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Significant Improvement in Sensory Nerve Function with Electroacupuncture in Diabetic Peripheral Neuropathy: A Case Report

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ABSTRACT

Introduction: Diabetic Peripheral Neuropathy (DPN) is a common and debilitating complication of diabetes mellitus, characterized by sensory deficits and increased risk of foot ulcers. Conventional treatments often focus on glycemic control and symptom management but do not reverse nerve damage.

Objective: To evaluate the effectiveness of electroacupuncture as a complementary therapy for improving sensory nerve function in DPN.

Case Presentation: A 56-year-old male with a 6-year history of type 2 diabetes mellitus and recently diagnosed DPN presented with numbness in the soles. His HbA1c was 8.5%, with fasting blood sugar at 189 mg/dL. He underwent 12 sessions of electroacupuncture over 12 days, targeting points traditionally associated with nerve function and circulation.

Intervention: Electroacupuncture was applied to specific points, including St44, GB41, UB60, St36, K2, K3, Sp6, and Sp9.

Results: Post-treatment, the patient exhibited marked improvement in protective sensation, vibration perception, and hot and cold stimuli perception. These findings suggest enhanced sensory nerve function and potential nerve regeneration.

Conclusion: This case report indicates that electroacupuncture may be an effective adjunctive treatment for DPN, improving sensory function. Further research is needed to validate these findings and assess long-term benefits. Integrating electroacupuncture into standard diabetes care may offer a holistic approach to managing DPN.

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Introduction

Diabetes comprises a range of metabolic disorders marked by elevated blood glucose levels due to issues with insulin production, insulin effectiveness, or both. Persistent high blood sugar in diabetes can lead to long-term damage, dysfunction, and failure of various organs, notably affecting the eyes, kidneys, nerves, heart, and blood vessels [1,2]. Marked hyperglycemia symptoms include frequent urination, excessive thirst, weight loss, sometimes increased hunger, and blurred vision. Chronic hyperglycemia can also cause impaired growth and increased infection risk. Acute complications of uncontrolled diabetes include ketoacidosis and nonketotic hyperosmolar syndrome [2]. Diabetes mellitus is rapidly increasing globally, including in developing countries like India. Neuropathic complications are common, with 8%-45% of people with type 2 diabetes mellitus (T2DM) affected. Chronic diabetic peripheral sensorimotor neuropathy (DPN) is the most common, impacting up to 50% of diabetics. DPN can lead to severe outcomes like diabetic foot ulcers, neuropathic pain, lower limb amputation, and death. Painful DPN affects up to half of those with the condition, with diabetes duration and glycemic control

being major risk factors [3]. Diabetic Peripheral Neuropathy is a significant complication of chronic, poorly managed diabetes mellitus. It encompasses a range of disorders impacting the nervous system, which can manifest as pain, numbness, loss of sensation, or altered sensations such as allodynia [4]. The World Health Organization (WHO) global report indicates that 422 million adults are living with diabetes worldwide, with the Southeast Asian Region (SEAR) accounting for 96 million cases. In India, the prevalence of high blood sugar levels among men is 8.8% in urban areas and 7.4% in rural areas. For women, the rates are 6.9% and 5.2% in urban and rural areas, respectively. Diabetes and its complications have a substantial impact on both the economic burden and quality of life for affected individuals [5]. Diabetic peripheral neuropathy (DPN) affects more than 50% of individuals with diabetes over their lifetime, with 15%–25% experiencing neuropathic pain, termed "painful DPN." Managing this painful condition is essential because it can severely impact the quality of life, causing issues such as sleep disturbances, anxiety, and depression[6]. The primary approach to managing painful diabetic peripheral neuropathy (DPN) involves controlling hyperglycemia and other modifiable risk factors, though these measures alone may not be sufficient to prevent or improve the condition. Since there are no effective disease-modifying medications for DPN, the focus shifts to managing the pain itself. Treatments for neuropathic pain in painful DPN include gabapentinoids, serotonin-norepinephrine reuptake inhibitors, tricyclic antidepressants, alpha-lipoic acid, sodium channel blockers, and topical capsaicin [6]. The FDA has approved pregabalin, duloxetine, tapentadol, and the 8% capsaicin patch for treating painful diabetic peripheral neuropathy (DPN). Recently, the FDA also approved spinal cord stimulation with electrical stimulation for this condition[6]. Pharmacological treatments for hypesthesia are lacking, as current symptomatic therapies only target additional symptoms like pain or tingling. In this context, anticonvulsants and antidepressants are typically used [7]. Neuropathic pain results from changes in the somatosensory system, which includes several neural pathways that transmit sensory information from the skin, muscles, tendons, and internal organs to the central nervous system and, ultimately, to conscious perception [8]. The somatosensory system mediates the sensation of de qi during acupuncture and is crucial to its pain relief effects. Aβ, Aδ, and C fibers are key in transmitting acupuncture signals. Additionally, acupuncture influences the brain and spinal cord to relieve pain. As a non-invasive nerve stimulation method, acupuncture is an effective treatment for neuropathic pain with minimal adverse effects [8]. In electroacupuncture (EA), an electrical stimulator delivers current to acupoints through needles. The therapeutic effects of EA depend on the stimulation's frequency, current amplitude, and pulse width. Electroacupuncture (EA) offers more consistent stimulation and may be significantly more effective than manual acupuncture (MA) in providing continuous stimulation and reducing response times [8]. Conventional treatments for diabetic peripheral neuropathy (DPN), including medications and glycemic control, often fall short in addressing complex pain and sensory issues. Drugs like gabapentinoids and serotonin-norepinephrine reuptake inhibitors may provide partial relief but do not alter disease progression and can have limited efficacy or side effects. Electroacupuncture (EA) offers a promising complementary approach by non-invasively stimulating the somatosensory system and central nervous pathways. Evaluating how EA can enhance or complement existing treatments may improve outcomes for patients with painful DPN.

Case Presentation

A 56-year-old male patient presented to the outpatient department of the International Institute of Yoga and Naturopathy Medical Sciences, Chengalpattu, on June 23, 2024, with a primary complaint of numbness in the soles of both feet. The numbness had progressively worsened over time, leading to discomfort during daily activities. The patient sought treatment due to the impact of these symptoms on his quality of life.

Medical History

The patient has a history of type 2 diabetes mellitus for the past 6 years, with his most recent HbA1C recorded at 8.5%. His fasting blood sugar was 189 mg/dL, and postprandial blood sugar was 258 mg/dL. Additionally, the patient had a history of hypertension for 5 years, for which he was on medication. He was not on any specific treatment for diabetic peripheral neuropathy before this presentation.

Diagnosis

Upon clinical examination and screening for sensory nerve functions, the patient was found to have significantly altered sensations in several areas of the sole. The tests conducted included

- Protective Sensation (Monofilament test) – 10gm, 25gm, 50gm Monofilaments used
- Vibration Perception Threshold (VPT) [9,10]
- Hot and Cold Perception Threshold (HPT & CPT) using a Biothesiometer (Neuro Touch) [10]

The results indicated diminished protective sensation and impaired perception of vibration, heat, and cold, confirming the diagnosis of Diabetic Peripheral Neuropathy (DPN).

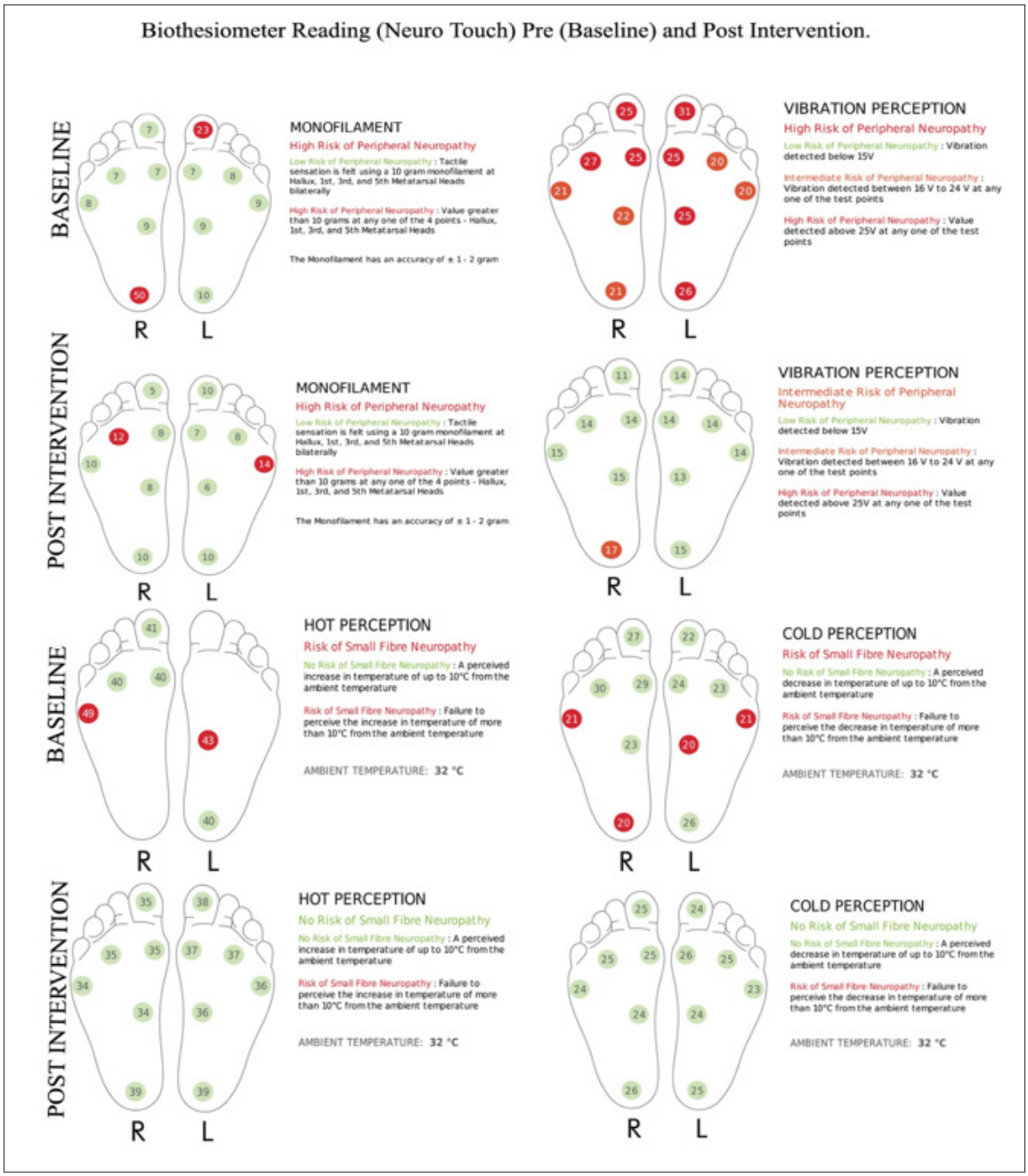

Figure 1: Biothesiometer Reading (Neuro Touch) Pre (Baseline) and Post Intervention

Table 1

Sl. No.	Sensory Components	Baseline (Pre)	Post-Intervention
1	Protective Sensation (Monofilament test)	12.833 ± 2.5	9.00 ± 2.523
2	Vibration Perception Threshold (VPT)	24.00 ± 303	14.167 ± 1.403
3	Hot Perception Threshold (HPT)	42.333 ± 2.774	36.250 ± 1.765
4	Cold Perception Threshold (CPT)	23.833 ± 3.433	24.667 ± 0.888

Intervention

The patient was treated with electroacupuncture over 12 days, with sessions conducted on alternate days. The acupuncture points selected for treatment were: St44 (Yingxiang), GB41 (Foot Governor of Tears), UB60 (Kunlun), St36 (Zusanli), K2 (Rangu), K3 (Taixi), Sp6 (Sanyinjiao), Sp9 (Yinlingquan). These points were chosen for their traditional association with improving nerve function, circulation, and overall health in the lower extremities.

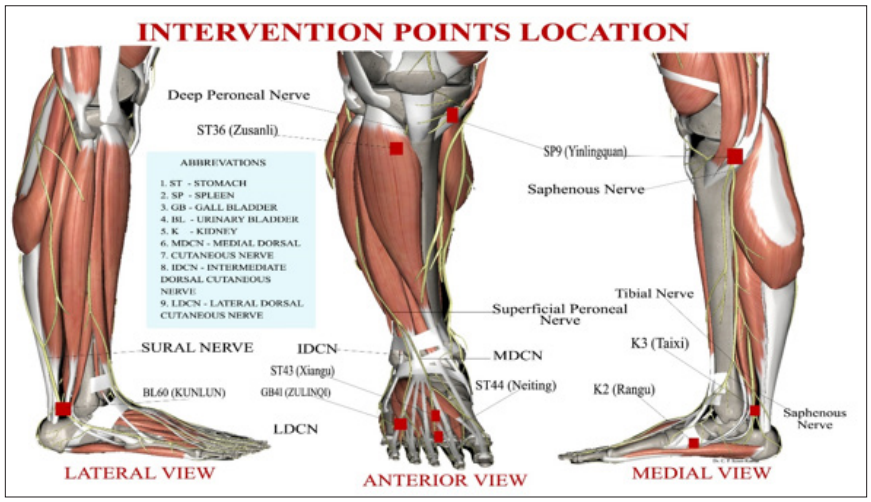

Figure 2: Intervention Points Location

Results

After 12 sessions of electroacupuncture, the patient showed marked improvement in sensory nerve functions. Follow-up testing indicated

- Monofilament Test: Improved protective sensation in both soles.
- VPT: Decreased vibration perception threshold, indicating better nerve conduction.
- • HPT & CPT: Improved perception of both hot and cold stimuli, reflecting enhanced sensory function.

These results suggest that electroacupuncture significantly improved the patient's sensory nerve functions.

Discussion

Diabetic Peripheral Neuropathy (DPN) is a common and debilitating complication of diabetes mellitus, often leading to sensory loss and an increased risk of foot ulcers and infections. Standard treatment approaches for DPN typically focus on glycemic control and symptom management but often fail to reverse nerve damage [11].

In this case, electroacupuncture was used as a complementary therapy to address the sensory deficits associated with DPN. The selected acupuncture points are traditionally recognized for their ability to enhance nerve function and improve blood circulation, both of which are critical in managing diabetes-related complications.

The improvement in the patient's sensory functions following electroacupuncture aligns with the hypothesis that this treatment modality may enhance nerve conduction and promote nerve regeneration. The mechanisms underlying these benefits may include increased microcirculation, modulation of neuropeptide release, and improved metabolic control, all of which contribute to nerve repair and regeneration.

Conclusion

This case report highlights the potential of electroacupuncture as an adjunctive treatment for Diabetic Peripheral Neuropathy. The significant improvements observed in the patient's sensory functions suggest that electroacupuncture may play a valuable role in managing DPN. However, further research, including randomized controlled trials, is necessary to establish the efficacy and long-term benefits of this treatment modality. Integrating electroacupuncture with conventional diabetes care could offer a more holistic approach to managing the complications of diabetes.

Conflict of Interest Statement: The authors declare no conflicts of interest and received no financial support for this study.

Patient Consent: The patient provided written informed consent for participation in this study and the publication of their case details.

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References

1. What is diabetes (2024) International Diabetics Federation. Available from: https://idf.org/about-diabetes/what-is-diabetes/.
2. American Diabetes Association (2014) Diagnosis and classification of diabetes mellitus. Diabetes Care 37: 81-90.
3. Jugal KS (2021) RJMS Article 2. RJMS 11: 85-91.
4. Cho E, Kim W (2021) Effect of acupuncture on diabetic neuropathy: A narrative review. International Journal of Molecular Sciences 22: 8575.
5. Mathiyalagen P, Kanagasabapathy S, Kadar Z, Rajagopal A, Vasudevan K (2021) Prevalence and Determinants of Peripheral Neuropathy Among Adult Type II Diabetes Mellitus Patients Attending a Non-communicable Disease Clinic in Rural South India. Cureus 13: e15493.
6. Jang HN, Oh TJ (2023) Pharmacological and Nonpharmacological Treatments for Painful Diabetic Peripheral Neuropathy. Diabetes and Metabolism Journal. Korean Diabetes Association 47: 743-756.
7. Hoerder S, Habermann IV, Hahn K, Meyer-Hamme G, Ortiz M, et al. (2023) Acupuncture in diabetic peripheral neuropathy-neurological outcomes of the randomized acupuncture in diabetic peripheral neuropathy trial. World J Diabetes 14: 1813-1823.
8. Ma X, Chen W, Yang NN, Wang L, Hao XW, et al. (2022) Potential mechanisms of acupuncture for neuropathic pain based on somatosensory system. Frontiers in Neuroscience. Frontiers Media 16: 940343.

9. Medakkel AA, Sheela P (2018) Vibration perception threshold values and clinical symptoms of diabetic peripheral neuropathy. Journal of Clinical and Diagnostic Research 12: 5-8.
10. Riddhi D, Jebasingh F, Thomas N, KN M, Sharma S, et al. (2022) Neuro Touch: A novel digital device for assessment and screening of peripheral neuropathy. Foot 51: 101888.
11. Shahana Shermin, Aysha Noor, Samsad Jahan (2019) Polycystic Ovary Syndrome: A Brief Review with Recent Updates. Delta Med Col J 7: 84-99.