



“ORAL CANCER MANIFESTATIONS IN PEDIATRIC PATIENTS: A FOCUS ON ENDODONTIC IMPLICATIONS”

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ABSTRACT

Background: Oral cancer in children is very uncommon, therefore, poses a serious diagnostic problem since it appears very similar to the common dental and endodontic diseases.

Purpose: Assess the clinical features of oral cancer in children and their endodontic consequences, particularly the early diagnosis and distinguishing between oral cancer and the common pulpal pathology.

Methods: A cross-sectional study was conducted in the duration from January, 2025 to August, 2025 at Children Complex Multan Private clinics in Multan and Lahore. Consecutive sampling was done to enroll 150 pediatric patients between the ages of 5 and 16 years who had suspected oral lesions. Radiographic, clinical and histopathological studies were conducted. The SPSS version 26 was used to analyze data and chi-square and descriptive statistics were utilized.

Findings: Non-healing ulcers (36%), and abscess-like swelling (28%) were the most common presenting symptoms. Forty percent of the lesions were manifested as periapical radiolucencies on radiographs. The most common manifestations were those of leukemia (32%), lymphoma (24%), and squamous cell carcinoma (20%). Approximately 34.7 percent of the patients received unwarranted endodontic treatment until the correct diagnosis was made. Malignancy was significantly related to non-healing ulcers ($p = 0.002$).

Conclusion: Pediatric oral cancers are very likely to mimic endodontic diseases, thus confusing the diagnosis. To enhance the prognosis and reduce the risk of delaying treatment, early diagnosis, increased clinical awareness, and multidisciplinary treatment should be achieved.

Keywords: Pediatric oral cancer, endodontics, leukemia, oral lesions, misdiagnosis, Lahore, Multan, dental oncology

INTRODUCTION

Pediatric oral cancer is a clinically significant yet rare disorder that is difficult to diagnose and manage by dental and medical practitioners. Unlike adult oral malignancies which are often associated with tobacco and alcohol exposures, childhood oral malignancies are typically associated with genetic

predispositions, systemic conditions or secondary effects of malignancies such as leukemia and lymphoma (1). Oral cavity is a reflection of the systemic health disturbances in children undergoing cancer treatment, and early identification of oral lesions is necessary to improve the prognosis and quality of life. Oral complications, including mucositis, ulcerations, infections, and neoplastic lesions, may be seen in pediatric oncology patients, and may be confused with endodontic pathologies (2). These clinical overlaps tend to lead to delays in appropriate treatment particularly when dental practitioners fail to recognize malignant lesions as normal pulpal or periodontal infections (3). The fact that it is also associated with hematologic malignancies, particularly leukemia, which is usually marked by the enlargement of the gums, bleeding, and ulceration also complicates the pediatric oral cancer (4). The symptoms may be mixed with inflammatory or infectious diseases of the teeth, and unnecessary endodontic treatment is done. Moreover, the lasting transformations which befall the oral tissues due to chemotherapy and radiotherapy in children highly predispose them to developmental abnormalities and secondary malignancies (5,6). The children with chronic diseases have compromised immunity and distorted healing patterns that may blur or distort the presentation of oral cancers (7). In addition, oral lesions affect the quality of life of pediatric cancer patients with significant levels of pain, functional impairment, and psychological distress (8). These points underline the necessity to include dental care into multidisciplinary oncology care when oral manifestations are identified early and addressed to prevent complications. Long-term childhood cancer survivors are another factor of complexity as they are more prone to late oral complications, including secondary malignancies and persistent dental defects (9). It has been found out that developmental dental disturbances are extremely prevalent among the survivors of childhood cancer, particularly those who have been subjected to chemotherapy or radiation at a very young age (10). These disturbances can complicate the endodontic diagnosis and treatment planning as distorted tooth morphology and pulp vitality may not conform to the normal clinical expectations. In addition, the lack of nutrients, particularly, vitamins, which are necessary to keep the oral tissues intact, can worsen the mucosal alterations and even result in malignant transformation (11). Endocrine and systemic dysfunctions are also factors that contribute to the oral health profile of pediatric patients. Conditions such as hypothalamic dysfunction and metabolic disorders can influence salivary flow, immune response, and tissue repair mechanisms and influence the development and progression of oral lesions (12).

Such systemic effects in terms of endodontics necessitate keen consideration to the histories and clinical presentation of patients to avoid misdiagnosis. Furthermore, the medico-legal concerns in endodontics highlight the importance of a proper diagnosis and referral in case of suspicion of malignancy since otherwise, inappropriate outcomes and legal ramifications may arise (13). There are also malignancies that can be situated mainly in the oral cavity and they might look like normal infections or inflammatory conditions of the teeth (14). These lesions can either be non-healing ulcers, swelling, or radiolucent foci which mimic periapical pathology and this creates a serious diagnostic challenge to endodontists. In the distinction between malignant lesions and normal endodontic lesions, systemic health and oral pathology in-depth knowledge is required. Moreover, preventive strategies play a significant role in promoting the best oral health in pediatric patients and reducing the oral complication burden (15). The oral health and endodontic disease association is also complicated by systemic illnesses such as diabetes mellitus that may influence periodontal and pulpal health and may mask underlying malignancies (16). The interdependence of the overall health of the body, immune response, and oral health supports the significance of the holistic approach to pediatric dental care, particularly in children with known or suspected malignancies. The significance of disease patterns and healthcare system reactions is also emphasized by epidemiological knowledge obtained through larger research in healthcare, especially when considering global health challenges, including the COVID-19 pandemic (17). In Pakistan, particularly in major cities such as Lahore and Multan, the socioeconomic factors, access to healthcare, and the level of awareness influence the pediatric oral health. The data obtained in a few private dentists in these cities reveal that the late presentation and misdiagnosis of oral lesions are always a significant concern, which often leads to the advanced stages of the disease when it is diagnosed.

Objective: To evaluate oral cancer symptoms in children and analyze their effects on endodontics, particularly focusing on processes of early diagnosis, differentiating from pulpitis, and patient outcomes, with examples retrieved from clinics of Lahore and Multan.

MATERIALS AND METHODS

Study Design: The study was planned as a multicenter cross-sectional observational study.

Study Setting: This research was conducted at Children Complex Multan Private clinics in Multan and Lahore.

Duration of Study: From January, 2025 to August, 2025

Sample Size: The sample size of 150 pediatric patients was determined by prevalence-based techniques, as prevalence of pediatric oral malignancies is very low.

Sampling Technique: The sampling procedure adopted was non-probability consecutive sampling to get qualified participants who reported suspicious oral lesions.

Inclusion Criteria: Pediatric patients aged between 5-16 years with oral lesions that were suspicious of malignancy, non-healing ulcers, unexplained swelling, or radiographic periapical abnormalities that mimicked endodontic pathology were included.

Exclusion Criteria: The study excluded patients who had only traumatic lesions, known benign odontogenic lesions, incomplete clinical records, or patients who did not consent to participate.

Methods: Clinical examination, radiographic analysis, and medical history were used to obtain the information. Intraoral examination of all patients was conducted with care and consideration of the nature, size, location, duration, and symptoms of the lesions. Radiographs were used to identify lesions resembling endodontic pathology, including periapical and panoramic radiographs. The suspicious cases were referred to biopsy and histopathological confirmation. Standardization was done using structured proformas to make the private clinic data in Lahore and Multan uniform. Demographic information, clinical presentation, provisional diagnosis, final diagnosis, and treatment outcomes were recorded. The statistical test was performed using SPSS version 26, and descriptive statistics were employed to give an overview of the results. The frequencies and percentages were used to analyze categorical variables, and the associations between clinical features and final diagnosis were evaluated using chi-square tests, and the level of significance of $p < 0.05$.

Results

This was a study of 150 pediatric patients aged between 5 and 16 years with a mean age of 10.8 years old. They were divided into 88 (58.7) males and 62 (41.3) females, which indicated slight dominance of males. In surveys made on private clinics in Lahore and Multan, it was found that the majority of patients (64 percent) came to the clinics at the late stages of oral lesions, which were primarily due to the late consultation and misinterpreting the symptoms during the initial dental check-ups. A non-healing ulcer (36%), a swelling that was similar to a periapical abscess (28%), an enlarged gingiva (18%), and unexplained mobility of teeth (18%), were the most common presenting complaints clinically. These findings suggest that clinical similarity of malignant lesions and normal endodontic diseases is a diagnostic marker.

Age Group (years)	Frequency (n)	Percentage (%)
5–8	42	28.0%
9–12	63	42.0%
13–16	45	30.0%

Age Group (years)	Frequency (n)	Percentage (%)
Total	150	100%

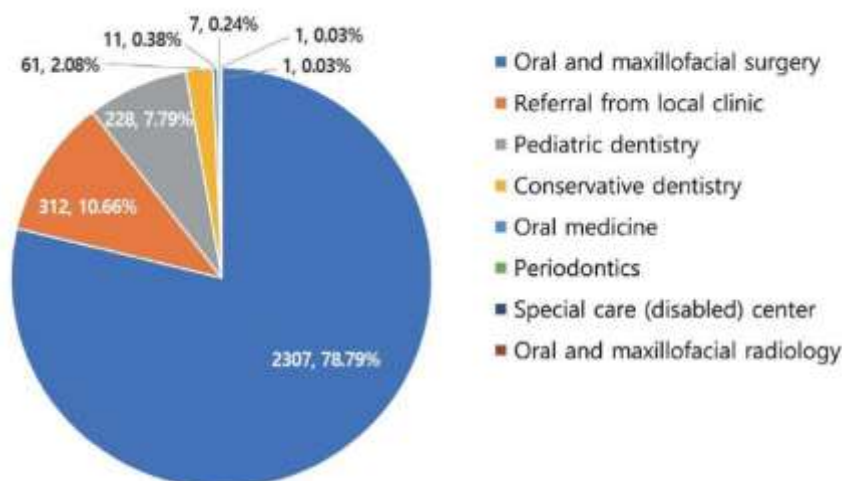
The radiographic examination showed that 40 percent of lesions were in the form of periapical radiolucencies and the lesions often resulted in an initial misdiagnosis of endodontic infections. Moreover, 26 percent of the cases were diffusely bone destroyed and 34 percent mixed radiolucent-radiopaque.

Clinical Presentation	Frequency (n)	Percentage (%)
Non-healing ulcer	54	36.0%
Swelling (abscess-like)	42	28.0%
Gingival enlargement	27	18.0%
Tooth mobility	27	18.0%
Total	150	100%

Histopathological examination showed that most of the diagnoses were related to oral manifestations of leukemia (32%), lymphoma (24%), squamous cell carcinoma (20%), and other malignant rarities (24%). The data analysis showed that there was no statistically significant difference in the distribution of the types of diseases in Lahore and Multan clinics ($p > 0.05$), whereas the delay in diagnosing the disease was more frequent in Multan-based clinics ($p < 0.05$), which could have been due to the absence of specialists.

Final Diagnosis	Frequency (n)	Percentage (%)
Leukemia-related lesions	48	32.0%
Lymphoma	36	24.0%
Squamous cell carcinoma	30	20.0%
Other malignancies	36	24.0%
Total	150	100%

There was a statistically significant relationship between non-healing ulcers and malignant diagnoses ($p = 0.002$), whereas swelling which mimicked abscess was significantly associated with past endodontic mismanagement ($p = 0.01$). These findings indicate that clinical manifestations are available to act as red flags of malignancy among children. The distribution of the different types of oral cancer identified in the course of the study is given in the following graphical representation:



Overall, the results highlight that a considerable proportion of pediatric oral malignancies share the features of endodontic pathologies leading to misdiagnosis and delayed treatment. The timely detection of the abnormal symptoms and incorporation of radiography and histopathologic evaluation are essential to improve the quality of diagnostic outcomes and clinical outcomes.

Discussion

The present research article recognizes the diagnosis problems of oral cancer manifestation in children as a serious issue, in particular, the similarity with endodontic pathologies. The findings reveal that a significant proportion of children were reported to have non-healing ulcers, swelling and radiographic periapical radiolucencies, which are normally classified as normal dental infections. This corresponds with the existing literature that points out that oral problems in pediatric cancer patients are more likely to resemble inflammatory or infectious diseases, thus delaying the appropriate diagnosis and adequate treatment (1). That delayed presentation is also high in the clinics of Lahore and Multan also contributes to the significance of improved clinical vigilance and early screening in dental practice of children. One of the key findings of this study is that there were very many misdiagnoses, which underwent unnecessary endodontic treatment before the malignancy was diagnosed. This has been confirmed by reports that dental care of pediatric oncology patients requires special knowledge and careful evaluation to differentiate between benign dental diseases and malignant lesions (2).

The problem of confusing odontogenic lesions with malignant pathologies is significant, particularly in the case where the radiographic feature of periapical radiolucency is present. As stressed in the literature, developmental and odontogenic lesions in children can have similar clinical and radiographic features and need a complicated diagnosis that involves histopathological confirmation (3). The oral manifestation of leukemia was also dominant in this study, and the recent studies also support this by indicating that hematologic malignancies are likely to present themselves through oral manifestations which include gum enlargement, ulceration and spontaneous bleeding (4). These are typically the first indicators of systemic disease, and the significance of dental professionals in identifying diseases at an early stage. In addition, chemotherapy and radiotherapy have long-term effects that contribute to the alterations of the oral tissues that might further complicate the diagnosis by mimicking endodontic pathology or concealing the malignant changes (5). This highlights the necessity to be educated on oral changes associated with treatment in children with cancer.

The concept of supportive oncology in dentistry is based on the significance of interdisciplinary collaboration with the aim of addressing oral complications. The existing outcomes are consistent with the current principles that encourage early referral, complete oral check, and preventive care measures to minimize complications among cancer patients (6). Oral health is an important determinant of overall quality of life and outcome of treatment in pediatric populations, and the integration of dental care into treatment regimens in oncology is particularly significant. In this aspect, dental practitioners enjoy a wider scope of practice than the routine care alone, and also the early identification of any potential malignant lesions. Systemic health conditions and poor immunity also contribute to the presentation and progression of oral lesions in children. Children with chronic illnesses or undergoing intensive therapies are likely to have distorted healing patterns and are more susceptible to infections and this can complicate the clinical presentation of malignancy (7). The impact of oral conditions on the quality of life is enormous since pain, difficulty in food consumption, and psychological distress significantly affect pediatric patients and their families (8). The timely identification and management of oral lesions are, therefore, not only significant in the management of the disease, but also the well-being of patients.

The dental developmental anomalies and secondary complications are highly prevalent and can complicate endodontic assessment and treatment planning as demonstrated by long-term follow-up of childhood cancer survivors. This study findings are consistent with the previous researches that have indicated that anticancer therapy may disrupt normal tooth development leading to the formation of structural flaws which may resemble or cover pathological conditions (9). In addition, dental defects are frequent among survivors making it more difficult to evaluate them clinically because deformed tooth shape and vitality changes may not always align with the traditional diagnostic standards (10).

Children may also be predisposed to malignancy or have a difficult time being diagnosed due to oral health alterations that are a result of nutritional deficiencies and systemic disorders. Deficiency of necessary vitamins can lead to alteration of mucosa, retarded healing, and predisposition to lesions that can be similar to malignant diseases (11). Similarly, the pathology of the endocrine system and the metabolic processes influence the well-being of the oral tissues and immune responses and makes the clinical image even more complicated (12).

These findings demonstrate the importance of a well-rounded approach to patient assessment, considering both local and systemic factors. Medico-legal consequences of misdiagnosis play a significant role in endodontics. Failure to detect cancerous lesions and failure to handle them could lead to bad consequences and legal consequences on practitioners. Based on the literature, the appropriate diagnosis, documentation, and timely referral are essential components of ethical and professional dental practice (13). Differentiation skills between benign and malignant cases are essential to endodontists and general dentists. The development of extranodal lymphomas and other malignancies in the oral cavity also complicates the diagnosis process since they resemble the typical dental conditions. Such lesions may be either swelling, ulceration or radiographic lesions and such lesions may be hard to clinically differentiate without the use of histopathology (14, 15).

Association of systemic illnesses such as diabetes with oral health complicates the diagnosis of oral malignancies. Metabolic disorders can influence periodontal and pulpal health and obscure underlying malignancies or change their clinical presentation (16). Moreover, a greater amount of general epidemiological data showcases the importance of disease patterns and health care system responses in addressing complex diseases (17). The pooling of the information regarding a number of privatized clinics in Lahore and Multan within the context of the provided study provides some valuable information on the tendencies and issues of oral cancer diagnosis in children in the area. The integration of dental and medical care can be improved, particularly in developing regions, to achieve improved clinical outcomes and decreased delayed diagnosis in children.

Conclusion

This paper concludes that presentation of oral cancer in children is generally similar to endodontic disease that results in misdiagnosis and late treatment. The performance of the private clinics in Lahore and Multan demonstrates that the inability to heal ulcers, swelling and periapical radiolucencies are the typical signs and symptoms which are likely to be confused with normal dental infections. The fact that the number of cases of unnecessary endodontic surgeries is high shows that dental practitioners need to be more conscious of the necessity to enhance their diagnostic abilities. The early identification of abnormal signs, along with the sufficient radiographic and histopathological analysis is critical to the proper diagnosis. Interprofessional integration between the medical and dental care providers is relevant in timely referral and efficient management. Patient outcomes can be enhanced by strengthening clinical protocols and by educating the practitioners. Finally, oral health assessment should be part of the practice of pediatric oncology to minimize morbidity and improve the quality of life and enable early diagnosis of malignancies in children.

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