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Prevalence of Odontogenic Infections in Primary Facial Spaces and Identify Associated Demographics in Patients Presenting to a Tertiary Care Hospital at Swat

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ABSTRACT

Background: Infections originating from the teeth are widespread and severe, posing significant health risks in the oral and facial areas with high rates of morbidity and mortality.
Objective: To assess the prevalence of odontogenic infections in primary facial spaces and identify associated demographic and clinical factors.
Materials and Methods: A cross-sectional study was conducted at the Oral and Maxillofacial Surgical Unit at Blind, from January 2023 to April 2024. A total of 159 patients with odontogenic infections in primary facial spaces were included using a non-probability consecutive sampling technique. The study involved clinical examinations, investigations, and radiographic imaging to diagnose primary space involvement. Data were analyzed using SPSS version 22.00, and chisquare test was applied to identify differences in infection frequency by age and gender.
Results: The study involved 159 patients with a mean age of 32.40 years. Moderate pain was most common, affecting 111 patients (69.81%), followed by mild pain in 32 patients (20.13%) and severe pain in 16 patients (10.06%). Sinus involvement occurred in 32 cases (20.13%). The most frequently affected facial space was submandibular, present in 79 cases (49.66%), followed by sublingual in 64 cases (40.25%), and submental in 32 cases (20.13%).
Conclusion: Male patients were more commonly affected by odontogenic infections than female patients. Moderate pain was most frequent, and sinus involvement occurred in some cases. The submandibular space was the most affected, followed by the sublingual and submental spaces.
Keywords: Facial spaces, Odontogenic infections, Pain severity, Submandibular space, Sublingual space, Submental space.

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INTRODUCTION

Odontogenic infections are a common and potentially serious type of infection that originates from the teeth or their supporting structures. [1] They can progress rapidly from mild to severe, leading to complications such as abscess formation and spread to surrounding tissues.[2] If left untreated, these infections can extend beyond the oral cavity, affecting surrounding tissues like the face and neck, and even deeper structures such as the airway or mediastinum.[3] In severe cases, the infection can spread systemically, leading to sepsis. This systemic spread poses a significant risk of mortality.[4] Additionally, infections in the orofacial region can cause swelling and inflammation, which may compromise the airway and lead to breathing difficulties. [5] Even when not immediately life-threatening, these infections can cause significant discomfort, pain, and functional impairment, affecting a person's quality of life. Diagnosing and managing odontogenic infections can be challenging due to their non-specific initial symptoms and the need for multidisciplinary care involving dentists, oral surgeons, and other specialists.[6] Moreover, the overuse or misuse of antibiotics can lead to the development of antibiotic-resistant strains of bacteria, complicating treatment efforts. To mitigate these risks, prompt diagnosis and treatment are essential, as is the appropriate use of antibiotics and timely surgical intervention if necessary.[7] Preventive measures such as maintaining good oral hygiene and regular dental check-ups can also help reduce the incidence of these infections.

Odontogenic infections originate from various sources and can extend to nearby soft tissues, impacting facial spaces.[8] This spread may lead to facial cellulitis, affecting both primary and secondary spaces depending on whether the infection spreads directly or indirectly.[9] The primary spaces associated with the maxilla include the canine, buccal, and infratemporal spaces, while the mandible is linked to the submental, submandibular, buccal, and sublingual spaces. The submandibular space is the most common site for odontogenic infections, and the masseter space is often affected as well, occasionally causing Ludwig's angina.[10]

The most prevalent odontogenic infection is acute periapical abscess, which often arises from endodontic disease or periodontal conditions such as pericoronitis and periodontal abscess. The mandibular third molar is the tooth most commonly affected in these infections. Patients with odontogenic infections often report pain, facial swelling, pus discharge, and sometimes trismus. Factors contributing to the spread of odontogenic infections include self-medication, inadequate oral hygiene, failure to treat the affected tooth, improper use of antibiotics, delayed hospital visits, and antibiotic resistance in the bacteria causing the infection.

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This study aims to determine the frequency of odontogenic infections in primary facial spaces among patients at Saidu College of Dentistry in Swat. By identifying which primary facial spaces are most commonly affected and which specific teeth are involved, this research will facilitate early detection and management of these infections, thereby reducing associated morbidity and mortality. Additionally, the study will raise awareness within the community about the importance of timely consultation with an oral surgeon. This study also provide information the spread patterns of odontogenic infections, addressing a literature gap regarding their prevalence and primary space involvement in facial anatomy. This information can improve early diagnostic and treatment strategies.

MATERIALS AND METHODS

The study was carried out in the Oral and Maxillofacial Surgical Unit at Blind. It followed a cross-sectional (descriptive) design and took place from 27th January 2023 to 15th April 2024. The sample size was determined using a computer-based software called "Sample Size Determination in Health Studies" by the World Health Organization. The software calculated the sample size based on the prevalence of odontogenic infections in the submandibular primary facial space, which was 28.12%,[12] with an absolute precision of 7% and a 95% confidence level. The calculated sample size was 159 patients. The study used a non-probability consecutive sampling technique and included patients with odontogenic infections in primary facial spaces, both male and female, aged 18 to 65 years. Patients with infections in primary facial spaces that were not of odontogenic origin, such as sialadenitis, parotitis, or foreign bodies, were excluded from the study.

After obtaining approval from the hospital's ethical review committee (8890/SCD/Swat/EC, Dated; 27/01/2024), patients who met the inclusion criteria and visited the Oral and Maxillofacial Surgery Department at Saidu College of Dentistry in Swat were included in the study. All participants provided informed, written consent. A comprehensive medical history was taken, followed by a detailed clinical examination and necessary investigations. The diagnosis of primary space involvement was established through both extraoral and intraoral clinical examinations, conducted in a respectful and comfortable manner. To identify the source of infection, such as the specific tooth involved, patients underwent relevant radiographic imaging including periapical views and orthopantomograms. Potential confounding factors like sialadenitis, parotitis, and foreign bodies were managed by excluding them from the study based on history, clinical, and radiographic findings. The exclusion criteria were strictly adhered to in order to minimize bias in the study.

Operational definitions for the study include the following: Odontogenic infection refers to all primary facial infections that present clinically with pain of any intensity, as well as fluctuant or firm swellings, or draining sinuses (or a combination of these symptoms). Primary facial spaces are anatomical compartments in the face and neck that can harbor and facilitate the spread of infections originating from dental or oral sources.[13] Primary facial spaces are those directly affected by odontogenic infections, such as the buccal, infratemporal, and canine spaces in the maxilla, and the buccal, submandibular, submental, and sublingual spaces in the mandible. Pain severity was assessed using a visual analogue scale and categorized as mild (1-3), moderate (3-7), or severe (7-10).

The data was analyzed using the SPSS statistical package version 22.00. Mean and standard deviation were calculated for age, while frequencies and percentages were determined for categorical variables such as gender and primary facial spaces involved in the maxilla (buccal, infratemporal, canine) and mandible (buccal, submandibular, submental, sublingual), as well as the affected tooth. Data was stratified by age and gender to assess effect modification. The Chi-square test at a 5% significance level was used to identify differences in infection frequency by age and gender.

RESULTS

In this study of 159 patients with facial space infection, the mean age was 32.40± 8.992 years, and the mean severity of pain on the Visual Analogue Scale was 4.79 (SD ± 1.476). The distribution of gender showed that 59.75% of patients were male (n=95), while 40.25% were female (n=64). (Table 01)

The most common pain category was moderate (n=111, 69.81%), followed by mild (n=32, 20.13%), and the least common was severe (n=16, 10.06%). (Fig 01) Sinus involvement in odontogenic facial space infection was present in 32 cases (20.13%). (Fig 02)

Table 02 presents the pattern of facial spaces involvement in odontogenic infection. Among the spaces involved, the most frequently affected was the submandibular space, observed in 79 cases (49.66%). This was followed by the sublingual space, present in 64 cases (40.25%). The submental space was involved in 32 cases (20.13%), along with both the maxillary canine and buccal spaces, each observed in 32 cases (20.13%).

Table 02 illustrates the distribution of mandibular teeth involved in various facial spaces in cases of odontogenic infection. In the submandibular space (n=79), the most common involvement was observed in the 2nd molar (43.03%), followed by the 3rd molar (39.2%), while no involvement was noted for the canine, 1st premolar, and 2nd premolar. For the submental space (n=32), all involvement was observed in the 2nd and 3rd molars, with equal distribution (50%) between them. In the sublingual space (n=64), involvement was evenly distributed among the 1st premolar, 1st molar, 2nd molar, and 3rd molar (25% each), while the canine showed no involvement.

Table 04 presents the distribution of maxillary teeth involved in various facial spaces in cases of odontogenic infection. In the Maxillary canine space (n=32), predominant involvement was observed in the canine (96.5%), with no involvement in other teeth. In the Maxillary Buccal space (n=32), involvement was evenly distributed between the 2nd premolar and 2nd molar (50% each), while the canine and 1st molar showed no involvement.

Table 01. Distribution of age, gender and overall pain level among patients

Variable	Characteristics	n=159 (%)
Age (Years)	Mean±SD	32.40±8.992
Severity of Pain on Visual Analogue Scale	Mean±SD	4.79±1.476
Gender, n(%)	Male	95(59.75)
	Female	64(40.25)

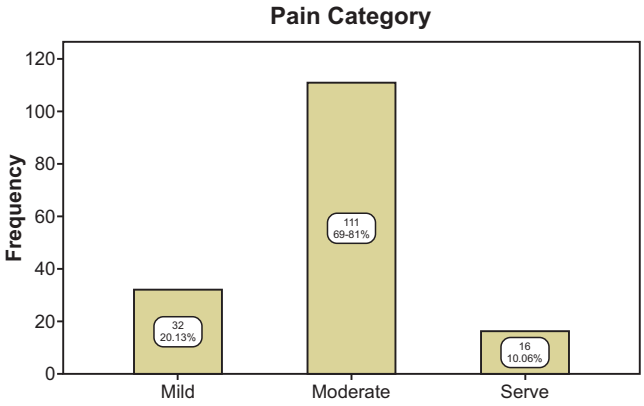


Fig 01. Frequency of pain severity on VAS (n=159)

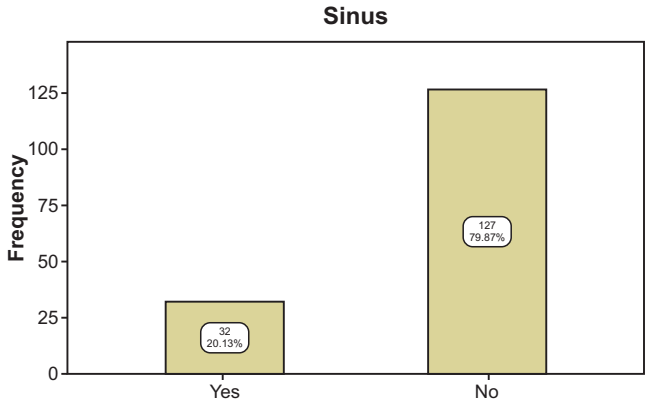


Fig 02. Frequency of Sinus involvement in odontogenic facial space infection (n=159)

Table 02. Pattern of facial spaces involvement in odontogenic infection

Space Involved	n(%)
Submandibular	79(49.66)
Submental	32(20.13)
Sublingual	64(40.25)
Maxillary Canine Space	32(20.13)
Maxillary Buccal Space	32(20.13)

Table 03. Distribution of mandibular teeth Involved in various facial spaces

Facial Spaces	Mandibular Tooth Involved					
	Canine	1st Premolar	2nd Premolar	1st Molar	2nd Molar	3rd Molar
Submandibular space(n=79)	0(0)	0(0)	0(0)	16(20.2)	32(43.03)	31(39.2)
Submental (n=32)	0(0)	0(0)	0(0)	0(0)	16(50)	16(50)
Sublingual space (n=64)	0(0)	16(25)	0(0)	16(25)	16(25)	16(25)

Table 04. Distribution of maxillary teeth Involved in various facial spaces

Facial Spaces	Maxillary Tooth Involved					
	Canine	1st Premolar	2nd Premolar	1st Molar	2nd Molar	3rd Molar
Maxillary Canine Space (n=32)	31(96.5)	0(0)	0(0)	0(0)	0(0)	0(0)
Maxillary Buccal Space (n=32)	0(0)	0(0)	16(50)	0(0)	16(50)	0(0)

DISCUSSION

The most common pain category in patients with odontogenic facial space infection was moderate, followed by mild pain, with severe pain being the least common. This distribution of pain levels may be related to the typical progression of odontogenic infections, which often cause inflammation and pressure in the affected tissues.[14] Moderate pain could reflect the body's response to infection without it being severe enough to cause extreme discomfort. Mild pain may be due to early treatment intervention, individual pain thresholds, or the infection being less extensive in certain patients. Severe pain, while less common, could indicate a more advanced infection or complications.[15] This lower incidence may suggest that most infections are addressed before they reach a stage where severe pain is experienced. Previous studies also reported pain in odontogenic infections. Mutwiri et al.[16] reported swelling in 96.3% of cases and pain in 58.9% of patients. Similarly, Fu et al.[17] and Eltohami and colleagues[18] found that swelling was the most common symptom, followed by pain.

Sinus involvement in odontogenic facial space infection was present in some cases. This may occur due to the proximity of the dental roots to the maxillary sinuses, particularly in upper jaw infections. Additionally, the inflammation from the infection can potentially extend to the sinuses, causing further discomfort and complications.[19]

The pattern of facial space involvement in odontogenic infections revealed that the submandibular space was the most commonly affected, followed by the sublingual space. This may be attributed to the anatomical proximity of the submandibular space to the roots of the mandibular molars, which are a common source of odontogenic infections.[20] The sublingual space's involvement could also be linked to its proximity to the submandibular space and its location beneath the tongue, making it susceptible to the spread of infection. similar results were found in previous study conducted in Peshawar.[21] Another study conducted at Abbottabad also found that submandibular space was most commonly involved in odontogenic infections.[11] Similar results were reported in studies from the Middle East and South Asia.[22,23] However, Nigerian researchers have found that the buccal space is more frequently affected in most cases.[24] The 2nd and 3rd mandibular molar teeth play a significant role in the origin of infections in the deep neck region.

Maxillary canine and buccal spaces were equally involved, indicating that infections originating in the maxilla can spread to these areas. The canine space is located near the roots of the maxillary canine teeth, and buccal space involvement may result from the close proximity of the roots of the posterior teeth to this space.[25] In both cases, the spread of infection from the dental source to these spaces is plausible given their anatomical positioning. Similar results were found in previous study.[21]

Strengths of this study include its use of a well-defined sample and detailed diagnostic approach. Limitations involve the single-center design and sample size, which may restrict generalizability. Future research could explore longitudinal studies on the progression of these infections and the effectiveness of different treatment approaches.

CONCLUSION

Male patients were more commonly affected by odontogenic infections than female patients. Moderate pain was most frequent, followed by mild and severe pain. Some cases involved sinus complications. The most affected facial space was submandibular, followed by sublingual, submental, and maxillary spaces. The submandibular space often involved the 2nd and 3rd molars, the submental space had equal involvement of these teeth, the sublingual space featured an even distribution of premolars and molars, while the maxillary canine primarily involved the canine tooth, and the maxillary buccal space showed equal involvement of premolars and molars.

Ethical Consideration

This study was approved by Institutional Review Board of Saidu College of Dentistry, Swat, Pakistan.

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Conflict of Interest

Authors declared no conflict of interest.

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DATA SHARING STATEMENT: The data that support the findings of this study are available on request from the corresponding author. The data is not publicly available due to privacy or ethical restrictions.

AUTHORS' CONTRIBUTION

The following authors fulfill authorship criteria as per ICMJE guidelines;

Ali I, Alam F: Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.

Shah A, Naeem M: Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.

Zaman R: Analysis and interpretation of data, drafting the manuscript, final approval, agreed to be accountable for all the work.

Khan A: Analysis and interpretation of data, critical revision, final approval, agreed to be accountable for all the work.

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