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ANALYSIS OF CURRENT PRINCIPLES OF DIAGNOSIS AND TREATMENT OF ODONTOGENIC PHLEGMON OF THE MAXILLOFACIAL AREA

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Odontogenic phlegmons of the maxillofacial region remain a significant issue in modern clinical medicine due to the increasing incidence and the high risk of complications. Despite advances in diagnostic and treatment methods, these pathological conditions may progress rapidly and lead to severe outcomes, which highlights the need for continuous analysis of current approaches to their management. The purpose of this study was to summarise and analyse data from the current literature on the diagnosis and treatment of odontogenic phlegmons of the maxillofacial region, taking into account the pathogenetic mechanisms of purulent inflammatory processes. The study was conducted as an analytical review of scientific publications indexed in the PubMed databases for the period from 2021 to 2026. Clinical studies, systematic reviews and meta-analyses addressing aetiology, pathogenesis, clinical course and modern treatment approaches were included in the analysis. Infectious factors, particularly Gram-positive bacteria, were found to play a leading role in the development of odontogenic phlegmons, alongside comorbidities and individual patient characteristics, including immune response. The importance of early diagnosis using laboratory and instrumental methods, as well as comprehensive treatment combining surgical intervention and rational antibiotic therapy, was demonstrated. Particular attention was paid to the risk of complications such as orbital phlegmon, mediastinitis, sepsis and Ludwig's angina, as well as to the specific features of disease progression in patients with comorbid conditions and in pregnant women. Effective treatment of odontogenic phlegmons of the maxillofacial region is possible with timely diagnosis, a comprehensive therapeutic approach, and individualised treatment strategies based on the patient's general condition.

Key words: odontogenic phlegmon, maxillofacial region, purulent inflammatory processes, inflammation, diagnostic, treatment, complication.

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АНАЛІЗ СУЧАСНИХ ПРИНЦИПІВ ДІАГНОСТИКИ ТА ЛІКУВАННЯ ОДОНТОГЕННИХ ФЛЕГМОН ЩЕЛЕПНО-ЛИЦЕВОЇ ДІЛЯНКИ

Одонтогенні флегмони щелепно-лицевої ділянки залишаються однією з актуальних проблем сучасної клінічної медицини у зв'язку з тенденцією до зростання їх поширеності та високим ризиком розвитку ускладнень. Незважаючи на удосконалення методів діагностики та лікування, ці патологічні стани можуть швидко прогресувати та призводити до тяжких наслідків, що обумовлює необхідність постійного аналізу сучасних підходів до їх ведення. Метою дослідження було узагальнення та аналіз сучасних літературних даних щодо діагностики та лікування одонтогенних флегмон щелепно-лицевої ділянки з урахуванням патогенетичних механізмів розвитку гнійно-запального процесу. Дослідження виконано у форматі аналітичного огляду наукових публікацій, індексованих у базах даних PubMed за період 2021—2026 років. До аналізу включено клінічні дослідження, систематичні огляди та метааналізи, що висвітлюють етіологію, патогенез, клінічний перебіг та сучасні підходи до лікування флегмон. Встановлено, що провідну роль у розвитку одонтогенних флегмон відіграють інфекційні чинники, зокрема грампозитивна мікрофлора, а також супутні захворювання та індивідуальні особливості організму, включаючи імунну реактивність пацієнта. Показано важливість ранньої діагностики із застосуванням лабораторних та інструментальних методів, а також комплексного лікування, що поєднує хірургічне втручання та раціональну антибіотикотерапію. Окрему увагу приділено ризику розвитку ускладнень, таких як флегмона орбіти, медіастиніт, сепсис та стенокардія Людвіга, а також особливостям перебігу захворювання у пацієнтів із супутньою патологією та у вагітних. Ефективне лікування одонтогенних флегмон щелепно-лицевої ділянки можливе за умови своєчасної діагностики, комплексного підходу до терапії та індивідуалізації лікувальної тактики з урахуванням загального стану пацієнта.

Ключові слова: одонтогенна флегмона, щелепно-лицева ділянка, гнійно-запальні процеси, діагностика, лікування, ускладнення.

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Odontogenic phlegmons of the maxillofacial area (MFA) are acute, diffuse inflammations of the soft tissues of the head and neck, lacking clear boundaries and rapidly spreading to adjacent anatomical spaces. Year on year, these conditions show a tendency to increase and spread, accounting for between 35 % and 55 % of all admissions to maxillofacial surgery departments [26, 31].

The main reasons for the steady trend towards the spread of these diseases are delayed oral sanitation and increased resistance of the microflora to antibiotics. The primary cause of the condition is odontogenic factors, most commonly represented by chronic forms of periodontitis, pericoronitis and complications following tooth extraction [25].

The body's immune response also has a significant impact on the course of phlegmon of the maxillofacial region, as do concomitant diseases and pathologies (diabetes mellitus, cardiovascular insufficiency, kidney disease, etc.), which act as additional negative factors. Rapid systemic intoxication due to disruption of tissue barriers poses

a risk of dangerous complications, such as mediastinitis, sepsis, cavernous sinus thrombosis, orbital cellulitis, etc. [11]. As the condition of these patients deteriorates, they experience severe pain, trismus of the masticatory muscles, and impaired chewing, swallowing and speech functions, as well as a pronounced inflammatory response manifested by collateral oedema and fever, which may pose a threat to life and health [22, 27].

Upon reviewing the literature, we pointed out that there are sometimes differing views on the methods of treating odontogenic phlegmon of the maxillofacial region, particularly in the presence of systemic pathology. Therefore, we have analysed and systematised the data, focusing on critical points in treatment, in order to develop diverse and individualised algorithms that will minimise the invasiveness of interventions.

The purpose of the study was to analyse the prevalence, course, complications and laboratory diagnostic methods for phlegmon of the maxillofacial region among patients with various systemic conditions.

Materials and methods. The study was conducted as an analytical review of the current scientific literature on the treatment of purulent-inflammatory processes in the maxillofacial area. The review analysed the pathogenesis, treatment characteristics and clinical course of phlegmon, as well as their complications.

A search was conducted for peer-reviewed literature published in the PubMed databases for the period from 2021 to 2026, last search was on 8 March 2026. Exclusion years: publications prior to 2021. We assessed patients' microbiological profiles, the influence of systemic immuno-inflammatory indices on treatment approaches for these conditions, and identified the most common complications of purulent-inflammatory processes described in the international literature. The analysis included recent clinical studies, systematic reviews and meta-analyses covering the aetiology, pathogenesis, clinical course and current approaches to the treatment of purulent-inflammatory processes of the maxillofacial region. Particular attention is paid to studies devoted to the surgical treatment of phlegmon, antimicrobial therapy and the prevention of complications. The search terms used included both individual and combined queries, specifically: Database PubMed ("odontogenic phlegmon" AND "maxillofacial phlegmon" AND "surgical drainage" AND "antibiotic therapy for purulent infections") OR ("odontogenic phlegmon" AND "antimicrobial therapy") OR ("maxillofacial infections" AND "purulent inflammatory processes" AND "systemic immuno-inflammatory indices. Selection criteria: Peer-reviewed clinical studies, systematic reviews and meta-analyses focusing on the aetiology, pathogenesis, clinical course, surgical treatment and antibiotic therapy of purulent-inflammatory processes in the maxillofacial region were included. Publications that did not correspond to the topic of odontogenic purulent-inflammatory processes or did not contain clinically relevant data were excluded (Table 1).

Table 1

Simplified PRISMA Flow

Stage	Stage name	Description	Number
1	Identification	Total number of records found in databases and other sources	104
2	Removal of duplicates	Number of records removed prior to screening (duplicates)	22
3	Screening	Number of records that passed the title and abstract check	82
4	Eligibility assessment	Number of full-text articles checked for compliance with inclusion criteria	35
5	Inclusion	Total number of studies finally included in the systematic review	48

Ethical approval was not required, as the study is a review and is based on publicly available sources. During the selection of articles, their abstracts and bibliographies were analysed. A total of 104 sources were selected, of which 48 remained after evaluation and exclusion of irrelevant ones.

Results of the study and their discussion. During analysing the factors leading to the development and rapid spread of purulent-inflammatory processes, we can identify the following causes of purulent-inflammatory processes in the maxillofacial region. Most commonly, radicular dental cysts are detected, particularly in the mandible, which contribute to bone resorption and may lead to the spread of infection into the cervical spaces. It is important to inform patients during preventive examinations and consultations in order to prevent possible complications [18].

It shoud be noted that even a simple (solitary) bone cyst, which occurs more frequently in children and adolescents, particularly in boys, and which also affects long tubular bones, can be a cause of maxillofacial cellulitis. As a rule, it is detected incidentally due to its slow growth and asymptomatic course. Timely diagnosis is crucial for establishing the correct diagnosis and subsequent treatment, where imaging techniques, in particular computed tomography, panoramic radiography or magnetic resonance imaging, play a decisive role [40].

An important factor influencing treatment outcomes in patients with odontogenic phlegmons of the MFA is chronotype. Researchers have established that the evening chronotype predominates over the morning chronotype among patients with odontogenic purulent-inflammatory processes in the MFA. The data obtained by scientists indicate that in patients with odontogenic purulent-inflammatory diseases of the maxillofacial-facial region with an evening chronotype, there is a disruption in the expression of the *per1* gene in buccal epithelial cells,

manifested by an increase in its evening expression compared to patients with a morning chronotype. It has been found that such patients are more prone to developing more adverse health consequences (allergic rhinitis, eczema, etc.), whilst patients with a morning chronotype exhibited more pronounced manifestations of circadian rhythm dysregulation, which may positively influence post-operative wound healing processes [21].

To confirm the diagnosis, blood tests are also carried out both before and after surgery. These tests enable the assessment of changes in key indicators, namely the neutrophil-to-lymphocyte ratio, C-reactive protein levels, and white blood cell count. al blood tests conducted on patients before and after surgery revealed a sharp decrease in C-reactive protein to an average of 2.4 mg/l±1.1, with a range of 55.5 to 228.4 mg/l, whereas prior to surgery the average was 133.6 mg/l. There was also a change in white blood cell count from 17.7×10^9/L (with a range of 13.1 to 23.5×10^9/L) to 8.6×10^9/L±2.3×10^9 /L [11, 31].

According to data, prior to the commencement of treatment for patients with odontogenic phlegmons of maxillofacial localisation, microbiological examination revealed that Gram-positive cocci predominated in the purulent wound exudate, in particular *Staphylococcus aureus*, which contributed to the spread and progression of the purulent-inflammatory process. [32, 37]. To reduce the spread of microbial colonies, some researchers used quercetin, which has antioxidant and anti-inflammatory properties. It was also combined with ethylmethylhydroxypyridine succinate, which exhibits similar properties and complemented the treatment regimen [19, 47].

Infrared thermography is a non-radiative, non-contact, non-invasive and rapid imaging technique based on the detection of infrared radiation, which is naturally emitted by any object with a temperature above absolute zero. This method allows for the acquisition of functional and anatomical information, as temperature changes can serve as an indirect marker of a pathological process, particularly inflammation.

Modern diagnostic technologies, in particular medical infrared thermography (MIT), continue to be actively refined. Their use provides more accurate localisation and assessment of the spread of the inflammatory process compared to clinical examination alone. In particular, MIT makes it possible to identify foci of infection by analysing changes in thermal conductivity in the surrounding tissues in cases of facial cellulitis, as well as to differentiate between various forms of the condition; for example, to distinguish between diffuse buccal cellulitis with spread to the periorbital tissues and isolated buccal cellulitis with reactive oedema of the perioral region [2].

The results of previous studies demonstrate the presence of a temperature difference between infected and healthy tissues, which can range from 1.4 °C to 4 °C. It is believed that local differences in skin surface temperature exceeding 3 °C are a highly sensitive indicator of an inflammatory process. Thus, thermography can be used as an additional method for differentiating between phlegmon and abscess, thereby improving diagnostic accuracy.

In addition, the method may be useful in the comprehensive assessment of the severity of cellulitis and in making clinical decisions regarding the need for hospitalisation. Facial examination using MIT is technically simple to perform, and the results obtained are characterised by high reproducibility and reliability [12].

Ultrasound examination (US) is an imaging technique based on the penetration of ultrasound waves into tissues, followed by the detection of their reflections in the form of echo signals. In maxillofacial surgery and dentistry, ultrasonography retains significant diagnostic value, particularly in the assessment of inflammatory processes in the soft tissues of the face [15].

Clinical examination of inflammatory is largely limited to visual assessment and palpation, which does not always allow for an accurate determination of the nature and depth of the lesion. This is due to the complex anatomical structure of the head and neck, which means that clinical methods alone are often insufficient to establish a complete diagnosis. In cases of severe cellulitis, soft tissue induration may mask the presence of an abscess, complicating the determination of the stage of the infectious process and its precise location. In such cases, ‘blind’ clinical exploration can lead to excessive tissue trauma, the making of excessively large incisions, a prolonged treatment period, increased pain, as well as difficulties in identifying and draining the purulent cavity [1].

The ultrasound picture in cellulitis is usually characterised by indistinct margins of the lesion, a heterogeneous structure, and reduced echogenicity with thickening of the affected muscle and subcutaneous tissues. In contrast, an abscess is visualised as a clearly demarcated formation with relatively homogeneous hypoechoic content and the presence of posterior acoustic enhancement, corresponding to a formed fluid collection.

Ultrasound also allows for the assessment of the abscess’s relationship with superficial tissues, as well as the determination of its dimensions, depth and the volume of purulent contents. The study additionally analysed parameters such as cavity volume, the amount of exudate and the distance from the focus to the skin surface. At the same time, a significant limitation of ultrasound diagnostics is its insufficient effectiveness in detecting infections of deep fascial spaces, in particular the parapharyngeal, retropharyngeal, masticatory, pterygomandibular, infratemporal and sublingual spaces, which may remain inaccessible for accurate visualization [34].

Differences among leading international guidelines on the use of antibiotics in the treatment of children and adolescents with odontogenic facial edema highlight the need for a more detailed analysis of scientific sources and clinical guidelines to more fully reflect the current evidence base. To this end, a literature review was conducted to assess the scope and nature of the available evidence, examine the

reasons for discrepancies between study results and the recommendations of various professional organizations, and identify under-researched aspects that require further scientific investigation. The results obtained may be useful for planning future studies and improving clinical approaches to the treatment of this patient population. It was found that intravenous penicillin was the most commonly prescribed antibiotic among hospitalized children and remained the primary antibacterial agent in the inpatient setting [8].

The duration of antibiotic therapy typically ranged from 24 hours to 5 days, and in many cases, it directly depended on the length of the patient's hospital stay and the progression of their clinical condition. For outpatients, the most common drug was oral amoxicillin. It was often prescribed following more intensive treatment, which included intravenous administration of antibiotics. An analysis of the publications showed that the authors proposed not one but several possible first-line antibiotics, which may also have contributed to the development of different treatment approaches. In addition, earlier studies described antibiotic regimens and clinical protocols that are no longer relevant today and are rarely used in modern dental and medical practice. This complicates the direct comparison of results across different studies and their application in current clinical settings. The use of tetracyclines in children is a matter of particular concern [23].

Following the first reports the use of these drugs to the development of permanent tooth discolouration, aureomycin and related drugs came to be regarded as relatively contraindicated for children under the age of eight. This had a significant impact on the subsequent development of approaches to antimicrobial therapy in paediatric dentistry and prompted the search for safer alternatives. It was found that antibiotic regimens varied considerably between individual studies and clinical guidelines. Despite this, oral amoxicillin was most frequently recommended as the first-line drug, whilst phenoxymethylpenicillin was usually considered an alternative and ranked second in terms of frequency of recommendation [14].

The vast majority of sources emphasised that antibiotic therapy should not be regarded as a standalone treatment but should only be used as an adjunct to the primary dental intervention aimed at eliminating the source of infection. It was also noted that several important factors influenced the choice of antibiotic and the treatment regimen, including the child's body weight, the presence of allergic reactions or hypersensitivity to penicillin-based drugs, and the clinical response to previous treatment. The discrepancies identified between individual clinical guidelines are most likely due to a lack of high-quality studies specifically addressing the use of antibiotics in the paediatric population. This highlights the need for further multicentre studies, which will enable the development of more consistent and scientifically sound recommendations for the treatment of children and adolescents with odontogenic infections [45].

Odontogenic phlegmons may also occur in pregnant women, posing a significant risk to the lives of both mother and child. In view of pregnancy, it has been recommended that adjustments be made to the prescription of antibiotic therapy and the management of such patients. In some cases, the condition may lead to premature birth or a threatened miscarriage. It has been established that close collaboration between the gynaecologist and the maxillofacial surgeon was crucial in some cases, highlighting the need to enhance future cooperation [17].

Pregnant women are more susceptible to infections, which is associated with physiological suppression of the immune response against a background of reduced neutrophil chemotaxis and cellular immune activity involving T-lymphocytes. Furthermore, during pregnancy, levels of the hormones oestrogen and progesterone rise, leading to increased gum sensitivity to irritation and bleeding [13]. Particular attention should be paid to children and adolescents with phlegmon, as their symptoms differ from those of adult patients. The paediatric age group is more susceptible to trauma and purulent-inflammatory processes, particularly in the maxillofacial region. Therefore, all manifestations should be considered as potential complications to recognise a varied clinical picture, where symptoms may present as either excessive or less pronounced [3, 4, 10].

Odontogenic infections in adults and children have a number of significant differences. The course of infections in childhood is generally more acute and dynamic, which is explained by the tendency for the process to spread rapidly into deep anatomical spaces [46]. This is often accompanied by the development of systemic manifestations, in particular fever, dehydration and respiratory dysfunction. An additional difference lies in the characteristics of the microbiological spectrum: in adults, odontogenic infections of the soft tissues of the head and neck are usually polymicrobial in nature with a marked involvement of anaerobic flora, whereas in children, staphylococci and streptococci predominate. Furthermore, in paediatric patients, the infectious process more frequently spreads via the lymphatic route, which may be associated with relatively more developed lymphoid tissue compared to adults [7].

The study noted a difference in the length of hospitalisation depending on the aetiological factor, specifically in cases involving deciduous and permanent teeth: 2.2 and 3.42 days respectively. A statistically significant association was demonstrated between patient age and the duration of inpatient treatment, noting that in the 14–17 age group, the length of hospital stay was approximately twice as long as in children under 6 years of age. It was also shown that the average length of hospital stay was 5.10 days for upper facial infections and 5.21 days for lower facial infections. Some authors identified two factors that were statistically associated with a shorter course of treatment for odontogenic infections in children: the use of intravenous antibiotic therapy and the presence of deciduous teeth as the aetiological source of infection [29].

Baby teeth were more frequently the source of infection, which may be due to poor oral hygiene in young children, as well as dietary factors, in particular prolonged bottle-feeding, which contributes to the development of so-called 'bottle caries' [38].

An important aspect is the performance of a differential diagnosis. This is because the clinical manifestations of odontogenic phlegmon may resemble angioedema (Quincke's oedema), particularly in cases of bilateral facial involvement. To confirm the diagnosis, clinical blood tests, pathogen identification and radiographic examinations are used. The link between medication intake and the onset of symptoms should be considered, as this may be misleading and caused by the presence of infection foci in patients [5]. An additional diagnostic tool is ultrasound, which is recommended as a promising adjunct to the clinical examination of patients with phlegmon. It allows the detection not only of the extent of the lesion but also of tumours, cysts and tissue developmental abnormalities [34].

Odontogenic facial cellulitis may present with clinical features that closely resemble drug-induced angioedema, which often leads to diagnostic difficulties and delays in initiating appropriate treatment. This infection is characterised by diffuse erythematous soft-tissue oedema, which may extend to the periorbital region. In cases of bilateral involvement, the clinical picture is sometimes so similar to non-infectious conditions that differentiation, particularly from angioedema, becomes difficult [24].

Angioedema, unlike an infectious process, is a non-inflammatory condition and is characterised by the sudden development of asymmetric oedema of the deep layers of the dermis and subcutaneous tissue. The face, lips and eyelids are most commonly affected. The drug-induced form of angioedema, particularly that associated with the use of non-steroidal anti-inflammatory drugs (NSAIDs), is a well-known clinical phenomenon and may develop within a few hours of drug exposure. Its incidence is approximately 0.1–0.3 % among individuals receiving NSAIDs, with higher rates observed in patients with existing allergic conditions [42].

Among the NSAIDs most commonly associated with the development of pseudoallergic angioedema, acetylsalicylic acid is the most prevalent, followed by ibuprofen, naproxen and diclofenac. Diagnosis is based primarily on a thorough clinical history and the exclusion of other possible causes of oedema. In the presented clinical case, the absence of typical signs of angioedema, combined with the presence of marked inflammatory changes and the absence of eosinophilia, made it possible to virtually rule out this diagnosis [5].

Despite the rapid development of modern maxillofacial surgery, the issue of complications arising from maxillofacial cellulitis remains a pressing concern. One of the most serious complications is orbital cellulitis, characterised by marked chemosis, pain, conjunctival hyperaemia, ptosis, as well as reduced visual acuity and restricted eye movement. Above all, it can lead to partial or complete loss of vision due to optic nerve atrophy. In 84 % of cases, the primary cause is a bacterial infection, whilst other aetiological factors may include periorbital trauma, periocular infections, and thrombophlebitis [20, 35].

Odonto-orbital cellulitis is a serious complication of odonto-genic infections and can lead to a rapid deterioration in vision, with the prospects for subsequent recovery often remaining limited. According to an analysis of cases of odontogenic orbital cellulitis described in the literature, in patients (45.8 %), final visual acuity corresponded only to light perception or a complete absence of light perception. A similar trend was observed, and following completion of treatment, complete loss of vision was recorded, whilst another patient required orbital exenteration [46].

The rapid spread of the infectious process is facilitated by the anatomical features of the upper jaw. In particular, the thin buccal cortical plate of the alveolar process creates conditions for the infection to penetrate the maxillary sinus. If an inflammatory process develops in the sinus, an additional pathway is formed for the further spread of the infection through the structures of the midface to the orbital tissues [41].

Orbital cellulitis is accompanied by characteristic clinical and radiological signs of inflammation. These most commonly include enlargement of the extraocular muscles and changes in the retrobulbar fat pad, manifesting as bulging or infiltration [36]. Another important radiological sign is orbital emphysema, which may indicate the involvement of anaerobic microflora in the infectious process. Its occurrence is associated with the presence of a communication between the infected maxillary sinus and the orbit, which creates conditions for the spread of anaerobic microorganisms, particularly members of the genus Streptococcus [29].

In general, in orbital cellulitis of various aetiologies, the medial rectus muscle is most commonly affected, which is explained by its anatomical proximity to the ethmoid sinuses. At the same time, in half of the patients included in the analysis, enlargement of the lateral rectus muscle was observed. This localisation of changes is more consistent with the inferolateral route of infection spread from the soft tissues of the maxilla, the canine fossa region, and through the inferior orbital fissure [43].

Other serious complications include Ludwig's angina, which is a severe form of diffuse phlegmon characterised by an acute onset and rapid spread. It affects the floor of the mouth and the neck, posing a risk of airway obstruction and accompanied by displacement of the tongue. Prior to the discovery of antibiotics, the mortality rate was as high as 50 % of patients; currently, with improvements in surgical and therapeutic treatment methods, mortality from Ludwig's angina stands at around 8 %, according to Marcelo Gusman-Letelie and co-authors [26].

Ludwig's angina is a severe, potentially life-threatening emergency in maxillofacial surgery, the

danger of which stems from the rapid development of massive soft-tissue swelling in the floor of the mouth and neck, leading to displacement and compression of the airways. In most cases, this condition arises as a complication of odontogenic infections, particularly dental abscesses, often associated with involvement of the lower second and third molars [28].

The primary anatomical site of involvement is usually the submandibular space, which is anatomically divided by the myohyoid muscle into the sublingual space above and the submandibular space below. The infectious process originating from the periapical region of the molars can spread through the cortical plate and further penetrate the submandibular, sublingual and submental spaces, as well as indirectly into the parapharyngeal and retropharyngeal spaces. Such spread leads to rapid progression of neck oedema, which surrounds and compresses the upper airways.

Due to anatomical constraints of the fascial structures of the floor of the mouth, the tongue and soft tissues are displaced upwards and backwards, further narrowing the airway and creating a risk of acute respiratory failure and asphyxia. Clinically, this manifests as rapidly progressing oedema of the submental and submandibular regions, the formation of a so-called ‘bull neck’, and tenderness and induration of the tissues [6].

Patients usually report recent toothache, as well as general symptoms of intoxication, including weakness, chills, fever and marked exhaustion. As the disease progresses, trismus may develop, indicating the spread of infection to deeper anatomical spaces. Signs of airway involvement include drooling, dysphagia, laboured breathing, a forced forward-leaning posture, and changes in the voice, particularly hoarseness. Additionally, neck stiffness, tongue swelling, oral pain and progressive speech difficulties may be observed [9].

On physical examination, marked submental and submandibular swelling, tenderness of the affected areas, and elevated body temperature are noted. A characteristic sign is the elevation and upward displacement of the tongue, as well as swelling of the floor of the mouth. In some cases, lymphadenopathy may be absent, which does not rule out a severe course of the disease. Treatment of Ludwig’s angina requires urgent surgical intervention, which involves decompression of the sublingual, submental and submandibular spaces via a wide external incision followed by drainage. A mandatory component of treatment is ensuring airway patency, which depends on the severity of the patient’s condition and may be achieved by endotracheal intubation or tracheostomy [44].

Due to marked soft tissue, mask ventilation is often ineffective; therefore, pre-oxygenation and thorough preparation for complex airway management are crucial steps. Blind orotracheal or nasotracheal intubation is not recommended due to the high risk of trauma, laryngospasm and worsening of the obstruction. The use of supraglottic devices is also limited due to anatomical changes and progressive oedema.

In complex cases, preference is given to intubation using a flexible fibre-optic endoscope in a conscious patient; if airway patency cannot be secured, emergency cricothyroidotomy or tracheostomy is performed. Tracheostomy under local anaesthesia is considered the most optimal method in severe cases of neck infections [39].

A brain abscess is a localised purulent-inflammatory process within the brain parenchyma. It is most commonly found in the frontal, temporal, frontoparietal, cerebellar and occipital lobes. Less common aetiological factors include odontogenic infections, congenital and acquired heart defects, infectious endocarditis, and pulmonary infectious processes. Approximately 5–7 % of brain abscess cases are associated with dental diseases or dental procedures. In most cases, odontogenic brain abscesses have an anaerobic aetiology (up to 78 %) [16].

The clinical presentation of a brain abscess is variable and depends on its location, size, and stage of development. The incidence is approximately 0.2–1.9 cases per 100,000 population per year, whilst the mortality rate ranges from 0 to 24 %. One possible source of infection is complications of odontogenic processes, which create conditions for the haematogenous or contact spread of bacterial flora to brain tissues [30].

Clinically, patients may experience severe headaches (particularly on one side), hearing loss, altered consciousness, recurrent episodes of nausea and vomiting, and the development of hemiparesis over the course of several days. Such manifestations may be associated with dental procedures, particularly surgical interventions in the region of the lower molars, as well as with the drainage or treatment of odontogenic phlegmons, as described in the clinical case presented.

A brain CT scan is diagnostically important, as it can reveal multiple abscesses, hydrocephalus or other mass lesions, which sometimes requires differential diagnosis with highly malignant tumours, as well as associated inflammatory changes, particularly mastoiditis. Identification of the bacterial pathogen at the site of the lesion is crucial for selecting effective treatment. The main methods of treatment are surgical drainage of the abscess combined with systemic antibiotic therapy [33].

Furthermore, the diagnosis or decompensation of diabetes mellitus in the context of odontogenic phlegmon in the maxillofacial region may complicate treatment. Hospital stays for patients with diabetes are significantly longer, and involvement of the head and neck regions is more common than in patients without concomitant pathology. Therefore, particular attention should be paid to patients at increased risk of complications [13]. In some cases, odontogenic phlegmons can lead to sepsis and meningitis, following pulpectomy or against a background of other inflammatory processes. In this regard, dentists should exercise due care when treating even mild cases and carry out diagnostic assessments of patients both before and after treatment [48].

Conclusion

An analysis of the literature indicates that purulent-inflammatory processes in the maxillofacial region develop under the influence of various aetiological factors, among which odontogenic foci of infection play a leading role. At the same time, even minimally symptomatic pathological formations, particularly cysts, can act as a trigger for the development of phlegmon, which underscores the importance of their timely detection.

The course and rate of spread of the purulent-inflammatory process are largely determined by individual characteristics of the organism, including chronotype, the state of the immune system, and the presence of concomitant pathology. This necessitates a personalised approach to patient management.

The diagnosis of phlegmon of the maxillofacial region should be based on a combination of clinical observations with modern laboratory and diagnostic imaging methods, which allows for an objective assessment of the progression of inflammation and the effectiveness of treatment.

The high risk of complications, in particular the spread of infection to adjacent anatomical areas and the development of systemic involvement, necessitates early intervention and inter-hospital collaboration in the management of such patients.

Prospects for further research. Future studies should focus on identifying reliable predictive biomarkers of the progression of purulent-inflammatory processes in the maxillofacial region, with particular emphasis on systemic immuno-inflammatory indices and their clinical applicability. Further investigation is required to clarify the role of host-related factors, including immune response variability and chronobiological patterns, in determining disease severity and treatment outcomes. Additionally, there is a need for large-scale prospective multicentre studies to evaluate the effectiveness of different surgical and antimicrobial treatment strategies. The development of standardized diagnostic and therapeutic algorithms, integrating clinical, laboratory, and imaging data, may significantly improve early detection, reduce complication rates, and optimise patient management strategies.

References

1. Abu-Shanab A, Vangala A, Albdour Z, Nasr H, Rathod M, Du D. From Routine to Ruin: An Astonishing Computed Tomography Scan Reveals Catastrophic Ludwig's Angina and Necrotizing Mediastinitis after a Simple Dental Procedure. Eur J Case Rep Intern Med. 2025 Apr 3;12(5):005285. doi: 10.12890/2025_005285.
2. Aliabadi E, Farshad MM, Kheirkhah M, Jafari SH. Clinical, CT scan, and laboratory changes of abscess patients with odontogenic origin admitted to Shiraz acute surgical care center, Iran. J Family Med Prim Care. 2021 Sep;10(9):3314-3318. doi: 10.4103/jfmpc.jfmpc_1047_21.
3. Aloua R, Kerdoud O, Slimani F. Cavernous sinus thrombosis related to orbital cellulitis: a serious complication to prevent – a case report and literature review. Ann Med Surg (Lond). 18 January 2021;62:179-181. doi: 10.1016/j.amsu.2021.01.036.
4. Antonio R, Stefania T, Umberto C, Antonio A, Dell'Aversana Orabona G, Francesco S, et al. Surgical Approaches in Odontogenic Orbital Cellulitis (OOC): Our Experience and Review of the Literature. Indian Journal of Otolaryngology and Head and Neck Surgery. December 2022;74(Suppl 3):4552–4561. doi: 10.1007/s12070-021-02576-y.
5. Bal Reddy P, Humayun S, Naga Sujata D, Anil Kumar K, Sanjeev Naik J. Unusual Presentation of Odontogenic Cellulitis Mimicking Drug-Induced Angioedema: A Case Report. Cureus. 22 October 2025;17(10):e95162. doi: 10.7759/cureus.95162.
6. Balaji VCR, Vani K. Ludwig's Angina During Pregnancy-A Case Report. Indian J Dent Res. 2024 Jan 1;35(1):104-106. doi: 10.4103/ijdr.ijdr_839_23.
7. Böttger S, Zechel-Gran S, Schmermund D, Streckbein P, Wilbrand JF, Knitschke M, et al. Odontogenic Cervicofacial Necrotizing Fasciitis: Microbiological Characterization and Management of Four Clinical Cases. Pathogens. 2022 Jan 9;11(1):78. doi: 10.3390/pathogens11010078.
8. Brian Ngokwe Z, Tchiekou Audrey K, Ntep David Bienvenue N, Stephane NK, Messanga Charles B. Antibiotic resistance: a case of a chronic maxillofacial osteomyelitis complicating an odontogenic cellulitis. Int J Surg Case Rep. 2026 Apr 14;138(5):2038-2042. doi: 10.1097/RC9.0000000000000477.
9. Canas M, Fonseca R, De Filippis A, Diaz L, Afzal H, Day A, et al. Ludwig's Angina: Higher Incidence and Worse Outcomes Associated With the Onset of the Coronavirus Disease 2019 Pandemic. Surg Infect (Larchmt). 2023 Nov;24(9):782-787. doi: 10.1089/sur.2023.163.
10. Chew WCD, Kwek JWM, Anicete R, Low MY. Paediatric orbital cellulitis: Case report of an unusual aetiology and pathogen. Ear Nose Throat J. 2024 Sep;103(9):559-564. doi: 10.1177/01455613211064002.
11. Demkovych A, Kalashnikov D, Hasiuk P, Zubchenko S, Vorobets A. The influence of microbiota on the development and course of inflammatory diseases of periodontal tissues. Front Oral Health. 2023 Aug 7;4:1237448. doi: 10.3389/froh.2023.1237448.
12. Derruau S, Bogard F, Exartier-Menard G, Mauprivez C, Polidori G. Medical Infrared Thermography in Odontogenic Facial Cellulitis as a Clinical Decision Support Tool. A Technical Note. Diagnostics (Basel). 2021 Nov 4;11(11):2045. doi: 10.3390/diagnostics11112045.
13. Evsen EA, Candan M. Serious Complications and Treatment Strategies Associated with Odontogenic Infections. Eurasian J Med. 2023 Dec;55(1):142-149. doi: 10.5152/eurasianjmed.2023.23378.
14. Ferjaoui M, Kolsi N, Bergaoui E, Naouar M, Bouatay R, Harrathi K, et al. Cellulites cervico-faciales odontogènes: à propos de 87 cas [Odontogenic cervical-facial cellulitis: report of 87 cases]. Rev Med Liege. 2022 Mar;77(3):181-186. French.
15. Frid H, Bilder A, Hija A, Emodi O. Diagnostic Accuracy and Clinical Impact of Handheld Point-of-Care Ultrasound in Pediatric Odontogenic Infections: A Prospective Cohort Study. Children (Basel). 2025 Oct 15;12(10):1392. doi: 10.3390/children12101392.
16. Ghannam LI, Doush RAA, Yacoub RK, Amro Z, Ayyesh J. Subperiosteal Abscess following tooth infection in early childhood: a case report. BMC Oral Health. 2025 Feb 14;25(1):240. doi: 10.1186/s12903-025-05575-5. Erratum in: BMC Oral Health. 2025 Mar 19;25(1):409. doi: 10.1186/s12903-025-05738-4.
17. Isankova O, Safronovs J, Berke K, Taurmane L. Deep Neck Infections. Review of 111 cases. Otolaryngol Pol. 2025 Jan 15;79(1):1-5. doi: 10.5604/01.3001.0054.8465.
18. Iwata E, Kusumoto J, Hasegawa T, Tachibana A, Akashi M. The Radiographic Characteristics of Mandibular Wisdom Teeth That Can Cause Severe Deep Neck Infection. Cureus. 3 October 2024;16(10):e70791. doi: 10.7759/cureus.70791.
19. Kusumoto J, Iwata E, Huang W, Takata N, Tachibana A, Akashi M. Hematologic and inflammatory parameters for determining severity of odontogenic infections at admission: a retrospective study. BMC Infect Dis. 2022 Dec 12;22(1):931. doi: 10.1186/s12879-022-07934-x.
20. Liu X, Luo W, Ren W. Case Report: Vision Loss in a Child Caused by Streptococcus constellatus. Optom Vis Sci. 2023 Oct 1;100(10):721-725. doi: 10.1097/OPX.0000000000002062.

21. Lokes K, Lychman V, Izmailova O, Shlykova O, Avetikov D, Kaidashev I. Expression of peripheral core molecular clock genes in oral mucosa depends on the chronotype in patients with maxillofacial cellulitis. J Oral Biol Craniofac Res. 2023 Sep-Oct;13(5):517-521. doi: 10.1016/j.jobcr.2023.06.001. Epub 16 June 2023. Erratum in: J Oral Biol Craniofac Res. 2024 Sep-Oct;14(5):667. doi: 10.1016/j.jobcr.2024.09.007.
22. Opoko U, Salissou I, Aloua R, Raiteb M, Slimani F. Cervicofacial cellulitis on vascular malformation: About two case reports. Ann Med Surg (Lond). 2021 Jun 30;67:102526. doi: 10.1016/j.amsu.2021.102526.
23. Özbakır Ç, Ergün D, Kaçar P, Kahraman Çetin B, Özbakır H, Özer A, et al. Clinical and economic burden of preseptal cellulitis in children: a 6-year review. Turk J Pediatr. 2026 Feb 27;68(1):79-86. doi: 10.24953/turkjpediatr.2026.6660.
24. Panda BB, Behera S, Vishwanath S. Successful Management of an Acute Case of Orbital Cellulitis of Odontogenic Origin. J Emerg Trauma Shock. 2023 Jan-Mar;16(1):29-30. doi: 10.4103/jets.jets_112
25. Perez A, Cimini V, Lenoir V, Lombardi T. Facial Cellulitis of Unusual Odontogenic Origin. Reports (MDPI). 21 June 2024;7(3):50. doi: 10.3390/reports7030050.
26. Pirvulescu RA, Vasile VA, Romanitan MO, Zemba M, Ciulei OC, Geamanu A, et al. Odontogenic Orbital Cellulitis at the Crossroads of Surgeries: Multidisciplinary Management and Review. Diagnostics (Basel). 2024 Jun 29;14(13):1391. doi: 10.3390/diagnostics14131391.
27. Pluščiauskaitė S, Bojarskas S. Aetiopathogenesis and Treatment Evaluation of Odontogenic Cellulitis in the Maxillofacial Region: a Retrospective Study. J Oral Maxillofac Res. 30 September 2025;16(3):e4. doi: 10.5037/jomr.2025.16304.
28. Poorna T A, J R L, Ek J, John B. Ludwig's angina in a COVID positive patient-An atypical case report. Spec Care Dentist. 2022 Jan;42(1):99-102. doi: 10.1111/scd.12643.
29. Preda MA, Sarafoleanu C, Mușat G, Preda AA, Lupoi D, Barac R, et al. Management of oculo-orbital complications of odontogenic sinusitis in adults. Rom J Ophthalmol. 2024 Jan-Mar;68(1):45-52. doi: 10.22336/rjo.2024.09.
30. Rim K, Seo E, Kwon D, Ahn J, Paeng JY. Brain abscess following right maxillary odontogenic infection in a patient with diabetes mellitus: a case report. J Korean Assoc Oral Maxillofac Surg. 2025 Oct 31;51(5):314-320. doi: 10.5125/jkaoms.2025.51.5.314.
31. Roi CI, Roi A, Nicoară A, Nica D, Rusu LC, Soancă A, et al. Impact of Treatment on Systemic Immune-Inflammatory Index and Other Inflammatory Markers in Odontogenic Cervicofacial Phlegmon Cases: A Retrospective Study. Biomedicines. 14 June 2023;11(6):1710. Doi: 10.3390/biomedicines11061710.
32. Rosca O, Bumbu BA, Ancusa O, Talpos S, Urechescu H, Ursoniu S, et al. The Role of C-Reactive Protein and Neutrophil to Lymphocyte Ratio in Predicting the Severity of Odontogenic Infections in Adult Patients. Medicina (Kaunas). 2022 Dec 22;59(1):20. doi: 10.3390/medicina59010020.
33. Sasmanto S, Wasito EB. Odontogenic brain abscess due to Anaerococcus prevotii infections: A case report and review article. Int J Surg Case Rep. 2022 Aug;97:107450. doi: 10.1016/j.ijscr.2022.107450.
34. Shah N, Patel S, Rupawala T, Makwana S, Mansuri S, Bhimani K. Evaluation of the Efficacy of Ultrasonography as an Additional Diagnostic Tool for Determining the Management Protocol of Odontogenic Superficial Fascial Space Infections: A Prospective Clinical Study. J Maxillofac Oral Surg. Dec 2022;21(4):1148-1154. doi: 10.1007/s12663-021-01560-x.
35. Sheils CR, Cypen SG, Tao JP. Blindness Secondary to Odontogenic Orbital Cellulitis During the COVID-19 Dental Shutdown. Ophthalmic Plast Reconstr Surg. 2021 Sep-Oct 01;37(5):e194. doi: 10.1097/IOP.0000000000002020.
36. Shenoi R, Situt N, Waghchoure A. Multispace Maxillofacial Space Infections Involving Orbit: Report of a Rare Case. Indian J Otolaryngol Head Neck Surg. 2024 Apr;76(2):2095-2099. doi: 10.1007/s12070-023-04421-w.
37. Słotwińska-Pawlaczyk A, Orzechowska-Wylęgała B, Latusek K, Roszkowska AM. Analysis of Clinical Symptoms and Biochemical Parameters in Odontogenic Cellulitis of the Head and Neck Region in Children. Children (Basel). 2023 Jan 16;10(1):172. doi: 10.3390/children10010172.
38. Słotwińska-Pawlaczyk A, Orzechowska-Wylęgała B, Latusek K, Roszkowska AM. Analysis of the Clinical Status and Treatment of Facial Cellulitis of Odontogenic Origin in Pediatric Patients. Int J Environ Res Public Health. 2023 Mar 10;20(6):4874. doi: 10.3390/ijerph20064874.
39. Sonar PR, Panchbhai A, Lande AN. Potentially Fatal Ludwig's Angina: A Case Report. Cureus. 2023 Nov 16;15(11):e48885. doi: 10.7759/cureus.48885.
40. Tanaka K, Tsutsumi Y, Nakatani T, Tagaya M. Facial Cellulitis and Skin Abscess: A Case of a Simple Bone Cyst in the Mandibular Bone. Cureus. 20 February 2024;16(2):e54579. doi: 10.7759/cureus.54579.
41. Teoh RJJ, Lai YP, Alias R. Fatal Orbital Cellulitis With Intracranial Abscess: A Case Report. Cureus. 2023 Jul 25;15(7):e42435. doi: 10.7759/cureus.42435.
42. Tsao YT, Tsai YJ, Chen CY, Chu YC, Tsai YS, Liao YL. Impact of the COVID-19 Pandemic on Microbial Profiles and Clinical Outcomes in Orbital and Preseptal Cellulitis. Microorganisms. 2024 Nov 8;12(11):2262. doi: 10.3390/microorganisms12112262.
43. Tumuluri V, Tong JY, Tumuluri K, Selva D. Clinical and radiological characteristics of odontogenic orbital cellulitis. J Ophthalmic Inflamm Infect. 2024 Oct 1;14(1):48. doi: 10.1186/s12348-024-00422-0.
44. Vasanth S, Chandran S, Pandyan DA, Gnanam P, Djearamane S, Wong LS, et al. Case Report: Ludwig's angina - 'The Dangerous Space'. F1000Res. 2024 Jun 27;11:1511. doi: 10.12688/f1000research.127242.2.
45. Welti R, Ravindra D, Teoh L, Sloan A, Burgner D, Silva M. The use of antibiotics in the management of odontogenic facial swellings in children and adolescents: A scoping review.
46. Welti R, Teoh L, Sloan AJ, Long E, Burgner D, Silva M. Pediatric odontogenic facial cellulitis: A comprehensive review for multidisciplinary management. J Pediatric Infect Dis Soc. 2025 Nov 24:piaf108. doi: 10.1093/jpids/piaf108.
47. Yankov YG, Bocheva Y. Comparative Characterization of Procalcitonin (Sensitivity, Specificity, Predictability, and Cut-Off Reference Values) as a Marker of Inflammation in Odontogenic Abscesses of the Head and Neck in the Female Population. Cureus. 2023 Nov 3;15(11):e48207. doi: 10.7759/cureus.48207.
48. Yoshizawa K, Hanihara M, Harada D, Myose N, Sakata H, Moriguchi T, et al. Meningitis with septic shock resulting from an odontogenic infection misdiagnosed as a locked-jaw condition in temporomandibular disorder: A case report and literature review. Medicine (Baltimore). 7 July 2023;102(27):e34177. doi: 10.1097/MD.0000000000034177.

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