ACAVIS PUBLISHERS

Annals of Orthopedics and Traumatology

Case Report

Volume 1, Issue 1

The Impact of Physiotherapy Interventions for Madelung Deformity: A Case-study

Md. Nazmul Haq*

Clinical Physiotherapist, CRP-Mirpur, Bangladesh

ABSTRACT

Introduction: Madelung deformity is a congenital wrist disorder caused by premature distal radial growth arrest, leading to volar subluxation. Physiotherapy supports pain reduction, protects healing, and gradually restores wrist mobility and strength.

Objective: To evaluate the effectiveness of pre-operative physiotherapy in reducing pain and symptoms, improving wrist range of motion, and enhancing functional ability and overall quality of life.

Case summary: Himel, a 17-year-old male student from Sirajganj, presents with a 3-month history of moderate, aching pain in both wrist joints following trauma. The pain (VAS 7/10) is constant and limits daily functional activities, with occasional paresthesia. Symptoms worsen with gripping and weight lifting and improve with rest. The condition has progressively worsened since onset, with only mild relief from painkillers, significantly affecting hand movement and overall function.

Discussion: Physical examination revealed previously unrecognized bilateral Madelung deformity without symptoms. Conservative management, including wrist range-of-motion exercises, was initiated for six weeks and extended after improvement. Treatment should be individualized based on age, skeletal maturity, deformity severity, symptoms, and etiology. The main goals are preserving function, improving appearance, and protecting joint health. Mild cases are effectively managed with physiotherapy, splinting, pain control, and activity modification.

Conclusion: Madelung deformity is a rare congenital wrist disorder caused by premature distal radial growth arrest, leading to volar subluxation, deformity, and limited motion. Often bilateral and more common in females, management includes supportive physiotherapy and structured post-surgical rehabilitation to improve function.

KEYWORDS: Madelung deformity, Physiotherapy, Wrist range of motion, Pain management, Functional ability, Quality of life, Conservative management.

***Correspondence:**
Md. Nazmul Haq
Clinical Physiotherapist, CRP-Mirpur, Dhaka-1206, Bangladesh.
Email: nazmul.sawon2021@gmail.com

Article Info:
Received Date: July 15, 2026
Published Date: September 01, 2026

Citation:
Md. Nazmul Haq. The Impact of Physiotherapy Interventions for Madelung Deformity: A Case-study. Ann Orthop Traumatol. 2026;1(1):1-7.

INTRODUCTION

Madelung deformity (MD) is a congenital wrist condition characterized by volar subluxation of the wrist caused by premature growth arrest of the distal radius. In 1878, Otto W. Madelung reported on a rare disease of the wrist, now known as Madelung deformity. In his clinical observations, he describes a palmar subluxation of the hand, a prominent distal ulna, and volar angulation of the distal radial epiphysis and identified an abnormally thickened volar ligament, the so called "Vickers ligament," that tethers the lunate to the radius and is hypothesized to hinder growth by compressing the epiphyseal plate.[1] It is a rare entity with a prevalence of less than 2%. There is a female preponderance with a female to male ratio of 3-5:1. The deformity is generally bilateral and Henry and Thorburn described four etiologic factors of MD: posttraumatic, dysplastic, genetic, and primary. Posttraumatic can be due to repetitive trauma (as seen in gymnasts) or a single event. The most common dysplasia associated with MD is Leri-Weill dyschondrosteosis, which is characterized by mesomelic short stature due to a mutation in the SHOX gene.[2]

Figure 1. Madelung Deformity of Patient

Madelung deformity presents with characteristic radiographic changes affecting the radius, ulna, and carpal bones. Key features include increased dorsal and radial bowing of the distal radius, widened distal radioulnar joint, triangular arrangement of the carpal bones with lunate subsidence, increased volar tilt of the distal radial articular surface, and exaggerated ulnar tilt. Clinically, patients may experience pain, swelling, bluish skin discoloration, prominent distal ulna, decreased wrist motion—particularly in supination and extension—and joint instability due to incongruent surfaces. Functional deficits include reduced grip strength, limited mobility, and difficulty performing daily activities. Despite these structural and functional impairments, many patients adapt effectively and maintain relatively good function, often managing daily tasks with minimal disability, although symptoms may progress over time and impact quality of life.[3]

Physiotherapy is a key supportive strategy in the management of Madelung deformity, aiming to reduce pain, restore wrist function, and maintain upper limb strength. Rehabilitation protocols are tailored according to the surgical approach but generally follow the principle of early joint protection followed by gradual mobilization. After procedures such as Vickers ligament release, patients typically undergo immobilization using a short-arm orthosis for 3–4 weeks to allow soft tissue healing. Following this period, progressive range-of-motion (ROM) exercises are initiated, alongside gentle loading and strengthening activities to restore flexibility, muscle function, and grip strength. Structured physiotherapy also addresses compensatory movements and promotes optimal wrist mechanics. Long-term functional outcomes are highly dependent on patient adherence to these rehabilitation protocols, with consistent engagement enhancing recovery of mobility, hand strength, and overall upper limb function. Early, targeted physiotherapy is therefore essential to maximize surgical benefits and improve quality of life in individuals with Madelung deformity.[4]

Aim of the Study

To determine the impact of Physiotherapy treatment for Madelung deformity.

Objectives

- To pre-operative management refers to the evaluation, planning, and preparation of a patient before surgery to minimize complications and improve outcomes.
- To evaluate the normalize of ROM in wrist joint
- To assess the role of therapeutic exercises that enhancing daily activities and overall quality of life.

CASE SUMMARY

Patient Profile

Name: Himel

Age: 17 years old

Sex: Male

Occupation: Student

Address: Sirajganj.

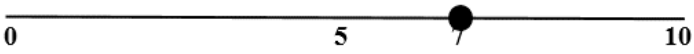
Patient ID: 25.01. 057378

Presenting Complaint

Describe complain: Pain in wrist joint and he can't move hand properly within 3 months.

Exact area of pain: Both wrist joint

Severity of pain: Moderate type pain present in wrist joint (VAS: 7/10)



Characteristics of pain: Aching type pain present

Constant symptoms: Pain in wrist joint and he can't perform functional activity of daily activity

Intermittent symptoms: He feels sometimes paresthesia also

Aggravating factors: Gripping, weight lifting etc.

Easing factors: Resting, lying etc.

History of Present Complaint (HPC)

Onset: Sudden

Duration: Within 3 months

Causative factors: Traumatic

Progress: Worse

Pain at: All time pain feels but he takes pain killer mild reduce pain.

Past Medical History (PMC)

Medical history: Tab: Naprosen 500 mg, Tab: Beklo 10 Tab: Neuro-B

DM(-), HTN(-), Bronchial Asthma(-), Heart Disease(-), Kidney Disease(-), Epilepsy(-) etc.

Major operation: No

Investigation: Yes, X-ray of Wrist joint

Additional: Pace-maker(A), Skin color(Red), Deformity(P), Synovial thickening(N), Temperature(Incred), Posture(N), Gait(N)

Movement: Wrist Joint

Table 1. Active movement

Movement	Pain	ROM	Willingness
Wrist flexion	(+)	50-degree loss	(+)
Wrist extension	(+)	40-degree loss	(+)
Ulnar deviation	(+)	20-degree loss	(+)
Radial deviation	(+)	10-degree loss	(+)

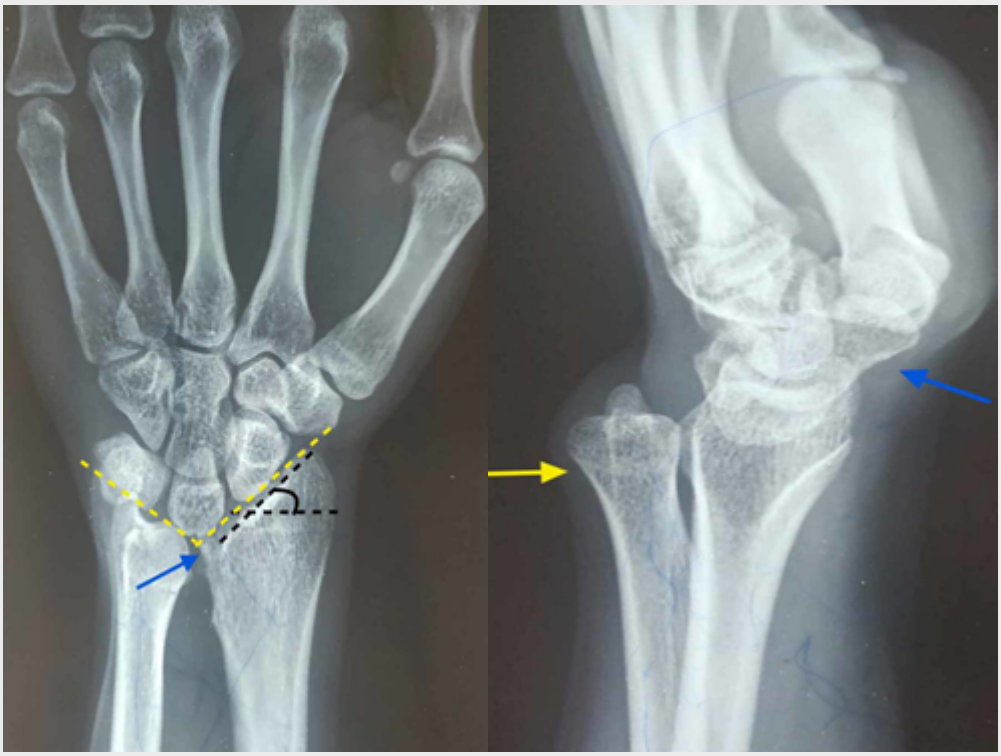


Figure 2. X-ray of wrist joint

Table 2. Passive movement

Movement	Pain	ROM	End feel	Capsular pattern
Wrist flexion	(+)	40-degree loss	Soft	Negative
Wrist extension	(+)	30-degree loss	Soft	Negative
Ulnar deviation	(+)	15-degree loss	Soft	Negative
Radial deviation	(+)	10-degree loss	Soft	Negative

Static Muscle Test

- Flexor muscle grade: G-III (Oxford grade)
- Extensor muscle grade: G-III (Oxford grade)
- Ulnar & radial deviation muscle grade: G-III (Oxford grade)

Neurologically

- Sensory: Intact
- Motor: Intact
- Reflex: Normal

Special test

- Phalens test (-) ve
- Tinel sign (-) ve

Confirm Diagnosis: According to the clinical reasoning process I was used Hypothetico-Deductive Reasoning (HDR) approach to diagnosis differently.

Madelung Deformity (Left side)

Differential Diagnosis

Some important conditions that should be considered **separately in the differential diagnosis of Madelung deformity** include:

- **Post-traumatic distal radius deformity**: especially growth plate injury after childhood fractures
- **Leri–Weill dyschondrosteosis**: genetic disorder commonly associated with bilateral Madelung deformity
- **Turner syndrome**: may present with wrist deformities resembling Madelung deformity
- **Multiple hereditary exostoses**: causes forearm deformity due to osteochondromas
- **Congenital radioulnar synostosis**: limits forearm rotation rather than causing wrist tilt
- **Distal radius malunion**: deformity following improperly healed fracture
- **Positive ulnar variance**: isolated ulnar overgrowth without classic Madelung changes

Problem List

- **Increased pain (left wrist):** The patient complains of pain in the left wrist, especially during movement or weight-bearing activities, due to abnormal joint alignment.
- **Decreased joint range of motion (ROM):** Limited wrist movements (flexion, extension, pronation, and supination) caused by deformity of the distal radius and joint incongruity.
- **Swelling:** Mild to moderate swelling around the left wrist joint, possibly due to joint irritation or soft tissue involvement.
- **Muscle weakness:** Weakness in the muscles of the left forearm and hand, leading to reduced support and control of the wrist joint.
- **Loss of gripping ability:** Reduced grip strength in the left hand due to pain, deformity, and muscle weakness, affecting the ability to grasp objects.
- **Difficulty in functional activities:** The patient has difficulty performing daily activities such as writing, holding objects, lifting, and self-care tasks because of pain, reduced ROM, and decreased strength in the left upper limb.

Aims of Treatment

- **Reduce pain:** To reduce pain in the left wrist from present level to minimal (e.g., ≤2/10 on pain scale) within 2–3 weeks using appropriate physiotherapy interventions.
- **Normalize joint ROM:** To improve and achieve near-normal range of motion of the left wrist joint within 4–6 weeks, enabling functional movements.
- **Reduce swelling:** To decrease swelling around the left wrist within 2 weeks, as measured by girth measurement or visual assessment.
- **Increase muscle power: To** improve muscle strength of the left forearm and hand muscles to at least Grade 4/5 (MMT) within 6–8 weeks.
- **Improve gripping pattern:** To restore functional hand grip (e.g., cylindrical and spherical grip) within 4–6 weeks, allowing effective object handling.
- **Improve functional activity:** To enable the patient to perform daily living activities (writing, lifting light objects, self-care tasks) independently within 6–8 weeks.

The overall, we showed that physiotherapy intervention helps for reducing or minimizing symptoms, promoting quality of life for Madelung deformity.

Table 3. Physiotherapy Intervention

Exercise name/Intervention	Frequency	Intensity
Patient Education	Daily	Advice on joint protection, activity modification, ergonomic training
ROM Exercise	3 times/day	5–10 repetitions (active & assisted, pain-free range)
Soft Tissue Release	3 times/day	5–10 minutes (gentle pressure techniques)
Gentle Stretching	3 times/day	5–10 repetitions (slow, controlled stretch, no pain)
Isometric Exercise	3 times/day	5–10 repetitions (hold 5–10 seconds, pain-free contraction)
Strengthening Exercise	3 times/day	5–10 repetitions (light resistance, gradual progression)
Assistive Device (Splint/Orthosis)	Every 4 hours/day	30 minutes usage (support & protection)
Ice Pack (Cryotherapy)	3 times/day	5–10 minutes application (post-activity or pain)
Home Exercise Program	Daily	Follow prescribed exercises regularly for maintenance

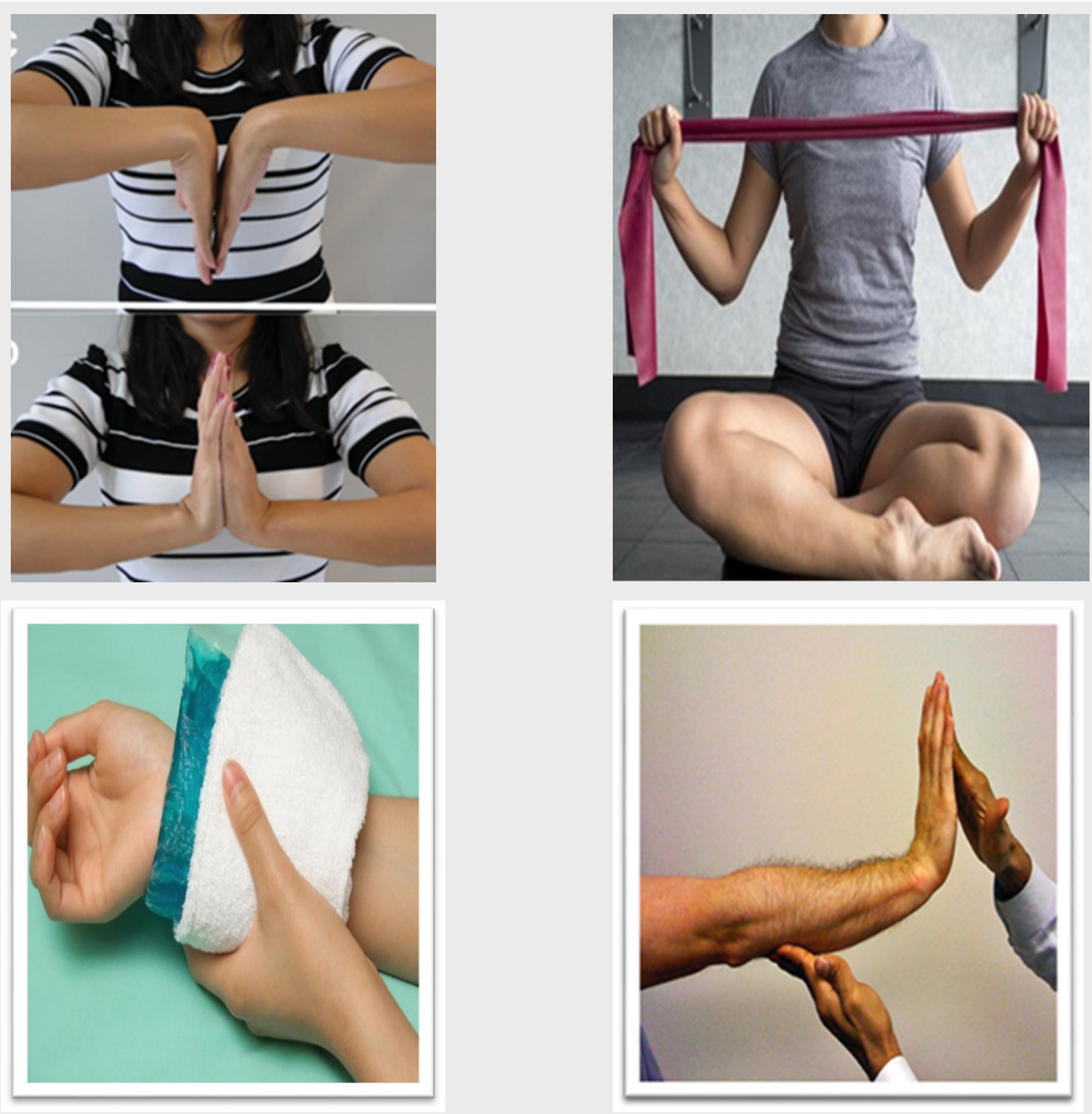


Figure 3. Physiotherapy intervention of Madelung Deformity

Table 3. Outcome measures

Parameter	Initial	Discharge	Result
Pain	VAS: 7/10	VAS: 2/10	70% reduction
Muscle strength (Oxford)	G-III	G-IV	Mostly improve
ROM	Moderate loss	Mild Loss	Significant improve
Functional status	Moderate impact of life	Minimum impact of life	Satisfactory improve

Intervention Outcome

Physiotherapy intervention for Madelung deformity primarily aims to reduce symptoms, improve wrist function, and enhance the patient's overall quality of life through conservative management. A key component is patient education, which helps individuals understand the nature of the deformity, its progression, and the importance of joint protection and activity modification. Avoiding excessive wrist loading and adopting proper ergonomics are essential to prevent further complications.

Exercise therapy plays a central role in management. Range-of-motion (ROM) exercises help maintain and gently improve wrist, forearm, and hand mobility, preventing stiffness. Gentle stretching targets tight muscles and soft tissues, promoting flexibility and balanced joint mechanics. Isometric exercises are useful in the early stages to maintain muscle activation without stressing the joint, while progressive strengthening exercises improve muscle power, joint stability, and functional capacity. These exercises are typically performed in low repetitions (5–10) multiple times a day to ensure safety and effectiveness.

Soft tissue release techniques are also beneficial, as they reduce muscle tightness, improve circulation, and enhance movement quality. Additionally, cryotherapy (ice pack application) helps manage pain and inflammation, especially after activity. The use of assistive devices such as wrist splints provides external support, improves alignment, and protects the joint during daily activities.

A structured home exercise program is essential for long-term management, reinforcing clinical treatment and encouraging patient independence. Overall, physiotherapy offers an effective, non-invasive approach to managing Madelung deformity by focusing on symptom relief, functional improvement, and prevention of further progression.

DISCUSSION

Madelung deformity is a developmental and progressive condition affecting the distal radioulnar and radiocarpal joints, caused by impaired growth of the medial portion of the distal radial physis, leading to radial shortening and wrist deformity. This case report describes a 22-year-old woman with left-sided Madelung deformity who presented with progressive dorsal and ulnar wrist pain, which was aggravated during sports activities, along with noticeable cosmetic deformity. Due to persistent symptoms and functional limitations, she underwent corrective dome osteotomy. Following surgery, the patient experienced significant pain relief and improvement in wrist alignment. A structured rehabilitation program, including range of motion exercises, was initiated postoperatively, which further enhanced wrist mobility and functional use. The outcome demonstrates that surgical correction, combined with appropriate physiotherapy, is an effective approach for managing symptomatic and cosmetically concerning deformities of the distal radius, leading to improved function and quality of life.[5]

Surgical management of Madelung deformity is complex and depends on several factors, including the underlying cause of the condition, clinical presentation, radiographic findings, and the specific surgical technique chosen. Clinical evaluation typically focuses on key aspects such as pain, range of motion, cosmetic deformity, and sometimes grip strength. Among these, pain is the most common and significant indication for surgical intervention, especially when it interferes with daily activities or quality of life. A wide variety of surgical procedures have been described for the treatment of Madelung deformity, reflecting both the variability of the condition and differences in surgeon preference and expertise. These procedures aim to correct deformity, relieve pain, and improve wrist function. In general, most surgical approaches report favorable outcomes, particularly in reducing pain and enhancing wrist range of motion. However, comparing the effectiveness of different surgical techniques remains challenging. This is mainly due to variations in treatment methods, patient characteristics, and the absence of standardized patient-reported outcome measures. As a result, there is limited high-quality evidence to support one superior technique over another, making it difficult to establish clear, universally accepted guidelines for optimal surgical management.[1]

Patients with mild Madelung deformity and minimal symptoms are generally managed conservatively. Non-surgical treatment focuses on symptom relief through hand therapy, use of orthoses, range-of-motion exercises for the hand and wrist, physical therapy, anti-inflammatory medications, and supportive measures such as ice application. In contrast, patients who are symptomatic or have cosmetic concerns, particularly those with progressive deformity approaching skeletal maturity, often require surgical intervention. Surgical treatment is considered when pain, functional limitation, or deformity progresses despite adequate conservative management.[6]

According to Carvalho[7] stated that Madelung's deformity is characterized by volar and ulnar tilt of the distal radius, resulting in radial shortening, ulnar prominence, wrist pain, and restricted motion. Traditional surgical techniques are often less effective in skeletally mature patients. This report presents a 25-year-old woman treated with a novel volar approach involving distal radius osteotomy and joint realignment. The procedure aimed to correct deformity and restore wrist alignment. Early clinical and radiographic outcomes were encouraging, showing reduced pain and improved function. The findings suggest that shelf osteotomy may be a promising surgical option for young adults with Madelung's deformity who do not yet have degenerative wrist changes.

According to Savage-Lobeck & Gogu[8] reviewed that physical examination revealed that the deformity was bilateral, a finding previously unrecognized, and neither wrist was symptomatic at the time. Conservative management was initiated with a combination of physical therapy, emphasizing wrist range-of-motion exercises, and continued for six weeks, with extension for an additional six weeks following clinical improvement. Although surgical intervention is often considered for Madelung's deformity, particularly in the presence of Vickers' ligament, it is not always required to enhance function, quality of life, or long-term outcomes. Conservative treatment, including physiotherapy and functional activities, can be effective.

According to Karunarathna[4] stated that Management of Madelung deformity should be tailored to each patient, taking into account factors such as age, skeletal maturity, severity of deformity, symptom intensity, and the underlying etiology, whether congenital or acquired. The primary goals are to preserve wrist function, improve cosmetic appearance, and maintain long-term joint health. Conservative management is often appropriate for patients with mild symptoms, focusing on pain control with nonsteroidal anti-inflammatory drugs, wrist splinting for stability, and activity modification to reduce repetitive stress on the wrist. Patients undergoing nonoperative treatment require close monitoring, including regular clinical assessments and radiographic follow-up, typically every six months until skeletal maturity. If imaging shows progressive deformity or if symptoms worsen, surgical intervention may be considered to prevent functional impairment. Overall, individualized management that balances conservative care and timely surgical consideration provides optimal outcomes in maintaining function and quality of life for patients with Madelung deformity.

CONCLUSION

Madelung deformity (MD) is a rare congenital wrist condition caused by premature growth arrest of the distal radius, leading to volar subluxation of the wrist. First described by Otto W. Madelung in 1878, the condition is characterized by palmar displacement of the hand, prominence of the distal ulna, and volar angulation of the distal radial epiphysis. A key pathological feature is the thickened volar radio-lunate ligament, known as the Vickers ligament, which restricts normal growth of the distal radius. MD has a prevalence of less than 2%, shows a strong female predominance, and is commonly bilateral. The etiology may be posttraumatic, dysplastic, genetic, or primary, with Leri-Weill dyschondrosteosis being the most common associated dysplasia linked to SHOX gene mutations. Radiographic findings include bowing of the distal radius, widened distal radioulnar joint, altered carpal alignment, and increased volar and ulnar tilt. Clinically, patients may present with wrist pain, swelling, reduced range of motion, instability, and grip weakness, though daily functional limitations are often minimal.

Physiotherapy is a crucial component in the management of Madelung deformity, supporting both conservative and post-surgical care. Its primary goals are to reduce pain, improve wrist mobility, and restore muscle strength and functional use of the hand. In post-surgical rehabilitation, patients often undergo a period of short-term immobilization, followed by carefully graded exercises targeting range of motion, flexibility, and strengthening. Consistent adherence to physiotherapy programs significantly influences long-term outcomes, enhancing joint function, reducing complications, and supporting overall recovery. Early and structured physiotherapy is therefore essential for optimizing functional improvement and quality of life in affected patients.

ACKNOWLEDGEMENT

None

FUNDING

None

CONFLICT OF INTEREST

The author declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

1. Peymani A, Johnson AR, Dowlatshahi AS, et al. Surgical management of Madelung deformity: a systematic review. *Hand*. 2019;14(6):725-734.
2. Pratyush S, Aarushi S, Apoorv S, et al. Madelung Deformity of the Wrist Managed Conservatively. *Cureus*. 2020;12(5):e8225.
3. Otte JE, Popp JE, Samora JB. Treatment of Madelung deformity with Vicker ligament release and radial physiolyses: a case series. *The Journal of hand surgery*. 2019;44(2):158-e1.
4. Karunarathna I, Aluthge P, Senanayake K, et al. Madelung Deformity: Pathophysiology, Clinical Spectrum, and Evolving Management Strategies. *Uva Clinical Anaesthesia and Intensive Care*. 2025;1-9.
5. Salih AHS, Aslantürk O, Ertem K. Treatment of Madelung deformity: a case report and literature review. *SM J Orthop*. 2017;3(2):1053.
6. de Oliveira RK, Ribak S, Brunelli JPF, Aita M, Delgado PJ. Madelung deformity: diagnosis and treatment options. *Revista Iberoamericana de Cirugía de la Mano*. 2021;49(02):e140-e154.
7. Carvalho M, Cardoso PS, Alves C, Balacó I, Ling TP, Matos G. Madelung Deformity - Esthetic and Functional Outcomes from the Surgical Treatment with Distal Radial Dome Osteotomy and Vickers Ligament Section. *Rev Bras Ortop (Sao Paulo)*. 2021;57(1):113-119.
8. Savage-Lobeck D, Gogu S. Conservative Management of Madelung Deformity of the Wrist in a 15-Year-Old Male: A Case Report. *Cureus*. 2023;15(11):e49594.