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[ ]

: 가 -  
(IC Nail®, Osteo, Switzerland)

: 20, 21

44 (18~69), 8 45 (19),

6 49 (29)

10,

10, 1, 17 (dynamization)

가, 17, 3,

1 . ,

: 1 20, .

4 15 (7.4) 1

2 36 12 .

: -

가 .

: , , -

:  
135-710, 50

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가 , 가  
 ,  
 1,4,8,11,13,15,18~20,22)  
 ,  
 가 - (interlocking-compre-  
 ssion nail, Osteo, Switzerland) (Fig. 1),  
 10).

가 ,  
 가 ,  
 가 ,  
 2,21) , 가  
 -  
 가

1998 11 2002 6 -  
 21 , 20  
 (Table 1).

9 , 11 , 44 (18~69)  
 , 8 45 ( (transverse)  
 19 ) . (oblique) 4 , (butterfly)  
 10 , 3 , 3 , 1 .  
 10 , 10 , 2  
 10 , 1  
 (dynamization) ,



**Fig. 1A.** Proximal part of Interlocking-Compression (IC) nail composed of locking holes, screw and a compression screw.  
**1B.** Feature of dynamic compression generated by the compression screw via the proximal dynamic locking screw.

가 1 가  
 17 .  
 17 , 3  
 1 .  
 .  
 1 , ,  
 , , ,  
 .  
 0.5 1 mm  
 4 mm ( 2 mm) 가 (Table 2).  
 - , 2  
 10 mm 가 ,

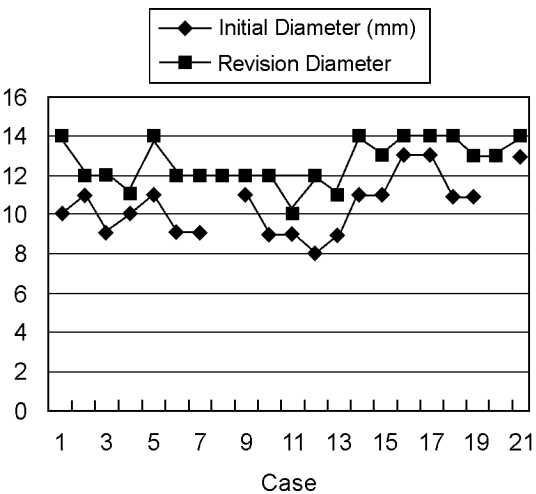
**Table 1.** Case Summary of Nonunions of femoral shaft fracture

	Age	Sex	Fracture site	Fracture pattern	Initial operation	Additional procedure (s)	Interval (month)	Type of Nonunion	Radiographic union (month)
1	65	F	Distal 1/3	Comminuted	ON + W		27	Hypertrophic	5
2	25	M	Distal 1/3	Oblique	CN	Dyn	22	Hypertrophic	4
3	41	M	Subtroch	Transverse	ON		43	Hypertrophic	6
4	47	F	Proximal 1/3	Transverse	CN	Dyn	20	Oligotrophic	6
5	59	F	Midshaft	Transverse	ON	Dyn	14	Oligotrophic	9
6	39	F	Midshaft	Transverse	CN	Dyn	18	Oligotrophic	9
7			Midshaft	Transverse	CN	BG	15	Oligotrophic	6
8	60	F	Distal 1/3	Oblique	ON + BG	Infection treatment	8	Infected	15
9	54	M	Subtroch distal 1/3	Segmental	ON + BG	BG	45	Hypertrophic	12
10	67	F	Midshaft	Transverse	CN		24	Oligotrophic	6
11	30	F	Midshaft	Transverse	ON	Dyn	14	Oligotrophic	7
12	43	F	Distal 1/3	Butterfly	ON	Static locking Dyn	12	Oligotrophic	9
13	24	F	Midshaft	Comminuted	ON + BG	BG	10	Avascular	7
14	57	M	Distal 1/3	Transverse	CN		45	Hypertrophic	9
15	18	M	Distal 1/3	Comminuted	ON + BG	W + BG	14	Oligotrophic	6
16	36	M	Distal 1/3	Butterfly	ON + W + BG	1 Exchange nailing 2 Dyn	31	Avascular	Not healed at postop 12 mo
17	42	M	Midshaft	Butterfly	CN	Dyn / BG	20	Avascular	7
18	69	M	Midshaft	Transverse	CN	Dyn	8	Oligotrophic	5
19	29	M	Midshaft	Transverse	CN	Dyn	35	Hypertrophic	4
20	41	M	Midshaft	Oblique	Plating		25	Oligotrophic	7
21	47	M	Midshaft	oblique	CN	W	16	hypertrophic	6

Abbreviations: CN = closed nailing, ON = open nailing, W = wiring, BG = bone graft, Dyn = dynamization  
Case 6 and 7 is bilateral nonunions in the same patient

가  
, ,  
, 가 , ,  
PACS 가  
, 가  
, 가  
7.4 mm , ,  
3.1 mm . 4 3

**Table 2.** Diameters of IM nails used for treatment



As case 8 was infected nonunion where hardware had been removed and case 20 had been treated with plate before revision nailing, so initial data were not available in these 2 cases

가

( 95.2%)

3

7.3 (4~

15) (Fig. 2).

7.4 mm (4.1~16.6) , 10 mm

3 , 3.1

mm (1.4~5.5)

(hypertrophic)

(oligotrophic) 17

6.8 , 3

2 7

, 1

15

36

1/3,

1 2

8.9 mm 2 6

12

(ESR, CRP)

5.5 mm

가

53%<sup>15)</sup>

100%<sup>5,21)</sup> , (95.2%)

8,13,19,22)

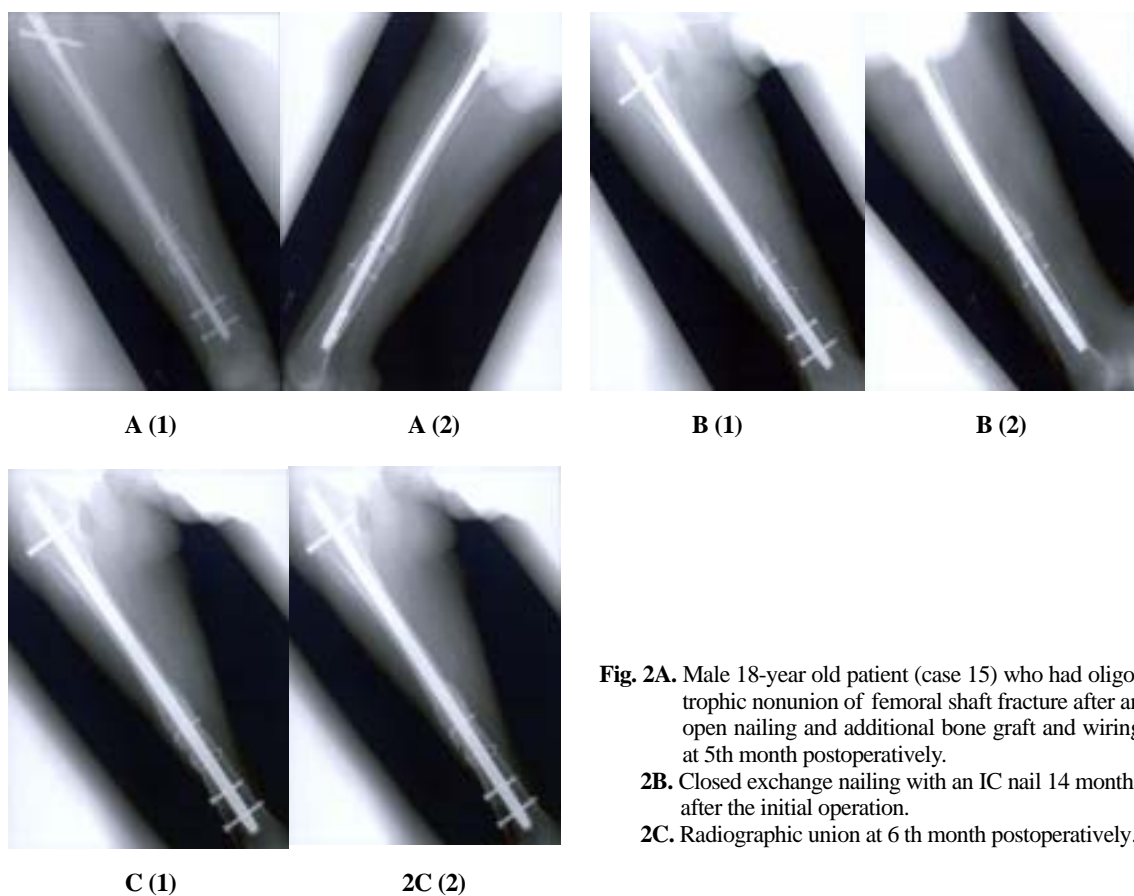
18,19,21,22)

3 가

1 , 2 cm

Weber<sup>14)</sup>

가



**Fig. 2A.** Male 18-year old patient (case 15) who had oligotrophic nonunion of femoral shaft fracture after an open nailing and additional bone graft and wiring at 5th month postoperatively.  
**2B.** Closed exchange nailing with an IC nail 14 months after the initial operation.  
**2C.** Radiographic union at 6 th month postoperatively.

15 , 16)  
7.4 mm  
3 2 .  
가 가 2,6),  
가 가 2,13,  
가 ,  
19,21),  
, Wu<sup>17)</sup>  
(52%)  
가 9),  
가 가  
가 가 7,10,12),  
가

, (dynamization) 가

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**Abstract****Treatment of Femoral Shaft Nonunions with Dynamic Compression using Interlocking-Compression (IC) Nail****Youn-Soo Park, M.D., Young-Wan Moon, M.D., Ki-Sun Sung, M.D.***Department of Orthopaedic Surgery, Samsung Medical Center,  
Sungkyunkwan University School of Medicine, Seoul, Korea*

**Purpose:** To evaluate the effectiveness of a specially designed Interlocking-Compression Nail (IC Nail®, Osteo, Switzerland) which allows compression force across the nonunion site for the treatment of femoral shaft nonunions.

**Materials and Methods:** Between Nov. 1998 and June 2002, twenty one nonunions of femoral shaft fractures in twenty patients were treated with reamed IC nails of larger diameters without bone grafting in 9 men and 11 women, 8 to 45 months after initial operations. Seventeen cases were hypervascular nonunions, 3 avascular, and 1 infected. For initial operation, 10 closed nailing, 10 open nailing and 1 plate fixation were performed. One or more additional procedures had been done in 17 cases prior to IC nailing.

**Results:** The nonunion gap was considerably narrowed from 7.4 mm to 3.1 mm with IC nailing and bony unions were achieved in all but one case. The time for radiographic union was 4 to 15 months postoperatively with an average of 7.4.

**Conclusion:** Reamed IC Nail® with a larger diameter is an effective procedure for femoral shaft fracture nonunion regardless of initial treatment modalities and even in 3 avascular nonunions, 2 have shown radiographic union without bone grafting. Additional procedures are to be considered in failed surgery of avascular nonunions.

**Key Words:** Femoral shaft fracture, Nonunion, IC (Interlocking-Compression) nail

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