

Table 3-c Response to Question 5: “How is the usability of the hand at the surgically-treated site in comparison to before surgery?”

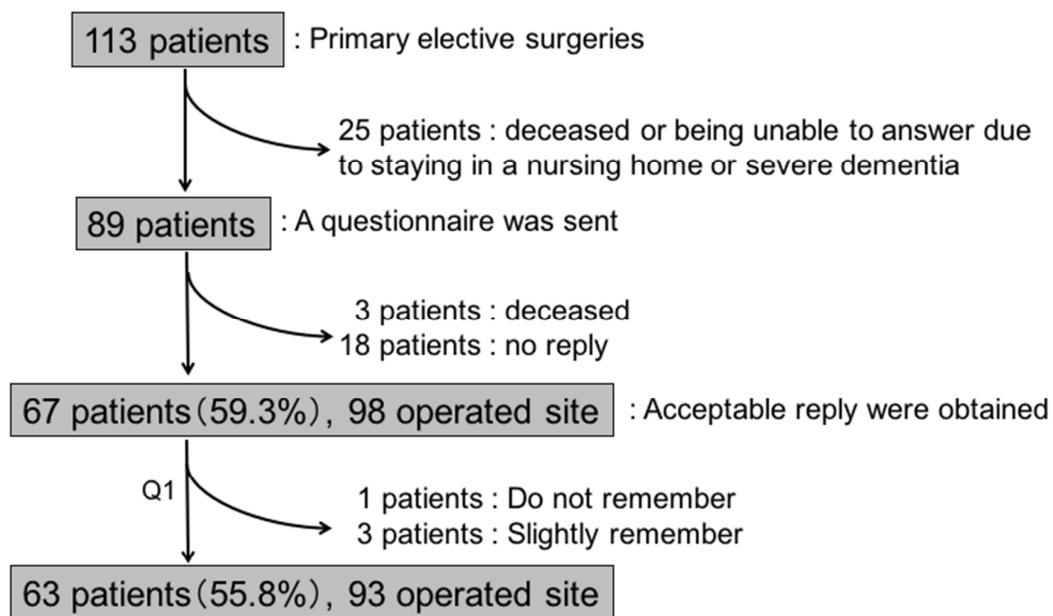
	Elbow (n=20)	Wrist (n=41)	Thumb (n=15)	Finger (n=16)	Total (n=91)
Good	7	18	5	5	35(38.5%)
Relatively good	9	19	8	10	46(50.5%)
Neither good nor poor	1	3	1	0	5(5.5%)
Relatively poor	0	1	0	0	1(1.1%)
Poor	2	0	1	1	4(4.4%)
Good or Relatively good	84.2%	90.2%	86.6%	93.8%	81(89.0%)

Table 3-d Response to Question 6: “Are you satisfied with the results of the surgical treatment?”

	Elbow (n=19)	Wrist (n=41)	Thumb (n=15)	Finger (n=16)	Total (n=91)
Highly satisfied	6	16	5	6	33 (36.2%)
Satisfied	8	20	7	9	44 (48.4%)
Neither satisfied nor dissatisfied	0	0	2	1	3 (3.3%)
Somewhat dissatisfied	3	5	1	0	9 (9.9%)
Dissatisfied	2	0	0	0	2 (2.2%)
Highly satisfied or satisfied	73.7%	87.1%	80.0%	93.8%	77 (84.6%)

Table 3-e Response to Question 7: “Would you recommend the same surgery for patients such as yourself?”

	Elbow (n=19)	Wrist (n=40)	Thumb (n=15)	Finger (n=16)	Total (n=90)
Yes	12	29	8	8	57 (63.3%)
Uncertain	4	10	7	8	29 (32.2%)
No	3	1	0	0	4 (4.5%)

**Fig.1**

This chart shows the target patients who sent our original questionnaires and their response rates.

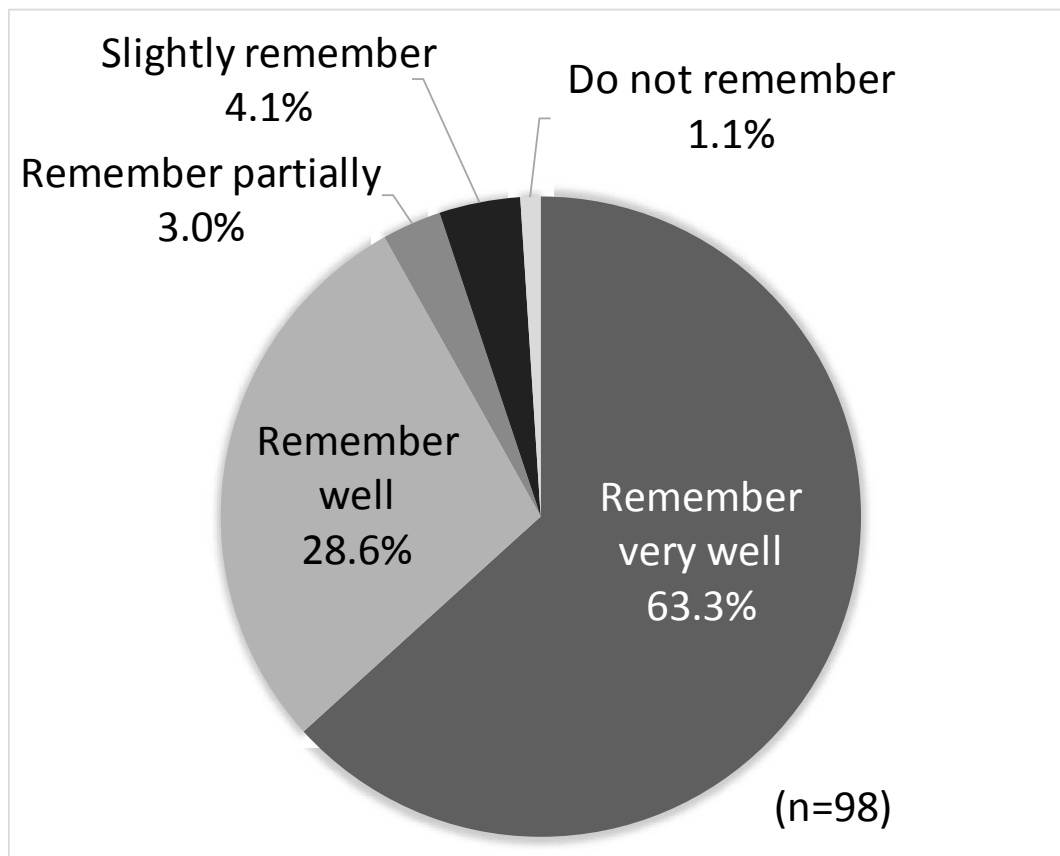


Fig. 2

Response to Question 1: "Do you remember the type of surgery that you received 10 years previously?"