Clinical and radiological outcomes of coronoid process reconstruction in coronoid-deficient elbows: A medium-term follow-up study

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INTRODUCTION:
Coronoid-deficient elbow results from coronoid process fracture or atraumatic recurrent subluxation of the elbow, which could induce persistent subluxation or elbow dislocation and early degenerative changes. Coronoid reconstruction is performed to prevent further instability and early osteoarthritic change in coronoid-deficient elbows; however, medium-term outcomes after coronoid reconstruction are unclear. This study was to assess the clinical and radiological outcomes of coronoid reconstruction in patients with coronoid-deficient elbow.
METHODS: Patients with coronoid-deficient elbow who underwent coronoid reconstruction between January 2013 and February 2022 were enrolled. Range of motion (ROM), visual analogue scale (VAS) pain score, and Mayo elbow performance score (MEPS) were assessed. Presence and progression of elbow osteoarthritis (OA) were evaluated by the Broberg–Morrey classification using plain radiographs preoperatively and at a final follow-up. Graft union was assessed using computed tomography. Subgroup analysis according to graft type (iliac crest cortical bone vs. osteochondral graft, including radial head and olecranon tip), severity of coronoid height loss (≥50% vs. <50%), and injury type (traumatic vs. dysplastic) were performed.
RESULTS: Fourteen patients participated, mean age was 41.4 □ 15.3 years, with mean follow-up of 48.2 □ 26.8 months. VAS pain score (3.4 □ 1.6 to 0.9 □ 1.2, P=0.003) and MEPS (55.0 □ 19.8 to 92.9 □ 8.9, P=0.008) significantly improved at final follow-up, whereas ROM did not show significant difference before and after the surgery (119.4° □ 56.5° to 125.0° □ 14.9°, P=0.673). OA progression rate was 14.3%. Subgroup analysis revealed comparable postoperative outcomes (ROM, VAS pain score, MEPS, and OA progression rate), regardless of graft type, coronoid height loss severity, and injury type, except dysplasia group had significantly better postoperative ROM than trauma group (140.0° ± 5.0° vs. 120.9° ± 14.1°, P=0.034).
DISCUSSION AND CONCLUSION: Coronoid reconstruction is a favorable treatment option for restoring stability and preventing OA progression in coronoid-deficient elbows at medium-term follow-up. Overall clinical and radiological outcomes at final follow-up were similar across graft types, coronoid height loss severity, and injury type, except for better postoperative ROM in the dysplasia group compared to that in the trauma group.

Table 1. Patient demographics data[a]

	Mean ± SD or No. (%)
Age, years	41.4 ± 15.3
Male sex	11 (78.6%)
Follow-up, months	48.2 ± 26.8
Graft type	
IC	7 (50.0%)
RH	5 (35.7%)
OT	2 (14.3%)
Severity of coronoid height loss	
Stage I	9 (64.3%)
Stage II	5 (35.7%)
Trauma history	11 (78.6%)

[a]Categorical data are presented as n (%); continuous data are presented as mean ± standard deviation

SD, standard deviation; IC, iliac crest; RH, radial head; OT, olecranon tip

Table 2. Preoperative patient demographics data and comparison of preoperative and postoperative clinical and radiological outcomes in the subgroup analysis according to graft type[a]

Graft type	IC (n = 7)	OC (n = 7)	*P*-value
Age, years	31.1 ± 5.6	51.6 ± 15.2	0.025[b]
Male sex	7 (100.0%)	4 (57.1%)	0.060
Follow-up, months	33.9 ± 18.1	62.6 ± 27.3	0.046[b]
Severity of coronoid height loss			0.591
Stage I	4 (57.1%)	5 (71.4%)	
Stage II	3 (42.9%)	2 (28.6%)	
Trauma history	5 (71.4%)	6 (85.7%)	0.530
Preoperative			
Extension (°)	5.0 ± 21.4	7.5 ± 31.8	0.881
Flexion (°)	127.1 ± 36.8	117.5 ± 53.0	0.765
ROM arc (°)	122.1 ± 54.9	110.0 ± 84.9	0.883
VAS pain score	4.1 ± 1.9	2.6 ± 0.8	0.103
MEPS	52.9 ± 22.0	62.5 ± 10.6	0.658
Postoperative			
Extension (°)	8.6 ± 14.9	9.3 ± 6.1	0.326
Flexion (°)	135.0 ± 7.7	132.9 ± 8.1	0.508
ROM arc (°)	126.4 ± 17.3	123.6 ± 13.5	0.518
VAS pain score	0.9 ± 1.1	0.9 ± 1.5	0.567
MEPS	90.0 ± 10.0	95.7 ± 7.3	0.244
Patient satisfaction			0.030[b]
Very satisfied	0 (0.0%)	3 (42.9%)	
Satisfied	5 (71.4%)	4 (57.1%)	
Neutral	2 (28.6%)	0 (0.0%)	
Complication rate	2 (28.6%)	3 (42.9%)	0.591
OA progression rate	2 (28.6%)	0 (0.0%)	0.141

[a]Categorical data are presented as n (%); continuous data as mean ± standard deviation
IC, iliac crest; OC, osteochondral; ROM, range of motion; VAS, visual analog scale; MEPS, Mayo elbow performance score; OA, osteoarthritis
[b]*P* < 0.05

Table 3. Preoperative patient demographics data and comparison of preoperative and postoperative clinical and radiological outcomes in the subgroup analysis according to severity of coronoid height loss[a]

Severity of coronoid height loss	Stage I (n = 9)	Stage II (n = 5)	*P*-value
Age, years	40.7 ± 16.3	42.6 ± 14.9	0.689
Male sex	7 (77.8%)	4 (80.0%)	0.925
Follow-up, months	53.3 ± 29.2	39.0 ± 21.4	0.405
Graft type			0.591
IC	4 (44.4%)	3 (60.0%)	
RH	3 (33.3%)	2 (40.0%)	
OT	2 (22.2%)	0 (0.0%)	
Trauma history	6 (66.7%)	5 (100.0%)	0.160
Preoperative			
Extension (°)	-6.0 ± 20.4	20.0 ± 14.1	0.080
Flexion (°)	143.0 ± 18.6	102.5 ± 45.0	0.049[b]
ROM arc (°)	149.0 ± 38.8	82.5 ± 56.8	0.049[b]
VAS pain score	3.2 ± 1.5	3.6 ± 1.9	0.605
MEPS	67.0 ± 10.4	40.0 ± 19.1	0.048[b]
Postoperative			
Extension (°)	3.9 ± 5.5	18.0 ± 13.0	0.047[b]
Flexion (°)	134.4 ± 7.7	133.0 ± 8.4	0.782
ROM arc (°)	130.6 ± 9.5	115.0 ± 18.7	0.157
VAS pain score	1.2 ± 1.4	0.2 ± 0.4	0.156
MEPS	90.6 ± 9.5	97.0 ± 6.7	0.197
Patient satisfaction			0.531
Very satisfied	1 (11.1%)	2 (40.0%)	
Satisfied	7 (77.8%)	2 (40.0%)	
Neutral	1 (11.1%)	1 (20.0%)	
Complication rate	4 (44.4%)	1 (20.0%)	0.378
OA progression rate	1 (11.1%)	1 (20.0%)	0.661

[a]Categorical data are presented as n (%); continuous data as mean ± standard deviation
IC, iliac crest; RH, radial head; OT, olecranon tip; ROM, range of motion; VAS, visual analog scale; MEPS, Mayo elbow performance score; OA, osteoarthritis
[b]*P* < 0.05

Table 4. Preoperative patient demographics data and comparison of preoperative and postoperative clinical and radiological outcomes in the subgroup analysis according to injury type[a]

Injury type	Trauma (n = 11)	Dysplasia (n = 3)	*P*-value
Age, years	46.1 ± 13.7	24.0 ± 2.0	0.010[b]
Male sex	9 (81.8%)	2 (66.7%)	0.585
Follow-up, months	48.1 ± 23.8	48.7 ± 42.7	0.808
Graft type			0.530
IC	5 (45.5%)	2 (66.7%)	
RH	4 (36.4%)	1 (33.3%)	
OT	2 (18.2%)	0 (0.0%)	
Coronoid height loss			0.160
Stage I	6 (54.5%)	3 (100.0%)	
Stage II	5 (45.5%)	0 (0.0%)	
Preoperative			
Extension (°)	15.0 ± 20.7	-13.3 ± 2.9	0.114
Flexion (°)	111.7 ± 39.7	151.7 ± 2.9	0.035[b]
ROM arc (°)	96.7 ± 56.8	165.0 ± 5.0	0.092
VAS pain score	3.2 ± 1.3	4.0 ± 2.6	0.706
MEPS	47.5 ± 20.4	70.0 ± 5.0	0.091
Postoperative			
Extension (°)	10.9 ± 11.6	1.7 ± 2.9	0.151
Flexion (°)	131.8 ± 7.2	141.7 ± 2.9	0.029[b]
ROM arc (°)	120.9 ± 14.1	140.0 ± 5.0	0.034[b]
VAS pain score	1.0 ± 1.3	0.3 ± 0.6	0.542
MEPS	92.3 ± 9.3	95.0 ± 8.7	0.658
Patient satisfaction			0.784
Very satisfied	3 (27.3%)	0 (0.0%)	
Satisfied	6 (54.5%)	3 (100.0%)	
Neutral	2 (18.2%)	0 (0.0%)	
Complication rate	5 (45.5%)	0 (0.0%)	0.160
OA progression rate	2 (18.2%)	0 (0.0%)	0.442

[a]Categorical data are presented as n (%); continuous data as mean ± standard deviation
IC, iliac crest; RH, radial head; OT, olecranon tip; ROM, range of motion; VAS, visual analog scale; MEPS, Mayo elbow performance score; OA, osteoarthritis
[b]*P* < 0.05