

13, 4, 2000 10

**The Journal of the Korean Society of Fractures**  
Vol.13, No.4, October, 2000

\* . . .

< >

:

: 6

16mm 32mm

:

32mm

16mm

10.26N, 25.85N, 48.37N

16mm

32mm

16mm

16mm

16mm

:

(32mm)

가

:

,

,

4,7,11,12,21,23,24,26).

: Poong-Taek Kim, M.D.

Department of Orthopedic Surgery, Kyungpook National University Hospital,  
50 Samdok-2ga, Chung-gu, 700-721, Taegu, Korea

Tel : (053) 420 - 5632

Fax : (053) 422 - 6605

E-mail : ptkim@kyungpook.ac.kr





1,2,10,17-20)

6

Formalin

가  
22)

44.3

1

5

, 1

stainless steel

7mm cannulated

(Synthes, thread diameter 7.0mm, core diameter

4.5mm)

(32mm)

(16mm)

가

4,7,22)

25)

5,8,17-20)

1,2,13)

1

2

K-

K-

4.5mm cannulated

2,13)

drill

tapping

. 32mm

가 7mm cannulated

K-

16mm

가

(Fig. 1).

14)

16mm

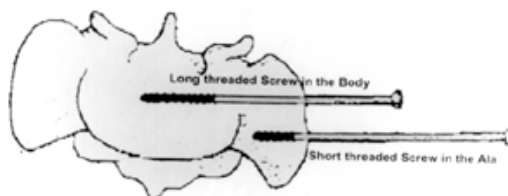
K-

16mm

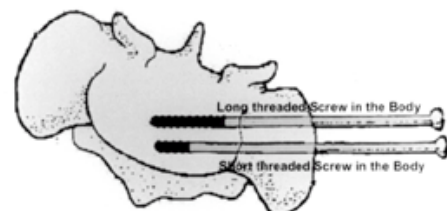
(Fig. 2).

Instron 4200(Series IX Automated

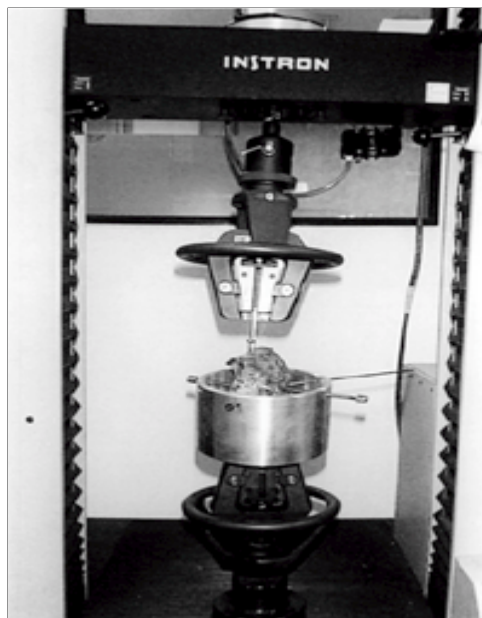
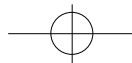
Material Testing System v4.05a, Instron Corporation, USA)



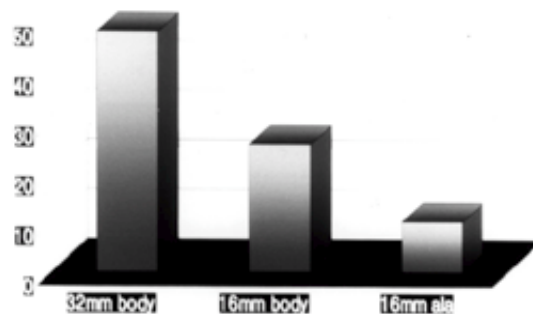
**Fig 1.** Superior view of the sacrum comparing a long-threaded screw in the sacral body and a short-threaded screw in the ala.



**Fig 2.** Comparison of a long-threaded and short-threaded screw in the body of the sacrum.



**Fig 3.** Screw extraction testing apparatus (Instron).



**Fig 4.** Mean extraction strengths (in Newtons) for the three groups of cancellous screws.

Instron chuck (Fig. 3).

16mm

32mm

,

16mm

,

10mm( 0.16mm)

.

load cell Newton(N)

16mm  
32mm , 16mm  
25.85 ± 22.66N, 48.37 ± 28.66N 10.26 ± 7.71N,  
(Fig. 4. Table 1).

32mm

16mm

16mm

(p=0.0214, p=0.0036).

16mm

16mm

가

(p=0.1251).

가

16mm

16mm

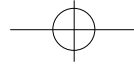
32mm

repeated measures of variance

p 0.05

가

가

**Table 1.** Extraction strengths of the three groups of cancellous screws (Newton)

Specimen	Short thread ala	Short thread body	Long thread body
1	7.86	2.89	10.87
2	5.772	18.58	46.87
3	1.6	4.1	35.33
4	24.21	29.1	45.69
5	11.25	37.64	53.11
6	10.87	62.79	98.36
Mean	10.26	25.85	48.37

가

22)

14)

가

가

가

(44.8 )

(28-36 )

15,16)

가

가

Kraemer 9)

가

(extraction force)

가

5

10

가

16mm

16mm

32mm

6-8

71N, 374N, 925N

10)

32mm

16mm

16mm

가

가

가

3,6)



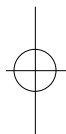


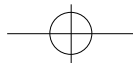
(32mm)

가

## REFERENCES

- 1) **Duwelius PJ, Allen MV, Bray TJ and Nelson DW** : Computed tomography- guided fixation of unstable posterior ring disruptions. *J Orthop Trauma*, 6:420-426, 1992.
- 2) **Ebraheim NA, Rusin JJ, Coombs RJ, Jackson WT and Holiday B** : Percutaneous computed-tomography-stabilization of pelvic fractures : preliminary report. *J Orthop Trauma*, 1:197-204, 1987.
- 3) **Frandsen PA, Christoffersen H and Madsen T** : Holding power of different screws in the femoral head. *Acta Orthop Scand* 55:349-351, 1984.
- 4) **Goldstein A, Phillips T, Scalafani SJ et al** : Early open reduction and internal fixation of the disrupted pelvic ring. *J Trauma*, 26:325-333, 1986.
- 5) **Guyton JL** : Fractures of hip, acetabulum, and pelvis. In: Campbell 's operative orthopaedics. 9th ed. St. Louis. *Mosby*. 2265-2270, 1998.
- 6) **Hughes AN and Jordan BA** : The mechanical properties of surgical bone screws and some aspects of insertion practice. *Injury*, 4:25-38, 1972.
- 7) **Kellam JF, McMurry RY, Paley D and Tile M** : The unstable pelvic fracture: Operative treatment. *Orthop Clin North Am*, 18:25-41, 1987.
- 8) **Kim JJ, Kim DH, Chang JS and Kim KY** : Early results of percutaneous iliosacral screw fixation in unstable posterior pelvic ring injury, *J Korean Orthop*, 32:391-398, 1997.
- 9) **Kraemer W, Hearn T, Tile M and Powell J** : The effect of thread length and location on extraction strengths of iliosacral lag screws. *Injury*, 25:5-9, 1994.
- 10) **Matta JM and Saucedo T** : Internal fixation of pelvic ring fractures. *Clin Orthop*, 242:83-97, 1989.
- 11) **Mears DC and Fu FH** : External fixation in pelvic fractures. *Orthop Clin North Am*, 11:465-479, 1980.
- 12) **Mears DC and Fu FH** : Modern concepts of external skeletal fixation of the pelvis. *Clin Orthop*, 151:65-72, 1980.
- 13) **Nelson DW and Duwelius PJ** : CT-guided fixation of sacral fractures and sacroiliac joint disruptions. *Radiology*, 180:527-532, 1991.
- 14) **Perren SM** : Basic aspects of internal fixation. In: Muller ME et al. ed. *Manual of internal fixation*, 3rd Ed. Berlin, *Springer-Verlag*, 30, 1991.
- 15) **Richardson JD, Harty J, Amin M and Flint LM** : Open pelvic fractures. *J Trauma*, 22:533-538, 1982.
- 16) **Rothenberger D, Velasco R, Strate R, Fischer RP and Perry JF** : Open pelvic fracture: a lethal injury. *J Trauma*, 18:184-187, 1978.
- 17) **Roult ML, Meier MC, Kregor PK and Mayo KA** : Percutaneous iliosacral screws with the patient supine technique. *Op Tech Orthop*, 3:35-45, 1993.
- 18) **Roult ML, Kregor PJ, Simonian PT and Mayo KA** : Early results of percutaneous iliosacral screws placed with the patient in the supine position. *J Orthop Trauma*, 9:207-214, 1995.
- 19) **Roult ML and Simonian PT** : Internal fixation of pelvic ring disruptions. *Injury*, 27S:B20-B30, 1996.
- 20) **Roult ML, Simonian PT, Agnew SG and Mann FA** : Radiographic recognition of the sacral alar slope for optimal placement of iliosacral screws : A cadaveric and clinical study. *J Orthop Trauma*, 10:171-177, 1996.
- 21) **Shaw JA, Mino DE, Werner FW and Murray DG** : Posterior stabilization of pelvic fractures by use of threaded compression rods, case reports and mechanical test. *Clin Orthop*, 192:240-254, 1985.
- 22) **Slatis P and Huittinen VM** : Double vertical fractures of the pelvis. A report on 163 patients. *Acta Chir Scand*, 138:799-807, 1972.
- 23) **Stocks GW, Gabel GT, Noble PC, Hanson GW and Tullos HS** : Anterior and posterior internal fixation of vertical shear fractures of the pelvis. *J Orthop Res*, 9:237-245, 1991.
- 24) **Tile M** : Fractures of the pelvis and acetabulum. 2nd





- ed. Baltimore, *Williams and Wilkins*:12-36, 183-190, 1995.
- 25) **Tile M**: Pelvic ring fractures : should they be fixed?  
*J Bone Joint Surg[Br]*, 70:1-12, 1988.
- 26) **Ward EF, Tomasin J and Vander Griend RA** :  
Open reduction and internal fixation of vertical shear pelvic fractures. *J trauma*, 27:291-295, 1987.

# Abstract

## The biomechanical Study on the Extraction Strengths of Iliosacral Lag Screws

Poong-Taek Kim,M.D., Chang-Wug Oh,M.D.,  
Joo-Chul Ihn,M.D., and Jun-Dae Kwun,M.D.

*Department of Orthopedic Surgery, School of Medicine,  
Kyungpook National University, Taegu, Korea*

**Purpose** : The purpose of this study is for the rigid fixation of the pelvic ring by quantifying and comparing the extraction strength of cancellous screws in the sacral ala and body.

**Materials and Methods** : Six cadaveric human pelvis were obtained for test of the extraction strengths of three groups of 7.0mm cannulated cancellous screws: short-threaded in the sacral ala, short-threaded in the sacral body, long-threaded in the sacral body. The extraction strengths of these groups were compared with each other.

**Results** : The mean extraction strengths of short-threaded screws in the sacral ala, short-threaded screws in the sacral body and long-threaded screws in the sacral body were 10.26N, 25.85N and 48.37N respectively. The mean extraction strength of the long-threaded screws in the body was significantly greater than that of the short-threaded screws in the ala and body. The mean extraction strength of the short-threaded screws in the body was greater than that of the short-threaded screws in the ala, but insignificant statistically.

**Conclusion** : In choosing iliosacral lag screws to stabilize the posterior pelvic ring disruption, superior fixation is achieved by inserting the long-threaded screw in the sacral body.

**Key words** : Sacrum, Iliosacral lag screw, Extraction strength

### Address reprint requests to

Poong-Taek Kim, M.D.

Department of Orthopedic Surgery, Kyungpook National University Hospital,  
50 Samdok-2ga, Chung-gu, 700-721, Taegu, Korea

Tel : (053) 420 - 5632

Fax : (053) 422 - 6605

E-mail : ptkim@kyungpook.ac.kr