Total Elbow Replacement History and Indications

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Europe

Population : 10 million

Territory : 93 000 square Km

Language : Hungarian

Politics : parliamentary democracy

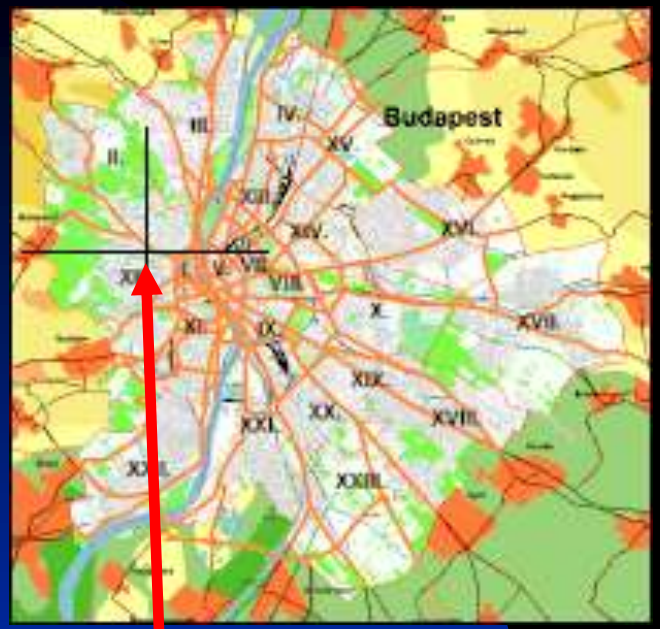
National health service

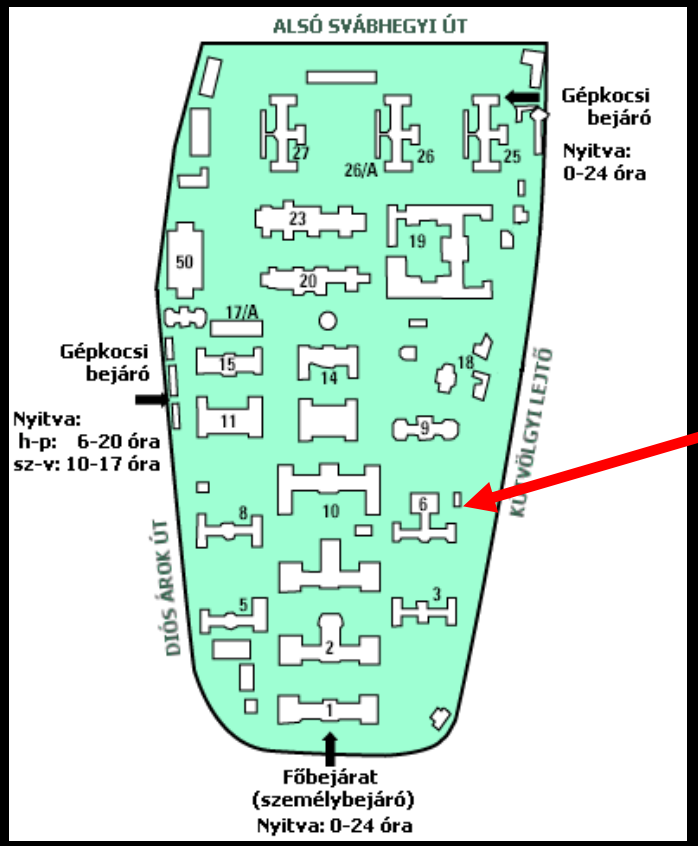
35 000 doctors

1 000 orthopedic and trauma surgeons

Saint John's Hospital, Budapest

founded in 1893



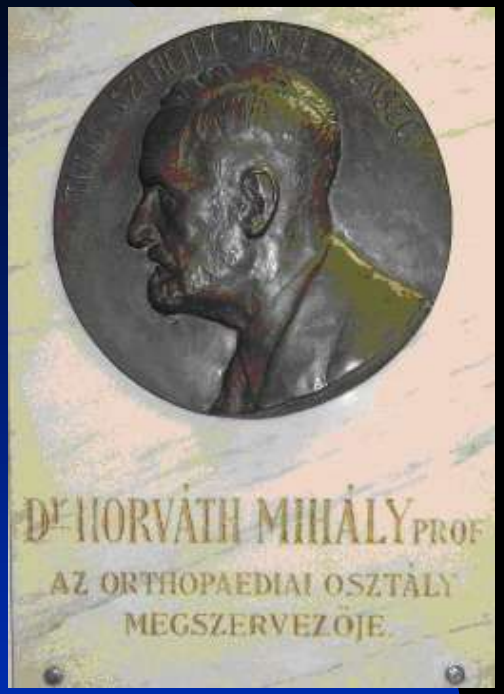


Ortop.-
Trauma

1 100 beds,
more than 40 000 inpatients treated yearly
700 000 outpatient examinations yearly

Department of Orthopaedic and Trauma Surgery

founded in 1919



68 beds
19 doctors
3 000 operations done yearly
40 000 outpatients seen yearly

Indication of elbow arthroplasty

- rheumatoid arthritis
- primary osteoarthritis
- post-traumatic arthritis
- non-union
- instability
- comminuted fracture
- pathological fracture
- previous infection
- stiff elbow
- failed elbow replacement

Contraindications

- active sepsis
- neuropathies
  - diabetes, syringomyelia, etc.
- nutritional deficiencies
- lack of co-operation
- severe bone deficiency (?)
- severe soft-tissue deficiency (?)

Surgical options

- fusion
- interposition arthroplasty
- reconstruction with massive allograft
- total joint replacement
  - costum made implant
  - oncological total joint
  - implant from shelf
- +/- soft-tissue reconstruction

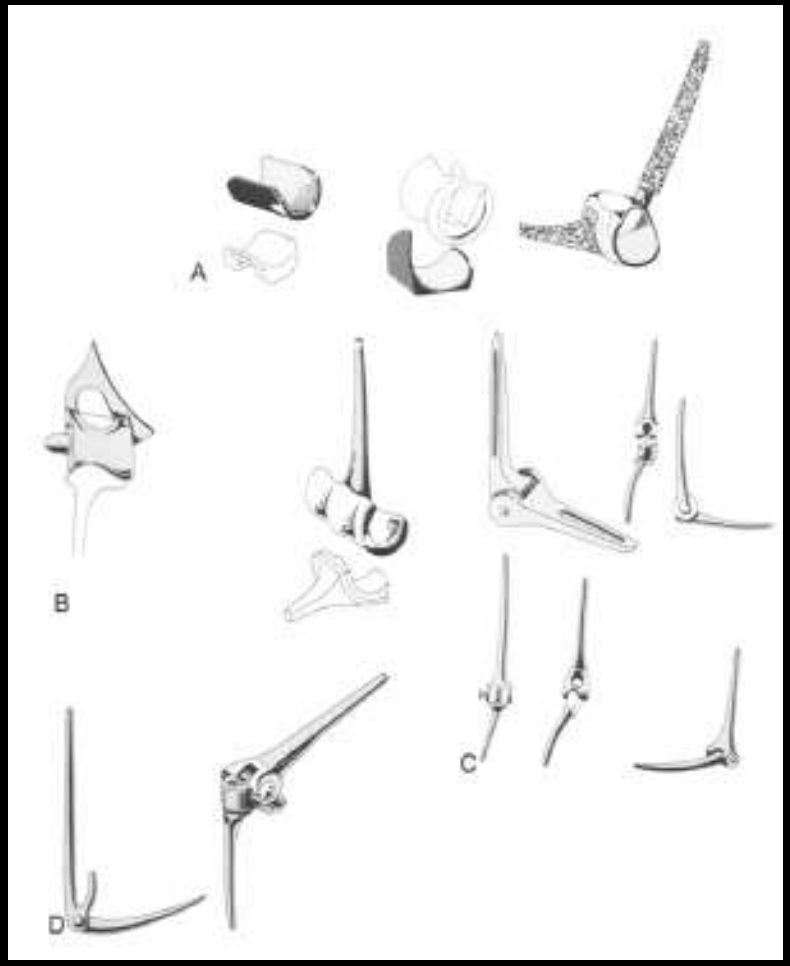
Which is the good total elbow

- durable
- few complications
- easy to implant
- good clinical results
- wide range of indications
- interchangeable

Classification

linked or unlinked

- constrained
- semiconstrained
- unconstrained



HEMIARTHROPLASTY

limited number of cases with moderate experience

1927 - Rubineau	- metal + rubber on humerus
1937 - Virgen	- metal on olecranon
1947 - Mellen	- acrylic humeral comp.
1951 - Carr	- Vitallium radial head
1953 - Cherry	- acrylic radial head
1971 - Peterson	- Vitallium on olecranon notch
1974 - Street	- humeral resurfacing

RIGID HINGES

24 - 30% poor results, 13 - 68% loosening,

up to 48% complications

1972 - Dee

1973 - Souter

1977 - Garrett & Edwald

1979 - Cooney & Bryan (111 cases)

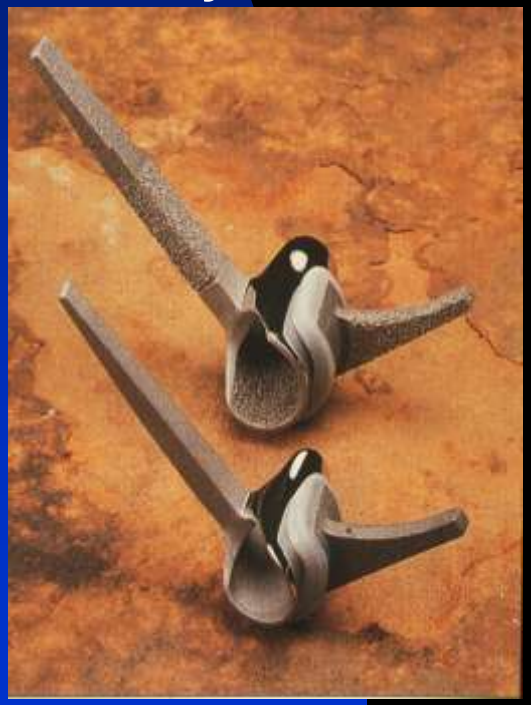
1979 - Cofield (346 cases)

1982 - Morrey and Bryan

UNLINKED TEA (nonconstrained ?)

80 - 90% excellent and good results

- needs relatively good bone stock and intact ligaments
- minimal bone resection
- adjusts more naturally to normal kinematics
- but instability and loosening are still a concern

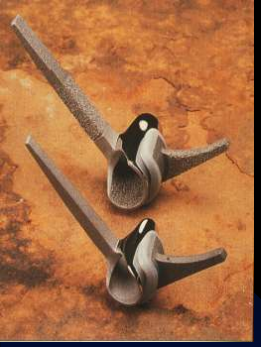


Unlinked TEA (nonconstrained ?)

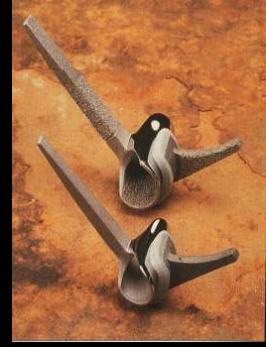
1984 - Soni - 80 Liverpool elbows at 3.5 years with 17% loosening

2003 – Mansat – 19 GUEPAR-I elbows at 5.5 years with 68% complications and 31% revisions

2003 – Alnot – 16 GUEPAR-III elbows at 2 years with 15 excellent and 1 fair results



Unlinked Kudo TEA (nonconstrained)



1980, 1994, 1999 - Kudo - different series of Kudo I-II-III-IV-V elbows (!!!)

2004 – Willems – 36 elbows at 4.8 years with high rate of loosening and dislocation

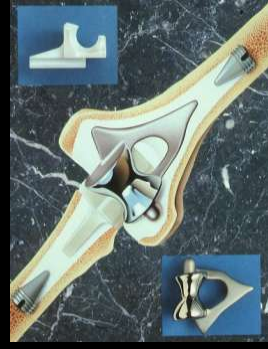
2006 – Mori – 14 elbows with bone grafting in severe RA at 5 to 11 years no major complications (?)

2006 – Thillemann – 17 elbows at 9.5 years 68% survival, 5 revised, high rate of ulnar valgus tilt observed

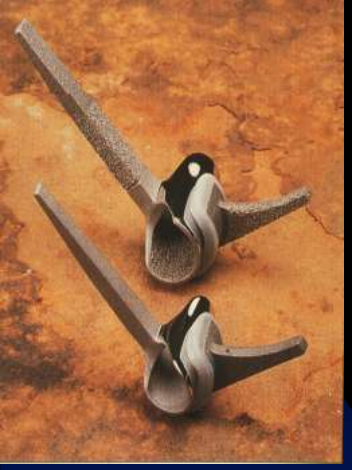
2006 – Tanaka – 56 elbows with two different cemented ulnar comp. metal-backed were superior to all-poly comp.

2007 – van der Heide – 89 elbows at 6 years, 7 ulnar revised and 7 loose out of 40 uncemented, no revision performed of cemented ulnar and uncemented humeral comp.

Unlinked Souter TEA (nonconstrained ?)



- 1989 – Souter - 250 elbows at minimum 10 years with 12% loosening and 5.5% instability
- 1999 - Trail - 186 elbows at 12 years with 13% loosening and 12.5% instability
- 2002 - Trail - 107 elbows with long humeral implant and 202 with standard at 4.4 and 9.3 year with less loosening of humeral comp. when long stem used, more revisions if snap-fit ulna used
- 2005 – van de Lugt – 204 elbows with 77% survival at 10 years and 65% survival at 18 years
- 2005 – Khatri – 47 elbows at 7 years 75% survival for all failure, and 97% survival for loosening
- 2006 – Landor – 49 elbows used in RA at 9.5 years with 17% loosening, 1.7% instability



Souter TEA versus Kudo

2008 – Skyttä – 21 Souter and 21 Kudo TEA in RA

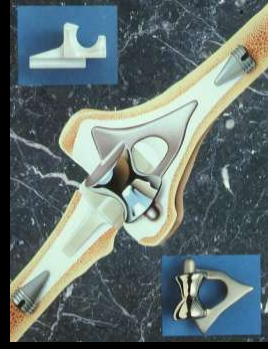
- 5 year survival was 85 % and 95% respectively
- only slight functional improvement
- more than half of the patients were independent
- 6 revisions overall
- no significant difference between the two implants

Unlinked iBP TEA (nonconstrained ?) used for distal humeral fractures

2008 – Kalogrianitis – 9 iBP TEA

- at 3.5 years Mayo score 95 (65-100)
- all were stable
- all patients capable for self-care

Unlinked Souter TEA (nonconstrained ?) used for revision



2006 – van de Lung – 24 revisions performed with Souter TEA

- At 5 years 74% still in situ
- 8 had to be re-revised
- 3 of them revised third time
- 7 further loosening
- 2 excision due to infection

Unlinked surface replacement TEA (nonconstrained ?) used for revisions

2007 – Tomita – 30 revisions of surface replacements to surface replacements

at 6.5 years Mayo score improved from 43 to 76

CONVERTABLE ACCLAIM TEA

conversion from nonconstrained to semiconstrained with special locking mechanism or by using different component

2007 – Bassi – 36 elbows , no loosening at 3 years

11 intraop. humeral fractures (!!!), 1 deep infection

COSTUM-MADE TEA

2008 – Anmin – 8 cases for revisions of failed TEA or for complex fracture complications

- at 4 years one failed due to sepsic but 7 satisfactory

SEMICONSTRAINED TEA (sloppy hinge)

- Since 1975, wide range of indication
- 85-90% excellent and good results
- Better implant survival
- No instability

1976 - Schlein - 400 Schlein elbows at 3 years, 2.75% loosening

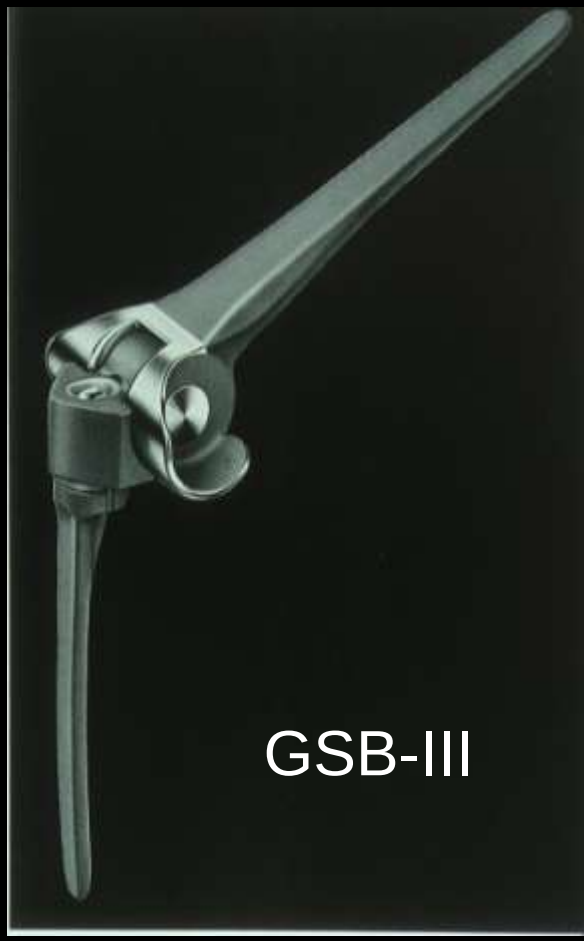
1980 - Inglis - 36 Pritchard and Tri-Axial elbows at 3.7 years, 53% complication rate

SEMICONSTRAINED TEA (sloppy or loose hinge)

1988 - Gschwend - 71 GSB-III elbows at 4 years, only 1 loosening, 91% excellent and good results

2006 – Jensen – 20 GSB-III elbows at 5 years, only 1 loosening, 91% excellent and good results

2007 – Cesar – 58 GSB-III elbows at 6 years, 2 revised, 6 loose but 84% excellent and good results



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
- wide range of indications
- most published data

Literature

1992 - Morrey and Adams - 54 RA cases
91% excellent and good at 2-8 years, no loosening
1995 - Morrey and Adams - 36 humeral nonunions
86% excellent and good at 4.2 years, no loosening
1997 - Cobb and Morrey - 21 acute fractures
96% excellent and good at 3.3 years, no loosening
1997 - Schneeberger et al. - 41 post-trauma cases
83% excellent and good at 5.8 years, no loosening but 12% ulnar comp. fracture
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 excisions
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
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
2005 – Muller at al. - 49 acute fractures
5 revisions performed at 7 years
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
2006 – Athwal at Morrey – 37 revisions of different fractured elbow replacements
good functional results, but high complication rate if cement had to be removed
2006 – Aldridge at al. – survival of 41 elbows at 10 to 31 years
21 were functional 10-14 years, 10 between 15-19 years, and 10 between 20-31 years, 14 complications, 13 revisions
2006 – Lee at al. – 7 acute fractures
at 2 years Mayo score was 94, average flexion arc was 88 degrees
2007 – Shi at al. – 67 elbows, 37 primary and 30 revisions
at 5.5 years Mayo score was 85 and 84 and the survival was 72% and 64% respectively
2007 – Matsumoto at al. – 13 elbow with periop. condylar fractures and 27 intact elbows
no difference of Mayo score strength and ROM at 4.8 years
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
2008 – Peden and Morrey - 13 cases of ankylosed elbows
7 good and excellent at 12 (2-26) years, 37 to 118 degrees of flexion, but high complication rate
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

Complication rate of TEA according to the literature

20-57% !!!

ulnar nerve neuritis	3-15 %
instability	3-10 %
infection	2-6 %
wound brake down	2-4 %
triceps rupture	2-4 %
periprothetic fracture	1-5 %
component fracture	0.5-1.5 %
hematome	3-7 %
pulmonary embolism	0.3 %
90 day mortality	0.6 %

Complications

J Shoulder Elbow Surg (2011) 20, 158-168

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Complications of total elbow replacement: A systematic review

Ilya Voloshin, MD[a,*], David W. Schippert, MD[a], Sanjeev Kakar, MD, MRCS, MBA[b], Elizabeth Krall Kaye, PhD, MPH[c], Bernard F. Morrey, MD[b]

1993-2009
64 studies
2938 cases

Late complications in elbow arthroplasty

Norbert Gschwend, MD, Beat R. Simmen, MD, and Z. Matejovsky, MD,
Zurich, Switzerland

1058-2746/96/$5.00 + 0 **32/1/71200**

1986-1992
22 studies
828 cases

Change of complications by time

Gschwend (1996) versus Voloshin (2011)

Complication	Incidence (%) 1986-1992[22]	Incidence (%)* 1993-2009
Aseptic loosening (clinical)	6.4	5.1 ± 3.4**
Aseptic loosening (clinical and radiographic)		
Linked designs		13.7 ± 6.8***
Unlinked designs		10.1 ± 4.8†
Dislocation/subluxation	6.5	4.7 ± 3.0**
Infections, deep	4.6	3.3 ± 2.9**
Intraoperative fractures	3.2	3.0 ± 2.7**
Fractures of prosthesis	0.6	2.9 ± 3.6**
Ulnar nerve complications	10.4	2.9 ± 2.4**
Delayed healing		2.5 ± 2.6**
Postoperative fracture		2.4 ± 2.1**
Triceps complications		2.4 ± 2.4**
Bushing wear		2.3 ± 3.4‡
Disassembly		2.3 ± 3.5‡

* Incidence as weighted mean ± SD.
** Total number of TEAs = 2938.
*** Total number of TEAs = 703.
† Total number of TEAs = 1071.
‡ Total number of TEAs = 865.

Overall complication rate by implant

Linked	25.9 ± 8.4 %	More complex cases
Unlinked	27.2 ± 6.2 %	More RA cases

n.s.

Instability

Linked	1.4 ± 4.5 %
Unlinked	4.9 ± 3.9 %

$P < 0.05$

Loosening

	Clinical	Clinical + radiological
Linked	5.2 ± 4.5 %	13.7 ± 6.8 %
Unlinked	5.2 ± 3.8 % n.s.	10.1 ± 4.8 % P<0.05

Resultant vector of forces = 3 times body weight

Complications by diagnosis

Rheumatoid arthritis	24.3 ± 5.8 %
Trauma	21.5 ± 9.2 %
Post-trauma	37.5 ± 9.2 %*

*P<0.05

Differences in TEA in RA

2007 – Schmidt – 177 elbows

- 126 GSB-III, 46 Coonrad-Morrey, 24 Souter, 4 rigid hinge, 2 custom-made, 1 Pritchard
- 34.4% complication rate
- 27% revision rate for loosening, infection or dislocation
- linked implants had better survival and no dislocation
- implants with ventral or epicondylar flanges had better load transfer and better survival

Thank you for your attention!