Archives of Orthopaedic and Trauma Surgery (2025) 145:127
https://doi.org/10.1007/s00402-024-05663-1

RESEARCH

Total joint arthroplasty of the thumb CMC joint

Jiří Jurča[1,2] · Martin Vlach[2] · Vojtěch Havlas[2]

Received: 21 June 2024 / Accepted: 17 October 2024

Abstract

Purpose of the study Rhizarthrosis—osteoarthritis of the thumb carpometacarpal (CMC) joint is usually a primary idiopathic disease. Total joint arthroplasty (TJA) is one of the surgical treatment options for symptomatic advanced thumb CMC arthritis. This retrospective study aims to evaluate the mid-term functional and radiological results of TJA with the minimum follow-up period of 3 years after the surgery.

Material and methods Presented are the results of 136 total trapeziometacarpal joint replacements in the group of 105 patients consisted of 96 women and 9 men. Used prostheses were ELiS® implant (27 cases), Ivory® implant (42 cases), Touch® Dual mobility (67 cases). The follow-up period was minimally 3 years postoperatively. In all the patients, along with range of motion and radiologic evaluation of implant position, the function and pain of operated joint were evaluated using DASH and VAS score at regular intervals pre- and postoperatively.

Results At a mean of 85 months (range 38–126 months) post-operatively, patients in 116 cases (85%) reported full satisfaction and absence of symptoms and difficulties. In 12 cases (9%) some slight residual post-exercise pain was reported. In eight cases (6%) patients suffered from episodic rest-pain, but with a lower intensity than in the preoperative period. Postoperatively, the patients declared subjective improvement in hand function. The total DASH score and VAS score decreased in all patients, while ROM increased. The course of all of TJA surgeries was complication-free. Five patients needed revision surgery. In two patients a dislocation has occurred and in three cases a loosening of the cup's implant was reported. The most frequent postoperative complication was the occurrence of transient paraesthesias of the thumb in eight cases (6%).

Conclusions TJA is the method of choice in management of advanced symptomatic osteoarthritis of the thumb CMC joint. Mastering surgical technique, TJA represents safe and effective treatment method in advanced degenerative changes of the thumb CMC joint and it's benefits exceed possible perioperative and postoperative risks.

Keywords Rhizarthrosis · Total joint arthroplasty · Thumb CMC joint · Trapezium component

Introduction

Rhizarthrosis—basal joint arthritis of the thumb is a degenerative disorder of the first carpometacarpal (CMC) or trapeziometacarpal (TMC) joint. The base joint of the thumb has a saddle shape, which allows for a movement of the thumb in all planes—flexion and extension, abduction and adduction and axial rotation. The extensive range of motion (ROM) is given by the shape of the joint, especially opposition of the thumb, that consists of flexion, pronation and abduction of the thumb in which the thumb rotates along its axis [1]. Opposition of the thumb is essential for a grip. In addition to the shape of the articular surface, the stability of the joint is provided, in particular, by the joint capsule, which is strengthened by the ligaments and tendons extending to the thumb. The anatomical and functional aspects of the joint along with the extensive ROM lead to considerable load on the base joint of the thumb, therefore causing a more frequent and earlier onset of the degenerative changes and arthritis. Rhizarthrosis is usually a primary idiopathic disease. Postmenopausal women are most frequently affected, often bilaterally. The radiologic prevalence of osteoarthritis of the thumb basal joint in postmenopausal women is estimated to 33%, however only one third of patients is

✉ Jiří Jurča
jiri.jurca@gmail.com

[1] Department of Orthopaedic Surgery, Hospital Chomutov, Krajská Zdravotní a.s., Chomutov, Czech Republic

[2] Department of Orthopaedics and Traumatology, Second Faculty of Medicine, Charles University in Prague and University Hospital Motol, Prague, Czech Republic

Published online: 15 January 2025

symptomatic [2]. The secondary basal joint arthritis of the thumb is trauma-related or associated with rheumatoid arthritis.

Clinical signs of early stage of the thumb CMC arhtritis include swelling and gradually increasing stress pain. The late stage of the osteoarthritis of the I. CMC joint is associated with rest pain, the loss of muscle strenght in the thumb and weak grip, the ROM decreases, shape and axial deformities of the thumb CMC joint develop [3].

Conservative treatment methods are effective in early stages of osteoarthritis of the thumb CMC joint. These methods include NSAIDs, orthoses, steroid injections and physical therapy. If the conservative methods prove ineffective, a surgical treatment should be considered. Numerous surgical techniques have been described, that are indicated depending on the patient's age, level of activity and occupation, as well as on the stage of disability and also on the basis of the habits and experiences of individual workplaces.

The surgical methods used at our department include carpometacarpal arthrodesis (joint fusion), resection arthroplasty—trapeziectomy and FCR ligament reconstruction and tendon interposition (LRTI), and total joint arthroplasty (TJA). The technique is chosen individually based on patient`s age, activity, occupation and stage of basal joint arthritis of the thumb. The purpose of this study of retrospective design is to evaluate the results of the total joint replacement of the thumb CMC joint in patients with 3 years follow-up.

Material and methods

Since September 2013 until September 2023, the first author of this paper performed 238 total joint replacement procedures of the thumb CMC joint in 181 patients. In this retrospective study, the postoperative results of 136 TJA in 105 patients are evaluated. All of 105 patients have been followed regularly every year for at least 3 years postoperatively. The shortest follow-up time in our group was 38 months, longest 126 months. The mean follow-up was 85 months. In 31 patients the TJA was performed in both limbs, in two different sessions with minimal interval of 9 months between the surgeries.

The studied group of 105 patients consisted of 96 women and 9 men. The age of patients at the time of surgery ranged from 43 to 77 years (median 56 years). The TJA was performed mainly in the left hands. The ratio of dominant to non-dominant upper extremity was 63:73. In 125 cases the CMC arthritis of the thumb was classified as primary, secondary (rheumatic) arthritis was classified in seven patients and only four cases were of trauma-related aetiology. The group was divided by age and occupation into three subgroups. First sub-group consisted of 80 TJA in 60 patients of senior age. Second sub-group consisted of 34 TJA in 25 patients, whose occupation was non-manual labour or working at the office. The third sub-group, consisted of 22 TJA in 20 patients who performed manual labour of varying degrees of load. All participants of this study provided signed informed consent for surgery and subsequent therapy, as well as consented to participate in the study and to process personal data.

Only patients in whom conservative treatment was ineffective, a surgery was indicated. At the same time, these patients had positive clinical and radiological findings. As part of the preoperative clinical examination, we performed manoeuvres to investigate disorders of the thumb CMC joint such as grind test, compression test, resisted opposition manoeuvre and reduction grind test. We also measured ROM in terms of abduction and opposition of the thumb. Kapandji classification was used for such purpose [1]. Patients indicated to TJA surgery had symptomatic osteoarthritis of the thumb basal joint and the radiologic examination showed second, third and early fourth stage of osteoarthritis according to Eaton–Glickel classification [4]. The radiologic findings showed second degree in 12 cases, third degree in 101 cases and early fourth degree was found in 23 cases. A significantly reduced or destroyed *os trapezium* and pantrapezial arthritis were considered a contraindication to TJA surgery. In the postoperative protocol all patients were evaluated by clinical and radiodiagnostic examinations in regular follow-ups at the time of 6 weeks, 3 months, 6 months and 1 year after the surgery, and then as part of regular annual controls (Fig. 1). Along with ROM examination—the extent of abduction and opposition of the thumb according to Kapandji's classification and radiologic evaluation of implant position, the functional properties and pain were evaluated using DASH [5] and VAS (visual analog scale) score, respectively.

TJA surgery of the thumb CMC joint is performed under general or regional anesthesia (axillary block) using tourniquet and antibiotic prophylaxis. A short longitudinal incision is made over the dorsum of the first CMC joint. The dorsoradial sensory nerve branches to the thumb are identified and protected. The dorsal capsule of the thumb CMC joint is incised longitudinally in the interval between the abductor pollicis longus (AbPL) and extensor pollicis brevis (EPB) tendons. The articular surface of the base of the metacarpal is removed using a saw. The abundant osteophytes and the tip of palmar process of the first metacarpal are resected. Using original surgery rasps, from the smallest to the largest, the medullary canal in metacarpal bone is formed, allowing insertion of the trial stem implant, according the size of the last used rasp. Afterwards, the trapezium bone is prepared. Osteophytes are removed and minimal amount of articular surface is cut with the oscillating saw removing only bone processes, which gives the trapezium its` saddle-shape. After

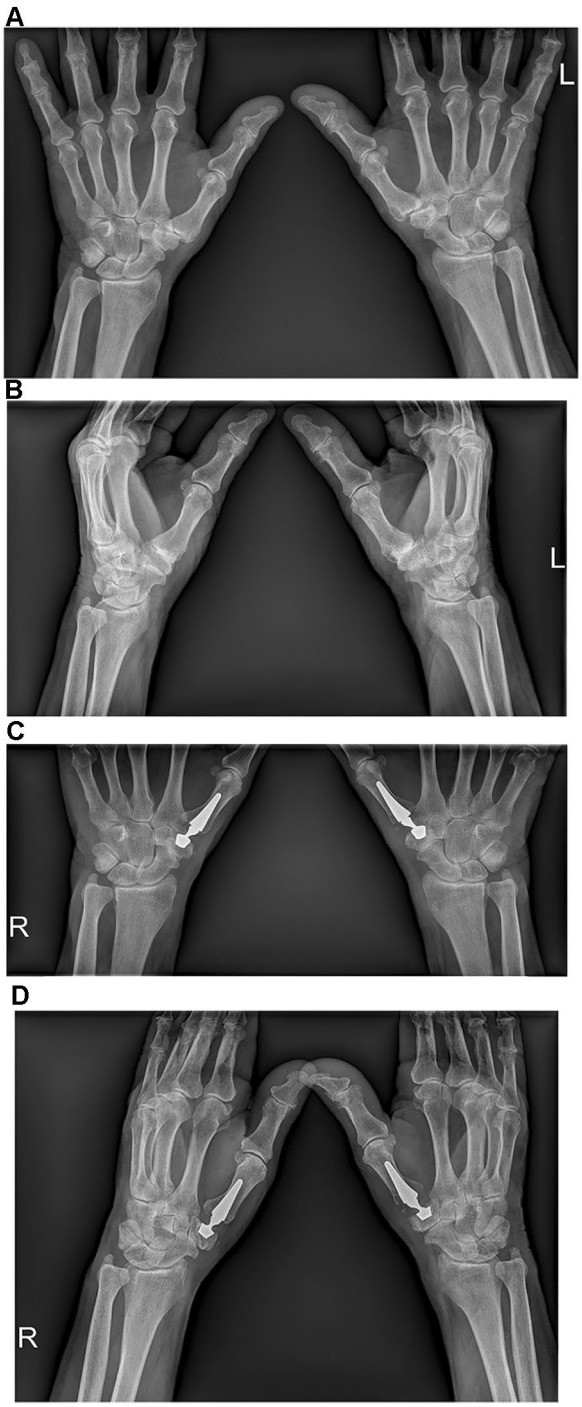

Fig. 1 X ray preoper: **A** Posteroanterior view, **B** oblique view; X ray 3-years postoper: **C** Posteroanterior view, **D** Oblique view

exposing the newly formed surface, using original milling cutters, the medullary bed in the center of trapezium is made for a trapezium implant. After testing, the definitive cup component is implanted into the trapezium, followed by insertion of polyethylene (PE) insert. Then the trial modular neck-head part is tested in various sizes evaluating joint stability and impingement of the first CMC joint in all planes and during full ROM. When the result is satisfactory, the definitive components—stem and neck-head are implanted (Fig. 2). It is of paramount importance to evaluate the stability of the joint in terminal positions in flexion, abduction and hyperextension with dorsiflexion of the carpal joint. The surgery is finished by closure in anatomical layers and a splint is applied for 2 weeks. Splint immobilization is only analgesic, allowing soft tissues to heal. After 2–3 weeks we remove the splint and instruct the patients about individual physical therapy. Simultaneously, we gradually allow normal daily self-service activities. The limb after surgery must be spared from a greater or longer load. Full use of the hand is allowed 3 months post-surgery. The reason is the pressfit anchoring of the implants. Three months should provide adequate time for bone to heal, minimalizing the risk of loosening of the implant during full-strength grip and activities.

In 27 cases of patients in the studied group of TJA ELiS® implant (Beznoska, Czech republic) was used, in 42 cases we used Ivory® implant (Memomental, Bruz, France) and in 67 cases Touch® Dual mobility carpometacarpal prosthesis was used. Most of the used implants were cementless, pressfit anchored endoprothesis with hydroxyapatite coating. The choice of implants was largely influenced by availability on the Czech market. Since 2011, the author began to focus on the treatment of advanced CMC arthritis of the thumb with methods such as CMC arthrodesis, resection arthroplasty—HDA and LRTI. Since 2013, we have introduced TJA in our department in addition to these methods. We started with the Czech-made Elis implant, which at the time only had a cemented cup component. At the same time, we looked around for an uncemented version of the implant. That was the Ivory implant that we switched to. The distribution of the Ivory implant in the Czech Republic ended in 2017–2018. We solved the failure with the Elis implant, which was already fully uncemented. Since 2019, we have only implanted the Touch dual mobility implant at our departement.

The ELiS offers a cemented cup component, which was used in 10 of the 27 cases. These modular endoprostheses consist of the cup with removable high-molecular-weight polyethylene Cestline®, stem and neck with a head. ELiS® implants are available with oval cup, while Ivory® offered conical cup. ELiS® implants are offered in two sizes of trapezium component—9 and 10 mm and the surgeon can choose five sizes of stem. Neck-head components are offered either straight or 15° valgus, both in four lengths. The diameter of the head is 5 mm. Ivory® implants are offered in three sizes of trapezium components—9, 10 and 11 mm, stem in five sizes and neck-head parts with diameter of 4 mm are offered either straight or 15° valgus, both in three lengths, allowing for implantation in neutral position, minus 30° or plus 30° rotation [6]. The TOUCH® prosthesis, using the

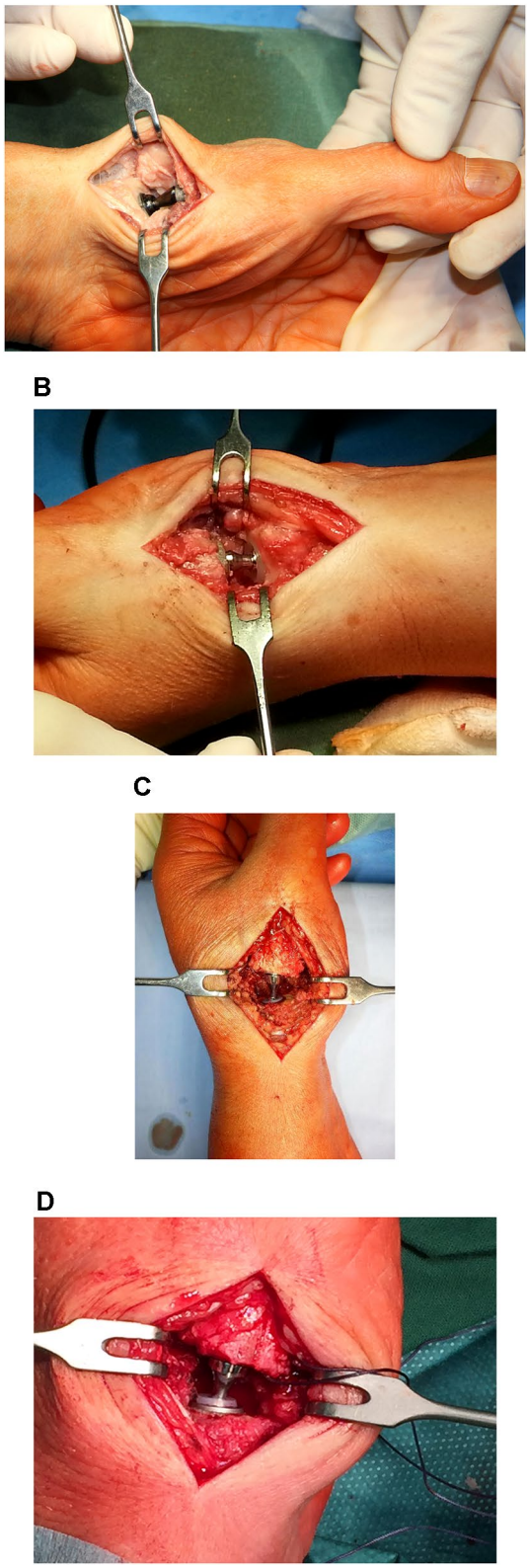

Fig. 2 **A** Beznoska uncemeted, **B** Beznoska cemented - peroper, **C** Ivory - peroper, **D** TOUCH - peroper

dual mobility concept, consists of an anatomical stem made of titanium alloy, available in five different sizes, in which a stainless-steel neck (available in 6, 8 and 10 mm height) with a 4 mm head either in a straight or 15° offset version is inserted. The dual mobility mechanism is warranted by a polyethylene insert, which is pre-assembled on the head. The inner surface with a 4 mm diameter articulates with the prosthesis's head the outer surface of 7 mm diameter by articulating with the stainless-steel cup implanted in the trapezium. Thus, this prosthesis consists of two concentric articulations: a smaller one between the stainless-steel head and a polyethylene insert as well as a larger one between the polyethylene insert and the trapezial cup [7–9]. The cup is either spherical with five anti-rotation fins and spiked crown or conical. Both of them are available in 9 and 10 mm diameter.

Results

Both clinical and radiologic assessment were made 6 weeks, 3 and 6 months and 1 year post-operatively as mentioned in methodics. Periodic annual controls followed in all patients afterwards. The details are shown in Tables 1, 2, and 3.

ROM of the thumb significantly improved in all patients with confirmed osteoarthritis of the thumb CMC joint of stage IV preoperatively. Thumb opposition, classified by Kapandji score system, improved from preoperative average 8.12/10 to postoperative average 9.82/10 (Table 2).

Exercise-related pain levels of the thumb decreased from 7.04, as staged preoperatively, to 0.40 three years post-op by VAS score. Rest pain disappeared in all of the 105 patients (Table 1).

Postoperatively, the patients declared subjective improvement in hand function. The DASH score decreased from mean preoperative 60.44 to 9.4 assessed 2 and 3 years post-op. Comparing of groups of the patients by age and occupation showed best functional results in patients, whose occupation was non-manual labour or office work. In this group, the overall DASH score decreased from 59.31 preoperatively to 7.88 at 2-year post-op follow up. In opposite, group of manually working patients showed the least improvement (Table 3).

Overall, patients claimed their satisfaction with the procedure. Three years post-operatively, patients in 116 cases (85%) claimed full satisfaction and absence of symptoms and difficulties. In 12 cases (9%), some slight residual post-exercise pain was reported. In eight cases (6%) patients reported episodic rest-pain, however, patients described such pain of lower intensity compared to preoperative pain. Until the end of September 2023, 57 patients overall and 31 patients of the studied group underwent TJA of the thumb CMC joint on the second limb, proving an overall satisfaction rate of the patients with TJA procedure.

Table 1 Visual analogue scale (VAS) of pain

TJA	Number of implants (%)	VAS					
		Preoperative	After 3 months	After 6 months	After 1 year	After 2 years	After 3 years
Total file	134 (100)	7.04	1.59	1.02	**0.5**	0.48	0.4
Retired, household	79 (59)	6.9	1.5	0,8	0.4	0.4	0.3
Non-manual and office working	33 (25)	6.9	1.64	1.27	0.45	0.45	0.39
Manual working	22 (16)	7.73	1.82	1.45	0.9	0.77	0.73

Table 2 Kapandji thumb opposition test

TJA	Number of implants (%)	Kapandji					
		Preoperative	After 3 months	After 6 months	After 1 year	After 2 years	After 3 years
Total file	134 (100)	8.12	9.39	9.76	9.82	9.82	9.82
Retired, household	79 (59)	8.1	9.25	9.69	9.75	9.75	9.75
Non-manual and office working	33 (25)	8.33	9.6	9.89	9.94	9.94	9.94
Manual working	22 (16)	7.95	9.45	9.77	9.82	9.82	9.82

Table 3 The disabilities of the arm, shoulder and hand (DASH) score

TJA	Number of implants (%)	DASH					
		Preoperative	After 3 months	After 6 months	After 1 year	After 2 years	After 3 years
Total file	134 (100)	60.44	19.18	14.79	10.43	9.4	9.4
Retired, household	79 (59)	61.35	20.74	15.94	11.76	10.41	10.41
Non-manual and office working	33 (25)	59.31	17.12	13.56	8.65	7.88	7.88
Manual working	22 (16)	58.82	16.67	12.5	8.33	8.06	8.06

In described group of patients, the course of all of TJA surgeries was complication-free. Postoperatively, not a single case was complicated by infection.

In eight cases we recorded transient paresthesias of the thumb and scar, which disappeared spontaneously within 2 months after the surgery. Neither complex regional pain syndrome, allergic reaction to metal nor heterotopic ossification were reported.

In three cases, deQuervain`s disease (tendosynovitis of the first extensor compartment) has occurred postoperatively [10], which we solved with a surgical release of EPB and AbPL tendons in the area of the radial styloid 3 months after implantation, with the subsequent disappearance of the problems.

In two cases a dislocation has occurred. In the first case the cause was traumatic—fall of the patient, however, without damaging the endoprosthesis. In the second case the reason was a suboptimal cup placement into the trapezium. Both cases were treated by open reduction was and in the second case we also performed a reimplantation of the trapezium component. A splint was applied for 3 weeks postoperatively.

In three cases a loosening of the cup was reported.

In the first case, the cemented cup of the hybrid-endoprosthesis has loosened by injury—fall and distortion of the thumb 4 months post-op. Trauma radiograph was negative, showing no dislocation, loosening of the implant or signs of bone trauma. However, a swelling and pain has occurred after the trauma. A splint was applied for 3 weeks which led the symptoms to subside. After another 6 months an exercise-pain developed. An X-ray showed loosening of the cup, therefore we decided for revision surgery. Perioperatively a loosen cup was found along with deep defect of trapezium bone and a fracture of the dorsal aspect of the cup-hole. In this case, a re-implantation could not be performed, therefore complete extraction of the endoprosthesis, trapeziectomy and conversion to LRTI were performed, using a flexor carpi radialis (FCR) tendon along with trapezium prosthesis—TIE-IN implant [11, 12], approximately 10 months after primary surgery.

Two times an aseptic loosening has occurred. In one case it was a cemented cup primo-implantation, where, during a routine 6-month follow up, we observed X -ray evidence of cup loosening accompanied by clinical symptoms of pain during movement.We decided to proceed to two-stage reimplantation—extraction of the cup, spongioplasty using an autologous bone graft and after 3 months since spongioplasty, a reimplantation of the cementless cup was performed. We noticed no complications post-operatively. Periodic radiologic assessment showed satisfactory osteointegration of the cup into reconstructed trapezium. Currently, after more than 4 years since the reimplantation, the patient is pain free showing no other complications and according to X-ray studies, TJA of the thumb CMC joint shows no loosening. In the second case, an aseptic loosening occurred in 74 year old patient with early stage IV of osteoarthritis of the thumb CMC joint according to Eaton–Glickel classification [4]. The pain has occurred 9 months after surgery. During a revision surgery 11 months after the primary implantation, a massive defect of the trapezium bone was noted, making a one-time reimplantation impossible. Considering the patient`s age and an X-ray findings showing pantrapezial arthritis, an extraction of the endoprosthesis, trapeziectomy and conversion to LRTI using a FCR tendon was performed along with trapezium prosthesis—TIE-IN implant [11, 12] (Table 4).

Discussion

Nowadays, possibilities of surgery as a treatment method in advanced osteoarthritis of the thumb CMC joint are vast. From suspension or interposition arthroplasties, arthrodesis of CMC joint, trapeziectomy, up to after TJA. According to Vermeulen, there is non type of surgery superior to another, all types of surgeries they have their advantages and complications [13].

In addition to the evaluated surgical technique at our department in cases of advanced stage IV osteoarthritis of the thumb CMC joint with pantrapezial arthritis and in stage III rhizartrosis with significant destruction of trapezium, which prevents implantation of endoprosthesis, we perform total trapeziectomy with LRTI according to Burton–Pellegrini [14, 15] or trapeziectomy with TIE-IN implant [11, 12].

Table 4 Postoperative complications

Postoperative complications	Number	Percentage
Intermittent paresthesia	8	6
M. de Quervain	3	2
Dislocation of endoprosthesis	2	1
Loosening of the socket implant	3	2

Fusion of the first CMC joint [16–20] is indicated in sporadic cases, due to it`s disadvantages, especially loss of fine motor skills. Such cases are, on the one hand, advanced rheumatic arthritis of the thumb CMC joint in elderly patients, and, on the other hand, younger, hard-working men, but only, if rest of the carpal joints stay intact, therefore providing a compensation for fused trapezium-metacarpal joint.

In late 70 s, de La Caffiniere developed the very first cemented endoprosthesis of the first CMC joint, wich was based on the concept of total hip arthroplasty (THA)—"ball and socket" [21]. Post implantation, fast healing was observed as well as pain-free movement and improvement of grip strength. However, frequent failure of the implants was described, most often it's trapezial component [22, 23].

In early 90s, new types of "ball and socket" prostheses were developed, that already have acceptable both mid-term and long-term results. These are represented by modular cementless or hybrid total endoprostheses with hydroxyapatite coating [24]. A good example is Arpe® implant, for which excellent mid-term and long-term results have been published. Arpe® implant achieves 5-year survival in 97% [25] and 10-year in 93.8% of cases [26]. Another implant, Maïa®, was showing very good short-term and mid-term results. In a group of 36 patients with Maïa® implants, only single case of aseptic loosening was reported 3 years post-operatively [27]. Studies on Ivory® implants shows very good short-term and mid-term clinical results [6, 28, 29]. Gobau published a paper describing a total 5-year survival of 95% in group of 22 patients. He described single revision surgery in a case of PE wear, resulting in dynamic instability [28]. Spaans published three surgical revisions in a group of 20 patients with average 37 months follow-up. Two times due to dislocation and once due to trapezium bone collapse [29].

The most recent innovation in thumb CMC TJA is the introduction of dual mobility. This concept was initially developed by Gilles Bousquet in 1976 for total hip arthroplasty: The association of two articulating surfaces in the prosthesis cup intends to reduce the dislocation rate and increases the angular displacement to decrease the mechanic loads on the fixation points [7, 30]. TOUCH® prosthesis, which was introduced in 2015 by Bruno Lussiez a Pascal Ledoux, adopts this concept for the thumb CMC joint [7–9, 31]. Since 2019 we have been performing TJA of the thumb CMC joint exclusively with this implant at our department.

A failure of trapezium cup component is well known and described post-operative complication in TJA of the thumb CMC joint [23, 24, 29, 32–35]. Forces acting on the cup component in the trapezium are, because of ball-and-socket joint biomechanics, higher than forces acting on the stem component in the first metacarpal, therefore demands for cup

osteointegration are far greater. Trapezium has both lesser amount of cancellous bone and thinner cortical bone compared to metacarpal, therefore providing an inferior support for an implant. A precise centration of the socket part is crucial during implantation, concurrently without weakening of the cortical bone. A thermal necrosis occurs during a coarse milling and could be a possible negative factor, that increases risk of cup implant failure.

At our workplace, preserving maximum of subchondral bone during implantation is desired, therefore we perform milling considerately and we also implant the smallest 9 mm cups.

Correctly placed implantation into trapezium bone is crucial. Suboptimal implantation may lead to adverse biomechanical conditions post-operatively and thus to an increased risk of endoprosthesis failure.

The number of reimplantations is highly variable with TJA of the thumb CMC joint, as in many cases implant failure is well tolerated. The radiological findings of replacement loosening may not always correlate with the clinical findings [22, 24, 36].

However, in cases of failure of TJA of the thumb CMC joint, most commonly due to a failure of trapezium cup implant, possible solutions are limited. One of the possible solutions is prosthesis extraction and trapeziectomy accompanied with LRTI. Other solution is represented by one-stage or two-stage reimplantation of the cup, using cemented or uncemented implants and without/with spongioplasty using an autologous bone graft.

A study published by Knak proved no statistically significant difference in subjective and objective rating in patients, whom underwent either trapezium component reimplantation or trapeziectomy. In cases of reimplantation, a risk of more surgical revisions is unacceptably high. Knak suggests, that trapeziectomy should be preferred salvage method after failure of the trapezium component over reimplantation [34]. Kaszap`s paper shows similar postoperative results in the case of both primary and secondary trapeziectomy following failed total trapeziometacarpal joint replacement [33].

Conclusion

The TJA of the thumb preserves the CMC biomechanics of the thumb joint. Thanks to preservation of the joint capsule and the minimal resection of the joint surfaces, it restores the fulcrum between the trapezium and the first metacarpal, preserves the length of the I. column of the hand and the physiological center of rotation to ensure anatomical conditions for the activity of the thenar muscles. TJA of the thumb CMC joint thus combines the advantages of other surgical methods, where, in addition to the loss of pain and restoration of the range of motion, it ensures good strength and stability, which are necessary attributes for the restoration of grip strength.

Our experiences with TJA of the thumb CMC joint are corresponding with other authors describing very good short-term and mid-term functional and radiologic results, without early aseptic loosening of the implant.

This method of dealing with advanced symptomatic osteoarthritis of the thumb CMC joint is fully indicated in patients of middle and older age with mild or moderate demands on manual labour and load, and in patients, who prefer physiological ROM and adequate grip strength. In hard manual working patients the TJA is an unsuitable method. High demand of hard manual working patients reduce the survival rate of the implants with need for surgical revisions as well as increase in post-operative complications. Nonetheless, some hard manual labourers were assessed in our group too.

We believe that, if the indication criteria for TJA of the thumb CMC joint are met, TJA surgery is the method of choice in management of advanced symptomatic osteoarthritis. When mastered, TJA represents safe and effective treatment method in advanced degenerative changes of the thumb CMC joint and it's benefits exceed possible perioperative and postoperative risks.

The shortest follow-up time in our group was 38 months, longest 126 months. These are mid-term to long-term results that, in agreement with results of other autors prove TJA of the first CMC joint as a correct technique in treatment of advanced symptomatic osteoarthritis of the thumb CMC joint.

Acknowledgements The project was supported the grant project MH CZ-DRO, Motol Univesity Hospital, Prague, Czech Republic 00064203, and by the Cooperatio Program, research area MED/DIAG and research area SURG.

Author contributions All authors contributed to the study conception and design. Material preparation, data collection a analysis were performer by Jiří Jurča. The first draft of the manuscript was written by JIŘÍ JURČA and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding The project was supported the grant project MH CZ-DRO, Motol Univesity Hospital, Prague, Czech Republic 00064203, and by the Cooperatio Program, research area MED/DIAG and research area SURG.

Availability of data and materials Data supporting the findings of the study will be deposited in the data repository of Krajská zdravotní, a.s., Czech republic.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no, and has never been, conflict of interest. At the same time, the authors declare that there were not and are not competing interest related to the work submitted for publication. The corresponding author has been dealing with the issue of advanced os-

teoarthritis CMC I. for more than 12 years. For his scientific work comparing surgical techniques for the treatment of advanced osteoarthritis CMC I. received the Ph.D. this year.

Ethical approval and consent to participate This study and its own medical care, including operations and postoperative therapy, is conducted in accordance with applicable legislation of the Czech republic and in accordance with the requirements of good clinical practice and ethical principles set out in the Declaration of Helsinki. All participants provided signed informed consent for surgery and subsequent therapy, as well as consented to participate in the study and to process personal data.

Consent for publication All authors consent to the publication of the original article "Total Joint Arthroplasty of the Thumb CMC Joint" in Archives of Orthopaedic and Trauma Surgery.

References

1. Kapandji IA (2007) The physiology of the joints. Churchill Livingstone, Edinburg
2. Armstrong AL, Hunter JB, Davis TR (1994) The prevalence of degenerative arthritis of the base of the thumb in post-menopausal women. J Hand Surg Br 19:340–341
3. Pilný J, Jindra M, Krejzová J, Řihošková M, Bažantová K (2008) Rhizarthrosis of carpometacarpal (CMC) joint of a thumb. Cech Revmatol 3:110–113
4. Eaton RG, Glickel SZ (1987) Trapeziometacarpal osteoarthritis. Staging as a rationale for treatment. Hand Clin 3:455–471
5. Hudak PL, Amadio PC, Bombardier C (1996) Developement of an upper extremity outcome measure: DASH (disabilities of the arm, shoulder and hand). The upper extremity Collaborative group (UECG). Am J Ind Med 29:602–608
6. Závodný I, Pavličný R, Holinka M (2018) Short-term results of the carpometacarpal joint arthroplasty using the Ivory prosthesis. Acta Chir Orthop Traumatol Cech 85:130–136
7. Froschauer SM, Holzbauer M, Mihalic JA, Kwasny O (2021) TOUCH® prosthesis for thumb carpometacarpal joint ostheoarthritis: a prospective case series. J Clin Med 10(18):4090
8. Gonzales-Espino P, Pottier M, Detrembleur CH, Goffin D (2021) TOUCH® double mobility arthroplasty for trapeziometacarpal osteoarthritis: outcomes for 92 prostheses. Hang Surg Rehabil 40(6):760–764
9. Lussiez B, Falaise C, Ledoux P (2021) Dual mobility trapeziometacarpal prosthesis: a prospective study of 107 cases with a follow-up of more than 3 years. J Hand Surg Eur 46:961–967
10. Goubau JF, Goubau L, Goorens CK, Van Hoonacker P, Kerckhove D, Vanmierlo B, Berghs B (2015) De Quervain tenosynovitis following trapeziometacarpal ball-and-socket joint replacement. J Wrist Surg 4:35–42
11. Avisar E, Elvey M, Tzang C, Sorene E (2015) Trapeziectomy with a tendon Tie-in implant for osteoarthritis of the trapeziometacarpal joint. J Hand Surg Am 40:1292–1297
12. Jurča J, Havlas V (2018) Interposition and suspension arthroplasty of carpometacarpal joint of the thumb using the TIE-IN implant. Acta Chir Orthop Traumatol Cech 85:125–129
13. Vermeulen GM, Slijper H, Feitz R, Hovius SER, Moojen TM, Selles RW (2011) Surgical management of primary thumb carpometacarpal osteoarthritis: a systematic review. J Hand Surg Am 36:157–169
14 Burton RI, Pellegrini VD Jr (1986) Surgical managment of basal joint arthritis of the thumb. J. Hand Surg Am 1-A:324
15. Jurča J, Němejc M, Havlas V (2016) Surgical treatment for advanced rhizarthrosis. Comparison of results of the Burton–Pellegrini technique and trapeziometacarpal joint arthroplasty. Acta Chir Orthop Traumatol Cech 83:27–31
16. Caroll RE (1987) Arthrodesis of the carpometacarpal joint of the thumb. Clin Orthop 220:106–110
17. De Smet L, Van Meir N, Verhoeven N, Degreef I (2010) Is still a place for arthrodesis in the surgical treatment of basal joint osteoarthritis of the thumb? Acta Orthop Belg 76:719–724
18. Chamay A (1994) Arthrodesis of the trapeziometacarpal joint. J Hand Surg 19:489–497
19. Pech J, Veigl D, Hromádka R, Dobiáš J, Zatrapa T (2014) Shape-memory osteosynthesis for trapeziometacarpal joint arthrodesis. Acta Chir Orthop Traumatol Cech 81:335–339
20. Zdráhal M (2009) Arthrodesis of carpometacarpal joint of the thumb using a cannulated screw. Acta Chir Orthop Traumatol Cech 76:326–328
21. De la Caffiniere JY, Aucouturier P (1979) Trapezio-metacarpal arthroplasty by total prosthesis. Hand 11:41–46
22. De Smet L, Sioen W, Spaepen D, Van Ransbeeck H (2004) Total joint arthroplasty for osteoarthritis of the thumb basal joint. Acta Orthop Belg 70:19–24
23. Van Cappelle H, Elzenga P, Van Horn JR (1999) Long-term results and loosening analysis of de la Caffiniere replacements of the trapeziometacarpal joint. J Hand Surg Am 24:476–482
24. Krughaug Y, Lie SA, Havelin LI, Furnes O, Hove LM, Hallan G (2014) The results of 479 thumb carpometacarpal joint replacements reported in the Norwegian Arthroplasty Register. J Hand Surg Eur 39:819–825
25. Eecken SV, Vanhove W, Hollevoet N (2012) Trapeziometacarpal joint replacement with the Arpe prosthesis. Acta Orthop Belg 78:724–729
26. Martin-Ferrero M (2014) Ten-year long-term results of total joint arthroplasties with ARPE implant in the treatment of trapeziometacarpal osteoarthritis. J Hand Surg Eur 39:826–832
27. Kubát P, Trtík L (2012) Maïa Trapeziometacarpal implant for treatment of advanced osteoarthritis of the basal joint of the thumb. Acta Chir Orthop Traumatol Cech 79:520–523
28. Goubau JF, Goorens CK, Van Hoonacker P, Berghs B, Kerckhove D, Scheetlinck T (2013) Clinical and radiological outcomes of the Ivory arthroplasty for trapeziometacarpal joint osteoarthritis with a minimum of 5 years of follow-up: a prospective single-centre cohort study. J Hand Surg Eur 38:866–874
29. Spaans AJ, Van Minnen LP, Weijns ME, Braakenburg A, Van der Molen AB (2016) Retrospective study of a series of 20 Ivory prostheses in the treatment of trapeziometacarpal osteoarthritis. J Wrist Surg 5:131–136
30. Noyer D, Caton JH (2017) Once upon a time…. Dual mobility: history. Int Orthop (SICOT) 41:611–618
31. Filus D, Pavlicny R (2023) Short-term outcomes of Touch® prosthesis for thumb carpometacarpal joint. Acta Chir Orthop Traumatol Cech 90:277–282
32. Hansen TB, Stilling M (2013) Equally good fixation of cemented and uncemented cups in total trapeziometacarpal joint protheses. A rabdomized clinical RSA study with 2-year follow up. Acta Orthop 84:98–105
33. Kaszap B, Daecke W, Jung M (2013) Outcome comparision of primary trapeziectomy versus secondary trapeziectomy following failed total trapeziometacarpal joint replacement. J Hand Surg Am 38:863–871
34. Knak J, Hansen TB (2016) Trapeziectomy or revision into a cemented polyethylene cup in failed trapeziometacarpal total joint arthroplasty. J Plast Surg Hand Surg 50:286–290
35. Wachtl SW, Sennwald GR (1996) Non-cemented replacement of the trapeziometacarpal joint. J Bone Surg Br 78:787–792

36. Semerse A, Vuillerme N, Corcella D, Forli A, Moutet F (2015) Results with the Roseland® HAC trapeziometacarpal prosthesis after more than 10 years. Chir Main 34:59–66