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Original Research

# Comparative Analysis of Prosthetic (Touch) and Arthroplastic Surgeries for Trapeziometacarpal Arthrosis: Functional Outcomes and Patient Satisfaction With a 2-Year Follow-Up

Eleonora Piccirilli, MD, PhD, [*] Priscilla di Sette, MD, [†] Michele Rampoldi, MD, [†] Matteo Primavera, MD, [*] Chiara Salvati, MD, [*] Umberto Tarantino, MD [*]

[*] Department of Orthopedic and Traumatology, University of Tor Vergata, Rome, Italy
[†] Department of Orthopedic and Traumatology, CTO Andrea Alesini, Rome, Italy

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*Purpose:* Trapeziometacarpal (TMC) joint prosthesis poses its own challenges for the treatment of TMC arthrosis, especially when compared with the present gold standard, arthroplasty. The aim of this study was to highlight possible outcome differences and patients' satisfaction regarding the treatment of TMC arthrosis.
*Methods:* We evaluated 100 patients with TMC arthrosis treated in two centers and divided into two groups: group A received TMC prosthesis (Touch), whereas group B was treated with arthroplasty, with a 2-year follow-up period.
*Results:* In a comparative analysis, findings revealed group A's superiority in the shortened disabilities of the arm, shoulder and hand questionnaire scores at 1 and 6 months, with significant differences: 34.6% vs 67.1% and 2% vs 9.1%, respectively ($P < .0001$). Although group A also showed lower the shortened disabilities of the arm, shoulder and hand questionnaire scores at 3 months, this was not statistically significant. Notably, at 1 and 2 years, group A demonstrated better scores without statistical significance. The Kapandji score differed significantly at 6 months: 9.8 vs 9.1 ($P = .029$). Although the visual analog scale showed generally lower values for the prosthesis group, no statistical differences emerged. Additionally, the M1/M2 ratio became significant postoperatively, favoring group A ($P < .05$).
*Conclusions:* Trapeziometacarpal prosthesis shows promise for TMC arthrosis, enhancing function, thumb length, and patient recovery, warranting further research and x-ray guidance.
*Type of study/level of evidence:* Therapeutic III.

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The management of trapeziometacarpal (TMC) joint arthrosis poses a significant challenge for hand surgeons. Comparative studies have focused on the difference between TMC prosthesis replacement and the actual gold standard: arthroplasty. Trapeziometacarpal prosthesis design advancement (specifically with the introduction of the dual mobility) has decreased the percentage of complications (namely, loosening and dislocation).[1] Numerous surgical variants have been described for biological arthroplasty, most of them including trapezium removal, followed by tendon interposition: this technique is well-known, with lower complication rates if compared with TMC prosthesis, but may decrease the length of the thumb and its strength. These two factors alone could limit the surgical benefits for younger patients who are still employed, even if an age range for TMC prosthesis indication is still missing.[2] Our paper aims to critically evaluate their respective clinical outcomes, functional benefits, and complications to clarify which treatment best fits patients, with a follow-up of 2 years.

## Material and Methods

### *Study design and participants*

Our prospective cohort study selected 100 patients affected by TMC arthrosis, divided into two groups: group A ($n = 50$) was

**Corresponding author:** Matteo Primavera, MD, Department of Orthopedic and Traumatology, University of Rome Tor Vergata, Rome, Italy.
*E-mail address:* matteo.primavera91@gmail.com (M. Primavera).

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**Table 1**
Preoperative Patient Characteristics

| | Group A: Prosthesis | Group B: Arthroplasty |
|---|---|---|
| *N* | 50 | 50 |
| Average age (y) | 59.2 y | 63.3 y |
| Self-identify male | 8 | 10 |
| Self-identify female | 42 | 40 |
| Symptoms duration | 2.3 y | 2.1 y |
| Average preoperative VAS | 6.4 | 6 |
| Average preoperative QuickDASH | 42.3 | 66.4 |
| Average preoperative Kapandji | 5.9 | 4.5 |
| M1 length | 54.98 | 53.95 |
| M1/M2 ratio | 0.749 | 0.745 |

treated with a Touch (KeriMedical) prosthesis, whereas group B ($n = 50$) was treated with tendon interposition arthroplasty (patients characteristics have been summarized in Table 1). The present study has been approved by our center's ethical committee; informed consent and Health Insurance Portability and Accountability Act consents have been collected for all patients. Criteria of inclusion for group A were more restricted and included absence of scaphotrapezium-trapezoid arthrosis and trapezium height equal or superior to 8 mm. All patients have been treated in two different centers by two different surgeons between 2021 and 2022.

*Clinical and radiographical assessments*

All 40 patients completed the shortened disabilities of the arm, shoulder and hand questionnaire (QuickDASH) questionnaire preoperatively (around 1 week before surgery) and at follow-ups with the following schedule: 1, 3, and 6 months and 1 and 2 years. The visual analog scale (VAS) and the Kapandji score were also recorded for all patients at the same time points. Dual-plane radiographs were taken preoperatively to assess for criteria of inclusion and deformities and postoperatively to determine the length of the first (M1) and second metacarpal (M2); the M1 has been calculated as the distance from the proximal surface of the trapezium to the distal articular surface of the first metacarpal, whereas M2 has been extrapolated as the distance from the proximal surface of the trapezoid and the distal articular surface of the second metacarpal. The M1/M2 ratio in the two groups was calculated preoperatively and postoperatively. In group A, 38 patients were Eaton stage II and 12 were Eaton stage III, whereas in group B, 27 were Eaton stage II and 23 were stage III. Of note, the inclusion criteria for group A may have inadvertently favored the selection of more Eaton stage II cases over Eaton stage III cases, potentially introducing bias into the group composition; however, prosthesis implantation can still be done in patients with more severe Eaton stages, provided the aforementioned inclusion criteria.

*Statistical analysis*

Statistical analysis was performed by using Excel (Microsoft). Descriptive statistics were used to summarize the data, including means, standard deviations, frequencies, and percentages. The Shapiro-Wilk test was used to assess data normality distributions. The comparative analysis between groups A and B was conducted using Student *t* test, with *P* values $< .05$ considered statistically significant.

*Surgical technique*

Following a brachial plexus block, the patient was placed supine, and a high-arm tourniquet was inflated to 250 mmHg. A dorsal longitudinal incision was made over the TMC joint, followed by careful superficial and deep dissection to the TMC joint. The radial artery and its volar branches have been identified: the kit for the Touch prosthesis includes an instrument to be put under the trapezium for protection of those volar branches during the trapezium cut and cup placement. A longitudinal capsulotomy, in line with the skin incision, was performed, carefully ligating the venous plexus.

*Prosthesis placement*

Any osteophytes have been removed carefully; with the aid of an oscillating saw, the base of the first metacarpal and the distal portion of the trapezium were cut. The metacarpal stem has been implanted first, by convention with implant selection assessed intraoperatively using x-rays. Centering of the cup on the trapezium was made using a Kirschner wire. Lastly, neck and head components were chosen according to subjective length restoration during passive TMC mobility tests and according to the surgeon's preference. Correct thumb length was assessed intraoperatively, and the capsule was sutured back. Dressing was used to immobilize the thumb for 2 weeks for both groups.

*Arthroplasty with flexor carpi radialis interposition*

The trapezium and any osteophytes (specifically the one between the first and second rays) were removed entirely. The flexor carpi radialis was identified, isolated, and cut (as proximally as possible) with an L-shaped incision within the surgical window: the radial bundle was then secured ("like a hammock") to the base of the first metacarpal with a bone anchor or sutured to the capsule depending on the operating center. Correct thumb length was assessed intraoperatively. The capsule was carefully sutured back. Postoperative care includes immobilization of the hand with restrictive bandages for both groups A and B.

## Results

After surgery, group A (TMC prosthesis) was superior to group B arthroplasty at 1 and 6 months for the QuickDASH: 34.6% versus 67.1% ($P < .0001$) and 2% versus 9.1% ($P < .0001$), respectively; the TMC prosthesis group showed a lower QuickDASH score also at 3 months, but this result was not significantly different. The prosthesis group showed a better QuickDASH score at 1 and 2 years, but those results were not statistically significant. The Kapandji score was found significantly different just at the 6 month mark: 9.8 versus 9.1 ($P = .029$). The VAS score did not exhibit any statistically significant disparities across the observed time points, even if the prosthetic group generally showed lower values. The M1/M2 ratio did not differ preoperatively but became statistically significant postoperatively, with the group A reporting the highest score ($P < .05$; Table 2).

## Discussion

The high worldwide prevalence of TMC arthrosis has generated various surgical techniques: prosthesis and arthroplasty are two of the most used techniques.[3] The objectives of any surgical intervention for TMC arthrosis encompass decreasing pain, providing stability to the base of the first metacarpal, and enhancing grip and pinch strength while preserving the thumb's mobility. The introduction of dual mobility prosthesis has increased the implant's stability and range of motion, mimicking the natural mechanics of the thumb.[4] When compared to thumb arthroplasty with tendon interposition, the surgical gold standard for thumb-metacarpal arthrosis, TMC prosthesis implant has the main advantage of restoration of thumb length and more rapid functional recovery.[5–9]

**Table 2**
Postoperative Clinical and Radiological Outcomes

| Parameters | Group A: Prosthesis | Group B: Arthroplasty | *P* Value |
|---|---|---|---|
| QuickDASH at: | | | |
| 1 mo | **34.6** | **67.1** | < .0001 |
| 3 mo | 17.0 | 26.6 | |
| 6 mo | **2** | **9.1** | < .0001 |
| 1 y | 2.3 | 1.2 | |
| 2 y | 0.2 | 0.9 | |
| Kapandji at: | | | |
| 1 mo | 7.4 | 5.5 | |
| 3 mo | 8.4 | 8.5 | |
| 6 mo | **9.8** | **9.1** | **.029** |
| 1 y | 9.8 | 9.5 | |
| 2 y | 9.7 | 9.5 | |
| VAS at: | | | |
| 1 mo | 7.1 | 6.7 | |
| 3 mo | 3 | 4.5 | |
| 6 mo | 0.5 | 0.2 | |
| 1 y | 0.3 | 0.4 | |
| 2 y | 0.3 | 0.3 | |
| M1/M2 ratio | **0.782** | **0.749** | **.03** |
| Time to return to work | 2.5 mo | 2.9 mo | |
| Complication rate | 3.3% | 0% | |
| Specific complications | | | |
| trapezium fracture | 1 case | | |
| De Quervain's tenosynovitis | 1 case | | |

Significant *P* values are indicated in bold.

Nowadays, a clear indication for TMC prosthesis implantation is still lacking, especially as arthroplasty with tendon interposition shows a lower complication rate overall.[1] This technique has already been demonstrated particularly useful in active young patients. When compared to arthroplasty, TMC prosthesis has the advantage of preserving thumb strength.[10] In the literature, patients receiving TMC prosthesis have a faster return-to-work time[11]; our cohort reported 2.5 versus 2.9 months for groups A and B, respectively (a limitation could be that group B included a higher percentage of retired patients: 52.2% versus 43.1%). Our reported QuickDASH scores are lower for the prosthetic group (2) than the arthroplasty (9.1) and generally lower than most studies reported in the literature comparing the two techniques, with values ranging between 12 and 20 for the prosthetic group.[8,12] Regarding thumb motion measured via the Kapandji score, the prosthetic group had better results at all time points, with a statistically significant difference at 6 months. Recorded VAS scores were not statistically different at the time points analyzed for the two groups, being comparable (0.5 vs 0.9) and in line with the literature[12]; Kim et al found a statistical difference in the VAS score in favor of the prosthesis at 6 weeks,[13] whereas others found no statistical differences at all in the long term.[5,14] Trapeziometacarpal prosthesis provides better mid-term results compared with arthroplasty when assessing the QuickDASH and the Kapandji scores, whereas VAS scores were registered low in both groups (group A: 0.5 and group B: 0.2) at 6 months. Almost all studies reported the use of pre- and postoperative x-rays without mentioning the assessment of the thumb length. De La Caffinière theorized that re-establishing the length of the first ray is the major principle in the trapeziometacarpal prosthesis.[15] In our study, measuring the M1/M2 ratio (as theorized by Ledoux[16] for group A [TMC group] and group B) we identified that group A had a larger ratio that was statistically significant, thus demonstrating that restoration of thumb length is achieved using a prosthesis. Indirectly, we suggest that restoring thumb length will result in restoring proper joint mobility, as supported by our improved Kapandji scores in group A. Also, it can be theorized that re-establishing length has a direct impact on tendon forces and general thumb mobility, possibly explaining a trend for improved results in the QuickDash and VAS scores for the prosthetic group. At the final follow-up of 2 years, there were no statistical differences between group A and group B when comparing the postoperative results of the QuickDash, VAS, and Kapandji scores. In addition, prior literature has identified that loosening is a concern with trapeziometacarpal prosthesis; however, no signs of aseptic loosening or cup migration were reported in group A.[7] The complication rate for group A was 3.3% consisting of a postoperative trapezium fracture at 1 month (treated by converting the TMC prosthesis to an arthroplasty) and a case of the De Quervain's tenosynovitis. Complications rate is dependent on intraoperative placement of the stem and the cup along with appropriate implant sizing.[17] The pivotal role of x-rays in restoring the thumb length is essential for optimal prosthesis placement. To minimize technical errors during TMC prosthesis implantation, fluoroscopy is used to assess the M1-M2 arch,[18] as it helps the surgeon identify the correct prosthesis placement by referencing the relationship between the first and second metacarpal and the distal carpal row. Further research is needed for developing intra- and postoperative radiographic landmarks that will facilitate correct prosthesis placement and result in reproducibility across surgeons. The TMC prosthesis was well-tolerated by our cohort: 93% of the group A patients would undergo the same procedure in the contralateral hand, with only one patient refusing because of persistent pain at the surgical incision present 6 months after the operation. Trapeziometacarpal prosthesis offers a promising advancement in surgical techniques for patients with TMC arthrosis. This prosthesis, with the benefits of thumb length restoration and swift functional recovery, has potential for improving patient outcomes and return-to-work timelines; however, further research with long-term follow-up timelines is required. We anticipate continued progress in enhancing the well-being of patients with TMC arthrosis using TMC prostheses.

## Conflicts of Interest

No benefits in any form have been received or will be received related directly to this article

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