

# Volar Intercalated Segmental Instability In Scaphoid Non-Union With Lunotriquetral Coalition: A Case Report

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## Abstract

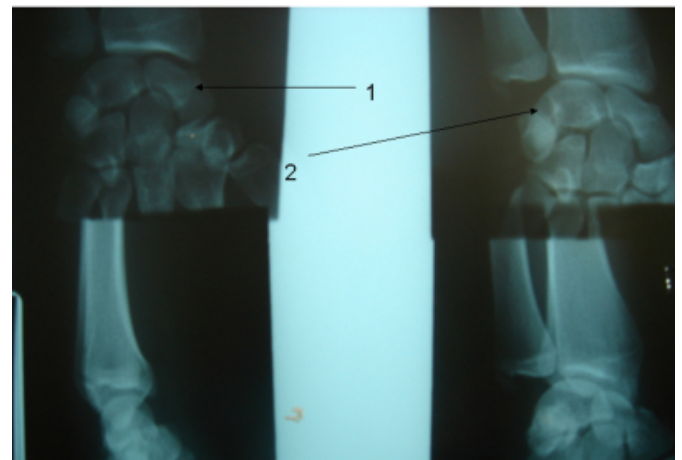
Scaphoid non-union is commonly encountered in clinical practice. Dorsal intercalated segmental instability is the most commonly seen carpal instability in scaphoid non-union. We present a case of ununited fracture scaphoid with lunotriquetral coalition which developed volar intercalated segmental instability due to altered biomechanics. Loss of radial support and increased mass on the ulnar aspect of the carpus resulted in the lunotriquetral mass going into abnormal flexion. We have attempted to explain the complex biomechanics leading to volar intercalated segmental instability in this case.

## INTRODUCTION

Scaphoid non-union is commonly encountered in clinical practice. Dorsal intercalated segmental instability (DISI) is the most commonly seen carpal instability in scaphoid non union [1]. Volar intercalated segmental instability (VISI) is very rarely seen in scaphoid non union. Lunotriquetral fusion is a rare abnormality in Caucasians with an incidence of 0.1 % [2]. Lunotriquetral coalition is most commonly seen in black Africans, incidence being 9% [2]. It is twice as common in women as compared to men [2]. Minaar classified lunotriquetral coalition into 4 types [3]. Type-I incomplete fusion, Type-II fusion with a notch of varying depth, Type-III complete fusion, Type-IV complete fusion associated with other carpal anomalies[3]. Complete lunotriquetral fusions are not known to cause symptoms [3]. They are most commonly identified accidentally [3]. We present a case of scaphoid non-union with lunotriquetral coalition which developed static VISI deformity due to alteration of the carpal biomechanics.

## Figure 1

Figure 1. X-Ray shows fracture scaphoid (1) and lunotriquetral coalition (2). Lateral radiograph does not show VISI deformity



## CASE REPORT

A 18 year old right handed Caucasian presented with a left fracture scaphoid sustained after punching an object. He incidentally also had same sided ulnar styloid process fracture and lunotriquetral fusion (Minaar type-3) (Fig 1). The scaphoid fracture was 1mm displaced and carpal instability was not noted on the radiograph (Fig 1). He was put on a scaphoid cast for a period of 6 weeks. He removed the cast against medical advice in 4weeks. A CT scan done at 8 weeks confirmed scaphoid non-union and lunotriquetral coalition. X-rays done also showed ununited scaphoid fracture with VISI deformity (Fig 2), scapholunate angle being 5 degrees. He was treated with open reduction and

internal fixation with iliac crest bone grafting of the scaphoid fracture and Accutrack screw.

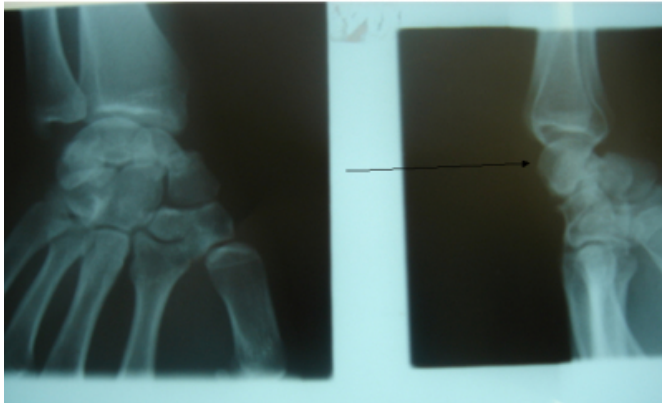
## **DISCUSSION**

Normal anatomic relationships and motion amongst the radius, scaphoid and lunate are essential for normal wrist function [4]. The proximal carpal row is an intercalated segment whose direction of motion depends on the posture and movement of distal carpal row and whose stability and range depend on its ligamentous integrity and articular surface anatomy [5]. Scaphoid is the coordinating linkage between the proximal and distal carpal row [6]. It is responsible for the synchronous movement of the carpus. Linscheid and associates noted two distinct patterns of intercalary collapse and named them dorsal intercalated segmental instability (DISI) and volar intercalated segmental instability (VISI) [7]. DISI is defined as abnormal extension of lunate relative to its proximal and distal links [8]. VISI is defined as abnormal flexion of lunate in the sagittal plane [8]. VISI and DISI are identified on the true lateral radiograph of the wrist using the scapholunate angle. This is obtained by drawing a line along the long finger metacarpal, the capitate, the lunate and the radius, this line is drawn through the centre of the head of the long finger metacarpal, centre of the head of the capitate, the mid-points of the convex proximal and concave distal joint surfaces of the lunate and through the mid-point of the distal articular surface of the radius and another line is drawn through the mid points of the proximal and distal poles of the scaphoid [7]. Normal scapholunate angle is 30-60 degrees in the lateral view [7]. DISI is present if scapholunate angle is greater than 60 degrees. VISI deformity is present if scapholunate angle is less than 30 degrees. In normal adult the lunate palmar flexes approximately 20 degrees in relation to radius during full radial deviation and dorsiflexes an average of 25 degrees in full ulnar deviation [7]. Scaphoid normally tends to flex under compressive load, and exerts a similar influence on lunate due to ligamentous attachments; triquetrum tends to extend with compressive loading & will tend to move the lunate into extension hence lunate is in a state of dynamic balance between two antagonists [9]. When the dynamic balance is interrupted, the lunate will tend to flex with loss of ulnar support from the triquetrum or extend if there is loss of radial stability. So a scaphoid non-union is expected to produce DISI. If scaphoid is divided into two or more fragments, the distal portion tends to follow the movement of the distal row while the proximal fragment follows that of the proximal row [8]. In scaphoid fractures because of the

loss of the radial stability DISI deformity is most commonly seen as the proximal part of scaphoid follows the unconstrained lunate and triquetrum by rotating into extension relative to both the radius and the capitate [1, 8]. The other carpal changes described in literature in scaphoid non union are reduced carpal height, ulnar translocation and arthritis [1]. Lunotriquetral coalition by itself is not known to produce carpal instability [2]. Scaphoid non union is not reported to produce a VISI deformity [1, 10]. DISI is the most common deformity reported in scaphoid non union incidence being 40-50% [1]. The lunotriquetral joint is stabilized by five ligaments, these are, palmar lunotriquetral, dorsal luno-triquetral, interosseous luno triquetral, dorsal radio-triquetral and dorsal scapho-triquetral ligaments [11]. Lunotriquetral interosseous ligament plays an important role in stabilizing the lunotriquetral joint [12]. Lunotriquetral dissociation which results in loss of ulnar support of lunate will progress to VISI deformity [12]. Sectioning of the lunotriquetral ligament will give rise to dynamic VISI deformity [9, 13]. Greater amount of VISI can be produced by sectioning the dorsal radiotriquetral and scaphotriquetral ligaments [11]. Lunotriquetral ligament is an important element in the linkage of the intercalated proximal carpal bones to one another [11]. This strong connection between triquetrum and lunate allows limited mutual mobility and serves as a closure to the kinematic chain of the wrist joint and thus functions as a key stabiliser [11]. Dorsal region of the lunotriquetral ligament is the most important rotational constraint [9]. In this case lunotriquetral coalition (Fig 1) resulted in the absence of the lunotriquetral ligament complex. The ulnar support to the lunate is lost. The lunate and triquetrum act as a single unit. Absent lunotriquetral ligament is known to increase mobility of triquetrum [11]. In normal circumstances the intact dorsal radiotriquetral and dorsal scaphotriquetral ligaments will prevent VISI deformity [11]. In this case due to lunotriquetral coalition the dorsal radio-triquetral and the dorsal scaphotriquetral ligaments were not strong enough to prevent abnormal lunate flexion. In addition the forces generated by the loss of radial support were not strong enough to dorsiflex the combined lunotriquetral mass. This resulted in lunotriquetral mass going into palmar flexion resulting in static VISI deformity (Fig 2).

**Figure 2**

Figure 2. Radiograph showing scaphoid non-union & VISI deformity (arrow)



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