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Effect of IFT and TENS on Patient with Non-Specific Low Back Pain. A Comparative Study

Dr. Md. Ahamedur Reza[1*], Dr. Shohel Ahmed[2], Dr. Reehum Haque[3], Dr. Rajee Mahmud Talukder[4], Chiranjeeb Biswas[5]

[1]Assistant Professor, Department of Physical Medicine, Medical College for Women and Hospital, Uttara, Dhaka, Bangladesh
[2]Consultant (Physical Medicine & Rehabilitation), Brac Healthcare limited, Uttara Center, Dhaka, Bangladesh
[3]Assistant Professor, Department of Internal Medicine Medical College for Women and Hospital, Uttara, Dhaka, Bangladesh
[4]Associate Professor, Department of Medicine, Medical College for Women & Hospital, Dhaka, Bangladesh
[5]Associate Professor and Head, Department of Psychiatry, Medical College for Women & Hospital, Dhaka, Bangladesh

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***Corresponding author:** Dr. Md. Ahamedur Reza
Assistant Professor, Physical Medicine department, Medical College for Women and Hospital, Uttara, Dhaka, Bangladesh

Abstract **Original Research Article**

Background: Non-specific low back pain (NSLBP) is a major public health concern with significant socioeconomic impact. Among various non-invasive management options, Interferential Therapy (IFT) and Transcutaneous Electrical Nerve Stimulation (TENS) are frequently employed electrotherapeutic interventions, though their comparative efficacy remains underexplored. ***Aim of the study:*** To compare the effectiveness of IFT and TENS in reducing pain and improving functional outcomes in patients with NSLBP. ***Methods:*** This prospective observational study included 50 NSLBP patients, randomized into two groups: Group A (IFT) and Group B (TENS), each with 25 participants. Pain intensity (VAS), disability (ODI), lumbar flexion range, and patient satisfaction were evaluated before and after 4 weeks of treatment. ***Result:*** Both groups showed significant improvement, but IFT demonstrated superior outcomes. Post-treatment VAS scores were significantly lower in Group A (2.8 ± 1.1) than Group B (3.6 ± 1.3) (p=0.02). Similarly, ODI and lumbar flexion improved more in Group A (p=0.006 and p=0.02, respectively). Patient satisfaction was also higher in the IFT group. ***Conclusion:*** IFT is more effective than TENS in reducing pain, enhancing mobility, and improving functional status in NSLBP patients. It also yields greater patient satisfaction, supporting its preferential use in clinical practice.

Keywords: Interferential Therapy, TENS, Non-specific Low Back Pain, Pain Management, Electrotherapy.

INTRODUCTION

Non-specific low back pain (NSLBP) is a prevalent musculoskeletal condition that affects individuals of all ages and is characterized by pain and discomfort in the lower back region without a clearly identifiable underlying pathology [1]. It is one of the leading causes of disability worldwide, significantly affecting quality of life and imposing a substantial socioeconomic burden [2]. According to the Global Burden of Disease Study 2017, low back pain affects nearly 377.5 million people globally, making it the most common cause of years lived with disability (YLDs) [3]. In Bangladesh, the prevalence of low back pain is also concerning, with studies reporting a rate of approximately 36.6% among adults, particularly those engaged in physically demanding occupations [4]. Etiology of Non-specific low back pain is multifactorial and includes biomechanical, postural, psychological, and occupational factors [5]. Factors such as prolonged sitting, improper lifting techniques, sedentary lifestyle, and stress contribute to the persistence and recurrence of NSLBP symptoms. Patients often experience chronic or episodic symptoms that significantly limit functional capacity, reduce productivity, increase healthcare visits, and result in long-term disability if not properly managed [6]. Given the non-specific nature of this condition, treatment strategies vary and often include pharmacologic therapy, physical modalities, manual therapy, exercise interventions, ergonomic training, cognitive-behavioral therapy, and lifestyle modifications [7]. Among non-pharmacologic and non-invasive approaches, Interferential Therapy (IFT) and Transcutaneous Electrical Nerve Stimulation (TENS) are two commonly administered electrotherapy modalities in physiotherapy settings for the alleviation of pain and muscle dysfunction associated with NSLBP [8]. TENS works by delivering low-frequency electrical impulses to peripheral nerves, helping to modulate pain perception by stimulating large-diameter afferent fibers based on the gate control theory [9]. In contrast, IFT applies medium-frequency currents that intersect within body tissues to produce a therapeutic low-frequency current at greater depths, thereby facilitating deeper tissue stimulation with comparatively reduced discomfort [10]. Several clinical trials and systematic reviews have explored the role of these modalities in reducing pain intensity, increasing range of motion, and enhancing overall functional capacity in patients with NSLBP [11]. However, the comparative effectiveness of IFT versus TENS remains a subject of debate. Some studies report superior outcomes with IFT due to its deeper tissue penetration and sustained analgesic effects, while others advocate for TENS, citing its affordability, safety, and ease of home use as key advantages [12]. This research is therefore vital in generating updated, evidence-based insights into the relative efficacy of IFT and TENS in treating NSLBP, especially in low-resource settings like Bangladesh where cost-effective, non-pharmacological interventions are of critical importance [13]. The study will also contribute to refining treatment guidelines and informing clinicians in selecting optimal electrotherapy modalities tailored to individual patient profiles [14]. The aim of this study is to compare the effectiveness of IFT and TENS in reducing pain intensity and improving functional outcomes in patients with non-specific low back pain.

METHODOLOGY & MATERIALS

This prospective observational study was conducted at the Department of Physical Medicine, Medical College for Women and Hospital, Uttara, Dhaka, Bangladesh, over a period of 1 year from January 2022 to December 2022. The study included a population of 50 participants who were divided into two groups:

Group A (n=25): Patients received Interferential Therapy (IFT)
Group B (n=25): Patients received Transcutaneous Electrical Nerve Stimulation (TENS)

Inclusion Criteria:

- Were 18 years or older
- Had non-specific low back pain for more than 3 months
- Reported pain intensity of 5 or more on the Visual Analog Scale (VAS)
- Were not receiving any pharmacological or physical therapy at the time of enrollment

Exclusion Criteria:

- Used analgesics during the study period
- Had a history of lumbar spine surgery
- Had diagnosed rheumatic diseases, radiculopathy, or pain radiating to the lower limbs
- Were pregnant (first trimester)
- Had cognitive impairments or were unable to complete questionnaires
- Missed two consecutive or three alternate treatment sessions
- Had contraindications for electrotherapy, such as cardiac pacemakers

Ethical Considerations

Informed consent was obtained where applicable, and the research protocol was reviewed and approved by the relevant institutional ethics committee, ensuring compliance with ethical standards in human subject research. All participants received verbal and written information about the study and its procedures. Written informed consent was obtained prior to participation.

IFT Protocol

Treatment was delivered in tetrapolar mode, with participants in the prone position. Electrodes (5×10 cm) were placed over the lumbar pain area using conductive gel. Parameters: Carrier frequency = 4000 Hz, modulated frequency = 20 Hz, ΔMFA = 10 Hz, with a 1:1 sweep pattern, for 30 minutes per session. Sessions were held twice weekly for 5 weeks (total 10 sessions).

TENS Protocol

Applied in acupuncture mode, with participants also in the prone position. Electrodes (10×10 cm) were placed to surround the pain region. Parameters: Frequency = 20 Hz, 10 pps, with intensity adjusted to patient tolerance. Duration was 30 minutes per session, twice weekly for 5 weeks.

Electrodes were sanitized after each use, and the application area was cleaned to ensure hygiene and safety.

Data Collection

Clinical data were collected at two key points: baseline (prior to treatment) and after 4 weeks of therapy. At both time points, patients were assessed using the Visual Analog Scale (VAS) to measure pain intensity, the Oswestry Disability Index (ODI) to evaluate functional impairment, and lumbar flexion range of motion, measured in degrees using a goniometer. Additionally, a follow-up assessment was conducted 30 days post-treatment, focusing on VAS scores to determine whether the analgesic effects of the interventions were maintained over time. Alongside these clinical measures, demographic and baseline characteristics—including age, gender, body mass index (BMI), marital status, level of physical activity, and history of low back pain—were recorded to provide context and support comparative analysis between the two groups.

Statistical Analysis

All collected data were analyzed using SPSS version 26.0. Continuous variables were presented as mean ± standard deviation (SD), while categorical variables were expressed as frequencies and percentages. To assess changes within each group from baseline to post-treatment, the paired t-test was used for normally distributed data. For comparisons between the two groups, independent t-tests were performed for parametric data, while the Mann-Whitney U test was used for non-parametric variables. The Chi-square test was employed to analyze differences in categorical variables between groups. A p-value less than 0.05 was considered statistically significant for all analyses.

RESULT

The mean age was 44.67 ± 18.23 years in Group A and 47.87 ± 17.45 years in Group B. The average body mass index (BMI) was slightly higher in Group B (28.21 ± 3.23) than in Group A (25.76 ± 6.44) (p=0.12). Females predominated in both groups (72% in Group A and 68% in Group B) (p=0.78). Most participants were married (60% in Group A and 68% in Group B) (p=0.23). Overall, the demographic characteristics were comparable between the two groups with no significance (Table 1). There were no statistically significant differences in baseline characteristics between Group A (IFT) and Group B (TENS) (p > 0.05). The majority of participants in both groups reported experiencing low back pain for more than 12 months (68% in Group A and 64% in Group B). Most had pain confined to the lower back (76% in Group A and 80% in Group B), while a smaller percentage experienced both low back pain and sciatica. Physical activity was generally low, with only 20% of participants in each group engaging in regular exercise (p=0.91). Furthermore, a high proportion of individuals in both groups had initially used medications for their condition (68% in Group A and 64% in Group B) (p=0.89) (Table 2). The mean VAS score decreased from 7.1 ± 1.2 to 2.8 ± 1.1 in Group A and from 7.3 ± 1.1 to 3.6 ± 1.3 in Group B, with a statistically significant difference in post-treatment scores (p=0.02). Similarly, the Oswestry Disability Index (ODI) improved more in Group A (from 44.3 ± 6.8 to 20.5 ± 5.4) than in Group B (from 45.1 ± 7.2 to 26.2 ± 6.1), with a significant difference (p=0.006). Lumbar flexion also increased significantly in Group A (from 40.2 ± 5.3° to 56.7 ± 6.2°) compared to Group B (from 41.0 ± 4.9° to 52.3 ± 5.7°), with a p-value of 0.02 (Table 3). In Group A, 64% of participants reported being very satisfied (scores 8–10) and only 40% in Group B reported the same, showing a statistically significant difference (p=0.04). Additionally, 32% of Group A and 44% of Group B were moderately satisfied (scores 5–7). Dissatisfaction (scores <5) was lower in Group A (4%) compared to Group B (16%) (Table 4).

Table 1: Demographic characteristics of the study population (N=50)

Variables	Group A (n=25)		Group B (n=25)		P-value
	n	%	n	%	
Age (years), Mean±SD	44.67 ± 18.23		47.87 ± 17.45		0.41
Body mass index	25.76 ± 6.44		28.21 ± 3.23		0.12
Gender					
Female	18	72.00	17	68.00	0.78
Male	7	28.00	8	32.00	
Marital status					
Single	5	20.00	4	16.00	0.23
Married	15	60.00	17	68.00	
Widowed	1	4.00	2	8.00	
Divorced	4	16.00	2	8.00	

Table 2: Baseline characteristics of participants (N=50)

Variables	Group A (n=25)		Group B (n=25)		P-value
	n	%	n	%	
History of low back pain (months)					
3-6	4	16.00	4	16.00	0.72
6-12	4	16.00	5	20.00	
>12	17	68.00	16	64.00	
Pain distribution					
Low back pain	19	76.00	20	80.00	0.45
Low back pain and sciatica	6	24.00	5	20.00	
Physical activity practiced					
Yes	5	20.00	5	20.00	0.91
No	20	80.00	20	80.00	
Initial use of medications					
Yes	17	68.00	16	64.00	0.89
No	8	32.00	9	36.00	

Table 3: Comparison of clinical outcome measures between Group A (IFT) and Group B (TENS) at baseline and after 4 weeks of treatment

Variables	Group A (Mean ± SD)	Group B (Mean ± SD)	P-value
VAS Scores			
Pre-treatment	7.1 ± 1.2	7.3 ± 1.1	0.52
Post-treatment (4 weeks)	2.8 ± 1.1	3.6 ± 1.3	0.02
Oswestry Disability Index - ODI			
Pre-treatment	44.3 ± 6.8	45.1 ± 7.2	0.62
Post-treatment (4 weeks)	20.5 ± 5.4	26.2 ± 6.1	0.006
Lumbar Flexion in Degrees			
Pre-treatment	40.2 ± 5.3	41.0 ± 4.9	0.56
Post-treatment	56.7 ± 6.2	52.3 ± 5.7	0.02

Table 4: Patient Satisfaction Scores (on a 10-point scale)

Satisfaction Level	Group A (n=25)		Group B (n=25)		P-value
	n	%	n	%	
Very Satisfied (8–10)	16	64.00	10	40.00	0.04
Satisfied (5–7)	8	32.00	11	44.00	
Dissatisfied (<5)	1	4.00	4	16.00	

DISCUSSION

Non-specific low back pain (NSLBP) is a prevalent musculoskeletal condition affecting individuals across all age groups, often leading to disability and reduced quality of life. Interferential Therapy (IFT) and Transcutaneous Electrical Nerve Stimulation (TENS) are commonly used electrotherapeutic modalities for pain relief. This comparative study aimed to evaluate and contrast the effectiveness of IFT and TENS in managing symptoms of NSLBP. The demographic characteristics of participants in this study showed no statistically significant differences between the IFT (Group A) and TENS (Group B) groups, indicating that the groups were comparable. The mean age of participants was 44.67 ± 18.23 years in Group A and 47.87 ± 17.45 years in Group B (p=0.41), aligning with findings from previous studies where NSLBP was most prevalent in middle-aged individuals [15]. Similarly, the BMI was higher in Group B (28.21 ± 3.23) compared to Group A (25.76 ± 6.44), suggesting that overweight or obesity may be associated with NSLBP, as supported by Shiri et al, who reported a positive association between elevated BMI and the prevalence of low back pain [16]. Gender distribution was also similar between groups, with a slightly higher proportion of females in both (72% in Group A and 68% in Group B). This is consistent with other studies [17,18]. Marital status varied slightly, with the majority of participants in both groups being married, consistent with other study in similar clinical settings [19]. In this study, most participants had chronic low back pain lasting over 12 months, consistent with Maher et al, who noted the high prevalence of chronicity in NSLBP [20]. Pain was mostly localized, with a few cases of sciatica, similar to findings by Airaksinen et al [21]. Physical activity was low (20% in both groups) in this study. Smeets et al reported reduced activity levels in chronic LBP patients [22]. Initial medication use was also common in both groups, aligning with Foster et al, who observed frequent early pharmacological treatment [23]. These similarities help ensure unbiased comparison of treatment outcomes. At baseline, both groups reported comparable VAS scores (7.1 ± 1.2 for IFT and 7.3 ± 1.1 for TENS; p = 0.52), indicating similar pain severity prior to treatment. After 4 weeks of intervention, both groups showed significant pain reduction; however, the IFT group showed a more substantial decrease (to 2.8 ± 1.1) compared to the TENS group (to 3.6 ± 1.3), with a statistically significant difference (p = 0.02). These findings are consistent with the results reported by Fuentes et al, who conducted a systematic review and meta-analysis and concluded that IFT significantly reduces musculoskeletal pain compared to control or other modalities, including TENS [10]. The deeper penetration and medium-frequency current used in IFT may stimulate deeper tissues and increase local blood flow, thus promoting better pain modulation than the surface-level action of TENS. The baseline ODI scores were not significantly different between groups (44.3 ± 6.8 vs. 45.1 ± 7.2; p = 0.62), indicating comparable levels of disability. However, post-treatment scores demonstrated a significant improvement in both groups, with IFT showing superior functional gains (reduction to 20.5 ± 5.4) compared to TENS (26.2 ± 6.1), with a p-value of 0.006. IFT likely contributes to reduced muscle spasm and improved soft tissue healing, thereby enhancing functional ability and reducing dependence in daily activities. Improvements in lumbar flexion were observed in both groups, but the gain was significantly higher in the IFT group (from 40.2° to 56.7°) than in the TENS group (from 41.0° to 52.3°), with a p-value of 0.02. Enhanced mobility is likely due to reduced stiffness and better muscle activation as a result of deeper neuromuscular stimulation by IFT. Our findings are further supported by Facci et al, who observed greater improvements in pain and physical function among patients receiving IFT compared to those receiving TENS for chronic low back pain [24]. In this study, patient satisfaction was significantly higher in the IFT group (64% very satisfied) compared to the TENS group (40% very satisfied, $p = 0.04$), with fewer dissatisfied patients in the IFT group. The smoother, medium-frequency currents used in IFT likely enhance tolerability and treatment experience, leading to greater overall acceptance and compliance.

Limitations of the study:

- The sample size was relatively small (n=50), limiting the generalizability of results.
- The absence of a placebo or control group restricts causal inference.
- Subjective outcome measures (e.g., VAS, satisfaction scores) may introduce response bias.

CONCLUSION

This study demonstrates that both IFT and TENS are effective modalities for managing non-specific low back pain; however, IFT offers significantly greater improvements in pain reduction, functional capacity, lumbar mobility, and patient satisfaction. Due to its deeper tissue stimulation and sustained analgesic effect, IFT should be considered a preferred option for NSLBP in physiotherapy settings, especially where rapid clinical improvement is prioritized. Nonetheless, larger, multicenter randomized controlled trials with longer follow-up periods are needed to confirm and generalize these findings.

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