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Clinical, forensic aspects of oral lesions during tobacco use

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Abstract. Tobacco use provokes the development of numerous pathological changes in the oral mucosa, from inflammatory processes to precancerous conditions and malignant neoplasms, which requires a comprehensive forensic medical assessment to establish cause-and-effect relationships in the investigation of cases of occupational pathology and compensation for harm to health. The study was aimed at summarising existing scientific data on the clinical and forensic features of oral lesions caused by tobacco use and determining the role of dentists in conducting forensic examinations of such cases. A systematic analysis of the literature was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 methodology, with a search in international databases. The results of the analysis revealed three categories of lesions with maximum forensic value: erythroplakia (severe dysplasia/carcinoma *in situ*), leukoplakia with epithelial dysplasia, and submucosal fibrosis with stromal hyalinisation due to the high risk of malignancy. An aetiological relationship was established between tobacco use and the pathogenesis of lesions through biochemical (decrease in glutathione and albumin), immunohistochemical (expression of SERPINA6, SERPINF1, p16), and molecular (microRNA-21) markers. Epidemiological data showed mucosal lesions in 60.1% of tobacco users, with submucous fibrosis (110 cases, 27.5%) and leukoplakia (102 cases, 25.5%) dominating the 400 surveyed. A gradation system for assessing the severity from mild (5-15% disability) to severe (40-100%, persistent dysfunction) was developed, which provides a legal qualification of lesions. Comparative analysis showed a functional differentiation of the competencies of forensic medical experts and dentists, which justified the need for interdisciplinary integration in the examination of tobacco-related lesions. Morphological characteristics of lesions of forensic significance were systematised, and criteria for assessing the severity of tobacco-associated mucosal changes were determined. The necessity of integrating dental knowledge into forensic medical practice and involving dentists in conducting an expert examination in cases of oral pathology associated with tobacco use was substantiated

Keywords: mucosa; pathological changes; nicotine stomatitis; malignant transformation; interdisciplinary integration; functional disorders

Introduction

Tobacco use remains a substantial medical and social problem, as it leads to the development of a wide range of pathological changes in the oral mucosa, from inflammatory processes to precancerous conditions and malignant neoplasms. Timely detection and objective forensic medical assessment of such lesions is of particular importance for establishing cause-and-effect relationships in the investigation of cases of occupational pathology, accidents, and cases of compensation for health damage.

The prevalence and morphological variability of oral mucosal lesions associated with tobacco use became the object of a comprehensive research in clinical and pathological analysis at the training hospital. P.P. Domadiya *et al.* [1] focused on a combination of histological, immunohistochemical, and imaging diagnostic methods, especially in cases of malignant transformations. It was established that more than half of the 200 patients examined had malignant neoplasms, and the verified lesion in the form of

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squamous cell carcinoma was most often localised in the buccal region and directly correlated with chronic tobacco use. Non-specific white lesions of the oral cavity induced by chewing tobacco use were the subject of clinical observation in an adolescent patient. A.M. Buendia *et al.* [2] described a case where mucosal changes were misinterpreted as a consequence of orthodontic treatment, although further analysis revealed that the source of the pathology was tobacco addiction. The authors proved that the severity of damage is directly dependent on the intensity and duration of tobacco use. The spread of precancerous changes in the oral mucosa among high-risk groups was investigated as part of an epidemiological survey of representatives of the Malayali tribe in India. D.L. Francis [3] uncovered that almost half of the participants (49.8%) had morphological signs of precancerous or cancerous transformations, with prolonged tobacco use in various forms being the main cause. Clinical lesions were most often localised in the buccal and labial areas.

In the work of clinicians from India, an examination of almost 200 cases of changes in the oral mucosa was conducted with verification of morphological diagnoses. R.R. Mahapatra *et al.* [4] analysed the relationship between lesion localisation, tobacco use, and histological characteristics, focusing on the area of the gingival complex. The main attention was paid to the morphotypes of epithelial changes – hyperkeratosis and benign neoplasms, which can be predictors of malignant transformations. The authors pointed out the lack of early diagnosis programs and the lack of integration of clinical and socio-behavioural data, which makes it difficult to conduct a forensic assessment of the likely genesis of such lesions. The spread of new forms of tobacco use, in particular, tobacco heating systems, has made it necessary to evaluate their impact on the oral cavity in a clinical context. A study conducted by M. Ilchyshyn *et al.* [5] analysed the dental status of 75 people, some of whom used tobacco heating systems (GLO, IQOS). A considerable decrease in the resistance of hard tissues of teeth to caries and a deterioration in the hygiene index in this group were established. The prevalence of inflammatory and dystrophic-inflammatory lesions of periodontal tissues increased with increasing duration of tobacco use. The researchers stress the need for further clinical trials and standardisation of dental support for people who use heated tobacco products.

The growing prevalence of smoking among adolescents and young people in Ukraine has made it necessary to research biophysical changes in oral fluid as markers of impaired homeostasis of the oral mucosa. I.S. Lisetska & M.M. Rozhko [6] analysed saliva properties in 114 people aged 15-24 years, divided into four groups by type of tobacco use (traditional cigarettes, e-cigarettes, tobacco heating systems, and the control group). Smokers of all types presented a decrease in buffer capacity, salivation rate, and increased saliva viscosity. These changes are interpreted as a decrease in the functional reserves of the oral cavity, which, according to the authors, may indicate a potential role of oral fluid as an early diagnostic indicator. The problem of the effect of tobacco heating systems on periodontal tissues was considered in an analytical publication by I.D. Kiiun & O.M. Šoltys [7]. The paper summarised data on the prevalence of smoking in Ukraine, particularly the growing popularity of electronic cigarettes and tobacco heating systems. The authors underline the presence of toxic components in the aerosol of these devices (metals, aldehydes, flavourings), which can cause dysfunction of oral cells. The search for correlations between the type of tobacco use, the age of patients, and the condition of the oral mucosa was presented in the study by R. Moroka *et al.* [8]. An online survey was conducted among 1,113 people of different ages, where the types of tobacco products consumed, features of hygienic behaviour, and the presence of visually noticeable mucosal lesions were recorded. Strong correlations were found between smoking experience ($r = 0.79$), consumption intensity ($r = 0.75$), and oral hygiene disorders ($r = 0.71$) with the development of pathological changes in the oral cavity.

The analysis of the publications indicated that the vast majority of works concentrate exclusively on the clinical and morphological aspects of tobacco-related lesions without integrating forensic approaches to the assessment of cause-and-effect relationships, legal qualification of the severity of injuries, and determining the role of dental specialists in conducting an expert examination. Despite the large number of studies devoted to oral lesions in tobacco use, the papers aimed at a comprehensive investigation of the clinical and forensic aspects of this problem and the role of dentists in conducting forensic medical examinations were not enough, which led to the need for an ongoing systematic review of the literature to summarise the available scientific data on the integration of dental knowledge into forensic practice. The purpose of the study was to summarise scientific data on the clinical-forensic aspects of oral lesions during tobacco use and determine the role of dentists in conducting forensic medical examinations. Objectives of the study: systematise the clinical and morphological features of oral lesions associated with tobacco use, which have forensic medical significance; determine the criteria for forensic medical assessment of the severity of lesions of the oral mucosa during tobacco use; justify the need to involve dentists in conducting a forensic medical examination in cases of oral pathology associated with tobacco use.

Materials and Methods

The current study was conducted in the format of a systematic literature review in accordance with the methodological recommendations of PRISMA 2020 [9]. The search and analysis of scientific sources was conducted during January-September 2025 in the international databases PubMed/MEDLINE, Scopus, Web of Science Core Collection, Google Scholar, Cochrane Library and OpenGrey. In addition, a manual search was performed in the literature lists of relevant review articles to identify potentially missed studies. The search strategy was based on a combination of

key terms in three thematic blocks: tobacco use ("tobacco use", "smoking", "smokeless tobacco", "heated tobacco products"), oral cavity lesions ("oral cavity lesions", "leukoplakia", "erythroplakia", "oral submucous fibrosis", "oral cancer"), and forensic aspects ("forensic medicine", "forensic odontology", "medicolegal aspects"). Search queries were generated using Boolean and/or operators and MeSH thesauri. The time frame covered publications from 2019 to 2025, with the possibility of including earlier fundamental works. Language restrictions were not applied.

Inclusion criteria included the availability of data on the clinical and morphological characteristics of tobacco-related oral mucosal lesions, forensic aspects of assessment, or the role of dentists in examination. The review included original studies, clinical observations, systematic reviews, meta-analyses, and regulatory documents. The exclusion criteria covered publications without full-text access, with an insufficient description of the methodology, work on exclusively systemic effects of tobacco without analysing local changes in the oral cavity. Initially, 387 sources were identified. The final sample consisted of 61 literature sources, of which 53 were scientific publications (original studies, systematic reviews, clinical observations) and 9 were regulatory documents (international guidelines, forensic standards, classifications). A detailed source selection process is shown in Figure 1.

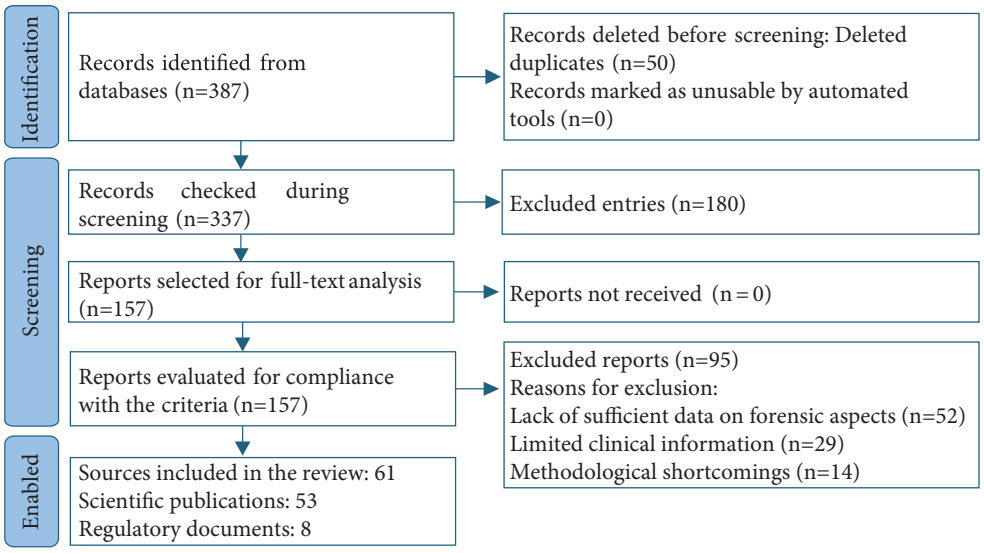

Figure 1. PRISMA flowchart

Source: compiled by the author

A standardised form was used to extract the data, including bibliographic information, study design characteristics, sample size, diagnostic methods, clinical and morphological characteristics of lesions, forensic evaluation criteria, and conclusions about the role of dentists. The quality of the studies was evaluated on the Newcastle-Ottawa Scale [10] for observation studies and AMSTAR-2 [11] for systematic reviews. The risk assessment for systematic errors considered the completeness of documentation, the validity of methods and conclusions. Content analysis was used for regulatory documents. Data synthesis was conducted in the format of a narrative review with thematic grouping in accordance with the objectives of the study: systematisation of clinical and morphological characteristics of lesions, generalisation of forensic medical evaluation criteria according to Order of the Ministry of Health of Ukraine No. 6 [12] and justification of the role of dentists in the examination. For quantitative data, descriptive statistical processing was performed with the calculation of prevalence percentages and correlation coefficients.

No meta-analysis was performed due to the high heterogeneity of the studies. The interpretation was based on a comparison of clinical characteristics with forensic criteria for qualifying the severity of injuries, which allowed establishing the compliance of pathological conditions with legally defined categories of harm to health. The results of a systematic review directly contribute to the achievement of the goal through the formation of an evidence base on the clinical, forensic, and medical aspects of tobacco-associated lesions. The systematisation of characteristics allowed the identification of diagnostic markers to establish causal relationships, the generalisation of criteria provided a standardised approach to severity qualification, and the justification of the role of dentists provided the basis for the development of interdisciplinary protocols for assessing oral pathology.

Results and Discussion

Clinical and morphological characteristics of tobacco-associated oral lesions with forensic significance. In patients with chronic tobacco use, persistent clinical and morphological patterns of oral mucosal lesions were observed, which differed depending on the form of use and had different levels of forensic relevance. According to

J. Öhman *et al*. [13], erythroplakia manifested itself as a bright, well-defined erythematous plaque with a "velvety" surface, pathohistologically dominated by severe epithelial dysplasia, carcinoma *in situ*, or early invasive squamous cell carcinoma; the transformational potential of this nosology was higher than that of leukoplakia, which made it a priority to document the severity of the lesion in forensic assessment. For leukoplakia in smokers, as evidenced by A.E. Şerban *et al*. [14], the clinical picture included homogeneous and non-homogeneous white plaques with localisation on the buccal mucosa, dorsal surface of the tongue and retromolar region; hyper-and parakeratosis, acanthosis, variable dysplasia with impaired cell stratification and polarity, and increased density of lymphoplasmocytic infiltration of its plate were microscopically recorded. The presence of dysplasia and a non-homogeneous phenotype increased the risk of malignant transformation, which gave such foci more forensic weight in terms of qualifying harm to health. With prolonged chewing of tobacco (often in combination with areca), submucosal fibrosis was formed. X. Cai *et al*. [15] described gradual restriction of mouth opening, dense fibrous strands in the buccal areas, pallor, and rigidity of the mucosa; histologically dominated by hyalinisation of subepithelial connective tissue, dense collagen bundles with reduced vascularity, epithelial atrophy with loss of epithelial processes and areas of superficial parakeratosis. The combination of clinical signs of rigidity, long-term chewing habits, and described morphological markers was considered informative for forensic confirmation of long-term harmful effects and assessment of persistent changes, including due to the established risk of developing squamous cell carcinoma.

Hookah smoking was characterised by nicotine stomatitis of the hard palate. H. Dashti & D. Sundaram [16] recorded a dose-dependent relationship in water smokers between the number of "bowls" and smoking hours and the appearance of multiple white keratotic fields with punctured erythematous openings of the excretory ducts of small salivary glands; hyperkeratosis and metaplasia of the ductal epithelium with periductal inflammation were histologically noted. This combination of thermal action and tobacco aerosol created a reproducible macro- and micro-pattern suitable for forensic interpretation of the duration and intensity of exposure. In addition, when using snus/nicotine sachets, local "tobacco pockets" with a whitish-grey keratous area at the site of laying were recorded; pathohistologically described thickening of the stratum corneum, acanthosis, vacuolisation of cells, subepithelial lymphocytic-plasmocytic infiltrate and areas of micronecrosis, which corresponded to chronic mechanical and chemical damage to the mucosa [17]. Although these foci usually regressed after discontinuation of exposure, the presence of cytological changes and persistent hyperkeratosis formed the basis for careful fixation and dynamic control. Summarising, lesions with a proven high risk of transformation and specific micromorphological criteria were of the greatest forensic importance for documenting the severity of the lesion: erythroplakia with a predominance of severe dysplasia/carcinoma *in situ*, leukoplakia with epithelial dysplasia and non-homogeneous phenotype, and submucosal fibrosis with hyalinisation and collagen rearrangement of the stroma. For hookahsmokers, nicotine stomatitis with a characteristic "cobblestone" pattern and metaplasia of the ductal epithelium served as a marker of intense thermal exposure and chronic irritation, which complemented a comprehensive forensic assessment.

In 2019-2025, a number of studies were published that contributed to the deepening of scientific understanding of the differential diagnosis of precancerous and cancerous lesions of the oral cavity caused by tobacco, with an emphasis on the causal relationship between tobacco use and the development of pathological changes in the context of forensic medical examination. Research efforts have focused on exploring biochemical, immunohistochemical, and molecular genetic markers that can verify early-stage carcinogenesis. A. Nimbal *et al*. [18] determined that blood glutathione and serum albumin levels were statistically significantly reduced in smokeless tobacco users with precancerous and especially cancerous lesions compared to the control group. These indicators were considered as reliable biomarkers for early diagnosis and prediction of the course of malignant transformations, while total serum protein was poorly associated with these processes. Another study, conducted by V. Mohanty *et al*. [19] focused on proteomic changes in the serum of patients with oral squamous cell carcinoma, accounting for the type of tobacco use. Increased expression of serpin family proteins, in particular, SERPINA6 and SERPINF1, was found in patients who used tobacco in the form of chewable products. These proteins have been proposed as potential serum biomarkers for screening individuals at high risk of developing oral squamous cell carcinoma.

From the standpoint of immunohistochemistry, A.E. Fares & A.M. Kamel [20] analysed the expression of P16 and CD34 proteins in gum tissue in smokers. P16 expression was found to be greatly elevated, indicating activation of apoptotic mechanisms in response to tobacco loading. However, the increase in CD34, a marker of angiogenesis, did not reach statistical significance, which called into question the prognostic value of this indicator for predicting malignant transformation in such conditions. At the molecular genetic level, D. Vageli *et al*. [21], in a pilot study, established considerable overexpression of miRNA-21 in the saliva and serum of patients with oral squamous cell carcinoma, especially among smokers. They proposed a panel of multiple microRNAs (miR-21, miR-136, miR-3928, miR-29b) that could potentially be used as a non-invasive index for early diagnosis of oral squamous cell carcinoma and assessment of the risk of smoking-related tumours. Consequently, the research base has demonstrated a clear causal relationship between tobacco use and the development of precancerous and malignant changes in the oral cavity, which is important for forensic examination. Biomarkers, in particular, GSH, SERPINA6, P16, CD34,

and microRNA molecules, have been proposed as tools for verifying the mechanisms of carcinogenesis and establishing an aetiological relationship with the tobacco factor.

In clinical practice and forensic medical examination, several classification systems were used to assess tobacco-related lesions of the oral mucosa, which allowed for both diagnosing the stage of the pathological process and conducting an objective assessment of the degree of harm to health. These included the World Health Organisation's (WHO) classification of potentially malignant oral conditions, the dysplasia gradation system, and the TNM classification (Tumour, Node, Metastasis) used for staging oral cancer. According to S. Gupta & P.M. Shrestha [22], in a population-based study in Nepal, a diagnosis of tobacco-induced lesions was conducted considering the WHO classification to assess potentially malignant disorders of the oral mucosa, where among the lesions, the highest proportion were varieties of leukoplakia. Histological examination revealed that moderate to severe dysplasia was most often recorded in patients aged 41 to 80 years, which was of direct importance for assessing the stage of precancerous changes and justifying serious harm to health in the forensic context.

A study by Y. Abbas *et al.* [23], tobacco lesions were also evaluated in accordance with international guidelines, including criteria for dysplastic changes and nosological boundaries between leukoplakia, erythroplakia, palatal keratosis, and malignancies. Systematic detection of such conditions was important for further gradation according to the TNM system, especially in cases of verified squamous cell carcinoma of the oral cavity, which was recorded in 2.75% of cases. As part of a retrospective analysis conducted by M. Alshayeb *et al.* [24], used the WHO classification to register leukoplakia, palatine keratosis, submucous fibrosis, and other lesions. Data from patients' medical records were systematised, accounting for the topography of the lesions and the probability of their progression, which provided for further applying the TNM classification in confirming malignant transformation, which is crucial for forensic determination of the severity of damage. In a study by J. Sidhu *et al.* [25], the severity of tobacco-induced lesions was graded according to the clinical aspect and the potential progression to dysplasia of varying degrees, for which morphological criteria consistent with the WHO histopathological scale were used. As a result, it was revealed that the predominant forms were hyperkeratosis and leukoplakia, which, in the context of frequent tobacco use, were subject to dispensary observation, and when confirming dysplastic changes – pathoanatomical analysis to assess the risk of malignant degeneration, which is the basis for establishing moderate or severe harm to health. Thus, interrelated classification systems have been used in clinical practice and Forensic Medicine – WHO for malignant diseases of the oral mucosa, TNM for assessing the prevalence of oral cancer, and the histopathological scale of dysplasia. Their simultaneous use helped to reliably assess the severity of tobacco-induced lesions and establish the legal qualification of harm to health in accordance with forensic criteria.

Epidemiological studies on tobacco-related oral diseases have confirmed their prevalence in different socio-demographic groups and regions, focusing on significant gender, age, and social differences that are important for forensic assessment and prevention policy formation. A study by L. Jacob *et al.* [26] established that among the urban population in southern India, 24.19% of adults used tobacco in any form, and 60.1% of users experienced oral mucosal lesions, with a predominance of conditions such as "smoker's palate", especially in patients over 45 who used tobacco for more than 20 years. This emphasised the importance of anamnestic factors (duration and type of consumption) in predicting health damage and the possibility of a legal assessment of the severity of these injuries. According to the results of an epidemiological study among adolescents in 133 countries conducted by M.A. Nazir *et al.* [27], the prevalence of tobacco use in the 13-15 age group was 19.33%, with a predominance among boys, especially in high-income countries, where rates reached 24.76% among boys and 19.4% among girls. The most common lesions in this age group were gingivitis (72.8%), gingival bleeding (51.2%), and bad breath (39.6%), indicating systemic harm caused by tobacco in the early stages of life and the importance of early intervention in prevention.

In a regional study in the city of Jammu (India), Y. Abbas *et al.* [23] determined that oral submucous fibrosis (110 cases) and leukoplakia (102 cases) were the most common clinical manifestations among 400 tobacco-dependent individuals examined, indicating a high proportion of precancerous lesions among tobacco users, mainly smokeless-type (63.5%). This allowed extrapolating the results for clinical and forensic interpretation of the severity of injuries. In the study by A. Das *et al.* [28], concerning the structure of tobacco lesions among migrant construction workers in Chennai, determined that 84.8% of respondents used tobacco in smokeless form, and the prevalence of oral mucosal lesions was 36.8%, among which leukoplakia (8.6%) and oral submucous fibrosis (7.8%) were the most common. The more vulnerable group was men aged 28-38 years, which indicated the age-specific nature of clinical manifestations and their potential forensic significance in determining the severity of harm to health. Thus, the data showed a high level of prevalence of tobacco-related oral lesions, considerable regional differences, and gender-age imbalances, which created the basis for medical and social assessment, planning of preventive measures, and legal qualification of injuries in forensic medical examination.

Analysis of the clinical and morphological characteristics of tobacco-associated oral lesions indicated the formation of specific patterns of mucosal damage depending on the form of tobacco use. Erythroplakia with a predominance of severe dysplasia or carcinoma *in situ*, leukoplakia with epithelial dysplasia and non-homogeneous phenotype, along with submucosal fibrosis with hyalinisation and collagen restructuring of the stroma, are of the highest forensic significance for documenting the severity of harm to health due to the proven high risk of malignant

transformation and specific micromorphological criteria. Current studies have demonstrated a clear causal relationship between tobacco use and the development of precancerous and malignant changes, confirmed by biochemical, immunohistochemical, and molecular genetic markers. Reduced levels of glutathione and serum albumin, increased expression of serpin family proteins (SERPINA6, SERPINF1), P16 protein, and overexpression of miRNA-21 have been proposed as potential biomarkers for verifying the mechanisms of carcinogenesis and establishing an aetiological association with tobacco factor in forensic medical examination. Simultaneous application of the WHO classification for potentially malignant oral conditions, the histopathological dysplasia gradation scale, and the TNM classification provides an objective assessment of the degree of harm to health. Epidemiological data confirm the high prevalence of tobacco-related lesions with considerable regional, gender, and age imbalances, which actualises the need for early diagnosis, the formation of preventive policies and the unification of approaches to the legal qualification of injuries in forensic medical practice.

Criteria for assessing the severity of injuries caused by tobacco use and methodology of expert research. In the period from 2019 to 2025, the issue of legal regulation of forensic medical examination of the severity of injuries in cases of oral pathologies, including tobacco-related lesions, was examined in the context of harmonisation of national and international approaches. In Ukraine, the main document regulating the procedure for such an examination remained Order of the Ministry of Health of Ukraine No. 6 [12]. In international practice, World Health Organization [29, 30] documents, and J. Payne-James & R.M. Jones [31] and J. Payne-James *et al.* [32] served as guidelines. However, the specific nature of tobacco-related lesions, such as leukoplakia, nicotine stomatitis, black hairy tongue, erythroplakia, and premalignant or malignant conditions of the mucous membrane, required additional detail, which was not always provided by existing regulations.

In international practice, the importance of adapting clinical protocols to the specifics of tobacco damage has been recognised. For instance, A. Ralho *et al.* [33] indicated high attachment loss index scores, elevated levels of pro-inflammatory cytokines, and frequent manifestations of hyperplastic candidiasis and nicotine stomatitis in e-cigarette users, which required an extension of damage classifications to these conditions as part of peer review. In addition, F.R. Lozano [34] underscored that international hygiene and dental societies, including the European Network for the Prevention of Smoking and Tobacco, actively promoted changes in damage assessment standards in connection with new forms of tobacco addiction. It has been proposed to include conditions such as refractory periodontitis, hyperplastic mucosal changes, and delayed healing after dental interventions as important clinical criteria that should be considered in the forensic examination of the severity of injuries. Thus, the current regulatory documents in Ukraine mostly disregarded the specific features of tobacco-related damage, and international practice demonstrated a desire to integrate clinical, biochemical and forensic criteria that would reflect the complex nature of injuries caused by tobacco use. A classification of the severity of tobacco-associated lesions has been developed, which is presented in Table 1 to systematise approaches to forensic medical assessment.

Table 1. Forensic classification of the severity of tobacco-related oral lesions with documentation criteria

Severity of the injury	Nosological form	Clinical criteria	Morphological features	Duration of the health disorder	Disability	Legal qualification
Mild	Nicotine stomatitis	Hyperemia, papillary hyperplasia of the palate	Hyperkeratosis, acanthosis, dilated excretory ducts	Up to 21 days	5-10%	Minor leasure
	Tobacco leukoplakia (flat form)	White spots, not removed, asymptomatic	Hyperkeratosis without dysplasia	21-60 days	10-15%	Minor leasure
Medium	Leukoplakia with mild/moderate dysplasia	Rough plaques, discomfort, localisation on the tongue, cheeks	Epithelial dysplasia (lower/middle third), cellular atypia	60-180 days	15-30%	Moderate bodily injury
	Submucosal fibrosis of the oral cavity	Restricted mouth opening, burning sensation, pale fibrous strands	Collagen hyalinisation, vascular reduction	>180 days	30-40%	Moderate bodily harm
Heavy	Leukoplakia with severe dysplasia	Foci of red-white plaques, painful	Lesions of the entire thickness of the epithelium, pathological mitoses	Persistent loss of function	40-60%	Grievous bodily harm
	Oral cancer *in situ*	Visually similar to dysplasia, minimal symptoms	Loss of architecture, without invasion	Threat to life	60-80%	Serious bodily harm (threat to life)
	Invasive squamous cell carcinoma	Tumour, ulcer, bleeding, dysphagia	Invasion of underlying tissues, lymphovascular invasion	Permanent loss of function, life-threatening	80-100%	Serious bodily harm (life-threatening)

Source: created by the author based on Y. Abbas *et al.* [23], F.M. Zahran *et al.* [35], M. Aroquiadasse *et al.* [36]

Analysis of the proposed classification table allowed tracing a clear correlation between the severity of tobacco-associated oral lesions, the nature of histopathological changes, the duration of health disorders, and the legal qualification of injuries. A gradual gradation was observed-from reversible superficial inflammatory and hyperkeratotic processes to severe proliferative changes with high oncogenic potential. A direct relationship was established between the morphological complexity of the pathology and the need for advanced verification methods, including immunohistochemistry and molecular diagnostics. Therewith, a clear distinction between moderate and severe severity of injuries was reflected not only in the biological aggressiveness of the process but also in the level of potential disability and threat to life. Methodologically, the table recorded the priority of biopsy and morphological assessment as the main source of forensic evidence, accounting for objective clinical indicators (for example, restriction of mouth opening or persistence of symptoms), which emphasised the evidence-based validity of an interdisciplinary approach in the qualification of injuries.

In the complex forensic medical examination of tobacco-associated oral lesions, a multicomponent methodology was used, which included clinical-anatomical research, pathomorphological analysis, toxicological studies, immunohistochemical, and molecular genetic methods. The clinical and anatomical stage was based on detailed fixation of the localisation, morphology, duration, and progression of the pathological process, in particular, in malignant lesions, such as squamous cell carcinoma. Pathomorphological analysis of biopsies allowed determining the degree of differentiation of tumours, revealing, for example, highly differentiated squamous cell carcinoma, which was a common morphological form of damage in chronic tobacco users, as shown by A. Guddur *et al.* [37]. The toxicological examination was based on determining the levels of cotinine – the main metabolite of nicotine – in biological fluids (blood serum, saliva). The enzyme-linked immunosorbent assay technique was widely used to quantify this biomarker. The results of V. Mayank & C.Z. Pardeshi [38] pointed to a considerable increase in cotinine levels in chronic tobacco smokers, which correlated with the duration and frequency of tobacco use, along with the development of malignancies, thus confirming the role of cotinine as an evidence-based marker of tobacco exposure. Immunohistochemical methods have detected the expression of carcinogenesis-related proteins, such as p53, Ki-67, or cell cycle proteins. Such approaches provided for assessing the proliferative activity of tissues and the potential for malignant transformation, which supplemented the pathomorphological picture. In addition, molecular genetic studies, in particular, polymerase chain reaction, were used to detect mutations or epigenetic changes in critical oncogenes and suppressor genes that could be induced by components of tobacco smoke, although such methods remained mainly within the framework of scientific research and were not always implemented in routine forensic practice.

In terms of evidence, the determination of cotinine levels had the greatest forensic value as an objective and quantitative marker of tobacco exposure, suitable for both lifetime and post-mortem studies. This was confirmed by the high sensitivity and specificity of the method, particularly when using saliva as an alternative non-invasive biomaterial [39]. It was also established that a decrease in the total antioxidant capacity of saliva at elevated cotinine levels had diagnostic value for the destructive effect of tobacco on oral tissues, enabling the integration of a biochemical approach to a comprehensive assessment [40]. Thus, the most evidence-based approach in terms of establishing a causal relationship between tobacco use and oral lesions was a combined approach that included pathomorphological analysis in combination with toxicological determination of cotinine, while immunohistochemical and molecular genetic methods played an auxiliary role in stratifying the malignant potential of the detected lesions. In forensic medical practice, the establishment of a causal relationship between tobacco use and the development of severe oral lesions was accompanied by a number of methodological and epistemological difficulties. One of the main problems was the presence of a latent period between the onset of tobacco use and the appearance of clinically significant lesions. As shown in the study by M. Gabhane *et al.* [41], the majority of patients with a verified diagnosis of oral squamous cell carcinoma had a history of tobacco use for over 10 years, and the frequency of consumption was also high. This prolonged latent period complicated the determination of the time limit between exposure and the development of pathology, especially in cases where other risk factors existed in parallel.

The multifactorial aetiology of precancerous and cancerous conditions was instrumental in the complication of causal analysis. Specifically, R.K. Kommalapati *et al.* [42] proved that in South Indian industrial workers, the proportion of people with oral lesions was statistically associated not only with tobacco but also with background exposure to occupational hazards and likely low socio-economic status. This multiplicity of factors made it impossible to establish the isolation effect of only one agent – tobacco – without thorough stratification of all cofactors. A separate aspect was the individual genetic predisposition to the transformation of normal epithelium into dysplastic. Y. Shahi *et al.* [43] determined that carriers of interleukin-6 gene variants (IL-6 – 596 G/A and – 572 G/C) who were simultaneously smokers had a remarkably higher risk of developing precancerous lesions compared to individuals without such polymorphisms. Thus, even with the same dose and duration of tobacco use, the degree of carcinogenic effect varied depending on the genetic profile, which significantly complicated the assessment of the weight of tobacco as a separate aetiological factor.

Expert conclusions in such cases were based on a combination of several parameters: the duration and intensity of tobacco use, the nature of the lesion (morphological verification), the exclusion of other significant risk factors, and

consideration of the existing scientific base on the carcinogenicity of tobacco components. E.A. Saeed *et al.* [44] noted that even when multiple factors (tobacco, alcohol, age, localisation) were identified, smokeless tobacco remained the leading aetiological factor if there was a chronic nature of consumption, confirmed by anamnesis and biological markers. The emphasis was placed on typical histopathological changes characteristic of tobacco lesions, which supported the logic of the expert opinion on the causal link. Thus, the establishment of a causal relationship required a comprehensive approach with mandatory consideration of the time of exposure, the degree of consumption, the presence of concomitant risk factors, and the individual biological reactivity of the patient.

The analysis of forensic criteria for evaluating tobacco-related oral lesions indicates the insufficiency of the current Ukrainian regulatory documents for adequate qualification of specific pathologies caused by both traditional and alternative forms of tobacco use. The proposed classification demonstrated a clear gradation from mild reversible processes to severe proliferative changes with high oncogenic potential, establishing a direct correlation between the morphological complexity of the pathology, the duration of the health disorder, and the legal qualification of injuries. The comprehensive methodology of expert research covered pathomorphological diagnostics, toxicological determination of cotinine as an objective biomarker of tobacco exposure, immunohistochemical and molecular genetic methods, while the combined approach has the greatest evidentiary value for establishing a causal relationship. Expert assessment is complicated by a long latent period, multifactorial aetiology, and individual genetic predisposition, which requires a comprehensive analysis considering the duration and intensity of exposure, morphological verification, and exclusion of other substantial risk factors.

The role of the dentist in the forensic examination of tobacco-related lesions and interdisciplinary integration. In order to conduct a high-quality forensic medical examination of oral cavity lesions associated with tobacco use, a dentist must possess a range of specific professional knowledge, clinical competencies, and diagnostic skills. First, a deep knowledge of the anatomy of the maxillofacial region, specifically, the oral mucosa, is necessary, which allows accurately localising lesions, determining their boundaries and relationship with nearby structures. According to B.W. Chaffee *et al.* [45], the dentist's anatomical awareness is crucial for identifying pathologies such as periodontitis, leukoplakia, lesions associated with tobacco use and the latest tobacco products, since they most often leave specific signs in the oral cavity. Along with this, pathomorphological training of the dentist helps differentiate different forms of mucosal lesions, from benign to potentially malignant, and, importantly, in the context of forensic medical examination, determine the aetiological role of the tobacco factor. R. Jayaram *et al.* [46] accentuated that the visual and histopathological characteristics of tobacco-induced lesions can only be identified at an early stage with proper professional training, which is crucial for the correct legal interpretation of causal relationships. In addition, knowledge in the field of oncostomatology plays a central role, as tobacco is the main aetiological factor in the development of malignant neoplasms in the oral cavity.

Finally, professional training in the field of clinical diagnosis of changes in the oral cavity associated with tobacco use seriously increases the level of objectivity of the expert opinion. As a study by B. Chandrashekar *et al.* [47] presented, the integration of specialised training modules into dental training seriously improved their ability to recognise the clinical manifestations of tobacco lesions and increased their confidence in making an expert diagnosis. This is significant in the context of forensic cases, where the correct interpretation of the clinical picture has the weight of legal evidence. Thus, the involvement of a dentist as a specialist or expert in the process of forensic medical examination of oral lesions during tobacco use provides a deeper understanding of pathological changes, allows for establishing an accurate diagnosis, tracing the causal relationship between tobacco exposure and clinical manifestations, and remarkably increases the completeness and objectivity of the expert opinion. Comparative characteristics of the competencies of forensic experts and dentists in the context of tobacco-related oral lesions research are key to determining the role of each specialist in the examination process and forming an interdisciplinary approach. Table 2 presented data based on current scientific sources highlighting the interaction between forensic and dental professionals in the assessment, diagnosis, and management of tobacco-related pathologies.

Table 2. Comparative analysis of the competencies of a forensic medical expert and a dentist in the examination of tobacco-related oral lesions

Peer review parameters	Competence of a forensic medical expert	Competence of a dentist	Common areas of competence	Limitations of the forensic expert	Limitations of the dentist	Advantages of an interdisciplinary approach
Clinical interpretation of tobacco lesions	Determination of time limits of damage, legal examination of pathological changes	Assessment of functional dental consequences and precancerous changes	Visual diagnosis, recording of lesions, collection of medical history	May not recognise the initial mucosal changes caused by tobacco	Does not always have legal qualifications in relation to personal injuries	Unified interpretation of clinical manifestations, in view of the legal context

Continued Table 2

Peer review parameters	Competence of a forensic medical expert	Competence of a dentist	Common areas of competence	Limitations of the forensic expert	Limitations of the dentist	Advantages of an interdisciplinary approach
Applying special methods	Postmortem histology, toxicology (nicotine, cotinine), forensic imaging	Lifetime biopsy, stomatoscopy, fluorescence	Joint use of biopsy, cytology, digital imaging	Unavailability of dental equipment	Lack of experience in forensic protocols	Combined use of intravital and postmortem methods
Interpretation of morphology	Identification of post-traumatic changes, determination of the nature of damage	Detection of dysplasia, degree of malignancy	Joint histopathological assessment	Limited knowledge of the specifics of the oral epithelium	Lack of practice in assessing post-mortem changes	Morphological consensus in the case of disputable lesions

Source: created by the author based on R. Jayaram *et al.* [46], A. Shatara & C.E. Lahham [48], P.J. Ford & A.M. Rich [49]

Analysis of Table 2 revealed systematic differentiation between the roles of forensic medical experts and dentists in the examination of tobacco-related oral lesions. The most noteworthy aspect was the asymmetry of competencies, which is due to the different methodological bases of both specialities: the forensic medical expert is focused on the legal qualification of injuries and the time characteristics of the pathological process, while the dentist focuses on the biological mechanisms of damage and functional consequences. This dichotomy creates gaps in diagnostic coverage that can only be addressed through interdisciplinary interaction. It is in common areas – such as histopathological interpretation, fixation of morphological changes, and documentation of the clinical picture – that both specialists are able to complement each other. The expert activity of each of them has certain limits: dental specialisation does not cover the legal aspects of expertise, and forensic medicine does not provide full details of the functional state of the oral cavity organs. Thus, the table reflects not only the competence distribution but also the need for standardised collaborative assessment algorithms, especially in the face of expert contradictions or complex oncological pathology.

The International and Ukrainian experience of involving dentists in conducting forensic medical examinations in cases related to oral pathology demonstrated the gradual institutionalisation of forensic odontology as an interdisciplinary field that requires specialised legal training in addition to clinical expertise. In the study by V. Osmolian *et al.* [50], the criminal and procedural legislation of Ukraine, Georgia, Poland, and the Czech Republic was analysed to identify legal prerequisites for involving dentists in forensic examinations. The authors concluded that, despite the existence of international legal acts ratified by these countries, the regulatory framework remains insufficiently specified, specifically, in terms of determining the limits of competence of a dentist in the framework of forensic medical research. It was recommended to amend the guidelines and training programmes regulating the participation of dentists in the collection of evidence in criminal proceedings.

In the world practice, as evidenced by the results of the study by S. Indu *et al.* [51], the role of forensic odontological units in the structure of military medical services has increased. The paper substantiates the need to create specialised laboratories for forensic odontology in the armed forces, which would allow effective identification of dead servicemen based on dental records, including in conditions of mass losses. The authors focused on the uniqueness of the dentoalveolar apparatus as a bioidentification indicator, which is able to persist in extreme conditions longer than other tissues. The issues of training and training of specialists were covered by S. Pavičin *et al.* [52], who analysed the practice of maintaining dental records and the level of awareness of Croatian dentists about the forensic odontological potential of these records. It was determined that only a third of respondents were aware of the legal norms for maintaining medical records, and a considerable part of them did not understand the potential legal value of their own clinical practice for identifying individuals. The authors concluded that it is necessary to integrate forensic odontology into basic dental education.

In the context of interdisciplinary cooperation, coordination by forensic institutions with the participation of dentists, forensic experts, anthropologists, and criminologists has proved to be an effective model. As noted by M. Hachem *et al.* [53], it was this integration that ensured the full use of the potential of dental impressions, bite analysis, and age assessment for identification. The authors emphasised the importance of standardising techniques such as creating digital jaw models, computerised bite analysis, and dental profiling. Current areas of development were also described by G.V. Lacasella *et al.* [54], summarising the latest technologies used in forensic odontology, including the use of artificial intelligence for image analysis, three-dimensional jaw modelling, digital identification, and molecular diagnostics using tooth enamel and pulp. The authors accentuated that the effectiveness of these instruments depended largely on inter-agency cooperation and the existence of unified legal and procedural standards, which currently remained fragmented. Thus, International and

Ukrainian practice demonstrated that the effectiveness of involving dentists in forensic medical examinations largely depended on the availability of legislative regulations, professional training, and institutional support in the form of specialised units, in addition to the technological integration within the framework of multidisciplinary expert models.

In forensic practice, there were a number of clinical scenarios in which the participation of a dentist as an expert was mandatory or appropriate within the framework of a commission examination. Firstly, such situations included cases of diagnostic uncertainty between dental pathologies and other lesions of the maxillofacial region, cases of severe oral injuries, suspicions of medical negligence or errors during dental treatment, and the need to identify individuals by dental remains in cases of mass disasters. As noted by H.U. Brauer & A. Bartols [55], in German court practice, the dentist was a key expert in civil lawsuits concerning the quality of dental care, in particular, in assessing the compliance of the treatment performed with clinical standards and the existence of a causal relationship between the doctor's actions and complications. The authors emphasised that in difficult cases, the expert should conduct a systematic review of the literature, and not just rely on their own clinical practice.

In cases of differential diagnosis, especially when it came to distinguishing between tobacco-related pathologies, such as leukoplakia or precancerous conditions of the oral mucosa, the involvement of the dentist allowed verifying the diagnosis and assessing the likely aetiology of lesions. As indicated by M. Daoudian [56], the detection of such diseases had not only clinical but also legal importance since it could be associated with claims against health care providers for late diagnosis or improper informing of the patient about the risks. In the context of criminal proceedings, the involvement of dentists was mandatory when analysing bites that remained on the victim's body in cases of physical violence, rape, or self-defence. As noted by M. Hachem *et al.* [53], such examinations provided for the comparison of dental fingerprint samples with suspects, and in some cases isolated DNA from saliva left in wounds. Thereby, dentists who were proficient in 3D modelling, digital morphometry, and computer bite analysis played an important role.

Another area of mandatory involvement of dental specialists was the identification of bodies by dental remains in cases of mass disasters or significant destruction of soft tissues. As described in a study by S. Jain *et al.* [57], in such situations, even in the absence of complete dental documentation, it was possible to perform facial profiling based on the morphological characteristics of the teeth, the presence of dentures or implants, which greatly improved the accuracy of identification. The legal mechanisms for initiating the participation of a dentist as an expert were based on procedural rules that provided for the appointment of a forensic examination if special knowledge was needed. As displayed by the findings of S. Farooq *et al.* [58], even in jurisdictions where judicial odontology was not systematically integrated into expert practice, dentists could be involved on the basis of a petition from the parties or a court order, as well as on the basis of special contracts with expert institutions. The authors noted the need to unify the procedures for training expert dentists and develop standards for professional opinion, which would increase the legitimacy of such examinations in court. Consequently, dental examination was important in the context of clinical identifications, legal disputes about the quality of medical care, analysis of injuries, as well as in criminal proceedings with the lack of other biological material. Legal mechanisms provided for to initiating such involvement on the basis of an expert request or on the initiative of a court in the presence of a clinically significant dental component in the case.

In the context of the development of forensic dental examination of tobacco-related oral lesions in Ukraine, the need to create specialised training programmes for dentists who should conduct expert activities was shown. As noted by B. Chandrashekar *et al.* [47], the development of the Tobacco Counseling Training Module greatly improved the level of knowledge, diagnostic skills of tobacco-related lesions, and confidence in communication with patients. The effectiveness of implementing such modules in the educational process was confirmed by a marked improvement in results on all key educational indicators. O. Oyapero *et al.* [59] presented a policy proposal for the integration of tobacco cessation interventions into the dental care system, where special attention was paid to the reform of training programs, the introduction of certification of specialists in the treatment of tobacco addiction, and improving the skills of dentists in the field of evidence-based approaches to prevention. Financial incentive mechanisms for dentists' participation in the tobacco control system are proposed, which can be adapted in the Ukrainian context, accounting for the needs of institutionalising the role of the dentist in forensic medical examination. In turn, the analysis of Ukrainian legislation conducted by I. Demchenko [60] demonstrated that although Ukraine has made progress in implementing the provisions of the WHO Framework Convention on Tobacco Control, legislative gaps still prevented a clear definition of the role of specific health professionals in implementing tobacco control interventions. This analysis highlighted the need to define primary health care standards for tobacco addiction, paying attention to the role of dentists.

S.A. Trofimets [61], within the framework of methodological recommendations for the examination of tobacco raw materials, outlined the potential of using spectral analysis, gas chromatography, and mass spectrometry as tools for assessing the quality and safety of tobacco products, which, if adapted to the dental context, can ensure the objectivity of expert conclusions. The proposed technologies can be part of a comprehensive approach to the development of standardised protocols for the examination of oral lesions. In conclusion, the prospects for the development

of forensic dental examination of tobacco-related lesions in Ukraine included the need to create specialised training modules, improve the regulatory framework, introduce the latest diagnostic technologies, harmonise with international approaches to assessing the state of the oral cavity and integrate dentists into the system of expert medicine.

The analysis of the role of a dentist in the forensic medical examination of tobacco-related oral lesions indicates the need to possess specific professional competencies, covering deep knowledge of the anatomy of the maxillofacial region, pathomorphological training, oncostomatological examination, and clinical diagnostics of tobacco lesions. The comparative characteristics of competencies demonstrated a systematic differentiation between a forensic expert focused on legal qualifications and time characteristics of the pathological process, and a dentist focused on biological mechanisms of damage and functional consequences, which determines the need for interdisciplinary integration to eliminate diagnostic gaps. International experience has shown the gradual institutionalisation of forensic odontology with the mandatory involvement of dentists in cases of diagnostic uncertainty, severe oral injuries, suspected medical negligence, bite analysis in criminal proceedings, and identification of persons by dental remains, but the Ukrainian regulatory framework remains insufficiently specified regarding the limits of competence of a dentist in forensic medical research. Prospects for the development of forensic dental expertise in Ukraine include the creation of specialised training modules, improvement of the regulatory framework with a clear definition of expert opinion standards, introduction of digital imaging and molecular diagnostics technologies, and systematic integration of dentists into multidisciplinary expert models with unification of procedures based on international standards of forensic odontology.

Conclusions

A systematic review of 61 scientific sources confirmed the complex nature of tobacco-associated oral lesions and justified the need to integrate dental knowledge into forensic medical practice. Systematisation of clinical and morphological characteristics revealed priority nosological forms for forensic expert practice: erythroplakia as the most aggressive form with the dominance of severe dysplastic changes in the epithelium and carcinoma *in situ*, leukoplastic lesions with a heterogeneous clinical picture and enhanced malignancy potential of heterogeneous varieties, oral submucosal fibrosis with specific structural changes in the form of hyalinisation of collagen fibres and epithelial atrophy. The causal relationship of tobacco exposure with the pathogenesis of lesions was confirmed through a system of diagnostic markers: biochemical link (glutathione and blood albumin depression), immunohistochemical indicators (activation of SERPINA6, SERPINF1, p16) and molecular level (miRNA-21 elevation). According to the results of population studies, the frequency of mucosal pathologies in tobacco-dependent individuals is 60.1%, and in a cohort of 400 patients, the leading positions were occupied by fibrous transformations of the submucosal layer (27.5% or 110 observations) and leukoplastic changes (25.5% or 102 observations), while invasive carcinomas were verified in 2.75% of the subjects.

A multi-level system of expert qualification was created that differentiates lesions by severity: the initial level is characterised by a 5-15% functional deficit and a 21-60-day recovery period, the intermediate level is characterised by 15-40% labour loss for 60-180 days, and the critical level is characterised by 40-100% loss of functionality with irreversible masticatory disorders, which allows legally adequately classifying injuries in accordance with national legislation. It was proven that the optimal expert strategy is an integrative method that combines morphological verification with toxicological detection of cotinine as a specific bioindicator of tobacco exposure, supplemented by immunohistochemical and molecular genetic profiling to predict malignancy. Critical methodological barriers of expertise were identified: extensive latent interval between the initiation of tobacco use and the manifestation of clinically relevant lesions (decade or more), aetiological polyfactoricity with the need to eliminate competitive professional exposures, genetic heterogeneity with respect to dysplastic susceptibility, which determines a multiparametric analytical algorithm with quantification of exposure characteristics.

The comparative characteristics of professional capabilities demonstrated functional asymmetry: forensic experts specialise in the legal interpretation of traumatic consequences and temporal parameters of the pathological process, while dentists focus on the biopopathogenetic links of the lesion and functional-anatomical deficits, which generates expert gaps in a monodisciplinary approach and argues for multispecialty collaboration. The requirement of unification of protocols of primary documentation of dental status with detailed registration of morphological descriptors of lesions (chromatic characteristics, linear parameters, textural features, topographic localisation) and exposure history (quantitative, temporal, formal attributes of tobacco use) for constructing an evidence-based causal communication platform was substantiated. Promising areas include conducting prospective clinical studies to form national standards for the expert assessment of tobacco-related lesions and developing molecular genetic markers to objectify the causal relationships between tobacco exposure and pathological changes in the oral mucosa.

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Conflict of Interest

None.

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Клініко-судово-медичні аспекти уражень порожнини рота при тютюнокористуванні

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Анотація. Тютюнокористування провокує розвиток численних патологічних змін слизової оболонки ротової порожнини, від запальних процесів до передракових станів та злоякісних новоутворень, що потребує комплексної судово-медичної оцінки для встановлення причинно-наслідкових зв'язків при розслідуванні випадків професійної патології та компенсації шкоди здоров'ю. Дослідження було спрямоване на узагальнення існуючих наукових даних щодо клініко-судово-експертних особливостей уражень ротової порожнини, спричинених вживанням тютюну, та визначення ролі стоматологів у проведенні судово-медичних експертиз таких випадків. Здійснено систематичний аналіз літератури відповідно до методології Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020 з пошуком у міжнародних базах даних. Результати аналізу виявили три категорії уражень з максимальною судово-експертною цінністю: еритроплакію (тяжка дисплазія/карцинома *in situ*), лейкоплакію з епітеліальною дисплазією та підслизовий фіброз з гіалінізацією строми через високий ризик малігнізації. Встановлено етіологічний зв'язок між тютюнокористуванням та патогенезом уражень через біохімічні (зниження глутатіону та альбуміну), імуногістохімічні (експресія SERPINA6, SERPINF1, p16) та молекулярні (мікроРНК-21) маркери. Епідеміологічні дані продемонстрували ураження слизової у 60,1 % користувачів тютюну, при цьому серед 400 обстежених домінували субмукозний фіброз (110 випадків, 27,5 %) та лейкоплакія (102 випадки, 25,5 %). Розроблено градаційну систему оцінки тяжкості від легкого ступеня (5-15 % втрата працездатності) до тяжкого (40-100 %, стійка дисфункція), що забезпечує юридичну кваліфікацію тілесних ушкоджень. Компаративний аналіз засвідчив функціональне розмежування компетенцій судово-медичних експертів та стоматологів, що обґрунтувало потребу міждисциплінарної інтеграції при експертизі тютюнасоційованих уражень. Систематизовано морфологічні характеристики уражень, що мають судово-експертне значення, та визначено критерії оцінки тяжкості тютюнасоційованих змін слизової оболонки. Обґрунтовано необхідність інтеграції стоматологічних знань у судово-медичну практику та залучення лікарів-стоматологів до проведення експертизи у випадках патології порожнини рота, пов'язаної з тютюнокористуванням

Ключові слова: слизова оболонка; патологічні зміни; нікотиновий стоматит; злоякісна трансформація; міждисциплінарна інтеграція; функціональні порушення