

가

*

**

* ** . . * . * .

: 가

69

4 9 . International Symposium On Limb Salvage(ISOLS)
가 (Radiological Implants Evaluation System)

가 1 . , , , , ,
4, 3, 2, 1 가 ,
(<20 vs 20) T-test

ANOVA

:
(anchorage)

가

: ,
(anchorage)

: , , 가

:

2 646-1
Tel : 054) 288-2121, Fax : 054) 770-8349, E-mail : msh@dumc.or.kr

* (02-97-083)

*

Kotz , LINK , Orthoplast , ISO , Stanmore
5가 Kotz가 39 , LINK 9
Orthoplast 11 , ISO 8 , Stanmore 2
Stanmore 가
4

(tumor prosthesis)

ISO

가 . 30

. 20 20 34 , 20

가

20 34 , 20

가

35 . 가 1

6

가 1 가가 가

가 54 , 1 6 가 50 .

가

2. ,

69 44 , 25

가

9 59 , 20

34 , 20 가 17 , 30 가 6 , 40 가 6 , 50

가 6 . 1 1

가 1 6 , 1 7

17 4 4 9 .

3. 가

1.

가

1988 6 International Symposium On Limb
Salvage(ISOLS)

1982 2 1998 9

가 가 (Radiological Implants Evaluation
System) 6가

69

가 가

5가

(bone remodel-
ling), (interface), (anchorage),
(implant body problem), (implant
articular problem), (extracortical
bone bridging)

가 1

30 39 . (excellent), (good),

(fair), (poor) 4가

4가

(comment)

10 , 31, 21, 가

7 가

55 , (interobserver vias)

14 6 , 5 1 가 .

1 가 , (hypertrophy),

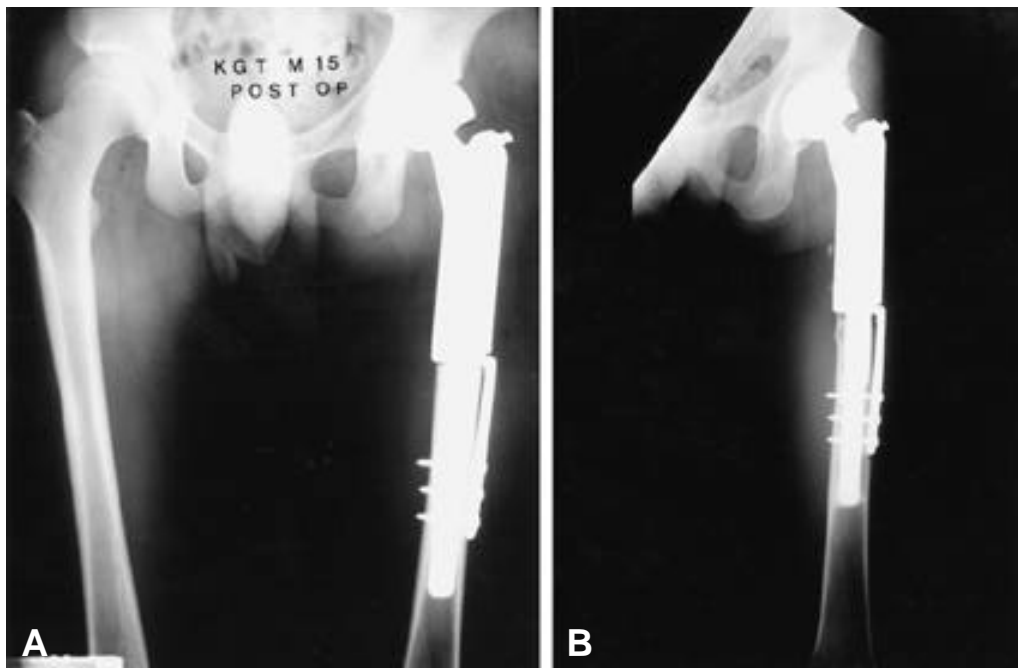


Fig. 1-A. Immediate postoperative AP radiograph of 15-year-old male with proximal femoral osteosarcoma shows proximal femoral prosthesis on left side.
B. Three years after the operation, radiograph shows resorption which has 2.5cm length and 70% of cortical thickness at medial proximal end of the femur.

(sclerosis), (osteopenia), 5
 , 가
 50% 가 2cm ,
 가 50% 가 2cm
 (Fig. 1)
 , (osteolysis)
 가 , ,
 , (radiolucent line)
 가 2mm
 , 2
 mm 가 2mm
 , 5mm
 , 5
 , 2mm
 (Fig. 2) 5mm ,
 , (plate), 가
 가 가



Fig. 2. Postoperative AP and lateral radiographs of 14-year-old boy with proximal tibial osteosarcoma show radiolucent line around prosthesis of distal femur.



Fig. 3. 16-year-old girl with parosteal osteosarcoma of distal femur has stem fracture at 3 years after the operation.

가 (porosity)
 (Fig. 3)
 가
 가 , 1cm
 가 (Fig. 4) , 1cm 가
 , Modular
 (coupling joint rotation)
 Modular (seg
 mental separation)
 가
 2mm
 2mm 4mm
 5 가 , 4mm
 5 가 가

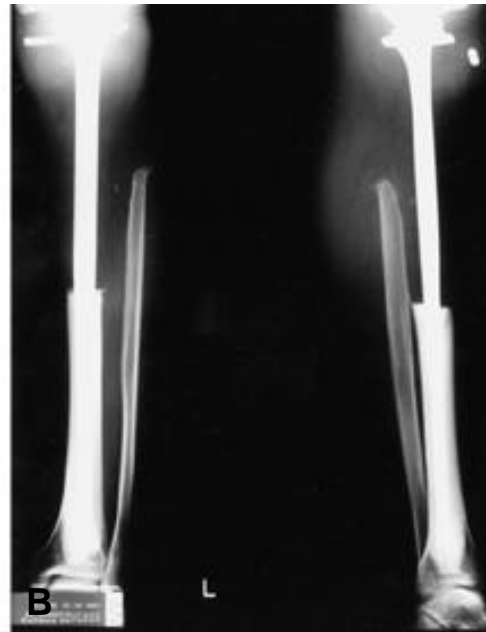


Fig. 4-A. 18-year-old male has right proximal tibia prosthesis because of osteosarcoma.

B. Three years later, follow-up radiographs show component loosening of proximal tibia.

Table 1. Comparison of cement vs. cementless (postoperative 1 year)

Group	Bone Remodelling	Interface	Anchorage	Implant Body Problem	Implant Articular Problem
Cement	3.2 ± 1.0	3.5 ± 0.9	3.6 ± 0.5	4.0 ± 0.0	3.8 ± 0.2
Cementless	2.5 ± 0.5	3.1 ± 1.1	4.0 ± 0.0	4.0 ± 0.0	4.0 ± 0.0

Table 2. Comparison of cement vs. cementless (last follow-up)

Group	Bone Remodelling	Interface	Anchorage	Implant Body Problem	Implant Articular Problem
Cement	2.6 ± 1.1	3.0 ± 1.7	3.5 ± 0.6	3.9 ± 0.4	3.7 ± 0.7
Cementless	2.0 ± 0.9	2.1 ± 1.4	4.0 ± 0.0	3.9 ± 0.1	3.6 ± 1.0

Table 3. Comparison of 4 anatomic sites (postoperative 1 year)

Group	Bone Remodelling	Interface	Anchorage	Implant Body Problem	Implant Articular Problem
PF*	2.1 ± 0.8	3.4 ± 0.7	4.0 ± 0.0	3.8 ± 0.7	4.0 ± 0.0
DF†	2.9 ± 0.8	3.3 ± 1.0	3.9 ± 0.3	3.9 ± 0.2	4.0 ± 0.0
PT‡	3.1 ± 0.8	3.2 ± 1.2	3.7 ± 0.8	3.9 ± 0.3	4.0 ± 0.0
DT§	2.8 ± 1.2	3.5 ± 1.2	3.7 ± 0.5	4.0 ± 0.0	4.0 ± 0.0

PF* : Proximal Femur, DF† : Distal Femur, PT‡ : Proximal Tibia, DT§ : Distal Tibia

3.2 ± 1.0, 2.5 ± 0.5 (p=0.02).
 4.0 ± 0.0 3.6 ± 0.2
 가 0.5 (p=0.003)(Table 1).
 2.6 ± 1.1
 4. 2.0 ± 0.9 (p=0.023)
 3.0 ± 1.7 2.1 ± 1.4
 (excellent), (good), (fair), (p=0.013).
 (poor) 4, 3, 2, 1
 4.0 ± 0.0 3.5 ± 0.6
 ± (p=0.001).
 (SEM) . SAS (Window 가 (Table 2). 가
 version 6.11, 1988) t-test ANOVA , ,
 (Analysis of Variance) procedure , 가 가
 , 0.05 . Mann-Whitney U test
 (homogeneity) (p>0.05).
 2.
 1. 1 가
 가 (Table 3).

Table 4. Comparison of 4 anatomic sites (last follow-up)

Group	Bone Remodelling	Interface	Anchorage	Implant Body Problem	Implant Articular Problem
PF*	1.2 ± 0.8	2.6 ± 1.3	4.0 ± 0.0	3.9 ± 0.4	3.0 ± 1.4
DF [†]	2.6 ± 0.9	2.4 ± 1.3	3.9 ± 0.2	3.8 ± 0.7	3.7 ± 0.8
PT [‡]	2.6 ± 1.0	2.7 ± 1.3	3.6 ± 0.8	3.9 ± 0.3	3.8 ± 0.8
DT [§]	1.6 ± 0.8	2.0 ± 1.3	3.4 ± 0.8	4.0 ± 0.0	3.6 ± 1.1

PF* : Proximal Femur, DF[†] : Distal Femur, PT[‡] : Proximal Tibia, DT[§] : Distal Tibia

Table 5. Comparison of osteosarcoma vs. non-osteosarcoma (postoperative 1 year)

Group	Bone Remodelling	Interface	Anchorage	Implant Body Problem	Implant Articular Problem
Osa*	2.8 ± 0.9	3.3 ± 1.0	3.8 ± 0.5	4.0 ± 0.0	3.9 ± 0.3
Non-Osa [†]	2.5 ± 1.0	2.8 ± 1.3	4.0 ± 0.0	4.0 ± 0.0	3.8 ± 0.5

Osa* : osteosarcoma, Non-Osa[†] : non-osteosarcoma

Table 6. Comparison of osteosarcoma vs. non-osteosarcoma (last follow-up)

Group	Bone Remodelling	Interface	Anchorage	Implant Body Problem	Implant Articular Problem
Osa*	2.3 ± 1.0	2.6 ± 1.3	3.7 ± 0.6	3.9 ± 0.5	3.5 ± 1.0
Non-Osa [†]	2.1 ± 1.1	2.1 ± 1.4	4.0 ± 0.0	3.9 ± 0.4	4.0 ± 0.0

Osa* : osteosarcoma, Non-Osa[†] : non-osteosarcoma

Table 7. Comparison of prosthetic design (postoperative 1 year)

Group	Bone Remodelling	Interface	Anchorage	Implant Body Problem	Implant Articular Problem
Kotz	2.6 ± 0.8	3.2 ± 1.0	4.0 ± 0.0	4.0 ± 0.0	4.0 ± 0.0
LINK	3.1 ± 0.8	3.3 ± 1.0	3.8 ± 0.5	4.0 ± 0.0	3.5 ± 0.8
Ortho	3.1 ± 0.9	3.4 ± 1.1	3.8 ± 0.4	4.0 ± 0.0	4.0 ± 0.0
ISO	2.9 ± 1.1	3.3 ± 1.3	3.7 ± 0.5	4.0 ± 0.0	4.0 ± 0.0

1.3±0.8, 1.6±0.8 가 (Table 5).
 가 (p=0.002). 가 4.0±0.0
 (Table 4). 가 3.7±0.6 (p=0.01).
 4 , , 가 가 4.0±0.0
 , 가 가 3.5±1.0 (p=0.005).
 Kruskal-Wallis test 가 (Table
 (p>0.05). 6). , ,
 3. Mann-Whitney
 U test
 1 가 (p>0.05).

Table 8. Comparison of prosthetic design (last follow-up)

Group	Bone Remodelling	Interface	Anchorage	Implant Body Problem	Implant Articular Problem
Kotz	2.1 ± 1.0	2.2 ± 1.2	4.0 ± 0.0	3.9 ± 0.2	3.6 ± 1.0
LINK	2.8 ± 1.1	3.0 ± 1.4	3.6 ± 0.6	4.0 ± 0.0	3.0 ± 1.4
Ortho	2.7 ± 1.0	3.1 ± 1.2	3.7 ± 0.5	3.4 ± 1.1	4.0 ± 0.0
ISO	1.8 ± 0.9	2.3 ± 1.4	3.5 ± 0.8	4.0 ± 0.0	3.8 ± 0.7

Table 9. Comparison of < 20 year vs 20 year-old (postoperative 1 year)

Group	Bone Remodelling	Interface	Anchorage	Implant Body Problem	Implant Articular Problem
< 20*	3.0 ± 0.8	3.5 ± 1.0	3.6 ± 0.5	4.0 ± 0.0	3.8 ± 0.2
20 [†]	2.5 ± 0.4	3.1 ± 1.4	4.0 ± 0.0	4.0 ± 0.0	3.9 ± 0.5

< 20* : less than 20 year-old, 20[†] : equal or more than 20 year-old

Table 10. Comparison of < 20 year vs 20 year-old (last follow-up)

Group	Bone Remodelling	Interface	Anchorage	Implant Body Problem	Implant Articular Problem
< 20 year*	2.2 ± 1.4	2.5 ± 1.7	3.7 ± 0.7	3.9 ± 0.4	3.6 ± 0.6
20 year [†]	2.3 ± 1.1	2.3 ± 1.2	4.0 ± 0.0	3.9 ± 0.2	3.7 ± 0.2

< 20* : less than 20 year-old, 20[†] : equal or more than 20 year-old

4. LINK
3.5±0.8
(Table 7) 가 가
(Table 8). 4 , , 가 가 (allograft-prosthesis composite)
Kruskall-Wallis test 가 . , (neoadjuvant chemotherapy)
가
5. 가 (Table 9, 10). 가 ³⁾.
, , 가 가 , 가
, 가 가 Mann-Whitney U test 가
(p>0.05). ISOLS 가
1988 가

가

가

. Capanna ²⁾
51

ISOLS

가
Kotz
가

가

Shih ⁸⁾

Kinematic

Friedlaender ⁴⁾

dox-

Walldius

orubicin methotrexate

가

3.0, 2.1

(loosening)가

(osteoid)

가 가

^{3,10)}

가

가

(torsion)

가,

(bone ingrowth)

(constrained)

(biologic fixation)

Shih ⁸⁾

가

Kinematic

rotating hinge

Walldius

Kinematic

가

¹²⁾

가

1.3±0.8, 1.6±0.8

가

Damron³⁾

1

가

(stress shielding)

1

가

67~77%

가

43%

가

(prosthetic plateau)

Unwin ¹¹⁾

가

77%

(initial stability)

가

3~4

가

가

Capanna ¹⁾
(anchorage)

Rechl ⁷⁾

가

(joint mechanism)

Kawai ⁶⁾

가

40%

가

가

(p=0.49)

(anchorage)

Henry ⁵⁾

가

가

가

REFERENCES

Wykman ¹²⁾

(isthmus)

(restrictor)

가

가

가

Volz ⁹⁾

(porous-coated)

3가

(micromotion)

가

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Abstract**Radiologic Evaluation of Limb Salvage Operation with Tumor Prosthesis**

**Sang-Ho Moon, M.D.*, Sang Hoon Lee, M.D., Han Soo Kim, M.D., Joo Han Oh, M.D.,
Byung Won Ko, M.D.***, Ki Hyung Koo, M.D., Jae Hag Lee, M.D.*,
Chung Soo Hwang, M.D.*, and Han Koo Lee, M.D.**

Department of Orthopedic Surgery, College of Medicine, Seoul National University, Seoul, Korea
*Department of Orthopedic Surgery, College of Medicine, Dongguk University, Pohang, Korea**
*Department of Orthopedic Surgery, College of Medicine, Kyung Hee University, Seoul, Korea***

Purpose : To verify radiological changes of limb salvage operation using tumor prosthesis.

Materials and Methods : Sixty-nine cases which used tumor prosthesis were reviewed. They have been followed up for average four years and nine months. We evaluated radiographs by ISOLS(International Symposium On Limb Salvage) radiological implants evaluation system immediate postoperatively, at postoperative 1 year and last follow-up. After converting 'excellent, good, fair, poor' to '4, 3, 2, 1' for stastical analysis, data were analyzed according to the use of cement, anatomical sites, diagnosis implant designs and age (< 20 year vs. 20 year) using t-test and ANOVA.

Results : The outcomes of cemented type prostheses were superior in remodelling and interface but inferior in anchorage. The scores of proximal femur and distal tibia were worse in bone remodelling. Osteosarcoma group had lower scores in anchorage and implant articular problem. There were no significant differences according to four different implant designs and age.

Conclusion : In the intermediate term follow-up radiological evaluation, cemented type prosthesis were better in the aspects of bony resorption and osteolysis, and cementless one in anchorage. Distal femur and proximal tibia have higher scores in bony resorption, and osteosarcoma was worse tumor entity in anchorage and articular problem, and chemotherapy may be the cause.

Key Words : Bone tumor, Tumor prosthesis, Radiologic evaluation

Address reprint requests to

Sang Ho Moon, M.D.
 Department of Orthopedic Surgery, College of Medicine, Dongguk University
 #646-1 Jook-do-dong, Pohang, Kyongbuk, 791-052, Korea
 Tel : 82-54-288-2121, Fax : 82-54-770-8349, E-mail : msh@dumc.or.kr