

# Partial Wrist Fusion

title: "Partial Wrist Fusion" slug: partial-wrist-fusion region: wrist audience: patient mesh\_terms: ["Arthrodesis", "Carpal Bones"] article\_count: 316 model\_used: qwen3.5-35b-a3b-q8 generated\_at: '2026-05-18T14:13:49+00:00' key\_articles: - title: "How Much Scaphoid Can be Safely Resected? A Biomechanical Analysis of the Effects of Distal Scaphoid Resection" ref\_num: 1 evidence\_tier: paper evidence\_level: 5 doi: 10.1177/1558944720966717 year: 2020 - title: "Vascularized Bone Graft to the Lunate Combined with Shortening of the Capitate and Radius for Treatment of Advanced Kienböck Disease After a Follow-Up for More Than 10 Years" ref\_num: 2 evidence\_tier: paper evidence\_level: 4 doi: 10.1016/j.jhsg.2019.09.012 year: 2020 - title: "The use of a pyrocarbon capitate resurfacing implant in chronic wrist disorders" ref\_num: 3 evidence\_tier: paper evidence\_level: 4 doi: 10.1177/1753193413501730 year: 2013 - title: "Midcarpal instability" ref\_num: 4 evidence\_tier: paper evidence\_level: 5 doi: 10.1177/1753193415617756 year: 2015 - title: "Resilience of SLAC 4-Corner Fusion: Long-Term Follow-Up" ref\_num: 5 evidence\_tier: paper evidence\_level: 4 doi: 10.1016/j.jhsa.2014.06.118 year: 2014 - title: "The Outcome of Scaphoid Excision and Four-Corner Arthrodesis for Advanced Carpal Collapse at a Minimum of Ten Years" ref\_num: 6 evidence\_tier: paper evidence\_level: 4 doi: 10.1016/j.jhsa.2010.01.025 year: 2010 - title: "Reduction and Association of the Scaphoid and Lunate Procedure: Short-Term Clinical and Radiographic Outcomes" ref\_num: 7 evidence\_tier: paper evidence\_level: 4 doi: 10.1016/j.jhsa.2014.07.014 year: 2014 - title: "Ten-Year Minimum Follow-Up of 4-Corner Fusion for SLAC and SNAC Wrist" ref\_num: 8 evidence\_tier: paper evidence\_level: 4 doi: 10.1177/1558944716681949 year: 2016 - title: "Pyrocarbon Interposition Arthroplasty for Proximal Capitate Avascular Necrosis" ref\_num: 9 evidence\_tier: paper evidence\_level: 5 doi: 10.1007/s11552-014-9698-7 year: 2014 - title: "2007 IFSSH Committee Report of Wrist Biomechanics Committee: Biomechanics of the So-Called Dart-Throwing Motion of the Wrist" ref\_num: 10 evidence\_tier: paper evidence\_level: 5 doi: 10.1016/j.jhsa.2007.08.014 year: 2007 - title: "Radioscapholunate Arthrodesis With Compression Screws and Local Autograft" ref\_num: 11 evidence\_tier: paper evidence\_level: 4 doi: 10.1016/j.jhsa.2013.01.026 year: 2013 - title: "Three-dimensional analysis of the proximal articulating surfaces of the lunate and capitate" ref\_num: 12 evidence\_tier: paper evidence\_level: 4 doi: 10.1177/1753193413488303 year: 2013 - title: "A new plate for partial wrist fusions: results in midcarpal arthrodesis" ref\_num: 13 evidence\_tier: paper evidence\_level: 4 doi: 10.1177/1753193410395357 year: 2011 - title: "Radiocarpal fusion and midcarpal resection interposition arthroplasty: long-term results in severely destroyed rheumatoid wrists" ref\_num: 14 evidence\_tier: paper evidence\_level: 4 doi: 10.1186/s12891-018-2172-x year: 2018 - title: "A Case of Implant Failure in Partial Wrist Fusion Applying Magnesium-Based Headless Bone Screws" ref\_num: 15 evidence\_tier: case\_report evidence\_level: 4 doi:

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## Overview

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- Resection of over 25% of the scaphoid should be avoided or supplemented with partial wrist fusion due to induced instability and unpredictable kinematics [1].
- Fusion of the proximal carpals developed in 3 of 7 patients who received vascularized bone graft with capitate shortening and radial shortening [2].
- The use of a pyrocarbon capitate resurfacing implant may represent a good alternative to total and partial wrist arthrodesis [3].
- Treatment options for midcarpal instability including partial wrist fusions, tenodesis stabilizations, and arthroscopic capsular shrinkage have been described in small case series with limited follow-up [4].
- There are no comparative series or randomized studies for the treatment of midcarpal instability [4].
- Scaphoid excision and four-corner fusion remains a viable option for patients with advanced wrist arthritis with reliable, resilient functional results that remain stable over time [5].
- There is a low rate of conversion to total wrist arthrodesis following scaphoid excision and four-corner arthrodesis for advanced carpal collapse at a minimum of ten years [6].
- The reduction and association of the scaphoid and lunate procedure should be abandoned due to a majority of patients experiencing early radiographic failure in the short term [7].
- It is difficult to predict long-term survival of pyrocarbon interposition arthroplasty for proximal capitate avascular necrosis, but the outcome so far is encouraging [9].
- Conversion to midcarpal fusion remains a salvage option for pyrocarbon interposition arthroplasty for proximal capitate avascular necrosis [9].
- Radioscapholunate arthrodesis with compression screws and local autograft is an effective method to perform the procedure in appropriately selected patients with a preserved midcarpal joint [11].
- Radioscapholunate arthrodesis with compression screws and local autograft achieves a 100% union rate at mean follow-up of 12 months with no complications [11].
- Scaphoidectomy and midcarpal fusion is a useful salvage procedure in a variety of degenerative conditions [13].

- The use of magnesium-based headless bone screws for partial wrist arthrodesis is not supported due to premature mechanical instability [15].
- Radial wrist hemiarthroplasty implants are not approved by the FDA for use in humans in the United States [23].
- Radial wrist hemiarthroplasty implants must be performed as off-label use with full patient understanding and appropriate institutional review board approval [23].

## Anatomy & Pathophysiology

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- Resection of over 25% of the scaphoid induces instability and unpredictable kinematics [1].
- A dart-throwing motion (DTM) at approximately 30° to 45° from the sagittal plane allows continued functional wrist motion while minimizing radiocarpal motion [10].
- Surgical groups for scapholunate advanced collapse demonstrate decreased wrist kinematic motion and functional performance compared with individuals with normal wrists [16].
- Scaphoid nonunions partially uncouple the proximal and distal carpal rows [17].
- Computed fiber elongations of the dorsal carpal ligaments vary linearly with wrist position [29].
- During simple unresisted wrist motions, force in the scapholunate interosseous ligament does not exceed 20 N [30].
- Kinematic changes in scapholunate instability may predict the development of radioscapoid arthritis [31].
- Comprehending carpal dysfunctions and instabilities hinges on understanding carpal anatomy and normal biomechanics [32].
- The distal carpal row has negligible intercarpal motion while the proximal row drives motion [33].
- More than half the motion of the carpus when the wrist was loaded in extension occurred at the midcarpal joint [34].
- Static imaging techniques may accurately depict major wrist ligamentous injury, while dynamic ultrasound and videofluoroscopy may demonstrate dynamic instability and kinematic dysfunction [35].
- A pattern of kinematic changes was established after scapholunate ligament injury despite individual variance [38].
- Accurate identification of carpal bone morphology is required to improve understanding of carpal mechanics and pathology [39].
- A wide range of dart-throwing motion planes exists [40].
- Midcarpal arthrodesis adversely affects dart-throwing motion compared with radiocarpal arthrodesis [40].
- During forearm rotation, the contact site of the scaphoid and the lunate on the distal radial articular surface changed minimally [41].
- Reconstruction of both volar and dorsal limbs of the scapholunate interosseous ligament aims to approximate original anatomy and restore normal carpal mechanics [42].

## Classification

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- Resection of over 25% of the scaphoid should be avoided or supplemented with partial wrist fusion due to induced instability and unpredictable kinematics [1].
- Fusion of the proximal carpals developed in 3 of 7 patients who received vascularized bone graft with capitate shortening and radial shortening [2].
- The use of a pyrocarbon capitate resurfacing implant may represent a good alternative to total and partial wrist arthrodesis [3].
- Treatment options for midcarpal instability including partial wrist fusions, tenodesis stabilizations, and arthroscopic capsular shrinkage have been described in small case series with limited follow-up [4].
- There are no comparative series or randomized studies for midcarpal instability treatment options including partial wrist fusions, tenodesis stabilizations, and arthroscopic capsular shrinkage [4].
- Scaphoid excision and four-corner fusion remains a viable option for patients with advanced wrist arthritis with reliable, resilient functional results that remain stable over time [5].
- There is a low rate of conversion to total wrist arthrodesis following scaphoid excision and four-corner arthrodesis for advanced carpal collapse at a minimum of ten years [6].
- Functional results were good at long-term follow-up for 4-corner fusion for SLAC and SNAC wrist despite radiographic changes in the radiolunate joint in 73% of patients [8].
- Scaphoid nonunions have a dramatic impact on carpal kinematics, partially uncoupling the proximal and distal carpal rows [17].
- Simulated radiocarpal fusion and simulated partial carpal fusion decreased range of motion compared with the intact wrist [53].
- The principal direction of wrist motion along the path of dart-thrower's motion was not significantly altered by simulated radiocarpal fusion or partial carpal fusion [53].
- The LFT and MFT demonstrate similar congruity to the proximal capitate in the sagittal and coronal planes of the wrist [56].
- Simulated radioscapolunate fusion confirmed the dart-thrower's hypothesis as wrist motion was primarily preserved from radial-extension toward ulnar-flexion [59].
- Midcarpal stabilisation and scaphoid and triquetrum excision retains most wrist motion [60].

## Clinical Presentation

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- Resection of over 25% of the scaphoid induces instability and unpredictable kinematics [1].
- Fusion of the proximal carpals developed in 3 of 7 patients who received vascularized bone graft with capitate shortening and radial shortening [2].
- Treatment options for midcarpal instability include partial wrist fusions, tenodesis stabilizations, and arthroscopic capsular shrinkage [4].

- There are no comparative series or randomized studies regarding treatment options for midcarpal instability [4].
- Scaphoid excision and four-corner fusion remains a viable option for patients with advanced wrist arthritis with reliable, resilient functional results that remain stable over time [5].
- There is a low rate of conversion to total wrist arthrodesis following scaphoid excision and four-corner arthrodesis for advanced carpal collapse [6].
- The reduction and association of the scaphoid and lunate procedure experiences early radiographic failure in the majority of patients in the short term [7].
- Functional results for 4-corner fusion for SLAC and SNAC wrist are good at long-term follow-up despite radiographic changes in the radiolunate joint in 73% of patients [8].
- It is difficult to predict long-term survival for pyrocarbon interposition arthroplasty for proximal capitate avascular necrosis, though outcomes are currently encouraging [9].
- Conversion to midcarpal fusion remains a salvage option for pyrocarbon interposition arthroplasty for proximal capitate avascular necrosis [9].
- A dart-throwing motion (DTM) at approximately 30° to 45° from the sagittal plane allows continued functional wrist motion while minimizing radiocarpal motion [10].
- Lunate excision without midcarpal fusion resulted in a disease-free state with good painless range of motion at 6 years [12].
- Scaphoidectomy and midcarpal fusion is a useful salvage procedure in a variety of degenerative conditions [13].
- Radiographic carpal collapse and ulnar translocation occurred in scaphocapitate arthrodesis for Kienböck disease, but patients were not symptomatic [19].
- From an 8- to 11-year perspective, patients with distal scaphoid fractures report normal self-assessed hand function as well as good wrist motion and strength [20].
- Parallel K-wire placement across the midcarpal joints with scaphoid leads to a high rate of fusion with good patient outcomes long term [21].
- Ulnar-sided wrist pain is a common cause of upper extremity disability with a complex differential diagnosis [43].
- Both trigger wrist and avascular necrosis of the capitate are rare disorders [49].
- Excision arthroplasty for scapho-trapezium-trapezoid (STT) arthritis can provoke severe malalignment and midcarpal instability [50].
- Midcarpal instability following excision arthroplasty for STT arthritis can lead to an intercarpal arthrodesis with an outcome potentially worse than STT fusion [50].

## Investigations

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- Resection of over 25% of the scaphoid should be avoided or supplemented with partial wrist fusion due to induced instability and unpredictable kinematics [1].

- Treatment options for midcarpal instability including partial wrist fusions, tenodesis stabilizations, and arthroscopic capsular shrinkage have been described in small case series with limited follow-up [4].
- There are no comparative series or randomized studies regarding treatment options for midcarpal instability [4].
- A dynamic CT scan of the wrist is a user-friendly way of measuring the scapholunate distance, which is minimal in the normal wrist below 40 years of age [57].
- Measurements in the middle of the scapholunate joint in neutral and 30° of ulnar deviation under fluoroscopic imaging best capture all stages of ligamentous disruptions [63].
- Plain radiographs, CT, 3D-CT, and MRI are suboptimal modalities to assess capitate type [64].
- A scaphoid fracture was by far the most common injury in patients with posttraumatic radial wrist tenderness, but it is not clear whether diagnosis of subtle injuries only demonstrated on MRI improves outcomes [62].
- Delayed diagnosis and late reconstructive surgery for traumatic nondissociative carpal instability were associated with no improvement in radiolunate angle [58].
- Delayed diagnosis of intercarpal injuries can result in persistent median nerve dysfunction [27].

## Treatment

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- Resection of over 25% of the scaphoid should be avoided or supplemented with partial wrist fusion due to induced instability and unpredictable kinematics [1].
- Fusion of the proximal carpals developed in 3 of 7 patients who received vascularized bone graft with capitate shortening and radial shortening [2].
- The use of a pyrocarbon capitate resurfacing implant may represent a good alternative to total and partial wrist arthrodesis [3].
- Treatment options for midcarpal instability including partial wrist fusions, tenodesis stabilizations, and arthroscopic capsular shrinkage have been described in small case series with limited follow-up, but there are no comparative series or randomized studies [4].
- Scaphoid excision and four-corner fusion remains a viable option for patients with advanced wrist arthritis with reliable, resilient functional results that remain stable over time [5].
- There is a low rate of conversion to total wrist arthrodesis following scaphoid excision and four-corner arthrodesis for advanced carpal collapse at a minimum of ten years [6].
- The reduction and association of the scaphoid and lunate procedure should be abandoned due to a majority of patients experiencing early radiographic failure in the short term [7].
- It is difficult to predict long-term survival of pyrocarbon interposition arthroplasty for proximal capitate avascular necrosis, but the outcome so far is encouraging, and conversion to midcarpal fusion remains a salvage option [9].

- Radioscapholunate arthrodesis with compression screws and local autograft is an effective method in appropriately selected patients with a preserved midcarpal joint, achieving a 100% union rate at mean follow-up of 12 months with no complications [11].
- Lunate excision without midcarpal fusion resulted in a disease-free state with good painless range of motion at 6 years, avoiding the recurrence associated with curettage and the motion loss associated with fusion [12].
- Scaphoidectomy and midcarpal fusion is a useful salvage procedure in a variety of degenerative conditions [13].
- The results after total wrist joint arthroplasty vary probably as the result of different patient groups, implant types and evolution of prosthetic designs, and are not comparable with the present study [14].
- The authors cannot support the use of magnesium-based screws for partial wrist arthrodesis due to premature mechanical instability [15].
- Load is preferentially transferred to the radiolunate joint after scaphoid excision with four-corner fusion [22].
- Radial wrist hemiarthroplasty implants are not approved by the FDA for use in humans in the United States and must be performed as off-label use with full patient understanding and appropriate institutional review board approval [23].
- Arthroscopic resection of the proximal capitate with tendon interposition for isolated capitolunate osteoarthritis does not preclude the possibility of secondary arthrodesis in case of failure [24].
- Better results were seen when arthrodesis fused in cases of avascular necrosis of the capitate [25].
- The technique of wrist arthrodesis combining proximal row carpectomy and rigid internal fixation has proved to be a highly predictable operation with much less morbidity and fewer complications than with older techniques using distant bone graft [48].
- Radiocarpal fusion aims to alleviate pain and improve range of motion in patients with isolated radiolunate or radioscapholunate arthritis who have failed non-surgical treatment [51].
- Pyrocarbon interposition arthroplasty is an alternative to total wrist arthrodesis when marked degenerative changes exist at the radiolunate joint, capitate head or both, and increases operative options for challenging clinical scenarios [52].
- Locking screws are important in improving the longevity of total wrist arthroplasty by imitating external or internal fixation for bridging large bony defects, allowing the carpal component to remain stable despite complete asymptomatic avascular bone necrosis around the capitate peg [55].
- Arthroscopic interposition tendon arthroplasty for stage 2 scapholunate advanced collapse preserves motion, yields acceptable functional outcome, and reduces pain [61].
- Arthroscopic partial capitate resection for type Ia avascular necrosis provided adequate pain relief and improved the range of wrist motion and grip strength during short-term follow-up [67].

# Complications

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- Resection of over 25% of the scaphoid induces instability and unpredictable kinematics [1].
- Fusion of the proximal carpals developed in 3 of 7 patients receiving vascularized bone graft with capitate shortening and radial shortening [2].
- Treatment options for midcarpal instability, including partial wrist fusions, tenodesis stabilizations, and arthroscopic capsular shrinkage, are described in small case series with limited follow-up without comparative series or randomized studies [4].
- There is a low rate of conversion to total wrist arthrodesis following scaphoid excision and four-corner arthrodesis for advanced carpal collapse [6].
- The reduction and association of the scaphoid and lunate procedure experiences early radiographic failure in the majority of patients in the short term [7].
- Radiographic changes in the radiolunate joint occur in 73% of patients at long-term follow-up despite good functional results after 4-corner fusion for SLAC and SNAC wrist [8].
- Long-term survival of pyrocarbon interposition arthroplasty for proximal capitate avascular necrosis is difficult to predict, though conversion to midcarpal fusion remains a salvage option [9].
- Radioscapholunate arthrodesis with compression screws and local autograft achieves a 100% union rate at a mean follow-up of 12 months with no complications in appropriately selected patients [11].
- Magnesium-based headless bone screws can result in premature mechanical instability and implant failure in partial wrist fusion [15].
- Parallel K-wire placement across the midcarpal joints with scaphoid leads to a high rate of fusion with good long-term patient outcomes [21].
- Arthroscopic resection of the proximal capitate with tendon interposition does not preclude the possibility of secondary arthrodesis in case of failure [24].
- While some intercarpal arthrodeses yield good, predictable outcomes, others are infrequently used due to unpredictable results and high complication rates [68].
- Wrist fusion rates are higher in the 4-corner fusion group compared to proximal row carpectomy without a significant difference in readmission rates [70].
- Conversion rates to total wrist arthrodesis are significantly higher with partial wrist arthrodesis (19.2%) than with proximal row carpectomy (4.9%) [71].
- Partial wrist arthrodesis has a greater associated direct cost than proximal row carpectomy [71].
- High complication rates following four-corner arthrodesis with a nonlocking plate have led to the recommendation for fixation with a locking screw plate [74].

# Recovery

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- Resection of over 25% of the scaphoid induces instability and unpredictable kinematics [1].

- Fusion of the proximal carpals developed in 3 of 7 patients who received vascularized bone graft with capitate shortening and radial shortening [2].
- Pyrocarbon capitate resurfacing may represent a good alternative to total and partial wrist arthrodesis [3].
- Scaphoid excision and four-corner fusion remains a viable option for patients with advanced wrist arthritis with reliable, resilient functional results that remain stable over time [5].
- There is a low rate of conversion to total wrist arthrodesis following scaphoid excision and four-corner arthrodesis for advanced carpal collapse at a minimum of ten years [6].
- The reduction and association of the scaphoid and lunate procedure should be abandoned due to a majority of patients experiencing early radiographic failure in the short term [7].
- Functional results were good at long-term follow-up for 4-corner fusion for SLAC and SNAC wrist despite radiographic changes in the radiolunate joint in 73% of patients [8].
- It is difficult to predict long-term survival of pyrocarbon interposition arthroplasty for proximal capitate avascular necrosis, but the outcome so far is encouraging [9].
- Conversion to midcarpal fusion remains a salvage option for pyrocarbon interposition arthroplasty for proximal capitate avascular necrosis [9].
- A dart-throwing motion at approximately 30° to 45° from the sagittal plane allows continued functional wrist motion while minimizing radiocarpal motion [10].
- Both surgical groups demonstrated decreased wrist kinematic motion and functional performance compared with individuals with normal wrists [16].
- Further studies need to be performed to address differences in anatomy and wrist movement among patients with different lunate shapes regarding the dart-splint [18].
- From an 8- to 11-year perspective, patients with distal scaphoid fractures report normal self-assessed hand function as well as good wrist motion and strength [20].
- Delayed diagnosis of intercarpal injuries can result in persistent median nerve dysfunction [27].
- Research underscores the importance of considering forearm rotation when developing rehabilitation protocols for scapholunate joint instability [44].
- Radiocapitate range of motion after proximal row carpectomy was sufficient for activities of daily living [45].
- A patient with complex carpal dissociation regained satisfactory function and returned to work at six months with stable carpus on radiographs [46].
- Multicomponent exercise is important in the treatment of wrist instability [47].
- Four-corner bone wrist arthrodesis by dorsal rectangular plating achieves an acceptable preservation of range of motion with good pain relief, an excellent consolidation rate and minimal complications [66].

# Key Evidence

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- [L5] Resection of over 25% of the scaphoid should be avoided or supplemented with partial wrist fusion due to induced instability and unpredictable kinematics. ([10.1177/1558944720966717](https://doi.org/10.1177/1558944720966717))
- [L4] Fusion of the proximal carpals developed in 3 of 7 patients who received vascularized bone graft with capitate shortening and radial shortening. ([10.1016/j.jhsg.2019.09.012](https://doi.org/10.1016/j.jhsg.2019.09.012))
- [L4] This surgical procedure may represent a good alternative to total and partial wrist arthrodesis. ([10.1177/1753193413501730](https://doi.org/10.1177/1753193413501730))
- [L5] Treatment options including partial wrist fusions, tenodesis stabilizations, and arthroscopic capsular shrinkage have been described in small case series with limited follow-up, but there are no comparative series or randomized studies. ([10.1177/1753193415617756](https://doi.org/10.1177/1753193415617756))
- [L4] Scaphoid excision and four-corner fusion remains a viable option for patients with advanced wrist arthritis with reliable, resilient functional results that remain stable over time. ([10.1016/j.jhsa.2014.06.118](https://doi.org/10.1016/j.jhsa.2014.06.118))
- [L4] There is a low rate of conversion to total wrist arthrodesis. ([10.1016/j.jhsa.2010.01.025](https://doi.org/10.1016/j.jhsa.2010.01.025))
- [L4] With a majority of patients experiencing early radiographic failure of the procedure in the short term, our experience suggests that the reduction and association of the scaphoid and lunate procedure should be abandoned despite the relatively low outcomes measures scores. ([10.1016/j.jhsa.2014.07.014](https://doi.org/10.1016/j.jhsa.2014.07.014))
- [L4] Functional results were good at long-term follow-up despite radiographic changes in the radiolunate joint in 73% of patients. ([10.1177/1558944716681949](https://doi.org/10.1177/1558944716681949))
- [L5] It is difficult to predict long-term survival, but the outcome so far is encouraging, and conversion to midcarpal fusion remains a salvage option. ([10.1007/s11552-014-9698-7](https://doi.org/10.1007/s11552-014-9698-7))
- [L5] Clinically, a DTM at approximately 30° to 45° from the sagittal plane allows continued functional wrist motion while minimizing radiocarpal motion. ([10.1016/j.jhsa.2007.08.014](https://doi.org/10.1016/j.jhsa.2007.08.014))
- [L4] This technique is an effective method to perform radioscapulohumeral arthrodesis in appropriately selected patients with a preserved midcarpal joint, achieving a 100% union rate at mean follow-up of 12 months with no complications. ([10.1016/j.jhsa.2013.01.026](https://doi.org/10.1016/j.jhsa.2013.01.026))
- [L4] Lunate excision without midcarpal fusion resulted in a disease-free state with good painless range of motion at 6 years, avoiding the recurrence associated with curettage and the motion loss associated with fusion. ([10.1177/1753193413488303](https://doi.org/10.1177/1753193413488303))
- [L4] Scaphoidectomy and midcarpal fusion is a useful salvage procedure in a variety of degenerative conditions. ([10.1177/1753193410395357](https://doi.org/10.1177/1753193410395357))
- [L4] The results after total wrist joint arthroplasty vary probably as the result of different patient groups, implant types and evolution of prosthetic designs, and are not comparable with the present study. ([10.1186/s12891-018-2172-x](https://doi.org/10.1186/s12891-018-2172-x))
- [Case\_report] Due to this disappointing result of the operation with premature mechanical instability, the authors cannot support the use of magnesium-based screws for partial wrist arthrodesis, at least not in dual use. ([10.1155/2016/7049130](https://doi.org/10.1155/2016/7049130))

- [L2] Both surgical groups demonstrated decreased wrist kinematic motion and functional performance compared with individuals with normal wrists. ([10.1016/j.jhsa.2015.04.035](https://doi.org/10.1016/j.jhsa.2015.04.035))
- [L4] Scaphoid nonunions have a dramatic impact on carpal kinematics, partially uncoupling the proximal and distal carpal rows. ([10.1016/j.jhsa.2008.03.008](https://doi.org/10.1016/j.jhsa.2008.03.008))
- [L5] Further studies need to be performed to address differences in anatomy and wrist movement among patients with different lunate shapes. ([10.1016/j.jht.2015.01.007](https://doi.org/10.1016/j.jht.2015.01.007))
- [L4] Although radiographic carpal collapse and ulnar translocation occurred, patients were not symptomatic. ([10.1016/j.jhsa.2014.12.013](https://doi.org/10.1016/j.jhsa.2014.12.013))
- [L2] From an 8- to 11-year perspective, patients with distal scaphoid fractures report normal self-assessed hand function as well as good wrist motion and strength. ([10.1016/j.jhsa.2017.06.016](https://doi.org/10.1016/j.jhsa.2017.06.016))
- [L4] Parallel K-wire placement across the midcarpal joints with scaphoid leads to a high rate of fusion with good patient outcomes long term. ([10.1177/15589447211057302](https://doi.org/10.1177/15589447211057302))
- [L5] Our findings suggest that load is preferentially transferred to the radiolunate joint after scaphoid excision with four-corner fusion. ([10.1007/s11552-007-9048-0](https://doi.org/10.1007/s11552-007-9048-0))
- [L5] Radial wrist hemiarthroplasty implants are not approved by the FDA for use in humans in the United States and must be performed as off-label use with full patient understanding and appropriate institutional review board approval. ([10.1016/j.jhsa.2012.10.050](https://doi.org/10.1016/j.jhsa.2012.10.050))
- [L4] This approach does not preclude the possibility of secondary arthrodesis in case of failure. ([10.1016/j.jhsa.2025.06.004](https://doi.org/10.1016/j.jhsa.2025.06.004))
- [L4] Better results were seen when the arthrodesis fused. ([10.1177/1753193414524876](https://doi.org/10.1177/1753193414524876))
- [Case\_report] This case illustrates the importance of careful review of radiographs for evidence of intercarpal injuries, as delayed diagnosis resulted in persistent median nerve dysfunction. ([10.1007/s11552-013-9545-2](https://doi.org/10.1007/s11552-013-9545-2))
- [L5] Despite complex carpal bone anatomy and kinematics, computed fiber elongations were found to vary linearly with wrist position. ([10.1016/j.jhsa.2012.04.025](https://doi.org/10.1016/j.jhsa.2012.04.025))
- [L5] However, during simple unresisted wrist motions, the force did not exceed 20 N. ([10.1016/j.jhsa.2015.04.007](https://doi.org/10.1016/j.jhsa.2015.04.007))
- [L3] These kinematic changes may predict the development of radioscapoid arthritis and help identify a kinematically abnormal wrist. ([10.1177/17531934241242676](https://doi.org/10.1177/17531934241242676))
- [L4] Comprehending carpal dysfunctions and instabilities hinges on understanding carpal anatomy and normal biomechanics. ([10.1016/j.jht.2023.09.011](https://doi.org/10.1016/j.jht.2023.09.011))
- [L5] Advances in 3-dimensional and 4-dimensional imaging have provided clearer insight into carpal kinematics, establishing that the distal carpal row has negligible intercarpal motion while the proximal row drives motion. ([10.1016/j.jhsa.2016.07.105](https://doi.org/10.1016/j.jhsa.2016.07.105))
- [L4] More than half the motion of the carpus when the wrist was loaded in extension occurred at the midcarpal joint. ([10.1016/j.jhsa.2012.10.035](https://doi.org/10.1016/j.jhsa.2012.10.035))

- [L4] Static imaging techniques may accurately depict major wrist ligamentous injury, while dynamic ultrasound and videofluoroscopy may demonstrate dynamic instability and kinematic dysfunction. ([10.1177/1753193415610515](https://doi.org/10.1177/1753193415610515))
- [L5] Despite individual variance, a pattern of kinematic changes was established after scapholunate ligament injury. ([10.1177/1753193415600669](https://doi.org/10.1177/1753193415600669))
- [L5] Accurate identification of carpal bone morphology is required to improve our understanding of carpal mechanics and pathology. ([10.1016/j.jhsa.2009.03.002](https://doi.org/10.1016/j.jhsa.2009.03.002))
- [L5] This report updates information on wrist dart-throwing motion based on recent research regarding its kinematics, kinetics, and clinical applications, noting that a wide range of DT planes exists and that midcarpal arthrodesis adversely affects DT motion compared with radiocarpal arthrodesis. ([10.1016/j.jhsa.2014.02.035](https://doi.org/10.1016/j.jhsa.2014.02.035))
- [L5] During forearm rotation, the contact site of the scaphoid and the lunate on the distal radial articular surface changed minimally. ([10.1016/j.jhsa.2013.01.021](https://doi.org/10.1016/j.jhsa.2013.01.021))
- [L4] The technique aims to approximate the original anatomy and restore normal carpal mechanics to prevent progression to scapholunate advanced collapse arthritis. ([10.1016/j.jhsa.2013.05.026](https://doi.org/10.1016/j.jhsa.2013.05.026))
- [L5] Ulnar-sided wrist pain is a common cause of upper extremity disability with a complex differential diagnosis. ([10.1016/j.jhsa.2012.04.036](https://doi.org/10.1016/j.jhsa.2012.04.036))
- [L5] This research underscores the importance of considering forearm rotation when developing rehabilitation protocols for scapholunate joint instability and provides a valuable perspective in line with current rehabilitation principles. ([10.1016/j.jht.2023.09.012](https://doi.org/10.1016/j.jht.2023.09.012))
- [L5] Radiocarpal range of motion after PRC was sufficient for activities of daily living. ([10.1016/j.jhsa.2006.10.014](https://doi.org/10.1016/j.jhsa.2006.10.014))
- [Case\_report] The patient regained satisfactory function and returned to work at six months with stable carpus on radiographs. ([10.1016/j.jhsa.2007.07.025](https://doi.org/10.1016/j.jhsa.2007.07.025))
- [L4] These results highlight the importance of multicomponent exercise in the treatment of wrist instability. ([10.1016/j.jht.2023.08.010](https://doi.org/10.1016/j.jht.2023.08.010))
- [L4] This technique of wrist arthrodesis combining proximal row carpectomy and rigid internal fixation has proved to be a highly predictable operation with much less morbidity and fewer complications than with older techniques using distant bone graft. ([10.1016/j.jhsa.2012.11.010](https://doi.org/10.1016/j.jhsa.2012.11.010))
- [Case\_report] Both trigger wrist and avascular necrosis of the capitate are rare disorders. ([10.1186/s12891-018-2010-1](https://doi.org/10.1186/s12891-018-2010-1))
- [L4] The procedure can provoke severe malalignment and midcarpal instability, leading to an intercarpal arthrodesis with an outcome potentially worse than STT fusion. ([10.1177/1753193408098903](https://doi.org/10.1177/1753193408098903))
- [L5] The procedure aims to alleviate pain and improve range of motion in patients with isolated radiolunate or radioscapolunate arthritis who have failed non-surgical treatment. ([10.1016/j.jhsa.2022.04.002](https://doi.org/10.1016/j.jhsa.2022.04.002))
- [L4] Pyrocarbon interposition arthroplasty is an alternative to total wrist arthrodesis when marked degenerative changes exist at the radiolunate joint, capitate head or both, and increases operative options for challenging clinical scenarios. ([10.1177/1753193417714400](https://doi.org/10.1177/1753193417714400))

- [L5] Although both simulated fusion types decreased ROM compared with the intact wrist, the principal direction of wrist motion along the path of DTM was not significantly altered by simulated RCF or PCF. ([10.1016/j.jhsa.2017.10.017](https://doi.org/10.1016/j.jhsa.2017.10.017))
- [L4] The case highlights the importance of locking screws in improving the longevity of total wrist arthroplasty by imitating external or internal fixation for bridging large bony defects, allowing the carpal component to remain stable despite complete asymptomatic avascular bone necrosis around the capitate peg. ([10.1016/j.jhsg.2024.01.002](https://doi.org/10.1016/j.jhsg.2024.01.002))
- [L4] The LFT and MFT demonstrate similar congruity to the proximal capitate in the sagittal and coronal planes of the wrist. ([10.1016/j.jhsa.2022.04.015](https://doi.org/10.1016/j.jhsa.2022.04.015))
- [L4] This novel dynamic CT scan of the wrist is a user-friendly way of measuring the scapholunate distance, which is minimal in the normal wrist below 40 years of age. ([10.1177/1558944717726372](https://doi.org/10.1177/1558944717726372))
- [L4] Delayed diagnosis and late reconstructive surgery were associated with no improvement in radiolunate angle. ([10.1016/j.jhsa.2021.04.024](https://doi.org/10.1016/j.jhsa.2021.04.024))
- [L5] The fusion model confirmed the dart-thrower's hypothesis as wrist motion was primarily preserved from radial-extension toward ulnar-flexion. ([10.1016/j.jhsa.2007.12.013](https://doi.org/10.1016/j.jhsa.2007.12.013))
- [L5] Results suggest that midcarpal stabilisation and scaphoid and triquetrum excision retains most wrist motion. ([10.1177/1753193408094923](https://doi.org/10.1177/1753193408094923))
- [L4] This procedure preserves motion, yields acceptable functional outcome, and reduces pain. ([10.1016/j.arthro.2018.10.134](https://doi.org/10.1016/j.arthro.2018.10.134))
- [L2] A scaphoid fracture was by far the most common injury, but it is not clear whether diagnosis of subtle injuries only demonstrated on MRI improves outcomes. ([10.1016/j.jhsa.2012.09.034](https://doi.org/10.1016/j.jhsa.2012.09.034))
- [L5] Measurements in the middle of the scapholunate joint in neutral and 30° of ulnar deviation under fluoroscopic imaging best capture all stages of ligamentous disruptions. ([10.1177/1558944717729219](https://doi.org/10.1177/1558944717729219))
- [L4] Plain radiographs, CT, 3D-CT, and MRI are suboptimal modalities to assess capitate type. ([10.1007/s11552-015-9743-1](https://doi.org/10.1007/s11552-015-9743-1))
- [L4] Four-corner bone wrist arthrodesis by dorsal rectangular plating achieves an acceptable preservation of range of motion with good pain relief, an excellent consolidation rate and minimal complications. ([10.1177/1753193409105684](https://doi.org/10.1177/1753193409105684))
- [L4] It provided adequate pain relief and improved the range of wrist motion and grip strength during short-term follow-up. ([10.1016/j.jhsa.2015.09.010](https://doi.org/10.1016/j.jhsa.2015.09.010))
- [L5] While some procedures yield good, predictable outcomes, others are infrequently used due to unpredictable results and high complication rates. ([10.1016/j.jhsa.2013.09.014](https://doi.org/10.1016/j.jhsa.2013.09.014))
- [L3] Wrist fusion rates and average costs are higher in the 4CF group without a significant difference in readmission rates. ([10.1016/j.jhsa.2019.12.010](https://doi.org/10.1016/j.jhsa.2019.12.010))
- [L3] Conversion rates to total wrist arthrodesis are significantly higher with PWA (19.2%) than with PRC (4.9%) and have a greater associated direct cost. ([10.1016/j.jhsa.2017.07.032](https://doi.org/10.1016/j.jhsa.2017.07.032))
- [L4] Based on the high complication rate following FCA with a nonlocking plate, the authors no longer use this implant and recommend fixation with a locking screw plate. ([10.1016/j.jhsa.2017.10.036](https://doi.org/10.1016/j.jhsa.2017.10.036))

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