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= Abstract =

## Spontaneous Correction of Angular Deformity after Femoral Shaft Fracture in Children

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Remodeling of long bones in children after posttraumatic deformity was accomplished by two distinctive mechanisms that axially oriented compression forces will slow physeal growth and similarly oriented tensile forces tend to enhance physeal growth, which occur at the fracture site and physis.

We reviewed 17 childrens with unilateral fractures of femoral shaft who had an angular deformity after union of 10° to 23°. At an average follow up of 52 months (36 to 85), we had measured remodeling of the proximal physis, the distal physis and the femoral shaft.

Two fracture patient 's torsional angle differences greater than 10°, and 15 fracture patient 's torsional angles smaller than 10° were selected and measured by C-T scans.

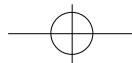
The average correction rate was 84.9% of the initial deformity and was no relation between the remodeling rate and degree of malunion. The correction of angulation, only 25% had occurred at the fracture site and 75% at physis.

Under the 10 years old, malunion as much as 23° in any plane will remodel enough to give normal alignment of the joints surfaces.

**Key Words :** Children, Femur shaft fracture, Torsional angle, C-T scan, Remodeling,

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가 가 , 가 , 10 (10 ~ 23 )  
28 , 17 C-T .  
가 10 ° 15 18  
(Table 1), Wallace and Hoffman,<sup>24)</sup>  
Orr<sup>16)</sup> (Fig 1).  
Brouwer<sup>6)</sup> 가 18 52 ,  
Blount<sup>5)</sup> Vontobel<sup>23)</sup> 가  
 , Davids<sup>12)</sup> C-T

Table 1. Anteversion(A-V) angle

A-V angle(°)		No of Cases
+ 10	+ 7	3
+ 6	+ 2	5
+ 2	- 2	5
- 2	- 6	2
- 6	- 10	0
Total		15

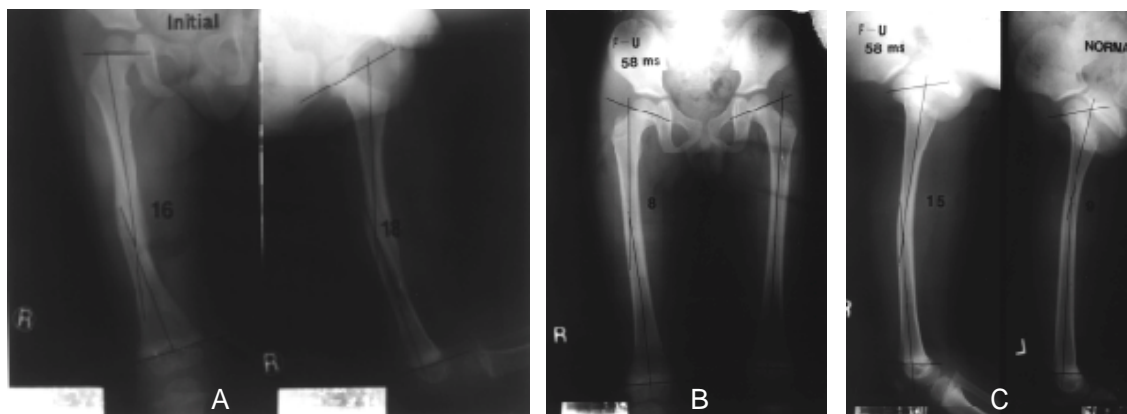


Fig 1-A. An anteroposterior and lateral radiography of the fractured femur of a 6-year-old child shows a 16° varus and 18° anterior tilt at union.

B,C. Follow up radiography at 58 months after fracture shows a residual fracture site angles of 8° (A-P) and 15° (lateral). The interphyseal angles were 3° (A-P) and 6° (lateral).

Total correction rate (Angle of initial fracture site - Interphyseal angle) were implying 13° (A-P) and 12° (lateral).

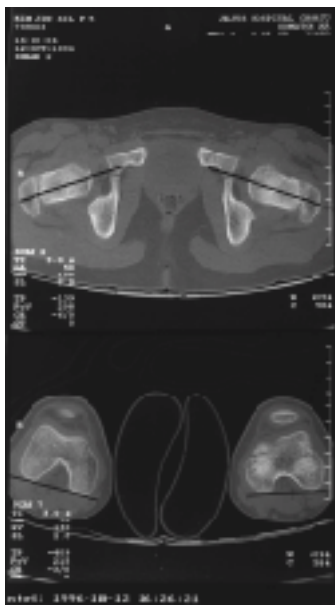


Fig 2. Torsional C-T scan of the 5-year-old child, 25 months after injury.

Superimposition of 3 images for each side, reveals 20° antetorsion on the uninjured site(Lt), and 26° anteversion on the fractured side(Rt). The difference of anteversion angle is 6°.

15, 8, 7, 3-5, 5, 6-10, 10, 가 10, 가 3, 가 2, 13, 4, 2, 10°-17°, 13.6°, 11°, 23°, 13.5°, 52 (36-85), 87%, 84%, 85% (Table 2).

Table 2. Correction rate of angulation deformity

	Initial angulation	Correction rate(%)
Varus/Valgus	10 - 17° (Avr '13.6°)	87
Ant 'Post '	11 - 23° (Avr '13.5°)	84
Total(Average)		85%

Table 3. Rate of correction by initial angulation

Initial angulation	Correction rate(%)
10° - 12°	84.2
13° - 15°	84.8
16° - 18°	84.9
19° - 21°	85.2
22° - 25°	87
Average	85%

(P<0.05)

Table 4. Rate of correction by follow-up

Follow up(month)	Correction rate(%)
36 - 45	82
46 - 55	83.3
56 - 65	84.8
66 - 75	86.5
76 - 85	90
Average	85%

(Fig 2).

52 C-T  
가 10°

one sampled t-

test

5 mm

C-T

6.2 (3-10°),  
8, 7, (anteversion angle)

가 가

,

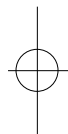




Table 5. Rate of correction at sites

(Table 4).

Site	Correction rate(%)
Fx site	25
Proximal physis	36
Distal physis	39
Total	100%

(P&lt;0.05).

5)

25%,

75%가

,

36%,

39%가

(Table 5).

1)

10 ° 14 °

84.7%,

가

15 ° 19 °

84.9%, 20 ° 24 °

87%

가

(P&lt;0.05, Table 3).

Hueter<sup>10)</sup> and Volkmann<sup>22)</sup>

2)

, Wolff

25)

가

가

,

,

가 가

(P&gt;0.05), ,

84.7%,

85.1%

24),

4,19)

가

가

3)

18

13

Neer Cadman<sup>15)</sup>

20 °

13.8 ° ,

3

12.3 °

2

, Irani

17.5 ° .

84%,

13)

30 °

15 °

88%,

85%

. Malkawi<sup>14)</sup>

87%

20 ° .

30 °

가

, Blount<sup>5)</sup>

(P&gt;0.05).

4)

84.9%

36-45

Wallace Hoffman<sup>24)</sup>

82%, 46-55

83.3%, 56-65

84.8%, 66-75

86.5%, 76-85

90%

85%

,

74%



648 • / 11 3

가 26%가

, 75%가 , 25%가

, 84%

10 °

6,9,20,21),

가

Davids<sup>12)</sup> C-T

10 °

10 °

, (non-physiologic)

, 6-50% 10 °

20 ° 25 °

17 2 (12%) 10 °

가

1989 8 1993 5

36

10 ° 23 °

가 10 ° 15 , 18

1. 85% , 75%,

25%

2.

(P&lt;0.05).

3. 10 10 ° 23 °

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