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Case Report

Physiotherapy Section

Integral Role of Physiotherapy Approach in Regaining Function following an Electrical Burn: A Case Report

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ABSTRACT

Electrical injuries frequently result in serious long-term problems because of their high rates of morbidity despite low death rates. Electrical injuries are when high-energy current travels through the body due to contact with an electrical source. A 45-year-old male electrician who, while troubleshooting a malfunctioning circuit, suffered a severe electrical burn to his right elbow. He was conservatively managed at a local hospital for a month following his injury, but after that, he needed additional care due to an ulcer over his anterolateral elbow joint. A clinical evaluation found a deep partial-thickness burn that covered 3.5% of his body's surface. The burn was associated with skin pigmentation, ulceration, and redness. On the Numerical Pain Rating Scale (NPRS) patient-reported a score of 6/10 during activity and 3/10 at rest. Considering the extent of the burn and the emergence of problems, a thorough physiotherapy program was started to address joint mobility, control discomfort, and promote healing. The outcome measures were used to evaluate patients' recovery before and after rehabilitation. A robust therapeutic regimen was planned, including reducing oedema and pain, improving joint mobility, preventing further contracture, enhancing strength and flexibility, quality of life, and managing depression. To enhance both physical and psychological outcomes, this case emphasises the significance of early and ongoing physiotherapy in rehabilitating electrical burn injuries. It also illustrates the necessity of a multidisciplinary approach.

Keywords: Benson's relaxation, Depression, Range of motion, Muscle energy technique

CASE REPORT

A 45-year-old male, electrician by profession, reported to the surgery Outpatient Department (OPD) with a history of electrical burns over his right elbow region, which he acquired four months back while working on a faulty circuit he accidentally came into contact with live wires resulting in an electric burn. He fell on the ground but at that time he was conscious, and developed a burn over his right elbow region and an injury on the forehead. Then nearby people took him to a local hospital where a dressing was done and the burn was managed conservatively. Presently, the patient complained about the formation of an ulcer over an anterolateral elbow joint, difficulty in performing elbow, wrist, and finger Range Of Motion (ROM), pain, and oedema over the wrist joint for one month. To reduce pain and oedema and to improve ROM the patient was advised for physiotherapy rehabilitation of the wrist and elbow joint.

Clinical Findings

Before the evaluation, consent was obtained from the patient, and the patient was observed in a seated position with right and left shoulders at the same level and his right and left forearm relaxed on his thighs. A burn injury on the right forearm was noted. skin discolouration was present, with grade three tenderness being present according to the tenderness grading scale [1] and redness. There was also oedema around the fingers and right wrist joint. Wallace rule of nine [2] was used to calculate the percentage of total body surface area burned. The patient had a 3.5% burn, a deep partial thickness burn of second degree, involving dermal injury in addition to epidermal damage. The patient had an ulcer, redness, tenderness, and formation of healthy granulation tissue over the anterolateral elbow joint with no discharge. Skin discolouration, local rise in temperature demarcation seen over the forearm region, and oedema over the wrist joint [Table/Fig-1].

Investigations

Blood culture showed *Klebsiella pneumoniae* and pseudomonas growth, which are prevalent organisms in burn sites that might impede healing. In pathology laboratory investigations like Complete Blood Count (CBC), electrolytes, creatine phosphokinase, and urine analysis were normal.

[Table/Fig-1]: Presentation of the patient's burn area.

Physiotherapy Assessment

Physiotherapy assessments, such as ROM, manual muscle testing, pain, and quality of life [3], were also conducted.

The patient was asked to rate the severity of pain using the NPRS [4], resulting in a score of 8/10 during activity and 4/10 at rest [Table/Fig-2]. Manual muscle testing [5] was performed for the elbow joint, wrist joint, and fingers to assess muscle.

ROM assessment was impossible as the patient could not perform elbow movement due to flexion contracture in the elbow joint. There was difficulty performing wrist joint flexion and extension due to oedema. Not able to perform Distal Interphalangeal (DIP), Metacarpophalangeal (MIP), and Proximal Interphalangeal (PIP) flexion and extension Also, inability to pronate and supinate the forearm.

Physiotherapy Intervention Following Electrical Burn		
Goals	**Intervention**	**Description/ Procedure**
Patient counselling and educating the patient and his relatives	-	The patient was given a comprehensive explanation of his illness as well as the value and benefits of physical therapy. Additionally, it was made clear to him and his family how the therapy would avoid problems and reduce pain, improve Range Of Motion (ROM), and improve quality of life
To reduce oedema	Early mobilisation compression and elevation. promoting early movement and exercise helps reduce oedema and improves circulation.	**Compression and elevation:** Compression bandaging of Figure of 8, along with raising the affected extremity above the level of the heart, can assist decrease fluid retention and encourage venous return.
To reduce pain	Early mobilisation minimising stiffness and increasing blood flow gentle exercises and early movement can assist in maintaining joint function and reduce pain.	Passive Range of Motion (PROM) Exercises Repeat 10-15 times within a pain-free range.
To prevent further contracture of the elbow joint and maintain elasticity	ROM exercise and stretching	Passive ROM exercise (10 repetitions x1 set) thrice a day for eight days, which was followed by AAROM exercises (10 repetitions x 1 set) twice a day for 6 days and which was followed by AROM exercises initiated (10 repetitions x1 set) Stretching was given from 1st week of three reps with a 5-seconds hold followed by a 10-seconds hold
To improve the ROM of the wrist joint, elbow joint, and MIP PIP and DIP joint	Muscle Energy Technique (METs) [6] and dynamic cock-up splint for wrist joint	the use of the METs. While the patient performs an isometric contraction at the Metacarpophalangeal (MIP) joints, the therapist stabilises the proximal and Distal Interphalangeal (DIP) joints. For maximum lengthening effect, the contraction is sustained for two to three seconds and then repeated three to five times. For eight days, twice a day [Table/Fig-3]. The affected muscle is placed in a mid-range position. The patient pushes towards the restriction/barrier whereas the therapist completely resists this effort (isometric) or allows a movement towards it (isotonic). This is followed by relaxation of the patient along with exhalation, and the therapist applies a passive stretch to the new barrier. The procedure is repeated between three to five times and five times more Splinting using a dynamic cockup splint was given for three weeks [Table/Fig-4]
To reduce depression and anxiety	Bensons Relaxation [7]	The patient is positioned in a state of ease and relaxation. The eyes are slowly closed. Calmness is maintained as every muscle in the body is gradually and slowly relaxed, from the feet to the face. Breathing is done through the nose, with awareness focused on the breath. The air is exhaled slowly through the mouth, and the number "one" is muttered as comfortable, normal breathing continues. This breathing pattern is maintained for 15 minutes while the muscles are relaxed. The eyes are then slowly opened, and the patient remains lying down for a few minutes. This procedure is repeated twice a day for 4 weeks.
To improve quality of life	Preparing the right hand for daily tasks including eating, drinking, grasping, and grooming as the patient was not able to perform activities of daily living	The patient is instructed to use the involved extremity in daily tasks after two to three weeks onwards.

Outcomes	Pre-treatment	Post-treatment after six weeks
Burn-depression checklist [8]	45- moderate depression	7- normal but not happy
Numerical pain rating scale [4]	8/10	4/10
Quality of life [3]	Moderately affected	Mild affected

[Table/Fig-2]: Outcomes measures like Burn depression checklist, numerical pain rating scale, S and Quality of life were taken.

[Table/Fig-3]: Muscle Energy Technique (METs) for elbow joint.

Physiotherapy Management

Early physiotherapy rehabilitation was started, as starting physiotherapy as soon as a burn patient is admitted offers several advantages and is essential to their early functional recovery

Home Exercise Program

The patient was instructed to carry out range-of-motion activities, such as active finger movements and range-of-motion exercises for the elbow, wrist, and fingers. Additionally, self-stretches that he can perform on a daily basis can be taught to the patient.

Manual Muscle Testing

According to Kendal, Manual muscle testing the strength of the muscles for the following muscle groups as shown in [Table/Fig-4,5] [5].

[Table/Fig-4]: Splinting with dynamic cockup splint.

Group of muscles	Pre-treatment (on the day of assessment)	Post-treatment (after three weeks)	After six weeks
Elbow flexors	2-	2+	3+
Elbow extensors	2-	3	3+
Wrist flexors	2-	2	3+
Wrist extensors	1	2+	3-
Finger flexors	1	2	3+
Finger extensors	1	3	3+

[Table/Fig-5]: Manual muscle testing according to patient condition [5].

DISCUSSION

Electrical injuries are distinct due to their high prevalence of acute and chronic morbidities. Despite low fatality rates, these injuries can result in severe long-term disabilities [9]. Electrical injuries, though rare, account for between 0.04% and 5% of admissions to burn units in developed countries and up to 27% in impoverished regions. Males, particularly those working in industrial jobs, are more commonly affected, with these injuries ranking fourth in traumatic work-related deaths [10]. High-voltage electrical injuries though less frequent, have a higher mortality rate and contribute to occupational deaths. The effects of high-voltage burns can include septicaemia, increased toxicity, and myoglobin release into the bloodstream, which can lead to life-threatening complications [11]. The damage caused by electrical burns results from both the electrical current and the heat produced as it flows through tissues. Coagulative necrosis and cell membrane rupture are the primary mechanisms of injury. Tissues such as bones and fat offer more resistance, while nerves and arteries offer less, making them more susceptible to damage [12]. The severity of injury also depends on factors such as voltage strength, individual sensitivity, and the care provided immediately after the injury [13]. Hypertrophic scarring is a common complication, with up to 77% of burn survivors developing this condition. These scars are often associated with functional limitations, including restricted joint mobility and pain [14]. Early splinting and positioning play a vital role in preventing contractures by maintaining tissue length and preventing ROM loss [15]. In low- and middle-income countries, burn injuries contribute significantly to lost Disability-Adjusted Life Years (DALYs), as reintegration into society can be challenging for burn survivors [16]. Early functional rehabilitation, including physiotherapy, is crucial in improving both physical and psychological outcomes for these patients. A multidisciplinary approach, including physiotherapy, should be initiated as soon as the patient is admitted to optimise recovery [17]. A case study involving a 45-year-old electrician with partial-thickness electrical burns to 3.5% of the body surface area illustrates these principles. The burn affected the right elbow and forearm, resulting in pain, decreased ROM, muscle weakness, and oedema. Infections with Pseudomonas and Klebsiella pneumoniae further complicated the recovery process [18]. Physiotherapy management focused on pain relief, reducing oedema, and preventing contractures, through techniques such as early mobilisation, compression, and ROM exercises. METs and dynamic cock-up splinting were also used to improve joint flexibility and strength. Elbow stiffness is a significant impairment in burn patients, and METs are effective in addressing limited ROM. In this case, stretching techniques were more beneficial than ROM exercises in preventing post-burn contractures. After therapy, the patient showed considerable improvements in manual muscle testing scores, pain levels, and psychological well-being. The use of Benson's relaxation technique, a non-pharmacological intervention, also contributed to reducing anxiety and depression, highlighting the importance of mental health in burn recovery. This case underscores the importance of a multidisciplinary approach, including physiotherapy, to ensure optimal functional recovery in burn patients.

CONCLUSION(S)

The present case highlights the crucial role of early and comprehensive physiotherapy in rehabilitation as well as the serious consequences of electrical burns. Improved joint mobility and general function resulted from the systematic physiotherapy regimen's successful pain management, oedema reduction, and contracture prevention. To get the best possible healing results, a multidisciplinary approach and patient education were necessary. This specific case highlights the significance of prompt intervention and tailored physical therapy in promoting both physical and psychological rehabilitation, thereby enhancing the patient's quality of life following an electrical burn injury.

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