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Review Article

Unveiling the spectrum: Pediatric oral lesions demystified

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ABSTRACT:
Pediatric oral pathology spans a wide range of conditions, from common issues like aphthous ulcers and traumatic injuries to more complex disorders such as viral infections and developmental anomalies. Accurate diagnosis and effective treatment planning typically involve a blend of clinical examination and histopathological analysis. Sometimes, radiographic imaging is necessary for a thorough assessment. Early recognition and proper management are crucial for optimizing outcomes and minimizing complications in young patients. Effective communication with caregivers is essential, including educating them about oral health and addressing their concerns comprehensively. Ongoing research and collaborative efforts are vital to advancing our understanding and improving diagnostic and therapeutic strategies in pediatric oral pathology. Continual professional development is essential for dental professionals to stay abreast of emerging trends and best practices in managing these conditions. This review offers valuable insights for pedodontists, dental surgeons, as well as undergraduate and postgraduate students, providing comprehensive knowledge on pediatric oral pathologies and precise treatment approaches to ensure optimal oral hygiene.
Keywords: Pediatric dentistry, Oral & maxillofacial Pathology, Oral Lesions, Management, Biopsy

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INTRODUCTION

Pediatric oral pathology encompasses a wide range of conditions from benign mucosal lesions to complex neoplastic and immunologic disorders.[1]These conditions, although primarily affecting the oral cavity can indicate broader systemic issues. Due to gaps in parental education and awareness, these conditions often go undiagnosed or untreated.[2] Effective management requires deep knowledge of various lesions and precise clinical assessment for accurate diagnosis, prognosis, treatment, and counseling of parents.[3] Children and adolescents present with diverse oral lesions affecting both hard and soft tissues of the mouth and face, including mucosal conditions, developmental anomalies, and inflammatory or neoplastic growths.[4] Many common oral lesions, such as aphthous ulcers, traumatic injuries, and viral infections like herpes labialis, can be diagnosed clinically. However, others such as mucoceles or viral papillomas may necessitate biopsy or surgical removal for definitive treatment.[5] Healthcare providers must skillfully distinguish normal oral tissues from pathological conditions such as gingivitis or periodontal abnormalities. Early identification of dental abnormalities, like primary tooth mobility or premature loss, can indicate

underlying medical issues.[6] Parents often express concern over any irregularities in their children's oral cavity, underscoring the importance of educating them about common oral conditions and providing reassurance about appropriate management strategies.[7] The prevalence of pediatric oral lesions is estimated at 4-10% in the United States, excluding infants.[8] Neonates with intraoral lesions require comprehensive assessment, diagnosis, and management, alongside parental counseling, to ensure timely intervention for both common and rare oral presentations.[9] Knowledge of oral diseases through epidemiological studies have an important role in public health, since they reveal the prevalence, incidence and progression of several diseases that affect the oral cavity, and particularize their distribution into characteristics of the environment where they are being executed.

The prevalence of oral lesions in children is demonstrated in the literature on retrospective studies that used oral biopsies performed in oral diagnostic centers in various countries or even by epidemiological studies related to specific conditions in pediatric populations, such as age, gender, systemic alterations and allergies.[10] The adult and the child/adolescent populations are different in many ways, not only because of their sizes. It is known, for example, that children and adolescents are more often target by certain lesions. Studies from various regions highlight disparities in the prevalence and understanding of pediatric oral lesions across different demographics and geographical areas. Continued research is essential to enhance our understanding and management of these conditions among children worldwide.[11]

DISCUSSION

Pediatric patients often present with a range of intraoral lesions that necessitate accurate diagnosis, treatment, or referral for dental evaluation. Regular review of oral soft-tissue pathology is crucial for enabling medical teams to identify both common and rare abnormalities in children.[12] Recent advances have enhanced the understanding and management of pediatric periodontal diseases, making previously untreatable conditions more manageable.[13] Early detection of these conditions can be life-saving. Globally, the prevalence of oral soft tissue pathologies in children varies significantly.[14] In Saudi Arabia, reactive lesions such as pyogenic granulomas and fibromas are commonly observed, along with mucus extravasation phenomena affecting the salivary glands.[15] Thailand similarly reports a higher incidence of reactive lesions compared to tumors, tumor-like growths, or dental cysts.[16]In contrast, Australia identifies mucoceles as the most prevalent pathology, followed by dentigerous cysts, hemangiomas, and pyogenic granulomas.[17] In India, cysts are the most common, followed by reactive lesions, non-odontogenic tumors, odontogenic tumors, and fibro-osseous lesions.[18]

Poland's findings reveal that aphthous ulcers and mucoceles are the most common oral lesions, with morsicatio buccarum being the third most frequent pathology among boys but least common among girls; papillomas are the third most frequent lesion among girls.[19] Malignancies, including non-Hodgkin lymphoma, rhabdomyosarcoma, and squamous cell carcinoma, are rare across these studies.[20] The distribution of oral mucosal lesions in young children generally shows the lip as the most commonly affected site, followed by the tongue, gingiva, buccal mucosa, jaw, palate, floor of the mouth, salivary glands, and lymph nodes.[21] Specifically, in Saudi Arabia, the gingiva is notably more affected than other oral sites .[22] Dental pathologies predominantly impact the mandible, while salivary gland pathologies are more common in the lower lip. Severe cases often show a male predominance, whereas cystic lesions are more frequently observed in females compared to other types of lesions.[23] Lower socioeconomic status correlated with higher rates of oral lesions, and school-aged children generally underwent more histopathology examinations compared to preschoolers. These studies aimed to assess the prevalence of Oral Lesions in pediatric patients aged 0 to 18 years, diagnosed via biopsy in the oral pathology department of an academic institution in Saudi Arabia, and investigated potential associations between Oral lesions types and demographic variables.[24]

Oral Lesions: Epstein pearls: These are non-odontogenic cysts that arise from epithelial remnants entombed along the fusion line of the palatal halves. These smooth, whitish papules are filled with keratin and typically range in size from 1-4 mm. They are benign and resolve spontaneously within the first 3 months of life, making treatment unnecessary. The incidence rate of Epstein pearls is approximately 7.3 per 1000 live-born male newborn babies.[25]

Bohn's Nodules: Bohn's nodules are remnants of minor salivary gland epithelium, typically asymptomatic, appearing as smooth, whitish, keratin-filled nodules or papules ranging from 1-3 mm in diameter. They are commonly found on the buccal and lingual aspects of the dental ridges away from the midline. These nodules resolve spontaneously within the first 2 to 3 months of life and have an incidence rate of approximately 47.4%.[26]

Dental Lamina Cysts They arise from remnants of the dental lamina. They are asymptomatic, usually presenting as multiple, 1-3 mm nodular creamy white lesions bilaterally on the anterior aspect of the dental ridges. Histopathological examination reveals keratin-filled true epithelial cysts. These lesions are present at birth and typically resolve without any intervention.

The prevalence of dental lamina cysts ranges from 25% to 53%.[27]

Congenital epulis of the newborn: Granular cell tumors, also known as Neumann's tumors, are rare benign growths that often appear as bulging masses on the gums of newborn infants. Despite their benign nature, their exact origins remain uncertain. The tumors present as solitary, firm lesions with a smooth surface, typically pink or red in color and non-tender when touched. They can range in size from small nodules to over 7 cm in diameter. Larger tumors may obstruct breathing and feeding, posing significant challenges.[28] Diagnosis involves evaluating the tumor's location, prenatal or birth history, and using imaging techniques like ultrasound (US), computed tomography (CT) scan, or Magnetic Resonance Imaging (MRI). Histopathological examination reveals scattered odontogenic epithelium and characteristic absence of interstitial cells, angulate bodies, and vessels. Treatment typically involves surgical removal. Granular cell tumors are exceedingly rare in newborns, predominantly affecting females, with an incidence of 0.0006.[29]

Eruption cyst: The eruption cyst is a soft, benign cyst that develops around an erupting tooth when the dental follicle separates from the tooth crown, causing fluid accumulation. It usually presents as a dome-shaped lesion and its color can range from normal to blue-black, purple, or brown, depending on the amount of blood present in the cystic fluid, such as in hematomas. It is also referred to as eruption hematoma and may sometimes appear transparent. As the tooth breaks through the cyst, the lesion usually resolves on its own. Surgical intervention to open the cyst's roof may be necessary if it becomes infected or fails to rupture. Eruption cysts have a prevalence rate of 22%.[30]

Epidermoid and dermoid cysts: This slowly developing, asymptomatic cyst typically originates in the floor of the mouth or submental region. These soft, cystic lesions appear as nodules with a broad base and are lined with squamous epithelium. An epidermoid cyst is lined by epidermal cells, whereas a dermoid cyst is lined with skin adnexal glands. Clinical diagnosis often occurs due to the cyst's enlargement, which can cause respiratory and feeding difficulties.[31] Diagnostic tests may include MRI, CT, prenatal or postnatal Ultrasonography (USG), Fine Needle Aspiration Biopsy (FNAB), and histopathology. Surgical enucleation, which involves the complete removal of the cyst, is the preferred treatment option, and recurrence is exceedingly rare. The prevalence of these cysts is 7% among head and neck patients and 1.6% in the oral cavity.[32]

Mucocele: This lesion presents as a bluish, well-defined, translucent, fluctuant swelling. It commonly occurs on the lower lip, lateral to the midline. It forms when the excretory duct of a minor salivary gland ruptures due to mechanical trauma, causing mucin leakage into surrounding connective tissues encapsulated by fibrous tissue. The lesion may appear normal or whitish and keratinized. It can also manifest in the retromolar region, buccal mucosa, ventral tongue surface, and floor of the mouth, known as a ranula. Superficial mucoceles typically resolve spontaneously by bursting and may result in a shallow ulcer. Treatment aims to reduce the risk of recurrence. The prevalence is approximately 2.4 cases per 1000 people.[33]

Riga-Fede disease: Natal or neonatal teeth can cause ulcers on the ventral tongue surface, lip, gingiva, vestibular mucosa, palate, and floor of the mouth due to friction during feeding. If not diagnosed and treated promptly, these lesions can lead to dehydration and malnutrition. Treatment typically involves conservative measures to round and smooth the incisal edges of the teeth. In severe cases, extraction may be required. Diagnosis is made through clinical examination and histopathology to exclude other causes such as bacterial or fungal infections, immunologic diseases, and neoplasia. The prevalence of natal or neonatal teeth ranges from 1 in 6000 to 1 in 800 births.[34]

Neonatal osteomyelitis of maxilla Neonatal osteomyelitis of the maxilla is a rare infection linked to factors such as catheter use, prolonged hospital stays, and ventilator support, often resulting in hospital-acquired or iatrogenic infections.[35] The condition is primarily caused by bacteria such as Staphylococcus aureus, group B Streptococcus (Streptococcus agalactiae), and Gram-negative organisms including Escherichia coli and Klebsiella pneumoniae.[36] A key characteristic is pronounced swelling on the affected side of the face, which impacts both eyelids and is accompanied by proptosis (eye bulging) and chemosis (conjunctival swelling).[37] Additional symptoms encompass conjunctivitis, cheek swelling, and unilateral nasal discharge. Chronic osteomyelitis is rare in children. Diagnosis is confirmed through positive blood cultures and laboratory tests such as erythrocyte sedimentation rate, C-reactive protein levels, and leukocyte count. Treatment typically involves intensive antimicrobial therapy, often combined with surgical intervention. The outlook is generally unfavorable due to the significant morbidity linked with the infection. The incidence is estimated at 1 to 3 cases per 1,000 births. [38]

Neonatal candidiasis: This condition spreads via external contamination in premature infants. The Candida species implicated are Candida albicans (75%), krusei, glabrata, tropicalis, and parapsilosis.[37] Risk factors include prolonged hospitalization,

underdeveloped immune systems, and extended catheter use. It presents as white patches containing hyphae, epithelial cells, and necrotic tissue on the mouth's mucous membranes. Systemic symptoms encompass endophthalmitis, meningitis, urinary tract, and cardiovascular infections. Diagnosis involves confirming through blood culture, urine analysis, and cerebrospinal fluid examination. Treatment primarily focuses on preventive measures. The prevalence of disseminated candidiasis among premature infants ranges from 7% to 20%.[39]

Neonatal herpes simplex virus infection: Acute herpetic gingivostomatitis, a symptomatic manifestation of initial Herpes Simplex Virus Type 1 (HSV-1) exposure, typically occurs in children who encounter HSV-1, often by age five, though the initial infection may be subclinical. Up to 30% of children may develop this condition within a week of exposure to an infected individual.[40] The clinical presentation includes numerous tiny vesicles that rapidly rupture, forming painful, irregular ulcerations covered by yellow-gray membranes. Accompanying symptoms often include submandibular lymphadenitis, halitosis, and a refusal to eat or drink, with prodromal symptoms such as fever (>38 °C or 100.4 °F), anorexia, irritability, malaise, sleeplessness, and headache appearing 3–4 days before the lesions.[41] While HSV-1 is the primary cause, HSV-2 can rarely be involved. Lesions affect both keratinized and non-keratinized mucosa, with the gingiva frequently inflamed and painful. Differential diagnoses include erythema multiforme and recurrent aphthous stomatitis. Treatment focuses on palliative care, including maintaining fluid intake and good oral hygiene, to prevent dehydration, the most common complication.[42] Medications such as topical anesthetics like viscous lidocaine, mouth rinses containing Benadryl and Kaopectate, and over-the-counter children's Tylenol can aid in managing symptoms.[43] However, viscous lidocaine carries a black box warning for children under 3 years due to severe risks including seizures and cardiopulmonary arrest; thus, its use should be avoided in this age group, and pediatric consultation is recommended for immune compromised or very young children.[44] Transmission of neonatal herpes simplex virus infection occurs during delivery and depends on maternal infection status, antibody levels, and muco cutaneous barrier integrity.[45] Symptoms may include vesicles in the mouth, face, scalp, palms, and feet, with severe manifestations such as hepatitis, pneumonitis, seizures, and disseminated intravascular coagulation. Diagnosis involves viral culture, serology, and Polymerase Chain Reaction analysis of cerebrospinal fluid, and treatment typically includes antiviral medication like acyclovir. The incidence of neonatal herpes simplex virus infection is about 31 cases per 100,000 births.[46]

Neonatal pemphigus vulgaris: This rare autoimmune vesiculobullous disorder arises from the transfer of maternal IgG autoantibodies across the placenta, targeting the transmembrane glycoprotein desmoglein three. It manifests with multiple ulcers affecting mucosal, cutaneous, or mucocutaneous areas postnatally. These blisters can appear on the soft palate, ventral tongue surface, gingiva, buccal mucosa, and lower lip. In advanced stages, desquamative or erosive gingivitis may develop.[47] Additional oral symptoms may include bad breath, excessive saliva production, and dark crusts at the lips' edges. Symptoms typically resolve within 2 to 3 weeks. Diagnosis is confirmed through histopathology and immunofluorescence testing. The incidence is approximately 0.68 cases per 100,000 persons annually, although regional rates may vary.[48]

Infantile hemangioma is a benign vascular neoplasm that presents as a macule at birth, progressing to spotted pigmentation within weeks. It typically undergoes rapid growth during the first year, followed by involution from ages 1 to 5, and resolution by ages 5 to 10. Commonly affected areas include the head, neck, trunk, and mucosal surfaces. Risk factors include infant age, low birth weight, and gestational hypertension. Diagnosis is based on clinical history, imaging techniques such as Fine Needle Aspiration Cytology (FNAC), MRI, and Doppler Ultrasonography (USG), as well as histopathology and immunohistochemistry. Treatment options depend on the stage and may include α-interferon, propranolol, corticosteroids, surgery, or laser therapy. While some cases resolve completely, others may result in residual skin changes.[49]

Melanotic Neuroectodermal Tumor of Infancy: A rare pigmented benign neoplasm typically presenting within the first 6 months, with a male predominance. Originating from neural crest cells, it affects various sites including the craniofacial region and genitals. It appears as a painless, pigmented, rapidly growing lesion with local aggressiveness. Diagnosis is based on clinical assessment, histopathology, and imaging (CT/MRI). Treatment includes chemotherapy, radiotherapy, and surgical excision due to high recurrence and metastasis rates.[50]

Restrictive mandibular lingual frenum/Ankyloglossia or Tongue Tie: This developmental condition features a thick, tight, short band of tissue called the lingual frenum that restricts tongue movement. This restriction can cause discomfort during breastfeeding in newborns, limited tongue mobility, speech difficulties, malocclusion, and swallowing problems.[51] It can also lead to localized gingival recession on the lingual side of the lower incisors. The severity ranges from partial restriction to complete fusion of the tongue to the floor of the mouth.[52] Ankyloglossia may occur alone

or in conjunction with craniofacial anomalies. Treatment typically involves frenuloplasty, a surgical procedure to release or lengthen the frenum, improving tongue function and alleviating symptoms. The condition affects 0.1% to 4.8% of the population.[53]

Mandibular Labial Frenum located in the shallow vestibular area near the mandibular central incisors, a high frenum can cause issues when it inserts into the free gingival tissue. This can trap food and plaque, leading to inflammation, pocket formation, gingival recession, and potential bone loss if untreated. Corrective procedures include frenuloplasty, frenotomy, or frenectomy, depending on severity. Post-surgery care involves a soft diet, oral hygiene instructions, and pain relief. Electrocautery or laser surgery may provide benefits such as reduced operation time, improved hemostasis, fewer complications, less pain, better patient comfort, and no need for suture removal. Avoiding frenum laceration is crucial to prevent significant bleeding. In primary dentition, interdental spacing occurs in approximately 70% of cases in the upper jaw and 63% in the lower jaw.[54]

Odontogenic infections are typically polymicrobial, involving aerobic, facultative anaerobes, and strict anaerobes. They develop intraorally through basic inflammatory processes, involving relevant pathogens and biochemical processes mediated by pro-inflammatory molecules.[55] These infections manifest as intraoral septic processes and are often secondary to caries, trauma, or periodontal issues, sometimes affecting multiple teeth. Soft tissue infections of odontogenic origin spread along paths of least resistance from affected tooth supporting structures to nearby potential spaces.[56] Pus accumulation requires bone perforation, typically at its thinnest and weakest site, before extending into periapical or deeper facial areas. Intraoral infections occur if pus perforates through the buccal plate within the buccinator muscle attachment, while extraoral infections occur if perforation is outside this attachment. Untreated odontogenic infections may lead to abscesses, pain, cellulitis, discomfort when eating or drinking, and dehydration. Upper facial infections present with facial pain, fever, difficulty eating or drinking, and can be challenging to localize.[57] Sinusitis can mimic odontogenic infection symptoms and should be ruled out. Lower facial infections involve pain, swelling, and trismus, potentially affecting skin, teeth, lymph nodes, and salivary glands.[58]Management includes pulp therapy, incision and drainage, or tooth extraction. Antibiotics are necessary for systemic manifestations such as facial cellulitis, difficulty swallowing or breathing, fatigue, high fever (102 to 104 degrees Fahrenheit), and nausea. Rare severe complications like Ludwig's angina and cavernous sinus thrombosis may be life-threatening; requiring immediate hospitalization, intravenous antibiotics, incision and drainage, and referral to oral and maxillofacial surgeon.[59] Diagnosing pediatric oral lesions relies on a thorough history, assessment of risk factors, and detailed examination of signs and symptoms. Initial management is determined by the likely diagnosis of the lesion.[60] A definitive diagnosis is confirmed through biopsy of the affected tissue, considered the gold standard for diagnosis. Biopsy involves removing a portion of live tissue for diagnostic study. Excisional biopsies entail total removal of small lesions under one centimeter, while incisional biopsies are performed on larger, diffuse, or multifocal lesions suspected of malignancy; multiple incisional biopsies may be necessary for diffuse lesions. Adjunctive tests such as fine needle aspiration, exfoliative cytology, and the cytobrush technique can aid in diagnosis.[61] Biopsy specimens from the oral and maxillofacial region are sent for histopathology, excluding carious teeth without soft tissue attachment, extirpated pulp, and normal tissue from gingival recontouring.[62] The patient record should document a detailed description of the removed tissue. A biopsy is indicated for lesions persisting over two weeks despite treatment or removal of causative agents. When differential diagnosis suggests multiple conditions or neoplasms, both hard and soft tissues should be evaluated by a pathologist. Histopathology provides crucial information on clinical behavior, definitive diagnosis, prognosis, and guides further treatment or follow-up, enhancing evidence-based care and improving outcomes.[63] Pediatric dentists are qualified to perform oral biopsies for various lesions, including gingival hyperplasia that does not respond to oral hygiene, mucocele, pyogenic granuloma, other reactive gingival lesions, squamous papilloma (oral wart), irritation fibroma, periapical cysts or granulomas (with or without attachment to extracted teeth), inflamed operculum, hyperkeratosis of uncertain origin, benign migratory glossitis with atypical or stationary patterns, smokeless tobacco keratosis, persistent oral ulcers, mucocutaneous diseases, odontoma, and dentigerous or dental follicle cysts.[64]
The study of oral lesions reveals considerable variability in classification due to differing systems and age ranges.[65] Despite this variability, mucocele remains the most common lesion among children aged 0 to 12 years. In Brazil, referral centers in Pernambuco, Minas Gerais, and Rio Grande do Sul exhibit varying prevalence rates, with children in these states constituting 10.54%, 8.97%, and 8.26% of the population, respectively.[66] Histopathological evaluations provide greater accuracy compared to clinical assessments, which can often be inconclusive. This study identified a 5.2% prevalence of oral lesions, aligning with the 5% to 8% range found in other research.[67] Variations in prevalence are likely due to differences in study design, including factors such as duration, age limits, healthcare access, and

cultural influences. While some studies report a higher incidence of lesions in females and others in males, this study found similar prevalence across genders.[68] Age stratification indicates that preadolescent children, especially those aged 9–12 years, are more prone to oral lesions, supporting the findings of Jaafari-Ashkavandi and Ashraf, which emphasize the impact of rapid growth and odontogenic activity in this developmental stage. Inflammatory lesions, such as mucocele, pyogenic granuloma, and ranula, were identified in 51.8% of cases.[69] Benign neoplasms, including odontomas, squamous cell papillomas, and ameloblastomas, were seen in 16.9% of children. Cysts were the most common lesions, affecting 21.3% of the pediatric population, with dentigerous cysts, odontogenic cysts, and radicular cysts being the most prevalent.[70] The high prevalence of cystic lesions in the 9–12-year age group reflects their association with the development of third molars and upper canines, influencing treatment strategies based on age and tooth development.[71] The lips were the most frequently affected site, accounting for 34.5% of lesions, consistent with other studies. Mechanical traumas, such as chronic lip biting and cheek suction, contribute to inflammatory lesions like mucocele and ranula.[72] Cysts were the second most common lesions, affecting 21.3% of children, with the mandible being the most frequent site.[73] Among cysts, dentigerous cysts were the most prevalent, followed by odontogenic cysts and radicular cysts, which are often underreported due to limited histologic examination. Benign neoplasms, including odontomas, were the third most common lesions, supporting findings from studies in other regions, such as Turkey.[74] Non-neoplastic bone diseases, particularly benign fibro-osseous lesions, were frequent, especially in the maxilla of girls aged 9 to 12 years.[75] Malignant neoplasms were rare, occurring in approximately 1 in 100 children, with four cases of oral squamous cell carcinoma. The mean age for patients with malignant neoplasms was 7.0 years, and for those with squamous cell carcinomas was 7.2 years.[76]Although oral squamous cell carcinoma is uncommon in this age group, some studies report similar findings.[77] Contributing factors to this type of cancer may include nutritional deficiencies, viruses, sporadic mutations, and passive smoking. None of the children in the present sample had a history of smoking, alcohol consumption, or Human Papilloma Virus infection.[78] However, passive smoke exposure, which significantly impacts morbidity and mortality, is linked to early development of respiratory diseases, behavioral issues, and an increased risk of childhood cancer. The prevalence of oral lesions may be influenced by various factors, including economic status, which affects attitudes toward self-care and acceptance of biopsies. Differences in lesion prevalence may also vary by region and gender, warranting further investigation into these variations.[79]

CONCLUSION

Oral lesions in neonates hold significant importance in pediatric dentistry, as they can indicate underlying systemic conditions. Unfortunately, these conditions are sometimes misdiagnosed or untreated due to lack of parental education, awareness, and resources. Managing these lesions requires in-depth knowledge and precise clinical assessment for accurate diagnosis, prognosis, treatment, and parental guidance. Many of these lesions are asymptomatic and benign, often resolving on their own without intervention. However, effective management of pediatric oral pathology demands a thorough understanding of various oral conditions. Clinicians must be adept at clinical and radiographic examinations, and may need additional investigations for precise diagnosis, predicting outcomes, planning treatment, and providing comprehensive parental counseling.

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