



# Clinical and radiologic outcomes of pyrocarbon radial head prosthesis: midterm results



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**Background:** The modular pyrocarbon (MoPyC) radial head prosthesis (Tornier, Saint-Ismier, France) is a monoblock modular radial head prosthesis. This study assessed midterm outcomes after implantation of the prosthesis.

**Materials:** A retrospective study was conducted of a consecutive cohort of 65 patients who underwent radial head replacement with the MoPyC prosthesis from January 2006 to April 2013. Indications were fractures, early or late failures from orthopedic or fixation treatments, and revisions after another implant. Patients were observed for >2 years for range of motion, pain, and stability; function by the Mayo Elbow Performance Score (total score, 100) and grip strength were assessed. Quality of stem implantation, bone resorption around the neck, and periprosthetic lucency were noted and quantified on radiographs. Capitulum shape and density as well as humeroulnar aspect (river delta sign) were evaluated. Complications and revision procedures were noted.

**Results:** We evaluated 52 of 65 patients (mean follow-up, 46 ± 20 months; range, 24-108). The Mayo Elbow Performance Score was 96 ± 7; pain score, 42 ± 7/45; and motion score, 18 ± 2/20. Function and stability were excellent. Radiology revealed 92% of patients with cortical resorption around the neck without mechanical failure. Bone resorption was mostly anterior and lateral; it resolved within the first year and thereafter was stable. Eight patients underwent revision surgery for stiffness. No implant failures were noted.

**Conclusion:** Results of the MoPyC radial head prosthesis appear to be satisfactory. Bone resorption around the neck (stress shielding) is frequent and stable after 1 year and does not impair stem fixation. The MoPyC prosthesis appears to be a reliable solution for replacing the radial head.

**Level of evidence:** Level IV, Case Series, Treatment Study.

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**Keywords:** Elbow prosthesis; radial head fractures; elbow dislocation; osteolysis; pyrocarbon implant

Institutional Review Board approval was not required for this study. It is a retrospective study of patients whose surgery followed validated techniques. No unnecessary invasive examination was performed. All patients consented to participate in this review and agreed that their anonymized data could be used for scientific purposes.

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The radial head is involved in secondary stability of the elbow. However, when the medial collateral ligament is injured in a “terrible triad” injury or when radial head fracture is associated with an Essex-Lopresti lesion, fixation or replacement of the radial head is mandatory.<sup>29,37,44</sup> Although conservation of the native radial head remains the “gold standard”<sup>32</sup> for radial head fracture, a high number of complications occur after fixation of >3 fragments<sup>23,35</sup> or when fixation is not stable. Radial head resection results in variation of elbow joint kinematics<sup>21</sup> with long-term radioulnar instability and ulnocarpal conflict. Moreover, determining whether radial head fracture is isolated in Mason type III fractures is difficult, and in those cases, radial head excision results in proximal migration of the radius, cubitus valgus deformation, and finally humeroulnar arthritis. Radial head replacement is then often recommended to avoid these complications. The radial head can be replaced as an initial procedure for acute unreconstructable fractures by itself<sup>25</sup> or in association with other procedures<sup>24,40,48</sup> for cases of terrible triad injury or Essex-Lopresti lesions.<sup>15</sup> Failed open reduction and internal fixation, nonunion, malunion, and necrosis of the radial head may also require radial head replacement. Less frequently, the radial head can be replaced in primary osteoarthritis or with post-traumatic sequelae to restore a stable, painless, and mobile elbow. Pyrocarbon has good and long-term biocompatibility, a low friction coefficient, and an elastic modulus that approximates that of the diaphysis of bone (about 20 GPa). These properties may reduce stress shielding, thus preserving the capitellum.<sup>17</sup> Tornier (Saint-Ismier, France) developed a radial head prosthesis with a pyrocarbon head, the modular pyrocarbon radial head prosthesis (MoPyC, BioProfile). Good early results of this implant have been shown.<sup>1,34</sup>

The aim of this study was to assess the clinical and radiologic midterm outcomes of the MoPyC radial head prosthesis.

## Materials and methods

### Initial population and inclusion criteria

In this retrospective consecutive cohort, all patients with implantation of a MoPyC prosthesis from January 2006 to April 2013 were included. During this period, 65 patients were operated on.

The inclusion criterion was the implantation of a pyrocarbon-titanium radial head prosthesis (MoPyC); all patients had to have >2 years’ of follow-up. The senior author (M.W.) was the surgeon for all patients. An independent observer (M.O.G.) assessed clinical and radiologic outcomes. All patients gave informed consent. Demographics and indications are summarized in Table I.

Overall, 42 patients underwent surgery for an acute closed injury. The mean delay between injury and surgery was 4.8 days (range, 0-16). In total, 34 patients presented with a terrible triad

**Table I** Initial population undergoing MoPyC implantation (N = 65)

Demographics	No.
Sex	
Male/female	30/35
Age (years) at surgery, mean (range)	52 (22-85)
Injured dominant side/nondominant side	36/29
Circumstance of injury (recent fractures)	
Highway accident	11
Sport accident	4
Accident fall	16
Work-related injury	11
Type of initial lesion	
Recent fracture	42
Early revision (fixation/resection)	10
Old trauma	
Initial fracture fixation	6
Orthopedic treatment	6
Complication of old arthroplasty	1
Kind of fracture (recent fractures)	
Terrible triad	34
Monteggia	5
Essex-Lopresti	2
Radial head fracture + olecranon (without coronoid fracture)	1
Coronoid fracture (recent fractures), Regan-Morrey classification	
None	11
Type I	23
Type II	5
Type III	3

injury, and 2 others had an associated Essex-Lopresti lesion. Five patients had a Monteggia fracture: 2 had type IIA fracture-dislocation according to the Bado classification modified by Jupiter,<sup>8</sup> 1 had type IIB, 1 had type IID, and 1 had Bado IV. One patient presented with a transolecranon dislocation type Mayo IIA without fracture of the coronoid process. All had grade III lesions according to the Mason-Hotchkiss lesions of the radial head, and all were complex fractures with associated injuries according to the Hotchkiss classification<sup>18</sup> modified by van Riet.<sup>45</sup> In all, 31 patients had a coronoid fracture: 23 had a type I fracture according to the Regan-Morrey classification, 5 had a type II fracture, and 3 had a type III fracture. Only type III fractures were fixed with a lag screw; others were sutured with the anterior capsule with use of an anchor.

Apart from the 42 patients with acute treatment, 10 patients had undergone early revision because of fixation failure (<3 months; n = 9) or radial head excision (n = 1); 12 had post-traumatic radiohumeral sequelae (4 with a radial head osteonecrosis), 6 with a fixation, 6 without. Finally, 1 patient underwent revision 30 years after a late complication after arthroplasty (Swanson prosthesis) with secondary radioulnar synostosis.

### Clinical and radiologic evaluation

Clinical assessment included sex, age, dominance side, injured side, occupation, medical history, injury mechanism,

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