The Coonrad-Morrey Total Elbow Replacement

Clinical results and personal experience

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COONRAD-MORREY ELBOW (1979)

- sloppy hinge (semiconstrained) with polyethylene bushing with 7 degrees of laxity
- „anterior flange”
- Tivanium (Ti-6Al-4V) alloy
- triangular humeral and quadrangular ulnar component
- 12 humeral and 10 ulnar components
- complete interchangeability
1992 - Morrey and Adams - 54 RA cases
91% excellent and good at 2-8 years
no loosening
1998 - Gill and Morrey - 76 RA cases
88% excellent and good at 10 to 15 years
92.4% prosthesis survival rate !!!
1999 - Connor and Morrey - 22 JCA cases
90% excellent and good at 7.4 years
10% loosening
Humeral nonunions

1995 - Morrey and Adams - 36 humeral nonunions
86% excellent and good at 4.2 years
no loosening

2008 – Cil at al. – 92 humeral nonunions
85% excellent and good at 5.5 years
44 complications, 32 reoperations, 23 revisions
96% survival at 2 years, 82% survival at 5 years, 65% survival at 15 years
Post-trauma cases

1997 - Schneeberger et al. - 41 post-trauma cases
83% excellent and good at 5.8 years
no loosening but 12% ulnar comp. fracture

2007 – Matsumoto at al. – 13 elbows with periop. condylar fractures and
27 intact elbows
no difference of Mayo score strength and ROM at 4.8 years
Acute fractures

1997 - Cobb and Morrey - 21 acute fractures
96% excellent and good at 3.3 years
no loosening

2005 – Muller at al. - 49 acute fractures
5 revisions performed at 7 years

2008 – Prasad and Dent – 15 acute fractures and 17 post-trauma cases
less complications and better survival in acute cases 93% versus 76% at 7 years
1999 - Ramsey et al. - 19 instability cases
  84% excellent and good at 6 years, no instability
  1 humeral comp. loosening, 2 ulnar comp. fractures
2005 - Mighell et al. – 6 chronic dislocations
  no loosening at 5.8 years, no instability
  1 periprosthetic fracture, 1 bushing exchange
Fused or ankylosed elbow

2008 – Peden and Morrey - 13 cases

- 7 good and excellent at 12 (2-26) years
- 37 to 118 degrees of flexion
- but high complication rate
  - more than half had been reoperated
  - 2 soft tissue breakdown
  - 1 ulnar comp. fracture
  - 3 deep infections
  - 3 manipulation under anesthesia
FAILED IMPLANT

EXCISION ARTHROPLASTY
  poor results with highly unstable elbow

ARTHRODESIS
  technically difficult, poor functional results

REVISION
  costume made TEA
  nonconstrained TEA
  semiconstrained TEA
  +/- bone grafting
Revisions

1997 - King et al. - 41 revisions
• 85% excellent and good at 6 years
• 41% intra-op. and 32% post-op. complications
• 8 additional op., 3 re-revisions, 4 excision

2007 – Shi at al. – 30 revisions
• at 5.5 years Mayo score was 84
• the survival was 64%
Revision for prosthetic fractures

2006 – Athwal and Morrey

- 27 revision TEA for 17 ulnar and 10 humeral component fracture of different designs
- 7 cortical perforations, 5 nerve injuries, 3 triceps avulsions, 1 deep infection
- Less complications if cement in cement revision performed
Bushing exchange

1.5% in 21 years
12 out of 923 TEA at Mayo Clinic

Bushing wear 2.3 ± 4%
Dissembling 1.7 ± 1%
3.8% infections out of 600 TEA at Mayo Clinic, USA
1.9% infections out of 305 primary TEA at Endoklinik, Germany

Causes of infection:

• Superficial joint
• Immunsupression
• Previous operations
• Long surgical time
TREATMENT OF INFECTION

1998 - Yamaguchi et al. 25 infected TEA
  14 irrigation and debridement
  6 staged revisions
  5 excisions

2006 – Gille et al. 6 infected TEA
  5 successful one-stage revisions
  1 excision

2008 – Cheung et al. 29 reimplantations after excision arthroplasty
  at 7.4 years Mayo score 66 (20-100)
  8 reinfections observed (28%)
Bone grafting

2002 – Sanchez-Sotelo – 11 periprosthetic fractures
  *strut allograft* + humeral comp. exchange
  10 unions at 3 years

2004 – Mansat – 13 revisions
  *allograft-prosthesis composite*
  4 infections, 2 nonunion, but good functional results

2005 – Loebenberg – 12 revisions
  *impaction bone grafting* of 4 ulna, 6 humerus, 2 both bones
  8 good bony integration at 6 years
  1 infection, 1 ulnar comp. fracture, 2 loosening
Pathologic fractures

2005 - Athwal et al. - 20 tumor cases

70% died but 75% had local control of tumor
Mayo score improved from 22 to 75
but 35% had early complications and 20% were revised
10 to 31 year survival analysis

2006 – Aldridge at al. – survival of 41 elbows

- 21 were functional 10-14 years
- 10 were functional 15-19 years
- 10 were functional 20-31 years
- 14 complications
- 13 revisions
Personal experience 1999-2010
53 patients
64 Coonrad-Morrey elbows

- 53 primary op. (2 bilateral)
- 11 revisions (6 patients)
- 53 patients (30 women, 23 men)
- Age 59 years (25-84)
- 64 elbows
  - 35 right, 29 left
  - 41 dominant, 23 non-dominant
Diagnosis

- Rheumatoid arthritis 15 elbows (13 patients)
- Osteoarthritis 4 elbows
- Hemophylia 1 elbow
- Post infection OA 1 elbow
- Post-trauma cases 27 elbows
  - 17 pseudoarthrosis
  - 2 chronic dislocation
  - 4 post-traumatic arthritis
  - 4 stiff elbows
- Comminuted fracture 5 elbows
- Prosthesis failure 11 elbows (6 patients)
15 additional procedures

- external fixator + cement spacer + soft-tissue reconstruction with local flaps and split skin in 2 cases
- bone grafting in 7 cases
- latissimus dorsi pedicle flap transfer in 2 cases
- radial forearm island flap + triceps transfer in 1 case
- tension band wiring of olecranon fracture in 1 case
- closure of synovial sinus 1 case
- excision of heterotopic bone 1 case
56 y. o. male
rheumatoid arthritis
56 y. o. male
rheumatoid arthritis

function at 2 years
62 y.o. man
pseudoarthrosis

pre-op.

post-op.
62 y.o. man
pseudoarthrosis
function at 2 years
60 y.o. man post-septic arthritis case

pre-op. function
60 y.o. man post-septic arthritis case

pre-op.

post-op.
60 y.o. man
post-septic arthritis case

function at 3 months
62 y.o. man
stiff elbow
62 y.o. man
stiff elbow

4 m. later
58 y.o. man - comminuted open fracture

stage 1
58 y.o. man - comminuted open fracture

stage 4
at 5 months
58 y.o. man - comminuted open fracture

Function and X-ray at 4 years
## Early complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Action taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>intraop. ulna fissure</td>
<td>cerclage</td>
</tr>
<tr>
<td>intraop. humerus fissure</td>
<td>cerclage</td>
</tr>
<tr>
<td>penetration of ulna cortex</td>
<td>revision at 1 day</td>
</tr>
<tr>
<td>olecranonon fracture</td>
<td>tension-band wiring</td>
</tr>
<tr>
<td>hematome</td>
<td>evacuation</td>
</tr>
<tr>
<td>synovial synus (2 cases)</td>
<td>closure</td>
</tr>
<tr>
<td>skin necrosis (2 cases)</td>
<td>1 latissimus dorsi flap</td>
</tr>
<tr>
<td></td>
<td>1 radial forearm flap</td>
</tr>
<tr>
<td>ulnar nerve neuritis (4 cases)</td>
<td>1 decompression</td>
</tr>
<tr>
<td>complete radial nerve palsy</td>
<td>no action</td>
</tr>
<tr>
<td>transient radial nerve palsy (2 cases)</td>
<td>no action</td>
</tr>
</tbody>
</table>
71 y.o. woman - pseudoarthrosis

pre-op.

olecranon fracture at two weeks

tension-band wiring
58 y.o. man – post-trauma OA

wound broke down at 3 weeks

radial forearm flap

function at 1 year
## Late complications

<table>
<thead>
<tr>
<th>Complication</th>
<th>Action taken</th>
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<tbody>
<tr>
<td>Heterotop ossification (6 m.)</td>
<td>excision</td>
</tr>
<tr>
<td>Synovial synus (2 y.)</td>
<td>synovectomy</td>
</tr>
<tr>
<td>6 Humeral comp. loosening of two patients(1 to 6 years)</td>
<td>revision +/- bone graft</td>
</tr>
<tr>
<td>Ulnar comp. loosening (2 y.)</td>
<td>revision</td>
</tr>
<tr>
<td>Bushing pin dissembling (4 m.)</td>
<td>revision</td>
</tr>
</tbody>
</table>
55 y.o. woman primary OA

Febr. 2001  Febr. 2003  June 2003

Febr. 2001

Febr. 2003

June 2003
25 y. o. man

- March 1997:
  - left elbow fix. ex. + skin transplant + fracture O.S.
  - right hand amputation
- October 1997: hinged total elbow replacement
- December 1997: latissimus dorsi myocutaneous neurovascular island flap
March 1999: revision total elbow replacement + impaction bone grafting with C-M elbow
May 2005: humeral component revision + impaction bone grafting

25 y. o. man
25 y. o. man

- Function at 6 years
1 year later: loosening of humeral component and revision with long stem + impaction bone grafting
Mayo score

Follow-up: 5 years (1-9)

All patients but two were satisfied with the results.
Range of motion
degrees

-35 97 38 35
-17
127 63 57
-60
-40
-20
0
20
40
60
80
100
120
140

extension flexion pronation supination

pre-op. at follow-up

pre-op. at follow-up
Conclusions

- Semiconstrained elbow replacement can provide stability and function when bony and soft-tissue anatomy of the elbow is grossly altered by arthritis or by previous trauma.
- But the surgery is demanding and complications are more common than following hip or knee replacement.
- Most of the complications appeared in post-trauma cases and sometimes the help from plastic surgeon was necessary.
Thank you for your attention!