FUNCTIONAL OUTCOME OF LATERAL WEDGE OSTEOTOMY IN STAGE II AND III OF KIENBOCKS DISEASE- A PROSPECTIVE OBSERVATIONAL STUDY

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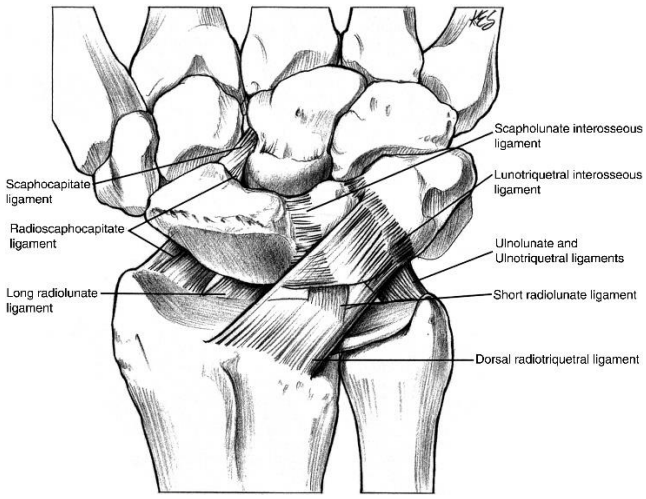
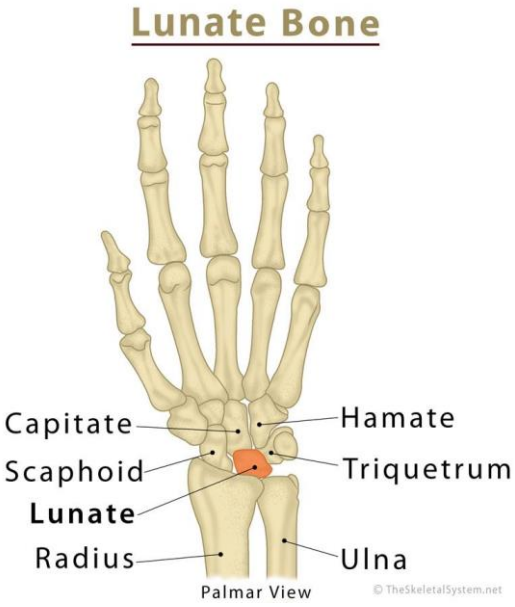
1. Introduction

- Kienbock's disease, also referred to as avascular necrosis (AVN) of the lunate, occurs when thde blood supply to the lunate bone, one of the eight small bones in the wrist, is compromised, resulting in necrosis. The lunate plays a crucial role in wrist movement and joint support, working in tandem with the radius and ulna, the two forearm bones. This condition predominantly affects men aged 20 to 40 and typically occurs in only one wrist.
- In 1910, Robert Kienbock, a Viennese radiologist, published a groundbreaking article on traumatic malacia of the lunate. He presented radiographic evidence showing changes in the proximal portion of the lunate bone and the radio lunate articulation. Kienbock observed the collapse of the lunate and attributed it to a disruption in its nutrition resulting from ligament and blood vessel rupture during contusions, sprains, or subluxations. His recommended approach involved symptomatic treatment, reserving excision of the lunate for advanced cases.

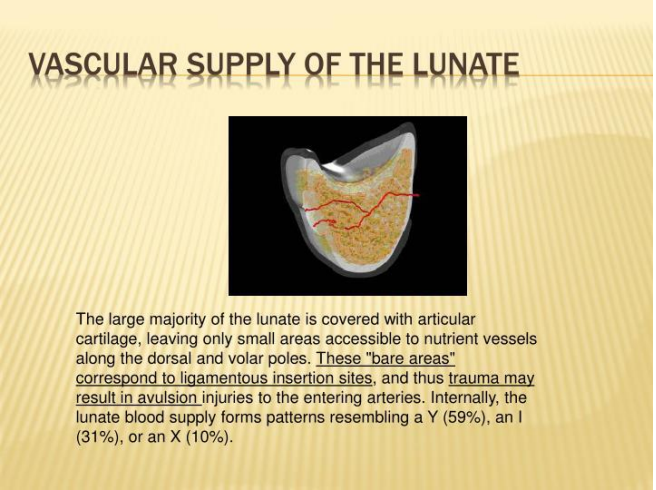
- Anatomy

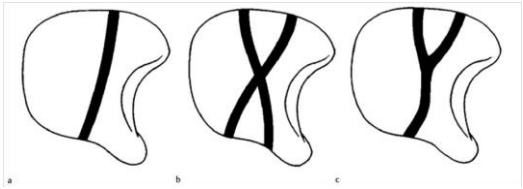




- Vascular Supply

• The lunate has a rich blood supply from dorsal radiocarpal and intercarpal arch branches, via its palmar and dorsal surfaces, or sometimes only the palmar surface





- Aetiology

- The exact cause of Kienbock's disease remains unknown, but it is believed to result from factors that disrupt blood flow to the bone. Individuals with Kienbock's disease often initially mistake it for a sprained wrist, commonly following wrist trauma like a fall. Such trauma can damage the blood vessels supplying the lunate bone.

Several Risk Factors May Contribute To The Development Of Kienbock's Disease:

- Some individuals may have a reduced number of blood vessels supplying the lunate; while most people have two arteries supplying blood to the lunate, some individuals have only one source.
- Variances in the relative lengths of the two forearm bones (radius and ulna) can lead to different forces acting on the lunate bone. When the radius and ulna are of differing lengths, increased pressure can be exerted on the lunate during certain wrist movements or when pressure is applied during activities like push-ups. Over time, this increased pressure may compromise blood flow to the lunate, contributing to the development of Kienböck's disease.

- Signs And Symptoms

Frequently reported symptoms of Kienböck's disease include:

- Wrist pain resembling that of a sprained wrist, which can range from a dull ache that comes and goes to a sharp, persistent pain.
- Pain specifically localized over the lunate bone, typically around the center of the wrist.
- Swelling in the wrist area.
- Stiffness experienced in the wrist.
- Weakness felt in the wrist.
- Creaking, crackling, or grating sounds (crepitation) during wrist movements.
- Decreased range of motion.
- Diminished strength when gripping objects.

- Diagnosis

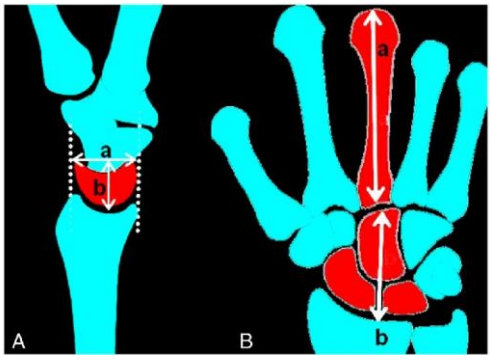
- Diagnosis can be made on clinical presentation along with imaging modalities
- X-ray is the most frequently used modality
- CT scan
- Bone density
- MRI- helps in diagnosing kienbocks disease in incipient stages

- Radiological Parametres

Stahl's lunate index

- 0.50-0.56
- Radiography (Postero anterior view)

- Radiography (Lateral view)
- a : length of lunate on PA view
- b : AP diameter of lunate on lateral view
- Stahl's index = a / b

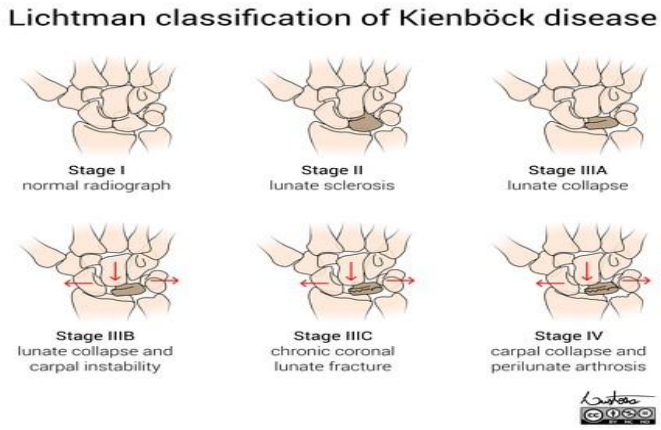


Radio lunate and radio scaphoid angle
Radio lunate angle
- -15-15°
- Radiography (Lateral)
- Lunotriquetral dissociation <-15° (palmar angle)
- Scapholunate dissociation >15° (dorsal angle)
- Angle between axis of radius and axis of lunate

Radio scaphoid angle
- 30-60°
- Radiography (Lateral)
- Angle between axis of radius and axis of scaphoid.

Carpal height (bouman's index)
Bouman's index no 2
- Carpal height
- 0.62-0.66
- Radiography (Postero anterior)
- a : length of capitate
- b : carpal height
- Bouman's index no 2 = a / b

Lichtman Classification



- **Clinical presentation**

The progression of Kienbock's disease is typically classified into four stages, with stage 1 being the mildest and stage 4 being the most severe. The staging is determined through MRI and CT scans, which help rule out fractures and assess blood flow to the lunate bone.

- **Stage 1**: At this initial stage, patients may experience pain similar to a wrist sprain. The cause may not be clear, but it is likely due to reduced or halted blood supply to the lunate bone.
- **Stage 2**: Progressing to stage 2, the lunate bone begins to harden (sclerosis) due to the diminished blood flow. This hardening process indicates bone degeneration.
- **Stage 3:** In stage 3, the hardened lunate will start to break. This might cause the other bones in wrist to move around. You'll feel more pain, struggle to grip things with as much power and the range of motion will be limited.
- **Stage 4:** In stage 4, the outsides of the bones near the lunate will also weaken. Your wrist might become arthritic.

It might be several months or several years between stage 1 and stage 4.

- **Treatment modalities**

- Initially, conservative management is typically pursued, which includes immobilization, pain relief using analgesics, and/or anti-inflammatory medications. If conservative measures fail to alleviate symptoms, surgical interventions are considered based on the severity of the condition.
- Various surgical options are available for Kienböck's disease, depending on the extent of involvement and the patient's specific needs. These options include:
- Autogenous tendon replacement arthroplasty
- Revascularization procedures
- Radial shortening
- Ulnar lengthening
- Limited intercarpal arthrodesis
- Silicone replacement arthroplasty

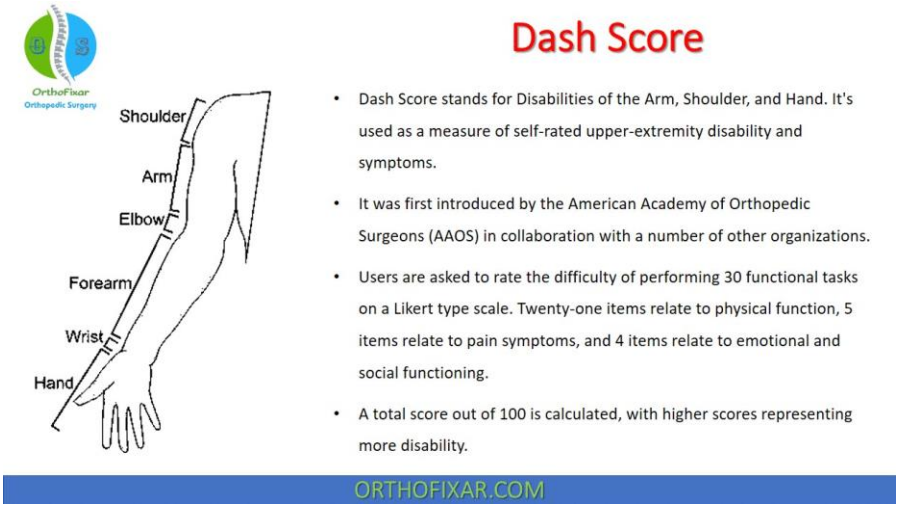
For cases where the disease has progressed significantly and conservative or primary surgical interventions are insufficient, salvage procedures become necessary. These salvage procedures may include:

- Wrist denervation
- Proximal-row carpectomy (removal of a row of carpal bones)

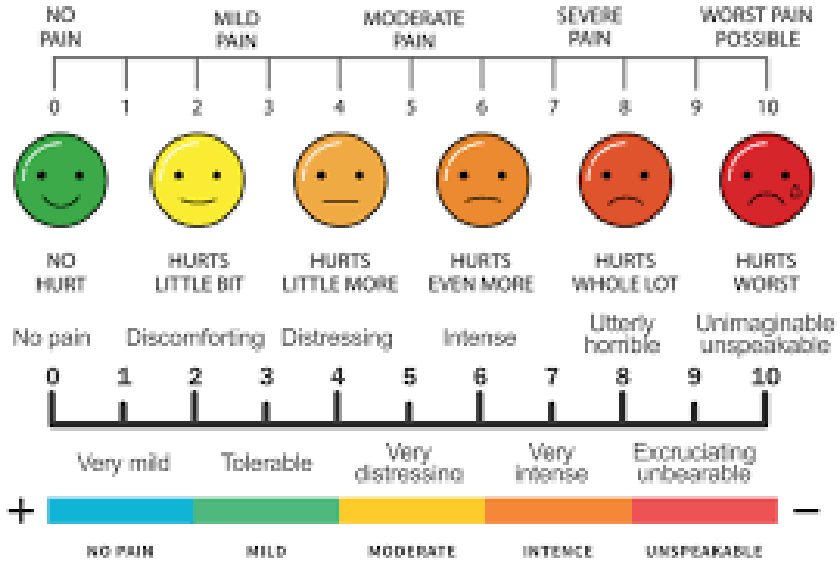
Nakamura scoring system

Clinical assessment	Points (21 points)
Pain in the wrist	
None	10
Mild with strenuous activity	7
Mild with light work	4
Grip strength (percentage of unaffected side)	
90%	5
80%	4
70%	3
60%	2
50%	1
Increase in range of flexion and extension	
>20°	6
10°–19°	5
5°–9°	3
Overall grade	Total points
Excellent	15–21
Good	9–14
Fair/poor	<8

Dash score



Vas score



Study Design:-

- A PROSPECTIVE OBSERVATIVE STUDY was performed and assessment was done as per VAS, DASH and NSSK. Study was performed at Department of orthopaedics , MGM Medical college and hospital, Chhatrapati sambhajinagar over the period of two years.
- ELLIGIBILITY CRITERIA
- INCLUSION CRITERIA –

1. Kienbocks stage 2 and stage 3 as per lichtmann classification.
2. Patients who were willing for operative intervention.
3. Age 18 to 65 years

- **Exclusion Criteria –**

1. Patients not providing consent for surgical intervention
2. individuals with previous surgical intervention
3. patients not medically fit for surgery
4. patients with kienbocks disease apart from stage 2 and stage 3

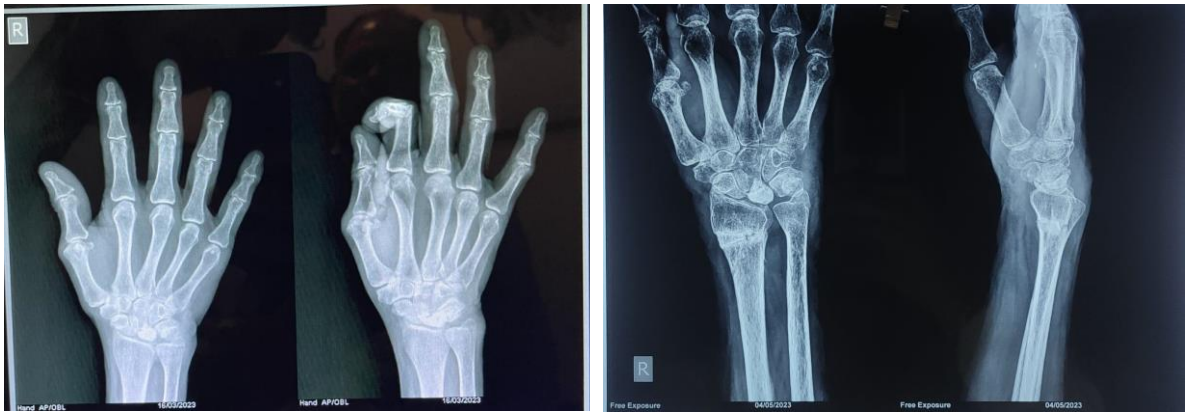
2. Methodology

- A total of 15 patients were studied out of which 3 were loss to follow up and 6 were diagnosed to have stage II and III of kienbocks disease for which radial wedge osteotomy were performed and follow up was taken at 3 stages (2 ,4 and 8 weeks).
- A distal radius wedge osteotomy was performed as a 10-degree lateral closing wedge osteotomy with the apex of the wedge distal to that of conventional lateral closing wedge osteotomy; this procedure was developed to avoid postoperative incongruous DRUj. We performed this procedure on 6 patients (stage II: 4, stage III: 2) with a mean age of 49 years.

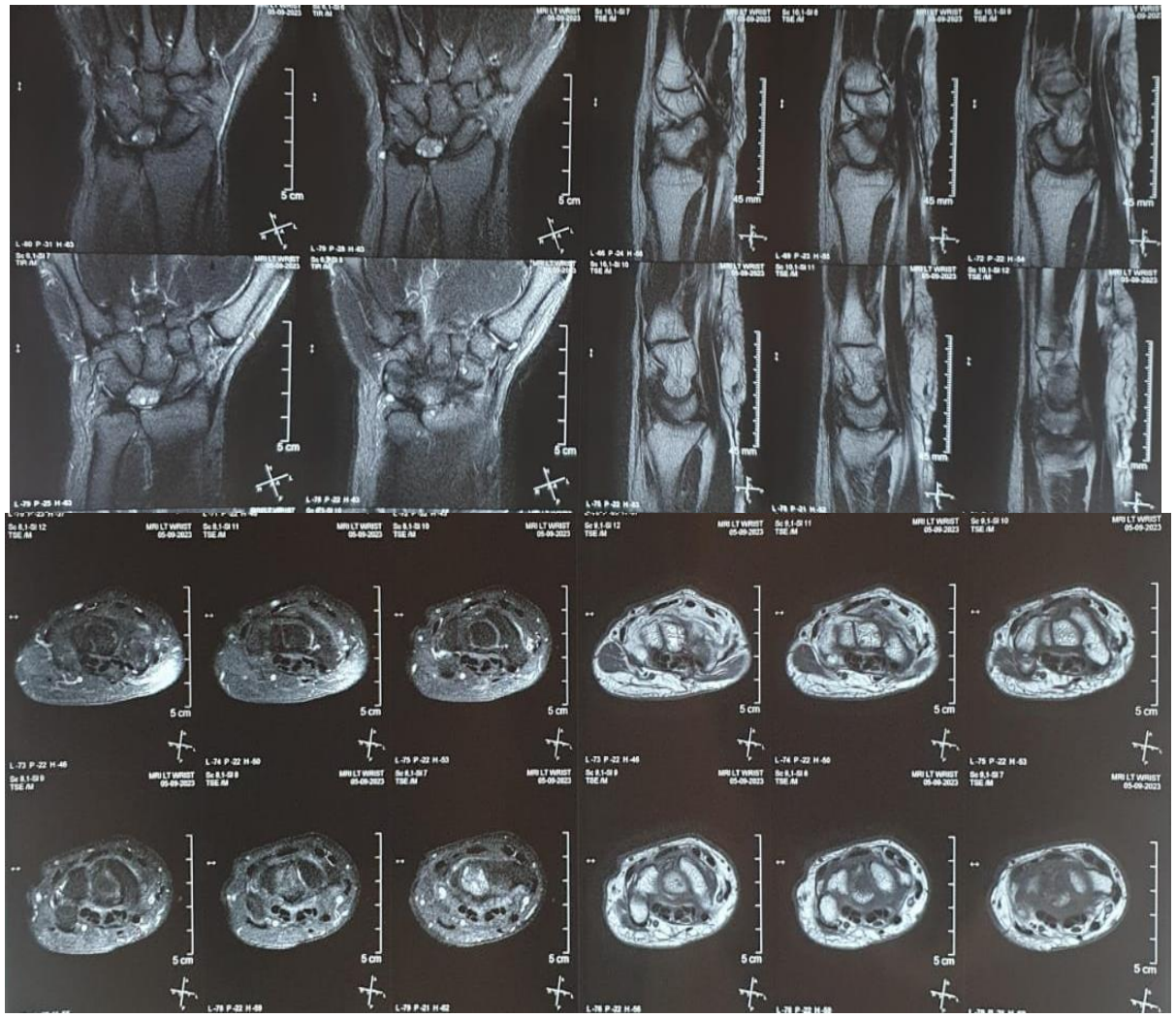
Post-operative care

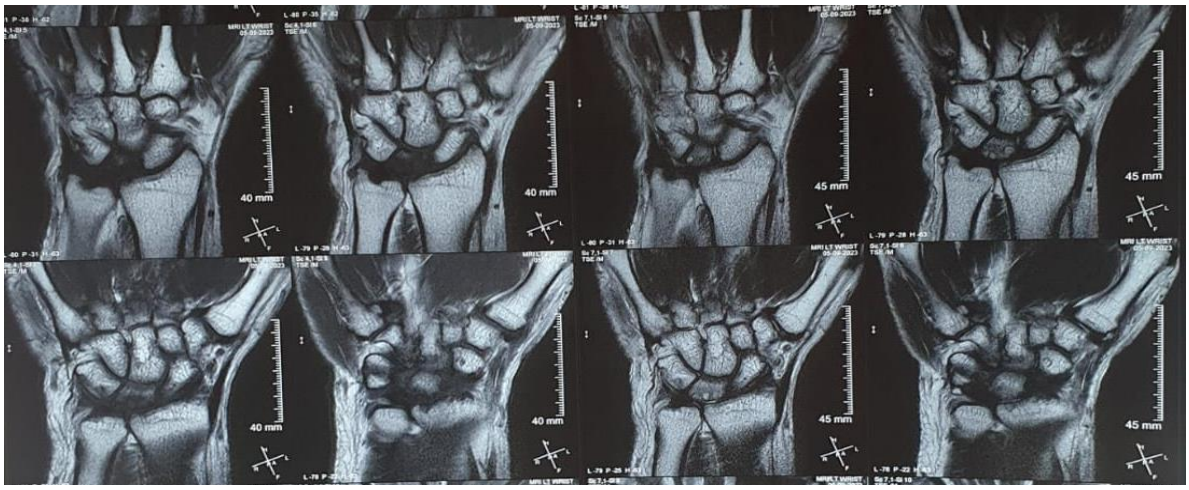
- All patients were given below elbow slab for a duration of 3 weeks.
- Finger rom was started immediately post-operative day 1.
- Suture removal was performed at 14 days post operatively.
- Follow up was performed at 2 weeks,4 weeks and 8 weeks respectively.
- Wrist joint rom was initiated after 3 weeks post operatively and functional outcome was assessed on each follow up.

Pre-op and post-op radiographs of lateral wedge osteotomy



Mri films





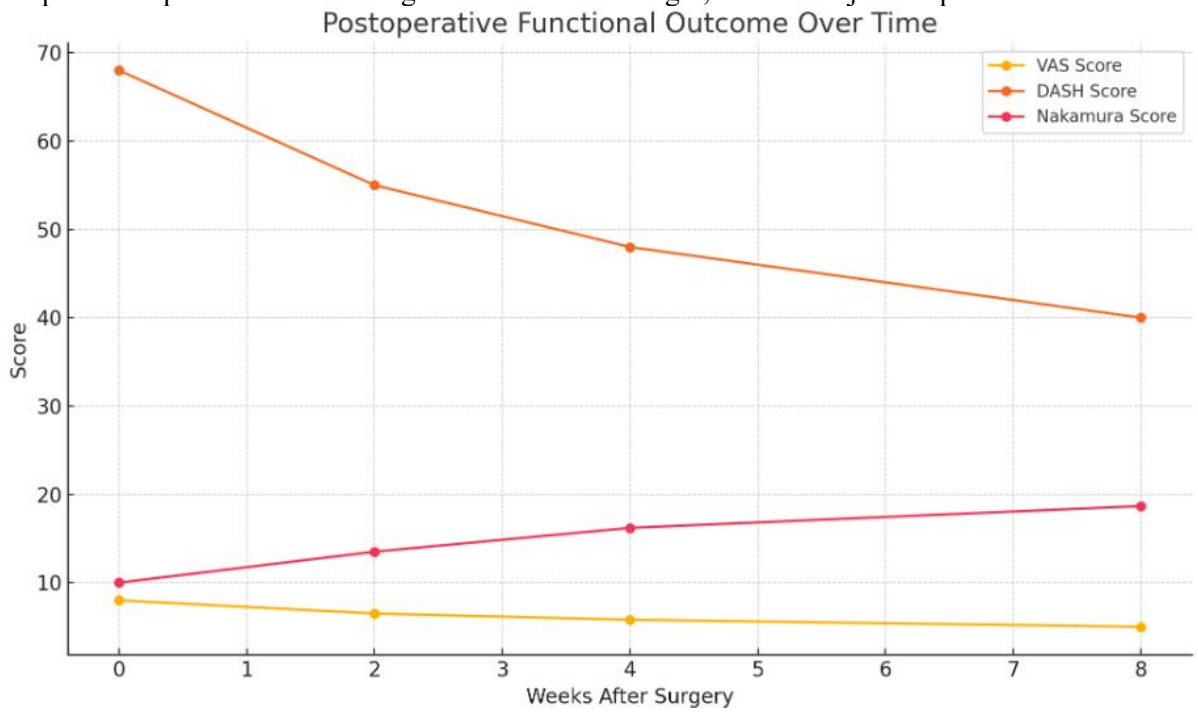
3. Results

Out of the initial 15 patients, 6 diagnosed with stage II (n=4) and stage III (n=2) Kienböck's disease were treated using lateral wedge osteotomy. Functional outcomes were measured using VAS, DASH, and Nakamura scoring systems at 2, 4, and 8 weeks postoperatively.

- **VAS score** reduced from a mean pre-operative value of 8 to 5 by the 8th week.
- **DASH score** improved from 68 to 40, indicating better upper limb function.

- **Nakamura score** increased from 10 to 18.67, reflecting improved wrist function and grip strength.

All patients reported increased range of motion and strength, with no major complications.



4. Discussion

Lateral wedge osteotomy demonstrated promising short-term functional improvement in patients with stage II and III Kienböck's disease. The observed reduction in VAS and DASH scores highlights a significant decrease in pain and improvement in upper limb function. Concurrently, the rise in Nakamura scores supports enhanced wrist mobility and strength recovery.

Biomechanically, this technique improves the load distribution across the lunate by modifying the radial inclination and enhancing the lunate-covering ratio. These changes reduce the stress concentration on the necrotic lunate, promoting vascular regeneration and structural stability. Moreover, avoiding postoperative distal radioulnar joint (DRUJ) incongruity adds to the advantage of this technique.

The results correlate well with existing literature emphasizing the role of biomechanical alteration in early-stage intervention. Though the sample size was limited, early functional restoration and minimal complications indicate the procedure's clinical relevance. A longer follow-up and larger cohort would be beneficial to further establish these findings

5. Conclusion

- All of the fore mentioned patients experienced significant improvements in wrist extension and flexion along with improved grip strength of around 55% of the contralateral side in this short term follow up. The mean nakamura score was 18.67 along with mean vas score of 5.
- The satisfactory clinical outcome of lateral closing wedge osteotomy of the distal radius for advanced-stage Kienböck's disease can be attributed to the effects of the increased lunate-covering ratio (from 61% to 75%) and the improved radio scaphoid angle on carpal alignment.

6. References

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