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Knowledge and Awareness of Practicing Dentists About Oral Manifestations of Haematological Diseases and Blood Count Interpretation: A Pilot Study

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Abstract

Objective: This study aimed to assess practicing dentists' knowledge, attitudes, and self-confidence regarding knowledge about oral manifestations of haematological disorders and interpretation of blood count (BC) tests. Materials and Methods: An online survey was sent to all practicing dentists via email addresses registered with the Dental Chamber. The questionnaire collected sociodemographic data and assessed knowledge of hematological diseases, their oral manifestations, and BC interpretation, as well as dentists' attitudes toward interdisciplinary collaboration and perceived need for continuing education. In the knowledge section, some questions required a single correct answer, while most allowed multiple selections. For multiple-choice items, any incorrect choice made the response incorrect; responses were partially correct if accurate but incomplete and fully correct only when all correct options were selected. Statistical analysis was performed with $p < 0.05$. Descriptive statistics, Shapiro–Wilk, Kruskal–Wallis H, Mann–Whitney U, and independent-samples *t*-tests were used. Results: A total of 308 dentists responded, representing only 7.6% of the national dental workforce. While most recognized the relevance of BC tests and systemic disease indicators in oral health, knowledge gaps were substantial. The mean score on knowledge items was low (2.81 ± 1.52 out of 11), with only 1.3% dentists achieving seven or more correct answers. Interestingly, dentists with higher self-reported confidence in interpreting BC tests had lower knowledge scores, suggesting a potential Dunning-Kruger effect. Knowledge did not differ by specialization or postgraduate education, likely reflecting limited curricular coverage, but was more strongly associated with clinical experience, practice location, and patient load. Most respondents (96.1%) expressed strong interest in further education on the topic. Conclusions: Targeted education and interdisciplinary collaboration are essential to overcome gaps and enhance knowledge and diagnostic accuracy in oral manifestations of blood diseases and BC interpretation.

Keywords: dentists; knowledge; blood count interpretation; oral manifestations of blood diseases

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Academic Editor: Hessam Nowzari

Received: 4 March 2026
Revised: 21 April 2026
Accepted: 12 May 2026
Published: 15 May 2026

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1. Introduction

Hematological diseases, including malignant forms, significantly increase the risk of infections and compromise the body's immune defence system [1–4]. Many hematologic and hemato-oncologic disorders often present clinical manifestations in the oral cavity and other regions of the head and neck. These manifestations pose challenges in clinical dentistry, both in terms of dental/oral treatment and early diagnosis. Although oral signs may sometimes be nonspecific, they often serve as early indicators of an underlying hematologic condition, even before it becomes clinically apparent [5–9]. Accurate recognition of orofacial manifestations of hematological disorders is crucial, as oral symptoms may be the first diagnostic indicators. A thorough oral examination should therefore be a standard part of the diagnostic protocol for patients with known or suspected hematologic or haemato-oncologic conditions. Experienced dentists may be the first healthcare professionals to suspect a hematological disorder and refer patients for blood count (BC) tests or to a hematology specialist [10,11]. Additionally, dental clinicians play a pivotal role in early detection by identifying the need for appropriate diagnostic tests, typically including complete BC, and by initiating timely management of oral symptoms [5]. A wide range of hematologic and haemato-oncologic diseases can manifest orally, depending on the affected blood cell type (e.g., leukocytes, erythrocytes, thrombocytes, or histiocytes) [12,13]. However, oral manifestations most commonly arise from disorders involving leukocytes, particularly leukemias, and erythrocytes, particularly anemias [5].

Leukaemia typically presents with impaired immune function due to dysfunctional leukocytes, suppression of healthy bone marrow cell production, infiltration of blood, tissues and organs with leukemic cells, and coagulation abnormalities [14–18]. In contrast, anaemias often manifest orally as chronic atrophic candidiasis, pale or erythematous-atrophic mucosa, and may be accompanied by oral sensitivity or a burning sensation [19]. Considering the broad spectrum of local manifestations that leukaemia may present, often involving the oral cavity, the role of the dentist and the entire dental team is very important. Early recognition of these symptoms and signs can profoundly influence the clinical course of the underlying disease and enhance the overall diagnostic process [5].

With rising workloads, growing patient expectations, demographic shifts such as an aging population, accompanied by increasing rates of multimorbidity and polypharmacy, the role of dentists, particularly in early disease detection, is becoming increasingly complex. All that raises important questions about dentists' knowledge and competencies in recognizing oral signs of haematological diseases, in interpreting relevant medical diagnostics, BC tests biochemical findings, etc. To the best of our knowledge, no studies to date have examined practicing dentists' awareness, knowledge, and attitudes regarding the understanding and interpretation of hematologic diseases and BC–related biochemical parameters. Therefore, the aim of this cross-sectional study was to investigate these factors.

2. Materials and Methods

2.1. Study Design and Participants

This study targeted actively practicing dentists across the Republic of Croatia. Data collection was conducted via an online questionnaire, which was designed and administered using Google Forms® (Google Inc., Mountain View, CA, USA). The questionnaire was distributed by email to all registered dentists currently active in clinical practices as listed in the official Croatian Dental Chamber database. Participation in the study was entirely voluntary and anonymous to ensure confidentiality and encourage responses. Prior to accessing the questionnaire, all participants received detailed information about the study's aims, objectives, and procedures. Informed consent was obtained electronically, with participants explicitly confirming their understanding of the study's purpose

and agreeing to participate before proceeding to complete the questionnaire. The full version of the questionnaire, as administered in the online survey, is provided in the Supplementary Material.

2.2. Ethical Considerations

Ethical approval for this study was obtained from the Ethics Committee of the School of Dental Medicine, University of Zagreb (approval number: 05-PA-30-IX-9/2024, approval date: 30 September 2024). The study was conducted in compliance with the Declaration of Helsinki and ethical guidelines, ensuring participants' confidentiality and voluntary participation. Additionally, respondents were assured that they could withdraw from the study at any time.

2.3. Questionnaire Design

The questionnaire comprised four sections designed to assess dentists' socio-demographic characteristics, clinical experience, knowledge about oral manifestations of blood disorders and BC-related biochemical parameters, and self-perceived competence of dental practitioners in managing oral manifestations of systemic blood disorders.

The first section collected demographic information, including gender, age, years of practice, specialization status (yes/no), workplace size, and employment setting. The second section focused on clinical experience, exploring participants' encounters with patients presenting oral mucosal changes. It evaluated dentists' ability to recognize the most common oral manifestations of hematologic disorders, their preferred diagnostic approaches when systemic blood disease is suspected based on oral findings, and the extent to which they rely on blood test results for diagnosing oral conditions. Additionally, this section asked participants to self-assess their competence in interpreting hematologic and biochemical parameters in the context of oral health. The third section assessed participants' knowledge of oral manifestations of systemic blood diseases and the corresponding hematologic parameters. Some questions from the third part required selecting a single correct or incorrect answer with responses categorized simply as correct or incorrect. Most of the questions in this section, however, permitted multiple selections. For these multiple-choice items, selecting any incorrect option resulted in the entire response being classified as incorrect. Responses were considered partially correct when all selected options were accurate but incomplete, that is, not all correct choices were identified. Only when all correct options were selected, and none of the incorrect ones, the response was classified as fully correct. The fourth section evaluated dentists' self-perceived preparedness in managing oral manifestations of systemic blood diseases, interpreting hematologic parameters. This section utilized a five-point Likert scale, ranging from 1 (extremely unprepared) to 5 (extremely prepared). Additionally, participating dentists were asked whether they would like to participate in continuous professional education about the matter and their interest and willingness to enhance their knowledge regarding blood diseases and the interpretation of BC tests. The questionnaire, including all sections and questions, translated into English is provided in the Supplementary Material for reference.

2.4. The Content Validity

The content validity of the questionnaire section assessing practicing dentists' knowledge of blood diseases and BC interpretation was established through a rigorous multi-step process to ensure adequate representation of the construct. Initially, items were developed based on an extensive literature review by a panel comprising two Oral Medicine specialists, two haematology specialists, and two general dentists.

The preliminary version was then reviewed by two Oral Medicine specialists, one haematologist, and one general dentist to identify and resolve ambiguities. Minor

revisions included syntactic corrections to two response options for clarity. An additional haematology expert subsequently evaluated the questionnaire for relevance, clarity, and comprehensiveness, and suggested small refinements that were incorporated into the final version.

For further validation, ten expert teams (each consisting of one haematology specialist and one Oral Medicine specialist) completed the questionnaire section on BC interpretation and hematologic diseases. Haematology specialists were expected to answer all items correctly, as were Oral Medicine specialists for items on oral manifestations. Overall accuracy was 99.1%, with the single incorrect response attributed to a typographical error.

The same expert teams (N = 10) rated each of the 12 items for relevance using a 4-point scale (1 = not relevant; 4 = highly relevant). The Item-Level Content Validity Index (I-CVI) was calculated as the proportion of ratings of 3 or 4 per item [20]. The Scale-Level Content Validity Index (S-CVI/Ave) was computed as the mean of I-CVIs, while the universal agreement index (S-CVI/UA) was defined as the proportion of items with unanimous expert agreement.

Interpretation thresholds were: I-CVI $\geq$ 0.78 (acceptable; $\geq$0.90 excellent), S-CVI/Ave $\geq$ 0.90 (excellent scale validity), and S-CVI/UA $\geq$ 0.80 (excellent), with 0.70–0.79 considered acceptable and <0.70 indicating questionable validity [20].

The item-level Content Validity Index (I-CVI) ranged from 0.90 to 1.00, indicating excellent agreement. The S-CVI/Ave was also excellent (0.98), as was the S-CVI/UA (0.83).

Finally, a pilot study with 30 general dentists confirmed item clarity, with all participants reporting that the questionnaire was clear and understandable.

2.5. Statistical Analysis

The collected data were organized using Microsoft Excel® (Microsoft Inc., Redmond, WA, USA) and statistically analyzed using SPSS® software, version 29 (IBM Corp., Armonk, NY, USA). Responses from the third section of the questionnaire, which assessed dentists' knowledge of BC tests and hematologic diseases, were categorized as correct, partially correct, or incorrect. Partially correct responses were applicable only to questions with multiple correct options (nine questions). Three questions had only correct or incorrect options. In such cases, responses were classified as partially correct when participants selected some, but not all, of the correct options without selecting any incorrect options. If any incorrect option was selected, the entire response was classified as incorrect. The number of correct, partially correct, and incorrect answers was recorded for each participant and used in the statistical analysis.

The normality of data distribution was assessed using the Shapiro–Wilk test. Categorical variables are presented as frequencies and percentages, while continuous variables are reported as means with standard deviations (mean $\pm$ SD). Between-group comparisons of continuous variables were conducted using independent samples t-tests. To examine differences in the combined number of correct and partially correct responses across groups, non-parametric tests, specifically the Kruskal–Wallis H test and the Mann–Whitney U test were applied. A two-tailed p-value of <0.05 was considered statistically significant. Since the study aimed to reach the entire population of active dentists in Croatia through nationwide questionnaire distribution, a formal sample size calculation was not performed. The emphasis was placed on maximizing the response rate rather than obtaining a representative sample.

3. Results

Participants' Characteristics

A total of 308 dental professionals participated in the study. Their gender, age, demographic characteristics, university of graduation, work experience, specialization status, postgraduate education, classification of their dental offices, estimated number of patients referred to their practices, and self-assessed frequency of encountering oral mucosal changes are summarized in Table 1a,b. Most respondents were female (n = 232; 75.3%), while male participants accounted for approximately one-quarter of the sample (n = 76; 24.7%). The mean age of participants was 43.23 years (SD = 11.03), with ages ranging from 25 to 64 years. An independent samples t-test indicated no statistically significant difference in age distribution between male and female participants, $t(306) = -0.602$, $p = 0.548$. The majority of respondents obtained their dental degrees from the University of Zagreb (67.5%), followed by the University of Rijeka (20.8%), the University of Split (7.8%), and the University of Osijek (3.9%), the most recently established dental school among the four.

Table 1. (**a**) Demographic and professional characteristics of the participants, including gender, age, university of graduation, years of clinical experience, and location of their dental office. (**b**) Educational background of participating dentists: postgraduate education, type of dental practice, and the approximate number of patients registered at their dental offices.

(a)			
Variable		***N***	**Frequency (%)**
Gender	Female	232	75.3
	Male	76	24.7
Graduation from	University of Zagreb	208	67.5
	University of Rijeka	64	20.8
	University of Split	24	7.8
	University of Osijek	12	3.9
Years of working as a dentist	1–5	52	16.9
	6–10	40	13.0
	11–15	60	19.5
	16–20	32	10.4
	21–25	48	15.6
	26–30	48	15.6
	35–40	28	9.1
Place of work (Dental office)	Rural area	44	14.3
	Small town < 50,000 inhabitants	124	40.3
	Small town 50,000–100,000 inhabitants	48	15.6
	Town > 100,000 inhabitants	80	26.0
	Adriatic island	12	3.9
(b)			
Variable			
	None (general dentist)	264	85.7
Specialization	Prosthodontics	4	1.3
	Orthodontics	12	3.9
	Periodontology	8	2.6
	Oral surgery	12	3.9
	Endodontics and Restorative Dentistry	4	1.3
	Pedodontics	4	1.3
Post-graduate Study	None	240	77.9
	Postgraduate Specialist study	40	13.0
	Doctoral study (Ph.D.)	28	9.1
Categorization of a dental office	Public Dental Office	96	31.2
	Private dental office	76	24.7
	Community Health Center	124	40.3
	Clinical hospital	12	3.9
Approximate number of patients referred to the Dental office	<700	28	9.1
	701–1275	36	11.7
	1276–1700	80	26.0
	1701–2125	68	22.1

N = number.

In terms of professional experience, the largest proportion of respondents (19.5%) reported having 11–15 years of clinical practice, followed by those with 1–5 years (16.9%) and 21–25 years (15.6%) of experience. The smallest subgroup comprised dentists with 35–40 years of work experience (9.1%) (Table 1a). Geographically, most participants practiced in small towns, while only 3.9% were based on one of Croatia's islands.

Regarding patient load, 31.2% of respondents reported serving more than 2126 patients, whereas only 9.1% reported having fewer than 700 patients (Table 1b). Most of the dentists were general practitioners without specialization (87.5%), and most had not completed postgraduate studies (77.9%), although 9.1% held a Ph.D. degree. In terms of employment setting, 40.3% of participants worked in Community Health Centres, 31.2% were employed in dental practices having a contract with the Croatian Health Insurance Fund (HZZO), 24.7% operated private dental offices, and 3.9% worked in University Clinical hospitals (Table 1b).

The second part of the questionnaire assessed several aspects of self-reported clinical experience and perceived competence among dental practitioners. Specifically, it examined the frequency with which practitioners encountered changes in the oral mucosa, their reliance on blood tests in clinical decision-making, and their self-perceived competence in interpreting hematological findings. In addition, it explored the respondents' typical approach when suspecting an underlying systemic blood disorder, their perceived knowledge of oral manifestations of hematologic diseases, and their opinions on strategies for improving their knowledge related to BC interpretation and hematological conditions. The frequencies and distributions of these responses are presented in Table 2a,b.

Almost 80% of the respondents reported that they occasionally encounter various alterations in the oral mucosa during clinical practice. Considerable heterogeneity was observed in the utilization of blood tests within diagnostic protocols. Specifically, 39% of participants indicated that they employ blood tests as an adjunctive diagnostic tool, whereas 24.7% primarily rely on clinical examination alone. Notably, 16.9% of dentists considered laboratory findings to be essential for reaching an accurate diagnosis, whereas 14.3% stated that they almost never referred patients for blood testing. Self-assessed competence in interpreting hematological test results also varied significantly. The largest proportion of respondents (41.6%) reported a moderate level of confidence in analyzing blood parameters, while 11.7% expressed low confidence in their interpretative abilities. Only 5.2% indicated that they felt very confident in evaluating hematological data (Table 2a).

When faced with suspected systemic blood disorders, participants reported employing diverse diagnostic and clinical strategies. Opinions regarding preferred methods for enhancing knowledge on BC interpretation and hematologic diseases varied and are comprehensively presented in Table 2b. A significant proportion of respondents (32.5%) believed that a multifaceted educational approach, incorporating professional literature, expert consultations, and digital learning resources, would be the most effective strategy for improving their knowledge. Furthermore, 19.5% favored consultations with medical specialists, such as hematologists and internists, as the primary means of professional development.

The third section of the questionnaire evaluated participants' knowledge of oral manifestations of systemic blood diseases and related hematologic parameters, including aspects such as BC tests, platelet numbers, iron levels, and various forms of anemia. Responses were categorized as correct or incorrect for single-answer questions (three questions), and as correct, partially correct, or incorrect for multiple-choice items (nine items). The distribution of correct, incorrect, and partially correct responses is summarized in Table 3.

Table 2. (**a**) Variables from the second part of the questionnaire: Clinical exposure, use of laboratory data, and self-perceived competence in practicing dentists. (**b**) Variables from the second part of the questionnaire: Diagnostic approach, opinion of clinical signs of blood diseases and self-perceived educational needs of practicing dentists.

(a)

Variable		*N*	Frequency (%)
Frequency of encountering any changes in oral mucosa	Almost never	16	5.2
	Rarely <5%	52	16.9
	Sometimes (5–20%)	176	57.1
	Often (20–50%)	60	19.5
	Very often >50%	4	1.3
Reliance on Blood Tests in a clinical practice	Almost never	44	14.3
	Almost never, only in exceptional cases	12	3.9
	Moderately, as a supplementary diagnostic method	120	39.0
	Rarely, I rely more on clinical examination	76	24.7
	Often, the blood count is crucial in diagnosis	52	16.9
	I refer to a specialist in oral medicine	4	1.3
Self-perceived competence in interpreting hematological findings	I am not confident enough	36	11.7
	I lack the knowledge to interpret the findings	40	13.0
	Neutral	88	28.6
	Moderately confident	128	41.6
	Very confident	16	5.2

(b)

Variable	Category	*N*	%
Approach in case of suspected blood disease	Consultation with specialists in medicine (general medicine, internist)	80	26.0
	Obtaining a detailed medical history with an emphasis on oral health	28	9.1
	All above	124	40.3
	Referring for basic laboratory tests (blood count, blood sugar, urea, creatinine, cholesterol)	36	11.7
	Follow-up of the patient and re-evaluation after a certain period	40	13.0
Manifestation of blood disease in the mouth	Long duration of healing mouth wounds	40	13.0
	Changes in the color of the gums and mucous membranes	76	24.7
	Bleeding gums	80	26.0
	Frequent aphthous ulcerations	48	15.6
	Increased tendency to infections in the mouth	36	11.7
	None of the above	16	5.2
	Loss of lingual papillae	12	3.9
Opinion on how to improve knowledge about blood count interpretation and blood diseases	Using online resources and learning platforms	60	19.5
	Consultations with internists (hematologists, gastroenterologists, etc.)	60	19.5
	Monitoring professional literature and research in the field of oral health	48	15.6
	Continuous professional development and education	28	9.1
	Participation in oral health courses and workshops dedicated to hematology	4	1.3
	All listed above	100	32.5
	Nothing of the listed above	8	2.6

N = number.

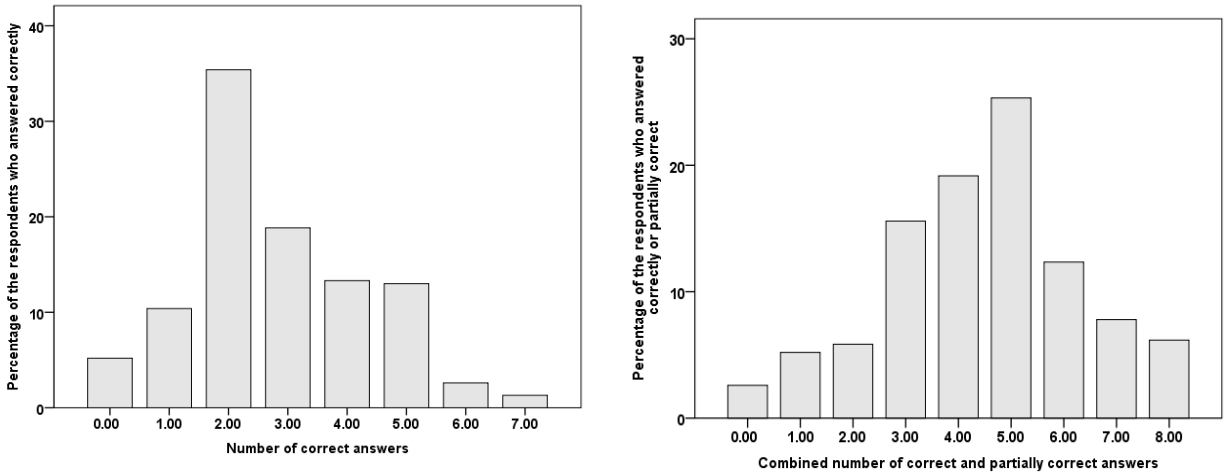
Table 3. Variables from the third part of the questionnaire assessing dentists' knowledge on oral manifestations of blood diseases and blood count interpretation.

	Variable		*N*	Frequency (%)
1.	If the gums are bleeding the essential test is	Correct answer	77	25.0
		Partially correct answer	23	7.5
		Incorrect answer	208	67.5
2.	If the platelet count is low, but >100 $\times$ 10^9 /L, it is necessary	Correct answer	28	8.8
		Partially correct answer	116	37.7
		Incorrect answer	165	53.6
3.	If the platelet count is 50–100 $\times$ 10^9/L, it is necessary to	Correct answer	79	25.6
		Partially correct answer	181	58.8
		Incorrect answer	48	15.6
4.	If the platelet count is <30 $\times$ 10^9/L, it is necessary to	Correct answer	84	27.3
		Partially correct answer	196	63.6
		Incorrect answer	28	9.1
5.	In case of mucositis without ulceration, the key examination is	Correct answer	100	32.5
		Incorrect answer	208	67.5
6.	Mild mucositis without ulceration requires a blood test because of	Correct answer	8	2.6
		Partially correct answer	146	47.4
		Incorrect answer	154	50.0
7.	Oral changes < Fe (Fe < 118, MCV < 82, iron and ferritin decreased)	Correct answer	4	1.3
		Partially correct answer	129	41.9
		Incorrect answer	175	56.8
8.	Oral changes < B12 and/or folic acid; megaloblastic anemia (Hb < 118, MCV > 110)	Correct answer	8	2.6
		Partially correct answer	158	51.3
		Incorrect answer	142	46.1
9.	In cases of severe mucositis with ulcerations the key examination is	Correct answer	95	30.8
		Partially correct answer	169	54.9
		Incorrect answer	44	14.3
10.	Severe granulocytopenia is when	Correct answer	220	71.4
		Incorrect answer	88	28.6
11.	Emergencies based on blood lab results	Correct answer	212	68.8
		Partially correct answer	96	31.2
12.	A lowered MCV in the blood count is a sign of	Correct answer	32	10.4
		Partially correct answer	156	50.6
		Incorrect answer	120	38

N = number.

It is evident that a substantial number of responses were either incorrect or only partially correct across the majority of the questions. An analysis of responses to 12 questions assessing Doctor of Dental Medicine on hematological parameters, BC interpretation, and oral manifestations of blood disorders (N = 308) yielded the following mean values (±SD): incorrect answers, 4.75 ± 1.76 (median = 5, modal value = 6); correct and partially correct answers, 4.45 ± 1.88 (median = 5, modal value = 5); fully correct answers, 2.81 ± 1.52 (median = 2, modal value = 2). When fully and partially correct responses were combined, the mean total score was 7.25 ± 1.76 (median = 7, modal value = 6).

Notably, 5.2% of respondents did not have any of the fully correct answers, whereas only four participants (1.3%) answered seven questions correctly, which was the maximum number of fully correct responses. The median number of fully correct answers was two (Figure 1a). When correct and partially correct answers were combined, 2.6% of respondents had no valid responses, and the highest combined score of eight was achieved by only 6.2% of participants. The median combined score was five (Figure 1b). Figure 1a illustrates the percentage of fully correct responses, while Figure 1b presents the distribution of combined correct and partially correct answers.



(**a**) (**b**)

Figure 1. The distribution of respondents based on their knowledge about oral manifestation of blood diseases and the blood count interpretation: (**a**) illustrates the percentage of respondents according to the number of fully correct answers, while (**b**) presents the percentages based on the combined number of fully and partially correct answers.

The fourth section of the questionnaire assessed practicing dentists' level of agreement with several key statements. These included the importance of BC parameters in providing quality dental care and the reliability of oral manifestations as indicators of certain hematologic disorders. Additionally, the section explored respondents' views on the necessity of continuously updating their knowledge in interpreting hematologic parameters and their confidence in interpreting blood test results. Finally, it evaluated their recognition of the significance of ongoing professional education on these topics. The results are summarized in Table 4. Only approximately 25% of respondents reported regularly updating their knowledge of BC parameters. However, a substantial majority (96.1%) expressed a strong interest in further education on the interpretation of blood and biochemical parameters.

The Mann–Whitney U test assessed gender differences in the combined number of correct and partially correct responses, and the results showed no statistically significant difference in the knowledge between male and female participants, $Z(306) = -1.01$, $p = 0.314$ (N.S.). Similarly, there were no significant differences in knowledge levels between respondents with and without specialization [$Z(306) = -0.95$; $p = 0.34$], or between those with and without completed postgraduate studies [$Z(306) = -0.58$; $p = 0.562$]. No significant differences in knowledge were observed based on the university of graduation. However, the lowest scores were recorded among graduates from the University of Rijeka (Kruskal–Wallis test: $\chi^2(3) = 6.90$, $p = 0.075$, N.S.). Additionally, knowledge levels did not significantly differ based on the type of dental office (private, public, community health centre, or clinical hospital), $\chi^2(3) = 3.02$, $p = 0.375$ (N.S.); the self-reported frequency of encountering oral mucosal changes, $\chi^2(3) = 8.10$, $p = 0.09$ (N.S.); or the reliance on blood tests in clinical practice, $\chi^2(3) = 9.64$, $p = 0.08$ (N.S.). Significant differences in the level of knowledge among groups are presented in Table 5. Interestingly, the oldest dentists demonstrated the highest level of knowledge, followed by those practicing for less than 10 years. Dentists working in rural areas had significantly lower number of correct or partially correct answers, as did those with the smallest patient load. One particularly interesting finding is that those who reported lacking confidence in interpreting hematological findings had the highest level of knowledge, while those who stated they were very confident had the lowest level of knowledge. A similar trend was observed regarding reliance on blood tests: those who reported not relying on blood tests had the highest level of knowledge.

Table 4. Variables from the fourth section of the questionnaire evaluating dentists' agreement with various statements regarding the interpretation of blood count results, oral manifestations of hematological disorders, ongoing knowledge updates, confidence in interpretation, collaboration with internal medicine specialists, and perceived insufficiency of knowledge in the area.

Statement	Frequency (*N*)	Percent
Knowing blood count parameters is crucial for providing quality dental care		
Strongly disagree	44	14.3
Disagree	44	14.3
Neutral	28	9.1
Agree	88	28.6
Strongly agree	104	33.8
Oral manifestations can be reliable indicators of certain blood or biochemical disorders		
Strongly disagree	52	16.9
Disagree	44	14.3
Neutral	8	2.6
Agree	100	32.5
Strongly agree	104	33.8
I regularly update my knowledge on blood tests and their relevance to oral health		
Strongly disagree	44	14.3
Disagree	60	19.5
Neutral	116	37.7
Agree	72	23.4
Strongly agree	16	5.2
I feel confident interpreting blood test results		
Strongly disagree	32	10.4
Disagree	104	33.8
Neutral	84	27.3
Agree	76	24.7
Strongly agree	12	3.9
Collaboration with internists/hematologists is necessary when oral and blood test changes are present		
Strongly disagree	56	18.2
Disagree	28	9.1
Neutral	28	9.1
Agree	48	15.6
Strongly agree	148	48.1
It is important to continuously educate patients about the connection between oral and systemic health		
Strongly disagree	52	16.9
Disagree	32	10.4
Neutral	24	7.8
Agree	68	22.1
Strongly agree	132	42.9
If you feel you lack sufficient knowledge about interpreting blood and biochemical parameters, would you like to learn more?		
No	4	1.3
Yes	296	96.1
I believe I already have sufficient knowledge	8	2.6

N = number.

Table 5. Significance of the differences in the level of knowledge across different groups.

	Years of Practice	*n*	Mean	Standard Deviation	Mean Rank	χ^2	df	*p*
Combined number of correct and partially correct responses	<10 years	92	7.45	1.47	166.17	12.32	3	0.006
	<20 years	92	7.07	2.13	145.09			
	<30 years	96	7.02	1.63	139.66			
	>30 years	28	8.04	1.40	197.98			
	Place of work							
	Rural area	44	6.45	1.92	118.11	14.77	4	0.005
	Very small city, <50,000 inhabitants	124	7.18	1.73	150.42			
	Small city, 50,000–100,000 inhabitants	48	7.19	1.41	152.45			
	City, >100,000 inhabitants	80	7.79	1.81	177.84			
	Adriatic island	12	7.67	0.98	182.67			
	Number of patients referred to a dental office							
	<700	28	6.57	2.10	118.21	14.88	4	0.005
	701–1275	36	7.33	1.43	161.19			
	1276–1700	80	7.81	1.70	181.18			
	1701–2125	68	6.85	1.81	138.04			
	>2126	96	7.24	1.64	151.99			
	Self-perceived competence in interpreting hematological findings							
	I am not confident enough	36	7.75	1.44	185.21	23.63	4	0.0001
	I lack the knowledge to interpret the findings	40	6.73	1.13	130.59			
	Neutral	88	7.57	2.01	171.05			
	Moderately confident	128	7.24	1.76	151.84			
	Very confident	16	5.81	0.98	75.47			
	Reliance on Blood Tests in a clinical practice							
	Almost never	44	7.57	1.73	168.90	10.04	5	0.07
	Almost never, only in exceptional cases	12	7.08	0.29	152.63			
	Moderately, as a supplementary diagnostic method	120	7.49	1.83	167.96			
	Rarely, I rely more on clinical examination	76	7.12	1.98	145.15			
	Often, the blood count is crucial in diagnosis	52	7.00	1.34	125.88			
	I refer to a specialist in oral medicine	4	7.00	0.00	147.50			

n = number of participants; df = degree of freedom.

Significant differences in the level of knowledge across different groups are presented in Table 5.

There was no significant difference in the level of knowledge dependent on the degree of agreement with the statement: "I regularly update my knowledge on blood tests and their relevance to oral health". Significant differences in the level of knowledge dependent on a degree of agreement with different statements in the fourth part of the questionnaire are presented in Table 6. Significantly the lowest level of knowledge presented the respondents who were neutral about the statements: "Knowing BC parameters is crucial for providing quality dental care", "Oral manifestations can be reliable indicators of certain blood or biochemical disorders", "Collaboration with internists/hematologists is necessary when oral and BC test changes are present", and "It is important to continuously educate patients

about the connection between oral and systemic health" (Table 6). In contrast, doctors who felt confident in interpreting BC test results (who strongly agreed with that statement) demonstrated the poorest knowledge regarding the oral manifestations of blood diseases and the interpretation of BCs. Conversely, those who lacked confidence, either disagreeing with the statement or remaining neutral, showed a higher level of knowledge (Table 6).

Table 6. Significant differences in the level of knowledge dependent on the degree of agreement with different statements.

Statement	Degree of Agreement	*n*	Mean	Standard Deviation	Mean Rank	X^2	df	*p*
Knowing blood count parameters is crucial for providing quality dental care	Strongly disagree	44	7.39	1.51	162.76	38.56	4	<0.001
	Disagree	44	7.32	1.91	149.52			
	Neutral	28	5.32	1.22	59.41			
	Agree	88	7.35	1.68	161.39			
	Strongly agree	104	7.61	1.66	172.88			
Oral manifestations can be reliable indicators of certain blood or biochemical disorders	Strongly disagree	52	6.75	1.20	130.09	24.40	4	<0.001
	Disagree	44	6.75	1.79	122.22			
	Neutral	8	5.00	2.14	75.00			
	Agree	100	7.47	1.77	165.27			
	Strongly agree	104	7.68	1.70	176.13			
I feel confident interpreting blood test results	Strongly disagree	32	6.69	1.26	124.72	31.88	4	<0.001
	Disagree	104	7.47	1.75	169.92			
	Neutral	84	7.81	1.48	183.26			
	Agree	76	6.78	2.04	124.97			
	Strongly agree	12	6.00	0.85	86.00			
Collaboration with internists/hematologists is necessary when oral and blood test changes are present	Strongly disagree	56	6.96	1.28	142.38	44.88	4	<0.001
	Disagree	28	7.04	1.82	136.05			
	Neutral	28	5.46	1.45	68.20			
	Agree	48	7.10	2.04	144.24			
	Strongly agree	148	7.79	1.59	182.23			
It is important to continuously educate patients about the connection between oral and systemic health	Strongly disagree	52	6.73	1.39	128.10	36.42	4	<0.001
	Disagree	32	7.19	1.71	147.22			
	Neutral	24	5.33	1.52	69.08			
	Agree	68	7.69	1.79	174.45			
	Strongly agree	132	7.60	1.64	171.92			

n = number of participants; df = degree of freedom.

4. Discussion

Dentists are often the first healthcare professionals to detect oral manifestations of hematologic and systemic disorders, making their role essential in early diagnosis and timely referral. Oral findings may indicate underlying systemic disease, while complete BC analysis provides important information on overall health, including anemia, infections, and bleeding disorders [21–26]. Despite this, limited research has specifically examined dentists' knowledge of these conditions and their ability to interpret hematological results. Therefore, this pilot study assessed Croatian dentists' knowledge of blood-related diseases, their oral manifestations, and BC interpretation, as well as their attitudes toward these responsibilities.

Although the questionnaire was distributed to all registered dentists in the country, only 308 responded (7.6%), possibly due to workload, survey length, or uncertainty in answering. The gender distribution reflects current educational trends in Croatia, suggesting reasonable representativeness of the workforce (Table 1).

The findings revealed considerable variability in knowledge, diagnostic confidence, and use of hematological parameters in practice, with overall knowledge levels being low to moderate. The mean number of correct answers was low, and only a small proportion of participants achieved higher scores. No significant differences were observed between dentists with or without specialization or postgraduate education. This may be explained by the limited inclusion of hematological content in most dental specialization and postgraduate programs in Croatia, except for oral medicine and oral surgery. These findings highlight the need for targeted continuing education. Similarly, knowledge was not associated with practice type, frequency of encountering oral mucosal changes, or reliance on BC tests, suggesting that clinical exposure alone does not ensure competence.

A discrepancy between self-perceived competence and actual knowledge was identified. Dentists who reported lower confidence achieved higher scores, whereas those expressing high confidence performed worse. This inverse relationship suggests the presence of the Dunning–Kruger effect, where individuals with lower competence overestimate their abilities [27–29].

In contrast, knowledge levels differed significantly by years of experience, practice location, and patient load. Dentists with over 30 years of experience achieved the highest scores, likely reflecting cumulative clinical experience, while those with less than 10 years also performed well, possibly due to recent academic training. Mid-career dentists (10–30 years) showed lower scores, which may reflect knowledge decay, time constraints, or limited access to continuing education [27,30,31]. Dentists practicing in rural areas and those with smaller patient volumes also demonstrated lower knowledge levels (Table 5), suggesting that clinical exposure and professional environment influence knowledge retention more than perceived engagement in continuing education [32–34]. Self-reported efforts to update knowledge were not associated with better performance, indicating that self-directed learning may be inconsistent or insufficiently effective (Table 6). Additionally, respondents who expressed neutral attitudes toward the importance of BC parameters, oral-systemic links, and interdisciplinary collaboration demonstrated the lowest knowledge levels, suggesting uncertainty or disengagement from these topics.

A particularly important finding was the inverse relationship between confidence in interpreting BC results and actual knowledge. Overconfident respondents demonstrated the poorest performance, reinforcing concerns about potential diagnostic errors and underestimation of the need for interdisciplinary collaboration. These findings emphasize that confidence should not be equated with competence and highlight the importance of objective knowledge assessment. Similar patterns have been reported in medical education, where self-rated confidence was inversely related to objective performance, particularly in analytical domains [35–38].

Encouragingly, most participants (96.1%) expressed a strong interest in further education on hematological parameters (Table 4), favoring diverse approaches such as expert consultation, online resources, and literature review. This aligns with global trends emphasizing interprofessional collaboration and supports the integration of hematological knowledge into undergraduate and continuing dental education [39–46]. Additionally, the limited use of novel hematological parameters in routine practice further underlines the need for targeted education [43].

Clinically, recognizing oral signs such as spontaneous gingival bleeding, pale mucosa, delayed healing, gingival overgrowth, or candidiasis can significantly improve early detection of hematologic disorders. These manifestations may precede systemic symptoms and are particularly relevant in conditions such as leukemia, anemia, and nutritional deficiencies, therefore dentists may play a pivotal role in early referrals and interdisciplinary care [47–51].

Several limitations should be acknowledged. The cross-sectional design provides only a single time-point assessment, and the low response rate may limit generalizability and introduce selection bias. Dentists who chose to participate may differ systematically from those who did not, particularly in their interest in hematologic conditions or self-perceived competence in BC interpretation. This restricts the generalizability of the findings to the national level and should be considered when interpreting the results.

The questionnaire was self-reported. Self-reported data are subject to response and social desirability biases, and some participants may have consulted external resources while completing the questionnaire. The strict scoring system (dichotomous approach: responses were marked as correct only if all selected options were accurate, or incorrect if any incorrect option was chosen) may underestimate partial knowledge levels and the questionnaire may not fully capture clinical complexity. Furthermore, the study assessed theoretical knowledge rather than actual clinical performance. Due to social desirability bias, participants may have selected answers they believed were professionally appropriate rather than those that reflected their actual knowledge or practices. The survey instrument was limited to a specific set of questions which may not fully captured clinical complexity. The study did not evaluate the effectiveness of continuing education programs, which is planned to be done in future. It was only a pilot-study to capture preliminary insight on this topic.

Despite these limitations, this study addresses an important and underexplored area. The findings indicate gaps in dentists' knowledge of hematological disorders and highlight the need for improved education. Future research should aim to establish international consensus on essential competencies, develop standardized assessment tools, and evaluate targeted educational interventions to support lifelong learning in this field.

5. Conclusions

Within the study's limitations, Croatian dentists demonstrated insufficient knowledge and a clear mismatch between perceived confidence and actual competence in interpreting oral manifestations of hematological disorders and blood test results. Targeted education and stronger interdisciplinary collaboration are needed to improve diagnostic accuracy. Educational initiatives should emphasize diagnostic skills, critical self-assessment, and interprofessional practice. Encouragingly, most participants expressed strong interest in further training in this area.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/oral6030057/s1, The complete questionnaire as sent online is presented as Supplementary Material.

Author Contributions: Conceptualization, Ž.L. and B.Š.; methodology, Ž.L., M.M.-S. and B.L.; software, B.Š. and A.Č.; validation, A.Č., B.L. and M.M.-S.; formal analysis, B.Š. and A.Č.; investigation, Ž.L., S.L. and B.Š.; resources, Ž.L., M.M.-S., B.Š., A.Č. and S.L.; data curation, A.Č., B.Š., M.M.-S. and B.L.; writing, B.Š., Ž.L., A.Č., B.L., S.L. and M.M.-S.; review and editing: B.Š., M.M.-S., B.L. and A.Č.; visualization A.Č.; supervision A.Č., M.M.-S. and B.Š.; project administration, B.Š., A.Č. and M.M.-S. All authors have read and agreed to the published version of the manuscript.

Funding: This research received partial funding by the European Union: NextGenerationEU through the National Recovery and Resilience Plan (NPOO) within the project: Innovation of therapeutic procedures by Introducing New Materials and Methods in Surgical, Prosthodontic, and Implant-Prosthodontic Patient Rehabilitation, ACRONIM: "INOVA-Dent-KPI"—Grant Number: SFZG-06-2025.

Institutional Review Board Statement: Ethical approval for this study was obtained from the Ethics Committee of the School of Dental Medicine, University of Zagreb (approval number: 05-PA-30-IX-9/2024, approval date: 30 September 2024).

Informed Consent Statement: The instructions for completing the online survey clearly stated that by accessing the questionnaire, the participant provides informed consent. Therefore, every participant who completed the survey gave the consent.

Data Availability Statement: Data are available on request to the second corresponding author.

Acknowledgments: To all practicing dentists who voluntarily dedicated their time to completing the questionnaire.

Conflicts of Interest: The author Željka Lovrić was employed by the Private Dental office. The author Boris Labar was employed by the Polyclinic A.B.R. The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Abbreviation

The following abbreviation is used in this manuscript:

BC Blood count

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