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= Abstract =

Ankle Fracture with Syndesmosis Separation - Radiographic Landmark and Results of Trans-Syndesmotic Screw Fixation -

**Chong Kwan Kim, M.D., Byung Woo Ahn, M.D., Sang Guk Lee, M.D.
Young Hwan Kim, M.D., Chae Ik Chung, M.D., Sik Hwang, M.D.**

*Department of Orthopaedic Surgery, Masan Samsung Hospital,
Sungkyunkwan University, College of Medicine*

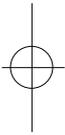
In the treatment of ankle fracture, anatomical reduction and restoration of ankle mortise is very important. But trans-syndesmotic screw fixation for syndesmosis separation is dependent on the condition in operation field. The purpose of this study is to analyse the radiographic and clinical results, to evaluate the need for trans-syndesmotic screw fixation, and to know the effectiveness of radiographic landmarks for diagnosis of the syndesmosis separation, retrospectively. The patients were divided into two groups. The Group (25 cases) were treated with trans-syndesmotic screw and group (42 cases) were treated without trans-syndesmotic screw fixation.

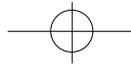
The clinical results were excellent in 13, good 9 in group and excellent in 19, good in 17 in group. The radiographic results were excellent in 16, good in 8 in group and excellent

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Tel : 82-551-290-6032
Fax : 82-551-295-6195
E-mail : msshos1 @ unitel.co.kr





in 23, good 14 in group . In the radiographic findings, the false negative result of tibiofibular overlap was 15.6 % (M: 20.8 %, F: 10.4 %), tibiofibular clear space was 16.8 % (M: 21.6 %, F: 11.9%) and ratio of tibiofibular overlap to fibular width was 14.2 % (M: 14.9 %, F: 13.6 %). There was no significant statistical difference in the ratio of tibiofibular overlap to fibular width between male and female.

We consider that the ratio of tibiofibular overlap to tibiofibular width are more reliable diagnostic criteria for syndesmosis separation than the tibiofibular overlap and tibiofibular clear space. Trans-syndesmotom screw fixation is not always required to maintain the integrity of the tibiofibular syndesmosis if the diastasis was satisfactorily reduced with rigid fixation.

Key Words : Ankle fracture, Syndesmosis separation, Radiographic landmark, Syndesmosis fixation.

(tibial

plafond) 1 cm

(Fig 1-A,B).

, 1) - (tibiofibular overlap 10 mm
), 2) - ° (tibiofibular clear space 5 mm
), 3) -
 (tibiofibular overlap to fibular width ratio 24%), 가
 (false negativity)

1.

67 47 가 20
 16 78 35.4

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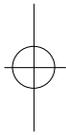
1 가가 67

25 1 , 42
 2 . Danis-

Weber²¹⁾ Lauge-Hansen¹⁵⁾
 (Table 2).

Table 1. Cause of injury

Cause of injury	No(%)
Traffic accident	35(52)
Slip down	17(25)
Fall down	6(8.9)
Sports injury	4(5.9)
others	5(7.4)
Total	67



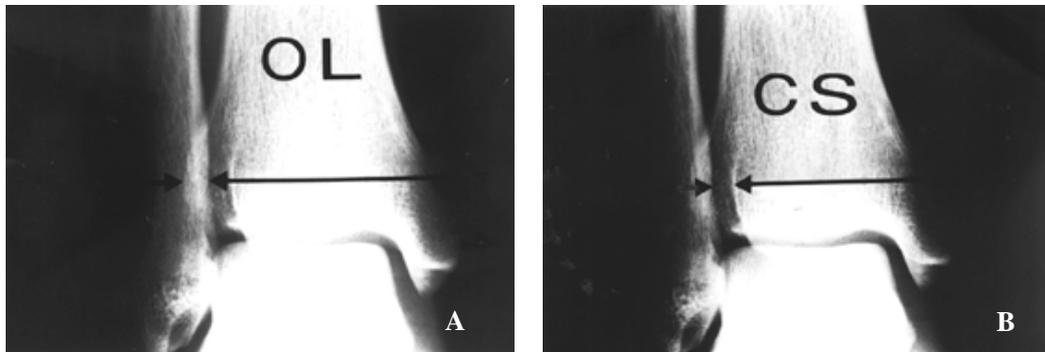
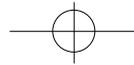


Fig 1. Measurements made on the anterior-posterior radiograph of the ankle
A : tibiofibular overlap B : tibiofibular clear space

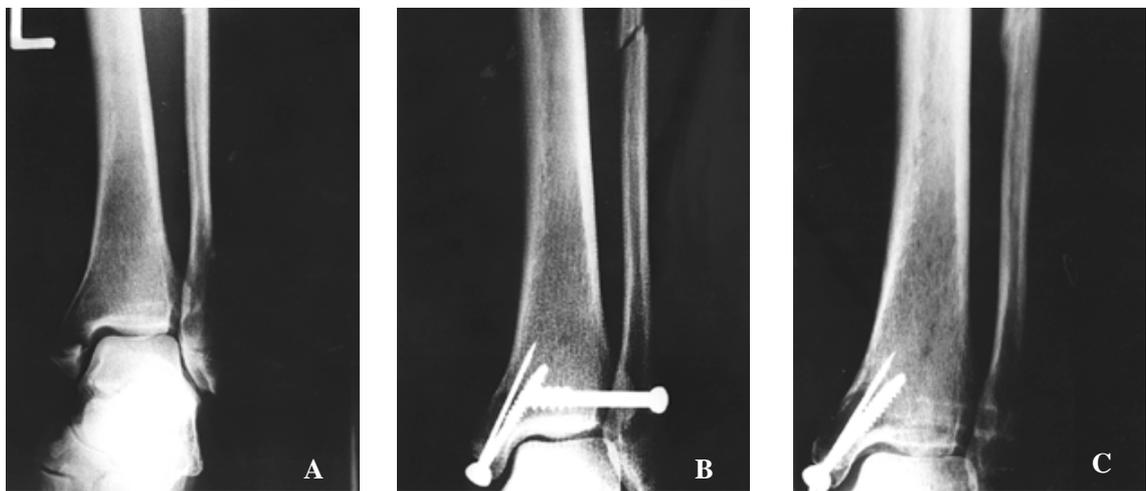


Fig 2. A Pronation-External rotation injury by traffic accident
B Internal fixation of the medial malleolus and maintenance of the reduction of the distal tibiofibular joint with a syndesmotomic screw.
C There was no recurrence of diastasis at follow-up radiograph.

Table 2. Comparison of classification between Danis-Weber method and Lauge-Hansen method(modified by Pankovich)

Danis-Weber	No	Lauge-Hansen	No
Type BS(+) [§]	27	SE [*]	18
		PA [†]	5
		PE [‡]	1
		unclassified	3
Type C	40	SE	11
		PA	5
		PE	20
		unclassified	4
Total	67		

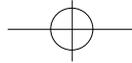
* SE : supination-external rotation

† PA : pronation-abduction

‡PE : pronation-external rotation

§S(+), syndesmosis separation





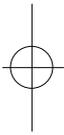
가 10 8 , 20 cm 30
 17 가 30 16 , 40 12 (Fig. 2).
 , 50 14 .
 5.
 2. 2
 가35 가 17 , 4 6
 6 4 , 가5 (Table 1). 8 12
 3. 9
 Danis-Webe²¹⁾
 Type B 가 , Type BS(+) 가 27
 , Type C 가 40 . Pankovich¹⁸⁾
 Lauge-Hansen¹⁵⁾ -
 29 , - 21 , - 10
 , 가 7 Meyer¹⁷⁾ Phillips¹⁹⁾
 (Table 2). (Table 3). 25
 22
 4. 24
 42
 36 , 37
 Cotton ¹¹⁾ 25 (Table 4).
 3 1) 5.8 mm,
 2 15.6%, 2) 5.7 mm,

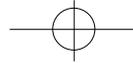
Table 3. Criteria used in assessment of the result(Meyer, 1980).

Result	Clinical	Radiological
Excellent	No pain with full ROM	Normal X-Ray
good	Pain after strenuous activity	Calcification of interosseous or deltoid ligament
Fair	Pain with normal activity	Malunion or Nonunion
Poor	Over 30% loss of motion Constant pain	Joint narrowing or marginal osteophytes

Table 4. Clinical & Radiologic results according to syndesmosis fixation

	Syndesmotic screw fixation group		Non Syndesmotic screw fixation group	
	Clinical	Radiological	Clinical	Radiological
Excellent	13	16	19	23
Good	9	8	17	14
Fair	2	1	5	4
Poor	1	0	1	1





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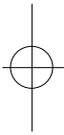
16.8%, 3) 17.7%, 14.2%, Type C
 . 1) 가
 6.7 mm, 20.8%, 2) 6.2 mm, Danis-Weber
 21.6%, 3) 17.5%, Pankovich¹⁸⁾
 14.9% . 1) 4.5 mm, Lauge-Hansen ,
 10.4%, 2) 5.1 mm, 가 7
 11.9% 3) 18.0%,
 13.6% . Bonnin⁴⁾
 1) (P<0.05), 2), 3) ,
 가 (P>0.05). , 1), 2)
 (P<0.05), 3) 가 ,
 (P>0.05)(Table 5). , mortise view, stress view ,
 가 . Petrone
 19) 가 5 mm
 가 . Husfeldt¹³⁾ 가
 5.5 mm 가 , Harper
 Keller¹²⁾ 12
 Lauge-Hansen¹⁵⁾ Danis- 5.7 mm
 . Danis-
 Weber²¹⁾ AO Ostrum¹⁷⁾
 Weber 가 24%
 가 17)
 , Type B 1) 100

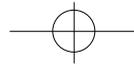
Table 5. Radiographic measurement result in males and females.

Diagnosis criteria	Average			FN † (%)		
	Male	Female	Mean	Male	Female	Mean
TF* overlap less than 10 mm	6.7	4.5	5.8	20.8	10.4	15.6
TF clear space greater than 5 mm	6.2	5.1	5.7	21.6	11.9	16.8
TF overlap : fibular width ratio less than 24%	17.5	18.0	17.7	14.9	13.6	14.2

* TF, tibiofibula

† FN, false negativity





1) - 10 mm
 87 % , 2) - 5 mm 3 15mm
 7 % , 3)
 24 %
 2 % ,
 가 . Close⁸⁾
 . 1), 2), 3) 가 , 가
 ,
 1), 2)
 , Cotton 11)
 가 가 5-9,13-15)
 1) 가 (P<0.05),
 가
 2), 3) (P>0.05)(Table 5).
 24 % 1) 6 10 가
 ,
 가
 1 1
 가
 Alldredge²⁾
 Boden³⁾

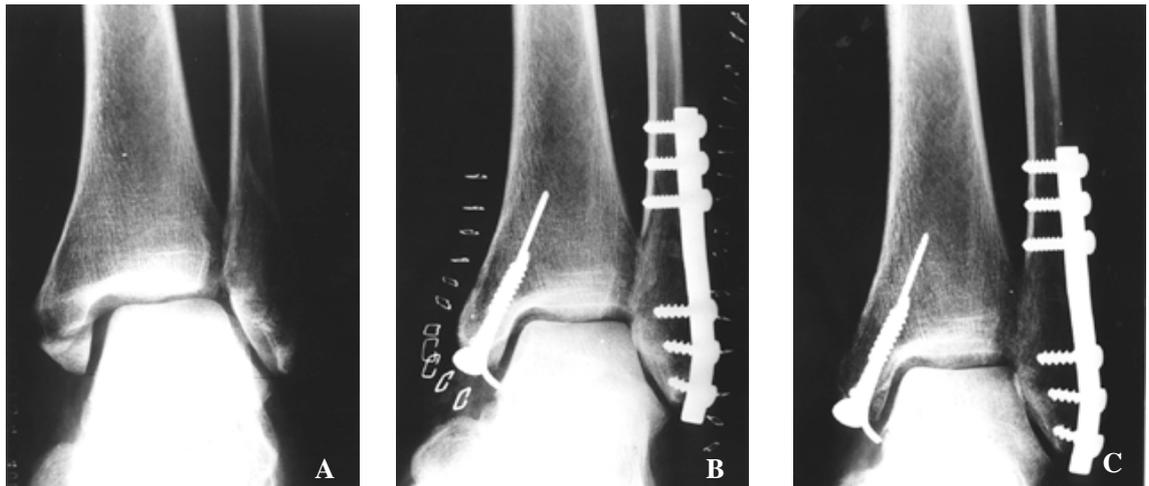
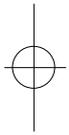
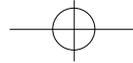


Fig 3. A Supination-External rotation injury by slip down.
 B Syndesmosis screw fixation was not required to maintain the integrity of the syndesmosis.
 C There was no recurrence of diastasis at follow up radiograph.





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(25)

(42

)

- 24 %

가

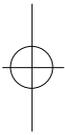
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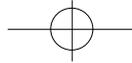
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REFERENCE

- 1) , , , , , , , : , 33 : 1263-1266, 1998.
- 2) **Allredge RH** : Diastasis of the distal tibiofibular joint and associated lesion, *JAMA*, 115 : 2168, 1940.
- 3) **Boden SD, Labropoulos PA, McCowin P, Lestini WF and Hurwitz SR** : Mechanical considerations for the syndesmotic screw. A cadaver study. *J Bone Joint Surg*, 71-A: 1548-1555, 1989.
- 4) **Bonnin JG** : *Injuries the Ankle*. 2nd ed. london, William Heinemann Medical books Ltd ; 307-314, 1950.
- 5) **Brodie, IAOD and Denham RA** : The treatment of unstable ankle fractures. *J Bone Joint Surg*, 56-B : 256-262, 1974.
- 6) **Burwell, HN and Charnley AD** : The treatment of displaced fractures at the ankle by rigid internal fixation and early joint movement. *J Bone Joint Surg*, 47-B : 634-660, 1965.
- 7) **Childress, HM** : Vertical tranarticular pin fixation for unstable ankle fractures. *J Bone Joint Surg*, 47-A : 1323-1331, 1965.
- 8) **Close JR** : Some applicaitons of the functional anatomy of the ankle joint. *J Bone Joint Surg*, 38-A: 761-781, 1956.
- 9) **Colton, CL** : Fracture-diastasis of the inferior tibiofibular joint. *J Bone Joint Surg*, 50-B : 830-835, 1968.
- 10) **Colton CL** : The treatment of Dupytren 's fracture-dislocation of the ankle. *J Bone Joint Surg*, 53-B : 63-71, 1971.
- 11) **Cotton CJ** : Fracture and Joint-dislocation. Philadelphia, W.B.sander, 1910(cited from Annunziato Amendola. Controversies in diagnosis and management of syndesmosis injuries of the ankle. *Foot and Ankle*, 13:44-50, 1992)
- 12) **Harper MC and Keller TS** : A radiographic evaluation of the tibiofibular syndesmosis. *Foot and Ankle*, 10: 156-160, 1989.
- 13) **Husfeldt E** : Significance of roentgenography of ankle joint in oblique projection of malleolar fracture. *Hospitalstid*, 80: 788-797, 1937.
- 14) **Kistensen TB** : Fractures of the ankle. Follow-up studies. *Arch Surgery*, 73 : 112-119, 1956.
- 15) **Lauge-Hansen N** : Fractures of the ankle. . Combined experimental-surgical and experimental-roentgenologic investigation. *Arch Surg*, 60: 957-967, 1950.
- 16) **Meyer TL Jr and Kumler KW** : A.S.I.F. technique and ankle fractures. *Clin Orthop*, 150:211, 1980.
- 17) **Ostrum RF, Meo PD and Subramanian R** : A critical analysis of the anterior-posterior radiographic anatomy of the ankle syndesmsis. *Foot and Ankle*, 16: 128-131, 1995.
- 18) **Pankovich AM** : Fractures of the fibula at the distal tibiofibular syndesmosis. *Clin Orthop*, 143 : 138-147, 1979.
- 19) **Pettrone FA, Gail M, Pu D, Fitzpatrick T and von Harpe LB** : Quantitative criteria for prediction of the results after displaced fracture of the ankle. *J*





Bone Joint Surg, 65-A: 66-77, 1983.

20) **Phillips WA, Schwartz HS and Keller CS, et al. :**

A prospective, randomized study of the management of severe ankle fracture. *J Bone Joint Surg*, 67A: 67-78, 1985.

21) **Weber BG :** Die verletzungen des oberen sprunggelenkes, Aktuelle probleme in der Chirurgie. 2nd ed, verlag, *Hans Huber*. 152-176, 1972.

