

가

가

. * . * . . * . * . . †

, * ,
†

< >

:가

가

: 가 52

20%

1

30%

2

5%

3

4

가 : 1 7.2 , 2 8.6 , 3 8.8 , 4 8.5 1
 가 1 (p<0.05)
 1 4 1 310.45
 $\pm 49.58 \text{ g/mm}^2$ 4 $291.16 \pm 55.79 \text{ g/mm}^2$ (p<0.05)가
 (bending stiffness) 1 $415.33 \pm 137.18 \text{ N/mm}$ 4
 $358.75 \pm 107.32 \text{ N/mm}$ (p<0.05)가
 :

가

가

: , , ,

:

90

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*

2000

(KRF-2000-041-F00232)

가

.

, , ,

,

.

가 6

1000g

가

가

62

20%

. 가 5

. 1,2,3,4

가 . 5.9)

5

. 1 (16)

가

(lignan),

(flavonoid),

(serotonin)

30%

2 (10)

가

5%

3 (10)

(estrogen)

5 microgram

4

4 (16) , 5 (10)

.

,

,

,

16

1-4).

(genistein)

(xylazine) 5-10mg/kg

(Ketamin) 40-80mg/kg

(daidzein)

(isoflavone)

(flaxseed)

(matairesinol)

(secoisolariciresinol)

1.5 mm

2.3 mm

(half-

pin)

가

4

,

,

,

가

2

(air saw)

20%

.

가

1

(WI: width index=width of new bone formation on operated femur/width of contralateral femur)

1 4
가

(Instron)

1 cm

(Somastom Plus-S, Simens, Germany)

(destructive 3-point-bending test)

2 cm

Instrument Ltd., U.K.)

가

10 kN (load cell)
(deflection speed) 5 mm

가

X-Y

(load-deflection)

(ultimate load),
(ultimate stiffness)

(ultimate stress),

Student t- test

p<0.05

1.

(WI: width index)

1,2, 3,4

5
1
7.2 , 2 8.6 , 3 8.8 , 4 8.5
1 가 1

(p<0.05)

(Table 1).

2

Table 1. Union time and width index.

	Group I	Group II	Group III	Group IV
Union time (week)	7.19 ± 0.63	8.60 ± 0.54	8.83 ± 0.75	8.44 ± 0.96
Width index	145.14 ± 16.16	115.66 ± 17.38	114.46 ± 14.17	121.00 ± 15.72

Group I: Fed on safflower seed powder(30%) and normal diet(70%)

Group II: Fed on matairesinol(5%) and normal diet(95%)

Group III: Fed on normal diet(100%) and intravenous injection of matairesinol

Group IV(%) : Fed on normal diet(100%)

Width index(%): width of new bone formation at the center of bone defect divided by width of the contralateral femur

3

30%

70%

50%

5

100%

6

9

(Fig.1).

14

(WI)

1

145% 가

(Fig. 2)

2

115%,

3

114%,

4

121%

1

(p<0.05)

2,3,4

가

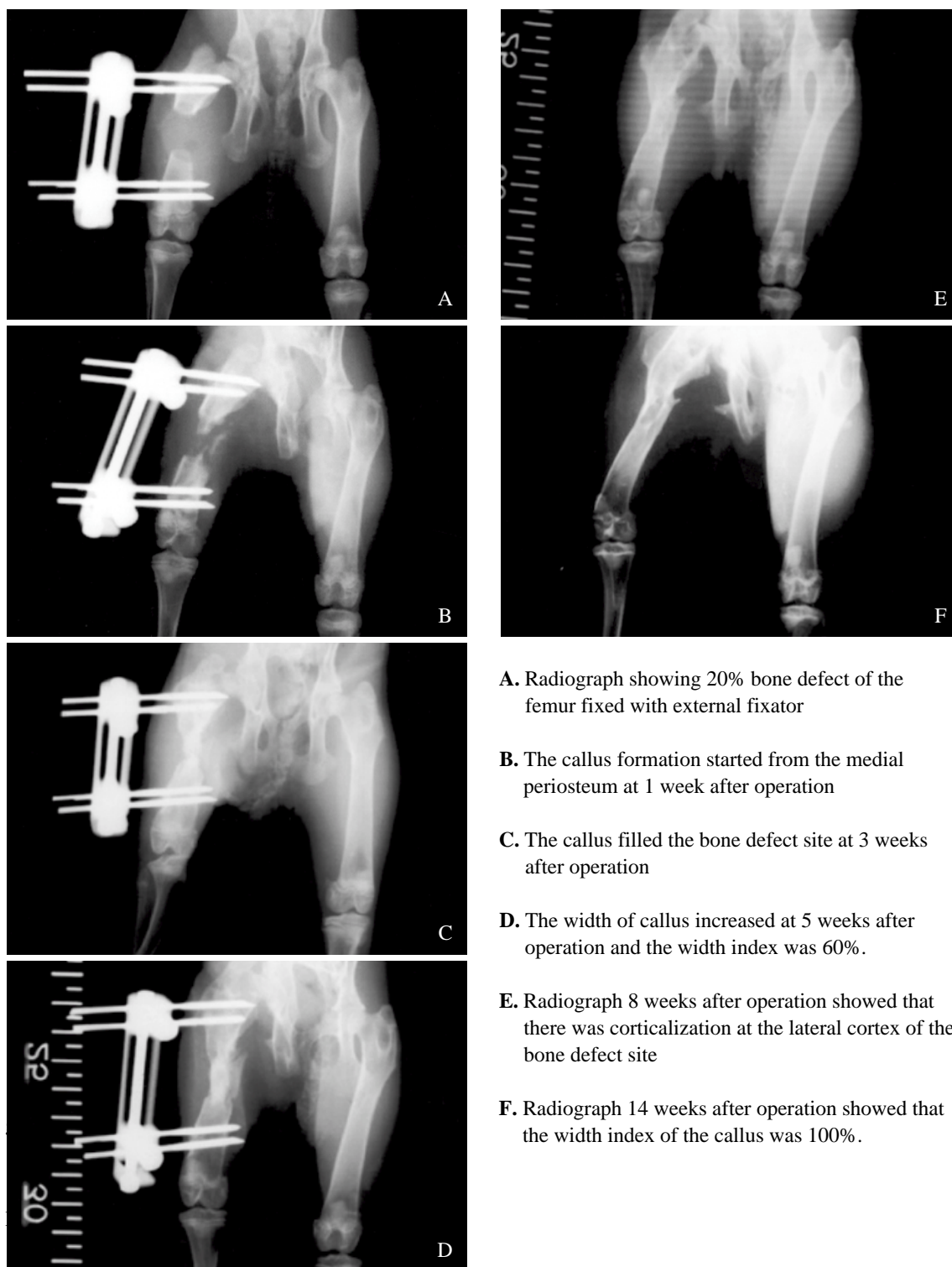
Fig 1. Group IV fed on normal diet(100%)

Table 2. Bone mineral density and bone strength in group I and group IV

	Group I (n = 10)	Nonop	Group IV (n = 10)	Nonop	<i>P</i> valueI
BMD (g/mm ²)	310.45 ± 49.58	492.01 ± 45.48	291.16 ± 55.79	480.47 ± 58.42	0.03 0.39
Failure load (N)	380.04 ± 83.27	346.25 ± 33.61	358.13 ± 76.80	339.23 ± 41.22	0.23 0.71
Stress (M Pa)	4.43 ± 1.19	8.79 ± 1.48	4.00 ± 0.77	8.51 ± 1.20	0.10 0.23
Stiffness (N/mm)	415.33 ± 137.18	480.81 ± 63.85	358.75 ± 107.32	433.04 ± 81.31	0.005 0.05

BMD, bone mineral density; Nonop, contralateral nonoperated side.

P values between group I and group IV were obtained using Student t-test.

Draper⁴⁾

1 4 가 (Table 2).

6,7)

10%

(high

(phytoestrogens) 가 1,4,12)

density lipoprotein cholesterol)

8)

가

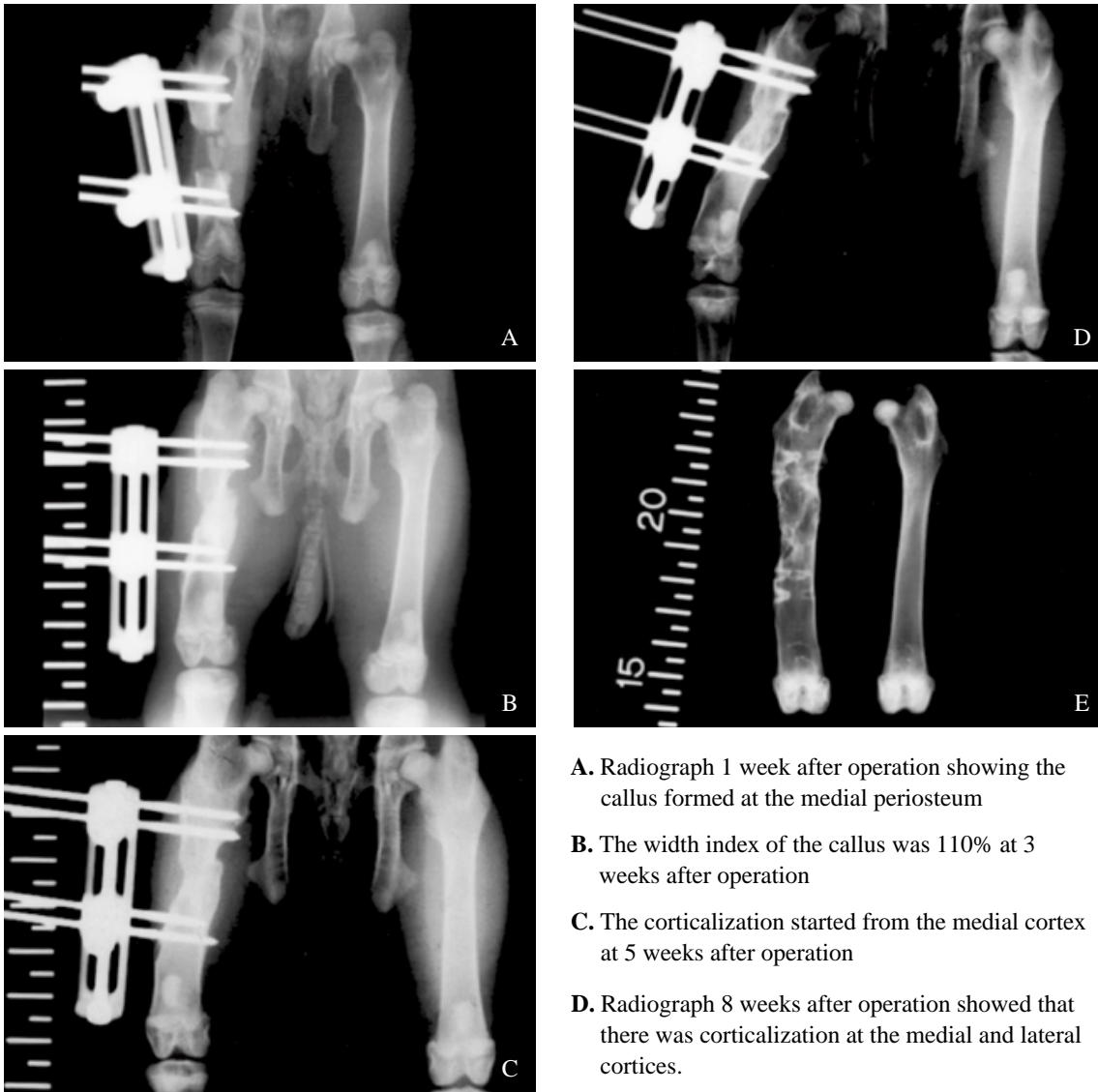
87%

55%

17%

8)

Fig 2. Group I fed on safflower seed powder(30%) and normal diet(70%)



- A. Radiograph 1 week after operation showing the callus formed at the medial periosteum
- B. The width index of the callus was 110% at 3 weeks after operation
- C. The corticalization started from the medial cortex at 5 weeks after operation
- D. Radiograph 8 weeks after operation showed that there was corticalization at the medial and lateral cortices.
- E. Radiograph 14 weeks after operation showing that the width index of the callus was 145%.

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REFERENCES

- | | |
|---|--|
| 가 | 1) Anderson JB and Gamer SC: The effects of phytoestrogens on bone. <i>Nutr Res</i> , 17: 1617-1632. 1997 |
| 가 | 2) Bae S.J., Shim, S.M., Park, Y.J., Lee, J.Y., Chang E.J., and Choi, S.W. Cytotoxicity of phenolic compounds isolated from seeds of safflower (<i>Carthamus tinctorius</i> L.) on cancer cell lines. <i>Food Sci. Biotechnol.</i> , 11, 140-146(2002) |
| 가 | 3) Cho SH, Choi SW, Choi YS, Lee WJ: Effects of defatted safflower and perilla seed powders on lipid metabolism in ovariectomized female rats fed high cholesterol diets. <i>J Kor Soc Food Sci Nutr</i> , 30, 112-118 (2001) |

- 4) **Draper CR, Edel MJ, Dick IM, Randall AG, Martin GB, Prince RL:** Physoestrogen reduce bone loss and bone resorption in oophorectomized rats. *J Nutr*, 127(9), 1795-1799, 1997.
- 5) **Kang GW, Chang EJ, Choi SW:** Antioxidative activity of phenolic compounds in roasted safflower (*Carthamus tinctorius* L.) seeds. *J Food Sci Nutr*, 4, 221-225 (1999)
- 6) **Kim JH, Jeon SM, Park YA, Choi MS, Moon KD:** Effects of Safflower seed(*Carthamus tinctorius* L.) powder on lipid metabolism in high fat and high cholesterol-fed rats *J Kor Soc Food Sci Nutr*, 28(3), 625-631, 1999
- 7) **Kim JH, Jeon SM, An MY et al.:** Effect of diet of Korean Safflower(*Carthamus tinctorius* L.) seed powder on bone tissue in rats during the recovery of rib fracture. *J Kor Soc Food Sci Nutr*, 27(4), 698-704, 1998.
- 8) **Kim HJ, Bae YC, Choi SW et al.:** Bone-sparing effect of safflower seeds in ovariectomized rats. *Calcified Tissue International*, (2002) in press.
- 9) **Lee, J.Y., Chang, E.J., Kim, H.J., Park, J.H. and Choi, S. W.** Antioxidative flavonoids from leaves of *Carthamus tinctorius*. *Arch. Pharm. Res.*, (2002) accepted
- 10) **Ra DK, Song HR., Kim JS et al.:** Effects of Safflower seed on new bone formation. *J Vet Clin Med*, 19(1), 505-509, 2002
- 11) **Song HR, Puri A, Kim JS et al.:** Spontaneous bone regeneration in surgically induced bone defects in young rabbits. *J of Korean Orthop Assoc*, 36:309-315, 2001
- 12) **Zhang HL, Nagatsu A, Watanabe T, Sakakibara J, Okuyama H:** Antioxidative compounds isolated from Safflower(*Carthamus tinctorius* L.) oil cake. *Chem Pharm Bull*, 45(12) 1910-1914, 1997

Abstract

The Effect of Safflower Seed or Matairesinol on Spontaneous Bone Formation in Surgically Induced Bone Defect in Young Rabbit

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Purpose: To investigate the effect of defatted safflower seed or matairesinol on spontaneous bone formation in surgically induced bone defects in young rabbits

Materials and Methods: Bone defects(20% of original femoral length) were created at the midshaft of the femur in 52 young rabbits and stabilized with external fixation. The periosteum was preserved. Fifty-two rabbits were divided into four groups as follows; the group I fed on safflower seed powders(30%) and normal diet(70%), the group II on matairesinol (5%) and normal diet(95%), the group III on normal diet(100%) with intravenous injection of matairesinol, the group IV on normal diet(100%). Radiographs were taken weekly to evaluate the bone regeneration and union time. Biomechanical testing on the new bone formation area was performed to measure bending stiffness. The area of new bone formation was scanned by quantitative computed tomography to measure bone mineral density(BMD).

Result: The mean union time(weeks) was 7.2 in the group I, 8.6 in the group II, 8.8 in the group III, and 8.5 in the group IV and was significantly different between the group I and the other groups($p<0.05$). The BMD and bone strength of the callus were compared between the group I and the group IV. The mean BMD was 310.45 ± 49.58 g/mm² in the group I and 291.16 ± 55.79 g/mm² in the group and there was significant difference($p<0.05$). The mean bending stiffness was 415.33 ± 137.18 N/mm in the group I and 358.75 ± 107.32 N/mm in the group IV and there was significant difference($p<0.05$).

Conclusion: The diet with safflower seed powder was effective for decreasing union time and increasing bone strength of the callus formed at the bone defect whereas the diet or injection with matairesinol was not effective. More experimental studies are necessary to prove the effect of matairesinol on the callus.

Key Words: Bone defect, Safflower seed powder, Matairesinol, Callus