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Cohort profile: the Schulthess registries in Zurich for hand implants and forearm corrective osteotomies

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ABSTRACT

Purpose Our hand and forearm registries were established to evaluate safety, function, quality of life and patient satisfaction in patients undergoing thumb and finger implant arthroplasties, as well as corrective osteotomy of the forearm with individual patient solution (IPS) implants.

Participants Four registries were initiated between 2010 and 2020 and enrolled patients who underwent implant arthroplasties of the thumb carpometacarpal (CMC) joint (n = 486), proximal interphalangeal (PIP) or thumb interphalangeal (IP) joint (n = 864) and metacarpophalangeal (MCP) (n = 34) joint, as well as 27 patients who underwent corrective osteotomy of the distal radius or forearm using an IPS implant. All patients complete disease-specific questionnaires and undergo clinical assessment before surgery (baseline) and up to 10 years thereafter.

Findings to date All operated patients (100%) were included in the registries with complete baseline data. One-year follow-up rates ranged from 59% to 95% and 5-year follow-up ranged from 48% to 83%. Data completeness rates (ie, the number of cases with available data divided by the expected number of cases) ranged from 66% to 96% for the 1-year follow-up and 60% to 89% for the 5-year follow-up. Patients showed significantly improved postoperative clinical and patient-reported outcomes compared with baseline. The registries serve as a basis for standardised patient monitoring, quality control and answering several clinical questions. With the help of these large databases, clinical practice can be improved for the benefit of our patients.

Future plans As the first patients approach the 10-year follow-up landmark, the registry will continue to provide essential data on long-term clinical and patient-reported outcomes, as well as revision rates. In addition to research and quality control, cohort data will be used to enhance real-time clinical decision-making for patients.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The strength of our hand implant registries is the prospective collection of clinical, radiological and patient-reported outcomes for up to 10 years after surgery.
⇒ Another strength is the high quality of the data ensured through regular data checks and a high follow-up rate of more than 90% at 2 years for prospectively enrolled patients.
⇒ The main limitation is that part of the proximal interphalangeal or thumb interphalangeal cohort was added to the registry retrospectively, resulting in missing data for this cohort.

INTRODUCTION

Hand osteoarthritis (OA) is a degenerative disease that may require surgical intervention when conservative treatment fails to control symptoms and improve function. Besides OA, other common causes of joint deformity or destruction of the hand include rheumatoid arthritis and trauma. Among various surgical techniques, implant arthroplasty is increasingly popular as the treatment of choice for affected joints, aiming to preserve the range of motion. Several implant arthroplasties are available for the thumb carpometacarpal (CMC),[1 2] thumb interphalangeal (IP),[3] proximal interphalangeal (PIP)[4–7] and metacarpophalangeal (MCP) joints,[8] all of which demonstrate good medium-term and long-term outcomes. For malunited fractures of the distal radius or forearm, individual patient solution (IPS) implants, which consist of three-dimensional printed, patient-specific anatomical plates, are available for corrective osteotomy.[9]

Clinical registries have gained international recognition as a continuous monitoring system that accumulates information on clinical outcomes and patient-reported outcome measures (PROMs), providing a valuable basis for improving hand surgery practices and patient care.[10 11] Compared with large national registries that require complex coordination and significant resources,[12] local registries often encourage active participation and ensure complete reporting with fewer logistical challenges.

Although several publications on hand and wrist implant registries are available to

date,[13 14] a detailed description of our cohort—incuding patients who underwent new-generation thumb and finger implant arthroplasties as well as three-dimensionally printed IPS implants for corrective osteotomies—is still missing. By publishing these cohort profiles, we aim to contribute to the existing information on establishing a local registry and its potential benefits for clinical practice. Our local hand and wrist implant registries are based at the Schulthess Klinik, an international high-volume orthopaedic centre in Zurich, Switzerland. The registries were established to evaluate safety, function, quality of life and satisfaction in patients undergoing implant arthroplasty for thumb CMC, thumb IP, PIP and MCP joints, and forearm osteotomy correction using IPS implants. The aim of the current cohort profile is to describe the structure and baseline characteristics of the registries and to share the collected technical and epidemiological experience in establishing and maintaining hand and forearm implant registries with high coverage and reasonable publication output. We also describe how data analysed from the registries have changed our clinical practice and improved patient care.

COHORT DESCRIPTION

Setting, patients and eligibility criteria

Four registries covering patients treated with finger and thumb implant arthroplasties and IPS implants at the Schulthess Klinik in Zurich, Switzerland are primarily funded by the Wilhelm Schulthess Foundation and by nested projects with industry partners. Before enrolment in the registries, the responsible surgeon informs the patient during the preoperative consultation that treatment data collected for the registries will be used primarily for internal quality control. Patients are also invited to voluntarily sign a general consent form indicating their agreement to have their treatment data used for future scientific projects and publications.

Thumb CMC registry

Patients receiving a thumb CMC implant arthroplasty have been prospectively included in the registry since June 2018. The implants currently included are the Touch (KeriMedical, Geneva, Switzerland) and Maïa dual mobility trapeziometacarpal prostheses (Groupe Lépine, Genay, France). All surgeries were performed using the standard dorsolateral approach described by Lussiez *et al*.[1]

PIP or thumb IP registry

The PIP or thumb IP registry includes patients who underwent PIP or thumb IP implant arthroplasties. Patients with a CapFlex (KLS Martin Group, Tuttlingen, Germany) implant arthroplasty have been prospectively enrolled since May 2010, whereas patients undergoing other implant arthroplasties were added retrospectively since May 2010 and prospectively enrolled since July 2019; retrospectively controlled treatment data were obtained from patient medical records. The implants currently included in the registry are KeriFlex (KeriMedical, Geneva, Switzerland), Swanson (Stryker, Michigan, USA), the silicone arthroplasty system (Stryker, Michigan, USA), Tactys (Stryker, Michigan, USA), HAPTIC (implantcast, Buxtehude, Germany) and NeuFlex (DePuy Synthes, Warsaw, USA). For PIP implant arthroplasties, a volar, dorsal Chamay or dorsal tendon-splitting approach was used at the surgeon's discretion. For thumb IP implant arthroplasties, a dorsal H-shaped approach was used as described by Schindele *et al*.[3]

MCP registry

Patients who were enrolled in the MCP registry implant arthroplasty at the index, middle, ring or small finger have been prospectively enrolled in this registry since January 2020. The implants currently included in the MCP registry are KeriFlex (KeriMedical, Geneva, Switzerland), Swanson (Stryker, Michigan, USA) and Ascension MCP pyrocarbon finger joint implants (Ascension Orthopedics, Austin, USA). In general, surgeries were performed using the dorsal transverse approach as described by Estermann *et al*.[15] For patients with rheumatoid arthritis or multiple MCP implant arthroplasties, surgeons used the transverse approach.

IPS registry

All patients who underwent corrective osteotomy of the distal radius or forearm using an IPS implant (KLS Martin, Tuttlingen, Germany) have been enrolled in this registry since March 2016. Surgeries were performed as described by Schindele *et al*.[9]

Measurement time points

For each registry, all measurement time points along with the designated time ranges, the number of enrolled cases, number of actual patients at each time point, data completion and follow-up rates from the beginning of each registry until January 2024 are outlined in figure 1. The calculations are as follows: expected number of cases is defined as the total number of enrolled cases minus the cases that are not due for follow-up as well as the dropout and revision cases that occured before the follow-up time point of interest.

Data completion rate is defined as the number of cases with available clinical outcomes or PROMs divided by the expected number of cases. The data collection rate quantifies our efficiency in acquiring data, excluding dropout and revision cases, which are considered beyond our control.

Follow-up rate is defined as the number of cases with available clinical outcomes or PROMs divided by the number of cases initially due for the respective follow-up, without excluding the dropout and revision cases. The follow-up rate reflects the proportion of data actually collected.

Data collection

Before surgery and at follow-up, all patients undergo clinical and radiographic assessment and complete a set

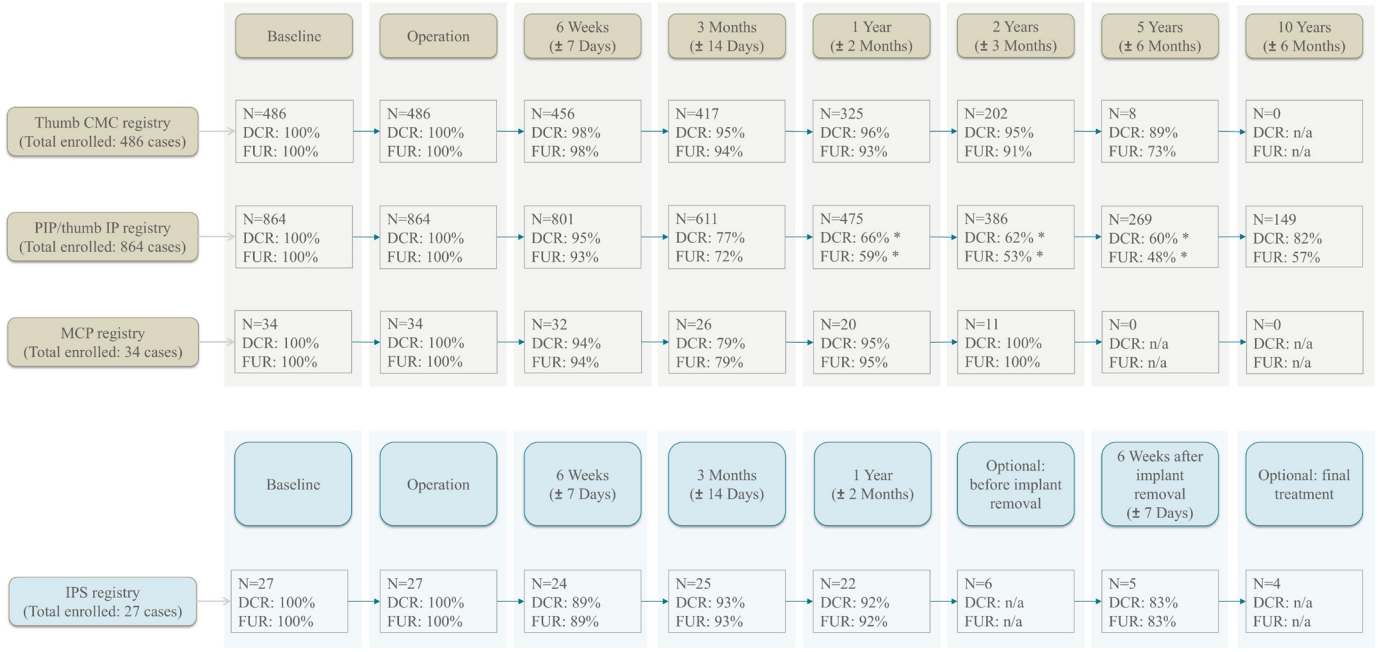

Figure 1 Cohort inclusion flowchart per registry including data completion and follow-up rates. The calculations are as follows: the expected number of cases is defined as the total number of enrolled cases minus the cases not due for follow-up, as well as dropout and revision cases that occurred before the follow-up time point of interest. Data completion rate is defined as the number of cases with available clinical outcomes or PROMs divided by the expected number of cases. Follow-up rate is defined as the number of cases with available clinical outcomes or PROMs divided by the number of cases initially due for the respective follow-up, without excluding the dropout patients and the revision cases. For the IPS registry, implant removal and the subsequent final treatment are optional interventions that are not performed for all patients. *Smaller data completion and follow-up rates are due to a high number of missing treatment data from retrospectively enrolled cases. CMC, carpometacarpal; DCR, data completion rate; FUR, follow-up rate; IP, interphalangeal; IPS, individual patient solution; MCP, metacarpophalangeal; n/a, not applicable; PIP, proximal interphalangeal; PROMs, patient-reported outcome measures.

of PROMs. In addition, adverse events are documented throughout the intraoperative and postoperative periods (figure 2).

A study assistant checks the surgery schedule each week and registers eligible patients in our database REDCap.[16] One week before surgery, the study assistant sends the PROM questionnaires to patients by email or post, depending on the patients' preferences. Using the surgical data as a basis, REDCap calculates the 6-week, 3-month, 1-year, 2-year, 5-year and 10-year follow-ups and automatically dispatches electronic questionnaires. If the patient prefers a hard copy, the study assistant sends the questionnaire by email. An analysis of the completion times in REDCap showed that patients require median of 7 min (IQR = 4) to complete electronic surveys.

The clinical assessment is done preoperatively by the study assistant on the day of the surgery and by the surgeons at each follow-up visit. Postoperative clinical examinations and radiographic analyses include the measurements that doctors would routinely take anyway.

Only the data entry into the database is an additional workload for the surgeons at the follow-up visits. For all registries, surgeons require, median of 2 min (IQR = 2) to input surgical details and 1 min (IQR = 2) for follow-up clinical outcomes.

Clinical outcomes

For all four registries, grip strength is measured using a JAMAR dynamometer (SAEHAN Corporation, Masan, South Korea) in a standardised test position.[17] In addition, thumb pinch strength is examined in the thumb CMC registry patients with a pinch gauge (B&L Engineering, Santa Ana, California, USA). For the thumb CMC, PIP or thumb IP and MCP registries, range of motion is assessed by measuring flexion and extension of the affected joints using a goniometer. Alternately, range of motion tests for patients enrolled in the IPS registry involves measuring flexion, extension, pronation and supination of the wrist with a goniometer. Axis deviation and lateral stability of the affected joints are documented in the PIP or thumb IP and MCP registries. In addition, patients in the thumb CMC registry are assessed for active thumb opposition using the Kapandji index, where scores range from 0 to 10 with higher values indicating better range of motion.[18]

Surgery details

Each surgery and its implants are documented in detail to include information about the surgical technique, name of implant, name of surgeon, initial diagnosis and duration of surgery.

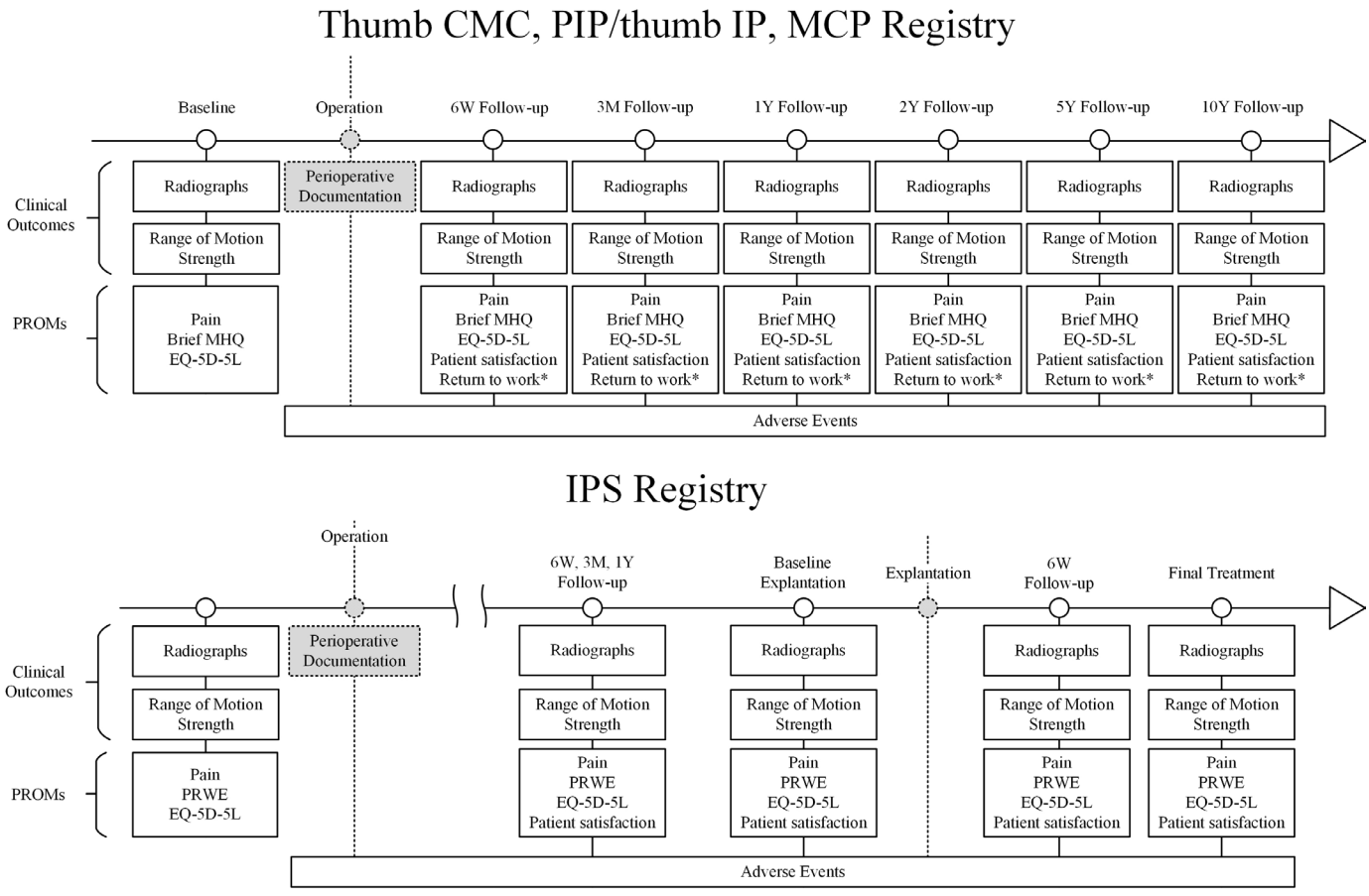

Figure 2 Documentation of measurement procedures for the thumb CMC, PIP or thumb IP, MCP (top) and IPS (bottom) registries. *Return to work is only assessed in the thumb CMC registry. CMC, carpometacarpal; EQ-5D-5L, European quality of life 5-dimensions 5-level questionnaire; IP, interphalangeal; IPS, individual patient solution; MCP, metacarpophalangeal; MHQ, Michigan Hand Outcomes Questionnaire; PIP, proximal interphalangeal; PROM, patient-reported outcome measure; RWE, patient-rated wrist evaluation.

Radiographs

Standard anteroposterior radiographs of the hand and anteroposterior and lateral radiographs of the affected finger or wrist are taken. Preoperative radiographs of the thumb CMC registry patients are specifically analysed for OA severity using the Eaton classification.[19] For all registries, adverse events of implant fracture, migration, luxation, radiolucent lines, cysts, fractures, bone reactions and peritendinous calcifications are monitored on postoperative radiographs. Lastly, the following postoperative anatomical parameters of palmar and radial tilt, radial length and ulnar variance are measured according to Mann *et al*[20] and collected in the IPS registry.

Patient-reported outcome measures

In the thumb CMC, PIP or thumb IP and MCP registries, we document hand function as measured using the brief Michigan Hand Outcomes Questionnaire (MHQ),[21–23] whereas wrist function is measured using the Patient-Rated Wrist Evaluation (PRWE) for the IPS registry.[24 25] Both PROMs are scored from 0 to 100, where 100 indicates the best score in the brief MHQ and the worst score in the PRWE. Pain at rest and during activities of daily living are measured using a numeric rating scale from 0 to 10, where 10 indicates the highest pain level. Quality of life is measured using the European Quality of Life 5-dimensions 5-level questionnaire,[26] which ranges in score from −0.66 to 1 (German value set), where 1 indicates the highest quality of life. In a similar manner to the patient satisfaction questions posed by De Ridder *et al*,[27] registry patients rate their satisfaction by answering the following questions on a 5-point Likert scale: 'How satisfied are you with the result of the surgery on your right thumb?', 'In hindsight, would you decide to have this surgery again?' and 'How is your operated right thumb in general compared to before the surgery?'. The thumb CMC registry further records the number of days to return to work, that is, the number of days it takes for the patient to return to work for the first time after surgery, whether full-time or part-time, in their original job or in an adapted job. We also asked about the number of hand therapy sessions the patient had after CMC I surgery.

Adverse events

Intraoperative and postoperative adverse events and the management of these reported incidents are documented according to the International Organisation for Standardisation.[28] Adverse events were defined as any

untoward medical occurrence related to the primary surgery that required treatment.

Data management and monitoring

Treatment data are collected, managed, and stored in the REDCap electronic data capture system, which is hosted in our clinic. Sociodemographic data are automatically uploaded from the clinic information system to REDCap, where a case is created for each surgery. Since more than one implant can be applied to the different joints during any single surgery, an individual case may comprise multiple implants. Furthermore, there may be multiple cases for any given patient, assuming the patient undergoes surgery more than once or if a previous surgery requires revision. In the event of a revision, a new case is created for the revision surgery. All cases follow their specific follow-up schedule, with the exception of revision cases, which are terminated on the day of revision surgery. In the event of a patient receiving a new implant, the schedule will be adapted accordingly. If the implant is removed during revision surgery and not replaced (eg, resection arthroplasty), the patient will not be followed up further.

Data checks

The REDCap system notifies the study assistant when surveys as well as surgical and clinical follow-up outcome forms have been completed, which ensures that the data are double-checked for completeness. In addition, the data manager performs specific data checks every 2 weeks. Examples include checking that the age is between 18 and 99 years, that key pinch strength is less than 14 kg (the limit of the pinch gauge), and that low pain on the numeric rating scale corresponds to low pain on the brief MHQ. The study assistant then attempts to correct missing or inconsistent data by checking the patient's medical record for clinical data or by calling the patient for missing or inconsistent PROM responses. Each reason for a retrospective change is documented in REDCap to ensure comprehensive tracking of data entry. Statistical analyses are carried out using Stata (V.17; StataCorp, College Station, Texas, USA) or R (V.4.4.1; R Core Team 2024) software.

Monitoring

To monitor patients who need to be recalled for a follow-up visit within the correct time range after surgery, the study assistant uses the FileMaker Pro Advanced (V.20.3.1.31; Claris International, California, USA) database connected to the clinic information system using an SQL server.

Patient characteristics

Until January 2024, there were a total of 486 cases enrolled in the thumb CMC registry, 864 cases in the PIP or thumb IP registry, 34 cases in the MCP registry and 27 cases in the IPS registry (table 1).

FINDINGS TO DATE

Since their establishment, each registry has been used to address several clinical and methodological questions. In principle, the results serve to improve our daily clinical practice as well as be available for the community, as described in the following paragraphs. Furthermore, our registry data are integrated into our clinic information system that displays the information on a dashboard (figure 3), which enables surgeons to assess indications and directly show surgery progress to their patients.

Thumb CMC registry

Based on data from our thumb CMC registry and a recent prospective study,[29] we could show that thumb CMC implant arthroplasty patients recover faster than those with a resection-suspension-interposition (RSI) arthroplasty. Thumb CMC implant arthroplasty patients had significantly better hand function and returned to work within a shorter period compared with RSI arthroplasty patients.[29] We further outlined the benefits of the thumb CMC implant arthroplasty with a high 2-year survival rate of 96% and promising clinical outcomes at 2 years.[30] With regard to the surgical technique, we found that the capsule can be safely resected during thumb CMC implant arthroplasty and have now changed our practice accordingly.[31] We also engage in surgeon discretion to preserve and suture the joint capsule, as our findings indicate this step as dispensable. Based on the promising results of thumb CMC implant arthroplasty compared with RSI, we have chosen implant arthroplasty as our standard procedure of care.

PIP or thumb IP registry

Surface-replacing implant arthroplasty is the most commonly recorded procedure for the PIP joint in this registry. In an analysis of 100 patients, we showed that the tendon-splitting approach produced better outcomes compared with two other approaches.[32] Thus, we changed our surgical technique and now only use the tendon-splitting approach. Five-year data on surface-replacing implant arthroplasties reveal promising clinical outcomes and PROMs,[4] even for the index finger.[33] Furthermore, surface-replacing implant arthroplasties correct axis deviations significantly better than a silicone implant arthroplasty.[34] With these positive results, we now routinely apply this implant at the index and middle finger instead of silicone implants as used previously. We also showed that a surface-replacing implant yields satisfactory outcomes at the thumb IP joint.[3] However, due to several reports of adverse events, thumb IP joint patients are selected more carefully with focus on those who place great importance on practising precision tasks.

We determined the minimal important change and patient-acceptable symptom state for pain, the brief MHQ and range of motion in patients 1 year after PIP implant arthroplasty.[35 36] These calculated thresholds may support surgeons in the preoperative process of deciding for or against a surgical intervention and in explaining the

Table 1 Baseline characteristics for all cases enrolled in the Schulthess hand implant and forearm osteotomy registries

Characteristic	Registry type			
	Thumb CMC (n = 486)	PIP/thumb IP (n = 864)*	MCP (n = 34)*	IPS (n = 27)
Age (years)	64 (8.8)	69 (10)	63 (14)	42 (21)
Gender (n, %)				
Female	366 (75)	627 (73)	24 (71)	17 (63)
Affected finger (n, %)				
Total number of fingers	486 (100)	1074 (100)	63 (100)	
I	486 (100)	32 (3.0)		
II		300 (28)	26 (42)	
III		346 (32)	19 (30)	
IV		251 (23)	9 (14)	
V		145 (14)	9 (14)	
Diagnosis (n, %)†				
Primary osteoarthritis	473 (97)	926 (86)	14 (22)	
Secondary osteoarthritis	1 (0.3)	44 (4.0)	2 (3.3)	
Rheumatoid arthritis	1 (0.3)	39 (3.7)	36 (57)	
Psoriatic arthritis			1 (1.6)	
Chondrocalcinosis			2 (3.3)	
Malunion distal radius				21 (78)
Malunion radius shaft				3 (11)
Malunion ulna				2 (7.4)
Other	2 (0.5)	17 (1.7)	2 (3.3)	5 (19)
Revision	9 (1.9)	48 (4.6)	6 (9.5)	
Missing	*0 (0)*	*0 (0)*	*0 (0)*	*0 (0)*
Grip strength (kg)‡	21 (11)	18 (9.3)	15 (9.0)	25 (12)
Missing (n, %)	*10 (2.1)*	*357 (41)*	*2 (5.9)*	*2 (7.4)*
Key pinch (kg)‡	4.3 (2.3)			
Missing (n, %)	*10 (2.1)*			
ROM of affected MCP joint: flexion and extension (°)‡				
I	60 (16)			
II			41 (23)	
III			46 (33)	
IV			42 (37)	
V			41 (42)	
Missing (n (%))	*14 (2.9)*		*0 (0)*	
ROM of affected IP/PIP joint: flexion and extension (°)‡				
I	73 (20)	48 (25)		
II		44 (20)		
III		50 (21)		
IV		46 (22)		
V		44 (24)		
Missing (n (%))	*15 (3.1)*	*847 (79)*		
ROM wrist (°)‡				
Flexion and extension				99 (37)
Pronation and supination				133 (37)

Continued

Table 1 Continued

Characteristic	Registry type			
	Thumb CMC (n = 486)	PIP/thumb IP (n = 864)*	MCP (n = 34)*	IPS (n = 27)
Missing (n (%))				*3 (11)*
Pain at rest (0, 10)‡				
I	5.3 (2.5)	4.9 (3.0)		
II		4.9 (2.8)	4.9 (3.1)	
III		4.9 (2.8)	4.1 (2.9)	
IV		4.3 (3.0)	3.8 (3.0)	
V		4.7 (2.9)	4.0 (3.5)	
Forearm				1.1 (1.7)
Missing (n, %)	*39 (8.0)*	*524 (49)*	*3 (4.8)*	*5 (19)*
Pain during activities (0, 10)‡				
I	7.3 (1.8)	7.1 (2.6)		
II		6.6 (2.2)	5.6 (2.8)	
III		6.8 (2.1)	5.2 (2.9)	
IV		6.3 (2.5)	5.0 (3.9)	
V		6.2 (2.6)	4.4 (3.5)	
Forearm				3.2 (2.8)
Missing (n, %)	*39 (8.0)*	*533 (50)*	*2 (3.2)*	*5 (19)*
Kapandji index (0, 10)‡	8.9 (1.5)			
Missing (n, %)	*13 (2.7)*			
EQ-5D-5L (–0.66 to –1)‡	0.7 (0.2)	0.8 (0.2)	0.8 (0.2)	0.8 (0.1)
Missing (n, %)	*39 (8.0)*	*389 (45)*	*1 (2.9)*	*5 (19)*
Brief MHQ (0, 100)‡	45 (15)	46 (16)	42 (17)	
Missing (n, %)	*41 (8.4)*	*388 (45)*	*1 (2.9)*	
PRWE (0, 100)‡				39 (26)
Missing (n, %)				*5 (19)*

All patients were prospectively enrolled in the registries, apart from patients who underwent PIP or thumb IP prostheses other than CapFlex-PIP. These patients who underwent surgery between 2010 and 2019 were retrospectively added to the PIP or thumb IP registry based on the patient's medical record, which explained the high number of missing values. Mean values with SDs are presented, unless otherwise indicated.
*1074 and 63 implants were included in the PIP or thumb IP and MCP registries, respectively.
†Only diagnoses for primary surgeries are listed. More than one diagnosis can be selected for the IPS registry.
‡For pain, lower values represent less to no pain and better outcomes. For grip strength, key pinch, ROM, Kapandji index (active thumb opposition), EQ-5D-5L, brief MHQ and PRWE, higher values represent better outcome or less disability.
CMC, carpometacarpal; EQ-5D-5L, European quality of life five-dimensions five-level questionnaire; IP, interphalangeal; IPS, individual patient solution; MCP, metacarpophalangeal; MHQ, Michigan Hand Outcomes Questionnaire; PIP, proximal interphalangeal; PRWE, patient-rated wrist evaluation; ROM, range of motion.

probability of achieving sufficient postoperative symptom relief for the patient.

IPS registry

We evaluated 1-year postoperative clinical outcomes and PROMs in patients who underwent three-dimensional planned corrective osteotomy of the distal radius, radial shaft, or ulnar shaft using a printed, anatomical, patient-tailored implant to determine the feasibility and effectiveness of this methodology. Wrist-related pain and disability (indicated by a lower PRWE score) and range of motion significantly improved after 1 year.[9]

Future perspectives

We continue to monitor our arthroplasty patients for up to 20 years, enabling us to analyse long-term outcomes and implant survival. A further step will be the implementation of an intake questionnaire to be sent to all patients before their first consultation. In this questionnaire, patients will be asked about their complaints and

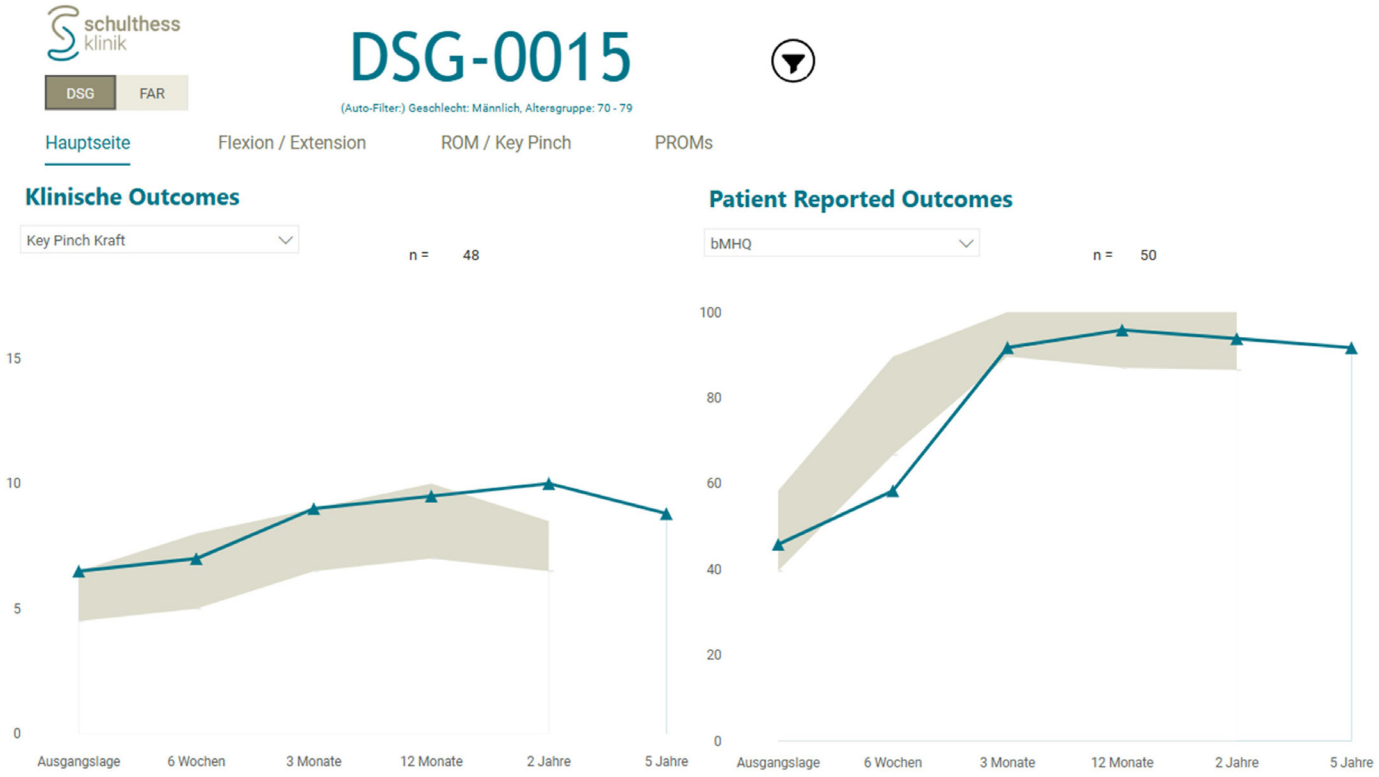

Figure 3 Dashboard integrated into the hospital information system showing the results of a carpometacarpal I implant arthroplasty in a male patient between the ages of 70 and 79 years. Data for key pinch (left) and the brief Michigan Hand Outcomes Questionnaire (bMHQ) are shown at baseline and at the various follow-up time points. The green rectangles are the patient's data and the shaded area is the IQR of data from all other patients of the same sex and age group. Various clinical and patient-reported outcomes can be displayed. PROM, patient-reported outcome measure.

expectations. This will enable patients to more thoroughly prepare for their appointments with doctors. For the doctor, such a questionnaire will allow for more targeted and efficient organisation of the consultation. Last, but not least, we are working on improving our outcome measures by introducing algorithm-based PROMs.

COLLABORATION

We invite researchers to contact the corresponding author for requests for statistical code and instruments used. Multicentre registries would overcome the limitations of single-centre data collection, including bias, lack of generalisability, limited variability and the inability to study rare conditions. However, cross-national multicentre trials are hampered by different national laws on data collection and protection. A possible solution is data sharing in a Common Data Model with the advantage of keeping data local and only sharing summary statistics.[37]

FURTHER DETAILS

Strengths and limitations

Among the main strengths of our registries are the high data completeness rates, except for the PIP or thumb IP registry, where some patient data were collected retrospectively. In addition, we maintain high data quality through regular data checks and the use of validated and standardised outcome measures. Our follow-up rates are among the highest reported in the hand surgery literature, where follow-up rates for clinical outcomes and PROMs range from 30–40% to 38–62% in other registries.[38 39] Our strengths enable us to continuously monitor patients and analyse clinical outcomes and PROMs not only at the individual patient level, but also across the patient population. Furthermore, our cohorts have enabled us to publish relevant papers on the new generation of implant arthroplasties and IPS implants, contributing to advancing research and enhancing the quality of care in hand surgery.

The main limitation is that not all patients are prospectively included in the PIP or thumb IP registry, contributing to an incomplete dataset with missing baseline values, especially those for PROMs. Revision rates might be slightly underestimated, as we do not know whether patients who dropped out had complications treated elsewhere. Nonetheless, because of our reputable collaboration with other Swiss hand surgeons, we usually receive information about our patients treated elsewhere and can record these events in our registry. Furthermore, although the registries are primarily funded by the Willhelm Schulthess Foundation, we also receive funding from the industry. We are aware of the potential influence this funding might have. However, in the contracts, we secured the right to publish all results, without

interference from the funding party. This reinforces our confidence that industry funding does not affect cohort, reporting or the independence of the research.

Data availability statement

Data are available on reasonable request and researchers are invited to contact the first author for requests concerning statistical codes and instruments used. The participant consent forms restrict data sharing on a public repository.

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Contributors KM, DBH, SS and MM developed the protocol. DBH and SS treated the patients. KM, DBH and SS were involved in data collection. KM and MM were responsible for data management. MM was involved in gaining ethical approval. KM analysed the data and wrote the first draft of the article. All authors edited and approved the final version of the article. The corresponding author attests that all listed authors meet authorship criteria and that no others meeting the criteria have been omitted. KM identifies as guarantor. The authors used OpenAI's ChatGPT, a large language model based on the GPT-4 architecture, to assist with word processing and language refinement throughout the article preparation process.

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Competing interests DBH and SS receive royalties from KLS Martin Group, Tuttlingen, Germany. DBH and SS have speaker contracts with Keri Medical, which obliges them to hold training courses on the surgical technique of the Touch prosthesis. Thumb CMC, PIP or thumb IP and MCP registries are partly sponsored by Keri Medical. IPS registry is partly sponsored by KLS Martin Group. MM has a consultancy agreement with KLS Martin Group. KM declares no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

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Data availability statement Data are available upon reasonable request. Data are available upon reasonable request, and researchers are invited to contact the first author for requests concerning statistical codes and instruments used. The participant consent forms restrict data sharing on a public repository.

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