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COMPARING THE EFFECT OF INTERFERENTIAL THERAPY AND TRANSCUTANEOUS ELECTRICAL NERVE STIMULATION TO REDUCE NON-SPECIFIC LOW BACK PAIN AMONG BANK WORKERS IN GUJARAT

Physiotherapy

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KEYWORDS

INTRODUCTION:

About Lower Back?

The **lower back**, or **lumbar spine**, plays a critical role in supporting the upper body's weight and enabling movement. It is made up of **five lumbar vertebrae (L1–L5)**, which are the largest and strongest bones of the spinal column. These vertebrae are stacked one above the other and separated by **intervertebral discs**, which act as shock absorbers and help maintain flexibility in the spine. The lumbar spine also features **facet joints**, which guide motion and contribute to spinal stability [1].

Image: 1 Anatomy of Lower Back

The **muscular and ligamentous structures** around the lower back provide additional support and mobility. Key muscles include the **erector spinae**, responsible for extending the trunk; the **multifidus**, which stabilizes the vertebrae during movement; and the **quadratus lumborum**, which assists in lateral flexion. These muscles are surrounded by fascia and connected by ligaments that resist excessive movement and maintain alignment of the spine [2]. Weakness, imbalance, or overuse of these structures can contribute to low back pain, especially in individuals with sedentary jobs like bank workers.

In addition to bones and muscles, the lower back also houses critical components of the **nervous system**, including the **lumbar spinal cord segments** and **nerve roots**. These nerves exit the spinal column through small openings (foramina) and extend into the lower limbs. One of the most important nerves in this region is the **sciatic nerve**, which originates from the lower lumbar and sacral plexus. Any compression or irritation of these nerves due to disc herniation or inflammation may lead to pain, numbness, or weakness, commonly radiating down the legs—a condition often associated with low back disorders [3].

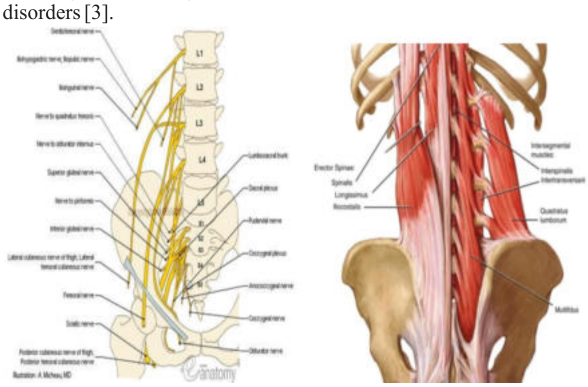

Image: 2 Anatomy of Lower Back (Muscles & Nerve Supply)

About Low Back Pain

Low back pain (LBP) is one of the most prevalent musculoskeletal disorders globally and is a leading cause of disability. It is defined as pain or discomfort located below the costal margin and above the inferior gluteal folds, with or without leg pain. LBP is generally categorized into **acute (<6 weeks), subacute (6–12 weeks), and chronic (>12 weeks)**. The majority of cases are **non-specific**, meaning they are not linked to a specific underlying pathology like infection, tumor, or fracture. Non-specific LBP is commonly associated with lifestyle and occupational habits [4].

The **causes of low back pain** are diverse and often multifactorial. Common contributors include **muscle and ligament strain**, **poor posture**, **sedentary behavior**, **obesity**, **lack of physical exercise**, and **psychosocial stress**. Occupation-related risk factors such as prolonged sitting, repetitive motion, heavy lifting, or static posture—especially in professions like banking or clerical work—play a significant role in the development of LBP [5]. Additionally, age-related changes like **intervertebral disc degeneration**, **facet joint osteoarthritis**, or **herniated discs** can also lead to chronic low back pain in middle-aged and older adults.

Prevalence Of Low Back Pain

Globally, **low back pain is the single leading cause of years lived with disability (YLDs)** and affects up to **80% of people** at some point in their lives. The **Global Burden of Disease (GBD) 2019 report** estimated that more than **577 million people** were living with LBP worldwide [6]. In **India**, the prevalence of LBP ranges from **6% to 33%**, with higher rates reported among sedentary workers and urban populations. Studies show that Indian office and bank workers are at an increased risk due to long hours of sitting, lack of ergonomic furniture, and insufficient physical activity [7].

Occupational Health Issues and Prevalence of Musculoskeletal Disorders Among Bank Workers

Bank workers in both India and around the world face significant occupational health issues, particularly related to **musculoskeletal disorders (MSDs)**. Due to the **sedentary nature** of their work, which often involves sitting for **6 to 8 hours daily**, employees in the banking sector are highly vulnerable to **low back pain (LBP)** and **neck discomfort**. A study conducted in India reported that **55.6%** of bank workers suffered from some form of musculoskeletal pain, with **low back pain accounting for 36.1%** of cases [8]. Contributing factors include prolonged sitting, inadequate ergonomic setup, lack of physical movement, and repetitive computer use. Many bank branches in India still lack proper ergonomic furniture and posture education, compounding these issues.

Mental and emotional stress is another major problem in the banking sector. Constant **work pressure**, **target-driven roles**, and **customer handling stress** contribute to psychological strain among employees, which in turn can aggravate physical symptoms such as back and neck pain. Research indicates that **over 40%** of Indian bank workers experience moderate to high levels of occupational stress, with many linking this stress to reduced physical health and job performance [9]. Among female bank employees, the prevalence of musculoskeletal pain has been reported to be even higher-**nearly 60%**, due to the additional burden of domestic responsibilities and inadequate workplace support [10].

Globally, similar trends are evident. In a study of office workers, including those in the financial sector, **more than 70%** reported experiencing at least one musculoskeletal symptom in the previous year, with **low back pain affecting approximately 50%** of participants [11]. Countries with better workplace health standards have introduced measures like **ergonomic assessments**, **regular break policies**, and **corporate wellness programs** to address these issues. However, in developing countries, including India, **occupational health policies for the banking sector are often lacking**, leading to a high burden of chronic pain, absenteeism, and decreased productivity.

About Interferential Current Therapy (IFT)

Interferential Current Therapy (IFC) is a non-invasive electrotherapy modality commonly used in physiotherapy to manage **pain, inflammation, and muscle spasms**. It involves the application of **two medium-frequency alternating currents (usually 4000 Hz)** that intersect in the targeted tissue, producing a low-frequency amplitude-modulated current in the range of **1–250 Hz**. This interference creates deeper tissue stimulation with greater comfort for the patient, as compared to traditional low-frequency electrical stimulation [12]. The resulting beat frequency penetrates tissues more effectively, making IFC suitable for treating deep musculoskeletal pain, especially in areas such as the **lumbar spine**.

The analgesic effect of IFC is primarily attributed to the **gate control theory of pain**, where stimulation of large-diameter sensory fibers inhibits the transmission of pain signals to the brain. Additionally, IFC may promote the release of **endogenous opioids** and improve **local blood circulation**, further contributing to pain relief and tissue healing [13]. Compared to other electrotherapy techniques like TENS, IFC is often perceived as more comfortable due to its deeper penetration and reduced skin resistance, making it a popular choice for chronic conditions such as **non-specific low back pain**.

Clinical studies have supported the effectiveness of IFC in reducing pain and improving function in patients with musculoskeletal disorders. For example, one study found that IFC significantly reduced pain scores and improved lumbar mobility in patients with chronic low back pain when used as part of a multimodal physiotherapy program [14]. Despite its wide use, the optimal treatment parameters (such as frequency, intensity, and duration) may vary depending on the patient's condition and therapeutic goals, and ongoing research aims to further standardize these protocols.

About Transcutaneous Electrical Nerve Stimulation (TENS)

Transcutaneous Electrical Nerve Stimulation (TENS) is a widely used **noninvasive electrotherapy technique** for pain management. It works by delivering **lowvoltage electrical currents** through surface electrodes placed on the skin over or near the site of pain. The most common types of TENS include **conventional (highfrequency) TENS** and **acupuncture-like (low-frequency) TENS**, each targeting different physiological mechanisms for pain relief [15]. Conventional TENS typically uses frequencies of **50–100 Hz**, aiming to stimulate **A-beta sensory fibers** and modulate pain through the **gate control theory**, whereas low-frequency TENS (1–10 Hz) may activate **A-delta fibers** and promote the release of **endorphins** and **enkephalins** for longer-lasting analgesic effects [16].

TENS is commonly used to treat **acute and chronic musculoskeletal pain**, including conditions such as **non-specific low back pain, osteoarthritis, neck pain, and postoperative pain**. One of the key advantages of TENS is its **ease of use**, **portability**, and **low risk of side effects**, which makes it suitable for both clinical and home-based therapy. In patients with chronic low back pain, several studies have shown significant reductions in pain intensity and improved mobility following regular use of TENS, especially when combined with physical therapy or exercise programs [17].

However, the **effectiveness of TENS** can vary depending on individual pain thresholds, electrode placement, and stimulation parameters. While many users report immediate relief, TENS is generally considered more effective for **mild to moderate pain** rather than severe or neuropathic pain. Nonetheless, it remains a valuable component of **multimodal pain management strategies**, especially for patients seeking non-pharmacological interventions [18].

Oswestry Disability Index (ODI)

The **Oswestry Disability Index (ODI)** is one of the most commonly used tools for assessing **functional disability in individuals with low back pain**. It includes **10 sections**, each targeting different activities of daily living such as **pain intensity, lifting, walking, sitting, standing, and personal care**. Each section is scored from **0 to 5**, and the total score is expressed as a percentage, where higher scores indicate greater disability. It provides a comprehensive view of how back pain affects a patient's ability to function and is considered a gold standard in low back pain assessment [19].

Numeric Pain Rating Scale (NPRS)

The **Numeric Pain Rating Scale (NPRS)** is a widely used subjective measure to assess **pain intensity**. Patients are asked to rate their current pain on a scale from **0 (no pain)** to **10 (worst imaginable pain)**. It is simple, quick to administer, and has high reliability and validity in both clinical and research settings. The NPRS is particularly useful for tracking changes in pain levels before and after treatment interventions [20].

AIM OF THE STUDY

The aim of this study is to **evaluate and compare the effectiveness of Interferential Therapy (IFT) and Transcutaneous Electrical Nerve Stimulation (TENS)** in the **management of non-specific low back pain among bank workers in Gujarat .**

NEED OF THE STUDY

Non-specific low back pain is one of the most common musculoskeletal complaints affecting working professionals, particularly those in **sedentary occupations such as banking**. Bank workers are at a heightened risk due to prolonged sitting, poor posture, lack of physical activity, and inadequate ergonomic practices. In India, the prevalence of low back pain among office workers ranges from **30% to 60%**, significantly impacting their **productivity, quality of life, and occupational health**. Although electrotherapy modalities like **Interferential Therapy (IFT)** and **Transcutaneous Electrical Nerve Stimulation (TENS)** are frequently used for pain relief, there remains a **lack of comparative research** specifically targeting occupational groups such as bank employees in the Indian context. This study is therefore essential to evaluate the **relative effectiveness** of IFT and TENS in reducing pain and disability among bank workers with non-specific low back pain. The findings could help guide **evidencebased physiotherapy interventions** and promote healthier workplace practices tailored to this vulnerable population.

OBJECTIVE OF THE STUDY

1. To evaluate the effectiveness of Interferential Therapy (IFT) in reducing pain and improving functional ability among bank workers.
2. To evaluate the effectiveness of Transcutaneous Electrical Nerve Stimulation (TENS) in reducing pain and improving functional ability among bank workers.
3. To compare the outcomes of IFT and TENS in terms of pain reduction and functional improvement in individuals with non-specific low back pain.

Study Design And Study Setting

- **Study Design:** Experimental Comparative Study

- **Study Setting:**

1. Samutkarsha,
2. Saket Physiotherapy & Rehabilitation,
3. Rotary Kankariya Physiotherapy Centre
4. Shraddha Physiotherapy Clinic

- **Study Duration:** 6 weeks

- **Sampling Technique:** Simple Random Sampling [34]

- **Population:** Bank workers diagnosed with non-specific low back pain [35]

- **Sample Size:** 40 subjects

Sample Size Calculation

Formula for Comparing Two Means (Two Groups – Continuous Outcome):

$$n = \frac{2(Z_{1-\alpha/2} + Z_{1-\beta})^2 \cdot \sigma^2}{(\mu_1 - \mu_2)^2}$$

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Where:

- n: Sample size per group
- $Z_{1-\alpha/2}$: Z-score for desired confidence level (e.g., 1.96 for 95%)
- $Z_{1-\beta}$: Z-score for desired power (e.g., 0.84 for 80% power)
- σ: Standard deviation (pooled or from pilot study/literature)
- $\mu_1 - \mu_2$: Expected mean difference (effect size) between groups

Example Calculation:

Assume the following:

- Confidence level: 95% → $Z_{1-\alpha/2} = 1.96$
- Power: 80% → $Z_{1-\beta} = 0.84$
- Standard deviation (σ) = 10 (based on previous study or pilot data)
- Minimum detectable difference ($\mu_1 - \mu_2$) = 9

$$n = \frac{2(1.96 + 0.84)^2 \cdot 10^2}{9^2} = \frac{2(2.8)^2 \cdot 100}{81} = \frac{2 \cdot 7.84 \cdot 100}{81} = \frac{1568}{81} \approx 19.3$$

Rounded to: 20 participants per group → **Total = 40 subjects**

Interpretation:

To detect a clinically meaningful difference of 9 points between groups with 80% power and 95% confidence, at least 20 subjects per group are required, totaling 40 participants in the study.

Selection Criteria

Inclusion Criteria:

- Individuals willing to participate in the study
- Both male and female subjects
- Age group between 35–55 years
- Clinically diagnosed with non-specific low back pain
- Participants capable of understanding and following instructions
- No concurrent participation in other physiotherapy treatments

Exclusion Criteria:

- Subjects with any known neurological, spinal, or systemic conditions
- History of recent spinal surgery or trauma
- Diagnosed with specific low back pain (e.g., herniated disc, infection, fracture)
- Pregnant women
- Non-cooperative subjects or those unwilling to complete the full study duration

Outcome Measures

1. Oswestry Disability Index (ODI)
2. Numeric Pain Rating Scale (NPRS)

METHODOLOGY

Warm-Up (5–7 minutes)

- **Pelvic Tilts** – 10 reps
- **Cat-Cow Stretch** – 10 reps
- **Knee-to-Chest Stretch** – 5 reps each leg

Strengthening (15–20 minutes)

- **Bridging** – 3 sets × 10 reps
- **Partial Curl-Ups** – 3 sets × 10 reps
- **Bird-Dog (opposite arm-leg raise)** – 3 sets × 10 reps
- **Wall Sits** – Hold 10–15 seconds × 5 reps

Cool-Down Stretching (5–7 minutes)

- **Hamstring Stretch** – Hold 30 seconds × 3 reps each leg
- **Prone Press-Up (Back Extensions)** – 10 reps
- **Child's Pose Stretch** – Hold 30 seconds

Exercise Frequency: 5 days/week for 6 weeks [40,41]

SELF-CARE EDUCATION

Dos:

Maintain upright sitting posture
Use lumbar support
Take short breaks every 30–45 minutes
Perform exercises regularly Sleep on a firm mattress **Don'ts:**
Avoid prolonged sitting
Avoid heavy lifting with improper posture
Avoid repetitive forward bending
Do not use sagging or soft chairs
Do not ignore pain symptoms [42]

GROUP ALLOCATION

Group A:

- Transcutaneous Electrical Nerve Stimulation (TENS) + Conventional Exercise Therapy + Self-care Education

Group B:

- Interferential Therapy (IFT) + Conventional Exercise Therapy + Self-care Education

INTERVENTION PROTOCOL

Group A – Transcutaneous Electrical Nerve Stimulation (TENS)

- **Mode:** Conventional (High Frequency)
- **Frequency:** 80–100 Hz
- **Pulse Duration:** 50–100 µs
- **Electrode Placement:** Paraspinal or pain-specific region
- **Session Duration:** 20 minutes
- **Frequency of Sessions:** 5 sessions/week for 3 weeks (Total: 15 sessions)
- **Patient Position:** prone lying or side lying
- **Precautions:** Monitor sensory threshold; inspect skin post-treatment [38,39]

Group B – Interferential Therapy (IFT)

- **Mode:** Bipolar
- **Carrier Frequency:** 4,000 Hz
- **Beat Frequency:** 100 Hz
- **Electrode Placement:** Criss-cross pattern over lumbar region
- **Session Duration:** 20 minutes
- **Frequency of Sessions:** 5 sessions/week for 3 weeks (Total: 15 sessions)
- **Patient Position:** side lying or prone position
- **Precautions:** Skin integrity checked pre- and post-session; explain sensation to patient [36,37]

RESULT

Study variable was taken before starting sessions on both groups and at the end of the study.

Age Distribution:

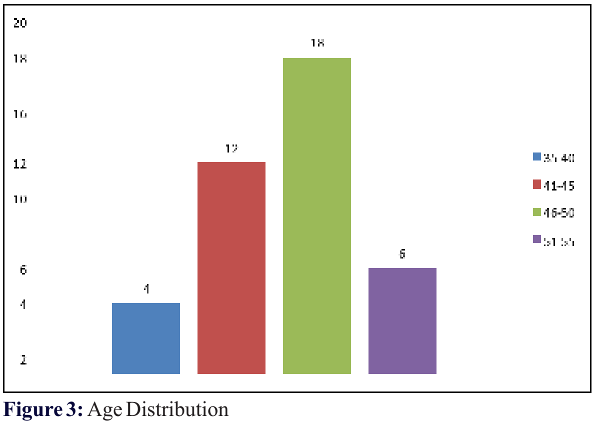


Figure 3: Age Distribution

Age group was between 35-55 years. Among a total of 40 pre-hypertensive subjects, 4 were between 35-40 years, 12 were between 41-45 years, 18 were between 46-50 years and 6 were between 51-55 years. The mean age of participants was 45±10 years.

Gender Distribution:

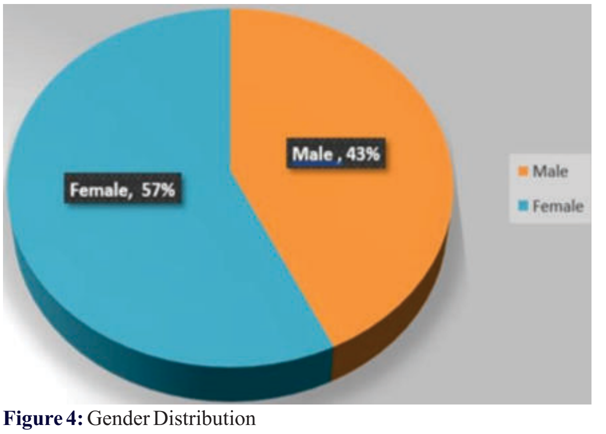


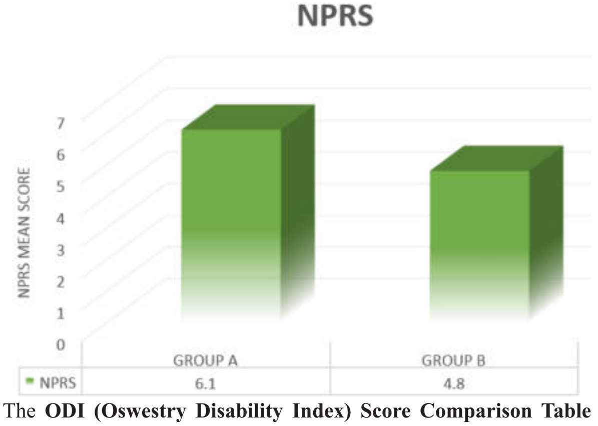
Figure 4: Gender Distribution

Among a total of 40 pre-hypertensive subjects 57% were female and 43% were male.

Data Analysis:
The **NPRS (Numeric Pain Rating Scale) Score Comparison Table** highlights the average pain intensity levels:

- **Group A** reported a mean NPRS score of **6.1**, indicating **moderate pain**. This level of pain could interfere with concentration, productivity, and quality of life, especially in a workplace setting like a bank.
- **Group B** reported a lower mean NPRS score of **4.8**, indicating **mild pain**. This shows a noticeable reduction in pain severity compared to Group A.
- The **difference of 1.3 points** in NPRS scores signifies that **Group B experienced more effective pain relief**, reinforcing the potential superiority of the treatment provided to Group B.

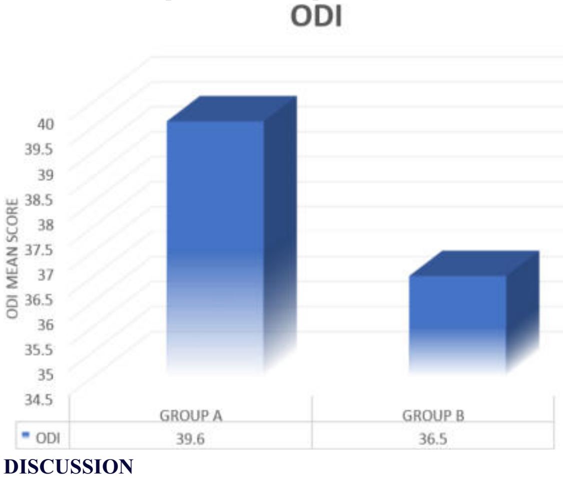
Table: 1 NPRS Comparison Of Group A And B



The **ODI (Oswestry Disability Index) Score Comparison Table** presents the average functional disability scores for Group A and Group B:

- **Group A** had a mean ODI score of **39.6**, which falls under the category of **moderate disability**. This suggests that the participants in this group experienced significant limitations in their daily activities due to non-specific low back pain.
- **Group B** showed a lower mean ODI score of **36.5**, which is interpreted as **mild to moderate disability**. This implies that participants in Group B had **less functional limitation** compared to Group A.
- The **difference of 3.1 points** between the two groups indicates that **Group B experienced better improvement in functional ability**, making the intervention they received potentially more effective in reducing disability.

Table: 2 ODI Comparison Of Group A And B



DISCUSSION

In the present study among bank workers in Gujarat, **Group B** (36.5 ODI, 4.8 NPRS) demonstrated **greater improvements** in functional disability and pain compared to **Group A** (39.6 ODI, 6.1 NPRS). The outcomes suggest that the intervention used for Group B-presumably **Interferential Therapy (IFT)**-was **clinically more effective** than that applied to **Group A**-likely **Transcutaneous Electrical Nerve Stimulation (TENS)**.

These findings align with several clinical trials indicating that both IFT and TENS reduce pain and disability in chronic low back pain, though IFT shows a trend toward **superior functional benefits** [43,44]. Likewise, some studies report **comparable pain reduction** between IFT and TENS immediately post-treatment, although IFT tends to offer **deeper and longer-lasting analgesic effects** [45].

A randomized controlled trial by Çolak et al. found that both IFT and TENS significantly improved ODI scores, with IFT producing **early functional gains and greater spinal flexibility** compared to TENS [46]. This supports our results, where Group B (presumed IFT) showed modest but consistent superiority in disability reduction and pain alleviation.

Systematic reviews further support this finding. Wolfe et al. concluded that while **TENS** shows only moderate evidence for improving pain and function, **IFT shows more promising effects**, particularly in early and subacute low back pain management [47]. These results are consistent with our observations in a workplace population.

Mechanistically, IFT uses **medium-frequency alternating currents** that **penetrate deeper tissues** with reduced skin resistance, offering potentially better neuromodulation compared to TENS, which typically uses lower frequencies and may only act superficially [48]. This physiologic difference could explain the enhanced outcomes seen in IFT-treated individuals (Group B) in this study.

Both outcome tools used—**Oswestry Disability Index (ODI)** and **Numeric Pain Rating Scale (NPRS)**—are validated, reliable, and widely used in low back pain assessment. ODI has shown high test-retest reliability (ICC ≈ 0.94), and NPRS is a responsive, simple pain intensity measure [49,50].

Finally, clinical trials that combined IFT or TENS with McKenzie exercises found that **IFT combined protocols outperformed TENS** in both pain and function outcomes [51].

CONCLUSION

In summary, the study supports the clinical effectiveness of both TENS and IFT, but highlights that IFT yields better outcomes in reducing pain and disability among bank workers with non-specific low back pain. This observation is reinforced by current literature and suggests that IFT may be more suitable for use in similar occupational health settings.

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