

The internal joint stabilizer of the elbow: a review of the clinical and biomechanical evidence

John J. Heifner MD¹, Gustavo E. Lacau MD², Jorge L. Orbay MD²

¹Miami Orthopaedic Research Foundation, ²Miami Hand and Upper Extremity Institute

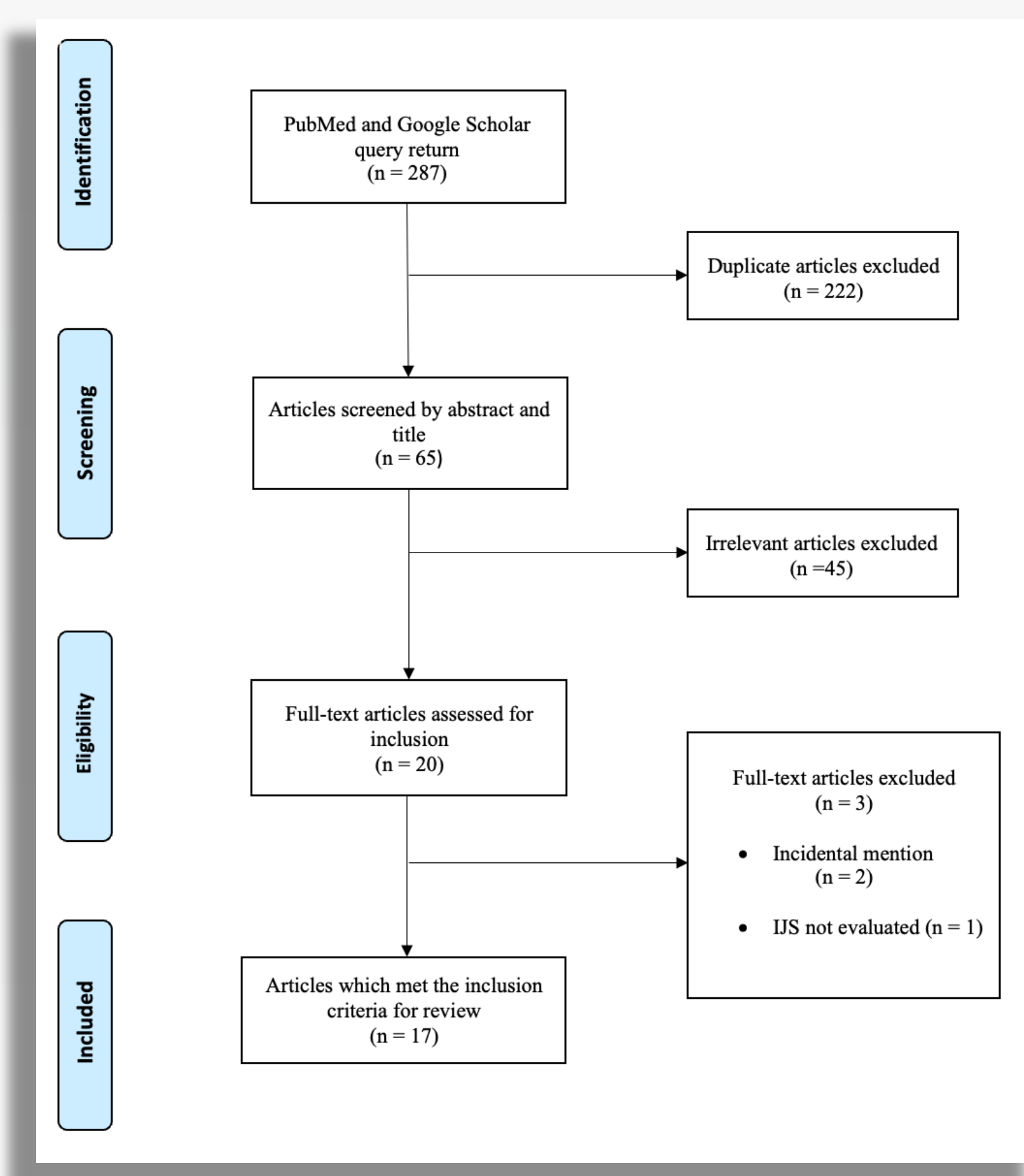
Introduction

- Following internal fixation of traumatic injury, elbow instability may persist
- Options to provide stability include ulnohumeral transfixation, external fixators, and the internal joint stabilizer
- External fixation provides stability and movement capability, but pin tract infections and the burdensome apparatus complicate this option
- Recently there has been momentum for internal stabilization that allows mobilization
- Our objective was to review the recent literature to aggregate the clinical and biomechanical evidence for the internal joint stabilizer of the elbow



Methods

- A systematic review was performed in keeping with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines
- The inclusion criteria specified case reports, retrospective and prospective reports, and biomechanical reports which investigated the manufactured internal joint stabilizer (IJS) of the elbow (Skeletal Dynamics, Miami, Florida)
- Data collected include sample size, injury type, time from injury to surgical management, term of follow up, clinical outcome metrics including rates of revision and removal, and biomechanical outcome metrics



Results

Biomechanical reports

- Using motion-capture sensor data, a medially placed IJS performed comparable to a lateral external fixator under simulated posteromedial rotatory instability.¹
- Using radiographic measures of ulnohumeral congruity, a laterally placed IJS performed comparable to hinged and static external fixators under varus stress.²

Retrospective clinical reports

Study	N*	Acute cases	Terrible triad*	Chronic cases	Term f/u	DASH*	MEPS*
Orbay, 2017	26	19	12	7	8	16	-
Sochol, 2018	20	9	8	11	16	37	82
Pasternack, 2020	10	9	6	1	13	28	-
Pardo-Garcia, 2021	5	5	5	0	10	11.7	94
Fene, 2022	17	13	7	4	9	28.4	-
Salazar, 2022	22	21	8	1	12.5	-	-
Sheth, 2022	30	16	20	5	16	24	74
Wynn, 2023	12	12	-	0	6	12	78
Total/mean	142	104	66	29	11.3	22.4	82

* N - sample size, terrible triad injury of the elbow, term of follow up in months, Disabilities of the Arm, Shoulder and Hand score, Mayo Elbow Performance Score

- There were eight retrospective clinical reports (N=142), at a mean follow up of 11.3 months
- The mean DASH score was 22.4, and the mean MEPS was 82
- The pooled rate of implant failure was 3.7%, and the pooled rate of recurrent instability was 3.3%

Complications

Study	Recurrent instability	Device failure	Device removal (symptomatic)
Orbay, 2017	3.8%	0%	100%
Sochol, 2018	5%†	5%†	30% (10%)
Pasternack, 2020	10%	0%	90%
Pardo-Garcia, 2021	0%	0%	100%
Fene, 2022	0%	12% [^]	100%
Salazar, 2022	4.5%	9% [^]	82%
Sheth, 2022	3.3%†	3.3%†	17% (7%)
Wynn, 2023	0%	0%	17% (17%)
Mean	3.3%	3.7%	67%

[^] - includes case(s) with device failure without recurrent instability, [†] - includes case(s) with device failure with recurrent instability

Case reports

Study	Injury	Approach	IJS position	Outcome/removal
Schneider, 2019	Recurrent instability in Ehlers-Danlos	Lateral	Lateral	IJS removed at 6 months, at 1 year no subsequent dislocations
Sheth, 2021	Recurrent instability	Medial	Medial	IJS removed at 8 months, at 1 year 120° elbow arc of motion
Schultz, 2021	Dislocation	Lateral	Lateral	Maintained concentric reduction
Salazar, 2021	Terrible triad variant with Essex-Lopresti	Lateral	Lateral	IJS removed at 3 months, 125° elbow arc of motion
Gonzalez, 2022*	Chronic dislocation	Posterior	Lateral	-
Salazar, 2022	Chronic dislocation	Lateral	Lateral	IJS removed at 6 weeks, at 6 months 125° elbow arc of motion
Jordan, 2022	Dislocation and coronoid fracture	Lateral	Lateral	IJS not removed, at 6 months 120° elbow arc of motion
	Fracture dislocation	Lateral	Lateral	IJS removed at 4 months, 85° elbow arc of motion

* Gonzalez et al - technique description

Conclusions

- The aggregate literature describes satisfactory clinical outcomes and biomechanical efficacy for the IJS
- The device provided demonstrable stability during the early postoperative period, at a mean follow up of less than one year
- Case reports have expanded the understanding for case application, device position, and surgical approach for the IJS
- The pooled rate of recurrent instability is comparable to those reported for external fixators
- Internal stabilization avoids the pin-related complications which commonly occur with external fixators

References

- 1 Reiter et al, Internal joint stabilizer for varus posteromedial rotatory instability of the elbow, JSES 2021
- 2 Stenson et al, Biomechanical comparison of elbow instability construct, JSES 2022

