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From flail to functional: Total elbow arthroplasty in a housemaid with advanced elbow arthritis

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Abstract
Background: Advanced elbow arthritis following post-traumatic conditions such as non-union of the ulna can result in pain, instability, and significant functional impairment. In severe cases, the elbow may become flail and non-functional, particularly affecting individuals involved in manual labor. Total elbow arthroplasty (TEA) is a well-established surgical option to restore joint stability, reduce pain, and improve functional outcomes. However, optimal recovery largely depends on a structured physiotherapy rehabilitation program.
Aim: To evaluate the functional outcome of total elbow arthroplasty combined with physiotherapy rehabilitation in a patient with advanced elbow arthritis and a flail elbow.
Case Presentation: A 46-year-old female housemaid presented with complaints of left-hand pain and swelling in the left elbow, limiting her ability to perform occupational and daily activities. She had a history of non-union of the left ulna operated in 2016, which progressed to advanced elbow arthritis and joint instability. She underwent left total elbow arthroplasty. She was also a known case of hypertension and hypothyroidism. On physiotherapy assessment, pain was graded 5/10 at rest and 8/10 during movement. Range of motion was restricted with flexion 60°, extension lag of -20°, supination 60°, and pronation 60°. Manual Muscle Testing revealed reduced strength in elbow and forearm musculature (3/5), with wrist strength at 4/5. Functional activities such as lifting and gripping were impaired.
Intervention: A structured physiotherapy program was initiated, including pain management using cryotherapy, gentle activeassisted range of motion exercises, and gradual progression to active and resisted strengthening exercises. Isometric exercises were introduced in the early phase, followed by functional training focusing on activities of daily living and occupational tasks.
Outcomes: After rehabilitation, the patient showed considerable improvement in DASH score, Oxford elbow score, Mayo Elbow Performance Score, Michigan Hand Outcomes Questionnaire, Grip strength test, Box and block test and SF 36 in pain reduction, range of motion of the elbow (flexion, extension, pronation, and supination), and muscle strength. Grip strength and joint stability also improved, along with better proprioception and functional performance in activities of daily living. Overall, there was a marked reduction in post-operative stiffness, leading to enhanced functional independence and improved quality of life.
Results: The patient demonstrated significant improvement on all outcome measures with reductions in pain and improved levels of mobility and independence when engaged in daily activities.
Conclusion: A structured, phase-wise physiotherapy program with early mobilization and progressive strengthening leads to improved pain relief, range of motion, and functional recovery after elbow surgery, consistent with American Physical Therapy Association guidelines.

Keywords: Total Elbow arthroplasty, post-traumatic Elbow arthritis, flail Elbow, Elbow joint replacement, physiotherapy rehabilitation, functional recovery

Introduction

The total elbow replacement (TEA) is considered a well-established procedure for the treatment of complex elbow conditions, such as post-traumatic arthritis and non-union cases, aiming at providing stability and functionality of the joint [1]. Originally used to treat older individuals suffering from rheumatoid arthritis, improvements in prosthetic devices and surgical approaches have led to the inclusion of young and physically active subjects [2]. Post-traumatic arthritis in the presence of non-union fracture, especially involving the ulna, causes persistent pain, stiffness, deformities, and disability [3]. These complications may further develop into an unstable elbow joint, affecting ADLs and work-related functions [4].

According to recent literature, TEA offers effective pain reduction and functional enhancement, with many patients obtaining a functional range of motion of more than 100° [5]. Moreover, satisfactory rates of medium- and long-term survival have been described in studies, with an implant survival of around 85%-90% after 5-10 years [6]. However, although TEA can be considered a successful procedure, it may cause adverse effects, including infection, aseptic loosening, and ulnar nerve injury [7]. Physiotherapy is very important in terms of improving recovery from TEA through mobilization and strengthening of muscles [8]. Early rehabilitation has been found to help patients return to normal activity and work, which is especially vital for those working in manual occupations, where arm use is crucial for everyday life [5]. Therefore, this case report highlights the role of total elbow arthroplasty combined with physiotherapy in transforming a flail, painful elbow into a stable and functional joint.

Case Presentation

The patient was a 46-year-old lady working as a maid who presented with a history of pain and swelling in her left hand and elbow joint that affected her ability to perform occupational activities. She had a previous history of nonunion of left ulna for which she had undergone surgery in 2016, resulting in progressive arthritis and instability of the elbow joint that prompted her to undergo left total elbow arthroplasty. The lady was hypertensive and hypothyroid. During the physiotherapy assessment, pain intensity of 3 out of 10 at rest and 6 out of 10 on movement was measured on the Numerical Pain Rating Scale.

The examination revealed a surgical scar and mild edema of the left arm with a guarded position. There was a limitation of range of motion in the left elbow, with 90° flexion, 20° lag of extension, 40° of supination, and 50° of pronation. Muscle power measurement through manual muscle testing indicated weakness in muscles, with 2 out of 5 in flexors of elbow, 2 minus out of 5 in extensors of the elbow joint, 2 out of 5 in forearms musculature, and 3 out of 5 in wrist muscles.

From the perspective of the patient's ability to carry out activities of daily living, the patient had problems with activities that involved lifting and carrying loads as well as repetitive motions of her arm which were necessary for her work. Functionally, the clinical case depicts a shift from a flail and painful elbow to a stable but less mobile joint due to total elbow arthroplasty.

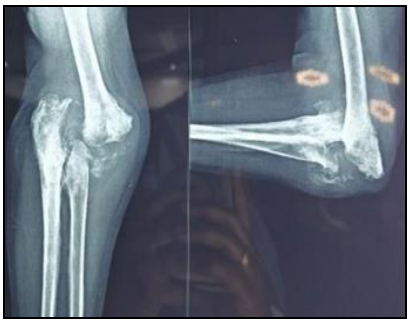


Fig 1: Pre-operative Elbow X-ray

Fig 2: Post-operative Elbow X-ray

Fig 3: Post-operative Elbow X-ray

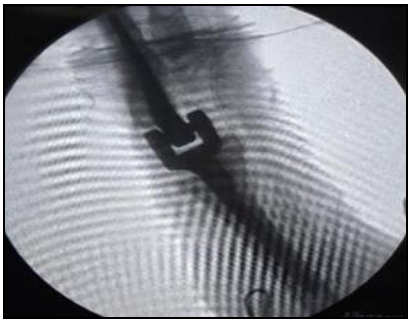


Fig 4: Post-operative Elbow X-ray

Materials and Methods

The patient/guardian has been provided with comprehensive information and consent has been obtained. The patient's identity has been suitably masked.

Physiotherapy Intervention

Pre-Rehabilitation-

- Instruct in application of ice and encourage use as much as tolerated within a 24-hour period for first week.
  If using ice packs, encourage to ice 20-30 minutes every 3-4 hours while awake.
- Instruct in home program of elbow flexion, extension, pronation and supination.
- Instruct in basic progression of rehabilitation program and expectations for time course to recovery.
- Arrange follow-up physical therapy appointment on 7th-10th day post-op to correspond with physician's post-operative evaluation.

Outpatient Phase 1: (Hospital Discharge To Week 2)

- Cryotherapy (15 mins/3 times/day)
- Effleurage
- Limb elevation (while sleeping at night/day)
- Active Range of motion exercises for wrist and fingers
- Shoulder Active range of motion exercises
- Gentle Active assisted range of motion Elbow Flexion exercise

Outpatient Phase 2: (Weeks 2-6) Early Mobilization Phase

- Scar tissue mobilization
- Instrument assisted Fascial Manipulation Technique (IAFMT)
- Isometrics for elbow (5seconds hold)
- Active Range of motion for Elbow Flexion
- Active Extension (Gravity assisted)
- Active assisted Supination and pronation
- Sensor based motion correction
- Biofeedback device
- Gentle grip Strengthening
- Continuous Passive Motion (30 reps)

Phase 3: (Strengthening Phase) (7-12 Weeks)

- Active ROM (Shoulder, Elbow, Wrist and fingers)
- Low level Laser therapy
- Strengthening for (Isotonic) Elbow Flexors and extensors
- Light Resistance Training
- Functional Training
- Active ROM Extension of Elbow With no resistance initially

Advanced Strengthening And Functional Phase (12-16 Weeks)

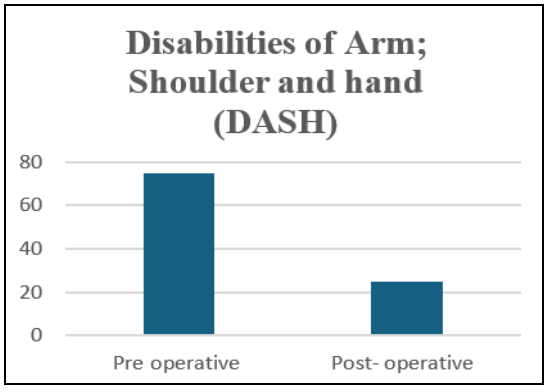
- Progressive resisted exercises
- Modified closed chain activities
- Task Specific training
- Proprioceptive training
- ADL and vocational training

Outcome Measures

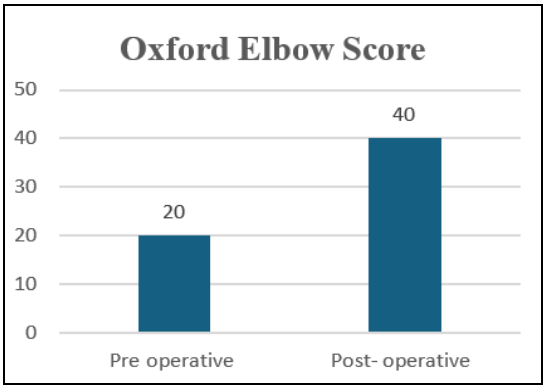
Sr. No.	Outcome measures	Pre-Operative	Post-Operative
1.	Disabilities of Arm; Shoulder and hand (DASH)	75 (Severe Disability)	25 (Mild disability)
2.	Oxford Elbow Score	20	40
3.	Mayo Elbow Performance Score	45 (Poor)	85 (Good)
4.	Michigan Hand Outcomes Questionnaire (MHQ)	35 (Poor hand Function)	75 (Good improvement) Functional
5.	Grip Strength Test	8 Kg	22 Kg
6.	Box and block test	25 blocks/min	52 blocks/min
7.	SF 36	40	75

	Range of Motion				
		Pre-Operative		Post-Operative	
A	Shoulder Joint	Right	Left (Affected)	Right	Left (Affected)
	Flexion	0-160	0-140	0-160	0-150
	Extension	0-60	0-40	0-60	0-50
	Abduction	0-180	0-160	0-180	0-150
	Adduction	180-0	160-0	180-0	150-0
	Internal Rotation	0-70	0-50	0-70	0-60
	External Rotation	0-80	0-50	0-90	0-60
B	Elbow Joint				
	Flexion	0-140	0-60	0-140	120
	Extension	0	-20 lag	0	0
	Supination	0-80	0-60	0-80	0-70
	Pronation	0-80	0-60	0-80	0-70
C	Wrist Joint				
	Flexion	0-80	0-60	0-80	0-70
	Extension	0-70	0-55	0-70	0-60
	Ulnar Deviation	0-30	0-25	0-30	0-30
	Radial Deviation	0-20	0-15	0-20	0-20
	MMT Grading According To MRC				
A	Shoulder Joint	Right	Left (Affected)	Right	Left (Affected)
	Flexors	Grade 5	Grade 3	Grade 5	Grade 4
	Extensors	Grade 5	Grade 3	Grade 5	Grade 4
	Abductors	Grade 5	Grade 3	Grade 5	Grade 4
	Adductors	Grade 5	Grade 3	Grade 5	Grade 4
	Internal Rotators	Grade 5	Grade 3	Grade 5	Grade 4
	External Rotators	Grade 5	Grade 3	Grade 5	Grade 4
B	Elbow Joint				
	Flexors	Grade 5	Grade 2	Grade 5	Grade 4
	Extensors	Grade 5	Grade -2	Grade 5	Grade -4
	Supinator's	Grade 5	Grade 2	Grade 5	Grade 4
	Pronators	Grade5	Grade 2	Grade 5	Grade 4
C	Wrist Joint				
	Flexors	Grade 5	Grade 3	Grade 5	Grade 4
	Extensors	Grade 5	Grade 3	Grade 5	Grade 4
	Ulnar deviators	Grade 5	Grade 3	Grade 5	Grade 4
	Radial Deviators	Grade 5	Grade 3	Grade 5	Grade 4

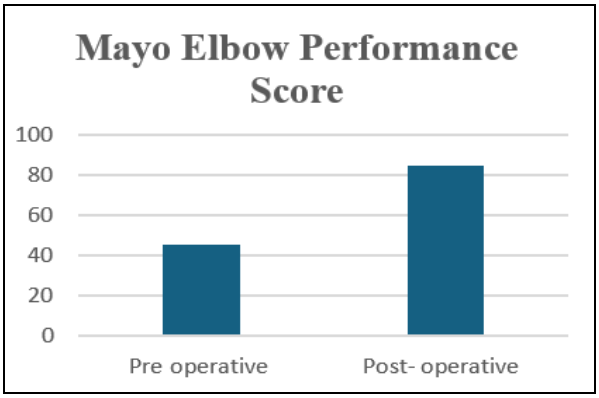
Results



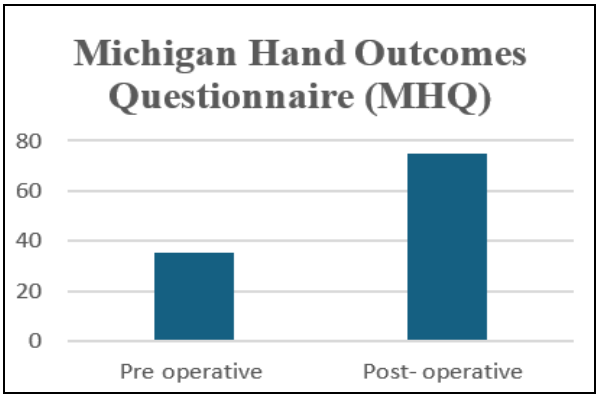
Graph 1: Pre-post operative DASH Score



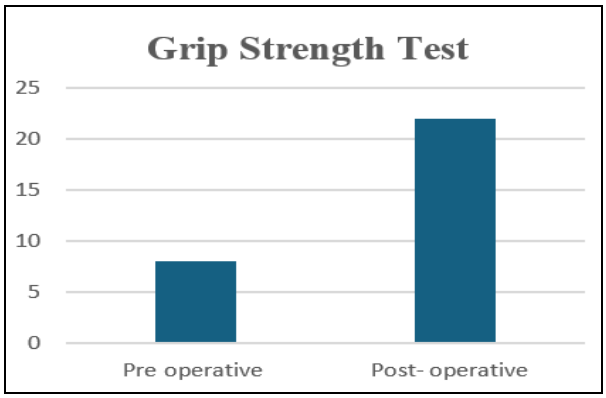
Graph 2: Pre-post operative Oxford Elbow Score



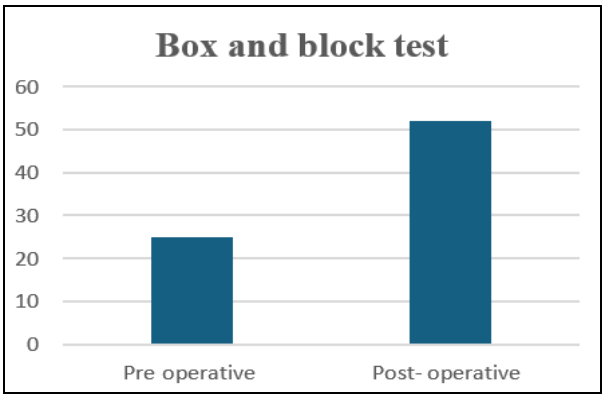
Graph 3: Pre-post operative Mayo Elbow Performance Score



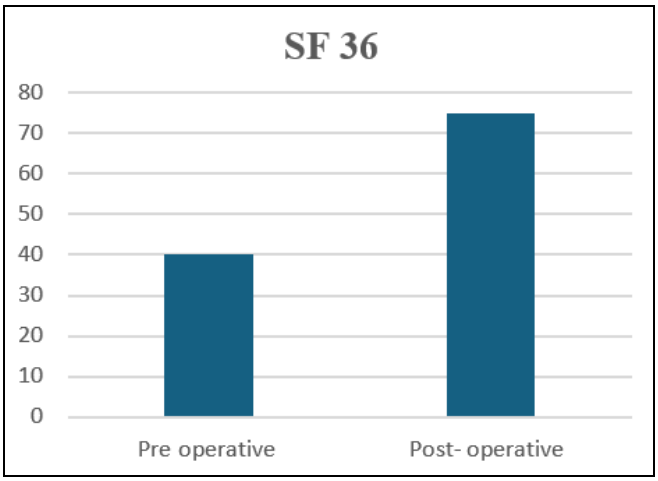
Graph 4: Pre-post MHQ Score



Graph 5: Pre-post operative Grip strength Score



Graph 6: Pre-post operative Box and block test score



Graph 7: Pre-post operative SF-36 score

Discussion

This particular case study shows the benefits of using an organized physiotherapy rehabilitation program after elbow surgery, with special emphasis on mobilization and functional improvement. Elbow stiffness is one of the most prevalent post-operative complications that result from fibrosis of the joint capsule, immobilization, and pain inhibition, which can have considerable effects on function if left untreated.

In this particular case, rehabilitation education and cryotherapy treatments were started immediately after surgery in order to manage pain and inflammation. Cryotherapy helps to decrease local metabolism and reduce swelling, thus promoting movement in patients and making them more compliant.

In Phase 1 (0-2 weeks), the primary objective was to protect the surgical repair and begin mobilizing. The active mobilization of the wrist, hand, and shoulder joints prevented stiffness in the neighboring joints and promoted blood circulation. Early active-assisted elbow flexion was also introduced, in line with research by O'Driscoll [16], which shows that early controlled mobilization prevents intra-articular adhesions and enhances ROM.

Phase 2 (2-6 weeks) involved progressing early mobilization with active and assisted ROM exercises, isometric strength training, and soft tissue manipulation. Scar tissue mobilization and IASTM were employed to prevent adhesion and increase tissue extensibility, backed by studies showing an increased ROM and decreased fibrosis [19] the inclusion of CPM is based on the research by Lindenhovius

et al. [17], which reveals that CPM may improve joint nutrition and reduce post-operative stiffness.

Other innovative techniques such as using motion correction sensors and biofeedback training were incorporated for accurate movement and neuromuscular control. Researchers have found out that biofeedback plays a vital role in promoting cortical reorganization and motor relearning process, thus helping patients recover much faster [20].

In the second phase (weeks 7 to 12), isotonic exercise regimen was used along with increasing resistance training. Resistance is necessary to strengthen muscles and joints without injuring the damaged areas. Furthermore, LLLT was also utilized as an additional therapy technique which has proven to be useful in reducing pain and inflammation [18].

During the more advanced stage of rehabilitation (12–16 weeks), the emphasis was placed on functional training, proprioception, and return to ADL. Based on the APTA guidelines, rehabilitation should proceed from treatment at the level of impairments to treatment at the level of activities and participation for better functional results [21]. Proprioception training and closed chain exercises will contribute significantly to joint stability and coordination of muscle activity.

As a result of this case report, one can note a significant improvement in pain, ROM, strength, and functional independence. This outcome corresponds with the current literature on the efficacy of structured elbow rehabilitation programs [14, 15] Successful treatment was achieved due to an early start of motion therapy, utilization of modalities, individualization of exercise prescription, and use of modern rehabilitation equipment.

Conclusion

The current case underscores the significance of adopting a "structured and phased physiotherapy regimen" post elbow surgery as an efficacious way to improve pain, movement, strength, and functional capacity. Early mobilization and gradual strength training, together with functional exercises, resulted in the best possible outcome. The strategy aligns with the standards set forth by the American Physical Therapy Association.

Acknowledgement

We thank the participant who contributed to the study.

Conflicts of Interest

None.

Disclosure

Authors have submitted an assurance that this piece of work presented here is true and original and has not in any form, either in whole or in part, been published previously.

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