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Case Report

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Functional Outcome in Upper Limb Burns: Dominant vs Non-dominant Hand: A Case Report

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Abstract

In cases of hand burns, early physiotherapy is essential to restore function and prevent long- term complications. The additional use of mobile devices to conventional therapy may improve outcomes. In this case report, a 14-year-old female patient with accidental flame burns over bilateral Upper limbs, torso, head and neck region; received treatment by the same doctor at the same place for her burns; demonstrated different outcomes for both upper limbs. Notable improvement was seen in range of motion in her dominant right hand compared to her left hand shows significant post burns clawing. Hand dominance may influence recovery, as the dominant hand is typically more engaged in daily tasks, providing continuous mobilization that can help prevent contractures. This case highlights the potential of high chances of recovery of the dominant hand compared to the opposite hand despite similar treatment and rehabilitation.

Keywords: Hand Burn, Functional Impairment, Hand Dominance, Mobile Use.

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Intrdouction

Burn injuries to the hand pose significant challenges due to the hand's intricate anatomy and its vital role in performing daily activities [1]. Such injuries frequently lead to functional impairment, scarring, and long-term disability and overall quality of life [1,3].

Rehabilitation is an integral part of management of hand burns. It helps in scar remodeling, prevents contractures and restore mobility and strength [1,2].

Recovery after upper limb trauma or burns is influenced not only by the extent of injury and the type of treatment provided but also by functional range of motion during daily activities. The dominant hand is habitually engaged in the majority of daily activities including feeding, writing, grooming, object manipulation and even in mobile phone usage. This constant use enforces natural stretching of soft tissues, promotes joint mobilization, and augments cortical and neuromuscular stimulation. In contrast, the non-dominant hand is relatively underutilized, predisposing it to stiffness and contracture formation when both are exposed to identical trauma.

In existing literature, the impact of hand dominance on recovery following bilateral, comparable upper limb burns has not been widely documented. This case highlights an unusual clinical observation: despite sustaining burns of similar depth and extent in both upper limbs and receiving identical surgical management and physiotherapy, the patient's dominant hand showed less functional impairment.

Material and Methods

A 14-year-old female sustained 44% total body surface area (TBSA) accidental flame burns involving the face, neck, torso, and bilateral upper limbs on 16 March 2025. She was admitted to a tertiary care hospital for management.

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Figure 1: Right Dominant hand

Figure 2: Left non dominant hand

Surgical Management

Initial management included fluid resuscitation, wound care, and infection control. On post- burn day 21, she underwent meshed skin grafting with interspersed allograft, avoiding placement of mesh or allograft over functional areas of the hands. Subsequently, she required multiple sessions of debridement and split-thickness autografting at intervals of 1 month 24 days; 2 months 18 days; and 4 months post-burn.

Figure 3: Comparison of both hands shows significant post burns clawing of non-dominant left hand while dominant right hand shows no functional impairment.

Figure 3: Comparison of both hands.

Postoperative Care and Rehabilitation

Postoperatively, bilateral upper limb splints were applied. By 2.5 months post-burn, wounds over both upper limbs had healed, splints were removed, and physiotherapy was initiated. As the patient lived in a remote area with limited access to physiotherapy services, she and her parents were instructed in home-based exercises, including active and passive range of motion (ROM) exercises and task-oriented activities such as writing, combing, self-feeding, and grasping objects. She also reported frequent use of a mobile phone, which contributed to continuous hand mobilization, particularly of the dominant hand.

Follow-up and Functional Assessment

At 6 months post-burn, the patient presented with a neck contracture and post-burn clawing of the left hand, while the right (dominant) hand demonstrated full range of motion. Despite identical surgical and rehabilitation protocols, differential recovery between hands was noted.

Functional Outcome Evaluation

To objectively assess recovery, quantitative outcome measures were recorded at 6 months post-burn. These included:

- Range of Motion (ROM): measured for wrist and finger joints using a goniometer.
- Grip Strength: measured using a Jamar hand dynamometer (in kilograms).
- DASH Score (Disabilities of Arm, Shoulder and Hand): used to assess upper-limb disability (score range 0–100; lower scores indicate better function).
- Michigan Hand Outcomes Questionnaire (MHQ): evaluated hand function, activities of daily living, pain, and satisfaction (score range 0–100; higher scores indicate better outcomes)

Table 1: Functional Outcome Measures at 6 Months Post-Burn

Outcome Measure	Dominant Hand (Right)	Non-Dominant Hand (Left)
Range of Motion (ROM)	90% of normal	65% of normal
Grip Strength (kg) Power	10kg	Not possible
Pinch	3.6 kg	1.16 kg
DASH Score	60.6	86
MHQ Score Total 57/100	13/50	44/50

Results

At 6 months post-burn, the patient demonstrated differential recovery between her upper limbs despite undergoing identical surgical and rehabilitation protocols. The dominant right hand achieved near-complete range of motion (90%), strong grip function (power grip 10 kg, pinch grip 3.6 kg), and better overall dexterity. In contrast, the non-dominant left hand developed post-burn clawing, limited joint mobility (65% of normal), and minimal functional grip.

Quantitatively, the DASH score was 60.6 for the right hand and 86 for the left, while MHQ scores were 57/100 and 13/50 + 44/50, respectively, confirming superior functional outcomes on the dominant side.

These findings indicate that the dominant hand exhibited faster and more complete recovery, likely aided by continuous daily use and self-directed mobilization, even in the absence of supervised physiotherapy.

Discussion

Burn injuries to the upper limb are recognized as a major cause of long-term morbidity, due to the essential role of the hands in performing activities of daily living. Several studies have emphasized that early initiation of physiotherapy facilitates recovery of hand mobility and reduces the severity of post-burn deformities [6, 9].

In the present case, despite identical surgical and rehabilitation interventions, the patient developed more functional impairment in the non-dominant left hand, whereas the (dominant right hand) achieved a near-complete range of motion. This observation highlights the role of habitual use and hand dominance in recovery. Evidence supports that functional outcomes are influenced by dominance, as the dominant limb is more frequently used in daily activities and possesses greater cortical representation [2,4,5,10-13].

In contrast, the non-dominant hand, with less functional use, is more prone to stiffness and contracture development if not actively exercised.

Table 2: Muscles Engaged During Functional Activities

Activity	Primary Muscles Engaged	Functional Role in Rehabilitation
Glass holding	Flexor digitorum superficialis & profundus, lumbricals, flexor pollicis longus, forearm stabilizers	Maintains grip strength and tendon gliding
Combing hair	Shoulder abductors, biceps, wrist extensors, extensor digitorum, intrinsic hand muscles	Promotes overhead movement, prevents stiffness, improves reach, Key pinch
Feeding	Flexor pollicis longus, thenar muscles, flexor digitorum, wrist extensors	Enhances thumb opposition and coordination for utensil use
Writing	Flexor pollicis brevis, first dorsal interossei, lumbricals, wrist stabilizers	Improves fine motor precision, intrinsic muscle balance
Mobile phone usage	Adductor pollicis, Flexor pollicis longus, Thenar muscles, Interosseous, Lumbricals, Long flexors	Intrinsic muscle balance, Thumb movement, long flexor action

Neuroplasticity, Cross-Education, and Physiological Mechanisms

The better recovery of the dominant hand can be explained by how the brain learns through use. When we repeatedly use one hand, the brain areas controlling that hand become stronger and more active [7,8].

This brain activity can even help the other hand through connected nerve pathways -a process called the cross-education effect.

In burn rehabilitation, daily tasks like eating, writing, and using a mobile phone act as a kind of natural therapy for the dominant hand. This helps keep the joints flexible, muscles active, and brain-hand connections strong. The non-dominant hand, if used less, does not get the same benefits and becomes more likely to develop stiffness and contracture.

Using both hands actively helps maintain muscle strength, prevent tightness, and support brain recovery. Encouraging patients to involve both hands in daily activities can therefore lead to more balanced and long-lasting improvement after upper-limb burns [14-16].

Rehabilitation programs may include simulated dominant-hand tasks for the non-dominant side. Wearable sensors or mobile-based hand exercise apps may encourage bilateral activity.

Quantitative measures such as ROM, grip strength, DASH, and MHQ scores supported the observation that the dominant hand achieved better functional recovery despite similar burn severity and rehabilitation.

Conclusion

This report shows that apart from surgical interventions and structured physiotherapy, there is a potential protective role of habitual functional use of the dominant hand in post-burn recovery. Better recovery of dominant hand compared to non-dominant hand despite equivalent treatment suggests that natural activity patterns may serve as a form of continuous, self-driven rehabilitation. These observations emphasize the need for rehabilitation programs that promote active and equal engagement of both hands. We need to document results in case series with this perspective in comparison of dominant vs non-dominant hand to establish that dominant hand has less chances of functional impairment.

Source of Support

Nil

Presentation at a Meeting

Nil

Conflict of Interest

Nil

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