Pakistan Journal of
Medical & Dental Sciences

ISSN Print: 3078-4263
ISSN Online: 3078-4271

Volume 2, Issue 1, January-June 2025

# PJMDS

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**Editorial Correspondence:** editor@pjmds.online & editorial_office@pjmds.online
**Website:** www.pjmds.online
**Publisher:** SCORM Services (Rgd)
**Designed and Layout by:** Yasir Shaikh
Graphic Designer, SCORM Services

Pakistan Journal of Medical & Dental Sciences

PJMDS

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MS No.: PJMDS/OA/016/2024

Original Article

# Evaluation of Post Operative Pain Intensity on Pain Scale Following Occlusal Reduction in Teeth Associated with Symptomatic Apical Periodontitis

Sundus Aleem[1], Fozia Rajput[2], Aleem Qureshi[3], Moomal Memon[4], Yusra[5], Pirah Sanjay[6]

## ABSTRACT

**Objective:** To compare the postoperative pain score, in teeth with symptomatic apical periodontitis, with and without occlusal reduction.

**Methodology:** This randomized controlled trial (RCT) was conducted at Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro with 75 patients in each group selected through non-probability, consecutive sampling. Patients between the age group 18 to 65 years, either gender, ASA status I, VAS pain score >3 with symptomatic apical periodontitis, were included and randomly assigned to Group A (Occlusal Reduction) and Group B (Non-Occlusal Reduction). VAS scores assessed postoperative pain at 12, 24, 48 hours, and 6 days. Tenderness to percussion was evaluated. SPSS was used for statistical analysis, with $p \leq 0.05$ considered significant.

**Results:** Pain scores were significantly lower in the occlusal reduction group (Group A) at 12 hours (8.40 ± 1.09 vs. 8.75 ± 1.01) and 6 days (2.32 ± 1.42 vs. 3.53 ± 1.70, $p < 0.05$) compared to the non-occlusal reduction group (Group B). Among 18-40 years, Group A had significantly lower pain at 12 hours ($p = 0.038$) and 6 days ($p = 0.000$), while in patients >40 years, pain reduction was significant only at 6 days ($p = 0.005$). By 6 days, pain was significantly lower in both males ($p = 0.002$) and females ($p = 0.001$) in Group A.

**Conclusion:** This study concluded that occlusal reduction significantly reduces postoperative pain in symptomatic apical periodontitis, with a notable effect by day 6. The reduction was significantly high in younger and female patients. These findings support occlusal reduction as an effective strategy for minimizing post-endodontic pain.

**Keywords:** Apical periodontitis, Endodontics, Occlusal reduction, Postoperative pain

## INTRODUCTION

One of the common postendodontic complications is postoperative endodontic discomfort. Postoperative pain has been documented to occur in 3% to 58% of patients[1]. Different measures have been taken to reduce pain during endodontic treatment such as using analgesics prior to the procedure, long-acting anesthetics and occlusal reduction[2]. Postoperative pain, on the other hand, typically follows a predictable course of decrease in which the pain level is halved on the first postoperative day and then reduced to 10% of the base level on the seventh day[3].

Postoperative pain is multifactorial and cannot be attributed to a single cause. Mechanical, chemical, and microbial factors associated with root canal instrumentation contribute to periapical inflammation, affecting both pain prevalence and intensity. Additionally, pain perception is subjective and influenced by social, cultural, and psychological factors, leading to variability among patients[4]. Percussion and biting sensitivity are reliable indicators of apical inflammation. According to the American Association of Endodontists (AAE) Glossary of Endodontic Terms, symptomatic apical periodontitis is defined as *"Inflammation, usually of the apical periodontium, producing clinical symptoms including a painful response to biting and/or percussion or palpation. It might or might not be associated with an apical radiolucent area".* This condition increases the risk of severe postoperative pain[5].

In a study, the mean pain score at 6 days after instrumentation was significantly lower in the occlusal reduction group than in the non-occlusal reduction group (2.44±0.86 vs. 3.24±0.89; $p = 0.0005$)[6]. While another study reported post-treatment pain scores at 24 hours and found comparable levels between the occlusal adjustment and control groups, no statistically significant difference was observed ($p=0.991$). By 72 hours, pain scores had declined in both groups. Although slightly higher scores were noted in the occlusal adjustment group compared to the control group, the difference remained statistically non-significant ($p=0.219$)[7]. In a study by Ahmed et al.[8], occlusal reduction significantly reduced postoperative pain intensity at 12 hours (mean reduction 1.84±2.18 in the intervention group vs. 2.64±2.72 in the control group) and 48 hours after root canal instrumentation (mean pain 0.95±1.71 in the occlusal reduction group vs. 1.06±1.90 in the control group). Additionally, occlusal reduction lowered the likelihood of moderate-to-severe pain by 53.2% at 24 hours and 37.7% in the non-occlusal reduction group[8].

## METHODOLOGY

It was a randomized controlled trial (RCT) carried out at the Department of Operative Dentistry, LUMHS, Jamshoro. A total of 150 patients, with 75 in each group, were recruited by non-probability, consecutive sampling technique. Symptomatic apical periodontitis (SAP) is an inflammation of the apical periodontium and is characterized by clinical symptoms of pain on biting/chewing and may or may not be associated with a radiolucent area as observed by radiographic examination. The sample size was determined using the OpenEpi sample size calculator, based on the Mean ± SD of the occlusal reduction (OR) group vs. non-occlusal reduction (NOR) group (2.44±0.86 vs. 3.24±0.89)[6], with a 95% confidence level and 80% power of the test. Patients aged 18 to 65 years, of either gender, systemically healthy (ASA status I), with a VAS pain score >3 and pain on biting/chewing, diagnosed with symptomatic apical

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**Submitted:** August 22, 2024
**Revised:** January 30, 2025
**Accepted:** February 18, 2025

periodontitis, were included. Patients with no opposing tooth, swelling, sinus, bruxism, recent analgesic use, periodontally compromised teeth, or fewer than three teeth on one side were excluded. Ethical approval was obtained from the LUMHS Research Ethics Committee, and written informed consent was secured.

The patients were randomly divided into two groups using computer-generated sequential numbers placed in sealed envelopes, which were opened only before the commencement of the study. The study was conducted in a single-blind fashion. Patients in Group A (Occlusal Reduction, OR) were managed by performing occlusal reduction, which was breaking the contacts between the biting and chewing surfaces of the maxillary and mandibular teeth by 1 mm, using a diamond bur with a high-speed handpiece and water spray. Group B (Non-Occlusal Reduction, NOR) received no occlusal adjustment.

Anesthesia was administered using 2% lidocaine with 1:100,000 epinephrine, and canals were instrumented up to file size No. 20, with Gates-Glidden burs (sizes 1 and 2) for coronal shaping. 1.3% of sodium hypochlorite solutions were used for irrigation.

Postoperative pain assessment was conducted using the VAS scale (0–10) at 12, 24, and 48 hours, with the final pain score recorded 6 days post-obturation. Tenderness to percussion was assessed using a cotton roll and mirror handle tap test. No analgesics were prescribed during the study.

Data was analyzed using SPSS, with independent t-tests for intergroup comparisons, considering $p \leq 0.05$ as statistically significant.

## RESULTS

A total of 150 patients were included in the study, with 75 in each group (Group A: Occlusal Reduction, Group B: Non-Occlusal Reduction). The mean ± standard deviation of the age in Group A was noted as 39.57 ± 14.29 years, while in Group B, it was 42.67 ± 16.66 years. Males accounted for 57.3% (n=43) in Group A and 49.3% (n=37) in Group B, while females represented 42.7% (n=32) in Group A and 50.7% (n=38) in Group B.

Regarding pain scores, at 12 hours, the mean pain score in Group A was 8.40 ± 1.09, slightly lower than Group B (8.75 ± 1.01). This trend persisted at 24 hours (7.89 ± 1.22 in Group A vs. 7.97 ± 1.39 in Group B) and 48 hours (6.33 ± 1.18 in Group A vs. 6.68 ± 1.56 in Group B). By 6 days post-instrumentation, Group A had a significantly lower mean pain score (2.32 ± 1.42) compared to Group B (3.53 ± 1.70), as shown in **Table I.**

**Table II** presents the comparison of pain scores by age group. At 12 hours, a statistically significant difference was observed among patients aged 18–40 years ($p = 0.038$), with Group A experiencing less pain (8.05 ± 1.06) compared to Group B (8.60 ± 1.14). However, for patients older than 40 years, the difference was not statistically significant ($p = 0.586$).

At 24 and 48 hours, no statistically significant differences in pain scores were observed between groups in both age categories ($p > 0.05$).

By 6 days post-instrumentation, a significant reduction in pain scores was seen in the 18–40 age group ($p = 0.000$), with Group A (2.18 ± 1.29) reporting lower pain than Group B (3.51 ± 1.68). Similarly, for patients older than 40 years, Group A (2.46 ± 1.55) had significantly lower pain than Group B (3.55 ± 1.73, $p = 0.005$). Pain scores at 12 hours were higher in females compared to males, with Group A females (8.38 ± 1.07) vs. Group B females (8.87 ± 1.04, $p = 0.056$), while males showed no significant difference ($p = 0.394$).

At 24 and 48 hours, no statistically significant differences were found between genders ($p > 0.05$).

By 6 days post-instrumentation, a statistically significant reduction in pain was observed in both males ($p = 0.002$) and females ($p = 0.001$). Males in Group A (2.30 ± 1.20) reported lower pain than those in Group B (3.30 ± 1.52). Similarly, females in Group A (2.34 ± 1.69) had lower pain than those in Group B (3.76 ± 1.85), as shown in **Table III.**

**Table I: Baseline Characteristics and Clinical Response of Patients**

| **Patient Characteristics & Pain Scores** | | **Group A** (n=75) | **Group B** (n=75) |
|---|---|---|---|
| Age in years, Mean ± SD | | 39.57 ± 14.29 | 42.67 ± 16.66 |
| Gender | Male, *n* (%) | 43 (57.3) | 37 (49.3) |
| | Female, *n* (%) | 32 (42.7) | 38 (50.7) |
| Pain Score at 12 hours, Mean ± SD | | 8.40 ± 1.09 | 8.75 ± 1.01 |
| Pain Score at 24 hours, Mean ± SD | | 7.89 ± 1.22 | 7.97 ± 1.39 |
| Pain Score at 48 hours, Mean ± SD | | 6.33 ± 1.18 | 6.68 ± 1.56 |
| Pain Score after 6 days, Mean ± SD | | 2.32 ± 1.42 | 3.53 ± 1.70 |

**Table II: Comparison of Mean Post Instrumentation Pain Scores by Age Group**

| **Age Group** (Years) | | **Mean** | **± SD** | **P-Value** |
|---|---|---|---|---|
| **Pain Score at 12 hours** | | | | |
| 18 – 40 | Group A (n=38) | 8.05 | ± 1.06 | 0.038* |
| | Group B (n=35) | 8.60 | ± 1.14 | |
| | | | | |
| >40 | Group A (n=37) | 8.76 | ± 1.01 | 0.586 |
| | Group B (n=40) | 8.88 | ± 0.88 | |
| **Pain Score at 24 hours** | | | | |
| 18 – 40 | Group A (n=38) | 7.57 | ± 1.24 | 0.408 |
| | Group B (n=35) | 7.82 | ± 1.31 | |
| | | | | |
| >40 | Group A (n=37) | 8.21 | ± 1.13 | 0.700 |
| | Group B (n=40) | 8.10 | ± 1.46 | |
| **Pain Score at 48 hours** | | | | |
| 18 – 40 | Group A (n=38) | 6.00 | ± 0.98 | 0.121 |
| | Group B (n=35) | 6.42 | ± 1.33 | |
| | | | | |
| >40 | Group A (n=37) | 6.67 | ± 1.29 | 0.525 |
| | Group B (n=40) | 6.90 | ± 1.73 | |
| **Pain Score after 6 days** | | | | |
| 18 – 40 | Group A (n=38) | 2.18 | ± 1.29 | 0.000* |
| | Group B (n=35) | 3.51 | ± 1.68 | |
| | | | | |
| >40 | Group A (n=37) | 2.46 | ± 1.55 | 0.005* |
| | Group B (n=40) | 3.55 | ± 1.73 | |

(*) Indicates Statistical Significance

**Table III: Comparison of Mean Post Instrumentation Pain Score with Gender Between Groups**

| **Gender** | | **Mean** | **± SD** | **P-Value** |
|---|---|---|---|---|
| **Pain Score at 12 hours** | | | | |
| Male | Group A (n=43) | 8.42 | ± 1.11 | 0.394 |
| | Group B (n=37) | 8.62 | ± 0.98 | |
| | | | | |
| Female | Group A (n=32) | 8.38 | ± 1.07 | 0.056 |
| | Group B (n=38) | 8.87 | ± 1.04 | |
| **Pain Score at 24 hours** | | | | |
| Male | Group A (n=43) | 7.93 | ± 1.03 | 0.257 |
| | Group B (n=37) | 7.62 | ± 1.38 | |
| | | | | |
| Female | Group A (n=32) | 7.84 | ± 1.46 | 0.163 |
| | Group B (n=38) | 8.31 | ± 1.33 | |
| **Pain Score at 48 hours** | | | | |
| Male | Group A (n=43) | 6.25 | ± 1.07 | 0.662 |
| | Group B (n=37) | 6.37 | ± 1.42 | |
| | | | | |
| Female | Group A (n=32) | 6.43 | ± 1.34 | 0.148 |
| | Group B (n=38) | 6.97 | ± 1.66 | |
| **Pain Score after 6 days** | | | | |
| Male | Group A (n=43) | 2.30 | ± 1.20 | 0.002* |
| | Group B (n=37) | 3.30 | ± 1.52 | |
| | | | | |
| Female | Group A (n=32) | 2.34 | ± 1.69 | 0.001* |
| | Group B (n=38) | 3.76 | ± 1.85 | |

(*) Indicates Statistical Significance

## DISCUSSION

Postoperative pain is a significant concern in endodontic treatment, particularly in patients with symptomatic apical periodontitis, as it can affect patient satisfaction and treatment outcomes. The present study aimed to compare postoperative pain intensity between teeth that underwent occlusal reduction and those that did not. The findings revealed that occlusal reduction significantly reduced pain scores over time, with a notable decrease by day 6.

The results of this study are consistent with Emara et al. (2019)[1], who reported that occlusal reduction significantly reduced postoperative pain in patients with irreversible pulpitis and mild tenderness to percussion. Similarly, Yousaf et al. (2020)[2] found that patients who underwent occlusal reduction experienced lower pain intensity compared to those without occlusal adjustment. However, Kiran et al. (2022)[3] observed that pain reduction followed a natural course regardless of occlusal intervention, suggesting that other factors such as mechanical, chemical, and microbial influences play a role in pain modulation. This aligns with the present study's finding that pain decreased over time in both groups, although it was significantly lower in the occlusal reduction group by day 6.

Additionally, Nguyen et al. (2020)[4] conducted a meta-analysis that concluded occlusal reduction can effectively reduce post-endodontic pain, especially in cases with preoperative percussion sensitivity. This supports the current study's findings, where patients with occlusal reduction had lower pain scores, particularly at 12 hours and 6 days post-treatment.

The role of age and gender in pain perception has also been discussed in previous literature. In the present study, younger

patients (18–40 years) and females reported higher pain levels initially, but occlusal reduction significantly reduced pain by day 6. This finding is in agreement with Tibúrcio-Machado et al. (2021)[5], who stated that younger individuals and females tend to experience higher pain sensitivity due to biological and psychological factors. Similarly, Nagendrababu et al. (2020)[9] highlighted that occlusal reduction is more beneficial for younger patients with symptomatic apical periodontitis, further supporting the current results.

Although the findings suggest that occlusal reduction is an effective strategy for managing post-endodontic pain, Buonavoglia et al. (2021)[10] and George et al. (2016)[11] emphasized that individual variations, microbial infection, and inflammatory responses also contribute to pain perception. This indicates that occlusal reduction should be combined with other pain management strategies for optimal outcomes.

Moreover, the present study supports the conclusions of Ahmed et al. (2020)[8], who found that occlusal reduction significantly lowered postoperative pain at 12 and 48 hours, with sustained relief over time. However, Chagas Carvalho Alves et al. (2021)[12] reported conflicting results, where occlusal reduction did not show a significant difference in pain relief, possibly due to differences in methodology, sample size, and pain assessment techniques.

The clinical implications of this study suggest that occlusal reduction should be considered in endodontic treatment planning, especially for patients with preoperative pain on percussion or biting[13]. The findings also reinforce the importance of individualized pain management approaches based on age, gender, and preoperative symptoms[14,15].

While the study provides strong evidence supporting occlusal reduction, certain limitations should be acknowledged. The study was single-centered, and long-term effects beyond six days were not evaluated. Additionally, patient-reported pain perception is subjective, and other confounding factors such as occlusal force variations and psychological factors were not assessed. Future multi-center trials with longer follow-up durations are recommended to validate these findings.

The findings of this study confirm that occlusal reduction significantly reduces postoperative pain in symptomatic apical periodontitis, particularly in younger patients and females. Given the consistency with previous research, clinicians should consider occlusal reduction as an effective strategy for minimizing post-endodontic pain. However, a multifactorial approach to pain management remains essential for optimizing patient outcomes.

## CONCLUSION

This study concluded that occlusal reduction significantly reduces the postoperative pain in symptomatic apical periodontitis, with a notable effect by day 6. The reduction was significantly high in younger and female patients. These findings support occlusal reduction as an effective strategy for minimizing post-endodontic pain.

**Conflict of Interest:** The authors declare no conflict of interest.

**Source of Fundings:** Nil

**Authors' Contributions:** All authors took part in this study to an equal extent. **Sundus A:** Data collection, follow-up the patients for final outcomes and drafting and conceptual framework. **Fozia R:** Developed the conceptual framework and provided guidance on data collection, statistical analysis, and result interpretation, while also supervising the study to ensure methodological accuracy. **Aleem RQ:** Facilitated in data collection. **Moomal M:** Assisted in data analysis. **Yusra:** Formatting & Discussion. **Pirah S:** Proofreading, designing and editing.

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**How to cite:** Sundus A, Fozia R, Aleem Q, Moomal M, Yusra, Pirah S. Evaluation of Post Operative Pain Intensity on Pain Scale Following Occlusal Reduction in Teeth Associated with Symptomatic Apical Periodontitis. Pak J Med Dent Sci. 2025;2(1):01-05

MS NO.: PJMDS/OA/036/2024

Original Article

# Comparison of Modified Darn Repair and Mesh Repair for Inguinal Hernia: Randomized Control Trial

Pirha Bhatti[1], Monika Mankani[2], Tanzeela Memon[3], Rukhsar Kandhro[4]

## ABSTRACT

**Objective:** To compare the outcome of modified darn repair and mesh repair in patients presenting with inguinal hernia.

**Methodology:** This randomized controlled trial was executed at SMBBMU, Larkana (November 2022–December 2023), encompassing 350 individuals diagnosed with inguinal hernia (ages 18–60, either gender). Subjects were randomly allocated to either the Modified Darn Repair (MDR) or Mesh Repair (MR) cohorts employing the SNOSE methodology. The evaluated outcomes comprised operative duration, postoperative discomfort, duration of hospital stay, recovery period, and complications. Data were subjected to statistical analysis utilizing SPSS version 26, with statistical significance established at $p \leq 0.05$.

**Results:** This study included 350 patients (186 MR, 164 MDR) with a mean age of 33.32 ± 9.85 years (MR) and 32.34 ± 8.37 years (MDR). Males constituted 90.3% (MR) and 95.7% (MDR). Compared to MR, MDR had a shorter operative time (38.75 ± 6.36 vs. 40.93 ± 7.31 mins, p = 0.003), lower pain scores (3.77 ± 1.29 vs. 4.16 ± 1.57, p = 0.012), faster recovery (15.06 ± 2.73 vs. 15.82 ± 2.93 days, p = 0.013), and fewer complications, supporting its efficacy as an alternative approach.

**Conclusion:** This investigation indicated that Modified Darn Repair (MDR) and Mesh Repair (MR) are both effective options for the treatment of inguinal hernia. MDR had some benefits such as shorter hospital stays, less postoperative pain, and lower complication rates. It is, therefore, a viable alternative, particularly for patients with a risk of mesh-related complications, given its lower infection and recurrence rates. The current findings need to be confirmed in larger studies involving multiple study centres.

**Keywords:** Hernia surgery, Mesh repair, Modified darn repair, Postoperative complications, Recurrence rate

## INTRODUCTION

Inguinal hernia is one of the most common types of surgical pathological entity, reaching a lifetime prevalence of 25% in men and 2% in women[1]. The elderly are particularly affected by this condition, and one study reported that nearly half of all hernias in males are diagnosed in the aged[1]. Inguinal hernia repair is one of the most frequently performed general surgical procedures worldwide owing to its high prevalence. Approximately 1 million abdominal wall hernia repairs are performed per year in the United States, 770,000 of which are for inguinal hernias[2]. Although surgical techniques have undergone an evolutionary process, they represent a historical continuum and the myriad makeups of effectiveness, safety and recovery are still debated amongst surgeons.

For decades, the Lichtenstein tension-free mesh repair (LMR) has remained the most viable surgical approach due to its low recurrence rates and long-term safety profile[3]. However, the increasing concerns about chronic postoperative pain, foreign body reactions, and mesh-related complications have encouraged scientists and surgeons to search for different treatment methods[4–6]. One such solution to these issues might be the Modified Darn Repair (MDR), which appears to supplement the weakened abdominal wall with reinforcement without the use of a permanent mesh. At the same time, MDR has been reported to offer similar or even better postoperative recovery, pain, and recurrence outcomes than the most common surgical approaches[7,8].

The darning repair technique offers an economical alternative to mesh-based approaches, particularly in settings where access to synthetic mesh is constrained due to financial or logistical limitations. This technique utilizes commonly available suturing materials, making it more feasible in resource-limited environments. In contrast, mesh-based techniques such as the Lichtenstein procedure often require specialized materials and training[9].

Several studies have evaluated differences between the MDR and the Lichtenstein technique in terms of mean operative time, post-operative pain and recurrence rates. Recent comparative studies evaluating the modified darn repair (MDR) versus mesh-based techniques have revealed meaningful clinical distinctions. The mean hospital stay was slightly shorter for the MDR group (1 ± 0.4 days) compared to the mesh repair group (1.2 ± 0.6 days). Although operative time was longer for the MDR technique (58.4 ± 9.2 minutes vs. 51.3 ± 10.6 minutes), early postoperative pain scores were marginally lower (3.9 vs. 4.1), indicating a potential benefit of MDR in early pain management[10]. In another study, the average surgical durations were recorded as 56 minutes for Lichtenstein repair and 48 minutes for MDR; however, neither technique significantly diminished the time required for patients to return to work, with individuals taking up to 20 days to resume normal activities post-intervention. Notably, the MDR was associated with fewer postoperative complications (1.9% compared to 11.7% for the Lichtenstein repair), and no recurrences were documented within the MDR cohort[11].

In consideration of these findings, Modified Darn Repair emerges as a superior alternative to mesh-based techniques, particularly in individuals with an elevated likelihood of enduring

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**Submitted:** October 2, 2024
**Revised:** February 21, 2025
**Accepted:** March 11, 2025

pain, mesh extrusion, or financial constraints[12,13]. Assessing the economic and clinical ramifications of various hernia repair methodologies is imperative in resource-constrained nations such as Pakistan, where healthcare accessibility poses a significant obstacle. Achieving optimal outcomes at minimal cost is essential, given that both patients and healthcare facilities are encumbered by the financial implications of hospitalization and extended recovery periods.

At present, there exists a paucity of local data that juxtaposes MDR with Lichtenstein repair within the Pakistani demographic. Hence, this investigation seeks to furnish a direct comparison between Modified Darn Repair and Mesh Repair, with the objective of ascertaining which technique yields superior recovery, diminished complications, and enhanced patient satisfaction. The results may serve to inform surgical decision-making processes and aid in the formulation of standardized protocols for hernia management across both affluent and resource-limited healthcare environments.

## METHODOLOGY

This randomized controlled trial (RCT) was executed from November 2022 to December 2023 at the Department of Surgery Unit III, Shaheed Mohtarma Benazir Bhutto Medical University (SMBBMU) located in Larkana. Employing a non-probability consecutive sampling approach, a total of 350 participants, irrespective of gender, aged between 18 and 60 years, who exhibited clinical symptoms (pain, swelling in the inguinal region, scrotal swelling accompanied by a positive cough impulse) suggestive of inguinal hernia were recruited.

This investigation included individuals categorized as American Society of Anaesthesiologists (ASA) I or II, while excluding those presenting with strangulated or recurrent hernias, obesity (BMI > 30 kg/m²), coagulopathy, or other significant comorbid conditions.

All subjects were given full details regarding the purpose, risks, and benefits to them of the study before they gave their written informed consent to take part.

The mean hospital stay reported in a previous comparative study between the Modified Darn Repair (MDR) and Lichtenstein Mesh Repair (MR) techniques was 1 ± 0.4 days and 1.2 ± 0.6 days, respectively[10]. Based on this effect size, the required sample size was calculated using OpenEpi version 3.0, with a power of 80% and a significance level of 5%. To accommodate potential attrition and ensure adequate statistical power, the final adjusted sample size was set at 350 participants, comprising 186 individuals in the MR group and 164 individuals in the MDR group.

Participants were randomly assigned to one of two groups through a computer-generated random number sequence, with allocation concealed throughout the randomization process to maintain the integrity of randomization and mitigate selection bias.

The concealment of allocation was achieved via the sequentially numbered, opaque, sealed envelope (SNOSE) approach, executed by an independent researcher who was not involved in the recruitment of subjects or the surgical procedures and examinations. Patients in group A (n=186) underwent Lichtenstein tension-free mesh repair (MR), while those in group B (n=164) received Modified Darn Repair (MDR) utilizing polypropylene sutures.

In the Mesh Repair (MR) cohort, Polypropylene sutures used the surgical intervention was performed under spinal anaesthesia. The hernia sac was carefully dissected, mobilized, and extracted through a conventional inguinal incision. The external oblique aponeurosis was subsequently closed over the mesh, followed by a layered closure of the skin.

In the MDR group, the hernia sac was dissected through the inguinal incision. Crossed continuous tension-free polypropylene sutures were utilized for the repair, engaging both the inguinal ligament and the fascia of the internal oblique muscle.

All procedures were carried out with the utmost precision to avert excessive pressure on the spermatic cord, with the final ligature positioned 2-3 cm lateral to the deep ring, accompanied by supplementary sutures to fortify the area prior to the layered closure of the skin.

The efficacy of both surgical techniques was assessed through various clinical parameters. The duration of the surgical procedure was meticulously documented (in seconds; stopwatch) from the initiation of the initial incision to the conclusion of the final suture. The Numeric Rating Scale (NRS; 0–10; 0 signifies no pain and 10 denotes the worst pain conceivable) was employed to appraise postoperative pain levels 24 hours following surgery.

The length of stay in the hospital was registered in days, from the time of admission to time of discharge. The time taken to return to normal physical activities was also documented. Postoperative complications (wound infection, hematoma, urinary retention, scrotal seroma, recurrence) were recorded systematically during the follow-up period.

Data collection was executed in a systematic manner employing a structured proforma, and subsequent statistical analysis was conducted utilizing SPSS version 26. The independent sample t-test and Chi-square test was used to compare the outcomes and complications between groups at a significance level of 5%.

## RESULTS

The investigation encompassed a total of 350 subjects, with 186 individuals assigned to the MR cohort and 164 individuals assigned to the MDR cohort. The average age of participants within the MR cohort was 33.32 years (SD ± 9.85), whereas the MDR cohort exhibited a marginally younger average age of 32.34 years (SD ± 8.37).

Gender distribution showed a significant preponderance of male subjects in both the MR cohort (90.3%) and the MDR cohort (95.7%). In contrast, the proportion of female participants was much lower 9.7% in the MR group and 4.3% in the MDR group.

The MR cohort had 33.3% of hernias classified as direct and 66.7% classified as indirect. In comparison, the distribution of direct vs indirect hernias in the MDR cohort was 25.0% and 75.0%, respectively. In MR cohort, local anaesthesia was used in 4.8% patients, spinal anaesthesia in 85.5%, and general anaesthesia was given to 9.7% patients

The MDR cohort displayed a marginally higher incidence of local anaesthesia (9.1%) and a lower incidence of general anaesthesia (6.1%).

The laterality of hernias was predominantly right sided in both cohorts, with 64.5% in the MR cohort and 72.6% in the MDR cohort. Left-sided hernias were comparatively infrequent, accounting for 35.5% in the MR cohort and 27.4% in the MDR cohort, as delineated in **Table I.**

The mean duration of hospital stay was slightly extended for the MR cohort (2.71 days) relative to the MDR cohort (2.52 days),

although this discrepancy did not achieve statistical significance (p-value = 0.063).

Pain assessment scores were elevated in the MR cohort (4.16) in comparison to the MDR cohort (3.77), with a statistically significant difference (p-value = 0.012), suggesting that individuals in the MR cohort experienced greater postoperative pain.

The length of the surgical procedure was greater for the MR cohort (40.93 minutes) when juxtaposed with the MDR cohort (38.75 minutes), and this difference was statistically significant (p-value = 0.003), indicating that MR surgical interventions may necessitate a longer duration.

The resumption of physical activity was observed to be slightly protracted in the MR cohort (15.82 days) compared to the MDR cohort (15.06 days), with a significant p-value of 0.013, indicating an extended recovery period for patients in the MR cohort.

Complications were observed to be more frequent in the MR cohort, particularly with regard to wound infections (8.1% vs. 1.8%, p-value = 0.007) and recurrence rates (10.8% vs. 3.7%, p-value = 0.012), both of which reached statistical significance, underscoring an elevated risk of complications among MR patients, as illustrated in **Table II.**

In the demographic cohort of individuals aged 18 to 30 years, the mean duration of hospitalization was marginally extended for the MR cohort (2.70 days) in comparison to the MDR cohort (2.53 days), although this disparity did not reach statistical significance (p-value = 0.212). The pain assessment scores were elevated in the MR cohort (4.12) relative to the MDR cohort (3.81), yet this variation similarly did not attain statistical significance (p-value = 0.150). The procedural duration was extended for the MR cohort (41.09 minutes) as opposed to the MDR cohort (39.25 minutes), with a p-value of 0.052, thereby indicating a trend that approaches statistical significance. The resumption of physical activity was marginally postponed in the MR cohort (15.87 days) compared to the MDR cohort (15.20 days), with a p-value of 0.066, implying a potential difference that may justify further scholarly inquiry. Complications, including wound infections, were more prevalent in the MR cohort (7.8%) than in the MDR cohort (2.2%); however, this distinction did not achieve statistical significance (p-value = 0.075). In the demographic cohort exceeding 30 years of age, the MR cohort exhibited a prolonged average hospitalization duration (2.72 days) in comparison to the MDR cohort (2.51 days), although this difference did not reach statistical significance (p-value = 0.167).

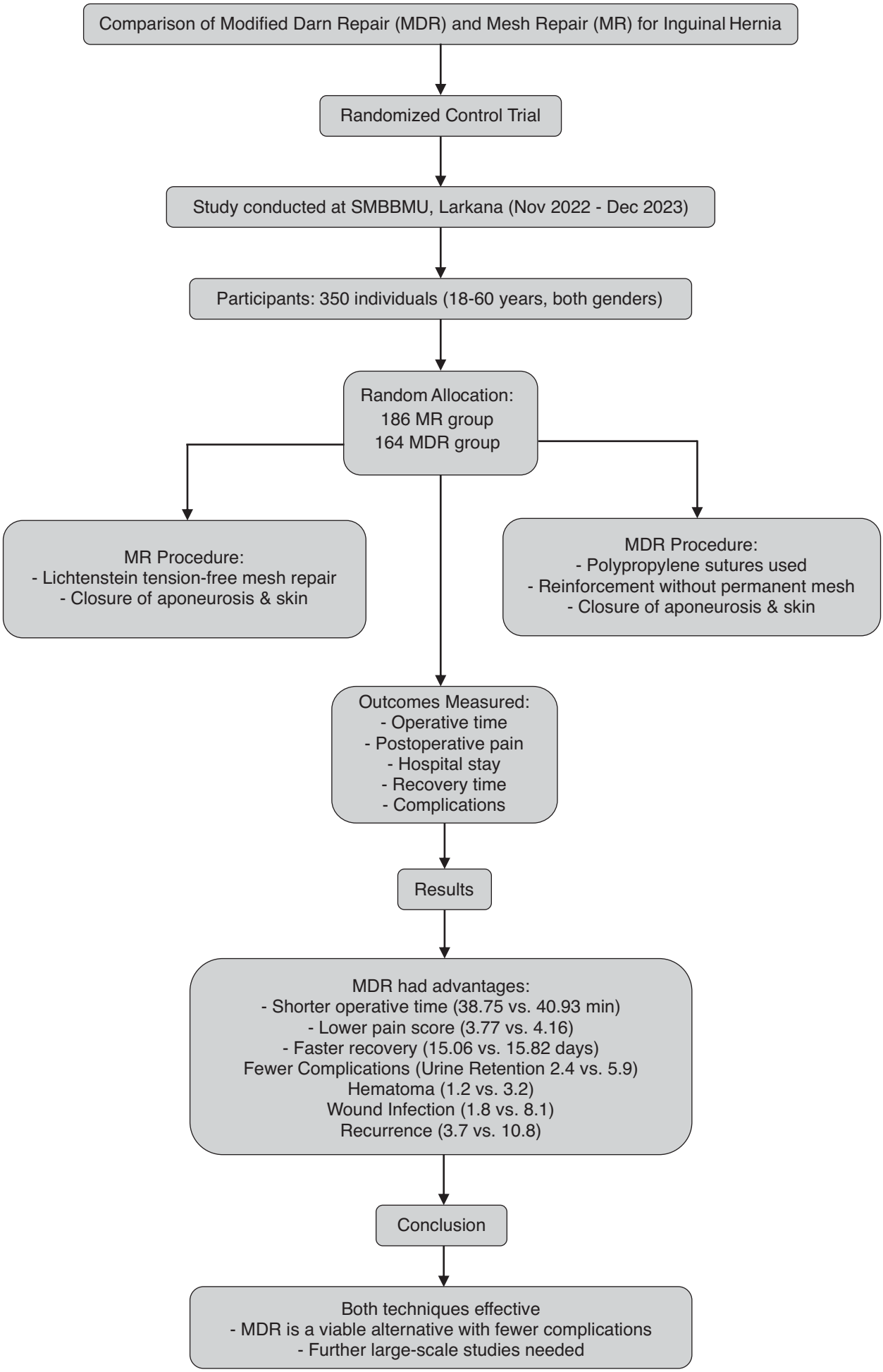
Pain assessment scores were significantly elevated in the MR cohort (4.22) as compared to the MDR cohort (3.71), with a p-value of 0.033, indicating a significant divergence in pain perception. The duration of the procedure was also prolonged for the MR cohort (40.73 minutes) in contrast to the MDR cohort (38.12 minutes), with a statistically significant p-value of 0.028. Complications within the over 30 age group revealed a significant difference in the incidence of wound infections (8.4% in MR vs. 1.4% in MDR, p-value = 0.047) and recurrence rates (12.0% in MR vs. 1.4% in MDR, p-value = 0.008), thereby indicating a heightened risk of complications in the MR cohort as depicted in **Table III.**

**Table I: Characteristics of Study Participants (n=350)**

| Baseline Characteristic | | Groups | |
|---|---|---|---|
| | | **MR** (n=186) | **MDR** (n=164) |
| Age in years, Mean ± SD | | 33.32 ± 9.85 | 32.34 ± 8.37 |
| Gender | Male, n (%) | 168 (90.3) | 157 (95.7) |
| | Female, n (%) | 18 (9.7) | 7 (4.3) |
| Type of Hernia | Direct, n (%) | 62 (33.3) | 41 (25.0) |
| | Indirect, n (%) | 124 (66.7) | 123 (75.0) |
| Anesthesia Type | Local, n (%) | 9 (4.8) | 15 (9.1) |
| | Spinal, n (%) | 159 (85.5) | 139 (84.8) |
| | General, n (%) | 18 (9.7) | 10 (6.1) |
| Side of Hernia | Right, n (%) | 120 (64.5) | 119 (72.6) |
| | Left, n (%) | 66 (35.5) | 45 (27.4) |

| Table II: Comparison of Outcomes and Complications Between Groups (n=350) | | | | | |
|---|---|---|---|---|---|
| **Surgical Outcomes & Complications** | | **Groups** | | **95% Confidence Interval** | **P-Value** |
| | | **MR** (n=186) | **MDR** (n=164) | | |
| Hospital Stay in days | | 2.71 ± 1.01 | 2.52 ± 0.88 | -0.010------0.393 | 0.063 |
| Pain Score | | 4.16 ± 1.57 | 3.77 ± 1.29 | 0.087------0.699 | 0.012* |
| Duration of Procedure in mins | | 40.93 ± 7.31 | 38.75 ± 6.36 | 0.729------3.631 | 0.003* |
| Return to Physical Activity in days | | 15.82 ± 2.93 | 15.06 ± 2.73 | 0.157------1.355 | 0.013* |
| **Complications, n (%)** | Retention of Urine | 11 (5.9) | 4 (2.4) | 0.785------8.055 | 0.089 |
| | Hematoma | 6 (3.2) | 2 (1.2) | 0.537------13.566 | 0.187 |
| | Seroma Scrotal | 9 (4.8) | 8 (4.9) | 0.373------2.632 | 0.986 |
| | Wound Infection | 15 (8.1) | 3 (1.8) | 1.338------16.565 | 0.007* |
| | Recurrence | 20 (10.8) | 6 (3.7) | 1.242------8.105 | 0.012* |

| Table III: Comparison of Outcomes & Complications Between Groups (n=350) | | | | |
|---|---|---|---|---|
| **Age Group 18---30** | | | | |
| **Outcomes & Complications** | **Groups** | | **95% Confidence Interval** | **P-Value** |
| | **MR** (n=186) | **MDR** (n=164) | | |
| Hospital Stay (days) | 2.70 ± 0.99 | 2.53 ± 0.89 | -0.099------0.442 | 0.212 |
| Pain Score | 4.12 ± 1.59 | 3.81 ± 1.28 | -0.111------0.717 | 0.150 |
| Duration of Procedure (mins) | 41.09 ± 6.74 | 39.25 ± 6.27 | -0.018------3.687 | 0.052* |
| Return to Physical Activity (days) | 15.87 ± 2.60 | 15.20 ± 2.46 | -0.044------1.396 | 0.066 |
| **Complications, n (%)** | | | | |
| Retention of Urine | 4 (3.9) | 2 (2.2) | 0.322------10.054 | 0.402 |
| Hematoma | 4 (3.9) | 1 (1.1) | 0.399------33.142 | 0.225 |
| Seroma Scrotal | 4 (3.9) | 4 (4.4) | 0.213------3.619 | 0.569 |
| Wound Infection | 8 (7.8) | 2 (2.2) | 0.775------18.125 | 0.075 |
| Recurrence | 10 (9.7) | 5 (5.5) | 0.608------5.628 | 0.273 |
| **Age Group > 30** | | | | |
| Hospital Stay (days) | 2.72 ± 1.04 | 2.51 ± 0.88 | -0.091------0.523 | 0.167 |
| Pain Score | 4.22 ± 1.56 | 3.71 ± 1.32 | 0.043------0.966 | 0.033* |
| Duration of Procedure (mins) | 40.73 ± 8.00 | 38.12 ± 6.45 | 0.290------4.933 | 0.028* |
| Return to Physical Activity (days) | 15.75 ± 3.32 | 14.89 ± 3.04 | -0.156------1.869 | 0.097 |
| **Complications, n (%)** | | | | |
| Retention of Urine | 7 (8.4) | 2 (2.7) | 0.657------16.267 | 0.118 |
| Hematoma | 2 (2.4) | 1 (1.4) | 0.158------20.020 | 0.548 |
| Seroma Scrotal | 5 (6.0) | 4 (5.5) | 0.285------4.283 | 0.581 |
| Wound Infection | 7 (8.4) | 1 (1.4) | 0.796------55.245 | 0.047* |
| Recurrence | 10 (12.0) | 1 (1.4) | 1. 231------79.047 | 0.008* |


Comparison of Modified Darn Repair (MDR) and Mesh Repair (MR) for Inguinal Hernia
Randomized Control Trial
Study conducted at SMBBMU, Larkana (Nov 2022 - Dec 2023)
Participants: 350 individuals (18-60 years, both genders)
Random Allocation:
186 MR group
164 MDR group
MR Procedure:
- Lichtenstein tension-free mesh repair
- Closure of aponeurosis & skin
MDR Procedure:
- Polypropylene sutures used
- Reinforcement without permanent mesh
- Closure of aponeurosis & skin
Outcomes Measured:
- Operative time
- Postoperative pain
- Hospital stay
- Recovery time
- Complications
Results
MDR had advantages:
- Shorter operative time (38.75 vs. 40.93 min)
- Lower pain score (3.77 vs. 4.16)
- Faster recovery (15.06 vs. 15.82 days)
Fewer Complications (Urine Retention 2.4 vs. 5.9)
Hematoma (1.2 vs. 3.2)
Wound Infection (1.8 vs. 8.1)
Recurrence (3.7 vs. 10.8)
Conclusion
Both techniques effective
- MDR is a viable alternative with fewer complications
- Further large-scale studies needed

## DISCUSSION

The comparison between modified darn repair (MDR) and mesh repair (MR) for inguinal hernia continues to be a significant topic in surgical research. While mesh repair remains the gold standard due to its lower recurrence rates, MDR is gaining attention for its advantages in reducing postoperative pain, avoiding foreign body reactions, and offering a faster recovery. Several studies have provided comparative data on key outcomes such as hospital stay, postoperative pain, operative duration, and return to physical activity, helping to refine surgical decision-making[14-16].

The available studies indicate that MDR has a slight edge in reducing hospital stay and postoperative pain. Our study found that the hospital stay was 2.71 ± 1.01 days for MR vs. 2.52 ± 0.88 days for MDR, and pain scores were lower in MDR (3.77 ± 1.29 vs. 4.16 ± 1.57 for MR). Additionally, operative time was marginally shorter in MDR (38.75 ± 6.36 vs. 40.93 ± 7.31 minutes for MR), and patients returned to physical activity sooner (15.06 ± 2.73 vs. 15.82 ± 2.93 days for MR). A similar study demonstrated comparable results with mean hospital stay of 33.97 ± 4.97 vs. 39.76 ± 6.40 days, lower MDR pain scores (3.64 ± 2.97 vs. 4.23 ± 2.69 in MR), and lower procedure time (36.38 ± 5.16 vs. 39.02 ± 7.65 min for MR)[17].

Kalim et al.[18] and Saeed et al[19] reported shorter mean operative times in MDR (35 ± 17.03 vs. 50 ± 19.76 minutes in MR; P = 0.0001) and 36.62 ± 6.98 vs. 45.81 ± 9.29 minutes, respectively. Thus, these results suggested that MDR can be a suitable alternative, particularly those associated with a relatively short recovery period and low pain scores.

Even though Modified Darn Repair (MDR) is related with less pain, less operating time and faster return to work, recurrence rate appears to remain a major complication. Implantable mesh has proven to be a chronic, durable approach to prevent hernia recurrence.

Studies performed by Lockhart et al.[20] and Smith et al.[21] have shown that recurrence rates with mesh repair are lower than similar results with native tissue repair; but with more chronic pain and foreign body reactions due to mesh. Oberg et al. have shown that chronic pain is more common after mesh repair than after non-mesh procedures[22]. These results provide additional support for using alternative methodologies, such as MDR, in certain populations.

A comparative analysis of modified darn repair and mesh repair for inguinal hernia yields critical insights regarding the advantages and disadvantages inherent to these two surgical techniques. Notable strengths of this study encompass a comprehensive evaluation of significant outcomes, including duration of hospital stay, postoperative pain levels, surgical time, and resumption of routine physical activities.

The findings reveal a modest benefit of MDR over mesh repair in terms of diminishing the length of hospital stay and postoperative pain; however, there is a marginally shorter operative time and a quicker return to athletic activities. These outcomes are consistent with earlier research, reinforcing the potential advantages of MDR for facilitating accelerated recovery and pain alleviation.

Nonetheless, there exist several limitations associated with the study. The recurrence rate remains the most critical concern, as mesh repair continues to be regarded as the gold standard due to its demonstrated long-term durability and reduced recurrence rates. This investigation did not provide sufficient long-term follow-up data, which is essential for assessing the sustainability of the benefits attributed to MDR.

Moreover, studies with longer duration should be organized with multi-center randomized controlled trials to provide accurate estimates of recurrence rates and potential complications. Finally, the cost-effectiveness of each surgical technique in different health care systems should also be assessed. For clinicians, MDR may be an acceptable compromise for patients with the goal of restoring function and minimizing pain early but it needs to be carefully balanced with the sacrifice of risk of recurrence.

## CONCLUSION

This investigation indicated that Modified Darn Repair (MDR) and Mesh Repair (MR) are both effective options for the treatment of inguinal hernia. MDR had some benefits such as shorter hospital stays, less postoperative pain, and lower complication rates. It is, therefore, a viable alternative, particularly for patients with a risk of mesh-related complications, given its lower infection and recurrence rates. The current findings need to be confirmed in larger studies involving multiple study centres.

**Conflict of Interest:** The authors declare no conflict of interest.

**Source of Fundings:** Nil

**Authors' Contributions:** All authors took part in this study to an equal extent. **Bhatti P:** Conceptualized and designed the study, collected and analyzed data, interpreted results, and drafted the manuscript. **Mankani M:** Provided guidance in study design, supervised data collection and analysis, reviewed and revised the manuscript for critical intellectual content. **Memon T:** Assisted with data collection, contributed to data analysis, and provided input on manuscript preparation. **Kandhro R:** Contributed to data collection, literature review, and manuscript preparation.

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**How to cite:** Bhatti P, Mankani M, Memon T, Kandhro R. Comparison of Modified Darn Repair and Mesh Repair for Inguinal Hernia: Randomized Control Trial. Pak J Med Dent Sci. 2025;2(1):06-12

MS NO.: PJMDS/OA/047/2025

Original Article

# Impact of Social Media on Oral Health Awareness and Treatment Knowledge

Bisma Anwar[1], Abdul Ghayas[2]

## ABSTRACT

**Objective:** To assess the impact of social media on oral health awareness and treatment knowledge in Pakistan, evaluating its role as an educational tool and its influence on oral hygiene behaviors.

**Methodology:** This cross-sectional study was conducted with 110 participants recruited through convenience sampling. Data were collected via structured interviews with a bilingual questionnaire covering demographics, oral hygiene practices, social media usage, and oral health knowledge. Statistical analyses examined associations between social media usage and oral health outcomes, including brushing frequency and knowledge levels.

**Results:** The participants had a mean age of 38.71 ± 8.56 years, with 61% males and 39% females. Most participants (93.6%) considered oral health as important as physical health, and 85.5% believed poor oral hygiene fosters systemic disease. Social media users (38.2%) demonstrated better brushing practices, with after-meal brushing reported only by users (11.9%, p = 0.002). However, no significant difference in oral health knowledge was found between users and non-users (p = 0.633). Among users, Google (69%) and YouTube (19%) were the primary sources, but 43.6% expressed doubts about the reliability of online information.

**Conclusion:** This suggests that social media can be used innovatively to improve oral health awareness and behaviors in Pakistan. Although social media is still not widely used, it has an effect mainly on practices such as brushing behavior. However, misinformation and doubts about the reliability of online information present challenges. Targeted interventions, culturally relevant content, and enhanced digital health literacy are essential to maximize social media's role in bridging knowledge gaps and promoting preventive oral health practices.

**Keywords:** Oral health awareness, Oral hygiene behaviors, Social media, Treatment knowledge

## INTRODUCTION

Regionally, in many parts of Asia and the Middle East, the use of social media in healthcare is growing rapidly. It has become an essential tool for public health campaigns, improving engagement with audiences and facilitating easier access to healthcare information. Social media platforms have been effective in educating the public about oral health, creating awareness on preventive care, and offering insights into various treatment options.

The advent of social media has revolutionized how individuals' access and share information, connecting people across geographical boundaries. In healthcare, particularly oral health, social media has emerged as a critical platform for disseminating knowledge, influencing treatment decisions, and promoting preventive care. Platforms like Facebook, Instagram, WhatsApp, and YouTube are widely used to share educational materials and enhance communication between healthcare providers and patients. Studies show that social media not only raises awareness about oral health issues but also fosters behavioral change in oral hygiene practices, especially among younger demographics and urban populations[1,2].

Despite the rising burden of dental caries, periodontal diseases, and oral cancers in several countries such as Pakistan and the subcontinent, social media has not been fully harnessed as a tool for positive impact[3]. The cultural, economic and infrastructural barriers do not allow raising awareness regarding oral health and there is also limited access to dental care in Pakistan[4]. Conversely, social media presents a solution to fill these gaps at low cost and on a wider scale[5,6]. India-based evidence indicated that WhatsApp and Instagram are more effective in imparting knowledge regarding oral health and decisions regarding dental treatment because of their visual and interactive nature[7,8].

Additionally, social media provides the ability to reach healthcare professionals directly so that patients are able to ask questions, obtain trustworthy information, and combat misinformation relating to dental treatments[7]. A study reported a significant gain after education through social platforms where social media is prevalent and easy to use[8], while other studies reported that education via Instagram could greatly improve participants' knowledge regarding oral hygiene practices with an emphasis on targeting[9-11]. Although studies have highlighted the use of social media among dentists and its influence on dental practice, as well as its impact on dental education, relatively few studies have examined the use and influence of social media on dental practice in Southeast Asia[12-14].

This study was conducted for the assessment of the role of social media to impart awareness about oral health and knowledge about treatment in Pakistan and its effectiveness as an educational tool and change of behavior. This research could help in strategizing future interventions to improve oral health by understanding the key drivers of the same and where exactly needs the most effort.

## METHODOLOGY

This cross-sectional study aimed to evaluate the impact of social media on oral health awareness and treatment knowledge in Pakistan. A total of 110 participants were selected through convenience sampling, ensuring a diverse representation in terms of gender, socioeconomic status,

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**Submitted:** January 28, 2025
**Revised:** March 17, 2025
**Accepted:** April 05, 2025

education levels, and occupations. The sample size was calculated using the WHO sample size calculator, considering a sufficient knowledge rate of 13.5% from a prior study[23], with a margin of error of 6.5% and a confidence level of 95%.

Data were collected using a structured questionnaire through face-to-face interviews, and the questionnaire was developed in English and Urdu. The questionnaire collected demographics (age, gender, marital status, education and socioeconomic status), oral hygiene practices (e.g., how often they brush their teeth and whether they previously had toothaches), social media usage patterns (e.g., preferred platform, how often they use it and what is the purpose), and oral health knowledge (e.g., whether they know that oral health is important and that oral health is related to systemic health). The inclusion criteria included adults aged 18 years and above, residents of urban, peri-urban or rural Pakistan, active social media users or users with other access to social media, willing to give informed consent form before the study, and willing to engage in an interview. Exclusion criteria included professional or academic experience in oral health, impairments in cognition or communication and failure to complete the interview.

The data was meticulously entered and subsequently analyzed employing SPSS version 26. Descriptive statistical parameters were calculated, specifically in relation to the mean alongside standard deviation and frequency alongside percentage, and the dataset was scrutinized and presented with a 95% confidence interval.

## RESULTS

The research study included a sample size of 110 participants, exhibiting a mean age of 38.71 ± 8.56 years, the majority of whom fell within the age bracket of 30 to 50 years, thus suggesting a demographic profile that is largely representative of young to middle-aged individuals **(Figure I).** In the assessment of knowledge, the participants exhibited a notable degree of awareness, achieving a mean knowledge score of 7.59 ± 2.566. The majority of participants attained scores ranging from 6 to 10 **(Figure II).** The analysis of gender distribution revealed that 67 individuals (61%) identified as male, while 43 individuals (39%) identified as female, thereby indicating a notable male predominance **(Figure III).** Concerning oral hygiene practices, 51 participants (46.4%) indicated that they engaged in brushing their teeth once daily, 44 participants (40%) reported brushing twice daily, 5 participants (4.5%) brushed after every meal, and 10 participants (9.1%) admitted to brushing either irregularly or occasionally, thereby suggesting that a significant proportion adhered to a consistent dental hygiene regimen **(Figure IV)**.

As delineated in **Table I**, a predominant proportion of the study cohort was comprised of individuals who were married (65.5%), whereas 34.5% remained unmarried. In the context of educational attainment, the majority of participants possessed a graduate degree (46.4%), succeeded by those holding postgraduate qualifications (40.0%), with a smaller fraction having intermediate (7.2%), secondary (5.5%), or middle-level (0.9%) education. In terms of occupational status, 88.1% were engaged in occupations characterized by office-based environments, 6.4% were identified as housewives, and 5.5% participated in fieldwork. Concerning socioeconomic standing, over half (51.8%) indicated a monthly income within the range of Rs. 25,000-50,000, 44.6% reported earnings exceeding Rs. 50,000, while a mere 3.6% earned below Rs. 25,000.

The participants in the study demonstrated a strong belief in the importance of oral health, with 103 participants (93.6%) considering it as important as physical health, while only 7 participants (6.4%) disagreed. Furthermore, a significant majority, 94 participants (85.5%), believed that poor oral hygiene fosters systemic disease, with 16 participants (14.5%) expressing the opposite view. In terms of personal experience, 71 participants (64.5%) reported having suffered from toothache, whereas 39 participants (35.5%) did not. Among those who experienced toothache, the most common action taken to alleviate the pain was visiting the dentist, reported by 51 participants (71.8%). Other responses included taking painkillers (self-medication) by 13 participants (18.3%), discussing the issue with relatives or friends who had experienced toothaches (5 participants, 7.0%), and searching for information online about the causes and treatments for toothache (2 participants, 2.8%). The frequency of social media and internet use to obtain information about oral health problems, the findings indicate that 42 participants (38.2%) utilized social media or the internet for this purpose, while the majority, 68 participants (61.8%), did not. Among those who did seek information online, 24 participants (57.1%) searched for the causes of toothaches, and 18 participants (42.9%) looked for treatments related to toothaches. The primary source for obtaining oral health information was Google, used by 29 participants (69.0%), followed by YouTube (19.0%) and Facebook (11.9%). When assessing the perceived reliability of the information available online, 45 participants (40.9%) believed it was accurate, while 17 participants (15.5%) did not, and 48 participants (43.6%) were uncertain about its reliability. Regarding knowledge about oral health care, the results showed that 29 participants (26.4%) had inadequate knowledge, whereas 81 participants (73.6%) demonstrated adequate knowledge, as shown in **Table II.**

The use of social media or the internet for obtaining information about oral health was examined in association with variables. In the proportion of having proper knowledge regarding oral healthcare, 76.19% of social media users demonstrated strong knowledge relative to 72.06% of non-users ($p = 0.633$). The distribution of gender was similar, with 59.52% of social media users and 61.76% of non-users being male ($p = 0.815$). There was a significant difference ($p = 0.002$) in brushing frequency as the after-meal brushing was practiced by 11.90% of social media users, while among the non-users, no one practiced it. Both groups accepted oral health as an integral component of overall health ($p = 0.543$), and 83.33% of users and 86.76% of non-users ($p = 0.620$) believed that poor oral hygiene promotes systemic diseases. 66.67% of users and 63.24% of non-users ($p = 0.715$) reported toothache history. Perception regarding the reliability of information on the internet/social media differed significantly, with 47.62% of users perceiving it as reliable, compared to 36.76% of non-users ($p = 0.005$). The association was not significant by age ($p = 0.202$) and occupation ($p = 0.304$) since most of the participants had ages 36–70 years and worked office jobs as shown in **Table III.**

**Figure I**

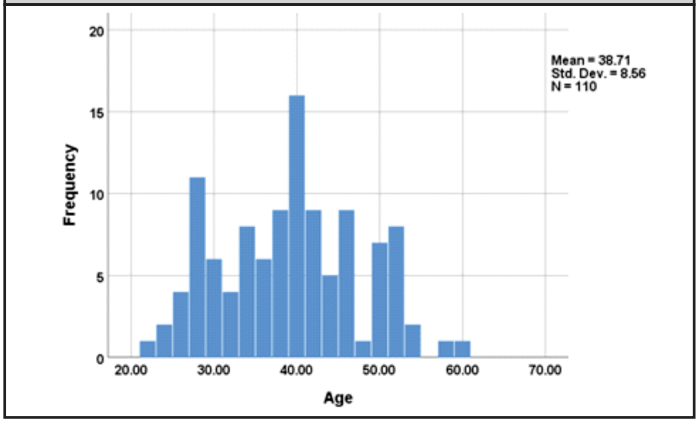


**Figure II**

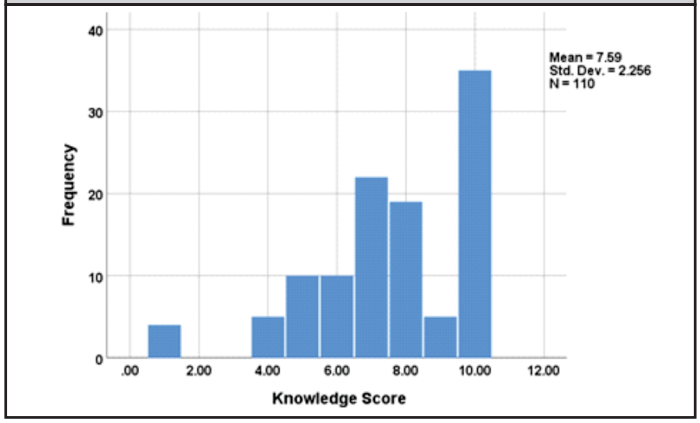


**Figure III**

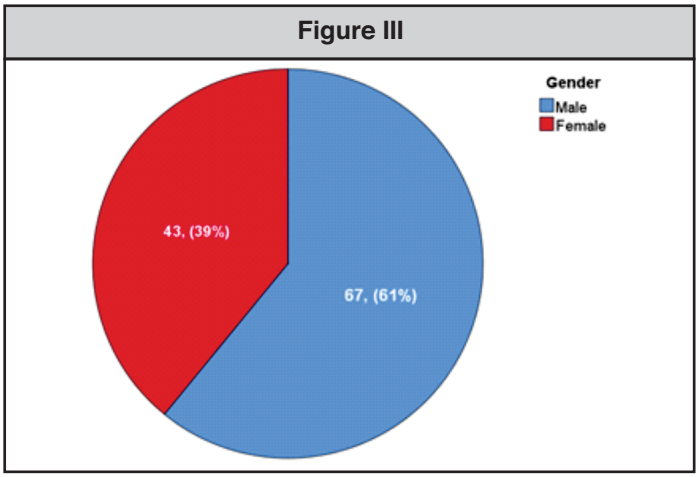


**Figure IV**

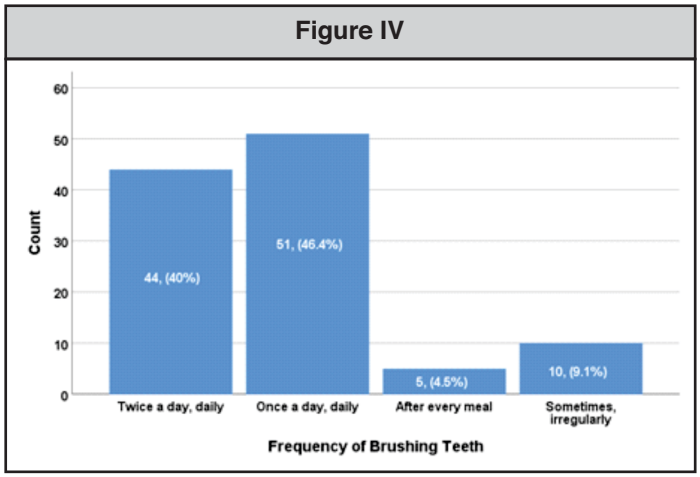


**Table I: Characteristics of Study Participants (n=110)**

| Participant Characteristics | | Frequency | Percent (%) |
|---|---|---|---|
| Marital status | Married | 72 | 65.5 |
| | Unmarried | 38 | 34.5 |
| Education | Middle | 1 | 0.9 |
| | Secondary | 6 | 5.5 |
| | Intermediate | 8 | 7.2 |
| | Graduate | 51 | 46.4 |
| | Postgraduate | 44 | 40.0 |
| Occupation | Housewife | 7 | 6.4 |
| | Office job | 97 | 88.1 |
| | Field work | 6 | 5.5 |
| Socioeconomic Status | Rs. < 25,000/- | 4 | 3.6 |
| | Rs. 25,000----50,000/ - | 57 | 51.8 |
| | Rs. > 50,000/- | 49 | 44.6 |

| Table II: Distribution of Oral Health Importance (n=110) | | | |
|---|---|---|---|
| **Oral Health Survey Items** | | **Frequency** | **Percent** |
| Think of oral health as important as physical health | Yes | 103 | 93.6 |
| | No | 7 | 6.4 |
| Think poor hygiene fosters systemic disease | Yes | 94 | 85.5 |
| | No | 16 | 14.5 |
| Ever suffered from a Toothache | Yes | 71 | 64.5 |
| | No | 39 | 35.5 |
| If yes, done to ease the pain | Took pain killer (self-medication) | 13 | 18.30 |
| | Visited the dentist | 51 | 71.84 |
| | Searched on the internet about toothache causes and treatment | 2 | 2.81 |
| | Discussed with relative/friend who had previously experienced a toothache | 5 | 7.05 |
| Frequency of use social media /internet to obtain information about oral health problems | Yes | 42 | 38.2 |
| | No | 68 | 61.8 |
| If Yes, Searched the most on internet / social media | Cause of toothache | 24 | 57.1 |
| | Treatment of toothache | 18 | 42.9 |
| Source used the most to gain oral health information | Google | 29 | 69.05 |
| | YouTube | 8 | 19.05 |
| | Facebook | 5 | 11.90 |
| Think information available on the internet / social media is reliable or accurate | Yes | 45 | 40.9 |
| | No | 17 | 15.5 |
| | Not Sure | 48 | 43.6 |
| Knowledge about oral healthcare, how important good oral health is to overall health | Inadequate Knowledge | 29 | 26.4 |
| | Adequate Knowledge | 81 | 73.6 |

**Table III: Association of the use of social media for obtaining information about oral health with knowledge, gender & other factors**

| Factors Associated with Social Media Use for Oral Health | | Use of social media / internet to obtain information about oral health problems | | 95% Confidence Interval (P-value) |
|---|---|---|---|---|
| | | Yes (n=42) | No (n=68) | |
| Knowledge about oral health care, how important good oral health is to overall health | Inadequate Knowledge | 10 (23.81) | 19 (27.94) | 0.332-------1.954 (0.633) |
| | Adequate Knowledge | 32 (76.19) | 49 (72.06) | |
| Gender | Male | 25 (59.52) | 42 (61.76) | 0.415-------1.999 (0.815) |
| | Female | 17 (40.48) | 26 (38.24) | |
| Frequency of brushing teeth | Twice a day, daily | 19 (45.24) | 25 (36.76) | 0.890-------2.296 (0.002) |
| | Once a day, daily | 18 (42.86) | 33 (48.53) | |
| | After every meal | 5 (11.90) | 0 (0) | |
| | Sometimes, irregularly | 0 (0) | 10 (14.71) | |
| Think oral health as important as physical health | Yes | 39 (92.86) | 64 (94.12) | 0.173-------3.824 (0.543) |
| | No | 3 (7.14) | 4 (5.88) | |
| Think poor hygiene fosters systemic disease | Yes | 35 (83.33) | 59 (86.76) | 0.261-------2.229 (0.620) |
| | No | 7 (16.67) | 9 (13.24) | |
| Ever suffered from toothache | Yes | 28 (66.67) | 43 (63.24) | 0.518-------2.611 (0.715) |
| | No | 14 (33.33) | 25 (36.76) | |
| Think information available on the internet / social media is reliable or accurate | Yes | 20 (47.62) | 25 (36.76) | 1.041-------2.462 (0.005) |
| | No | 11 (26.19) | 6 (8.82) | |
| | Not Sure | 11 (26.19) | 37 (54.41) | |
| Age | < 35 years | 18 (42.86) | 21 (30.88) | 0.755-------3.731 (0.202) |
| | 36-70 years | 24 (57.14) | 47 (69.12) | |
| Occupation | Housewife | 2 (4.76) | 5 (7.35) | 0.132-------1.477 (0.304) |
| | Office job | 36 (85.71) | 61 (89.71) | |
| | Field work | 4 (9.52) | 2 (2.94) | |

## DISCUSSION

The study underscores the growing potential of social media as an educational platform to enhance oral health awareness in Pakistan. Participants demonstrated a high level of recognition regarding the importance of oral health and its association with systemic health conditions, aligning with global research that emphasizes this critical connection[15,16,19]. Our study findings are supported by another study reporting knowledge before and after being given education about maintaining dental and oral health through Instagram social media results in the good category (59.5%) to (86.5%), in the sufficient category (37.8%) to (13.5%), and in the less category (2.7%) to no (0%) respondents with less knowledge category[23].

Despite this, the utilization of social media for seeking oral health information was moderate, with only 38.2% of participants engaging with these platforms. This suggests an underutilization of a powerful tool that could be leveraged to address oral health challenges on a broader scale. Platforms such as Google and YouTube emerged as the most frequently

used sources for obtaining oral health information, a pattern that mirrors findings from related studies conducted in India and Brazil, where similar online platforms dominate health information dissemination[2,16].

This study also found that, although there was no significant difference in oral health knowledge between social media users and non-users (p = 0.633), some specific behaviors were positively associated with social media usage. Interestingly, brushing after meals was only mentioned by users on social media (11.9% of posts, p = 0.002), again demonstrating that social media can have the potential to promote meaningful effects in the right direction[9, 17]. But misinformation continues to be a significant obstacle to its efficacy.

These findings indicate an urgent need for tailored, appropriate interventions designed to leverage the opportunities social media offers for oral health education. Healthcare providers and organizations in Pakistan should engage more actively with popular platforms such as WhatsApp, Instagram, and YouTube and disseminate evidence-based and culturally sensitive content via these platforms. This way, they will fill in the knowledge gap between professionals and the masses, encourage preventive care and nudge individuals to receive dental treatment on time and in the correct manner. As we have previously seen during the COVID-19 pandemic, targeted social media campaigns to promote positive health behaviors and mitigate misinformation can be successful[17,20].

Additionally, the study emphasizes the importance of increasing digital health literacy to empower individuals to critically evaluate and differentiate between credible and unreliable sources of information. Incorporating oral health into current digital platforms and interactive, evidence-based campaigns can uniquely address and improve population health while building societal trust in professionally endorsed guidance[16,18].

Nevertheless, there are several limitations to the study. Due to a small sample size (n=110) and that the study uses convenience sampling; its findings may limit its generalizability. In addition, the consideration of an urban and peri-urban population also excluded many rural communities, in which access to social media and the internet may be markedly different. Consequently, we propose these limitations showcase the requirement of conducting much broader and representative studies to explore the audiences on social media needs with regard to oral health education by demographics.

Future research should explore the development of regulatory frameworks and the active involvement of dental organizations in monitoring and curating online content. By ensuring the accuracy and credibility of disseminated information, these measures can mitigate the risks of misinformation and self-diagnosis while maximizing the positive impact of social media on oral health awareness and behavior[17,21,22].

## CONCLUSION

This suggests that social media can be used innovatively to improve oral health awareness and behaviors in Pakistan. Although social media is still not widely used, it has an effect mainly on practices such as brushing behavior. However, misinformation and doubts about the reliability of online information present challenges. Targeted interventions, culturally relevant content, and enhanced digital health literacy are essential to maximize social media's role in bridging knowledge gaps and promoting preventive oral health practices.

**Conflict of Interest:** The authors declare no conflict of interest.

**Source of Fundings:** Nil

**Authors' Contributions:** All authors took part in this study to an equal extent. **Anwar B:** Data collection, drafting and conceptual framework. **Ghayas A:** Statistical analysis and result interpretation.

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**How to cite:** Anwar B, Ghayas A. Frequency of Impact of Social Media on Oral Health Awareness and Treatment Knowledge. Pak J Med Dent Sci. 2025;2(1):13-19

MS No.: PJMDS/OA/035/2024

Original Article

# Frequency of Depression in Patient Presenting with Thyroid Dysfunction

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## ABSTRACT

**Objective:** To determine the frequency of depression in patient presenting with thyroid disorder at tertiary care hospital.

**Methodology:** This cross-sectional investigation was executed over an eighteen-month period from December 2022 to June 2023 within the Department of Psychiatry at DUHS, Karachi. A total of 231 subjects, ranging in age from 18 to 70 years, were recruited through non-probability consecutive sampling methodology. The assessment of depression was conducted utilizing the Hamilton Depression Rating Scale (HAM-D). The data were subjected to analysis via SPSS version 26.0. The evaluation of statistical significance was performed employing the Chi-square test, with a p-value of ≤0.05 deemed indicative of significance.

**Results:** Among a cohort of 231 participants (mean age 37.52 ± 11.38 years; 64.1% within the age range of 18–40), a significant association with depression was exclusively observed in relation to marital status, wherein individuals who were divorced exhibited markedly elevated odds (OR=11.010, P=0.000). Despite the predominance of male participants (90.5%), neither age (P=0.363) nor gender (P=0.533) demonstrated a significant association. Furthermore, thyroid dysfunctions did not reveal any significant relationship with depression (P=0.961).

**Conclusion:** The overall incidence of depression among individuals diagnosed with thyroid dysfunction was significant; nevertheless, no statistically meaningful association was identified between the specific type of thyroid disorder and the manifestation of depression. Marital status, particularly the condition of being divorced, surfaced as a notable predictor of depression within this demographic. Further longitudinal studies are required to explore causality and the mediating role of psychosocial factors in thyroid-related depression.

**Keywords:** Depression, Hamilton depression rating scale, Subclinical hyperthyroidism, Thyroid disorder

## INTRODUCTION

Thyroid disorders are among the most common endocrine conditions worldwide and are known to exert widespread effects on physical and psychological health. The thyroid gland plays a crucial role in regulating metabolism, and disturbances in its function have been increasingly linked to various neuropsychiatric manifestations, particularly mood disorders such as depression and anxiety[1,2].

Emerging evidence suggests a bidirectional relationship between thyroid dysfunction and mental health disturbances. Both hypothyroidism and hyperthyroidism can lead to alterations in neurotransmitter activity, hypothalamic–pituitary–thyroid (HPT) axis dysfunction, and structural brain changes, contributing to the onset or exacerbation of depressive symptoms[3,4]. Subclinical thyroid dysfunction, often overlooked due to its mild biochemical abnormalities, has also been implicated as a significant risk factor for depression. A meta-analysis by Tang et al.[5] demonstrated that the prevalence of depression was slightly higher among individuals with subclinical hypothyroidism (SCH) compared to euthyroid individuals (8.6% vs. 7.5%), reinforcing the subtle yet impactful role of thyroid status in mental health outcomes.

Patients with hypothyroidism frequently report fatigue, lethargy, and low mood—core features overlapping with clinical depression[6]. Conversely, those with hyperthyroidism may experience heightened anxiety, irritability, and depressive symptoms, often complicating the diagnostic and therapeutic processes[7,8]. Studies have shown a high prevalence of depression and anxiety among patients with both overt and subclinical thyroid dysfunction[9-11].

Moreover, thyroid-related conditions such as differentiated thyroid cancer have also been associated with impaired quality of life and increased rates of depression and anxiety[12]. Research utilizing large cohorts, including prospective data from the UK Biobank, further supports the association between thyroid abnormalities and depressive disorders, underscoring the importance of early recognition and integrated care[2].

In low-resource settings and tertiary care centers, the frequency of depression among patients presenting with thyroid dysfunction may be underreported or misdiagnosed due to overlapping symptoms and lack of routine mental health screening[13]. Given the clinical implications, assessing the psychological well-being of patients with thyroid disorders is essential for improving both endocrine and mental health outcomes.

In recent years, the prospective association between SCH and depression has garnered increased scholarly attention[13,14]. However, the findings remain heterogeneous. Investigation of depression has revealed the prevalence to be much higher in thyroid dysfunction compared with euthyroid[4,15], while others did not find a statistically significant difference[14,16].

Due to the conflicting results from previously published studies, we aim to determine the prevalence of depressive disorders in patients with thyroid diseases visiting a tertiary care center. The outcomes derived from this inquiry may yield pertinent local evidence and facilitate the formulation of focused therapeutic interventions. The prompt recognition and appropriate management of concurrent psychological conditions have the potential to markedly improve the overall quality of life for this specific patient demographic.

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**Submitted:** October 02, 2024
**Revised:** March 17, 2025
**Accepted:** April 19, 2025

## METHODOLOGY

This cross-sectional investigation was executed at the Department of Psychiatry, Dr. A.Q. Khan Institute of Behavioral Sciences, Dow University of Health Sciences (DUHS), Karachi, over a time period of eighteen months, commencing on December 30, 2022, and concluding on June 29, 2023. A total of 231 subjects were recruited utilizing non-probability, consecutive sampling methodology. Sample size was calculated using the WHO sample size calculator based on a prevalence rate of depression in patients with subclinical hypothyroidism of (12.2%)[13], a margin of error (d) of 4.5%, using a 95% confidence interval. Individuals aged from 18 to 70 years, regardless of gender, and possessing a confirmed diagnosis of thyroid dysfunction persisting for a minimum duration of three months were incorporated into the study. Exclusion criteria included a documented history of malignancy, chronic liver disease or chronic renal failure, pre-existing psychiatric disorders and pregnancy. Informed written consent was provided by all participants prior to their enrollment. Baseline demographic and clinical data included age, sex, and marital status, education, occupational status, monthly income, body mass index (BMI), type of thyroid disorder, and depression status. Thyroid dysfunction was categorized based on thyroid hormone profiles: hyperthyroidism was characterized by TSH levels < 0.5 mIU/ml with T4 levels > 120 ng/ml and T3 levels > 2.2 ng/ml; hypothyroidism was defined as TSH levels > 5 mIU/ml with T4 levels < 50 ng/ml and T3 levels < 0.8 ng/ml; subclinical hypothyroidism was indicated by TSH levels > 5 mIU/ml with normal T3 (0.8–2.2 ng/ml) and T4 (50–120 ng/ml); and subclinical hyperthyroidism was identified as TSH levels < 0.55 mIU/ml with normal T3 and T4 levels. The Hamilton Depression Rating Scale (HAM-D) was employed to assess depression and a score of ≥ 10 was considered as depression. All laboratory assessments were performed through the standard laboratory services of the hospital to ensure precision and quality control measures. Data entry and analysis were performed using SPSS version 26.0. Frequency with percentage and mean along with standard deviation were calculated with respect to both qualitative and quantitative variables. Statistical associations were calculated using the Chi-square test and a p-value of ≤ 0.05 was considered statistically significant.

## RESULTS

The research encompassed a cohort of 231 individuals with an average age of 37.52 ± 11.38 years. Within this sample, 148 participants (64.1%) fell within the age range of 18–40 years, whereas 83 participants (35.9%) were aged over 40 years. The average body mass index (BMI) was calculated to be 27.51 ± 4.43 kg/m², with 123 individuals (53.2%) exhibiting a BMI within the range of 19–27 kg/m², and 108 individuals (46.8%) having a BMI exceeding 27 kg/m². A significant proportion of the sample was female (209, 90.5%), while males constituted 22 participants (9.5%). In terms of religious affiliation, 182 participants (78.8%) identified as Muslim, 30 participants (13.0%) as Hindu, and 19 participants (8.2%) as Christian. The majority of participants resided in nuclear family structures (193, 83.5%), while 38 participants (16.5%) were part of joint family arrangements. With respect to marital status, 179 participants (77.5%) were married, 42 participants (18.2%) were unmarried, and 10 participants (4.3%) were divorced. The educational attainment of the participants varied considerably, with 19 individuals (8.2%) classified as illiterate, 31 individuals (13.4%) possessing primary education, 82 individuals (35.5%) achieving secondary education, 39 individuals (16.9%) completing matriculation, 25 individuals (10.8%) reaching the intermediate level, and 35 individuals (15.2%) attaining higher education. In terms of occupational status, 83 individuals (35.9%) were engaged in employment, 7 individuals (3.1%) were unemployed, and 141 individuals (61.0%) were homemakers. The distribution of socioeconomic status revealed that 55 individuals (23.8%) were categorized as belonging to the lower class, 106 individuals (45.9%) to the middle class, and 70 individuals (30.3%) to the upper class, as delineated in **Table I**.

**Table II** presents a statistical analysis comparing various characteristics between individuals diagnosed with depression (n=101) and those without such a diagnosis (n=130), emphasizing odds ratios (OR), 95% confidence intervals (CI), and associated P-values. The sole variable exhibiting a statistically significant correlation with depression is marital status, wherein individuals who are divorced demonstrate an OR of 11.010 (95% CI: 6.001–19.627, P=0.000), signifying a markedly significant association. An elevated body mass index (BMI) (≥ 27 kg/m²) is correlated with an increased likelihood of depression (OR=2.441, 95% CI: 0.986–6.047), with a P-value of 0.054, which, while not statistically significant, indicates a potential trend. Other examined variables do not attain statistical significance: age group (OR=1.288, CI: 0.746–2.223, P=0.363), gender (OR=1.642, CI: 0.549–4.918, P=0.533), type of family (OR=0.711, CI: 0.314–1.607, P=0.412), educational attainment (OR=1.056, CI: 0.884–1.262, P=0.857), employment status (OR=0.693, CI: 0.073–1.273, P=0.742), and socioeconomic status (OR=1.326, CI: 0.927–1.896, P=0.099). All corresponding P-values exceed the threshold of 0.05, thereby indicating a lack of statistical significance. Consequently, based on the findings presented in **Table II,** marital status (specifically the condition of being divorced) emerges as the only variable demonstrating a statistically significant association with depression within this particular sample.

The incidence of depressive disorders among individuals diagnosed with various forms of thyroid dysfunction was investigated; however, no statistically significant correlation was identified (P=0.961). The occurrence of depression was documented in 51.5% of patients with hyperthyroidism, which mirrors the rate found in the non-depressed cohort. Likewise, 34.7% of subjects suffering from hypothyroidism exhibited depressive symptoms, in contrast to 33.1% of those without such symptoms. Instances of subclinical hyperthyroidism were recorded in 5.9% of patients experiencing depression and 7.7% among those not experiencing depression, whereas subclinical hypothyroidism was noted in 7.9% and 7.7%, respectively. These results imply that depressive conditions manifest at comparable frequencies across various thyroid disorders, lacking a statistically relevant difference as illustrated in **Table III**.

| Table I: Demographic Characteristics of Study Participants (n=231) | |
|---|---|
| **Demographic Characteristics** | **Frequency (Percentage %)** |
| **Age (Mean ± SD) =** 37.52 ± 11.38 | |
| 18 - 40 years | 148 (64.1) |
| > 40 years | 83 (35.9) |
| **Body mass Index (Mean ± SD) =** 27.51 ± 4.43 | |
| 19 - 27 $kg/m^2$ | 123 (53.2) |
| > 27 $kg/m^2$ | 108 (46.8) |
| **Gender** | |
| Male | 22 (9.5) |
| Female | 209 (90.5) |
| **Religion** | |
| Christian | 19 (8.2) |
| Hindu | 30 (13.0) |
| Islam | 182 (78.8) |
| **Type of Family** | |
| Joint | 38 (16.5) |
| Nuclear | 193 (83.5) |
| **Marital Status** | |
| Married | 179 (77.5) |
| Unmarried | 42 (18.2) |
| Divorced | 10 (4.3) |
| **Educational Status** | |
| Illiterate | 19 (8.2) |
| Primary | 31 (13.4) |
| Secondary | 82 (35.5) |
| Matric | 39 (16.9) |
| Inter | 25 (10.8) |
| Higher | 35 (15.2) |
| **Occupational Status** | |
| Employed | 83 (35.9) |
| Unemployed | 7 (3.1) |
| Housewife | 141 (61.0) |
| **Socioeconomic Status** | |
| Lower Class | 55 (23.8) |
| Middle Class | 106 (45.9) |
| Upper Class | 70 (30.3) |

| Table II: Characteristics of Patients with and without Depression (n=231) | | | | | |
|---|---|---|---|---|---|
| **Sociodemographic and Clinical Profile** | | **Depression** | | **Odds Ratio 95% Confidence Interval** | **P-Value** |
| | | **Yes (n=101)** | **No (n=130)** | | |
| Age Group | 18 - 40 years | 68 (67.3) | 80 (61.5) | 1.288 (0.746----2.223) | 0.363 |
| | > 40 years | 33 (32.7) | 50 (38.5) | | |
| BMI Group | 19 - 27 kg/$m^2$ | 65 (64.4) | 58 (44.6) | 2.241 (1.314----3.824) | 0.003* |
| | > 27 kg/$m^2$ | 36 (35.6) | 72 (55.4) | | |
| Gender | Male | 11 (10.9) | 11 (8.5) | 1.322 (0.549----3.186) | 0.533 |
| | Female | 90 (89.1) | 119 (91.5) | | |
| Religion | Christian | 9 (8.9) | 10 (7.7) | 1.280 (0.837----1.958) | 0.271 |
| | Hindu | 17 (16.8) | 13 (10.0) | | |
| | Islam | 75 (74.3) | 107 (82.3) | | |
| Type of Family | Joint | 14 (13.9) | 24 (18.5) | 0.711 (0.347----1.457) | 0.350 |
| | Nuclear | 87 (86.1) | 106 (81.5) | | |
| Marital Status | Married | 78 (77.2) | 101 (77.7) | 1.010 (0.601----1.697) | 0.916 |
| | Unmarried | 18 (17.8) | 24 (18.5) | | |
| | Divorced | 5 (5.0) | 5 (3.8) | | |
| Educational Status | Illiterate | 8 (7.9) | 11 (8.5) | 1.056 (0.884----1.263) | 0.857 |
| | Primary | 14 (13.9) | 17 (13.1) | | |
| | Secondary | 39 (38.6) | 43 (33.1) | | |
| | Matric | 17 (16.8) | 22 (16.9) | | |
| | Inter | 8 (7.9) | 17 (13.1) | | |
| | Higher | 15 (14.9) | 20 (15.4) | | |
| Occupational Status | Employed | 35 (34.7) | 48 (36.9) | 0.969 (0.737----1.273) | 0.742 |
| | Unemployed | 4 (4.0) | 3 (2.3) | | |
| | Housewife | 62 (61.4) | 79 (60.8) | | |
| Socioeconomic Status | Lower Class | 31 (30.7) | 24 (18.5) | 1.326 (0.927----1.896) | 0.090 |
| | Middle Class | 41 (40.6) | 65 (50.0) | | |
| | Upper Class | 29 (28.7) | 41 (31.5) | | |

| Table III: Comparison of Depression Among Patients with Different Types of Thyroid Disorders (n=231) | | | |
|---|---|---|---|
| Type of Thyroid Dysfunction | Depression | | P-Value |
| | Yes (n=101) | No (n=130) | |
| Hyperthyroidism | 52 (51.5%) | 67 (51.5) | 0.961 |
| Hypothyroidism | 35 (34.7%) | 43 (33.1) | |
| Subclinical Hyperthyroidism | 6 (5.9%) | 10 (7.7) | |
| Subclinical Hypothyroidism | 8 (7.9%) | 10 (7.7) | |

## DISCUSSION

Although our investigation revealed a substantial proportion of individuals with thyroid dysfunction concurrently experiencing depressive symptoms, no statistically significant correlation was identified between the specific type of thyroid disorder and the manifestation of depressive symptoms. This finding stands in stark contrast to previous scholarly works that indicate more robust associations, particularly in instances of overt hypothyroidism and hyperthyroidism. A plausible explanation for this discrepancy may reside in the multifaceted pathophysiology of depression, encompassing autoimmune mechanisms and cytokine-mediated alterations, which were not examined within our study cohort.

The elevated rate of depression among hyperthyroid patients in our study closely mirrors the 56.4% reported by Gorkhali et al., who also identified a 36.7% prevalence in hypothyroid patients[10]. These similarities reinforce the notion that mood disturbances are a common clinical feature of thyroid dysfunction. While the precise mechanisms are multifactorial, Qiu et al. proposed that inflammatory cytokines may mediate the relationship between hypothyroidism and depression, further complicating the neuroendocrine-immune axis[17]. Chronic inflammation, frequently observed in thyroid disorders, is thought to influence neurotransmitter pathways, leading to depressive symptoms.

Autoimmune thyroid disease has also emerged as a significant contributor to mood disorders. Siegmann et al., in a systematic review and meta-analysis, demonstrated a strong association between autoimmune thyroiditis and both depression and anxiety disorders[18]. While our study did not specifically examine autoimmune markers, it is likely that a subset of our hypothyroid and subclinical hypothyroid patients had underlying autoimmune conditions such as Hashimoto's thyroiditis. This is especially relevant given the increasing recognition that thyroid autoimmunity itself—independent of hormone levels—can impact psychological health. Supporting this, Yalcin et al. found that patients with euthyroid Hashimoto's thyroiditis reported poorer psychological well-being compared to healthy controls, highlighting the importance of autoimmune status in mood disturbances[19].

In terms of subclinical thyroid dysfunction, our findings showed 7.9% prevalence of depression in subclinical hypothyroidism and 5.9% in subclinical hyperthyroidism. These rates are somewhat lower than those reported by Kafle et al., who observed depression in 12.2% and 1.5% of these groups, respectively[13]. The difference in findings may be attributed to variations in study populations, diagnostic tools, and clinical settings. However, both studies indicate that subclinical dysfunction, though milder in presentation, is not devoid of psychological consequences.

Roa Dueñas et al. emphasized that even minor alterations in thyroid hormone levels can be longitudinally associated with changes in depressive symptoms[20]. Their large population-based study underscores the need for regular psychological assessment in thyroid patients, even those without overt symptoms. This supports our recommendation that screening for depression should be an integral part of thyroid disorder management, particularly in tertiary care environments where complex and chronic cases are often managed.

Finally, while most studies focus on non-malignant thyroid dysfunctions, psychological impacts are also notable in thyroid cancer patients. Alexander et al. conducted a scoping review showing that anxiety and depression are common in this group due to concerns about recurrence, quality of life, and body image—even in cases with favorable prognoses[21].

This investigation delineates several merits that enhance its methodological integrity and clinical significance. Particularly, the employment of a validated instrument—the Hamilton Depression Rating Scale (HAM-D)—facilitated a consistent and objective evaluation of depressive manifestations. Moreover, the biochemical categorization of thyroid dysfunction into discrete clinical classifications permitted meticulous subgroup examinations. By engaging with a locally underrepresented domain, the investigation also provides substantive insights into the convergence of endocrine and mental health disorders within a tertiary care environment in Karachi, thereby augmenting the regional corpus of evidence.

Nonetheless, the investigation is subject to constraints that must be acknowledged when interpreting its outcomes. Its cross-sectional framework restricts the capacity to deduce causality or temporal associations between thyroid dysfunction and depressive manifestations. The single-center context and reliance on non-probability consecutive sampling may also introduce selection bias, thereby constraining the generalizability of the findings to broader or more heterogeneous cohorts. Furthermore, the omission of thyroid autoantibody assessments curtails the understanding of autoimmune thyroiditis's role, a potentially significant factor in the etiology of depression. Excluding participants with pre-existing psychiatric conditions, although methodologically deliberate, may have resulted in the underappreciation of subclinical or undiagnosed mood disorders. Finally, while the HAM-D is a prevalent screening instrument, its subjective characteristics may hinder the capture of cultural variations in the presentation of depressive symptomatology.

Future investigations should aspire to incorporate longitudinal, multicenter methodologies with more representative sampling, include evaluations of thyroid autoimmunity, and implement comprehensive psychiatric assessments. Such methodologies would facilitate a more profound examination of the thyroid–depression nexus and advocate for the integration of routine psychological screening within endocrine clinical practice.

## CONCLUSION

The overall incidence of depression among individuals diagnosed with thyroid dysfunction was significant; nevertheless, no statistically meaningful association was identified between the specific type of thyroid disorder and the manifestation of depression. Marital status, particularly the condition of being divorced, surfaced as a notable predictor of depression within this demographic. Further longitudinal studies are required to explore causality and the mediating role of psychosocial factors in thyroid-related depression.

**Conflict of Interest:** The authors declare no conflict of interest.

**Source of Fundings:** Nil

**Authors' Contributions:** All authors took part in this study to an equal extent. **Ramzan Z:** Developed the conceptual framework, provided guidance on data collection and result interpretation, and supervised the study to ensure methodological accuracy and quality. **Naseer S:** Led data collection, performed preliminary data analysis, and served as the principal author responsible for drafting the manuscript, including the discussion section. **Raza A:** Performed data entry, cleaning, analysis, and interpretation. **Mustafa S:** Assisted in data analysis. **Ahmed M:** Responsible for formatting, drafting the discussion section, proofreading, designing layout elements, and editing the final document.

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**How to cite:** Ramzan Z, Naseer S, Raza A, Mustafa S, Ahmed M. Frequency of Depression in Patient Presenting with Thyroid Dysfunction. Pak J Med Dent Sci. 2025;2(1):20-26

MS NO.: PJMDS/OA/034/2024

Original Article

# Management of Segmental Tibial Defect with Intercalary Bone Transport by Ilizarov Method

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## ABSTRACT

**Objective:** To determine the outcomes of intercalary bone transport using the Ilizarov technique in patients with segmental tibial defects.

**Methodology:** This empirical investigation was conducted at Shaheed Mohtarma Benazir Bhutto Medical University (SMBBMU), Larkana, during January 2023 to December 2024 to evaluate the consequences of intercalary bone transport in individuals aged between 18 and 65 years across both genders, ASA class I to III. The results were appraised utilizing the ASAMI criteria at intervals of 1, 3, and 6 months postoperatively. Data was analyzed by employing SPSS version 26, with outcomes categorized as excellent, good, fair, or poor.

**Results:** A total of fifty patients (mean age 33.7 ± 12.5 years; 80% male) underwent treatment utilizing intercalary bone transport. The incidence of pin tract infections was recorded at 74%, nonunion 32%, limb length discrepancies 42%, and infections 38%. Radiological results were categorized as excellent in 56% of cases, good 36%, and poor 8%. The functional outcomes were markedly influenced by the occurrence of complications, with bone grafting required in 32% of instances and refracture manifesting in 12% of cases.

**Conclusion:** The Ilizarov intercalary bone transport technique is a dependable and efficacious intervention for addressing segmental tibial defects, resulting in favorable radiological and functional outcomes. The occurrence of pin tract infections, discrepancies in limb length, and nonunion was prevalent; however, these complications did not markedly hinder the success of the treatment. Precision in surgery, patient compliance, and thorough postoperative care reduce complications and improve outcomes.

**Keywords:** Bone regeneration, Ilizarov technique, Intercalary bone transport, Orthopaedic outcomes, Segmental tibial defects

## INTRODUCTION

Segmental osseous defects of the tibia constitute one of the most complex and high-risk challenges faced in the realms of orthopedic trauma and reconstructive surgery, having an overall yearly incidence of 51.7 per 100,000 often requiring prolonged treatment periods[1]. Such defects commonly arise as a result of high-energy trauma, infectious processes, tumor excisions, or the failure of previous surgical interventions; if left unaddressed, they may precipitate considerable functional impairments and increased morbidity[1,2]. The principal aims of management include the re-establishment of length, alignment, stability, and functionality of the limb, while concurrently minimizing the risk of complications such as infections, non-union, and joint stiffness.

Numerous methodologies for the reconstruction of critical-sized tibial bone defects have been documented, including bone grafting, the induced membrane (Masquelet) technique, vascularized fibular grafts, and distraction osteogenesis[3,4]. Among these, apoptosis induction through circular external fixation utilizing the Ilizarov technique, grounded in distraction osteogenesis, remains one of the most efficacious and adaptable strategies for the reconstruction of extensive segmental defects, particularly within the tibia[5]. In essence, deformity correction, bone lengthening, and defect reconstruction can be executed concurrently, and the defect site does not necessitate internal implants, especially when these cases are further complicated by infections[6].

The utilization of the Ilizarov apparatus for intercalary bone transport has been substantiated as an effective methodology for the correction of such defects by facilitating the generation of new bone during the process of distraction osteogenesis[6,7]. The minimally invasive characteristics of this technique not only promote the regeneration of bone but also improve the healing mechanisms of the adjacent soft tissues. Depending on the size of the defect and the status of the affected extremity, bone transport may be performed unifocally or bifocally. Nevertheless, the methodological framework is not devoid of limitations, which encompass the extended duration of external fixation application, the incidence of pin tract infections, the manifestation of joint stiffness, non-union at the docking site, in addition to difficulties associated with patient adherence[8,9]. A comprehensive investigation documented favorable radiological results in 87.5% of individuals managed with the Ilizarov external fixator, wherein 54.2% attained excellent outcomes and 33.3% yielded good results, while a mere 12.5% exhibited suboptimal outcomes[10].

Research investigations have meticulously examined alterations to the traditional bone transport technique by amalgamating it with intramedullary nails or locking plates to bolster structural integrity and minimize the duration of external fixation[7,10]. These composite strategies have particularly exhibited effectiveness in reducing complication rates and enhancing patient comfort. Moreover, advancements in surgical techniques, preoperative assessments, and postoperative rehabilitation frameworks have significantly facilitated the enhancement of clinical outcomes[11,12].

Empirical evidence acquired from a multitude of medical institutions substantiates the efficacy of the Ilizarov technique. For instance, Kukreja et al. documented positive results in

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**Submitted:** October 01, 2024
**Revised:** April 29, 2025
**Accepted:** May 05, 2025

individuals exhibiting tibial bone deficiencies surpassing 11 cm, signifying that this approach is effective even for significant deficiencies[8]. In a similar vein, Ghorab et al. implemented segmental bone transport in a significant sample of patients and recorded elevated union rates in conjunction with favorable complication profiles[11]. Moreover, Abosalem et al. substantiated the relevance of this methodological approach within the context of Egyptian populations, while simultaneously illustrating its versatility across diverse healthcare frameworks[12].

Notwithstanding the necessity for a considerable level of proficiency from the surgeon and a high degree of adherence from the patient, the unique benefit of biological bone regeneration, devoid of donor site morbidity, remains a critical factor to consider[13]. The methodological frameworks delineated by McNally et al. regarding the Ilizarov technique, which is meticulously applied in the treatment of infected non-unions, serve to further validate this principle and affirm its relevance in more complex clinical contexts[14]. Moreover, the empirical studies conducted by Alshahrani et al. yield significant insights related to the clinical understanding associated with its application in severe tibial deficiencies[15]. The primary aim of the present investigation is to evaluate the clinical outcomes of patients who have received intervention through the Ilizarov intercalary bone transport technique for the reconstruction of segmental tibial defects, with the intent of enhancing the existing corpus of scholarly literature and clarifying the factors associated with treatment results, incidence of complications, and functional outcomes.

## METHODOLOGY

This empirical investigation was conducted within the Department of Orthopaedics at Shaheed Mohtarma Benazir Bhutto Medical University (SMBBMU) located in Larkana, spanning the period from January 2023 to December 2024, employing a non-probability, consecutive sampling approach to include the sample of 50 patients. The sample size was calculated based on an expected satisfactory radiological outcome of (87.5%)[9], with a margin of error (d) 9.2% and a 95% confidence level.

Individuals aged between 18 and 65 years, regardless of gender, who presented with segmental tibial defects—defined radiologically as the presence of at least two fracture lines that isolate a segment of the long bone—and who possessed an ASA classification of I–III were included subsequent to obtaining informed written consent. Individual's history of osseous abnormalities, pathological bone fractures, compound fractures, or multiple traumatic injuries were excluded from the research study. At the time of enrollment, demographic and clinical characteristics were meticulously recorded utilizing a pre-designed proforma.

All surgical interventions were conducted under either spinal or general anesthesia and comprised three distinct phases of bone transport utilizing external fixation, subsequently succeeded by the application of locking plates. In the initial phase, continuous debridement (with an average of 2.5 sessions) was executed until the infection was effectively managed. Necrotic bone was excised until hemostasis was achieved at both the proximal and distal margins of the defect, with the harvested specimens dispatched for microbiological culture. Temporary stabilization was accomplished through the application of double nails and antibiotic-laden bone cement containing 3 g of vancomycin. Soft tissue closure was executed, and the management of infection was diligently observed through the systematic assessment of erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), and procalcitonin levels during the initial month. In the following stage, reconstructive efforts commenced subsequent to the confirmation of the absence of any clinical or laboratory signs indicative of infection. The external fixator and bone cement were removed, and internal fixation utilizing locking plates was instituted. A corticotomy was performed at the metaphyseal region, and distraction osteogenesis commenced on the tenth postoperative day at a rate of 1 mm per day (0.25 mm, administered four times daily).

Patients were prompted to engage in joint mobilization exercises commencing on the first postoperative day and underwent biweekly radiographic evaluations to monitor callus development. The administration of antibiotic therapy was sustained for a duration of 2 to 4 weeks, contingent upon the results of microbial cultures and serological assessments. Union was operationally defined as the presence of bridging trabecular structures across three cortices, the absence of pain during dynamization, and the lack of movement at the union site as visualized on fluoroscopy. In the concluding phase of treatment, following the alignment and pressurization of the transport segment, the insertion of the cortical bone screw was executed in accordance with the principles of compression screw mechanics, subsequent to which the external fixator was removed. Patients were directed to progressively augment their weight-bearing exercises and were subjected to systematic clinical evaluations and radiographic examinations on a monthly basis. Full loading was permitted upon the successful development of three cortical layers within the transport segment. Outcome metrics were assessed at intervals of 1, 3, and 6 months postoperatively, utilizing the ASAMI criteria to evaluate both bone and functional recovery[16]. Bone outcomes were classified as Excellent, Good, Fair, or Poor, based on the degree of infection eradication, bone union, limb length discrepancy (LLD), and deformity correction. An Excellent bone outcome was defined as complete infection clearance, solid bone union, deformities less than 7°, and LLD under 2.5 cm. Good outcomes required bone union plus any two of the following: infection clearance, deformities less than 7°, or LLD under 2.5 cm. Fair outcomes included bone union with persistent infection, deformities under 7°, and LLD greater than 2.5 cm, while Poor outcomes indicated nonunion, active infection, severe deformities over 7°, and LLD greater than 2.5 cm. Functional outcomes were assessed separately to capture the clinical recovery of the patient. These were similarly categorized as Excellent, Good, Fair, or Poor, based on mobility, joint stiffness, reflex sympathetic dystrophy (RSD), and pain levels. Excellent function was defined as active patients without limp, minimal knee stiffness (<15° loss of extension), no RSD, and no significant pain. Good function included active, pain-significant individuals without limp, no RSD, and up to 20° loss of knee extension. Fair function indicated active but limping patients with knee stiffness, RSD, and significant pain, while Poor function represented inactive individuals unable to return to daily activities. In addition to these criteria, radiographic evaluation was conducted to confirm bone healing, assess alignment, and identify potential complications, ensuring a comprehensive assessment of both structural and functional recovery. An overall outcome was considered satisfactory if Excellent results were achieved in both the bone and functional domains.

All data were diligently recorded in a prestructured proforma. Data analysis was performed using SPSS version 26. Descriptive statistical methods were employed to present the

mean alongside the standard deviation for quantitative variables, whereas frequency distributions accompanied by percentages were computed for qualitative variables. The Chi-square test was utilized to evaluate the statistical significance at a 5% level of significance.

## RESULTS

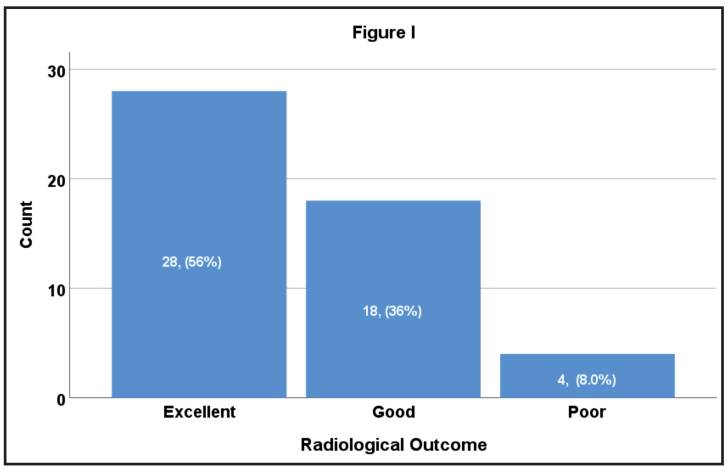
The investigation encompassed a cohort comprising 50 individuals, with a mean age of 33.72 ± 12.53 years and an average treatment duration of 10.06 ± 3.29 weeks. A notable proportion of the subjects were male (80%), and a substantial percentage of the debridement lesions were observed in the distal third of the tibia (54%), followed by the proximal third (26%) and the middle third (20%) of the tibia, respectively. In terms of smoking habits, 44% were identified as smokers, while 56% were categorized as non-smokers. Road traffic accidents were identified as the principal etiology, succeeded by congenital pseudoarthrosis, firearm-related injuries, and injuries from rock fragments (42%, 32%, 18%, and 8%, respectively). With respect to the fractures, 74% were categorized as open fractures, whereas 26% were classified as closed fractures; moreover, 38% of the participants demonstrated signs of infection. Prior to the debridement intervention, 64% of the subjects presented with a defect measuring ≤ 6 cm, while 36% displayed a defect length exceeding 6 cm. A total of 66% of the cases underwent proximal corticectomy, whereas 34% underwent distal corticectomy **(Table I)**.

A total of fifty subjects engaged in the tibial segment bone transport procedure, as delineated in **Table II**, alongside the concomitant complications that were observed. The most prevalent complication identified was pin tract infection, which occurred in 74% of the studied population, while 26% of the participants did not exhibit this pathology. Among those afflicted, 12% subsequently sustained a refracture, in contrast to 88% who did not. Furthermore, 38% of the participants developed an infection. In 42% of the instances, limb length discrepancies were noted, while 58% exhibited no such discrepancies. A nonunion was observed in 32% of the participants, whereas 68% achieved successful union. A malunion was documented in 10% of the cases, suggesting that 90% of the patients did not encounter this particular complication. Furthermore, merely 6% of the patients exhibited signs of compartment syndrome. Among the diverse complications, foot equinus was observed in 8% of the subjects, whereas impingement was the least frequently reported, manifesting in only 4%. In addition, the requirement for bone grafting was recognized in 32% of the subjects.

In terms of radiological outcomes, 56% as excellent, 36% as good and 8% as poor as shown in **Figure I**.

In the assessment of functional outcomes influenced by postoperative complications, pin tract disease emerged as the predominant complication, manifesting in 76.7% of individuals who attained excellent results, 66.7% within the cohort displaying good and fair results, and a comprehensive prevalence of 100% within the subgroup classified as having poor outcomes (p=0.725). The incidence of refracture was documented in 10.0% of individuals exhibiting exemplary results and in 25.0% of those attaining satisfactory outcomes, whereas no instances were detected within the classifications categorized as fair or poor outcomes (p=0.373). The occurrence of infection was observed in 30.0% of patients achieving excellent results, 41.7% among those with satisfactory outcomes, 66.7% in the fair outcome classification, and 50.0% in the group identified as having poor outcomes (p=0.377). Limb length discrepancy (LLD) was identified in 46.7% of individuals exhibiting excellent outcomes, 33.3% of those displaying good outcomes, 16.7% within the fair outcome classification, and a complete prevalence of 100% in the cohort characterized by poor outcomes (p=0.173). The phenomenon of nonunion was detected in 30.0% of patients achieving excellent outcomes, 41.7% in those classified as having good outcomes, and 33.3% within the fair outcome classification, whereas no instances were documented in the cohort with poor outcomes (p=0.678).

Malunion was noted in 16.7% of patients demonstrating outstanding clinical results, with no occurrences recorded within the alternative outcome classifications (p=0.295). The prevalence of compartment syndrome (CS) was rare, manifesting in 6.7% of individuals with excellent outcomes and 8.3% of those with good outcomes (p=0.885). The presence of foot equinus deformity was identified in 6.7% of patients demonstrating excellent outcomes, 8.3% of those with good outcomes, and 16.7% among patients with fair outcomes (p=0.835). Impingement phenomena were documented in 6.7% of the cohort with excellent outcomes, while absent in the remaining groups (p=0.708). Ultimately, the requirement for bone grafting was determined in 33.3% of patients with excellent outcomes, in 16.7% of those with good outcomes, and in 50.0% of patients categorized with fair and poor outcomes (p=0.473), as illustrated in **Table III**.



| Table I: Demographic and Clinical Characteristics of Study Participants (n=50) | | | |
|---|---|---|---|
| **Age in years (Mean ± SD) =** 33.72 ± 12.53 | | **Frequency** | **Percent** |
| **Duration of Treatment in months (Mean ± SD) =** 10.06 ± 3.29 | | | |
| **Gender** | Male | 40 | 80.0 |
| | Female | 10 | 20.0 |
| **Level of the Defect After Debridement** | Lower Third | 27 | 54.0 |
| | Middle Third | 10 | 20.0 |
| | Upper Third | 13 | 26.0 |
| **Smoking Status** | Smoker | 22 | 44.0 |
| | Non-Smoker | 28 | 56.0 |
| **Etiology** | Road traffic accident | 21 | 42.0 |
| | Congenital Pseudoarthrosis | 16 | 32.0 |
| | Firearm Injury | 9 | 18.0 |
| | Injury Due to Falling Rock Piece | 4 | 8.0 |
| **Type of Fracture** | Open | 37 | 74.0 |
| | Closed | 13 | 26.0 |
| **Length of the Defect After Debridement** | ≤ 6 cm | 32 | 64.0 |
| | > 6 cm | 17 | 36.0 |
| **Corticectomy Site** | Proximal | 33 | 66.0 |
| | Distal | 17 | 34.0 |

| Table II: Postoperative Complications Following Tibial Segment Bone Transport Using the Ilizarov Technique (n=50) | | | |
|---|---|---|---|
| **Type of Complication** | | **Frequency** | **Percent** |
| **Pin Tract Disease** | Yes | 37 | 74.0 |
| | No | 13 | 26.0 |
| **Refracture** | Yes | 6 | 12.0 |
| | No | 44 | 88.0 |
| **Infection** | Yes | 19 | 38.0 |
| | No | 31 | 62.0 |
| **Limb Length Discrepancy** | Yes | 21 | 42.0 |
| | No | 29 | 58.0 |
| **Nonunion** | Yes | 16 | 32.0 |
| | No | 34 | 68.0 |
| **Malunion** | Yes | 5 | 10.0 |
| | No | 45 | 90.0 |
| **Compartment Syndrome** | Yes | 3 | 6.0 |
| | No | 47 | 94.0 |
| **Foot Equines** | Yes | 4 | 8.0 |
| | No | 46 | 92.0 |
| **Impingement** | Yes | 2 | 4.0 |
| | No | 48 | 96.0 |
| **Need for Bone Grafting** | Yes | 16 | 32.0 |
| | No | 34 | 68.0 |

| Table III: Postoperative Complications & Functunal Outcomes (ASAMI) in Ilizarow Transport (n=50) | | | | | |
|---|---|---|---|---|---|
| Type of Complication, n (%) | Functional Outcomes | | | | P-Value |
| | Excellent | Good | Fair | Poor | |
| Pin Tract Disease | 23 (76.7%) | 8 (66.7%) | 4 (66.7%) | 2 (100.0%) | 0.725 |
| Refracture | 3 (10.0%) | 3 (25.0%) | 0 (0.0%) | 0 (0.0%) | 0.373 |
| Infection | 9 (30.0%) | 5 (41.7%) | 4 (66.7%) | 1 (50.0%) | 0.377 |
| Limb Length Discrepancy | 14 (46.7%) | 4 (33.3%) | 1 (16.7%) | 2 (100.0%) | 0.173 |
| Nonunion | 9 (30.0%) | 5 (41.7%) | 2 (33.3%) | 0 (0.0%) | 0.678 |
| Malunion | 5 (16.7%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 0.295 |
| Compartment Syndrome | 2 (6.7%) | 1 (8.3%) | 0 (0.0%) | 0 (0.0%) | 0.885 |
| Foot Equines | 2 (6.7%) | 1 (8.3%) | 1 (16.7%) | 0 (0.0%) | 0.835 |
| Impingement | 2 (6.7%) | 0 (0.0%) | 0 (0.0%) | 0 (0.0%) | 0.708 |
| Need for Bone Grafting | 10 (33.3%) | 2 (16.7%) | 3 (50.0%) | 1 (50.0%) | 0.473 |

## DISCUSSION

The existence of a segmental defect in the tibia presents a formidable challenge in the field of orthopedic surgery, usually arising from various etiological factors including trauma, infection, or the excision of tumors. The utilization of intercalary bone transport through the Ilizarov technique has become a prominent and frequently adopted approach for resolving these complex clinical issues. The objective of our investigation was to evaluate the outcomes and complications associated with this technique and to juxtapose our findings with the extant literature to furnish a more thorough context for our results.

The complication profile delineated in our investigation aligns with the established complications consistently documented in association with the Ilizarov technique. The incidence of infection at the pin tract was identified as the predominant complication, impacting 74% of our subjects, which bears resemblance to the results articulated by Gohrab et al. at 77.7%[11].

This heightened occurrence underscores the critical need for diligent care at the pin sites and the significance of thorough patient education throughout the entirety of the treatment process. Infection emerged as another significant complication within our group (38%), which, although concerning, reflects the inherent risks associated with the management of extensive bone defects, particularly in scenarios characterized by antecedent infections or open fractures.

Limb length discrepancy was documented in 42% of our subjects, which is marginally lower than the 45% indicated by Gohrab et al[11]. Such discrepancies may arise from uneven regenerative formation or premature consolidation, underscoring the necessity for meticulous surveillance during the distraction phase. Refracture was documented in 12% of our cohort, which is consistent with the 13.6% incidence reported in the study conducted by Gohrab, thereby underscoring the critical necessity for extended protective measures subsequent to the removal of the fixator to mitigate this event[11].

Nonunion and malunion were noted in 32% and 10% of the cases examined in the current study, respectively. These results align with those documented by Gohrab et al., who reported nonunion in 31.8% and malunion in 9.1% of their examined cohort[11]. The previously mentioned complications can be attributed to inadequate vascular supply, substandard quality of the regenerate, or mechanical instability, and often require additional interventions, including bone grafting, which was indicated in 32% of our cases. Additional complications, such as compartment syndrome (6%), foot equinus (8%), and impingement (4%), exhibited a frequency comparable to that observed by Gohrab et al., who recorded 4.5% for each of these complications[11]. These less prevalent yet potentially grave complications highlight the necessity for thorough postoperative surveillance and a multidisciplinary approach to management.

The radiological results identified in our study were classified as excellent (56%), good (36%), and poor (8%) within the patient population. These findings exhibit a remarkable degree of congruence with extant literature, including a comparative analysis that delineated excellent (54.2%), good (33.3%), and poor (12.5%) radiographic outcomes[12]. Similarly, our functional outcomes—categorized as excellent (60%), good (24%), fair (12%), and poor (4%)—exhibited a notable congruence with the findings from the comparative study, which documented excellent (58.3%), good (25%), fair (12.5%), and poor (4.2%) functional metrics[12]. Such parallels underscore the efficacy of the Ilizarov technique in achieving favorable outcomes, notwithstanding its rigorous demands and associated complications.

Further supporting our findings, a meta-analysis by Ren et al. compared the Ilizarov method with the Masquelet technique and highlighted the former's superior results in limb length restoration and infection control, albeit with a higher rate of complications[17]. Similarly, Liu et al. reviewed 282 cases over ten years and reported a broad range of complications, emphasizing the importance of surgeon experience and patient compliance[18].

Lastly, Tetsworth et al. contributed to a better understanding of bone defect classification, which aids in the surgical planning and prognosis of such challenging cases[19]. Incorporating such classifications can refine treatment protocols and anticipate complications more effectively.

The absence of statistically significant associations (P>0.05) between complications and functional outcomes is acceptable given our small sample size (n=50) and the low frequency of individual complications. These factors limit statistical power and increase the risk of type II error. However, clinically important complications like infection, limb length discrepancy, and nonunion still warrant close attention, as they can significantly affect long-term outcomes—especially in resource-limited settings. Thus, while not statistically significant, their clinical relevance remains high. The intercalary bone transport using the Ilizarov method remains a valuable and effective option for managing segmental tibial defects. Despite a notable rate of complications, the technique yields encouraging radiological and functional outcomes. Careful patient selection, meticulous surgical technique, and close follow-up are essential to minimize complications and optimize results.

A primary limitation of this study is the comparatively constrained sample size (n=50), which may restrict the generalizability of the results to wider populations. Furthermore, the employment of non-probability consecutive sampling introduces the potential for selection bias, which may curtail the representativeness of the study cohort. Furthermore, the metrics pertaining to the duration of follow-up and patient compliance were insufficiently delineated, which could potentially undermine the reliability of assessments regarding long-term functional outcomes.

Despite the constraints outlined in the preceding analysis, this study offers a comprehensive assessment of both radiological and functional outcomes, juxtaposing these findings with the established knowledge documented in the scholarly literature. The spectrum of complications documented facilitates an authentic representation of the genuine difficulties associated with the implementation of the Ilizarov method. The uniformity of outcome metrics promotes comparability with alternative investigations, thereby strengthening the credibility of the findings. Subsequent investigations ought to contemplate the implementation of more extensive, multicentric randomized controlled trials to evaluate the efficacy of the Ilizarov technique in relation to alternative reconstructive modalities. Longer follow-up periods and standardized outcome assessment tools are also recommended. Improved patient education and follow-up protocols may help reduce complication rates, particularly pin tract infections and limb length discrepancies.

## CONCLUSION

The Ilizarov intercalary bone transport technique is a dependable and efficacious intervention for addressing segmental tibial defects, resulting in favorable radiological and functional outcomes. The occurrence of pin tract infections, discrepancies in limb length, and nonunions was prevalent; however, these complications did not markedly hinder the success of the treatment. Precision in surgery, patient compliance, and thorough postoperative care reduce complications and improve outcomes. This method remains relevant in complex or resource-limited clinical settings.

**Conflict of Interest:** The authors declare no conflict of interest.

**Source of Fundings:** Nil

**Authors' Contributions:** All authors took part in this study to an equal extent. **Kalhoro JUR:** Conceptualization, statistical analysis, data interpretation, and overall manuscript supervision. **Magsi I:** Data collection, literature review, and initial drafting of the manuscript. **Muhammad R:** Clinical oversight, patient recruitment, and data acquisition. **Bhutto A:** Formatting, discussion, proofreading, designing and editing. **Shaikh B:** Data analysis support, figure preparation, and review of statistical outputs.

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**How to cite:** Kalhoro JUR, Magsi I, Muhammad R, Bhutto A, Shaikh B. Management of Segmental Tibial Defect with Intercalary Bone Transport by Ilizarov Method. Pak J Med Dent Sci. 2025;2(1):27-33

MS NO.: PJMDS/RA/039/2024

Review Article

# Advancements in Lipid-Based Delivery Systems: Enhancing Bioavailability and Therapeutic Potential of Dietary Lipids; A Narrative Review

Bilal Aheed[1], Maham Yousuf[2], Abid Ali[3]

## ABSTRACT

**Background:** Lipid-Based delivery systems (LBDS) are novel systems developed for improving the bioavailability, stability and bioactivity of lipid-soluble nutrients, such as the omega-3 fatty acids, carotenoids and fat-soluble vitamins. In particular, these systems (i.e. liposomes, nanoparticles, and nanoemulsions) target major issues of poor solubility, digestion instability, and absorption to improve the therapeutic potency of bioactive lipids.

**Methodology:** A systematic search of the literature was carried out using several databases (PubMed, Scopus and Google Scholar) targeting peer-reviewed articles published during the past 5-10 years on each of the aspects highlighted in this narrative review. Search terms included: lipid-based delivery systems, bioavailability, nanoemulsions, liposomes, and nanoparticles. The selected studies were relevant and robust, and the limited number of more innovative encapsulation technologies and their effects on bioavailability. The synthesized data were organized around themes, including formulation techniques, hurdles related to stability, and future clinical applications.

**Results:** Lipid delivery systems have shown great potential to improve the solubility, stability, and targeted delivery of bioactive lipids. Liposomes have been especially effective in protecting sensitive materials, while nanoemulsions have shown greater improvements in solubility. Still, challenges remain, among them high production costs, scalability issues, and variability in patient responses. Such systems could have applications in personalized nutrition and precision medicine, particularly for targeted delivery and improved therapeutic effects.

**Conclusion:** Lipid-based delivery mechanisms present a compelling approach for enhancing the bioavailability and therapeutic effectiveness of lipophilic nutrients. Nevertheless, additional investigation is requisite to tackle issues related to scalability, economic feasibility, and regulatory hurdles to comprehensively actualize their potential within the realms of nutraceuticals and individualized medicine.

**Keywords:** Bioavailability, Lipid based delivery systems, Liposomes, Micro/Nano-emulsions, Nanoparticles

## INTRODUCTION

Dietary lipids are necessary macronutrients that not only provide us with energy as the most calorie dense macronutrient, but are also key mediators of overall human health and wellbeing. They play important roles in the absorption and function of fat-soluble vitamins (A, D, E, and K), carotenoids, and function in maintaining physiological functions, immunity, and cellular health. In addition, dietary lipids are known to be structural components of cell membrane to maintain its integrity and fluidity which is necessary for cellular signaling as well as functioning[1]. As metabolic disorders, cardiovascular diseases, and other chronic diseases are becoming increasingly common worldwide, the important health-preserving and disease-preventing role of dietary lipids merits recognition[2].

Lipid intake characterized by certain dietary patterns like Mediterranean diet has been shown widespread effect on health by better cardio-cerebrovascular health, decreased inflammation, and better metabolic profile[3]. The diet focuses on healthy sources of lipids such as omega-3 and omega-6 fatty acids, monounsaturated fat, and polyunsaturated fat from fish, nuts, olive oil, and seeds[4]. Excessive dietary lipid intake, especially of saturated and trans fats, has also been associated with unfavourable human health effects, such as higher levels of low-density lipoprotein (LDL), inflammation, and a variety of risks for obesity and type 2 diabetes[5].

Though essential, human beings face great barriers to the bioavailability of dietary lipids, due to factors including the hydrophobic characteristics of lipids, the instability of lipid structures during digestion, and the low stability of lipids to environmental factors (e.g. oxidation, heat)[6]. The majority of bioactive lipid compounds such as omega-3 fatty acids, carotenoids, and fat-soluble vitamins have low solubility in aqueous systems, which leads to low absorption from the gastrointestinal tract, degradation during storage as well as processing[7]. New strategies of lipid-based delivery systems (liposomes, nanoparticles, and micro/nanoemulsions) are created to overcome them. Such systems present a paradigm shift in ability to increase lipid-soluble compound solubility, stability, absorption, and to enable their targeted delivery and therapeutic potentials[8].

Biologically available compounds can be encapsulated with lipid-based delivery systems to provide a level of protection from degradation and help facilitate bioavailability. One of the most studied candidates as possible delivery vehicles for this route is liposomes (bilayers of phospholipids) due to their known ability to encapsulate lipid-soluble nutrients[9]. Similarly, lipid-based carriers such as nanoemulsions and solid lipid nanoparticles have greatly improved the use of omega-3s and carotenoids into functional foods[10]. This progress not only has enhanced the effectiveness of dietary lipids but also pioneered the opportunity of their application in personalized nutrition and precision medicine[11].

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**Submitted:** November 18, 2024
**Revised:** May 08, 2025
**Accepted:** May 16, 2025

By novel lipid-based delivery systems this review aims to provide an overview about the analytical relevance of dietary lipids in health and nutrition. It describes how they change their bioavailability, stability & absorption of lipid-soluble nutrients, focusing on their prevention & treatment of diseases. In addition, the limitations of these systems i.e. scalability, cost-effectiveness and regulatory challenges are discussed, followed by future perspectives on improving their application in nutraceuticals and in the field of functional foods. This study highlights the potential role of lipid-based delivery systems in overcoming these factors to facilitate the delivery of bioactive lipids and improve overall public health.

## METHODOLOGY

In this review article, a systematic and comprehensive method was adopted to collate, analyze and synthesize up to date research on lipid-based delivery systems. A comprehensive literature search was performed on PubMed, Scopus, and Google Scholar with certain keywords: "lipid-based delivery systems", "bioavailability", "microemulsion", "nanoparticles", and "dietary lipids". Specific filters and Boolean operators were used to ensure relevant scientific literature that is most recent, high-quality, and peer-reviewed studies published within the last decade. We used strict National Institute of Health-Quality Assessment Criteria to select the studies. The review considered studies on lipid encapsulating technologies, their impact on bioavailability and their potential role as therapeutics for improved metabolic health. Excluded articles included articles that were non peer-reviewed, in a language other than English, or were related to dietary lipids or lipid delivery technologies that were unrelated to lipid-based drug delivery. The information extracted focused primarily on the methods of lipidic systems preparation (for example, high-pressure homogenization and nanoprecipitation) and the functional results of bioactive compounds in terms of solubility, uptake, and stability. It also analyzed some key challenges including scalability, cost-effective set up, and formulation stability. Finally, quality assessment of the studies included were conducted using validated tools such as CASP checklist for clinical trials, and AMSTAR guidelines for systematic reviews, resulting in accurate and reliable conclusions. These extracted data were subsequently organized into thematic areas based on delivery system innovations (e.g., liposomes, nano-emulsions, nanoparticles), clinical relevance, and potential for application as functional foods or nutraceuticals. Comparative system analysis revealed variability in system effectiveness relative to published patient outcomes, while also identifying opportunities for further research. The review employed a narrative synthesis and summarised key findings, challenges and opportunities in tables for an integrated overview of the space.

This method allowed a detailed and comprehensive review of the latest development on lipid anchorage systems and its application. The systematic search strategy employed for this review resulted in both a large number of relevant studies, in addition to providing the defined field of encapsulation technologies and effects on bioavailability that merited a detailed systematic review. Quality appraisal tools ensured the credibility of the findings and thematic categorization enhanced the systematic presentation of data. Such a strategy provided a snapshot of the current status of science and the feasibility of the systems based on lipids (e.g. scalability and cost) for production. Moreover, it paved the way for personalized nutrition and functional foods according to the bioactive lipids. The review demonstrated that the unification of research into one narrative might have great potential for enhancing therapeutic outcomes and supporting public health efforts via lipid-based delivery systems. This study is an important piece of the puzzle understanding lipid science, nutraceutical development and precision human nutrition and by being systematic in its design.

## RESULTS

The review elucidates the considerable promise of lipid-based delivery systems (LBDS) in enhancing the bioavailability, solubility, and clinical utilization of lipid-soluble nutrients. Micro- and nano-emulsions were observed to significantly augment the solubility and absorption of hydrophobic bioactive compounds, including carotenoids. Nevertheless, their vulnerability to oxidative degradation and instability under certain environmental conditions presents constraints, which may be mitigated through the formulation of more stable delivery systems. Liposomes exhibited pronounced protective properties for delicate bioactive entities and facilitated effective nutrient transport. However, elevated production costs and challenges related to scalability persist as formidable obstacles, despite the potential for advancements in manufacturing that could yield more economically viable and targeted liposomal technologies.

Nanoparticles facilitate precise delivery mechanisms and enhance therapeutic efficacy while minimizing adverse effects; however, discrepancies in particle size and the complexities of production persist as barriers to achieving consistent outcomes. Dietary lipids, particularly omega-3 and omega-6 fatty acids, have been reaffirmed to provide significant metabolic and cardiovascular advantages. Nevertheless, individual metabolic variability, coupled with the excessive intake of detrimental fats, constrains their widespread applicability in the absence of tailored strategies. Ultimately, lipid-based nutraceuticals have been recognized as promising agents for the provision of superior nutrition and therapeutic benefits. However, the lack of adequate long-term safety data and prevailing regulatory ambiguities pose substantial challenges. In spite of these obstacles, the systems examined underscore considerable opportunities, including biofortification, the formulation of personalized nutrition regimens, and the growth of the nutraceutical market through the innovation of lipid-enriched functional foods.

**Table I: Insights, Challenges, and Opportunities in Lipid-Based Delivery Systems for Nutrients and Therapeutic**

| Aspect | Key Insights | Challenges | Opportunities |
|---|---|---|---|
| Micro/Nano-emulsions[6] | Boost the bioavailability and solubility of lipid-soluble elements, such as carotenoids | Potential for oxidation and limited stability in specific circumstances | Creation of more stable formulations to extend their shelf life |
| Liposomes[4] | Prevent the deterioration of bioactive substances and enhance the delivery of nutrients | Expensive production costs and difficulties with large-scale manufacturing | More accurate targeting, cost-effective, scalable liposome production techniques |
| Nanoparticles[3] | Deliver medication precisely, enhance therapeutic results, and have few adverse consequences | Variability in size and cost, coupled with intricate manufacturing procedures, provide uneven outcomes | Therapeutic administration that is precisely tailored to particular tissues or cells |
| Dietary Lipids[7] | The benefits of omega-3 and omega-6 fatty acids for diabetes, inflammation, and cardiovascular health | Overconsumption of unhealthy fats, variability in individual lipid metabolism | Foods biofortified with healthy fats and customized nutrition plans |
| Lipid-Based Nutraceuticals[8] | Improved nutrition and therapeutic advantages are provided by lipid-based functional meals | Inadequate studies on the long-term consequences of consuming large amounts of fat and regulatory obstacles | Development of lipid-rich functional foods and expansion of the nutraceutical market |

## DISCUSSION

Lipid delivery systems have revolutionised dietary lipid (omega-3 fatty acids, carotenoids and vitamins) delivery, bioavailability, stability and functional attributes. Such evolutions have overcome significant pitfalls such as low solubility, instability, and narrow absorption spectrum of lipid-soluble compounds and offer innovative methods for nutritional and therapeutic functions[1,2]. Bioactive lipids can be emulsified with novel lipid-based delivery systems, including liposomes, nanoparticles, and micro/nanoemulsions, which can improve their solubility profiles and provide specific compartments and sites of action in the body[3,4]. These stable formulations — produced, e.g. by high-pressure homogenization, solvent evaporation or spontaneous emulsification — are capable of efficiently delivering the nutrients to their target tissues[5,6].

Enhancement of omega-3 fatty acids bioavailability are among the most mentioned benefits of these systems and such bioavailability improvement should suggest high potential use of these systems as treatments for metabolic disease, inflammation and cardiovascular diseases[7,8].

Liposomes are vesicles of phospholipids with dietary lipids that are protected from degradation via an optimized technique such as thin-film hydration or reverse-phase evaporation[9]. Likewise, nanoparticles that are formed upon emulsifting the lipid solutions in presence of surfactants, offer a relatively stable and more effective delivery strategy for lipid soluble nutrients with enhanced uptake[10,11]. In contrast, nanoemulsions are very efficient at improving solubility of hydrophobic compounds so they can be incorporated into functional foods and nutraceuticals[12,13].

Although highly efficacious, lipid-based delivery systems are limited by their stability, scalability and cost efficiency. Stability problems, especially during processing and storage, are still a major challenge since lipid formulations may easily degrade via oxidative degradation and phase separation under an unfavorable environment[14,15]. Besides, the steep synthesis expenses involved in sophisticated delivery methods such as liposomes and nanoparticles inhibit their bulk application, especially in the field of nutraceuticals[16,17]. These systems become more difficult to apply on a larger scale due to the variability in individual lipid metabolism, which is dependent upon factors such as genetics, physiology and diet[18].

Personalized medicine represents a promising approach to detail lipid-based therapies to individual metabolic profiles for improved results[19,20]. To illustrate, there is some evidence of the benefits of nanoemulsion-based omega-3 fatty acid formulations for decreasing inflammation and promoting lipid metabolism in metabolic syndrome[21,22]. Thus, studies that investigate the interaction of lipid-based delivery systems with gut microbiota are especially interesting as these systems can modulate the gut status affecting metabolic pathways at the systemic level[23].

The introduction of lipid-based delivery systems into nutraceuticals and functional foods might be an exciting opportunity to provide people with health-promoting dietary solutions in response to the increasing health consciousness of consumers. Encapsulated omega-3 fatty acids or carotenoids fortified foods can not only overcome the existing nutrient deficiency but also provide additional therapeutic advantages[24]. Such micro/nanoemulsions have been used to develop fortified beverages with improved storage and in vivo stability and bioavailability of lipophilic nutrients upon consumption.

Future studies will need to tackle the difficulties linked to such systems—namely, developing cheap and scalable production techniques. Solving these bottlenecks will mainly depend on innovations based on green synthesis techniques, biopolymers

and machine learning based approaches for optimization[25]. The widespread acceptance and approval of lipid-based delivery systems will also need some pre-defined protocols for assessment of safety, efficacy and stability.

Lipid-based delivery systems have the potential for revolutionising nutrition and medicine by improving the bioavailability and bioactivity of lipid soluble nutrients and bioactive compounds. Despite the promise of these agents, numerous hurdles must still be overcome before they can be fully realized, including formulation stability, high manufacturing costs, and interindividual differences in lipid metabolism. With the development of these systems and their continued advances, these systems will provide a foundational next step in the measures of precision nutrition, molecular medicine, and evolutionary vitamins by design of novel nutraceuticals and functional foods. The use of these technologies may eventually result in gains in public health by addressing both preventative and clinical lifestyle interventions for chronic diseases[26].

## CONCLUSION

Lipid-based delivery mechanisms present a compelling approach for enhancing the bioavailability and therapeutic effectiveness of lipophilic nutrients. Nevertheless, additional investigation is requisite to tackle issues related to scalability, economic feasibility, and regulatory hurdles to comprehensively actualize their potential within the realms of nutraceuticals and individualized medicine.

**Conflict of Interest:** The authors declare no conflict of interest.

**Authors' Contributions:** All authors took part in this study to an equal extent. **Aheed B:** Conceptualization, methodology, investigation, writing – original draft, supervision. **Yousuf M:** Literature review, data curation, writing – review & editing. **Ali A:** Literature search, references management, formatting & editing.

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**How to cite:** Aheed B, Yousuf M, Ali A. Advancements in Lipid-Based Delivery Systems: Enhancing Bioavailability and Therapeutic Potential of Dietary Lipids; A Narrative Review. Pak J Med Dent Sci. 2025;2(1):34-38

MS NO.: PJMDS/CR/041/2024

Case Report

# Atypical Complications of Chikungunya Virus Infection: A Case Report

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## ABSTRACT

**Background:** Chikungunya is a viral pathology mainly transmitted by Aedes mosquitoes, and the most important symptom is fever accompanied by severe arthralgy. Although the majority of the patients have mild self-limited course of the disease, serious complications may occur especially in some demographic groups.

**Case Presentation:** We report here the case of a 53-year-old male businessman from Baluchistan who presented with 10-day history of fever with myalgia and shortness of breath. His emergency investigations revealed elevated urea and creatinine with positive serology to Chikungunya virus. He subsequently developed acute axonal sensorimotor polyneuropathy, viral-induced pancreatitis, coagulopathy, and acute kidney injury during his hospital course. He was managed with intravenous corticosteroids, supportive care, and hemodialysis as indicated. He improved symptomatically and tolerates orally diet with normalization of renal function before discharge.

**Conclusion:** This case demonstrates the capacity for uncommon and impactful disease sequelae secondary to Chikungunya virus infections. This highlights the necessity for a high index of clinical suspicion and a multi-disciplinary approach to the diagnosis of patients presenting with atypical symptoms.


**Keywords:** Atypical complications, Acute polyneuropathy, Chikungunya virus, Coagulopathy, Pancreatitis

## INTRODUCTION

Chikungunya is an arthralgic febrile viral disease spread by Chikungunya virus (CHIKV) strains, an alphavirus mainly belonging to groups 1 and 2, and transmitted primarily by Aedes mosquitoes, typically Aedes aegypti and other Aedes albopictus species[1]. Chikungunya, first discovered in Tanzania in 1952[1], has since re-emerged as a significant human pathogen in Africa, Asia, Europe and, more recently, the Americas[2]. Chikungunya is characterized by a sudden onset of fever, debilitating polyarthralgia, myalgia and a typical rash[3]. Most people, however, recover within a week; a few patients develop long-lasting arthralgia and other frail, chronic symptoms lasting months to years[3]. Infections of Chikungunya are mostly self-limiting, however, severe complications might occur within particular populations[4]. Severe but less common forms of the disease can cross multiple organ systems and be associated with complications including respiratory distress, neurological injury and acute kidney injury[5]. In this case report we outline the clinical course of a 53-year-old man who developed the rare combination of chikungunya acute pancreatitis, coagulopathy and acute renal failure following an uncomplicated chikungunya infection. This highlights the need for a high index of suspicion and a broader view of the management of both typical and atypical or severe clinical manifestations.

## CASE REPORT

A 53-year-old male businessman from Baluchistan came to the emergency department with a 10-day history of high-grade fever, myalgia, and shortness of breath. The fever was sudden onset 102°F, associated with coldness, rigor, rhinorrhea, and diffuse myalgia. No previous history of chest pain, dyspnea at usual activities of daily living or paroxysmal nocturnal dyspnea was present. His medical history was not remarkable except for well-controlled hypertension; surgical history was not documented; and his family and social histories were all unremarkable.

Upon comprehensive evaluation, the subject demonstrated indicators of obesity and exhibited mild psychological distress; nevertheless, he was situated in a state of comfort. The vital parameters recorded included a pulse rate of 95 beats per minute, blood pressure measurements of 132/90 mm Hg, a respiratory rate of 21 breaths per minute and an oxygen saturation level of 93 percent while receiving 3 liters of supplemental oxygen.

He was afebrile, and no signs of jaundice, pallor, clubbing, koilonychia, or peripheral edema were noted. Cardiovascular, respiratory, and abdominal examinations were unremarkable. Laboratory investigations revealed elevated blood urea and creatinine levels, a normal anion gap metabolic acidosis, and a complete blood count within normal limits. Serology for chikungunya virus returned positive, while dengue and Zika virus serologies were negative.

After a few hours of admission, the patient experienced worsening shortness of breath despite stable oxygen saturation levels. Arterial blood gas analysis confirmed nonrespiratory failure, but noninvasive ventilation was added to reduce work of breathing while maintaining the patient's oxygenation. In light of the patient's symptoms and the clinical setting, a ventilation-perfusion scan was performed to exclude pulmonary embolus, which was found to be within normal limits. High-resolution CT of the chest also confirmed an absence of pleural or pulmonary abnormalities. However, as the cause of his neurology-related complaint was still unclear, the patient underwent electromyography and nerve conduction studies, which revealed an acute axonal sensorimotor polyneuropathy, a form of chikungunya-related viral radiculitis that is an uncommon, but a known complication.

The patient was treated with intravenous methylprednisolone (500 mg per day for a duration of three days), with the objective


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**Submitted:** December 16, 2024
**Revised:** May 22, 2025
**Accepted:** June 12, 2025

of attenuating the immune-mediated reaction to the viral pathogen. He was subsequently transitioned to an oral steroid regimen, resulting in significant clinical enhancement. Non-invasive ventilation was progressively reduced, and he successfully maintained normal oxygen saturation while breathing ambient air.

During the hospital stay, he developed several complications. Viral-induced pancreatitis was suggested by elevated serum amylase and lipase levels and managed conservatively with temporary bowel rest followed by gradual reintroduction of oral intake. Viral-induced coagulopathy manifested as an INR of 6.8, which was corrected using fresh frozen plasma and intramuscular vitamin K, normalizing the INR within three days. He also developed melena, indicating upper gastrointestinal bleeding, which was treated with a continuous somatostatin infusion. As hemoglobin levels remained stable and symptoms resolved, endoscopy was not deemed necessary. Worsening renal function, indicated by rising urea and creatinine, suggested acute kidney injury likely secondary to the viral illness. A right internal jugular double-lumen catheter was placed, and intermittent hemodialysis was initiated, resulting in improved renal function.

Over the subsequent days, the patient made significant clinical progress. He tolerated an oral diet, maintained oxygen saturation on room air, and achieved normalization of renal function. He was discharged in a stable condition. The clinical course progressed as follows: symptoms began on Day 0, hospitalization and supportive care were initiated on Day 9, and from Days 10 to 12, he received non-invasive ventilation, corticosteroids, and diagnostic evaluations. The clinical assessments between Days 13 and 15 revealed diagnoses of neuropathy, pancreatitis, coagulopathy, and renal failure. Interventions of hemodialysis and medical stabilization were performed between Days 16 and 18, leading to a degree of clinical improvement that allowed for discharge on the next day.

**Figure I:** Chest X-ray showed no acute changes

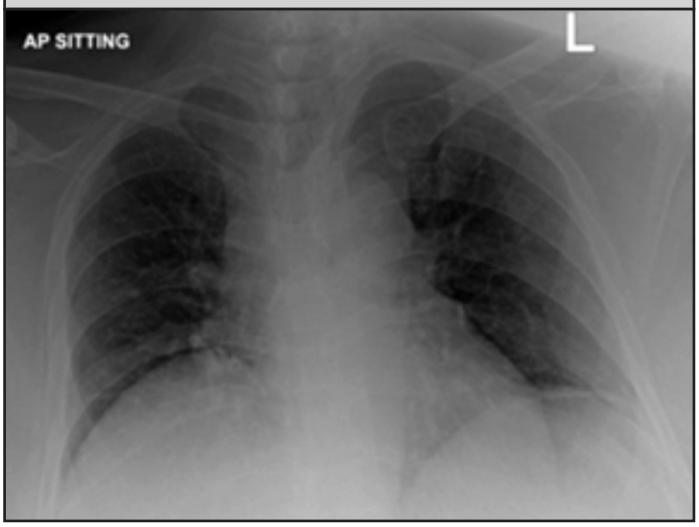
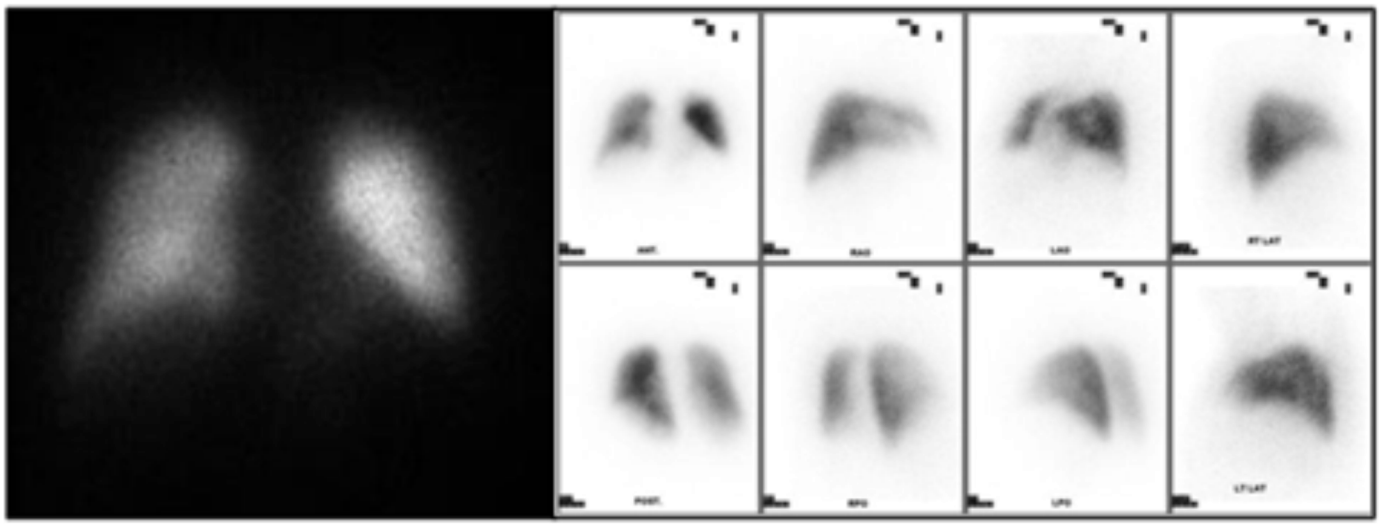



**Figure II:** Lung perfusion scintigraphy shows symmetrical normal perfusion in both lung parenchyma.



## DISCUSSION

Chikungunya fever is a viral disease caused by a species of alphavirus and is spread by infected Aedes mosquitoes[1]. At first, the disease course is typically mild and self-resolving. On the other hand, Chikungunya fever has been associated with diverse unusual clinical appearances.

The most prevalent manifestations upon initial presentation include fever and arthralgia[6-7]. In the case under discussion, our patient exhibited fever accompanied by myalgias, which are indicative of a potential chikungunya virus infection. It could, however, also present with serious complications of the nervous, gastrointestinal, liver, and renal systems.

His complaint of fever, myalgias, and shortness of breath for 9 days put up the suspicion for systemic failure. Clinical manifestations associated with chikungunya virus (CHIKV) infection have been documented, with Japan and India reporting the most frequent occurrence involving encephalitis or encephalopathy[5]. That said, there are multi-component nervous system diseases too. Here, a 52-year-old patient presented with recent-onset high-grade fever and then developed acute axonal sensorimotor polyneuropathy, 10 days after infection, which is more likely a post-infectious immune-mediated etiology. This begs the question of whether the viral infection affects respiratory muscle function, or causes central respiratory depression due to inflammation[8]. Previous studies have proposed that the cause of ARDS seen in Chikungunya patients is a severe type I inflammatory response to the CHIKV antigen[9].

It is hypothesized that the respiratory involvement pathophysiology occurs through immune mechanisms rather than direct infection of muscle tissue. Chikungunya induces host PTPN6 gene expression[8], which, in turn, may cause a reduced pro-inflammatory immune response in the host. Moreover, other studies have also implicated direct targeting of muscle tissue by the virus[9].

Although the association of pancreatitis in the setting of chikungunya virus is not frequently reported, the pathogenesis of pancreatitis in relation to the inflammatory response to CHIKV can be critical[10]. Melena in this patient indicated when they were diagnosed that they were having gastrointestinal (GI) bleeding most likely from coagulopathy (coagulation profile was also disordered). Disturbance of coagulation profiles in patients with viral infections, which could lead to serious gastrointestinal manifestations, highlights the need for close monitoring[11].

Additionally, the renal failure in this patient could be due to several mechanisms such as a systemic inflammatory response that may lead to acute tubular injury[12], dehydration related to fever, or direct viral invasion of renal tissue. Due to the interaction of these factors, similar cases demand a well-sustained evaluation and follow-up of renal function[13-14].

Importantly, this case highlights the need for clinicians to maintain a high index of suspicion for possible systemic complications of the chikungunya virus, especially in patients presenting with atypical symptoms. Due to the complexity of these kinds of cases, multidisciplinary care is necessary, and multiple experts, including infectious disease specialists, nephrologists, and gastroenterologists, should be engaged in case management.

## CONCLUSION:

This case demonstrates the capacity for uncommon and impactful disease sequelae secondary to Chikungunya virus infections. This highlights the necessity for a high index of clinical suspicion and a multi-disciplinary approach to the diagnosis of patients presenting with atypical symptoms.

**Conflict of Interest:** The authors declare no conflicts of interest related to this publication.

**Source of Funding:** No funding was received for this study.

**Authors' Contributions:** All authors took part in this study to an equal extent. **Anwar S:** Conceived and designed the case report. **Ahmed Z:** Conducted the literature review and prepared the initial draft. **Waqar H:** Participated in the clinical evaluation and contributed to manuscript preparation. **Shahzad S:** Critically reviewed the manuscript for intellectual content.

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**How to cite:** Anwar S, Ahmed Z, Waqar H, Shahzad S. Atypical Complications of Chikungunya Virus Infection: A Case Report. Pak J Med Dent Sci. 2025;2(1):39-41

# Encapsulation of Yeast Enzymes for Improved Fruit Juice Tolerance in Congenital Sucrase-Isomaltase Deficiency

**Khushbakht Baloch[1], Uzma Naseeb[2], Muhammad Salman[3]**

Dear Editor,

Congenital sucrase-isomaltase deficiency (CSID) is a rare autosomal recessive disorder that impairs the digestion of certain carbohydrates, particularly sucrose and isomaltose[1]. It typically manifests as chronic diarrhea, abdominal discomfort, bloating, and failure to thrive in affected individuals. Clinically, CSID can closely resemble irritable bowel syndrome (IBS), which often leads to misdiagnosis[2]. The estimated prevalence of CSID is 31.4 per million births (95% CI: 28.3–34.8)[3], but underdiagnosis remains a significant concern, particularly in regions such as Turkey[4].

Dietary management of CSID poses ongoing challenges. Even minimal consumption of sucrose-rich foods, including fruits and fruit juices, can provoke symptoms[5]. As an alternative to strict dietary exclusion, we investigated the potential of enzyme supplementation through yeast encapsulation. This method involves enclosing biologically active yeast—containing native sucrase and isomaltase—within sodium alginate, a safe, biocompatible polymer that preserves enzyme function while protecting against environmental degradation.

In our preliminary experiments, yeast was encapsulated in sodium alginate beads and introduced into sucrose-containing fruit juices. The metabolic activity of the encapsulated yeast facilitated the hydrolysis of sucrose and isomaltose into simpler sugars, notably glucose and fructose. Post-treatment, the encapsulated beads were removed from the juice and reused in subsequent cycles. Enzymatic activity was assessed using Benedict's test. Initially, the untreated juice tested negative for reducing sugars. Following treatment, however, the juice yielded a distinct orangish-yellow precipitate upon heating with Benedict's solution, confirming the presence of glucose.

The encapsulated yeast enzymes demonstrated functional stability over a temperature range of 0°C to 37°C and maintained efficacy for up to two weeks under refrigeration. This reusability suggests economic and practical advantages for routine use.

This simple, low-cost approach presents a novel and promising dietary adjunct for individuals with CSID, potentially reducing the need for complete avoidance of common dietary sugars. Moreover, the encapsulation strategy may be adapted to other enzyme-deficiency disorders, such as lactose intolerance, by encapsulating lactase to hydrolyze lactose in dairy products. Further clinical studies are warranted to evaluate the long-term safety, efficacy, and scalability of this intervention.

**Authors' Contributions:** All authors took part in this study to an equal extent. **Baloch K:** Worked on the concept, design, and drafting. **Naseeb U:** Critical review and supervision. **Salman M:** Revision, editing, and final version of the Letter.

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**How to cite:** Baloch K, Naseeb U, Salman M. "Encapsulation of Yeast Enzymes for Improved Fruit Juice Tolerance in Congenital Sucrase-Isomaltase Deficiency". Pak J Med Dent Sci. 2025;2(1):42

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**Submitted:** January 8, 2025
**Revised:** June 19, 2025
**Accepted:** June 20, 2025

# Scientific Consultancy on Research Methodology (SCORM Services)

Pakistan Journal of Medical & Dental Sciences

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