



# Does Radial Head Implant Fixation Type Affect Functional Outcomes? A Systematic Review and Meta-analysis



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## INTRODUCTION

- Radial head arthroplasty is a popular method of managing complex radial head fractures and instability.
- Some implants have been designed to be loosely fixed, smooth stemmed implants functioning more as spacers (unfixed).
- Other designs have introduced press-fit implants or even cemented implants: both rigidly fixing the stem (fixed).
- The purpose of this study was to help determine which fixation method results in better functional outcomes: 'fixed' or 'unfixed'.

## METHODS

- A systematic review and meta-analysis was employed. 63 articles were identified via 3 databases. 7 articles contained duplicate patient populations and were excluded, while 10 non-English or insufficient text articles were excluded. 3 others did not contain sufficient data or follow up. The remaining 38 articles were qualitatively and quantitatively reviewed.

Fixed Implants																						
Study	Country	Level of Evidence (I-V)	Study design	Inclusion Period	Number of Patients	Number lost to follow up	Mean FU (mo.)	Mean Age	Men	Women	Indication	Type of Fixation	Modularity (monoblock vs modular)	Material type	MEPS	DASH	Flexion/Ext Arc (Mean, degrees)	Revisions	Revisions rate (Revisions / Total pts)	Complications	Complications Rate (Complications / Total pts)	
Mason et al. (2015)	Canada	4	Retrospective	199-2003	24	3	39	54	11	13	Fracture only	Fixed press fit (Lock and Key) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	4	0.2
Wang et al. (2017)	China	4	Retrospective	1999-2003	11	0	34	43	8	3	Fracture only	Fixed cement (Choleky) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	4	0.2
Decker et al. (2016)	France	4	Retrospective	1990-2003	12	2	40	62	10	4	Fracture only	Fixed cement (Choleky) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	1	0.1
Chapman et al. (2016)	USA	4	Retrospective	1990-2000	16	3	21	50	9	7	Heterogeneous population	Fixed press fit (Lock and Key) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	3	0.2
Popovic et al. (2017)	Belgium	4	Retrospective	1990-2003	11	4	105	51	32	19	Fracture only	Fixed cement (Choleky) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	10	10
Lee et al. (2015)	Singapore	4	Retrospective	2001-2003	4	1	28.7	52	2	4	Fracture only	Fixed cement (Choleky) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	3	10
Reddy et al. (2016)	Germany	4	Retrospective	2001-2000	17	2	106	61	14	3	Heterogeneous population	Fixed cement (Choleky) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	108	108
Caporaso et al. (2015)	Italy	4	Retrospective	2000-2007	16	0	41.7	61	11	5	Fracture only	Fixed cement (Choleky) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	7	0.4
Hughes et al. (2016)	USA	4	Retrospective	1990-2002	8	0	36	30	4	4	Complex distal humerus fractures, distal humerus, distal humerus	Fixed cement (Choleky) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	5	0.4
Flückiger et al. (2012)	France	4	Retrospective	1998	11	11	30	34	14	14	Heterogeneous population	Fixed press fit	Metal	Modular	Sigular	105	126	108	3	0.2	12	0.4
Langlois et al. (2016)	Germany	4	Retrospective	2007-2011	29	2	20	60	8	13	Heterogeneous population	Fixed press fit (Lock and Key) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	11	0.4
Reddy et al. (2016)	Italy	4	Retrospective	2000-2010	30	0	34	44	19	11	Heterogeneous population	Fixed press fit (Lock and Key) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	3	0.1
Reddy et al. (2015)	China	4	Retrospective	1998	32	0	27	34	20	13	Fracture only	Fixed cement (Choleky) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	3	0.1
El Hachimi et al. (2015)	Spain	4	Retrospective	2007-2009	12	2	42	39	9	7	Fracture only	Fixed press fit (Lock and Key) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	0	0
Reiner et al. (2015)	Spain	4	Retrospective	2001-2008	28	0	25	34	11	17	Fracture only	Fixed cement (Choleky) by Tuxen	Polyethylene	Modular	Sigular	105	126	108	3	0.2	19	0.7
Reinhold et al. (2015)	USA	4	Retrospective	2004-2003	13	0	30	44	8	5	Fracture only	Fixed press fit (Lock and Key) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	10	10
Abramson et al. (2015)	France	4	Retrospective	2001-2003	22	0	30	40	15	7	Fracture only	Fixed cement (Choleky) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	14	0.4
Wang et al. (2016)	China	4	Retrospective	2008-2011	12	0	40.2	41	4	4	Fracture only	Fixed press fit (Lock and Key) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	0	0
Mason et al. (2015)	China	4	Retrospective	2000-2011	12	0	40.8	41	4	4	Fracture only	Fixed press fit (Lock and Key) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	0	0
Hughes et al. (2016)	USA	4	Retrospective	1997-2011	25	1	30	50	7	18	Fracture only	Fixed cement (Choleky) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	7	0.3
Reddy et al. (2016)	Germany	4	Retrospective	2007-2011	30	3	48	48	9	12	Fracture only	Fixed cement (Choleky) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	11	0.4
Lery et al. (2016)	USA	4	Retrospective	2007-2014	15	4	36	42	9	4	Fracture only	Fixed press fit (Lock and Key) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	4	0.3
Chen et al. (2016)	France	4	Retrospective	2006-2003	32	13	46	52	30	10	Heterogeneous population	Fixed press fit (Lock and Key) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	11	0.3
Wang et al. (2016)	USA	4	Prospective	2000-2013	16	0	75	49	3	14	Fracture only	Fixed cement (Choleky) by Tuxen	Metal	Modular	Sigular	105	126	108	3	0.2	0	0
Langlois et al. (2016)	Spain	4	Retrospective	1998	14	0	42	34	4	8	Fracture only	Fixed cement (Choleky) by Tuxen	Polyethylene	Modular	Sigular	105	126	108	3	0.2	4	0.4
<b>RESULTS</b>					<b>544</b>	<b>50</b>	<b>40.8</b>	<b>49.9</b>	<b>276</b>	<b>284</b>					<b>85.9</b>	<b>16.7</b>	<b>119.6</b>	<b>47</b>	<b>11.7%</b>	<b>377</b>	<b>14.9%</b>	

Unfixed Implants																						
Study	Country	Level of Evidence (I-V)	Study design	Inclusion Period	Number of Patients	Number lost to follow up	Mean FU (mo.)	Mean Age	Men	Women	Indication	Type of Fixation	Modularity (monoblock vs modular)	Material type	MEPS	DASH	Flexion/Ext Arc (Mean, degrees)	Revisions	Revisions rate (Revisions / Total pts)	Complications	Complications Rate (Complications / Total pts)	
Adachi et al. (2014)	Australia	4	Retrospective	1996-2001	16	0	33.6	45	8	8	Fracture only	Unfixed: smooth intentional loose fit (Evolve by Wright Med)	Metal	Modular	Monopolar	87.0	NR	NR	0	0.0	6	NR
Wassberg et al. (2016)	Sweden	4	Retrospective	1994-2001	22	4	44.6	52	11	7	Fracture only	Unfixed: smooth intentional loose fit (Evolve by Wright Med)	Metal	Modular	Monopolar	NR	NR	115	0	0.0	NR	NR
Domborg et al. (2017)	USA	4	Retrospective	NR	27	10	40	32	13	14	Fracture only	Unfixed: smooth intentional loose fit (Evolve by Wright Med)	Metal	Modular	Monopolar	83.0	17.0	111	2	0.1	7	NR
Chen et al. (2010)	Taiwan	4	Retrospective	2002-2008	13	0	38.3	37	9	4	Heterogeneous population	Unfixed: smooth intentional loose fit (Evolve by Wright Med)	Metal	Modular	Monopolar	86.9	NR	120.3	0	0.0	2	0.2
Mahn et al. (2010)	Germany	4	Retrospective	2001-2000	25	0	61.2	59	12	13	Heterogeneous population	Unfixed: smooth intentional loose fit (Evolve by Wright Med)	Metal	Modular	Monopolar	83.2	24.9	111.6	NR	NR	5	0.2
Chen et al. (2010)	China	4	Prospective	2004-2007	22	0	33.6	NR	34	11	Heterogeneous population	Unfixed: smooth intentional loose fit (Evolve by Wright Med)	Titanium	Modular	Monopolar	92.1	NR	NR	NR	NR	3	0.1
Zakrevics et al. (2012)	US	4	Retrospective	2004-2006	30	4	34	20-50	13	21	Heterogeneous population	Unfixed: smooth intentional loose fit (Evolve by Wright Med)	Metal	Modular	Sigular	92.0	13.8	126	2	0.1	NR	NR
Reinhold et al. (2016)	USA	4	Retrospective	2004-2010	14	7	33	50	6	8	Fracture only	Unfixed: smooth intentional loose fit (Evolve by Wright Med)	Metal	Modular	Sigular	92.0	14.6	121	NR	NR	NR	NR
Watson et al. (2013)	USA	4	Retrospective	1996-2008	30	4	34	48	16	14	Terrible T and H injuries	Unfixed: smooth intentional loose fit (Evolve by Wright Med)	Metal	Modular	Monopolar	90.0	15.7	106	3	0.1	2	0.1
Mogkaden et al. (2014)	Germany	4	Retrospective	2001-2009	85	10	41.5	56	33	40	Fracture only	Unfixed: smooth intentional loose fit (Evolve by Wright Med)	Metal	Modular	Monopolar	83.3	26.1	119.2	3	0.04	18	0.2
Yan et al. (2015)	China	4	Prospective	2005-2008	20	0	36	37	11	9	Fracture only	Unfixed: smooth intentional loose fit (Evolve by Wright Med)	Metal	Modular	Monopolar	85.8	NR	101.4	1	0.1	4	0.2
March et al. (2016)	Canada	3	Retrospective	2006-2008	52	17	96	61	21	34	Heterogeneous population	Unfixed: smooth intentional loose fit (Evolve by Wright Med)	Metal	Modular	Monopolar	91.0	NR	126	0	0.0	NR	NR
<b>RESULTS</b>					<b>356</b>	<b>56</b>	<b>43.1</b>	<b>49.7</b>	<b>189</b>	<b>34</b>					<b>88.2</b>	<b>18.7</b>	<b>115.8</b>	<b>11</b>	<b>3.1%</b>	<b>47</b>	<b>13.2%</b>	

Fixed versus Unfixed Outcomes				
	Fixed	Unfixed	95% CI	P-Value
Mean Follow Up (Mo.)	46.8 ± 21.1	43.1 ± 20.9		
MEPS	85.9 ± 6.1	88.2 ± 3.4	-5.9—1.2	0.084
DASH	16.7 ± 6.3	18.7 ± 5.4	-8.3—4.2	0.473
Flex/Ext (Degrees)	119.6 ± 14.8	115.8 ± 8.2	-4.4—12.1	0.082
Revision Rate (Relative Risk)	2.48	0.39	1.3—4.8	0.006
Complication Rate (Relative Risk)	1.88	0.53	1.4—2.6	<0.001

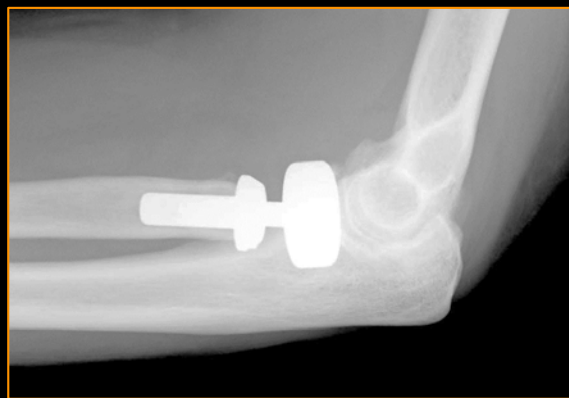
MEPS, Mayo Elbow Performance Score; DASH, Disabilities of the Arm and Hand

## RESULTS

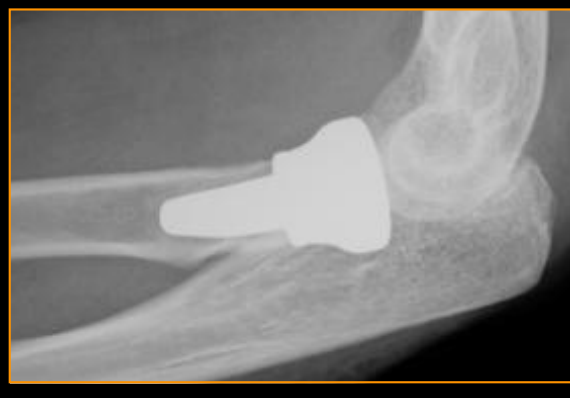
- 38 populations were identified, with 890 unduplicated patients: 534 fixed and 356 unfixed.
- See table of Fixed vs Unfixed Outcomes
- Relative risks of revision and complications for the fixed cohort were 2.48 (P = 0.006) and 1.88 (P = <0.0001), respectively.

## CONCLUSIONS

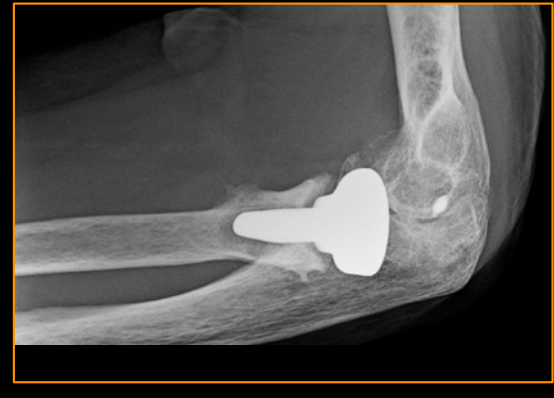
- In radial head arthroplasty, implant fixation type does not appear to affect functional outcomes. However, rigidly fixing the implant may increase the risks of revision and complications.



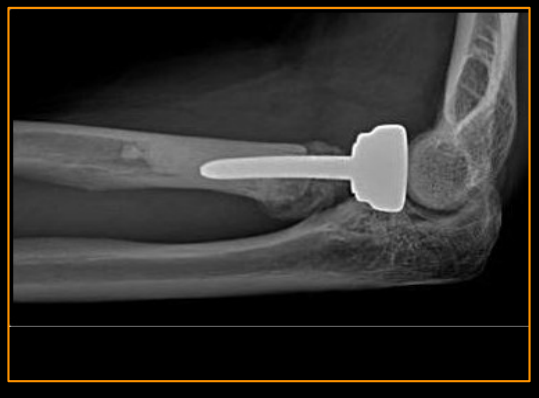
Smooth "Unfixed" Stem



Press-fit "Fixed" Stem



Press fix "Fixed" Stem With loosening undergoing revision



Cemented "Fixed" Stem With loss of elbow flexion Undergoing revision