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Assessment of Laboratory Parameters and Diagnosis of Patients Receiving NSAIDs

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ABSTRACT

Non-steroidal anti-inflammatory drugs are frequently prescribed for the management of pain and inflammation in dental practice. In spite of their therapeutic benefits, NSAIDs are associated with potential systemic adverse effects, including gastrointestinal bleeding, renal dysfunction, hepatotoxicity, electrolyte disturbances, and haematological changes. A prospective hospital-based observational study was conducted in the departments of orthodontics, prosthodontics, and oral surgery at a tertiary dental care centre. Baseline laboratory assessments included complete blood count, liver function tests, renal function tests, and electrolytes. Follow-up tests were performed on Day 10 or earlier if adverse drug reactions were suspected. Pain was assessed using the Visual Analogue Scale at Day 0 and Day 10. The study showed that most patients maintained normal haematological, hepatic, and renal parameters after NSAID use. The mean haemoglobin was 14.52 ± 0.69 g/dL, TLC 8157 ± 951.16 cells/mm³, and platelet count 266,820.87 ± 46,838.03 cells/mm³, indicating stable haematological profiles. Liver function tests showed serum bilirubin 0.75 ± 0.27 mg/dL, SGOT 22.88 ± 10.6 IU/L, and SGPT 30.09 ± 13.89 IU/L, all within normal ranges, suggesting minimal hepatotoxicity. Renal parameters such as serum creatinine (0.9 ± 0.12 mg/dL) and BUN (13.45 ± 3.75 mg/dL) also remained normal, with no evidence of nephrotoxicity. Electrolyte levels were stable, with sodium at 140.11 ± 2.85 mEq/L and potassium at 4.24 ± 0.44 mEq/L. The most common dental diagnosis was dental abscess with inflammation (37%), followed by TMJ pain (18%), post-denture fitting pain (14%), and pericoronitis (12%). Pain scores showed a significant reduction from baseline (VAS Day 0: 5.53 ± 1.12; Day 10: 3.46 ± 1.4; $P < 0.05$). NSAIDs were found to be effective and safe for short-term use in dental patients, with no important changes in haematological, hepatic, renal, or electrolyte parameters during the observation period.

Keywords: *Non-Steroidal Anti-Inflammatory Drugs, Adverse Drug Reactions, Laboratory Monitoring, Renal Function Tests, Liver Function Tests, Haematological Parameters, Dental Pain Management*

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1. INTRODUCTION

Non-steroidal anti-inflammatory drugs are among the most extensively prescribed and over-the-counter medications altogether, used primarily for their analgesic, anti-inflammatory, and antipyretic properties [1]. They play a serious role in the management of musculoskeletal disorders, arthritis, soft tissue injuries, and chronic pain syndromes [2]. In spite of their clinical benefits, NSAIDs are associated with a spectrum of adverse effects, which necessitates careful monitoring through laboratory evaluations and clinical assessments [3].

NSAIDs use their pharmacological effects by inhibiting the cyclooxygenase enzymes, COX-1 and COX-2, leading to decreased synthesis of prostaglandins and thromboxanes [4]. However, this mechanism also causes many of their side effects. The inhibition of COX-1, which plays a protecting role in the gastrointestinal tract and kidneys, can predispose patients to peptic ulcers, gastrointestinal bleeding, renal impairment, and cardiovascular complications [5].

One of the seriousapprehensions in chronic NSAID therapy is nephrotoxicity. NSAIDs can lead to acute kidney injury, electrolyte imbalances, and chronic kidney disease, especially in elderly patients or those with pre-existing renal disfunction [6]. Routine laboratory monitoring of renal function parameters, such as serum creatinine, blood urea nitrogen, and estimated glomerular filtration rate, is suggested to detect early renal injury [7]. In addition, NSAID-induced electrolyte disturbances, including hyperkalaemia and hyponatremia, must be evaluated during prolonged therapy [8].

NSAIDs also pose animportantdanger to hepatic function, although hepatotoxicity is less frequent compared to renal and GI problems. Laboratory assessments, including liver function tests, alanine aminotransferase, aspartate aminotransferase, and alkaline phosphatase, are essential in patients on long-term NSAID therapy or those with simultaneous hepatic disease [9]. Certain NSAIDs, such as diclofenac, have a higher potential for hepatic toxicity, which reinforces the importance of regular biochemical monitoring [10].

Another communal laboratory assessment in NSAID users involves the complete blood count. Chronic NSAID use may lead to iron-deficiency anaemia secondary to gastrointestinal blood loss, especially in patients taking non-selective NSAIDs without gastroprotective agents [11]. Faecal occult blood testing is also useful in detecting subclinical GI bleeding in asymptomatic individuals [12].

In addition, NSAIDs can interfere with platelet aggregation, increasing bleeding risks, particularly when combined with anticoagulants or antiplatelet agents [13]. Monitoring coagulation parameters,such as patients with cardiovascular disease or those experiencing surgical proceduresand bleeding tendencies, is important in susceptible populations [14].

Specified these apprehensions, a complete laboratory assessment strategy is serious in patients receiving NSAIDs to minimise adverse events, confirm early detection of difficulties, and guide appropriate therapeutic adjustments [15].

2. METHODS

Research design

A prospective, hospital-based observational study was conducted to diagnose profiles of patients prescribed nonsteroidal anti-inflammatory drugs in routine dental practice and to monitor the laboratory parameters. The study population included patientswho were prescribed NSAIDs for pain management. Eligible patients were joined after proper screening and consent.As part of the study protocol, any pre-existing abnormalities and baseline laboratory assessments were performed before the initiation of NSAID therapy to establish reference values. The investigations included a Complete Blood Count to assess haemoglobin levels, total leukocyte count, platelet count, haematocrit, and red blood cell count. Liver Function Tests, Renal Function Tests, and Electrolyte analysis were completed.Patients experienced follow-up laboratory assessments on Day 10 of NSAID therapy, or previous if they showed symptoms indicative of adverse drug reactions. Composed with laboratory monitoring, the diagnosis of the dental condition and pressure NSAID use was cautiouslyrecognised for each patient.Pain assessment to measure the effectiveness of NSAID therapy in alleviating dental painwas shown using the Visual Analogue Scale at two time points, Day 0 and Day 10. In addition, to confirm accurate reporting and assessment, any observed ADRs were recognised scientifically and measured using standard causality and severity assessment tools. This complete method acceptable the investigators to correlate clinical results, thereby providing appreciated data on the safety and efficacy of NSAID use in dental practice, laboratory parameters, and ADRs.

Inclusion Criteria:

- Patients aged 18–70 years.
- Patients prescribed NSAIDs for the management of dental pain or inflammation.
- Patients who provided informed written consent.

Exclusion Criteria:

- Patients with pre-existing hepatic or renal dysfunction.
- Patients with a history of gastrointestinal bleeding or peptic ulcer disease.
- Patients on chronic anticoagulant or steroid therapy.
- Pregnant or lactating women.
- Patients are unwilling to undergo laboratory investigations.

Statistical analysis

Statistical analysis was performed using SPSS version 26. Descriptive statistics were used to summarise the data, with mean values and standard deviations calculated for all laboratory parameters, including haematological, hepatic, renal, and electrolyte profiles. To assess the changes in laboratory parameters from Day 0 to Day 10, paired t-tests were applied for normally distributed data, while the Wilcoxon signed-rank test was used for non-parametric data, confirming appropriate

statistical treatment based on data distribution. In addition, to assess the association between laboratory parameter changes and the occurrence of adverse drug reactions, the Chi-square test was employed. A P-value of less than 0.05 was considered statistically significant throughout the analysis. This statistical method allowed for robust evaluation of both clinical and laboratory data, facilitating the identification of significant tendencies and associations in the study population.

3. RESULTS

Stimulatingly, the highest number of orthodontic consultations was observed in the 60–69 years age group (32 patients), followed by the 40–49 years (28 patients) and 30–39 years (20 patients) age groups. This tendency suggests a rising awareness and demand for adult orthodontic treatments, possibly linked to prosthetic rehabilitation or aesthetic corrections in older individuals. In contrast, prosthodontic consultations were most common in the 40–49 years group (30 patients), which reflects the typical onset of tooth loss and the need for dental prostheses during middle age. Oral surgery services peaked in the 50–59 years category (31 patients), likely due to procedures such as extractions, implant placements, or management of oral pathologies that are more prevalent in this age bracket. The 20–29 years group demonstrated the lowest utilisation across all three specialities, possibly due to better baseline dental health and fewer restorative or surgical needs at younger ages (Fig.1).

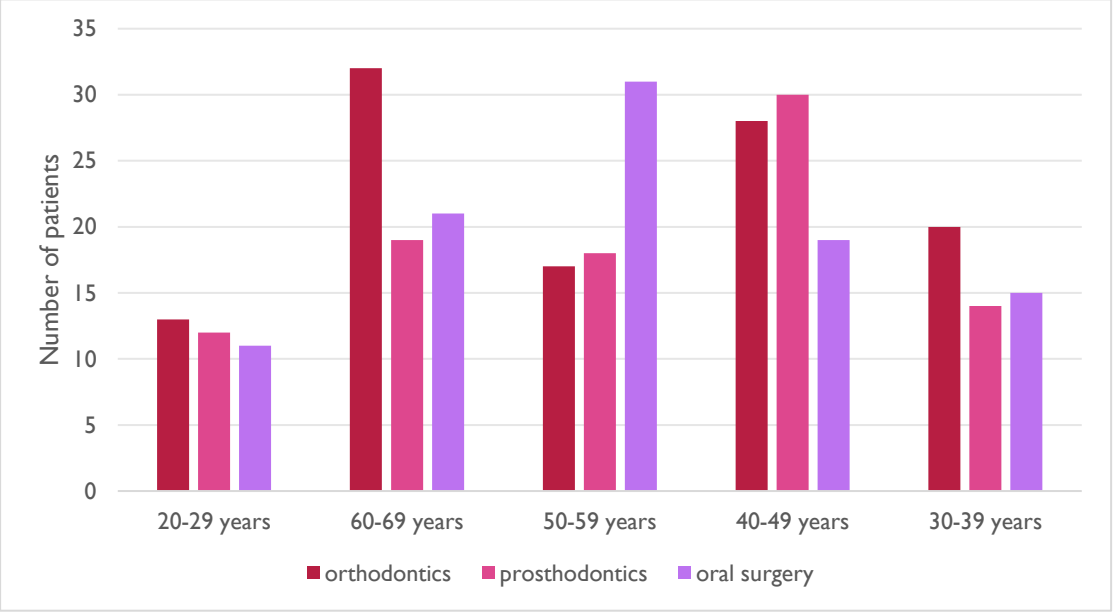

Fig. 1 Age-wise Distribution of Patients Across Dental Specialities

The prevalence of diabetes was seen in the 60–69 years (72 patients) and 40–49 years (76 patients) groups, whereas younger patients, particularly those in the 20–29 years group, had a lower occurrence of diabetes. This makes it even with established epidemiological data showing that the risk of diabetes escalates with age. Similarly, hypertension demonstrated a comparable pattern, with the 40–49 years and 60–69 years groups showing the highest number of hypertensive patients, both reaching numbers around 70 patients. Non-hypertensive individuals were predominantly from the younger age categories, but became progressively fewer with advancing age. Middle-aged and elderly individuals (40–69 years) are the predominant users of specialised dental care services, particularly prosthodontics and oral surgery. They also experience a higher prevalence of lifestyle risk factors, such as alcohol consumption and smoking, which are known contributors to oral diseases. Moreover, systemic comorbidities like diabetes and hypertension are frequently present in this population, necessitating careful medical management during dental treatment (Fig. 2).

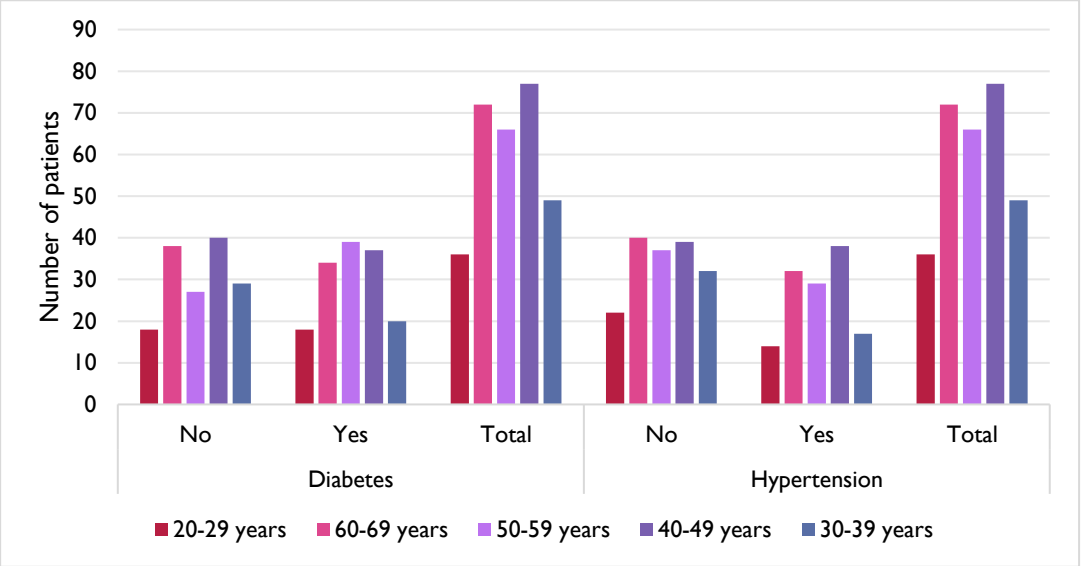

Fig. 2Association of Diabetes and Hypertension with Age

The most frequently reported condition was dental abscess with inflammation, accounting for 37% of the cases. Dental abscesses as the primary cause of emergency dental visits and acute pain management needs, reflecting the significance of timely dental care to prevent abscess formation. The next most common condition was TMJ pain, affecting 18% of patients, suggesting a substantial burden of temporomandibular disorders in the patient population. Post-denture fitting pain represented 14% of cases, likely due to mucosal irritation or improper prosthetic adaptation, while pericoronitis accounted for 12%, commonly related to partially erupted third molars. Orthodontic adjustment pain contributed to 9% of the cases, which is expected in patients undergoing active orthodontic treatment phases. The least frequent diagnosis was post-implant surgery inflammation, reported in 4% of cases, reflecting the generally low difficulty rate of implant procedures but still indicating the need for careful postoperative care (Fig. 3).

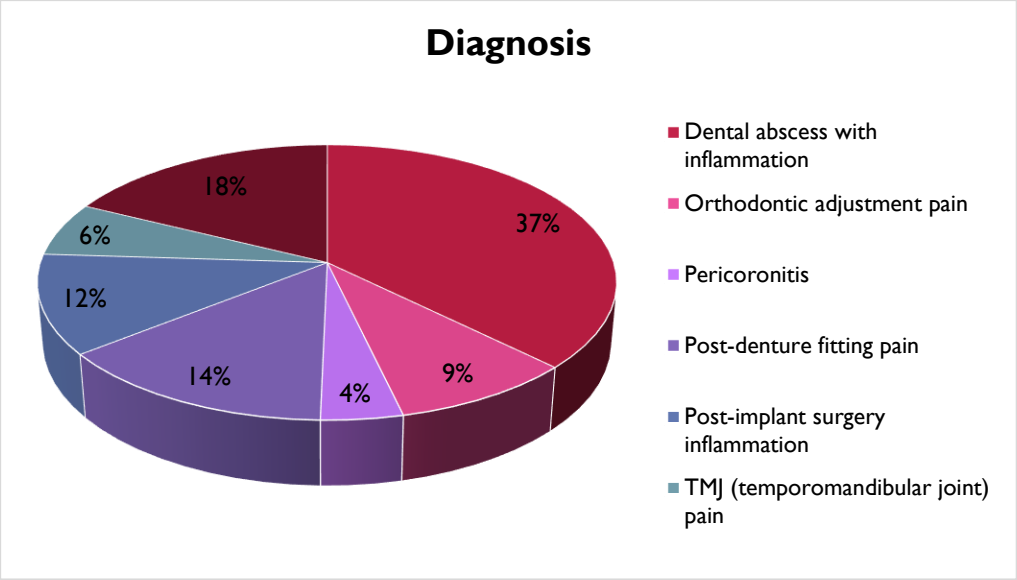

Fig. 3: Diagnosis ofa dental abscess with inflammation

The analysis of the haematological parameters in the study population provides important insights into the baseline health status of patients experiencing dental treatment. The mean haemoglobin level was found to be 14.52 ± 0.69 g/dL, which falls within the normal range for healthy adults, indicating that the majority of the patients did not present with anaemia. This is important, as adequate haemoglobin levels are important for optimal wound healing and tissue oxygenation, mainlyapplicable in surgical dental procedures.The total leukocyte count was 8157 ± 951.16 cells/mm³, reflecting a normal immune status in most of the participants. This suggests that there was no important ongoing infection or systemic

inflammatory process in the majority of cases, aside from localised dental infections such as abscesses.The platelet count was 266,820.87 ± 46,838.03 cells/mm³, indicating a normal coagulation profile in the study population. This is a seriousresult, especially in the situation of oral surgeries or extractions, where adequate platelet levels are necessary to prevent postoperative bleeding difficulties.The haematocrit value was recorded at 41.71 ± 2.35%, again within the normal physiological range, reinforcing the adequacy of the red cell mass and the patients' overall circulatory stability. Haematocrit levels correlate with hydration status and red blood cell concentration, both of which are important for tissue healing after dental involvement.Finally, the red blood cell count was 4.81 ± 0.26 million cells/mm³, which is consistent with normal reference values, suggesting the absence of important erythropoietic disorders in the patient group. Maintaining a normal RBC count is important for proper oxygen transport, especially in patients experiencing invasive dental procedures (Table 1).

Table 1: Findings of Blood Parameters of the patients

Blood Parameter	Mean Value
Haemoglobin	14.52±0.69
TLC	8157±951.16
Platelet Count	266820.87±46838.03
Haematocrit	41.71±2.35
RBC Count	4.81±0.26

The mean serum bilirubin level was found to be 0.75 ± 0.27 mg/dL. The serum glutamic oxaloacetic transaminase level was 22.88 ± 10.6 IU/L, and the serum glutamic pyruvic transaminase was 30.09 ± 13.89 IU/L. Both values are within normal limits, representing the absence of active hepatocellular injury or inflammation. These parameters are serious markers of liver cell veracity, and normal levels imply that patients did not have acute or chronic liver damage at the time of assessment.The alkaline phosphatase level was recorded at 86.24 ± 26.42 IU/L, which also lies within the normal physiological range. The serum albumin level was 4.26 ± 0.44 g/dL, reflecting adequate protein synthesis by the liver. Albumin is a key marker of the synthetic function of the liver and plays a crucial role in maintaining oncotic pressure and transporting various substances in the blood. A normal albumin level indicates preserved liver function and good nutritional status.The total protein level was 7.13 ± 0.67 g/dL, with an albumin/globulin (A/G) ratio of 1.71 ± 0.29. These results are within normal limits, suggesting a balanced protein profile and no important immunological abnormalities or protein-losing conditions. A normal A/G ratio reflects healthy liver function and proper regulation of albumin and globulin production (Table 2).

Table 2: Assessment of Hepatic Function in Dental Patients: Analysis of Liver Function Parameters

Hepatic Parameter	Mean Value
Serum Bilirubin	0.75±0.27
SGOT	22.88±10.6
SGPT	30.09±13.89
Alkaline Phosphatase	86.24±26.42
Serum Albumin	4.26±0.44
Total Protein	7.13±0.67
A/G Ratio	1.71±0.29

The serum creatinine level was recorded at 0.9 ± 0.12 mg/dL, indicating normal renal filtration capacity, as creatinine is a reliable marker of glomerular filtration rate. Normal creatinine values suggest the absence of significant renal impairment, which is essential in dental patients, especially before procedures requiring medications that are excreted renally. The blood urea nitrogen was measured at 13.45 ± 3.75 mg/dL, falling within the normal reference range. BUN levels reflect both renal function and protein metabolism status. A BUN/Creatinine ratio of 15.14 ± 3 was observed, which is considered normal and indicates balanced renal perfusion without signs of pre-renal or post-renal abnormalities. The serum uric acid level was 4.7 ± 0.77 mg/dL, also within normal limits. Uric acid levels are important to monitor because hyperuricemia can lead to conditions such as gout or renal stones, which could complicate patient management in the perioperative dental setting. The absence of hyperuricemia in this cohort indicates no immediate risk of such complications. Electrolyte analysis revealed that sodium levels were 140.11 ± 2.85 mEq/L, indicating normal extracellular fluid balance and osmoregulation.

Sodium is a crucial determinant of fluid balance and neural function, and its stability is vital during surgical and anaesthetic procedures in dentistry. Potassium was reported at 4.24 ± 0.44 mEq/L, reflecting normal serum potassium levels. Maintaining potassium within a narrow range is essential to prevent cardiac arrhythmias, especially when local anaesthesia with vasoconstrictors is used during dental surgeries. Chloride levels were 100.82 ± 2.9 mEq/L, signifying stable acid-base and electrolyte balance, while bicarbonate levels were 25.39 ± 1.98 mEq/L, which is within the normal range and suggests that there were no significant metabolic acid-base disturbances in the study group (Table 3).

Table 3: Evaluation of Renal Function and Electrolyte Balance in Dental Patients: A Descriptive Analysis

Renal Parameter	Mean Value
Serum Creatinine	0.9±0.12
Blood Urea Nitrogen	13.45±3.75
BUN Creatinine Ratio	15.14±3
Serum Uric Acid	4.7±0.77
Sodium	140.11±2.85
Potassium	4.24±0.44
Chloride	100.82±2.9
Bicarbonate	25.39±1.98

4. DISCUSSION

The widespread use of non-steroidal anti-inflammatory drugs in clinical practice mandates careful evaluation of their systemic effects, mainly through laboratory monitoring. Even if NSAIDs are effective for managing pain and inflammation, their adverse events can be silent initially, emphasising the importance of routine biochemical and haematological assessments [16].

One of the primary concerns with NSAID therapy is nephrotoxicity. NSAIDs inhibit prostaglandin synthesis, which plays a serious role in maintaining renal blood flow, especially in conditions of hypoperfusion [17]. NSAID-induced nephrotoxicity can manifest as acute kidney injury, chronic kidney disease, electrolyte imbalances, and papillary necrosis [18]. Studies have shown that prolonged NSAID use is associated with animportant increase in serum creatinine levels and a reduction in glomerular filtration rate [19]. Regular monitoring of serum creatinine, BUN, and eGFR is recommended, predominantly in elderly patients, those with diabetes, hypertension, or pre-existing renal impairment [20]. In addition, NSAIDs can cause hyperkalaemia by reducing renal potassium excretion, which may lead to cardiac arrhythmias if left unchecked [21].

Gastrointestinal difficulties are another major apprehension with NSAID therapy. NSAIDs inhibit COX-1, which is responsible for maintaining the integrity of the gastric mucosa [22]. This leads to a higher danger of gastric and duodenal ulcers, GI bleeding, and perforation. Laboratory parameters, such as a complete blood count, are essential to detect anaemia secondary to occult GI bleeding [23]. Studies have indicated that chronic NSAID use is associated with a 4–5 times higher risk of upper GI bleeding compared to non-users [24]. Faecal occult blood testing is a useful assistant to screen for subclinical gastrointestinal bleeding in long-term NSAID users [25].

Hepatic dysfunction, though less common than renal or GI difficulties, remains animportant NSAID-related adverse event. Diclofenac, for example, has been implicated in idiosyncratic hepatotoxicity, leading to elevated liver enzymes and, in severe cases, hepatic failure [26]. Monitoring of liver function tests, such as ALT, AST, and bilirubin, is serious, especially in patients receiving high doses or prolonged NSAID therapy [27].

NSAIDs also influence haematological parameters by inhibiting platelet aggregation via COX-1 blockade, increasing the risk of bleeding, particularly when combined with anticoagulants or antiplatelet agents like aspirin [28]. This is of particular apprehension in patients undergoing surgical procedures or those with cardiovascular comorbidities. Laboratory assessment of platelet function and coagulation profiles can help mitigate these risks [29].

Complete, the assessment of laboratory parameters in NSAID-treated patients serves multiple purposes: early detection of organ toxicity, prevention of serious difficulties, and guidance in dose modification or drug discontinuation [30]. Indication supports that personalised NSAID therapy with regular monitoring reduces morbidity, especially in high-risk populations [31]. Co-prescription of gastroprotective agents such as proton pump inhibitors, use of selective COX-2 inhibitors in appropriate cases, and patient education further enhance the safety of NSAID therapy [32].

Assuming the extensive use of NSAIDs, integrating routine laboratory monitoring into clinical practice is not justdesirable but essential to confirm safe and effective therapy while minimising adverse consequences.

5. CONCLUSION

This study established that the short-term use of NSAIDs in dental practice is generally safe, with no important changes observed in haematological, hepatic, renal, or electrolyte parameters over 10 days. The majority of patients presented with normal laboratory profiles, and the therapy was associated with effective pain reduction as indicated by asignificant decline in VAS scores. In spite of the absence of major adverse drug reactions or laboratory-detected toxicities in this cohort, careful NSAID prescribing remains essential, particularly in patients with fundamental systemic conditions such as diabetes and hypertension.The results support the need for routine baseline and follow-up laboratory assessments in patients receiving NSAIDs, especially when therapy is extended or when high-risk patients are involved. Complete patient monitoring not only improves the safety of NSAID therapy but also contributesto the early detection of potential difficulties such as nephrotoxicity, hepatotoxicity, electrolyte imbalances, and gastrointestinal dangers. Complete, integrating laboratory monitoring into routine dental care can minimise adverse results and promote safer pharmacological management in dental situations.

List of abbreviations

ADR – Adverse Drug Reaction

ALT (SGPT) – Alanine Aminotransferase (Serum Glutamic Pyruvic Transaminase)

AST (SGOT) – Aspartate Aminotransferase (Serum Glutamic Oxaloacetic Transaminase)

A/G Ratio – Albumin/Globulin Ratio

BUN – Blood Urea Nitrogen

CBC – Complete Blood Count

COX – Cyclooxygenase

eGFR – Estimated Glomerular Filtration Rate

GI – Gastrointestinal

NSAID – Non-Steroidal Anti-Inflammatory Drug

RBC – Red Blood Cell

SPSS – Statistical Package for the Social Sciences

TMJ – Temporomandibular Joint

VAS – Visual Analogue Scale

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