

Pyrocarbon interposition arthroplasty

Overview

- Pyrocarbon interposition arthroplasty is considered a viable option for patients with early trapeziometacarpal osteoarthritis who are unresponsive to conservative measures, where trapeziectomy may be considered too destructive and hemi or total arthroplasty overzealous [1].
- Pyrocarbon interpositional arthroplasty provides pain relief and high patient satisfaction with good implant longevity [2].
- Partial trapeziectomy with pyrocarbon arthroplasty provides excellent pain relief and high patient satisfaction for the treatment of trapeziometacarpal joint osteoarthritis [3].
- The PyroDisk implant for treating advanced trapeziometacarpal arthritis did not demonstrate superiority over published outcome data of trapeziectomy with or without ligament reconstruction and tendon interposition [4].
- The modified procedure of partial trapeziectomy and pyrocarbon interpositional arthroplasty increases active and passive range of movement at the trapeziometacarpal joint [5].
- The modified procedure of partial trapeziectomy and pyrocarbon interpositional arthroplasty provides joint stability comparable to standard techniques [5].
- The modified procedure of partial trapeziectomy and pyrocarbon interpositional arthroplasty provides pain relief comparable to standard techniques [5].
- The modified procedure of partial trapeziectomy and pyrocarbon interpositional arthroplasty preserves thumb length [5].
- The modified procedure of partial trapeziectomy and pyrocarbon interpositional arthroplasty preserves key pinch strength [5].
- Long-term follow-up data for pyrocarbon disc interposition for the treatment of CMC1 osteoarthritis grade 2 to 3 in more than 150 thumbs has been reported [6].
- Subjective and objective outcomes were similar following ligament reconstruction and tendon interposition and pyrolytic interpositional arthroplasty in patients with trapeziometacarpal arthritis [7].
- Pinch strength was more improved following pyrolytic interpositional arthroplasty compared to ligament reconstruction and tendon interposition [7].

- The Pyrocardan implant may be contraindicated in patients with symptomatic scaphotrapeziotrapezoid osteoarthritis who intend to continue high-load activities involving wrist extension under load, such as tennis [8].

Anatomy & Pathophysiology

TMC JOINT BIOMECHANICS AND FUNCTION

- The thumb metacarpal is independent and articulates with the trapezium [15].
- The thumb ray is the most divergent of the five rays of the hand [15].
- The thumb has a more proximal and lateral position, allowing movement inward and outward from the palm [10].
- The thumb is the master digit of the hand and represents the dominant element which gives value to all other digits [15].
- The web space of the thumb is the largest and deepest web space in the hand [10].
- The distal transverse ligament at the level of the thumb web is by far the deepest and most mobile commissural skeleton structure [11].

SURGICAL ANATOMY AND VASCULARIZATION

- The most important structure in the thenar area is the recurrent branch (motor) of the median nerve [17].
- Anatomic studies show that there is no single longitudinal incision in the proximal palm that completely avoids the palmar cutaneous branches of the median and ulnar nerves [17].
- The “princeps pollicis” artery is the terminal branch of the radial artery that crosses the first intermetacarpal space [16].
- The “princeps pollicis” artery runs along the ulnar side of the first metacarpal bone and along the volar surface of the adductor muscle [16].
- The “princeps pollicis” artery emerges onto the subcutaneous palmar tissue at the level of the cutaneous flexion crease of the metacarpophalangeal joint [16].
- At the metacarpophalangeal joint crease, the “princeps pollicis” artery divides into two terminal rami known as the collateral palmar arteries of the thumb [16].
- Only 15% of anatomical dissections of the palmar arteries of the thumb fall into the classical layout category [16].
- The ulnar collateral artery is the main artery in the second segment of the thumb and is more often easier to dissect than the radial collateral artery [16].
- A subtendinous anastomosis situated at the level of the neck of the first phalanx acts as a moderator between the two collateral arteries [16].
- The dorsal arteries of the thumb originate from palmar arteries (princeps, commissural, or anastomoses of the superficial arcade) at the level of the first metacarpal [16].

CQ HAND + UPPER LIMB

- The ulnar dorso-collateral artery generally stems from the “princeps pollicis” onto the medial border of the neck of the first metacarpal [16].

CLINICAL EVALUATION

- A careful physical examination is essential to direct care and future testing if indicated [9].
- Patients often have difficulty accurately describing their symptoms and may incorrectly attribute pathology to a perceived deficit [9].
- Diagnostic tests such as imaging and serum laboratory studies can be expensive, time consuming, and often nonspecific [9].

Classification

- Pyrocarbon interposition arthroplasty is considered a treatment option for patients with early trapeziometacarpal osteoarthritis who are unresponsive to conservative measures [1].
- Pyrocarbon interposition arthroplasty is considered for patients in whom trapeziectomy may be considered too destructive and hemi or total arthroplasty overzealous [1].
- Pyrocarbon interpositional arthroplasty is indicated for the treatment of trapeziometacarpal joint osteoarthritis [3].
- The PyroDisk implant is used for the treatment of advanced trapeziometacarpal arthritis [4].
- Pyrocarbon disc interposition is used for the treatment of CMC1 osteoarthritis grade 2 to 3 [6].
- The Pyrocardan implant may be contraindicated in patients with symptomatic STT OA who intend to continue high-load activities, particularly those involving wrist extension under load, such as tennis [8].

Clinical Presentation

- Pyrocarbon interposition arthroplasty is considered for patients with early trapeziometacarpal osteoarthritis who are unresponsive to conservative measures [1].
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- Pyrocarbon interposition arthroplasty is considered for patients in whom hemi or total arthroplasty may be considered overzealous [1].
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- The Pyrocardan implant may be contraindicated in patients with symptomatic STT osteoarthritis who intend to continue high-load activities [8].
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Investigations

- Clinical evaluation of the hand and wrist requires combining patient history with a careful physical examination to pinpoint or narrow the scope of possible pathologic processes [9].
- Diagnostic tests such as imaging and serum laboratory studies are useful in determining pathology but can be expensive, time consuming, and often nonspecific [9].
- The trapezium is clearly angled out in front of the carpal plane so that the first metacarpal makes an angle of about 45 degrees with the second metacarpal in the sagittal plane [20].
- The articular surfaces of the trapezium and the base of the first metacarpal have a saddle shape in opposing planes [20].

Treatment

- PyroDisk interposition has merit in patients with early trapeziometacarpal osteoarthritis unresponsive to conservative measures, in whom trapeziectomy may be considered too destructive and hemi or total arthroplasty overzealous [1].
- Pyrocarbon interpositional arthroplasty provided pain relief and high patient satisfaction with good implant longevity [2].
- Long-term follow-up data for pyrocarbon disc interposition for the treatment of CMC1 osteoarthritis grade 2 to 3 is available in more than 150 thumbs [6].
- Subjective outcomes were similar following ligament reconstruction and tendon interposition and pyrolytic interpositional arthroplasty in patients with trapeziometacarpal arthritis [7].
- Objective outcomes were similar following ligament reconstruction and tendon interposition and pyrolytic interpositional arthroplasty in patients with trapeziometacarpal arthritis, except for pinch strength [7].
- Pinch strength was more improved following pyrolytic interpositional arthroplasty than ligament reconstruction and tendon interposition [7].
- The Pyrocardan implant may be contraindicated in patients with symptomatic scaphotrapeziotrapezoid osteoarthritis who intend to continue high-load activities, particularly those involving wrist extension under load, such as tennis [8].

Recovery

- Partial trapeziectomy with pyrocarbon arthroplasty provides excellent pain relief and high patient satisfaction [3].
- The modified procedure improves functional results by increasing active and passive range of movement at the trapeziometacarpal joint [5].
- The modified procedure provides joint stability and pain relief comparable to standard techniques [5].
- The modified procedure preserves thumb length and key pinch strength [5].
- All subjective and objective outcomes were similar following ligament reconstruction and tendon interposition and pyrolytic interpositional arthroplasty, except for pinch strength [7].

Key Evidence

- [L4] PyroDisk interposition has merit in patients with early disease unresponsive to conservative measures, in whom trapeziectomy may be considered too destructive and hemi or total arthroplasty overzealous. [1] ([10.1177/1753193420981552](https://doi.org/10.1177/1753193420981552))
- [L4] Pyrocarbon interpositional arthroplasty provided pain relief and high patient satisfaction with good implant longevity. [2] ([10.1177/1753193420906805](https://doi.org/10.1177/1753193420906805))
- [L3] Partial trapeziectomy with pyrocarbon arthroplasty may prove to be a successful option for the treatment of trapeziometacarpal joint osteoarthritis, providing excellent pain relief and high patient satisfaction. [3] ([10.1177/1753193413519384](https://doi.org/10.1177/1753193413519384))
- [L4] The PyroDisk implant for treating advanced trapeziometacarpal arthritis did not demonstrate superiority over published outcome data of trapeziectomy with or without ligament reconstruction and tendon interposition. [4] ([10.1016/j.jhsa.2014.07.011](https://doi.org/10.1016/j.jhsa.2014.07.011))
- [L4] The modified procedure improves functional results by increasing active and passive range of movement at the TMCJ, providing joint stability and pain relief comparable to standard techniques, while preserving thumb length and key pinch strength. [5] ([10.1177/1753193414553368](https://doi.org/10.1177/1753193414553368))
- [L4] This is the first study with long-term follow-up after pyrocarbon disc interposition for the treatment of CMC1 osteoarthritis grade 2 to 3 in more than 150 thumbs. [6] ([10.1016/j.jhsa.2018.06.086](https://doi.org/10.1016/j.jhsa.2018.06.086))
- [L3] All subjective and objective outcomes were similar following LRTI and pyrolytic interpositional arthroplasty in patients with TMC arthritis, except pinch strength, which was more improved following pyrolytic interpositional arthroplasty. [7] ([10.1155/2019/7961507](https://doi.org/10.1155/2019/7961507))
- [Case_report] The Pyrocardan implant may be contraindicated in patients with symptomatic STT OA who intend to continue high-load activities, particularly those involving wrist extension under load, such as tennis. [8] ([10.1016/j.jhsg.2026.100964](https://doi.org/10.1016/j.jhsg.2026.100964))

References

- [1] Re: Smeraglia F, et al. Partial trapeziectomy and pyrocarbon interpositional arthroplasty for trapeziometacarpal osteoarthritis: minimum 8-year follow-up. *J Hand Surg Eur.* 2020, 45: 472–6. *Journal of Hand Surgery (European Volume).* 2021. DOI: 10.1177/1753193420981552
- [2] Partial trapeziectomy and pyrocarbon interpositional arthroplasty for trapeziometacarpal osteoarthritis: minimum 8-year follow-up. *Journal of Hand Surgery (European Volume).* 2020. DOI: 10.1177/1753193420906805
- [3] Partial trapeziectomy and pyrocarbon interpositional arthroplasty for trapeziometacarpal joint osteoarthritis: results after minimum 2 years of follow-up. *Journal of Hand Surgery (European Volume).* 2014. DOI: 10.1177/1753193413519384
- [4] Pyrocarbon Interposition (PyroDisk) Implant for Trapeziometacarpal Osteoarthritis: Minimum 5-Year Follow-Up. *The Journal of Hand Surgery.* 2014. DOI: 10.1016/j.jhsa.2014.07.011
- [5] Re: Mariconda et al. Partial trapeziectomy and pyrocarbon interpositional arthroplasty for trapeziometacarpal joint osteoarthritis: results after minimum 2 years of follow-up. *J Hand Surg Eur.* 2014, 39: 604–610. *Journal of Hand Surgery (European Volume).* 2014. DOI: 10.1177/1753193414553368
- [6] Long-Term Follow-Up After Pyrocarbon Disc Interposition for Thumb CMC Osteoarthritis. *The Journal of Hand Surgery.* 2018. DOI: 10.1016/j.jhsa.2018.06.086
- [7] Tendon versus Pyrocarbon Interpositional Arthroplasty in the Treatment of Trapeziometacarpal Osteoarthritis. *BioMed Research International.* 2019. DOI: 10.1155/2019/7961507
- [8] Game, Set... Revision! A Case Report of a Tennis Player Who Smashed His Scaphotrapezotrapezoid-Joint Pyrocardan Implant Twice. *Journal of Hand Surgery Global Online.* 2026. DOI: 10.1016/j.jhsg.2026.100964
- [9] Orthopaedic Knowledge Update 13 Ebook Without Multimedia. Anatomy, Evaluation, Clinical Examination, and Imaging > Evaluation and Clinical Examination: Current Concepts.
- [10] Exam Of The Hand Wrist 2Ed. INTRODUCTION.
- [11] Exam Of The Hand Wrist 2Ed. Functional cutaneous units.
- [15] Exam Of The Hand Wrist 2Ed. The arches of the hand > *The metacarpal arch.*
- [16] Exam Of The Hand Wrist 2Ed. Techniques of investigation of the arterial supply by J P Melki > Vascularization of the thumb > Palmar aspect.
- [17] Campbell S Operative Orthopaedics 4 Volume Set. RESULTS OF SUTURE OF THE SCIATIC NERVE > PALMAR INCISIONS.
- [20] Exam Of The Hand Wrist 2Ed. 1.1 SKELETON OF THE HAND > The osseous skeleton.