Natural Resources for Human Health
eISSN: 2583-1194

Original Research

Received 30 June 2026
Revised 05 Aug 2026
Accepted 18 Aug 2026

Natural Resources for Human Health 2026, Vol. 6 (18s): 975–985

KEYWORDS:
Laboratory tests; Dental surgery; Oral surgery; Postoperative complications; Treatment outcomes; Preoperative assessment.

Effectiveness of Laboratory Tests in Predicting Treatment Outcomes and Complications in Dental Surgery: A Systematic Review

Rose Ali Hazzazi[1], Ohood Almotawa[2], Rawan Askool[3], Rawan Alsodani[4], Njoud Saad Alqarni[5], Muneera Alfakeeh[6], Nemah Ibrahim Alatieq[7], Hadeel Tareq Sibih[8], Mawaddah Yousef[9], Najwa Saleh Aljehani[10]

[1]Laboratory Technician
[2]Laboratory Technician
[3]Laboratory Technician
[4]Laboratory Technician
[5]Laboratory Technician
[6]Laboratory Technician
[7]Laboratory Technician
[8]Dental Assistant
[9]Laboratory Technician
[10]Laboratory Technician

ABSTRACT: Background: Laboratory tests may help identify patients at increased risk of bleeding, infection, delayed healing, and other complications following dental surgery, but their routine use remains controversial.

Aim: To evaluate the effectiveness of laboratory tests in predicting treatment outcomes and complications following dental surgical procedures.

Methods: A systematic literature search was conducted in PubMed/MEDLINE, ScienceDirect, Cochrane Library, Wiley Online Library, and Google Scholar. Studies evaluating the association between laboratory parameters and outcomes of dental or oral surgical procedures were included. Data on hematological, coagulation, biochemical, and inflammatory tests and their association with postoperative complications and treatment outcomes were extracted and analyzed.

Results: The review found that laboratory testing has greater predictive value in patients with systemic disease or increased surgical risk than in healthy patients undergoing minor procedures. In a systematic review of preoperative testing in oral and maxillofacial surgery, 150 publications were initially identified and 51 were included. Routine blood counts, coagulation tests, and biochemical investigations showed limited predictive value in low-risk patients, whereas platelet and coagulation parameters were more useful for assessing bleeding risk in selected patients. A dental-specific review of thrombocytopenic patients identified 1,633 records and included 20 studies involving 983 cases.

Conclusion: Laboratory tests can assist in predicting complications and guiding dental surgical management, particularly in patients with relevant systemic or hematological abnormalities. Selective, risk-based testing appears more appropriate than routine laboratory screening in healthy patients.

Natural Resources for Human Health
eISSN: 2583-1194

I. INTRODUCTION

Dental surgery is generally safe; however, postoperative complications such as bleeding, infection, delayed healing, and treatment failure may occur, particularly in patients with underlying systemic or hematological disorders. Preoperative assessment is therefore important for identifying conditions that may increase surgical risk, while laboratory investigations can provide objective information that complements the patient's medical history and clinical examination (Kaur & Chatterjee, 2020).

Common laboratory investigations include complete blood count, hemoglobin and platelet count, coagulation tests, blood glucose, and renal and hepatic function tests. However, the routine use of these investigations in healthy patients undergoing minor dental procedures remains controversial. Evidence suggests that routine preoperative testing may provide limited additional information in low-risk patients and may contribute to unnecessary costs and delays in treatment (Kaur & Chatterjee, 2020).

Laboratory testing may be particularly valuable in patients with hematological abnormalities. Platelet count, for example, is an important parameter when assessing bleeding risk before invasive dental procedures. A systematic review of thrombocytopenic patients found a postoperative bleeding rate of 4.9%, with no clear evidence that prophylactic platelet transfusion reduced bleeding (Karasneh et al., 2019). More recent evidence involving 983 dental intervention cases reported postoperative bleeding rates of 12.9% among patients with platelet counts below 50,000/μL compared with 4.9% among those with higher platelet counts, suggesting an increased bleeding risk in patients with severe thrombocytopenia (Lim et al., 2026).

Similarly, patients with immune thrombocytopenia may undergo dentoalveolar procedures with relatively low rates of clinically significant bleeding, although the available evidence remains limited and heterogeneous (van Dijk et al., 2021). These findings emphasize that laboratory results should be interpreted together with the patient's clinical condition and the invasiveness of the planned procedure rather than being used as isolated predictors of outcome.

Despite the availability of numerous laboratory investigations, uncertainty remains regarding their ability to predict dental surgical outcomes and complications. Therefore, this systematic review aims to evaluate the effectiveness of laboratory tests in predicting treatment outcomes and complications following dental surgery, with particular emphasis on postoperative bleeding, infection, healing, and other clinically relevant outcomes.

Rationale and Hypothesis

Rationale

Dental surgical procedures may be associated with complications such as postoperative bleeding, infection, delayed wound healing, and treatment failure. Although laboratory investigations are frequently requested before surgery, their predictive value varies according to the patient's systemic health, the type of dental procedure, and the presence of underlying hematological or metabolic abnormalities (Kaur & Chatterjee, 2020). Routine testing in healthy patients may have limited clinical benefit, whereas targeted laboratory assessment may help identify patients at increased risk and support appropriate treatment planning (Karasneh et al., 2019). Therefore, evaluating the available evidence is important to determine which laboratory tests have meaningful predictive value and in which clinical circumstances they should be used.

Hypothesis

Laboratory investigations, particularly hematological, coagulation, and metabolic parameters, can provide clinically useful predictive information regarding treatment outcomes and postoperative complications in patients undergoing dental surgery, with greater effectiveness expected among patients with underlying systemic or laboratory abnormalities (Kaur & Chatterjee, 2020; Karasneh et al., 2019).

II. LITERATURE REVIEW

1. Laboratory Investigations in Dental and Oral Surgery

Laboratory investigations are an important component of medical assessment in selected patients undergoing dental and oral surgical procedures. Dental surgery is generally associated with a low risk of major systemic complications; however, the presence of underlying hematological, metabolic, cardiovascular, renal, hepatic, or immunological disorders may substantially

modify perioperative risk. Laboratory investigations can provide objective information about these conditions and may assist clinicians in determining whether a patient can safely undergo a planned procedure, whether additional medical assessment is required, and whether modifications to the treatment plan are necessary (Kaur & Chatterjee, 2020; Munro et al., 1997).

The increasing availability of laboratory investigations has led to their frequent use before surgical procedures. Nevertheless, the presence of an abnormal laboratory result does not necessarily indicate an increased risk of a clinically important complication. The usefulness of a test depends on the prevalence of the underlying abnormality, the patient's clinical characteristics, the type of surgical procedure, and whether the test result is capable of changing clinical management. Munro et al. (1997) reviewed the evidence for routine preoperative testing and found limited evidence supporting indiscriminate testing of apparently healthy patients. Similarly, Macpherson (1993) concluded that routine preoperative testing of all patients before elective surgery was not justified because unexpected abnormalities that actually changed patient management were relatively uncommon.

Thus, the current literature increasingly supports a selective rather than universal approach to laboratory testing in dental surgery. The most appropriate laboratory investigation should be determined by the clinical question being addressed rather than by the routine application of a fixed panel of tests.

2. Complete Blood Count and Hematological Assessment

The complete blood count (CBC) is among the most frequently considered laboratory investigations in patients undergoing invasive dental procedures. It provides information about hemoglobin concentration, red blood cell indices, leukocyte counts, and platelet numbers. These parameters may be relevant to different aspects of surgical risk, including oxygen delivery, infection susceptibility, and hemostasis.

Hemoglobin concentration may be important in patients with known or suspected anemia, particularly when extensive surgery or substantial blood loss is anticipated. Severe anemia may reduce oxygen delivery to tissues and may reflect an underlying systemic disorder requiring investigation and treatment. However, mild abnormalities in an otherwise healthy patient do not necessarily predict poor outcomes following routine dental surgery. Consequently, hemoglobin measurement is most useful when clinical history suggests anemia or systemic disease rather than as a universal screening test.

White blood cell abnormalities may similarly provide useful information in selected patients. Leukocytosis may indicate an active infection or inflammatory condition, while neutropenia may increase susceptibility to postoperative infection. These considerations are particularly important in patients receiving chemotherapy, immunosuppressive therapy, or treatment for hematological malignancy. However, routine CBC testing in healthy individuals undergoing uncomplicated dental procedures has limited demonstrated predictive value (Kaur & Chatterjee, 2020).

3. Platelet Count and Postoperative Bleeding

Postoperative bleeding represents one of the most clinically important complications following oral and dental surgery. Although most bleeding episodes are minor and can be controlled using local measures, severe bleeding can result in emergency intervention, hospitalization, blood transfusion, or interruption of planned treatment.

Karasneh et al. (2019) conducted a systematic review evaluating platelet count and platelet transfusion in thrombocytopenic patients undergoing invasive dental procedures. Nine cohort studies were included. The overall postoperative bleeding incidence was 4.9%, and the available evidence did not demonstrate a clear reduction in bleeding associated with prophylactic platelet transfusion. Importantly, the evidence did not establish a simple platelet-count threshold that could independently predict postoperative bleeding.

4. Coagulation Tests and Dental Surgical Bleeding

Coagulation investigations such as prothrombin time (PT), international normalized ratio (INR), activated partial thromboplastin time (aPTT), and fibrinogen measurements may be useful in patients with suspected coagulation disorders or those receiving anticoagulant therapy. Their principal purpose is to identify abnormalities that may increase bleeding risk and to support appropriate perioperative management.

However, the predictive value of coagulation tests in healthy dental patients is relatively limited. A normal PT or aPTT does not exclude all clinically relevant bleeding disorders, while an abnormal result does not necessarily predict clinically significant

postoperative hemorrhage. Therefore, coagulation tests should generally be requested when the patient's history, medication profile, systemic disease, or planned procedure provides a clinical indication (Kaur & Chatterjee, 2020).

5. Anticoagulants and Laboratory Assessment

Andrade et al. (2019) performed a systematic review and meta-analysis examining bleeding associated with oral surgical procedures in patients receiving oral anticoagulants. Fifty-eight eligible studies were identified, although only three randomized controlled trials involving 323 participants were included in the quantitative analysis. Among patients continuing anticoagulant treatment, 14.2% experienced bleeding. The authors did not find convincing evidence that discontinuation of anticoagulant therapy eliminates bleeding risk, and the certainty of evidence was very low.

A systematic review of antithrombotic therapy in dental procedures included eight randomized clinical trials and found that bleeding episodes were generally mild and occurred mainly during the first postoperative day. Local hemostatic measures were generally effective, and no thromboembolic complications were reported in the included studies (Migliorati et al., 2023).

Similarly, evidence concerning direct oral anticoagulants suggests that severe bleeding following oral surgery is uncommon and that most bleeding episodes can be managed using local hemostatic measures. Yefet et al. (2025) reviewed 17 studies involving patients receiving dabigatran, rivaroxaban, apixaban, or edoxaban and concluded that minor-to-moderate bleeding was more common than severe bleeding requiring hospitalization.

6. Direct Oral Anticoagulants and Dental Surgery

A systematic review by Manfredi et al. (2023) evaluated oral surgical procedures in patients receiving DOACs and identified 11 clinical studies from 2,792 screened abstracts. The available evidence was heterogeneous, but several studies reported that dental procedures could be performed safely with continuation or minimal modification of anticoagulant therapy, particularly when effective local hemostatic techniques were used.

Another systematic review comparing uninterrupted DOAC therapy with vitamin K antagonists included eight studies involving 539 patients receiving DOACs and 574 receiving vitamin K antagonists. The pooled analysis suggested a lower bleeding risk with DOAC therapy (RR 0.68, 95% CI 0.49–0.95), although sensitivity analysis reduced the statistical significance and the overall evidence was considered very low quality (Mendes et al., 2021).

Therefore, the role of laboratory testing in patients receiving DOACs differs from its role in warfarin-treated patients. Rather than relying solely on conventional coagulation tests, clinical assessment, medication timing, renal function, and procedural bleeding risk may be more informative.

7. Blood Glucose and Glycemic Control

Diabetes mellitus is an important systemic condition that may influence the outcome of dental surgery. Chronic hyperglycemia can impair immune responses, alter inflammatory pathways, affect vascular function, and interfere with tissue repair. Consequently, laboratory assessment of glycemic control may be relevant in patients undergoing invasive dental procedures, particularly implant surgery.

HbA1c is particularly useful because it reflects average glycemic exposure over approximately two to three months. It therefore provides a more stable assessment of metabolic control than a single blood glucose measurement.

Javed and Romanos (2009) similarly found that poorly controlled diabetes negatively affected implant osseointegration, whereas patients with adequate metabolic control could achieve successful osseointegration.

8. HbA1c and Dental Implant Outcomes

Similarly, a dose-response meta-analysis demonstrated that increasing HbA1c was associated with worsening peri-implant parameters. For each HbA1c category increase, bleeding on probing increased by approximately 10% and marginal bone loss increased by approximately 0.05 mm. These findings suggest that HbA1c may provide clinically relevant information when assessing implant-related risk (Shi et al., 2021).

A further systematic review of diabetes and dental implants included 40 clinical studies and 16 publications of aggregated literature and concluded that poorly controlled diabetes was associated with a greater frequency of peri-implantitis, particularly

after implant placement (Moraschini et al., 2022). Collectively, these findings suggest that glycemic control is potentially more informative than diabetes diagnosis alone when predicting dental implant outcomes.

9. Renal and Hepatic Laboratory Tests

Renal and hepatic function may also influence dental surgical management, particularly in patients with established systemic disease. Renal impairment can influence the elimination of several medications commonly used in dental practice and may be associated with platelet dysfunction and altered hemostasis. Hepatic disease may similarly influence drug metabolism and coagulation because the liver is responsible for synthesizing many coagulation factors. In patients with known renal or hepatic disease, however, laboratory investigations can provide important information for medication selection, dosage adjustment, bleeding risk assessment, and referral to the appropriate medical specialist. Thus, their value lies primarily in risk-directed assessment.

10. Laboratory Tests and Infection Risk

Postoperative infection is another important outcome that may be influenced by systemic conditions detectable through laboratory investigations. Abnormal leukocyte counts, neutropenia, uncontrolled diabetes, and other forms of immunosuppression may increase susceptibility to infection following invasive procedures. Laboratory testing can therefore be particularly relevant in patients with malignancy, immunodeficiency, chemotherapy exposure, or other conditions associated with impaired host defense. However, laboratory investigations should supplement rather than replace clinical assessment. Signs and symptoms of infection, oral examination, radiographic findings, and appropriate microbiological investigations remain important components of diagnosis. The predictive value of a laboratory test is therefore determined by whether it contributes additional information that changes treatment or identifies a patient at clinically meaningful risk. Routine testing without an appropriate clinical indication may have limited benefit (Kaur & Chatterjee, 2020).

11. Laboratory Tests and Wound Healing

Successful wound healing following dental surgery depends on adequate vascularization, oxygenation, immune response, metabolic control, and local wound conditions. Several systemic abnormalities may interfere with these processes.

Diabetes is particularly relevant because chronic hyperglycemia can alter inflammatory responses and bone metabolism. Evidence from dental implant studies demonstrates that patients with poor glycemic control may experience increased peri-implant inflammation, marginal bone loss, and other unfavorable outcomes (Javed & Romanos, 2009; Jiang et al., 2021; Shi et al., 2021). Similarly, significant anemia may compromise tissue oxygen delivery, while severe systemic disease may impair immune responses and tissue repair. However, laboratory abnormalities should generally be interpreted as markers of systemic risk rather than isolated determinants of wound healing. This distinction is important because the presence of a statistically significant association between a laboratory parameter and an outcome does not necessarily establish that the laboratory test can accurately predict the outcome in an individual patient.

12. Routine Versus Selective Laboratory Testing

The central controversy in preoperative laboratory assessment is whether all patients should undergo routine testing or whether investigations should be restricted to those with identifiable risk factors. Evidence from general surgery has consistently questioned the value of indiscriminate testing in healthy patients. Munro et al. (1997) found insufficient evidence to support routine testing in asymptomatic individuals, while Macpherson (1993) similarly concluded that routine testing was not justified because abnormalities sufficiently important to alter management were uncommon.

Dental-specific evidence supports the same approach. Kaur and Chatterjee (2020) concluded that routine laboratory testing in healthy patients undergoing elective oral and maxillofacial procedures can increase cost and cause delays without clear evidence of improved outcomes.

13. Predictive Value of Laboratory Tests in Dental Surgery

The concept of predictive value is particularly important when evaluating laboratory tests. A useful laboratory test should ideally identify patients who are genuinely at increased risk and should contribute information that cannot be obtained adequately through history and physical examination.

The available literature suggests that the predictive value of laboratory testing varies substantially between patient groups. Platelet count appears particularly relevant in patients with thrombocytopenia, although a single threshold cannot reliably predict bleeding in every patient (Karasneh et al., 2019; Lim et al., 2026). Coagulation-related assessment is particularly relevant in patients receiving anticoagulants, but medication management should not be based solely on laboratory results (Andrade et al., 2019; Yefet et al., 2025).

Similarly, HbA1c may provide clinically meaningful information in patients undergoing implant surgery because poor glycemic control has been associated with peri-implant inflammation and marginal bone loss (Jiang et al., 2021; Shi et al., 2021). These findings demonstrate that the predictive usefulness of a laboratory test is closely related to the clinical context in which it is applied.

III. METHODS

1. Study Design

This systematic review was conducted to evaluate the effectiveness of laboratory tests in predicting treatment outcomes and postoperative complications in patients undergoing dental surgical procedures. The review was structured according to the general principles of systematic review methodology.

2. Review Question

The review aimed to answer the following question: How effective are laboratory investigations in predicting treatment outcomes and postoperative complications following dental surgery? Particular attention was given to hematological, coagulation, biochemical, and inflammatory laboratory parameters.

3. Literature Search Strategy

A comprehensive literature search was performed using PubMed/MEDLINE, ScienceDirect, Cochrane Library, Wiley Online Library, and Google Scholar. The search included studies published in English and used combinations of keywords such as *laboratory tests*, *dental surgery*, *oral surgery*, *preoperative testing*, *postoperative complications*, *bleeding*, *wound healing*, *dental implants*, and *treatment outcomes*.

4. Eligibility Criteria

Studies were considered eligible when they evaluated laboratory investigations in patients undergoing dental or oral surgical procedures and reported their relationship with treatment outcomes or postoperative complications. Systematic reviews, meta-analyses, observational studies, and relevant clinical studies were considered, while studies unrelated to dental surgery, publications without relevant outcome data, and non-English articles were excluded.

5. Study Selection

The identified studies were screened according to their titles and abstracts to determine their relevance to the review question. Potentially eligible studies were subsequently assessed in greater detail, and studies that met the predefined eligibility criteria were included in the final review.

6. Data Extraction

Relevant information was extracted from the included studies, including study characteristics, patient population, type of dental procedure, laboratory parameters assessed, and reported clinical outcomes. Particular attention was given to laboratory abnormalities associated with bleeding, infection, delayed healing, implant failure, and other postoperative complications.

7. Laboratory Parameters

The laboratory investigations evaluated in this review included complete blood count, platelet count, coagulation tests, blood glucose, HbA1c, renal function tests, liver function tests, and other relevant biochemical or inflammatory markers. The predictive usefulness of each parameter was considered in relation to the patient's systemic condition and the type of dental procedure performed.

8. Outcome Measures

The primary outcomes were the ability of laboratory tests to predict postoperative complications and treatment outcomes. Outcomes included postoperative bleeding, infection, delayed wound healing, implant failure, peri-implant complications, and other clinically relevant adverse events.

9. Assessment of Evidence

The findings of the included studies were compared according to patient characteristics, laboratory parameters, and surgical procedures. Particular emphasis was placed on whether laboratory testing provided clinically meaningful predictive information and whether selective testing was more useful than routine testing.

10. Data Synthesis

Because of differences among the included studies in patient populations, dental procedures, laboratory parameters, and outcome definitions, the findings were synthesized descriptively. The evidence was summarized to determine which laboratory investigations appeared most useful for identifying patients at increased risk of complications and improving treatment planning.

IV. RESULTS

The included evidence demonstrated that the usefulness of laboratory investigations in dental surgery varies according to the patient's systemic condition, the type of surgical procedure, and the specific laboratory parameter evaluated. Overall, routine laboratory testing showed limited predictive value in healthy patients undergoing minor dental procedures, whereas targeted testing was more informative in patients with thrombocytopenia, anticoagulant use, diabetes, or other systemic abnormalities.

Table 1. Main Laboratory Investigations and Their Clinical Predictive Value in Dental Surgery

Laboratory investigation	Main clinical purpose	Predictive value	Main outcomes
Complete blood count	Detection of anemia, leukopenia, and thrombocytopenia	Limited in healthy patients; useful in selected high-risk patients	Bleeding, infection, general surgical risk
Platelet count	Assessment of platelet-related bleeding risk	Moderate to high in thrombocytopenic patients	Postoperative bleeding
PT/INR	Assessment of extrinsic coagulation pathway and anticoagulation	Useful in selected patients, particularly those receiving warfarin	Bleeding risk
aPTT	Assessment of intrinsic coagulation pathway	Mainly useful when a coagulation disorder is suspected	Bleeding risk
Blood glucose	Assessment of current glycemic status	Useful in patients with diabetes or suspected metabolic abnormalities	Healing and infection
HbA1c	Assessment of long-term glycemic control	Useful for risk stratification before selected procedures	Implant outcomes and wound healing
Renal function tests	Assessment of kidney function and drug-handling capacity	Useful in patients with renal disease	Medication safety and surgical management
Liver function tests	Assessment of hepatic function and possible coagulation abnormalities	Useful when liver disease is suspected	Bleeding and medication management

The reviewed evidence indicates that laboratory investigations have their greatest clinical value when they are directed toward a specific suspected abnormality. Complete blood count and coagulation testing are particularly relevant in patients with hematological disorders or bleeding risk, while HbA1c and glucose assessment are more relevant in patients with diabetes undergoing procedures in which healing and implant success are important (Kaur & Chatterjee, 2020; Javed & Romanos, 2009).

Table 2. Laboratory Testing and Risk of Postoperative Bleeding

Patient group / condition	Laboratory parameter	Main finding	Clinical implication
Thrombocytopenic patients	Platelet count	Bleeding risk varies with platelet level and clinical condition	Platelet count should be interpreted individually
Patients with platelet count <50,000/µL	Platelet count	Higher bleeding risk compared with higher platelet counts	Increased attention to hemostatic management is required
Patients receiving warfarin	INR	Anticoagulation status may influence bleeding management	Treatment decisions should consider thromboembolic risk
Patients receiving oral anticoagulants	Coagulation/anticoagulant status	Dental procedures can often be performed with appropriate management	Local hemostatic measures are important
Healthy patients undergoing minor procedures	CBC/coagulation tests	Routine testing has limited predictive value	Selective testing is generally more appropriate

Platelet count was one of the laboratory parameters with the clearest relationship to postoperative bleeding, particularly among thrombocytopenic patients. Karasneh et al. (2019) found that postoperative bleeding following invasive dental procedures in thrombocytopenic patients was generally uncommon and that available evidence did not support using a universal platelet threshold for all procedures. More recent evidence reported a higher bleeding risk among patients with platelet counts below 50,000/µL, although this level should not be considered an absolute contraindication to dental intervention (Lim et al., 2026). Anticoagulant-related bleeding should similarly be assessed in the context of the procedure and the patient's overall thromboembolic risk rather than laboratory results alone (Andrade et al., 2019).

Table 3. Laboratory Tests and Dental Treatment Outcomes

Laboratory parameter	Dental treatment/outcome	Evidence from reviewed studies	Overall interpretation
HbA1c	Dental implant survival and osseointegration	Poor glycemic control associated with less favorable outcomes	Useful for diabetic patients
Blood glucose	Wound healing and infection	Hyperglycemia may impair healing and increase susceptibility to infection	Useful when diabetes is suspected or established
Platelet count	Postoperative bleeding	Lower platelet levels associated with increased bleeding risk	Useful in thrombocytopenic patients
PT/INR	Postoperative bleeding	Relevant mainly in patients receiving anticoagulants or with coagulation disorders	Selective use recommended
CBC	General postoperative risk	Abnormalities may identify patients requiring further assessment	Limited value as universal screening
Renal function	Medication selection and perioperative management	Important in patients with renal impairment	Mainly clinically indicated
Liver function	Hemostasis and drug metabolism	Relevant in patients with hepatic disease	Mainly clinically indicated

The evidence concerning treatment outcomes showed that metabolic laboratory parameters, particularly glycemic markers, may be important in patients undergoing dental implant treatment. Diabetes and poor glycemic control have been associated with

impaired osseointegration, peri-implant complications, and increased risk of unfavorable implant outcomes, whereas adequately controlled diabetes may allow more predictable treatment results (Javed & Romanos, 2009; Naujokat et al., 2016; Jiang et al., 2021).

Overall, the reviewed evidence supports a selective rather than routine approach to laboratory testing in dental surgery. Laboratory investigations appear most useful when the patient has a relevant systemic disease, suspected hematological abnormality, anticoagulant therapy, or metabolic disorder; in contrast, routine testing in otherwise healthy patients undergoing minor dental procedures provides relatively limited additional predictive information (Kaur & Chatterjee, 2020; Munro et al., 1997).

V. DISCUSSION

The present systematic review examined the effectiveness of laboratory investigations in predicting treatment outcomes and postoperative complications following dental surgical procedures. The findings indicate that laboratory tests have an important but selective role in dental practice. Their usefulness is strongly influenced by the patient's systemic health, the type and extent of the planned dental procedure, the presence of hematological or metabolic abnormalities, and the medications being used. Overall, the evidence favors clinically indicated and risk-based laboratory testing rather than routine testing of all patients undergoing dental surgery.

One of the most important findings of the review was the limited predictive value of routine laboratory investigations in otherwise healthy patients undergoing minor dental procedures. Kaur and Chatterjee (2020) reviewed the relevance of preoperative laboratory testing in elective oral and maxillofacial surgery and concluded that routine investigations may provide little additional clinical information when there is no specific indication for testing. This is consistent with the broader evidence regarding routine preoperative testing, which suggests that investigations should be selected according to the patient's clinical history and the anticipated risks of the procedure rather than being automatically requested for every patient (Munro et al., 1997). Such an approach may reduce unnecessary investigations, avoid incidental abnormal findings, and improve the efficiency of preoperative assessment.

Coagulation testing represents another important area in the preoperative evaluation of dental patients. Prothrombin time, INR, and activated partial thromboplastin time may provide clinically relevant information in patients with known coagulation disorders, liver disease, or anticoagulant treatment. However, these tests have relatively limited value when performed indiscriminately in patients without a relevant clinical history. Therefore, the decision to request coagulation studies should be based on the patient's history of abnormal bleeding, underlying disease, medication use, and the expected bleeding risk associated with the dental procedure (Kaur & Chatterjee, 2020).

The management of direct oral anticoagulants has further strengthened the importance of individualized perioperative planning. Recent evidence suggests that many oral surgical procedures can be performed safely with continued or minimally modified anticoagulant therapy when appropriate local hemostatic measures are applied. Therefore, the role of laboratory testing in these patients is not simply to determine whether surgery is possible, but rather to contribute to an overall assessment of bleeding risk while balancing that risk against the potential consequences of unnecessary interruption of anticoagulation.

HbA1c is especially useful because it reflects longer-term glycemic control rather than a single blood glucose measurement. Javed and Romanos (2009) demonstrated that poor glycemic control may adversely affect osseointegration and the clinical outcomes of dental implants. Their findings suggest that assessment of glycemic control can help clinicians identify diabetic patients who may have a less predictable response to implant therapy and who may benefit from improved metabolic control before treatment.

The relationship between diabetes and implant outcomes was also supported by Naujokat et al. (2016), who reported that poorly controlled diabetes was associated with impaired osseointegration and increased peri-implant complications. These findings indicate that HbA1c should not necessarily be viewed simply as a diagnostic laboratory test for diabetes, but also as a potential component of dental treatment planning in patients with established diabetes. In such patients, the laboratory result may help the clinician determine whether additional medical optimization is advisable before proceeding with elective surgical treatment.

Jiang et al. (2021) further demonstrated an association between diabetes and dental implant complications, including increased marginal bone loss and unfavorable peri-implant parameters. Their findings reinforce the importance of metabolic assessment

when implant treatment is being considered in diabetic patients. However, diabetes itself should not automatically exclude a patient from implant treatment; rather, the degree of glycemic control and other patient-specific risk factors should be considered when estimating the probability of a favorable outcome.

An important consideration emerging from the reviewed evidence is that laboratory tests should not be interpreted independently of clinical findings. A patient with a mildly abnormal laboratory value may undergo dental surgery without significant complications, whereas a patient with apparently acceptable laboratory results may still experience an adverse outcome because of other risk factors. Surgical complexity, local tissue condition, medication use, smoking, systemic disease, age, nutritional status, and postoperative care may all influence treatment outcomes. Consequently, laboratory investigations should be regarded as complementary tools for risk assessment rather than independent predictors of surgical success or failure.

Another important issue is the potential disadvantage of excessive laboratory testing. Routine testing may produce abnormal findings that are unrelated to the planned dental procedure, resulting in additional investigations, referrals, treatment delays, and increased healthcare expenditure. Kaur and Chatterjee (2020) emphasized the limited usefulness of indiscriminate preoperative testing in elective oral and maxillofacial surgery, supporting a more individualized approach. This is particularly relevant in dental practice, where many procedures are minor and can be safely performed in patients without significant systemic disease.

The evidence therefore supports a selective laboratory testing strategy. Before requesting investigations, the dentist should consider the patient's medical history, previous bleeding episodes, systemic diseases, medications, clinical examination, and the anticipated invasiveness of the procedure. Laboratory tests should then be selected according to the specific risk suspected. For example, platelet count may be appropriate in a patient with suspected thrombocytopenia, INR may be relevant in a patient receiving warfarin, and HbA1c may be useful in a diabetic patient scheduled for implant surgery.

The findings of this review have important practical implications for dental clinicians. Rather than using laboratory investigations as a standardized checklist for every patient, clinicians should use them as part of an individualized risk-assessment process. This approach can help identify patients who require additional medical evaluation while avoiding unnecessary testing in low-risk patients.

The present evidence also highlights several gaps in the literature. Many available studies focus on specific patient groups, such as thrombocytopenic or diabetic patients, while evidence concerning the predictive value of laboratory tests in the general dental population remains more limited. Furthermore, differences in surgical procedures, definitions of postoperative bleeding, laboratory thresholds, and follow-up periods make direct comparison between studies difficult. Future research should therefore establish standardized laboratory thresholds and validated prediction models that combine laboratory findings with clinical and procedural variables.

CONCLUSION

Laboratory tests can assist in predicting complications and guiding dental surgical management, particularly in patients with relevant systemic or hematological abnormalities. Selective, risk-based testing appears more appropriate than routine laboratory screening in healthy patients.

REFERENCES

[1] Andrade, N. K. S., Motta, R. H. L., Bergamaschi, C. C., Oliveira, L. B., Guimarães, C. C., Araújo, J. O., & Lopes, L. C. (2019). Bleeding risk in patients using oral anticoagulants undergoing surgical procedures in dentistry: A systematic review and meta-analysis. Frontiers in Pharmacology, 10, 866. https://doi.org/10.3389/fphar.2019.00866. (PubMed Central (PMC))

[2] Chrcanovic, B. R., Albrektsson, T., & Wennerberg, A. (2022). Diabetes mellitus and dental implants: A systematic review and meta-analysis. Materials, 15(9), 3227. https://doi.org/10.3390/ma15093227. (PubMed)

[3] Javed, F., & Romanos, G. E. (2009). Impact of diabetes mellitus and glycemic control on the osseointegration of dental implants: A systematic literature review. Journal of Periodontology, 80(11), 1719–1730. https://doi.org/10.1902/jop.2009.090283. (PubMed)

[4] Jiang, X., Zhu, Y., Liu, Z., Tian, Z., & Zhu, S. (2021). Association between diabetes and dental implant complications: A systematic review and meta-analysis. Acta Odontologica Scandinavica, 79(1), 9–18. https://doi.org/10.1080/00016357.2020.1761031. (PubMed)

[5] Karasneh, J., Christoforou, J., Walker, J. S., Manfredi, M., Dave, B., Diz Dios, P., Lockhart, P. B., & Patton, L. L. (2019). World Workshop on Oral Medicine VII: Platelet count and platelet transfusion for invasive dental procedures in thrombocytopenic patients: A systematic review. Oral Diseases, 25(Suppl. 1), 174–181. https://doi.org/10.1111/odi.13082 (PubMed)

[6] Kaur, T. S., & Chatterjee, B. P. (2020). "Too much information with little meaning," relevance of preoperative laboratory testing in elective oral and maxillofacial surgeries: A systematic integrative review. National Journal of Maxillofacial Surgery, 11(1), 3–9. https://doi.org/10.4103/njms.NJMS_60_19 (PubMed Central (PMC))

[7] Lim, G. X. D., Al Sarraf, F., Cho, H., & Kumar, N. (2026). Platelet levels associated with bleeding risk for dental interventions: A systematic review. Oral Diseases, 32(6), 1506–1517. https://doi.org/10.1111/odi.70211 (PubMed)

[8] Macpherson, D. S. (1993). Preoperative laboratory testing: Should any tests be "routine" before surgery? Medical Clinics of North America, 77(2), 289–308. https://doi.org/10.1016/S0025-7125(16)30252-8. (PubMed)

[9] Manfredi, M., et al. (2023). The effect of direct oral anticoagulant therapy on oral surgical procedures: A systematic review. [Journal details should be verified before submission]. (PubMed Central (PMC))

[10] Mendes, M. L. T., et al. (2021). Bleeding outcomes after dental extraction in patients under direct-acting oral anticoagulants versus vitamin K antagonists: A systematic review and meta-analysis. [Journal details should be verified before submission]. (PubMed Central (PMC))

[11] Migliorati, C. A., et al. (2023). Perioperative management of antithrombotic therapy in patients who undergo dental procedures: A systematic review of the literature and network meta-analysis. [Journal details should be verified before submission]. (PubMed)

[12] Moraschini, V., et al. (2022). Systematic review on diabetes mellitus and dental implants: An update. [Journal details should be verified before submission]. (PubMed)

[13] Munro, J., Booth, A., & Nicholl, J. (1997). Routine preoperative testing: A systematic review of the evidence. Health Technology Assessment, 1(12), 1–62. (PubMed)

[14] Naujokat, H., Kunzendorf, B., & Wiltfang, J. (2016). Dental implants and diabetes mellitus—A systematic review. International Journal of Implant Dentistry, 2, 5. https://doi.org/10.1186/s40729-016-0038-2. (PubMed)

[15] van Dijk, W. E. M., van Es, R. J. J., & colleagues. (2021). Dentoalveolar procedures in immune thrombocytopenia: Systematic review and an institutional guideline. TH Open, 5, e348–e356. (PubMed Central (PMC))

[16] Yefet, E., Givol, N., & Pesis, M. (2025). Direct oral anticoagulant use in oral surgery: Insights from a systematic review. Oral and Maxillofacial Surgery, 29(1), 51. https://doi.org/10.1007/s10006-025-01348-0. (PubMed)