

RESEARCH ARTICLE**ANTHROPOMETRIC MEASUREMENTS TO ASCERTAIN TIBIO-FIBULAR DIASTASIS IN ANKLE INJURIES****¹Raza SMG, ¹Raza HKT and ^{1*}Upadhyay Sachin**

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June, 2015**Key words:**Anthropometric study, ankle
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articulation**ABSTRACT**

Management of Diastasis of inferior tibio-fibular articulation is one of the most important issues in ankle injuries. Recognition, and measurement of the quantum of displacement, is paramount for proper decision making. Anthropometric study in normal individuals is therefore of great importance. Antero-posterior neutral and 15° internal rotation radiographs of both ankles of twenty volunteers who had given informed consent were obtained. The width of ankle at Tibial plafond, maximum width of the ankle, the tibiofibular overlap and tibiofibular clear space were measured. Minimum width of ankle at tibial plafond was AP view – 53mm & in 15° internal rotation views – 57mm, while maximum was 72mm & 74mm respectively. The maximum width of the ankle measured was AP view – 74mm & 15° internal rotation – 74mm, while minimum is AP view - 63.95mm & 15° internal rotation view 68.8mm. The maximum Tibiofibular overlap measured was in AP view – 23mm & 15° internal rotation view – 7mm, while minimum measured was in AP view – 6mm & 15° internal rotation view – 1mm. The maximum clear space measured was in AP view – 6mm & 15° internal rotation view – 8mm, while minimum measured was in AP view – 6mm & 15° internal rotation view – 3mm. There was no statically significant difference between measurements on both sides ($p > 0.05$). We conclude that identical radiographs of both ankles in (AP) neutral & 15° internal rotation view should be obtained to assess quantum of diastasis on injured side.

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INTRODUCTION

Management of Diastasis of inferior tibio fibular articulation is one of the most important issues in ankle injuries. Robert Close, 1956 gave a good description of the basic stability of the syndesmosis. Pethrone et al, 1983 were the first to describe the tibio fibular clear space and tibio fibular overlap. Phillips et al, 1985, have further refined the definition of the tibio fibular clear space as well as the tibio fibular overlap. Recognition and pre operative measurement of quantum of displacement, as well as per operative assessment are paramount for proper decision making. The current study was carried out on neutral antero posterior and mortises view radiographs of both ankles of normal volunteers to ascertain these parameters in an Indian population. To the best of our knowledge such anthropometric study to Ascertain Tibio-Fibular Diastasis in Ankle Injuries has not been reported until now in Indian Population.

METHOD AND MATERIAL

The present research study was carried out on 20 normal volunteers after obtaining permission of the institution ethics committee as well as consent of all volunteers. Antero posterior views in neutral and 15 degree internal rotation (mortise view)

of both ankles were obtained for all 20 volunteers making a total of 80 radiographs. A standardized procedure of taking radiographs at similar distance of ankle from the x-ray done as well as use of a specially designed goniometer for accurate measurement of internal rotation was used in all volunteers. (fig. 1A & 1B)



Figure 1 a Showing the Technique used to standardize the ankle Radiographs for Neutral AP Views (Arrow showing the Jig used to standardized the rotation)

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Figure 1b Showing ankle in 15 degree of internal Rotation View by using the Jig. The Goniometer fixed on the Jig aids in setting the angle.

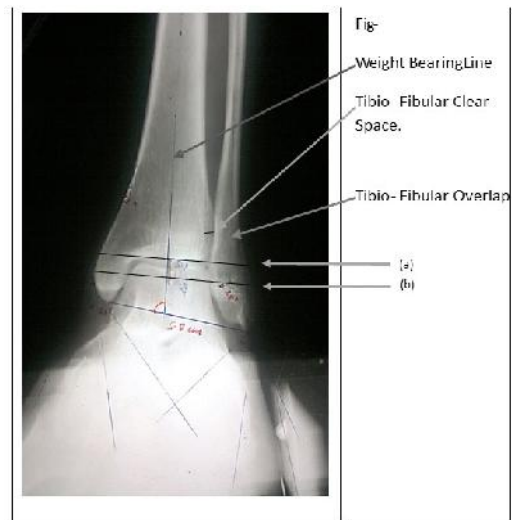


Figure 2 Showing: A: Tibiofibular clear space; B: Tibiofibular overlap; C: Width of the ankle at tibial plafond: line (a); D: Maximum width of ankle: line (b)

The following measurements were taken in all radiographs (Figure 2)

1. Tibio fibular overlap (maximum amount of overlap of the distal fibula and the anterior tibial tubercle.)(Phillips et al (1985) in neutral antero posterior and 15⁰ internal rotation radiographs.
2. Tibio fibular clear space (distance between the medial border of the fibula and the lateral border of the posterior tibia, measured 1cm above the distal tibial articular surface.) in neutral antero posterior and 15⁰ internal rotation radiographs.
3. Width of ankle at tibial plafond (measured at the level of tibial plafond on the ankle radiograph): This was taken as a horizontal line at the level of tibial plafond from medial surface of medial malleolus to lateral surface of lateral malleolus.
4. Maximum width of ankle (measured at any level where the width is maximum in ankle radiographs): This was the maximum distance between medial surface of medial malleolus and lateral surface of lateral malleolus.

RESULT

In current research the maximum **Tibio-fibular overlap** measured in Anteroposterior (AP) radiograph was 23mm and in 15 degree of internal rotation (IR) was 7mm. Minimum overlap measured in AP was 6mm and in IR was 1mm. The average in AP view was 11.2± 4.4(CI 95%: 12.65-9.80) and in IR was 4.2±1.7 mm (CI 95%: 4.83-3.72) (Table 1).

The maximum **Tibio-Fibular Clear Space** in AP view was 6mm and in IR was 8 mm while the minimum clear space in AP and IR view was 6mm and 3 mm respectively. The mean in AP and in IR was found to be 2.4±1.3 (CI 95%: 2.86-1.99) and 4.5±1.2 (CI 95%: 4.96-4.19) respectively (Table 2)

Table No. 1

TIBIO-FIBULAR OVERLAP(mm)	Right		Left		COMBINED	
	AP (Neutral)	IR(15 degree of internal rotation)	AP (Neutral)	IR(15 degree of internal rotation)	AP (Neutral)	IR(15 degree of internal rotation)
Minimum	6.0	1.0	6.0	1.0	6	1
Maximum	15.0	7.0	23.0	7.0	23	7
Mean	10.35	4.25	12.10	4.30	11.2	4.2
Mode	6	4	14	4	14	4
Median	11.00	4.00	12.00	4.00	11	4
SD	3.98	1.86	4.82	1.66	4.4	1.7

Table No. 2

CLEAR SPACE(mm)	Right		Left		COMBINED	
	AP (Neutral)	IR(15 degree of internal rotation)	AP (Neutral)	IR(15 degree of internal rotation)	AP (Neutral)	IR(15 degree of internal rotation)
Minimum	1.0	3.0	1.0	3.0	1	3
Maximum	6.0	8.0	6.0	8.0	6	8
Mean	2.45	4.45	2.40	4.70	2.4	4.5
Mode	1	4	2	5	1	5
Median	2.50	4.00	2.00	5.00	2	5
SD	1.43	1.19	1.35	1.26	1.3	1.2

The data are presented as means ±SD. All calculations and statistics were performed with Statistical package of social science (SPSS 20) software. A “p- value” of less than 0.05 (p<0.05) was regarded as significant.

The maximum **width of the ankle at tibial plafond** measured in AP 72mm and in IR was 74mm. Minimum width measured in AP was 53mm and in IR was 57mm. The average in AP was 61.8± 5.23mm (CI 95%: 60.15-63.50) and in IR is 66.6± 5.28mm (CI 95%: 68.32-64.93) (Table 3)

Table No. 3

Width of ankle at tibial Plafond(mm)	Right		Left		COMBINED	
	AP (Neutral)	IR(15 degree of internal rotation)	AP (Neutral)	IR(15 degree of internal rotation)	AP (Neutral)	IR(15 degree of internal rotation)
Minimum	53.0	57.0	53.0	57.0	53	57
Maximum	72.0	74.0	72.0	74.0	72	74
Mean	60.95	65.75	62.70	67.50	61.8	66.6
Mode	68	69	57	69	68	69
Median	60.00	66.50	63.50	69.00	61	68
SD	5.32	5.43	5.13	5.14	5.23	5.28

Table No. 4

1.Maximum Width of ankle(mm)	Right		Left		COMBINED	
	AP (Neutral)	IR(15 degree of internal rotation)	AP (Neutral)	IR(15 degree of internal rotation)	AP (Neutral)	IR(15 degree of internal rotation)
Minimum	55.0	59.0	55.0	59.0	55	59
Maximum	72.0	75.0	72.0	75.0	74	74
Mean	63.25	68.35	64.65	69.25	63.95	68.8
Mode	66	66	60	70	66	70
Median	63.00	70.00	66.00	70.00	63	70
SD	4.90	4.94	4.43	4.82	4.6	4.8

The maximum *width of the ankle* measured was, 74mm in AP and in IR is 74mm Minimum width measured was 55mm in AP and in IR was 59mm. The average found to be was, 63.95±4.6mm (CI 95%: 62.46-65.44) and 68.8mm±4.8 (CI 95%: 67.25-70.35) in AP and IR respectively.

DISCUSSION

The importance of Anthropometric considerations in ankle injuries is increasingly being reported by workers for proper management as well as to project outcomes. Along with the importance of the medial and lateral malleolus, the talar tilts/shifts and ligamentous injuries, instability of the inferior tibio fibular syndesmosis is an important consideration while managing ankle trauma. Robert Close, 1956 gave an excellent description of the factors responsible for stability of this articulation. However, it was Pethrone *et al*, 1983 who were the first to describe the tibio fibular clear space and the tibio fibular overlap. For assessment of the syndesmosis three categories (A, B, C) were established by them. Syndesmosis A, measured on the Anteroposterior radiograph was the width of the tibio fibular clear space. If this space was widened to five millimeters or more, the syndesmosis was assumed to be disrupted. Syndesmosis B, also measured on the Anteroposterior radiograph was the amount of overlap of the tibia and fibula. This was interpreted as showing disruption when the overlap was less than ten millimeters. Syndesmosis C, measured on the mortise radiographs was the amount of overlap of the tibia and fibula. This was interpreted as showing disruption when the overlap was one millimeter or less. If one or more of these measurements was abnormal, the syndesmosis was classified as disrupted. Post reduction measurements of syndesmosis A and syndesmosis B were more sensitive indications of persistence of disruption of the tibio fibular syndesmosis.

Phillips *et al*, 1985 further defined the tibio fibular clear space as the horizontal distance from the lateral border of the posterior tibial malleolus to the medial border of the fibula. It was measured on the antero posterior radiograph at the point where the posterior malleolus was widest.

The tibio fibular overlap was defined as the horizontal distance between overlap of the medial border of the fibula and the lateral border of the anterior tibial prominence at the level of the widest part of the posterior malleolus. Subsequent authors have used these criteria for the assessment of syndesmotoc diastasis.

In our study, in the Anteroposterior radiographs the tibio fibular overlap was found to be 11.2± 4.4(CI 95%: 12.65-9.80). Most of the workers have commented that tibio fibular overlap of less than 10.00mm denotes diastasis (p=.09; p >.05). We recommend that there may be normal variations of less degree of tibio fibular overlap, which, we feel, may be due to the Indian custom of sitting cross-legged. In all such situations radiograph of opposite ankle in similar position would be of value. Several workers including us have found variation of the two sides of only 1.00 to 2.00mm in vast majority of volunteers (p<0.05). In cases of doubt per-operative stress testing would be of value.

In the mortise view the tibio-fibular overlap in our series was found to be 4.2±1.7 mm (CI 95%: 4.83-3.72). This is similar to findings of Pethrone *et al*, 1983 .We also recommend that values below 1.00mm overlap should be classified as disruption of syndesmosis. The maximum normal range of clear space in our study was 6.00 mm in neutral AP view and 8.00mm in fifteen degree internal rotation view. Hence these may be taken as upper limits of normal rather than 5 mm as suggested by Pethrone. Recently Van der Bekerom, 2011 has stated that pre-operative radiograph assessments are of limited value in defining syndesmotoc instability in acute ankle fractures. Therefore comparison with radiograph of opposite side would give a better idea of instability.

In the present research we have also studied the width of the ankle at the level of the plafond as well as the maximum width in antero posterior and mortise views. On critical analysis it was found that disruption of the syndesmosis would cause these parameters to increase.

It is therefore recommended that comparison of these parameters on the radiographs of injured and uninjured joints

be done in all doubtful cases. However, these will have little value in bilateral ankle injuries.

CONCLUSION

A study of various parameters concerning the diastasis of interior tibio fibular syndesmosis was undertaken. We recommend that a tibio fibular overlap of less than 6.00 mm in antero posterior views and less than 1.00 mm in mortise views may be taken as abnormal. A tibio fibular clear space of more than 6.00 mm in antero posterior view and 8.00 mm in mortise view may be taken as abnormal.

Due to wide variations in parameters in the Indian population due to customs of sitting cross legged by some groups, it is recommended that radiographs of opposite uninjured ankle should be taken in all doubtful cases. A comparison of the width of the ankle on the injured and uninjured sides in radiographs taken in identical positions will also be of value for ascertaining disruption.

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