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## Original article

# Arthroplasty of the proximal interphalangeal joint with the Tactys<sup>®</sup> modular prosthesis: Results in case of index finger and clinodactyly



## *Arthroplastie de l'interphalangiennne proximale par une prothèse modulaire Tactys<sup>®</sup> : résultats en cas de clinodactylie et sur les index*

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## ABSTRACT

There are various surgical solutions for arthrosis of the proximal interphalangeal (PIP) joint: arthrodesis or denervation. Clinodactyly that is major and the index fingers are traditional contraindications for PIP arthroplasty prostheses. The recurrence of clinodactyly with ligament imbalance and mechanical complications are known complications. The purpose of our study was to evaluate the objective and subjective clinical results and radiological complications of Tactys<sup>®</sup> prostheses on the PIP joint of the index fingers or with clinodactyly of more than 5° in the other fingers. Two surgeons have implanted 35 total gliding modular Tactys<sup>®</sup> prostheses in 29 women and 3 men since 2010. The indications for surgery were arthrotic and painful PIP joints. Average pre-op clinodactyly was 7.03° (5–30°) with ulnar deviation (29 cases). Eleven index fingers presented with average clinodactyly of 14.2° (10–20°). The digits operated on were as follows: 13 index fingers, 14 middle fingers, 5 ring fingers and 3 little fingers. Arthrosis was primitive in 23 cases, post-traumatic in 6 cases and rheumatoid in 6 cases. The average age of patients undergoing surgery was 63.7 years (40–85). Objective (mobility, strength, index finger exclusion, scores, clinodactyly) and subjective (patient satisfaction, pain) functional results were collected by a neutral and independent observer, as were radiological complications. With an average follow-up of 2.6 years (1–6.3), the range of motion in all digits improved by 5.4° on average (55.5–60.8). The improvement in range of motion in the index fingers was 4.5° (57–61.5). Clinodactyly in all fingers was corrected by 1.36° (0–20). In the index fingers, average clinodactyly was 1.3° (0–10). The pinch strength in all PIP joints improved significantly from 2.3 kg (0.5–5) to 3.7 kg (1–8). On the PIP of the index fingers, the pinch strength had increased significantly from 2.5 kg (1–4) before surgery to 3.8 kg (1–7.5) post-op. Functional scores improved: PRWE (from 55.36 to 26.7/100), Quick DASH (from 54.6 to 30.5/100). Patient satisfaction was excellent in 15 cases, good in 8 cases, average in 10 cases, poor in 2 cases. The average VAS Pain Score improved from 5.6 to 1.45. We found 3 major complications requiring surgery: 2 stiffening and 1 mechanical loosening with secondary arthrodesis. Five patients presented with non-troublesome, reducible swan neck deformity and one algodystrophy. A gliding, fixed Tactys<sup>®</sup> prosthesis allowed us to restore ligament balance and to optimally rebalance the periarticular structures. The improvement in range of motion and the correction of clinodactyly was maintained over time. Total arthroplasty of the PIP with a Tactys<sup>®</sup> is no longer a formal contraindication for the index fingers and in cases of clinodactyly of more than 5°.

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## R É S U M É

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 Index

Les solutions chirurgicales de l'arthrose interphalangienne proximale (IPP) sont variées : arthroplastie, arthrodèse ou dénervation. Les clinodactylies importantes et les index sont des contre-indications classiques aux prothèses IPP. La récurrence de la clinodactylie avec déséquilibre ligamentaire et complications mécanique sont des complications connues. L'objectif de notre étude était d'évaluer les résultats objectifs et subjectifs cliniques et les complications radiologiques des prothèses Tactys<sup>®</sup> sur l'IPP des index ou avec clinodactylie de plus de 5° sur les autres doigts. Deux chirurgiens ont implanté 35 prothèses totales à glissement non contraintes Tactys<sup>®</sup> chez 29 femmes et 3 hommes depuis 2010. Les indications chirurgicales étaient des IPP arthrosiques et douloureuses. La clinodactylie préopératoire moyenne était de 7,03° (5–30°) avec une déviation ulnaire (29 cas). Onze index présentaient une clinodactylie moyenne à 14,2° (10–20°). Les rayons opérés étaient 13 index, 14 majeurs, 5 annulaires et 3 auriculaires. L'arthrose était primitive dans 23 cas, post-traumatique 6 cas et rhumatoïde 6 cas. L'âge moyen lors de la chirurgie était de 63,7 ans (40–85). Les résultats fonctionnels objectifs (mobilités, force, exclusion de l'index, scores, clinodactylie) et subjectifs (satisfaction du patient, douleur) étaient recueillis par un observateur neutre et indépendant, ainsi que les complications radiologiques. Au recul moyen de 2,6 ans (1–6,3) l'arc de mobilité de tous les rayons était amélioré de 5,4° en moyenne (5,5–60,8). L'amélioration de l'arc de mobilité sur les index était de 4,5° (5,7–61,5). La clinodactylie sur l'ensemble des doigts longs était corrigée de 1,36° (0–20). Sur les index, la clinodactylie moyenne était de 1,3° (0–10). La force de pince chez toutes les IPP était significativement améliorée de 2,3 kg (0,5–5) à 3,7 kg (1–8). Sur les IPP des index, la force de pince était significativement augmentée de 2,5 kg (1–4) avant l'opération à 3,8 kg (1–7,5) en postopératoire. Les scores fonctionnels étaient améliorés : PRWE (de 55,36 à 26,7/100), Quick DASH (de 54,6 à 30,5/100). La satisfaction des patients était excellente dans 15 cas, bonne dans 8 cas, moyenne dans 10 cas, mauvaise dans 2 cas. Le score douleur moyen sur l'échelle visuelle analogique était amélioré de 5,6 à 1,45. Nous avons relevé 3 complications majeures avec reprise chirurgicale : 2 enraidissements et 1 descellement mécanique avec arthrodèse secondaire. Cinq patients présentaient une déformation en col de cygne réductible non gênante et une algodystrophie. Une prothèse contrainte à glissement type Tactys<sup>®</sup> permet de rétablir la balance ligamentaire et de rééquilibrer les structures périarticulaires. L'amélioration des mobilités et la correction de la clinodactylie se maintiennent dans le temps. L'arthroplastie totale de l'IPP par une prothèse Tactys<sup>®</sup> n'est plus une contre-indication formelle sur les index et en cas de clinodactylie de plus de 5°.

Standard of proof: 4 (retrospective clinical study).

Niveau de preuve : 4 (étude clinique rétrospective).

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## 1. Introduction

The surgical solutions for symptomatic arthrosis of the proximal interphalangeal (PIP) joint that has not responded to medical treatment are varied: interposition arthroplasty, total arthroplasty, arthrodesis or denervation. Their aims are to alleviate pain while preserving a useful level of mobility for the patient.

To meet a growing functional demand, especially among women, silicone implants [1,2] then fixed metal alloy implants, then semi-fixed implants appeared. Due to the rates of rupture, collateral instability and a lack of long-term strength, the silicone implants have gradually been replaced by metal prostheses [3,4]. But, their lack of mobility and stability on the frontal plane has gradually led to their replacement by other modular implants.

The total, gliding, modular prosthesis appeared in the surgical treatment arsenal [5–7]. They are used in the case of major arthrotic degeneration, post-traumatic degeneration or rheumatoid arthropathy. The Tactys<sup>®</sup> prosthesis corrects frontal deviation, improves mobility and alleviates pain. Its results at two-year follow-up are well-known, displaying improvement in terms of pain and objective scores [6].

The use of implants is typically contraindicated for the index fingers and in cases of clinodactyly, because of a number of poor results: stiffness and/or exclusion of the index finger, loss of thumb-index pinch strength. Initial weakness or secondary loss of the correction of clinodactyly involves a major risk of collateral ligament imbalance and mechanical complications (loosening, implant fracture, wear and tear of contact surfaces).

In the objective literature review, we did not find that the correction of clinodactyly was maintained, of its clinical and radiological consequences after arthroplasty of the PIP.

Our objective was to evaluate objective and subjective functional results in the case of clinodactyly of more than 5° and on the index finger after the implantation of the Tactys<sup>®</sup> PIP prosthesis.

## 2. Material and methods

### 2.1. Population

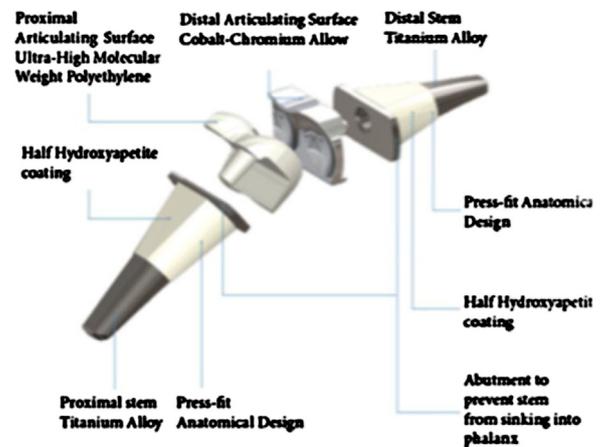
From January 2010 to March 2016, 33 patients (35 arthroplasties prostheses) who underwent surgery with total arthroplasty with a gliding Tactys<sup>®</sup> anatomic bicondylar prosthesis in the same site by two senior surgeons were included. The etiologies were: primary (23 fingers) or secondary (6) osteoarthritis, rheumatoid arthritis (6 fingers). The indications were painful and/or stiff PIP with pre-op clinodactyly of at least 5°. The population was composed of 29 women and 3 men aged on average 63.7 years ± 8.45 (40–85 years) (Table 1). Arthrosis was primitive in 23 cases, post-traumatic in 6 cases and rheumatoid in 6 cases. The exclusion criteria were clinodactyly of less than 5°, post-op follow-up of less than one year, or lack of pre-op data. The digits concerned on were as follows: 13 index fingers, 14 middle fingers, 5 ring fingers and 3 little fingers.

### 2.2. Surgical material and technique

The Tactys<sup>®</sup> modular prosthesis (Stryker–Memometal, Bruz, France) is a total gliding, modular prosthesis with an anatomic design. The two proximal and distal implants are titanium, with their epiphyseal-metaphyseal parts being coated in

**Table 1**  
Characteristics of the population operated on.

Population and characteristics		
Patients	28 women	3 men
Hand injured	15 right	18 left
Dominance	100% right-handed	
Finger	11 D2, 14 D3, 5 D4, 3 D5	
Number of digits concerned	1 for 31 patients      2 for 2 patients	
Age	63.7 years $\pm$ 8.45 (40-85 years)	
Osteoarthritis	Primary: 23 Post-traumatic: 6	
Rheumatoid arthritis	6	
Osteoarthritis stage	0 stage 1, 9 stage 2, 13 stage 3, 13 stage 4	
Clinodactyly	Ulnar 29/33	Radial 4/33
Follow-up	2.6 years $\pm$ 1.25 (0.83-6.34 years)	
Activities	85% retired, 15% workers (2 heavy manual labor)	



**Fig. 1.** Modularity of the Tactys<sup>®</sup> prosthesis: surgical technique: “Tactys<sup>®</sup> prosthesis for the proximal interphalangeal joint. Stryker<sup>®</sup> France SAS Pusignan 69330).

hydroxyapatite. The proximal joint surface is polyethylene, and the distal is made of a chrome-cobalt alloy.

What sets this prosthesis apart is its modular structure with four components of four different sizes, allowing over 400 combinations<sup>1</sup> (Fig. 1).

The surgical technique was standardized for the two surgeons. The surgery was performed with a tourniquet, under local anesthesia, with the forearm in pronation. The approach was dorsal, curvilinear and around 3 centimeters from the PIP. Access to the joint was created via a medial, transtendinous approach. The central slip was detached from the base of the medial phalanx, and the two strands of tendon were spread to either side of the joint.

The first bone cut with the oscillating saw concerned the resection of two condyles from the head of the proximal phalanx. The second bone cut was sparing, using the oscillating saw at the base of the medial phalanx. The dorsal osteophytes were resected upon request. The collateral ligaments were normal in appearance. The bone overlap with the oscillating saw, perpendicular to the diaphyseal axis, allowed the clinodactyly to be corrected and was adjusted depending on ligament tension.

The next step consisted of the centromedullary preparation of the diaphyses using instruments of increasing size. Particular attention was paid to perfectly centering the centromedullary pins on the sagittal and frontal planes. An X-ray check was carried out during the procedure. Periarticular tension with implants in place was evaluated based on the restoration of tenodesis (Video 1). Frontal and sagittal laxity was tested prior to surgery using the test implants, then the final implants.

For 31 fingers, a final suture was placed in the central slip with a slow-absorbing thread (p-dioxanone monofilament size 4/0), without reinsertion through the bone. Skin was closed using interrupted sutures, without drainage.

All the cases of clinodactyly were corrected by  $\pm 1^\circ$  during the procedure.

Patients were immobilized in a thermoformed, cradling splint from the first post-op day with immediate self-rehabilitation. The active-passive digital mobilization protocol was given to them immediately following the procedure.

During the clinical and radiological follow-up consultations on D15, D30, D90, D240 and D365, all of the clinical data and events that had occurred were recorded.

### 2.3. Method

At the last follow-up, a neutral observer collected objective functional results:

- range of motion in degrees in flexion-extension (of the metacarpal-phalangeal, the proximal and distal interphalangeal joints);
- clinodactyly, measured on the frontal plane with goniometer placed behind the finger in extension (average of two measurements), hand flat in pronation, digits in full extension on a hard surface, with the elbow in  $90^\circ$  flexion. The angle between the diaphysis axis of the proximal and medial phalanges was measured;
- grip was measured in kilograms (kg) using the hydraulic Jamar dynamometer and pinch was measured (kit Baseline<sup>®</sup>, Arex<sup>™</sup>, Palaiseau, France) (result: average of three successive grips compared with values on the healthy side);
- the standardized scores from Quick DASH/100 [8] and PRWE/100 [9] questionnaires.

Subjective results were also recorded:

- patient satisfaction measured using a self-questionnaire (bad, average, good or excellent);
- pain on the visual analogue scale rated from 0 to 10.

Preservation of thumb-index pinch was evaluated clinically by the capacity to hold an object between the thumb and index finger and to hold this position against resistance.

PIP ligament testing was carried out to look for laxity on the main radial or ulnar collateral plane. Two responses were possible: no instability, or instability with absence of stopping during valgus constraint or forced varus in PIP flexion. Slight neighboring laxity was observed on the adjacent digits, without this being considered to be physiological in nature.

All clinical (sepsis, overlapping, algodystrophy, digital exclusion, swan neck) or radiological complications were detected.

The X-ray evaluation was carried out with two anteroposterior and lateral radiographs of the finger operated on. The radiological criteria evaluated were: collapse of the implant [6], loosening of the prosthesis with periprosthetic edging, fractures (of the implant or the bone), instability or premature wear of the contact surfaces.

### 2.4. Statistical analysis

The statistical tests were carried out with a Student's *t*-test with Wilcoxon logistical regression. A *P*-value  $\alpha$  0.005 was accepted

<sup>1</sup> Surgical technique: “Tactys<sup>®</sup> prosthesis for the proximal interphalangeal joint. Stryker<sup>®</sup> France SAS Pusignan 69330).

**Table 2**  
Results and pre- and post-operative comparisons of clinical and radiological criteria.

Criteria (all digits)	Pre-operative	Post-operative	P
VAS (0–10)	5.35 (0–9)	1.4 (0–6)	0.9
Range of motion PIP (°)	54.84 (10–105)	61.4 (5–95)	0.3
PIP flexion (°)	21 (0/–20) in 8 patients	20.6 (–25/0) in 5 patients	
MCP range of motion (°)	81.22 (60–95)	84.3 (50–110)	0.4
DIP range of motion (°)	46.04 (10–80)	36.06 (–20–90)	0.01
Clinodactyly (°)	7.03 (5–30)	1.3 (0–20)	0.9
Grip strength (kg)	15 (9–38)	16.32 (2–50)	0.4
Pinch strength (kg)	2.3 (0.5–5)	3.7 (1–8)	< 0.005
Return to leisure activities		ALL	
QuickDASH (/100)	58.02 (6.8–97.7)	30.7 (0–77.5)	0.9
PRWE (/100)	57.3 (0.5–98)	27.05 (1–79.5)	0.9
Satisfaction		Excellent 15 Good 8 Average 10 Bad 2	
Digital exclusion		0	
Clinical complication		1 radial instability 1 mechanical loosening 1 CRPS, 2 non-reducible swan necks 5 reducible swan necks	
Radiological complication		1 loosening (post-traumatic arthrosis)	
Contact surface wear		0	
Implant collapse		0	
Periprosthetic osteophytes		5 lateral (radial) 1 dorsal in the index finger	

with a confidence interval of 95%. All of the results were compared with the pre-op data.

### 3. Results

The average follow-up for patients was 2.6 years  $\pm$  1.25 (1–6.34 years). Skin had healed by D15 in all patients.

#### 3.1. Functional evaluation

The results are presented in Tables 2 and 3.

Average post-op range of motion for all digits was  $61.4^\circ \pm 28.6$  (5–95°) vs.  $54.84^\circ \pm 23.6$  (10–105°) pre-op ( $P = 0.4$ ). In the index fingers, the increase in mobility was  $4.6^\circ$ , improving from  $55.4^\circ \pm 14$  (30–80°) to  $60^\circ$  post-op  $\pm 23.11$  (10–90°) ( $P = 0.6$ ).

The correction of clinodactyly was maintained over time at  $1.3^\circ \pm 3.6^\circ$  (0–10°) vs.  $14.2^\circ \pm 8.1^\circ$  (10–20°) before surgery ( $P = 0.9$ ).

The pinch strength in all digits improved significantly from  $2.3 \text{ kg} \pm 1.1$  (0.5–5) to  $3.7 \text{ kg} \pm 1.8$  (1–8) ( $P < 0.05$ ). On the PIP of the index fingers, the pinch strength had increased significantly from  $2.5 \pm 1.08$  (1–4) to  $3.8 \text{ kg} \pm 1.7$  (1–7.5) following surgery ( $P = 0.04$ ).

**Table 3**  
Clinical and radiological results of the index subgroup with pre- and post-operative comparisons.

INDEX criteria	Pre-operative	Post-operative	P
PIP Range of motion (°)	55.4 (30–80)	60 (10–90)	0.4
PIP flexion (°)			
Clinodactyly (°)	14.2 (10–20)	1.3 (0–10)	0.9
Grip strength (kg)	15.54 (8–38)	16.68 (4.5–26)	0.7
Pinch strength (kg)	2.5 (1–4)	3.8 (1–7.5)	0.04
Thumb-index pinch		100%	
Clinical complications		1 CRPS 1 reducible swan neck	
Digital exclusion		0	
Radiological complications		Dorsal osteophytes 1 patient	

The Quick DASH and PRWE Functional Scores improved after arthroplasty (Table 2). Following surgery, the average Quick DASH was 30.7/100 vs. 58.02 pre-op ( $P = 0.9$ ). Satisfaction was excellent in 15 patients (43%), good in 8 (22.7%), average in 10 (28.6%) and poor in 2 (5.7%). An improvement in pain on the VAS of  $5.35 \pm 2.1$  (0–9) to  $1.4 \pm 1.7$  (0–6) was observed ( $P = 0.9$ ).

Thumb-index pinch was preserved in all patients. There was radial collateral instability of one PIP on one little finger with subluxation of the implant in one patient who presented with mechanical loosening. All the other PIP joints were stable.

We did not note any overlap causing functional impairment. No septic complication was found at the last follow-up.

#### 3.2. Radiological results

No implant or periprosthetic fracture was found. We did not find collapse of the implant, or wear of the joint contact surfaces. The mechanical loosening of the prosthesis was unfortunate. The secondary appearance of collateral (5) and dorsal (1) osteophytes was observed without clinical consequences or ankylosis (Fig. 2).

#### 3.3. Complications and surgical revisions

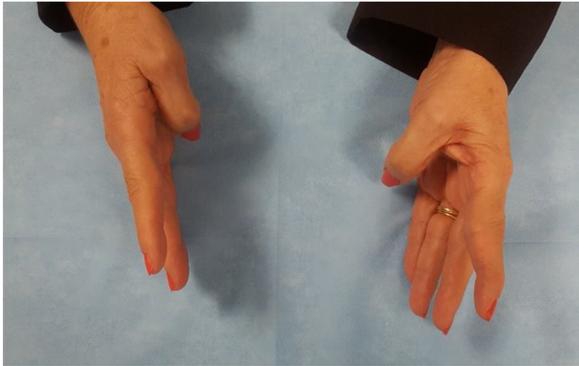
A total of 5 patients out of 35 had minor and reducible swan neck deformity, with no functional consequences for the patients (Fig. 3). Two patients presented with non-reducible, but non-troublesome, swan neck deformity, and their satisfaction was average and excellent respectively. The median strip was not reinserted through the bone in any of these patients.

We carried out three surgical revisions:

- one for lengthening tenotomy of the central slip on a ring finger after 8 months, with iterative tenoarthrolysis after 2 years and 3 months for recurrence of stiffness. PIP motion in flexion-extension at the last follow-up was 50/30°;
- arthroplasty of the middle finger was revised after 42 months due to dorsal ten-arthrolysis and change in the size of the



a)



b)

**Fig. 2.** Lateral and anteroposterior X-rays of the left index finger with presence of dorsal osteophytes.

implant (proximal joint surface) due to excessive joint blockage. The range of motion of the PIP improved from 30° to 85°;

- mechanical loosening occurred in one little finger in the first few post-op months with radial collateral instability. The patient presented with post-traumatic arthrosis with ulnar subluxation (Fig. 4). The revision consisted of arthrodesis of the PIP.



**Fig. 3.** Lateral and anteroposterior X-rays of the left index finger in one patient presenting with reducible swan neck deformity after 13 months follow-up (a). Comparison photos in the same patient of the right index finger, which was not operated on, without swan neck and the operated-on left index finger presenting with reducible swan neck (b).



**Fig. 4.** Preoperative and postoperative, anteroposterior and lateral X-rays of the PIP of the right little finger. Post-traumatic arthrosis with dorso-ulnar subluxation of the PIP (a, b). Loosening after four years of follow-up (c, d).

The complications appeared on the X-ray from the first year post-op (Table 4).

#### 4. Discussion

After properly provided medical treatment has failed, arthroplasty of the PIP is a reliable long-term surgical solution [3,5,6,10,11] to reduce pain and to improve joint mobility and strength. Arthroplasties with total gliding, modular prostheses provide good long-term results with fewer mechanical complications than fixed and semi-fixed silicon and metallic implants [12,13].

We counted fewer radiological complications [14,15] than in the other series, but these did not make up all the pre-op frontal deviations.

The silicone implants did not allow the correction of clinodactyly to be maintained over the long term, especially in patients in whom it was caused by rheumatism. Mares et al. even found a worsening by 7.4° in the deformity after five years in three out of four cases [12].

In their series with silicone implants, Delaney et al. found an improvement in clinodactyly from 26° to 9° maintained after two years. This was of inflammatory origin in all cases [16]. It would be interesting to study the correction of clinodactyly over the longer term.

In our study, the absence of loosening, fracture of the implant and collapse of the prosthesis after 2.6 years are all evidence of an absence of mechanical stress on the implants and satisfactory periarticular balance. The presence of collateral and dorsal osteophytes is of no clinical consequence.

The early mechanical loosening of the prosthesis on one little finger was unfortunate. The origin was post-traumatic with subluxation of the PIP on the sagittal plane prior to surgery (Fig. 4). We believe that the mechanical stress exacted on the implant was excessive on one finger, causing the force that led to the loosening.

The improvement in strength after arthroplasty was confirmed in all fingers and significantly in the subgroup of index fingers.

In terms of strength, pinch strength, the digits overall were weaker than in the other series [5,6] but it was 99% compared to the other side.

Our results in terms of range of motion are comparable with those of other PIP arthroplasties with a range of motion of 60° 2.6 years post-op [13,17,18]. This increase in range of motion allows the patient to touch thumb to index finger with grip and restoration of strength. A single patient presented with flexion limited to 10° due to dorsal adhesions. However, their strength was satisfactory, with a pinch of 7 kg vs. 8 kg on the non-operated side.

**Table 4**  
Post-operative results depending on follow-up.

Post-operative results depending on follow-up	Less than 2 years	More than 2 years
Number	11	24
Sex	10F	22F
Digit	5D2 4D3 1D4 1D5	8D2 10D3 4D4 2D5
Age	62.1 years $\pm$ 5.3 (55–72 years)	64.3 years $\pm$ 9.4 (40–85 years)
Average follow-up	1.3 years $\pm$ 0.3 (1–1.8 years)	3.2 years $\pm$ 1.02 (1.2–6.4 years)
Clinodactyly ( $^{\circ}$ )	Ulnar 1.5 (0–10) Radial 0.2 (0–2)	Ulnar 2.1 (0–15) Radial 0.8 (0–20)
ROM ( $^{\circ}$ )	68 $\pm$ 25 (10–90)	58.2 $\pm$ 29 (5–95)
Grip strength (kg)	15.4 (4.5–24)	16.7 (2–50)
Pinch strength (kg)	3.5 (1–8)	3.7 (1–7.5)
Clinical complications	2 swan neck: 1 non-reducible	5 swan necks, 1 non-reducible 1 algodystrophy 1 radial instability (loosening)
Radiological complications	0 Lateral osteophytes 3	1 loosening Lateral osteophytes 2 Dorsal osteophyte 1

Vitale et al. [19] compared arthrodesis and arthroplasty on the index finger PIP, and found that arthroplasty resulted in better overall strength and thumb-index pinch. The thumb-index pinch strength improved significantly following surgery in the case of arthroplasty and arthrodesis.

However, complications and rates of revisions were more frequent in the case of arthroplasty. The range of motion found in the index fingers of patients who underwent arthroplasty was, at 42° on average, weaker than in our series (60°), but their pre-op range of motion was equivalent. The increase in amplitude was 5° in both series. The increase in grip strength was in the order of 1 kg in both series, while the rise in thumb-index pinch was 2 kg in comparison to 1.3 kg in our series.

Their rate of major complications in the arthroplasty group was 63%. The majority of complications arose during the first year. Their revision rate was 12%. In our series, complications also arose in the first year post-op, but were not necessarily synonymous with the need for surgical revision.

Arthrodesis of the PIP, which to date has been the indication of choice for index fingers, remains indicated in the case of the loss of bone mass, a history of septic arthritis, major stiffness in flexion or weakness of the extensor or flexor apparatus. Major axial deformities do not appear to be an absolute contraindication for arthroplasty (up to 20° in our series).

The dorsal approach that we used with final suturing of the central slip but without reinsertion through the bone, does not appear to weaken the extensor apparatus, and we did not have any cases of buttonhole deformity in our series.

Two patients in the series underwent revision for dorsal tenarthrolysis, and the procedure was successful for one of them. Luther et al. reported 3 swan neck deformities and 9 surgical revisions due to tenolysis in 24 cases, with their Chamay approach probably being the source of the adhesion [20].

The swan neck deformities occurred in seven patients, and was not reducible in two of them, with range of motion of 20° and 80° respectively. The majority of swan neck deformities were reducible in our series.

Squeaking, which is often found in other types of implants [5,21], was not encountered in our series.

## 5. Conclusion

The anatomical and modular Tactys® prosthesis allowed us to restore ligament balance and to optimally rebalance the peri-

articular structures. The results on strength, range of motion and pain are indicative of an improvement after over 2 years. The increase in range of motion and the correction of clinodactyly appeared to be maintained at this follow-up. Total arthroplasty of the PIP with a Tactys® no longer appears to be a formal contraindication for the index fingers and in cases of clinodactyly of more than 5°. A longer-term study would allow these results to be confirmed.

## Disclosure of interest

Philippe Bellemère, co-designer of the Tactys® prosthesis, declares a conflict of interest with Stryker. The other authors declare that they have no competing interest.

## Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at <https://doi.org/10.1016/j.hansur.2019.03.001>.

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