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Reasonable necessity of preoperative laboratory tests in office-based oral and maxillofacial surgery

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Objectives: As medical history before surgery is often based on patient reporting, there is the possibility that patients intentionally hide underlying diseases or that dentists cannot recognize abnormal health states. Therefore, more professional and reliable treatment processes are needed under the Korean dental specialist system. The purpose of this study was to elucidate the necessity of a preoperative blood testing routine prior to office-based surgery under local anesthesia.

Patients and Methods: Preoperative blood lab data for 5,022 patients from January 2018 to December 2019 were assembled. Study participants were those who underwent extraction or implant surgery under local anesthesia at Seoul National University Dental Hospital. Preoperative blood tests included complete blood count (CBC), blood chemistry, serum electrolyte, serology, and blood coagulation data. Values outside of the normal range were considered an "abnormality," and the percentage of abnormalities among the total number of patients was calculated. Patients were divided into two groups based on the presence of underlying disease. The rates of abnormalities in the blood tests were compared between groups. Chi-square tests were performed to compare data from the two groups, and $P<0.05$ was considered statistically significant.

Results: The percentages of males and females in the study were 48.0% and 52.0%, respectively. Of all patients, 17.0% (Group B) reported known systemic disease, while 83.0% (Group A) reported no specific medical history. There were significant differences between Groups A and B in CBC, coagulation panel, electrolytes, and chemistry panel ($P<0.05$). In Group A, the results of blood tests that required a change in procedure were identified even though the proportion was very small.

Conclusion: Preoperative blood tests for office-based surgery can detect underlying medical conditions that are difficult to identify from patient history alone and can prevent unexpected sequelae. In addition, such tests can result in a more professional treatment process and build patient confidence in the dentist.

Key words: Preoperative laboratory test, Office-based, Oral and maxillofacial surgery

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I. Introduction

Preoperative assessments of the general status of patients before oral and maxillofacial surgery are often based on information reported by patients. However, the information can be limited, and the patient could intentionally hide underlying disease or not recognize abnormal health status. In a dental office, there are many surgical procedures performed under local anesthesia, and patients are often nervous and frightened. An urgent situation such as cardiac arrest, anaphylactic shock, syncope, or hypoglycemic shock can be encountered in the local clinic[1]. Preoperative evaluation is a basic and important step for identification of previously undetermined conditions that may place the patient at risk during surgery and the postoperative period as well as assessment of known conditions[2]. The utility of routine preoperative laboratory tests is controversial. Some authors encourage routine tests, while others suggest only obtaining a patient history and physical examination[3]. As life expectancy increases, the number of elderly patients who require oral and maxillofacial surgical treatment has also increased. There is also a need for a more professional and reliable treatment process under the Korean dental specialist system. A careful preoperative

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assessment can prevent unexpected emergencies, provide an opportunity to plan for pre- and postoperative care, and provide a better treatment outcome[4]. The purpose of this study was to elucidate the necessity of routine preoperative blood testing before office-based surgeries under local anesthesia.

II. Patients and Methods

This study was a retrospective evaluation of patients requiring minor oral surgery, such as surgical extraction or dental implant, under local anesthesia. Patients were enrolled between January 1, 2018 and December 31, 2019 at the Department of Oral and Maxillofacial Surgery in Seoul National University Dental Hospital. The total number of patents was 6,252, of which 5,022 older than 18 years were included in the study.

(1) Inclusion criteria

- Patients who underwent surgery under local anesthesia.
- Patients older than 18 years.

(2) Exclusion criteria

- Patients who underwent only blood testing and did not undergo surgery.
- Patients under the age of 18.

After history collection, which included the chief complaint, history of present illness, and past medical and dental histories, a physical examination was performed. All patients underwent blood sampling before the surgical procedure. This study was conducted according to the guidelines of the Declaration of Helsinki and was approved by the Institutional Review Board of Seoul National University (IRB No. S-D20200016).

Preoperative laboratory information was available on white blood cell (WBC) count, red blood cell (RBC) count, hemoglobin (Hb), hematocrit (Hct), platelets, absolute neutrophil count (ANC), partial prothromboplastin time (PTT), prothrombin time (PT) international normalized ratio (INR), albumin, alkaline phosphatase (ALP), protein, serum calcium, phosphorus, glucose, uric acid, total bilirubin, cholesterol, aspartate aminotransferase (AST), alanine aminotransferase (ALT), blood urea nitrogen (BUN), creatinine, serum sodium, potassium, chloride, and erythrocyte sedimentation rate (ESR). Serology tests including hepatitis B virus surface antigen (HBsAg), hepatitis B surface antibody (anti-HBs), hepatitis C virus antibodies (anti-HCV), venereal disease research laboratory (VDRL), and human immunodeficiency virus antigen/antibody (HIV [Ag, Ab]) were performed before the procedure. The normal ranges were defined as follows: WBC, 4,000-10,000/μL; RBC, 4.20×10^6-6.30×10^6/μL; Hb, 13-17 g/dL; Hct, 39%-52%; platelets, $130\text{-}400\times10^6$/μL; ANC, 1,800-7,000/μL; ESR, 0-9 mm/hr; partial thromboplastin time (aPTT), 29-45 seconds; prothrombin time international normalized ratio (PT INR), 0.8-1.2 INR; calcium, 8.8-10.5 mg/dL; phosphorus, 2.5-4.5 mg/dL; glucose, 70-110 mg/dL; BUN, 10-26 mg/dL; uric acid, 3-7 mg/dL; cholesterol, 0-240 mg/dL; total protein, 6-8 g/dL; albumin, 3.3-5.2 g/dL; total bilirubin, 0.2-1.2 mg/dL; ALP, 30-115 IU/L; AST, 0-40 IU/L; ALT, 0-40 IU/L; creatinine, 0.7-1.4 mg/dL; sodium, 135-145 mmol/L; potassium, 3.5-5.5 mmol/L; and chloride, 98-110 mmol/L. Values that deviated from the reference levels were defined as abnormal.

Patients were divided into two groups: Group A (no known past medical history) and Group B (history of systemic disease such as hypertension, diabetes, heart disease, or cerebrovascular disease). The rates of abnormal values in the blood tests were compared between groups. Chi-square tests were performed using IBM SPSS Statistics (ver. 26.0; IBM) for statistical analysis, for which $P<0.05$ was considered statistically significant.

III. Results

A total of 5,022 patients was included in the final analysis. Males and females made up 48.0% and 52.0% of the study population, respectively. The age distribution of patients is displayed in Table 1, which shows that 51.5% of the patients were age 18-29 years, 21.6% were in their 30s, 9.7% were in their 40s, 6.9% were in their 50s, 4.7% were in their 60s, 3.3% were in their 70s, and 2.2% were 80 years or older. Of all patients, 17.0% (Group B) stated that they had a known systemic disease, while 83.0% (Group A) reported no specific medical history.(Table 1) The proportions of abnormal results

Table 1. Demographic data (n=5,022)

Variable		Value
Sex	Male	2,410 (48.0)
	Females	2,612 (52.0)
Age (yr)	18-29	2,585 (51.5)
	30-39	1,084 (21.6)
	40-49	489 (9.7)
	50-59	347 (6.9)
	60-69	237 (4.7)
	70-79	168 (3.3)
	≥80	112 (2.2)
Medical history	Present	853 (17.0)
	Non specific	4,169 (83.0)

Values are presented as number (%).

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Table 2. Comparison of laboratory results between groups

	Group A	Group B	Total	Odds ratio (95% CI)
WBC	312 (7.5)	98 (11.5)	410 (8.2)	1.642** (1.291-2.088)
RBC	506 (12.1)	164 (19.2)	670 (13.3)	1.768** (1.455-2.147)
Hb	867 (20.8)	238 (27.9)	1,105 (22.0)	1.517** (1.282-1.794)
Hct	947 (22.7)	261 (30.6)	1,208 (24.1)	1.546** (1.313-1.820)
Platelets	105 (2.5)	50 (5.9)	155 (3.1)	2.463** (1.743-3.479)
ANC	238 (5.7)	73 (8.6)	311 (6.2)	1.586** (1.207-2.085)
aPTT	84 (2.0)	38 (4.5)	122 (2.4)	2.301** (1.557-3.401)
PT INR	24 (0.6)	27 (3.2)	51 (1.0)	5.721** (3.284-9.966)
Albumin	6 (0.1)	8 (0.9)	14 (0.3)	6.785** (2.348-19.609)
ALP	77 (1.8)	50 (5.9)	127 (2.5)	3.429** (2.381-4.936)
Protein	338 (8.1)	49 (5.7)	387 (7.7)	0.714* (0.524-0.973)
Ca	241 (5.8)	108 (12.7)	349 (6.9)	2.458** (1.932-3.128)
P	118 (2.8)	42 (4.9)	160 (3.2)	1.840** (1.283-2.639)
Glucose	344 (8.3)	240 (28.1)	584 (11.6)	4.606** (3.819-5.556)
Uric acid	615 (14.7)	136 (15.9)	751 (15.0)	1.139 (0.929-1.396)
Total bilirubin	231 (5.5)	47 (5.5)	278 (5.5)	1.030 (0.745-1.422)
Cholesterol	307 (7.4)	71 (8.3)	378 (7.5)	1.142 (0.873-1.495)
AST	173 (4.1)	70 (8.2)	243 (4.8)	2.065** (1.548-2.754)
ALT	407 (9.8)	129 (15.1)	536 (10.7)	1.647** (1.330-2.039)
BUN	769 (18.4)	137 (16.1)	906 (18.0)	0.878 (0.718-1.072)
Creatinine	457 (11.0)	121 (14.2)	578 (11.5)	1.396* (1.124-1.733)
Sodium	47 (1.1)	27 (3.2)	74 (1.5)	2.937** (1.817-4.747)
Potassium	9 (0.2)	9 (1.1)	18 (0.4)	5.036** (1.992-12.732)
Chloride	9 (0.2)	15 (1.8)	24 (0.5)	8.465** (3.690-19.418)
ESR	401 (9.6)	200 (23.4)	601 (12.0)	2.878** (2.383-3.476)

(WBC: white blood cell count, RBC: red blood cell count, Hb: hemoglobin, Hct: hematocrit, ANC: absolute neutrophil count, aPTT: partial thromboplastin time, PT INR: prothrombin time international normalized ratio, ALP: alkaline phosphatase, Ca: serum calcium, P: serum phosphorus, AST: aspartate aminotransferase, ALT: alanine aminotransferase, BUN: blood urea nitrogen, ESR: erythrocyte sedimentation rate, CI: confidence interval)

*P<0.05, **P<0.001.

Group A: no known past medical history, Group B: history of systemic disease such as hypertension, diabetes, heart disease, or cerebrovascular disease.

Values are presented as number (%).

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Table 3. Moderately to severely abnormal values in selected variables

Criteria		Group A	Group B
ANC	<1,000 μL	4	1
Hb	<8.0 g/dL	8	1
Platelets	<80,000 μL	3	13
Potassium	>5.5 mmol/L	5	7
ALT	>100 IU/L	48	21
AST	>100 IU/L	19	5
Glucose	>200 mg/dL	12	27

(ANC: absolute neutrophil count, Hb: hemoglobin, ALT: alanine aminotransferase, AST: aspartate aminotransferase)

Group A: no known past medical history, Group B: history of systemic disease such as hypertension, diabetes, heart disease, or cerebrovascular disease.

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are shown in Table 2. There were significant differences between Groups A and B with respect to WBC, RBC, Hb, Hct, platelets, and ANC (P<0.001). In the complete blood count (CBC), the odds ratio was highest for platelets at 2.463. We focused on abnormal levels of ANC, Hb, and platelet counts in the CBC; while other values have clinical importance, prevention of postoperative infection or delayed bleeding are critical issues in minor oral surgery. There were five patients with an ANC less than 1,000 μL, four of whom were healthy with no underlying disease. Patients with Hb level below 8.0 g/dL numbered 8 in Group A but only 1 in Group B. There were 16 patients with platelets less than 80,000 μL, four of whom mentioned that they had no underlying disease and were referred to the Department of Internal Medicine for further evaluation.(Table 3)

In the coagulation panel, PT INR and aPTT exhibited statistically significant differences between the groups (P<0.001). The odds ratio of PT INR was 5.721. One patient age 34 years was diagnosed with acute myeloid leukemia. There were three patients with a PT INR of 2.0 or higher. Two patients were taking warfarin, while one had end-stage liver cirrhosis. In addition, of the 20 patients who showed an increase greater than 10% over the normal aPTT, nine had no underlying disease.

In the chemistry panel, the rates of abnormal values exhibited significant differences between the two groups for albumin, ALP, serum calcium (Ca), serum phosphorus (P), glucose, AST, ALT (P<0.001), protein, and creatinine (P<0.05). (Table 2) Group A contained patients with mild to moderate ALT elevation, while 21 patients in Group B had elevated

levels. Nineteen patients in Group A and 5 patients in Group B showed mild to moderate AST elevation. Twelve patients in Group A exhibited a serum glucose level greater than 200 mg/dL, while 27 patients in group B showed such values.(Table 3) There were no significant differences between groups for uric acid, total bilirubin, cholesterol, and BUN levels. In serum sodium, potassium, chloride, and ESR analyses, there were significant differences between the groups (P<0.001).

In the serology test, statistical processing was not performed between the groups. Of the 5,022 total patients, there were 37 who were VDRL reactive, 130 patients who were HBsAg positive, 41 patients who were anti-HCV positive, and 3 who were HIV positive. In the anti-HCV-positive cases, 16 of 41 individuals (39.0%) did not know their medical history or did not inform clinicians. Of the 3 patients who tested positive for HIV, 2 were taking antiviral drugs, which they did not mention to the medical staff, while one patient was newly discovered and was referred to an infectious medicine specialist.

IV. Discussion

Preoperative patient evaluations are an essential process for any surgical procedure, and routine laboratory tests are widely performed prior to elective surgery. Such data help anesthesiologists to determine the suitability of patients for general anesthesia or sedative anesthesia. Patients with high risk of postoperative complications could be identified through routine work-ups for surgery. Preoperative investigations can be divided into routine and based on the purpose[5]. Routine tests are defined as those performed in the absence of any specific clinical indications or purposes. In contrast, indicated tests are performed for specific purposes such as evaluation of disease severity, progression, and effectiveness of therapy[6].

Surgical extraction and placement of implants are the most frequent ambulatory surgeries performed in the Department of Oral and Maxillofacial Surgery. These procedures are commonly performed under local or sedative anesthesia. In most cases, past medical history is based on a patient's statements. However, clinicians cannot determine if a patient has a hidden underlying disease or if the patient knowingly conceals a disease.

In this retrospective study covering two years, preoperative routine blood tests were performed for patients who were scheduled to undergo surgical extraction or implant surgery under local anesthesia. Study groups were divided into patients with a past medical history and those with no underlying disease. Differences in the rates of abnormal clinical values between the two groups were investigated. In CBC, coagulation panels, and electrolytes, there were significant differences between the two groups in all of the markers. In the chemistry panel, statistical differences were observed in albumin, ALP, total protein, Ca, P, glucose, AST, ALT, and creatinine. ESR exhibited significant differences between the groups. However, there were no statistical differences in uric acid, total bilirubin, cholesterol, and BUN levels. Preoperative evaluation protocols include routine laboratory tests before outpatient surgeries in the Department of Oral and Maxillofacial Surgery of Seoul National University Dental Hospital, although the necessity of routine preoperative laboratory tests remains controversial between clinicians. Biery et al.[7] studied 672 American Society of Anesthesiologists (ASA) class I patient serum glucose and Hct levels and determined that routine laboratory analysis was of little value for anesthetic management of ASA class I patients. Fattahi[8] mentioned that most ASA I patients undergoing elective outpatient procedures in oral and maxillofacial surgery offices do not require preoperative testing based on current suggestions. Fischer et al.[9] studied the utilization and predictive value of preoperative laboratory testing in outpatient plastic surgeries, and they concluded that there was no association between abnormal laboratory testing and postoperative morbidity. Benarroch-Gampel et al.[10] insisted that preoperative testing was overused in patients undergoing low-risk, ambulatory surgery, and that guidelines for preoperative testing should be established by surgical societies.

The proportions of abnormal results for all patients in our study were diverse by variable (0.4%-24.1%). Abnormal results did not always affect postoperative complications and outcomes. Based on the results of this study, Routine tests are more important for older patients and those with underlying diseases. However, even among patients with no underlying disease, in some cases, surgery cannot be performed or required changes. As a result, precautions must be taken for patients who have undetected risks. There were 5 patients with an ANC level less than 1,000 μL, four of whom were healthy patients with no underlying disease. Sixteen patients had a PLT level less than 80,000 μL, four of whom mentioned they had no underlying diagnosed diseases. One patient was diagnosed with acute myeloid leukemia. If the surgical procedures had been performed without blood tests, postoperative morbidity could have increased. In addition, the responsibility for problems caused by the failure to know the patient's

condition in advance could be assigned to the health professional. Routine preoperative tests including CBC, electrolyte, chemistry, coagulation panel, and serology cost 93.40 US dollars, with only 37.36 US dollars paid by the patient out of pocket.

One large randomized controlled trial and Cochrane meta-analysis demonstrated the lack of effectiveness of preoperative tests for low-risk surgery[11]. Another study demonstrated that abnormal preoperative laboratory testing was not a significant independent predictor of postoperative complications[12]. However, regarding medical legal issues and patient satisfaction, automated testing protocols are often accepted in routine ambulatory surgical procedures. In terms of efficacy, as shown by the results of this study, it is believed that such testing is more necessary in the group with systemic diseases based on patient reported history, which is consistent with the results of previous studies that have set criteria for preoperative testing in ASA class II and above[5,13,14]. Thorough medical history collection and physical examinations should be performed, and these findings should guide the selection of tests[15]. However, risks that can arise from hidden or deliberate patient nondisclosure can create unpredictable results.

This study involved patients undergoing procedures at the national university dental hospital, and no patient refused preoperative blood testing, a limited practice in the environment of private clinics due to limitations of the health insurance system and patients' perception of the treatment performed by a general dentist in the local clinic. However, the results of this study suggest preoperative laboratory testing to provide the dental practice with a more complete patient health status leading to better treatment outcome. Evaluation of the cost/benefit ratio for more extensive preoperative laboratory studies should also be considered.

V. Conclusion

This study included patients diagnosed with impacted teeth, dental caries, periodontal disease, or loss of teeth, who underwent surgical procedures such as extractions, implant installations, or bone grafting under local anesthesia. The abnormal rate of patient blood tests varied with clinical variable and was significantly higher for patients previously diagnosed with diseases. However, even in the normal group, unrealized diseases such as acute leukemia and thrombocytopenia were found, potentially affecting the outcome of surgeries. While routine lab testing is essential in ambulatory surgical procedures in the field of oral and maxillofacial surgery, the cost/benefit ratio for extensive laboratory studies should also be considered.

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Authors' Contributions

M.H.S. conceived, designed, and composed this study. M.Y.E. collected the data. K.R.M. and B.S.-I. contributed to the writing of the manuscript. H.M. analyzed the results, and S.M.K. revised the manuscript. All authors read and approved the final manuscript.

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Ethics Approval and Consent to Participate

The study protocol and access to patient records were approved by the Institutional Review Board of Seoul National University, Seoul, Korea (IRB No. S-D20200016) and all methods were performed in accordance with the relevant guidelines and regulations of the Declaration of Helsinki. The written informed consent was waived due to the retrospective nature of the study.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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