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Odontogenic Cysts: Contemporary Diagnostic Principles, Radiographic Assessment, and Evidence-Based Surgical–Pathologic Management in Dental Practice

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Abstract

Background: Odontogenic cysts are epithelial-lined cavities arising from odontogenic tissues, commonly detected incidentally during routine dental imaging. Their clinical significance lies in diagnostic overlap with aggressive odontogenic tumors, necessitating accurate identification and management.

Aim: To review contemporary diagnostic principles, radiographic assessment, and evidence-based surgical–pathologic management of odontogenic cysts in dental practice.

Methods: A comprehensive literature synthesis was performed, integrating epidemiologic data, pathophysiologic mechanisms, histopathologic features, and clinical evaluation strategies. Emphasis was placed on classification (inflammatory vs. developmental), imaging characteristics, and treatment modalities supported by outcome data.

Results: Periapical cysts represent the most prevalent subtype (≈60%), followed by dentigerous cysts (≈20%). Radiographically, most cysts appear as well-demarcated radiolucencies, but imaging alone cannot reliably distinguish subtypes. Histopathology remains the gold standard for definitive diagnosis. Management strategies vary: inflammatory cysts respond to endodontic therapy or enucleation, while developmental cysts often require extraction of associated teeth with curettage. High-recurrence entities such as odontogenic keratocysts and glandular odontogenic cysts demand aggressive surgical approaches and long-term surveillance.

Conclusion: Accurate diagnosis of odontogenic cysts requires integrated clinical, radiographic, and histopathologic evaluation. Tailored management—ranging from conservative endodontic therapy to surgical excision—optimizes outcomes and minimizes recurrence risk. Long-term follow-up is essential for high-risk lesions.

Keywords: Odontogenic cysts, periapical cyst, dentigerous cyst, keratocyst, radiographic diagnosis, histopathology, enucleation, recurrence.

Introduction

Odontogenic cysts constitute a diverse group of pathologic epithelial-lined cavities that arise from tissues involved in tooth development and eruption. In routine dental practice, these lesions are frequently detected incidentally during periodic clinical examinations and radiographic surveys, particularly because many odontogenic cysts remain asymptomatic until they attain sufficient size to produce cortical expansion, tooth displacement, or secondary infection. Their clinical significance lies not only in their prevalence but also in their capacity to mimic more aggressive odontogenic tumors and other jaw lesions, thereby creating diagnostic uncertainty and necessitating a systematic approach to evaluation and management. From a diagnostic standpoint, odontogenic cysts are traditionally categorized as either inflammatory or developmental, reflecting differences in etiology and pathogenesis. This classification is clinically useful because it informs the likely relationship of the lesion to adjacent teeth, helps anticipate biologic behavior, and supports decisions regarding definitive treatment and follow-up. Inflammatory odontogenic cysts typically arise as sequelae of pulpal necrosis and chronic periapical inflammation, whereas developmental cysts arise from remnants of odontogenic epithelium associated with normal odontogenesis or tooth eruption. Despite this conceptual distinction, there can be overlap in clinical presentation, and definitive categorization often relies on histopathologic correlation [1]. Radiographically, odontogenic cysts classically appear as radiolucent

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lesions that may be unilocular or multilocular and are frequently surrounded by a well-defined, corticated border suggesting slow growth and a benign process. However, radiographic appearance alone is insufficient for a definitive diagnosis because multiple odontogenic and non-odontogenic entities share similar imaging characteristics. Critically, odontogenic cysts cannot be reliably differentiated from one another based solely on radiographic features, and some may closely resemble aggressive odontogenic tumors, including lesions that exhibit locally destructive behavior or higher recurrence potential (see Image. Radiograph, Odontogenic Cyst in the Right Mandible). This limitation emphasizes the need for a comprehensive diagnostic strategy that integrates clinical history, vitality testing of adjacent teeth, lesion location and relationship to tooth structures, advanced imaging when appropriate, and ultimately histopathologic examination of the surgical specimen [1].

Inflammatory odontogenic cysts encompass lesions that are strongly associated with inflammatory stimuli originating from infected or necrotic pulpal tissue. These include the periapical cyst, which typically develops at the apex of a nonvital tooth as a consequence of chronic periapical inflammation; the residual cyst, which persists in the jaw after extraction of the offending tooth when the cystic lining is not completely removed; and the paradental cyst, which is commonly associated with partially erupted mandibular molars and may be linked to pericoronitis or chronic inflammatory changes in the adjacent periodontal tissues.[1][2] In clinical settings, these cysts may be suspected when radiolucencies are found in proximity to nonvital teeth or areas of prior extraction, but confirmatory diagnosis requires careful evaluation and tissue analysis. Developmental odontogenic cysts comprise a broader category of lesions derived from developmental odontogenic epithelium. This group includes the dentigerous cyst, classically associated with the crown of an unerupted or impacted tooth; the eruption cyst, a soft tissue counterpart that overlies an erupting tooth; the lateral periodontal cyst, typically located along the lateral root surface of a vital tooth; and the gingival cyst, which arises within gingival soft tissues. Of particular clinical importance are the odontogenic keratocyst (OKC) and the orthokeratinizing odontogenic cyst, entities that may share overlapping features but can differ in biologic behavior and recurrence risk. Glandular odontogenic cysts are also classified within the developmental category and are notable because they may display more aggressive behavior and diagnostic complexity due to histologic overlap with other lesions.[1] In summary, odontogenic cysts are commonly encountered jaw lesions that are often discovered incidentally but can pose substantial diagnostic challenges. While they are broadly classified into inflammatory and developmental groups, their radiographic similarity—both among cyst types and with aggressive odontogenic tumors—means that imaging alone cannot establish a definitive diagnosis. Consequently, accurate identification requires an integrated clinical–radiographic assessment supported by histopathologic confirmation, ensuring that patients receive appropriately tailored management and follow-up based on the lesion's true nature and biologic potential.[1][2]

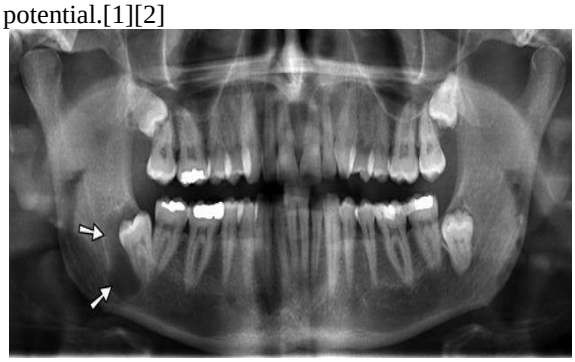

Fig. 1: Radiograph, Odontogenic Cyst in the Right Mandible.

Etiology

A cyst is defined histologically as an epithelial-lined cavity, and this defining feature is central to understanding the origin of odontogenic cysts. In the jaws, odontogenic cysts arise from odontogenic epithelium—epithelial tissues and remnants that participate in tooth formation and subsequently persist as residual "rests" after odontogenesis is complete. The principal sources of odontogenic epithelium implicated in cyst formation include reduced enamel epithelium (REE), epithelial cell rests of Serres, and epithelial rests of Malassez (ERM).[1] These epithelial components are normally quiescent, but under particular developmental or inflammatory stimuli they may proliferate, undergo cystic degeneration, and form a pathologic cavity that expands within bone or soft tissue. The REE is the epithelial layer that surrounds the developing crown of the tooth. After enamel formation is completed, this epithelium persists as a thin layer that contributes to the follicular apparatus of unerupted teeth, thereby providing a biologic substrate from which certain developmental cysts can arise.[1] The epithelial rests of Serres represent remnants of the dental lamina, the epithelial structure responsible for initiating tooth development during early embryogenesis. Tooth formation begins around the sixth week of embryonic life, and as development proceeds, the dental lamina degenerates, leaving behind epithelial islands and strands embedded within the gingiva and jawbones.[2] The ERM are residual epithelial cells derived from the disintegration of Hertwig's epithelial root sheath, a structure that orchestrates root formation. Once the root sheath fragments, epithelial remnants remain in the periodontal ligament space near the tooth root, where they may persist indefinitely.[2] Over time,

these epithelial rests become entrapped within the maxillary and mandibular gingiva and the alveolar bone, establishing the anatomic and cellular basis for cyst development when activating stimuli occur.[2]

Among odontogenic cysts, periapical cysts are inflammatory in origin and represent the most common subtype encountered in clinical practice. They typically develop at the root apex of a non-vital tooth, most often secondary to pulpal necrosis caused by dental caries or trauma.[3] In this setting, chronic periapical inflammation promotes activation and proliferation of the ERM located around the apex of the affected tooth. This epithelial proliferation, coupled with inflammatory exudation and tissue breakdown, contributes to formation of a cystic cavity. As the lesion becomes established, osmotic forces are believed to play a role in expansion: breakdown products and inflammatory mediators increase solute concentration within the lumen, raising osmotic pressure and drawing in fluid, which promotes progressive enlargement.[2] Importantly, not all periapical inflammatory lesions evolve into true cysts. In many cases, ERM proliferation is limited or absent, and the periapical response manifests instead as granulation tissue at the apex, termed a periapical granuloma. By definition, a periapical granuloma lacks an epithelial lining on histology, distinguishing it from a cyst, and it has been considered by some authors to represent a potential precursor stage in the evolution of a periapical cyst.[2] Residual cysts share a similar inflammatory pathogenesis and are closely related to periapical cysts in both clinical behavior and microscopic appearance. A residual cyst develops when a periapical cyst is not completely removed at the time of tooth extraction, leaving cystic epithelium behind within the alveolar bone. The lesion may persist and enlarge in the edentulous area, sometimes remaining asymptomatic and only being identified on radiographic examination. Microscopically, residual cysts are identical to periapical cysts, reinforcing the concept that the primary difference between the two is the clinical circumstance—persistence after extraction—rather than a distinct histopathologic entity.[1][2]

Paradental cysts represent another inflammatory odontogenic cyst type, with terminology that may vary depending on location and clinical context. When associated with mandibular molars, particularly in specific anatomic patterns, they may be referred to as buccal bifurcation cysts or mandibular infected buccal cysts. These lesions occur adjacent to the crown or root of a partially or fully erupted tooth and are often located on the buccal, mesial, or distal aspects.[2][4][2] Their etiologic basis is inflammation of the junctional epithelium within the gingival sulcus of an erupting or erupted tooth, frequently in association with pericoronitis or chronic periodontal irritation. A recurring anatomic contributor is the presence of a buccal enamel extension, which can predispose to plaque retention and localized inflammatory response, thereby triggering epithelial proliferation and cyst formation.[2][4][2] In contrast to these inflammatory entities, several odontogenic cysts are developmental in origin and arise through mechanisms related to tooth eruption, follicular dynamics, and persistence of odontogenic epithelial rests. Dentigerous cysts occur when fluid accumulates between the crown of an unerupted tooth and the enamel epithelium, resulting in dilation of the follicular space and, in many cases, inhibition of normal eruption.[2] Eruption cysts are regarded as the soft-tissue analogue of dentigerous cysts and are associated with erupting teeth when the dental follicle fails to separate normally from the overlying mucosa.[2] Lateral periodontal cysts are developmental lesions that arise from rests of Serres, reflecting their origin in dental lamina remnants.[2] Odontogenic keratocysts (OKC) are also developmental and are likewise derived from rests of Serres, a fact that aligns with their association with odontogenic epithelium and their characteristic keratinizing lining.[2] Orthokeratinizing odontogenic cysts are similarly developmental and arise from rests of Serres.[2] Glandular odontogenic cysts are developmental lesions believed to arise from rests of Serres or, in some cases, from ERM, consistent with their odontogenic epithelial origin and their distinctive gland-like histologic features. Collectively, the etiology of odontogenic cysts reflects the interplay between persistent odontogenic epithelial remnants and activating stimuli, whether inflammatory (as in periapical, residual, and paradental cysts) or developmental (as in dentigerous, eruption, lateral periodontal, keratinizing, and glandular odontogenic cysts).[1][2][3][4]

Epidemiology

Epidemiologic patterns of odontogenic cysts are clinically important because they inform diagnostic probability, guide differential diagnosis when radiolucent jaw lesions are discovered, and help clinicians anticipate typical anatomic distribution and age-related presentation. Although odontogenic cysts share overlapping clinical and radiographic features, their relative frequencies differ substantially, and large retrospective series have provided useful estimates of how commonly individual entities occur within the broader category of odontogenic cystic lesions. These distributions should be interpreted as approximations rather than absolute values, because reported rates vary by study design, referral patterns, population demographics, diagnostic criteria, and whether classifications were applied consistently across institutions. Nonetheless, the aggregate epidemiologic trends offer practical value in routine dental and oral–maxillofacial assessment. Periapical cysts are consistently identified as the most frequently reported odontogenic cysts. According to Johnson et al, periapical cysts comprise approximately 60% of all odontogenic cysts, establishing them as the dominant entity in most epidemiologic series.[3] This high

prevalence aligns with their inflammatory origin and their strong association with common dental diseases, particularly caries-related pulpal necrosis and apical periodontitis. Anatomic distribution data further indicate that periapical cysts are more commonly located in the maxilla, occurring there approximately 60% of the time.[3] This maxillary predominance is clinically relevant because periapical inflammatory lesions in the anterior maxilla are frequently detected during routine radiographic screening and may exhibit expansion into adjacent anatomical spaces, potentially complicating management when lesions enlarge or become secondarily infected.

Residual cysts, which represent persistent cystic lesions remaining after extraction of the associated nonvital tooth, are less common but still clinically significant, particularly in older adults and edentulous regions. Epidemiologic estimates suggest that residual cysts comprise approximately 5% of all odontogenic cysts.[3][4] Although their prevalence is far lower than periapical cysts, residual cysts can be detected incidentally on radiographs obtained for prosthodontic planning or implant assessment. Their persistence underscores the importance of thorough enucleation and curettage of periapical pathology at the time of extraction when cystic disease is suspected. Paradental cysts account for a relatively small proportion of odontogenic cysts, yet they are important because they may be clinically associated with pericoronitis-like symptoms and are often linked to molar regions. Available data indicate that paradental cysts comprise approximately 3% to 5% of all odontogenic cysts.[5] This relatively narrow range suggests a consistent but low prevalence across studies, and it reinforces the need to consider this diagnosis when cystic lesions are identified adjacent to partially erupted or erupted molars, especially when localized inflammatory signs are present. Among developmental odontogenic cysts, dentigerous cysts represent a major subgroup and are frequently encountered in association with impacted teeth. In the series cited, Johnson et al reported that dentigerous cysts comprise 20.6% of all odontogenic cysts.[4][1] Dentigerous cysts are also described as accounting for approximately 20% of mandibular cysts, highlighting their substantial contribution to mandibular cystic pathology.[4][1] These figures are clinically useful because they elevate dentigerous cysts as a leading consideration when a well-defined radiolucency is observed around the crown of an unerupted or impacted tooth, particularly in the mandibular third molar or maxillary canine region.

Eruption cysts are less commonly quantified in large series because many present in soft tissue and may resolve spontaneously or be managed conservatively without submission for histopathologic diagnosis. Nevertheless, they are known to occur primarily in young children during eruption of deciduous or permanent teeth, reflecting their developmental association with the eruption process. Lateral periodontal cysts are uncommon, accounting for less than 3% of all odontogenic cysts.[6] Their anatomic distribution is distinctive: approximately 70% occur in the mandibular canine-to-premolar region, whereas they occur less commonly in the canine-lateral region in the maxilla.[6] This localization pattern supports targeted diagnostic suspicion when a small, well-circumscribed radiolucency is identified along the lateral aspect of roots in these regions, especially adjacent to vital teeth. Odontogenic keratocysts (OKCs) have variable reported prevalence depending on classification approaches, but Johnson et al reported that they represent approximately 4% to 12% of all odontogenic cysts.[4] They also demonstrate age-related clustering, occurring more frequently in the second and third decades of life.[4] This epidemiologic profile, combined with their known propensity for recurrence, increases the clinical importance of early recognition and appropriate surgical planning. Orthokeratinizing odontogenic cysts are described as among the most uncommon odontogenic cysts and are reported to occur typically in males in their 40s, suggesting a demographic pattern that differs from OKCs and supporting consideration in the appropriate clinical context. Finally, glandular odontogenic cysts are rare, comprising less than 0.2% of all odontogenic cysts.[3] Despite their low prevalence, they are clinically important because diagnostic challenges and potential aggressive behavior have been described, making accurate recognition and histopathologic confirmation essential when such lesions are suspected. Overall, epidemiologic data indicate that periapical cysts predominate, followed by dentigerous cysts, while residual, paradental, lateral periodontal, keratinizing, orthokeratinizing, and glandular odontogenic cysts occur with lower frequency and more specific age and anatomic patterns.[1][3][4][5][6]

Pathophysiology

The pathophysiology of odontogenic cysts is heterogeneous and reflects the biologic behavior of the epithelial source, the presence or absence of inflammation, and the anatomic relationship of the lesion to teeth and surrounding periodontal structures. Although all odontogenic cysts share the defining characteristic of an epithelial lining, the mechanisms that initiate epithelial activation, promote cystic lumen formation, and drive progressive expansion differ by cyst subtype. In clinical terms, this variability explains why some odontogenic cysts behave as relatively indolent lesions, while others demonstrate more persistent growth, greater recurrence propensity, or more complex relationships with adjacent dentoalveolar structures. Periapical cysts arise through an inflammatory cascade linked to non-vital teeth. Bacterial infection and/or pulpal necrosis typically initiates apical periodontitis, leading to recruitment of inflammatory cells and the formation of granulation

tissue at the root apex. This chronically inflamed periapical tissue is a biologically active environment rich in cytokines, growth factors, and degradation products. As inflammation persists, tissue breakdown and exudative fluid accumulation increase the local osmotic gradient, thereby elevating osmotic pressure within the developing lesion. This osmotic environment contributes to cyst enlargement by drawing fluid into the lumen and promoting expansion of the cavity. Concurrently, inflammatory mediators stimulate proliferation of odontogenic epithelial remnants—classically the epithelial rests of Malassez in the periodontal ligament space—leading to formation of an epithelial lining that transforms an inflammatory periapical lesion into a true cyst.[1][2] While not every periapical lesion becomes cystic, this model explains the continuum from periapical granuloma to periapical cyst, with epithelial activation and sustained osmotic forces serving as key drivers of progression.[1][2]

Residual cysts are best understood as a persistence phenomenon rather than a distinct initiating mechanism. They represent remnants of periapical cysts that remain in the jaw after extraction of the associated tooth, typically due to incomplete removal of the cystic lining during prior surgery. Once retained, the epithelial-lined cavity may continue to exist as a space-occupying lesion, supported by ongoing low-grade inflammation, continued epithelial viability, and the same osmotic mechanisms that facilitate slow expansion. Clinically, this pathophysiology is important because residual cysts may enlarge silently in edentulous areas and may only be discovered incidentally during radiographic evaluation for prosthodontic or implant planning. Paradental cysts are inflammatory in origin but differ from periapical cysts in both anatomic site and initiating stimulus. Rather than arising at the root apex of a non-vital tooth, paradental cysts originate from the junctional epithelium of the gingival sulcus or from epithelial tissues near the cementoenamel junction on the lateral erupted aspect of a tooth, often in proximity to the root furcation.[5] Chronic localized inflammation—frequently associated with pericoronitis-like processes around molars, plaque retention, or anatomic enamel extensions—creates a microenvironment that stimulates epithelial proliferation and cystic degeneration. This localized inflammatory stimulation leads to development of an epithelial-lined cavity adjacent to the tooth, with expansion influenced by the same principles of fluid accumulation, osmotic gradients, and inflammatory mediator signaling that characterize other inflammatory cysts. In contrast, dentigerous cysts are developmental lesions associated with impacted teeth that fail to erupt normally. Their pathophysiology is centered on follicular dynamics: fluid accumulates between the enamel epithelium and the enamel surface of the crown, causing progressive dilation of the follicular space.[7] As the follicle expands, it forms a cystic cavity attached at the cementoenamel junction, and continued fluid accumulation may impede eruption and contribute to displacement of adjacent teeth or resorption of neighboring roots. This mechanism underscores why dentigerous cysts are classically linked to impacted third molars and canines and why their radiographic appearance frequently surrounds the crown of an unerupted tooth.

Eruption cysts are also developmental but arise in soft tissue rather than within bone, reflecting their relationship to the eruptive phase. They occur when blood or fluid accumulates within an expanding follicular space after separation of the dental follicle from the enamel of an erupting tooth.[8] The superficial location explains their clinical presentation as a fluctuant gingival swelling overlying an erupting tooth, sometimes with a bluish hue when hemorrhage contributes to the cystic contents. Lateral periodontal cysts are developmental lesions derived from remnants of the dental lamina situated along the lateral aspect of the root surface.[6] Their pathophysiology involves activation and cystic transformation of these epithelial rests in the periodontal region, typically adjacent to vital teeth. This origin accounts for their characteristic location between roots, often in the mandibular canine–premolar region, and supports why they may remain small and well circumscribed yet still require histologic confirmation due to overlap with other radiolucent entities. Odontogenic keratocysts are developmental and arise from remnants of the dental lamina.[2] Their epithelial lining exhibits keratinization, which is not merely a histologic feature but also a biologic characteristic that can influence lesion behavior and recurrence risk. Orthokeratinizing odontogenic cysts are likewise developmental and originate from the dental lamina remnants.[2] Although both entities share a lamina-derived origin, their epithelial differentiation patterns differ, which can translate into differences in clinical course and recurrence tendencies, making accurate diagnosis clinically relevant. Finally, glandular odontogenic cysts are developmental in origin.[9] Their pathophysiology is linked to odontogenic epithelial lining that demonstrates gland-like or duct-like differentiation, contributing to diagnostic complexity and potential for more locally aggressive behavior in some cases. This emphasizes that, across odontogenic cysts, epithelial origin and differentiation patterns are central determinants of pathophysiology, clinical behavior, and the need for individualized treatment planning. In summary, odontogenic cyst pathophysiology reflects two dominant mechanisms: inflammatory activation of odontogenic epithelial rests with osmotic-driven expansion (as in periapical, residual, and paradental cysts) and developmental follicular or dental lamina remnant–derived cyst formation (as in dentigerous, eruption, lateral periodontal, keratinizing, orthokeratinizing, and glandular odontogenic cysts).[1][2][5][6][7][8][9]

Histopathology

Histopathologic evaluation is essential for the definitive diagnosis of odontogenic cysts because clinical and radiographic findings frequently overlap among cyst subtypes and may mimic more aggressive odontogenic tumors. Although all odontogenic cysts are characterized by an epithelial lining surrounding a cystic lumen, the thickness, keratinization pattern, cytologic features of basal and superficial layers, and the nature of the supporting connective tissue wall provide key diagnostic cues. Inflammatory cysts typically demonstrate variable epithelial hyperplasia and a prominent inflammatory infiltrate within the fibrous capsule, whereas developmental cysts more often show a relatively thin epithelial lining with less inflammation unless secondarily infected. For the practicing dentist, oral surgeon, or oral pathologist, recognizing these recurring histologic patterns supports accurate classification and guides appropriate treatment intensity and follow-up surveillance. Periapical cysts are prototypical inflammatory odontogenic cysts. Histologically, they are lined by a thin, nonkeratinized stratified squamous epithelium, often only one to two cell layers thick in areas and are supported by inflamed fibrous connective tissue.[2] The cyst wall commonly contains dense chronic inflammatory infiltrates, typically composed of lymphocytes and plasma cells, reflecting the lesion's origin in persistent apical infection. A characteristic feature is the "looped and arcaded" appearance of the lining epithelium, which results from inflammatory epithelial hyperplasia and proliferative folding of the epithelial layer into the underlying connective tissue. This architecture is not merely descriptive; it reflects the biologic effect of chronic inflammation on epithelial proliferation and contributes to the diagnostic recognition of a periapical inflammatory cyst in the appropriate clinical context.

Residual cysts are defined by their clinical circumstance—persistence after extraction of the offending tooth—rather than by a unique microscopic identity. As such, residual cysts are histologically identical to periapical cysts.[2] They show the same nonkeratinized stratified squamous epithelial lining and inflamed fibrous capsule, and they often retain evidence of chronic inflammation. Because residual cysts may be discovered incidentally in edentulous regions, histopathology is particularly important to confirm that the lesion represents retained inflammatory cyst lining rather than another cystic entity that arose independently within the jaw. Paradental cysts are similarly inflammatory in nature and, on histologic examination, are generally indistinguishable from periapical cysts.[5] Their defining distinction is topographic rather than microscopic: paradental cysts occur in a pericoronal or lateral periodontal location, typically adjacent to partially erupted or erupted teeth, rather than at the root apex.[5] Therefore, histopathologic interpretation must be integrated with clinical and radiographic localization to avoid misclassification. In practice, a paradental cyst diagnosis is often supported when the inflammatory cyst lining and wall features are observed in a lesion situated pericoronally, frequently in association with molars and a history suggestive of localized gingival inflammation. Dentigerous cysts demonstrate a developmental pattern with a lining of nonkeratinized stratified squamous epithelium that is usually relatively thin but may show elongated, interconnecting rete ridges in some cases.[7] In contrast to inflammatory cysts, the fibrous capsule may be less inflamed unless the lesion has become infected. A notable feature is the potential presence of specialized epithelial differentiation, including mucous cells, ciliated cells, and, occasionally, sebaceous cells.[7] This metaplastic potential is clinically relevant because it can introduce diagnostic complexity and may be associated with long-standing lesions. The histologic picture must be interpreted alongside the classic anatomic association of dentigerous cysts with the crown of an unerupted or impacted tooth.

Eruption cysts are regarded as the soft-tissue analogue of dentigerous cysts and are histologically similar.[8] They typically show a comparable nonkeratinized epithelial lining, with the key difference being their location within the gingival soft tissues overlying an erupting tooth rather than within the bony follicular space. As with other cysts, secondary inflammation or hemorrhage may alter histologic appearance, but the foundational resemblance to dentigerous cyst lining remains a defining point.[8] Lateral periodontal cysts show a distinctive epithelial morphology that supports their identification. Histologically, they are lined by a nonkeratinized squamous or cuboidal epithelium, usually three to eight cell layers thick, and they often demonstrate focal epithelial thickenings described as plaques or "swirls."[2][6] Within these focal thickenings, clear cells containing glycogen are frequently observed, providing a helpful diagnostic clue.[2][6] The cyst wall is often relatively uninflamed, which aligns with their developmental origin and typical association with vital teeth, though inflammation may be present if the lesion becomes secondarily infected. Odontogenic keratocysts (OKCs) possess a classic keratinizing lining that is central to diagnosis. Histologically, an OKC typically shows six to ten layers of stratified squamous epithelium with a wavy or corrugated parakeratinized surface.[10] The basal layer is characteristically composed of cuboidal to columnar cells that are palisaded and hyperchromatic, producing a distinctive "picket fence" appearance.[10] These features reflect a unique epithelial differentiation pattern that also correlates with clinical behavior, including a recognized propensity for recurrence, thereby underscoring why accurate histopathologic

identification is clinically consequential. Orthokeratinizing odontogenic cysts also display keratinization but differ meaningfully from OKCs. Their lining consists of orthokeratinized stratified squamous epithelium with variable thickness, and importantly, these cysts lack the palisaded or hyperchromatic basal cell layer that typifies OKCs.[11] This absence is diagnostically important because it supports differentiation from OKC and may align with different biologic behavior and recurrence tendencies, reinforcing the need for precise pathologic classification.

Glandular odontogenic cysts demonstrate a more complex epithelial lining with features suggestive of glandular or duct-like differentiation. Histologically, they show variable thicknesses of squamous epithelium lined in areas by hobnail cells or eosinophilic cuboidal surface cells.[2][9] Epithelial spheres or plaque-like thickenings are commonly identified within the cyst wall, and the lining frequently contains mucous goblet cells, respiratory-type epithelium, or duct-like structures.[2][9] These features can overlap with other lesions and require careful interpretation by experienced oral pathologists, particularly because glandular odontogenic cysts may be clinically significant due to reported aggressive tendencies in some cases. In summary, histopathology provides the definitive framework for distinguishing odontogenic cyst subtypes, with inflammatory cysts (periapical, residual, paradental) showing characteristic nonkeratinized epithelium and inflammatory wall changes, and developmental cysts (dentigerous, eruption, lateral periodontal, keratinizing, orthokeratinizing, and glandular) demonstrating more specific epithelial differentiation patterns that carry diagnostic and management implications.[2][5][6][7][8][9][10][11]

History and Physical

Clinical evaluation of odontogenic cysts relies on a careful integration of history, intraoral and extraoral examination, and radiographic correlation, because many of these lesions are either asymptomatic or produce nonspecific signs until they enlarge, become infected, or compromise adjacent dentoalveolar structures. Consequently, the "history and physical" profile for odontogenic cysts is best understood as a spectrum: some entities are essentially radiographic diagnoses discovered incidentally, while others present with localized inflammatory findings, swelling, periodontal changes, or functional symptoms that prompt targeted investigation. Because radiographic appearances can overlap among cysts and with odontogenic tumors, the clinician's role is to identify contextual features—such as tooth vitality, eruption status, age distribution, and anatomic predilection—that raise or lower suspicion for specific entities and guide appropriate referral and biopsy planning. Periapical cysts are classically not evident on routine clinical examination and are most often suspected based on dental history and radiographic findings rather than visible mucosal changes. They are commonly associated with non-vital teeth that have sustained extensive carious destruction or prior trauma, which provides the inflammatory stimulus for apical pathology. Clinically, the index tooth may exhibit a history of pain, sensitivity, swelling, or prior endodontic intervention, but many patients are asymptomatic by the time imaging is obtained. The periapical cyst is therefore often recognized as a radiographic finding: it typically appears as a unilocular radiolucency with a well-demarcated border, frequently less than 10 mm in greatest diameter, centered at the root apex.[12] On physical examination, the tooth may test non-vital, demonstrate percussion tenderness during acute exacerbation, or show a sinus tract if chronic drainage is present, yet the cyst itself usually remains clinically occult. Residual cysts similarly cannot be visualized clinically in most cases and are commonly discovered incidentally. Radiographically, they resemble periapical cysts because they share the same inflammatory histologic background, but the key historical clue is that the associated tooth has already been extracted. Thus, the clinician's history should explore prior extractions and endodontic pathology in the region of the radiolucent lesion. On examination, the area may be edentulous and asymptomatic, and the lesion may be detected during radiographs obtained for prosthodontic rehabilitation or implant planning. This emphasizes that the physical exam may be unrevealing, making clinical history indispensable for narrowing suspicion toward a residual cyst rather than a new primary odontogenic process.

Paradental cysts are more likely to present with overt clinical signs because they are inflammatory lesions that develop adjacent to erupted or erupting teeth, most often the mandibular first molar in younger patients. Patients may report localized pain, swelling, or recurrent episodes consistent with pericoronal or periodontal inflammation. On examination, paradental cysts can present with gingival edema, purulent discharge, and deep probing depths or periodontal pockets adjacent to the involved tooth.[5][13] These findings may mimic localized periodontal abscess or pericoronitis, and careful evaluation is required to determine whether the process is primarily periodontal, endodontic, or cystic in nature. The association with a young age group and a mandibular molar region, combined with localized inflammatory periodontal findings, supports consideration of a paradental cyst.[5][13] Dentigerous cysts are developmental lesions associated with an unerupted, erupting, or impacted tooth. Clinically, many are discovered incidentally when radiographs are taken to assess delayed eruption or impacted teeth, with third molars and maxillary canines frequently involved. They show a higher occurrence in the first and second decades of life, reflecting the developmental timing of eruption and impaction patterns.[7] Most dentigerous cysts are asymptomatic

unless secondarily inflamed, at which point patients may present with pain, swelling, or signs of local infection. On physical examination, large lesions may cause buccal cortical expansion, facial asymmetry, or displacement of adjacent teeth, but many cases lack obvious clinical findings until they reach significant size.[7] Eruption cysts occur in infants and young children during eruption of deciduous or permanent teeth and are among the odontogenic cysts most likely to be appreciated clinically because of their superficial soft-tissue location. They typically present as localized alveolar or gingival swelling over an erupting tooth, sometimes with a bluish or translucent hue due to fluid or blood within the cystic space. Parents may notice a "bubble" or swelling in the child's gums, and the lesion may fluctuate in size as the tooth progresses toward eruption.

Lateral periodontal cysts (LPCs) are often subtle clinically. However, they may cause displacement of adjacent roots interproximally, which can manifest as spacing changes, mild malalignment, or radiographic root divergence. Unlike many developmental odontogenic cysts that present in younger individuals, LPCs tend to occur later in life—often in patients in their 40s and 50s—and they demonstrate a male predilection.[1] On examination, the associated teeth are typically vital, and the gingival tissues may appear normal unless secondary inflammation is present. Thus, the clinician may suspect LPC primarily from imaging findings combined with a compatible demographic profile and tooth vitality pattern.[1] Odontogenic keratocysts (OKCs) frequently remain asymptomatic and can be challenging to detect clinically because they often expand along the cancellous bone in an anteroposterior direction with relatively limited early cortical expansion. This growth pattern explains why substantial lesions may be present with minimal visible swelling. When symptoms occur, they may include intraoral swelling, pain, trismus, infection, or neurosensory disturbances such as paresthesia due to involvement of neural structures.[14][10] Clinically appreciable swelling may be absent until lesions are large, and patients may present late or be identified only through radiographs. The reported mean age distribution around 20 years further informs clinical suspicion when lesions are identified in younger patients.[14][10] Orthokeratinizing odontogenic cysts can appear clinically similar to OKCs, often presenting as radiographic findings and sometimes being associated with impacted teeth. They share a male predilection and commonly present in the 20 to 40 age range.[1] Although they may mimic OKCs in clinical and radiographic presentation, they are associated with a more favorable prognosis, which makes accurate histopathologic diagnosis important for guiding follow-up intensity and counseling.[1]

Glandular odontogenic cysts are considered potentially aggressive lesions and are predominantly detected radiographically, but clinical signs may appear when lesions are advanced. These may include increased tooth mobility, cortical thinning, or even cortical perforation, reflecting locally destructive growth patterns. The mean age of presentation is reported as 46 years, with a slight male predominance.[9] Because clinical manifestations can suggest a more aggressive process, recognition of mobility changes, expansion, and cortical compromise should prompt timely imaging, referral, and biopsy planning to confirm diagnosis and establish an appropriate management strategy.[9] Overall, the history and physical examination in odontogenic cysts must be interpreted through the lens of lesion biology and patient demographics. Many cysts—particularly periapical, residual, OKC, and glandular odontogenic cysts—are primarily radiographic diagnoses, while paradental and eruption cysts more often present with clinically observable soft-tissue or inflammatory findings.[1][5][7][9][10][12][13][14]

Evaluation

Evaluation of odontogenic cysts requires a structured, clinicoradiographic approach because many lesions are asymptomatic and discovered incidentally, while others present with inflammatory periodontal findings, delayed eruption, or jaw expansion. Since radiographic appearances overlap substantially among cyst subtypes—and may resemble aggressive odontogenic tumors—diagnostic accuracy depends on integrating patient age, symptom profile, tooth vitality, eruption status, lesion location, and imaging characteristics. Pulp vitality testing, periodontal probing, and a careful dental history are essential baseline steps. Radiographic evaluation typically begins with periapical and panoramic imaging, with cone-beam computed tomography (CBCT) considered when lesion extent, cortical perforation, relationship to vital structures, or surgical planning requires three-dimensional clarification. Ultimately, histopathologic confirmation is recommended for definitive diagnosis in most cases, particularly when radiographic features are atypical, lesion size is substantial, borders are scalloped or multilocular, or the lesion is associated with tooth displacement, resorption, or recurrence risk. For periapical cysts, evaluation hinges on identifying an inflammatory apical lesion associated with a non-vital tooth. Clinically, the involved tooth is typically non-vital due to extensive caries and/or prior trauma, and the history may include endodontic symptoms, prior swelling, or episodic pain. Pulp testing and percussion sensitivity can help distinguish periapical inflammatory disease from periodontal or non-odontogenic pathology. Radiographically, periapical cysts present as an unilocular radiolucency centered at the root apex with well-defined borders that may be corticated, supporting a slow-growing process.[12] Because a periapical granuloma can appear similar radiographically, lesion size, persistence, and response

to endodontic therapy become relevant clinical discriminators, but definitive differentiation between granuloma and cyst is histologic. Consequently, clinicians should interpret imaging in light of vitality findings and clinical history, and pursue endodontic treatment or surgical management when indicated.

Residual cysts require heightened attention to history because their defining feature is the absence of the associated tooth. Clinically, the patient is partially edentulous in the region, with a history of extraction of the offending tooth. Radiographically, residual cysts closely resemble periapical cysts in presenting as a well-demarcated unilocular radiolucency, but the absence of an adjacent non-vital tooth means the lesion cannot be anchored to an apical etiology without historical confirmation. Therefore, inquiry about previous extractions, prior endodontic disease, and timing of edentulism is essential to support a residual cyst diagnosis. In practice, evaluation should also consider alternative radiolucent entities that arise in edentulous bone, making histopathologic examination after enucleation important for confirmation and exclusion of other pathology. Paradental cysts demand a combined periodontal and radiographic assessment because their presentation often mimics localized inflammatory periodontal disease. These cysts are frequently associated with an erupted mandibular first molar or a partially impacted mandibular third molar, and patients may report recurrent pericoronitis-like symptoms.[5][13] Clinically, erythema and edema of marginal gingival tissues may be present, along with purulent discharge and deep probing depths adjacent to the involved tooth.[5][13] These findings highlight the need for careful probing, assessment of furcation involvement, and differentiation from periodontal abscess or endodontic–periodontal lesions. Radiographically, paradental cysts typically appear as a pericoronal, well-demarcated unilocular radiolucency positioned on the buccal, mesial, or distal aspect of the tooth rather than at the apex.[5][13] Correlating the radiolucency with the clinical site of periodontal inflammation and eruption status strengthens diagnostic confidence and supports appropriate surgical–periodontal management planning.

For dentigerous cysts, evaluation centers on the relationship of the radiolucency to an unerupted or impacted tooth. These cysts are commonly associated with delayed eruption or impaction, so imaging is essential whenever eruption is delayed or an impacted tooth is identified. Clinically, dentigerous cysts are often asymptomatic unless secondarily inflamed, in which case swelling or pain may occur.[7] Radiographically, they present as a well-demarcated unilocular radiolucency attached at the cementoenamel junction, typically enveloping the crown of an unerupted tooth.[1][2] Because dentigerous cysts can resemble OKC or ameloblastoma radiographically, clinicians should evaluate border characteristics, lesion extent, and any evidence of root displacement or resorption while recognizing that imaging cannot definitively distinguish these entities.[1][2] The observation that follicular radiolucencies exceeding 4 mm may suggest more aggressive cystic enlargement underscores the importance of measuring the pericoronal space and monitoring for tooth displacement when radiolucency appears expanded beyond normal follicular dimensions. Eruption cysts are primarily diagnosed clinically but benefit from radiographic confirmation to establish the relationship to the erupting tooth and to exclude bony pathology that could delay eruption. Clinically, the lesion presents as an edematous swelling overlying an erupting deciduous or permanent tooth, often with a bluish hue or translucent appearance reflecting fluid or blood accumulation.[8] Evaluation includes confirming whether the involved tooth is primary or permanent, assessing for eruption trajectory, and documenting the extent of soft tissue swelling. Radiographs can help verify that the tooth is positioned appropriately and that there is no associated intraosseous lesion contributing to delayed eruption. While eruption cysts are superficial, their evaluation remains important because parental concern is common and because differentiation from other gingival swellings or reactive lesions is sometimes necessary.[8]

Lateral periodontal cysts (LPCs) are typically discovered incidentally and require attention to tooth vitality and lesion position. Clinically, adjacent teeth are usually vital, and subtle findings may include minor root displacement, localized mobility, or mild buccal or lingual alveolar expansion in larger lesions. The overlying gingival tissue often lacks erythema or infection signs, and an interproximal gingival mass, when present, may feel firm and immobile. Radiographically, LPCs appear as a well-demarcated unilocular radiolucency located interproximally between the roots of adjacent teeth, commonly in the mandibular canine–premolar region.[6] Recognition of the botryoid odontogenic cyst variant is important because it arises in similar locations but appears multilocular or multicystic radiographically, potentially suggesting more extensive disease.[6] Given the overlap with other lateral root radiolucencies, correlation with vitality testing and histopathology is essential. For odontogenic keratocysts (OKCs), evaluation must account for their variable imaging appearance, their tendency to expand anteroposteriorly with minimal early cortical expansion, and their recurrence potential. A significant proportion—approximately 25% to 40%—are associated with impacted teeth, making radiographic evaluation crucial when eruption is delayed or impaction is present.[10] Clinically, OKCs are often asymptomatic; however, larger lesions may produce pain, swelling, trismus, infection, drainage, or neurosensory deficits.[10] Radiographically, OKCs may appear as a well-demarcated unilocular radiolucency with smooth borders, a unilocular lesion

with scalloped margins, or a multilocular radiolucency, reflecting heterogeneity in growth patterns.[2] When multiple OKCs are identified, evaluation must extend beyond the jaw lesion itself to consider syndromic association, particularly nevoid basal cell carcinoma syndrome (Gorlin syndrome), an autosomal dominant condition linked to PTCH tumor suppressor gene mutations on chromosome 9q22.[1][2] Clinical suspicion increases with multiple jaw cysts and characteristic systemic findings (e.g., multiple basal cell carcinomas, palmar pits, falx cerebri calcification), and formal diagnosis may require genetic testing of the patient and close family members.[1][2] This syndromic evaluation has important implications for surveillance, recurrence monitoring, and interdisciplinary care.

Orthokeratinizing odontogenic cysts should be evaluated as a distinct entity rather than being conflated with OKC. Clinically, they are often associated with impacted teeth, so delayed eruption may prompt imaging. Radiographically, they usually present as a well-demarcated unilocular radiolucency, most commonly in the posterior mandible.[2] Because the imaging appearance can resemble OKC, definitive differentiation depends on histopathology, and accurate classification matters due to differences in recurrence risk and prognosis. Consequently, evaluation should emphasize careful imaging assessment, documentation of tooth association, and biopsy or enucleation with pathologic confirmation. Finally, glandular odontogenic cysts (GOCs) require a high index of suspicion because they can behave aggressively and demonstrate features that overlap with other multilocular jaw lesions. Clinically, teeth associated with GOCs may show mobility or displacement, and patients may present with swelling, alveolar expansion, pain, or neurosensory disturbances when lesions enlarge or involve neural structures.[9] Radiographically, GOCs may be unilocular or multilocular radiolucencies with well-demarcated borders, and they may cross the midline, a feature that can broaden the differential diagnosis.[9] Their aggressive tendencies are reflected by frequent root displacement and resorption, which should prompt timely CBCT assessment for cortical perforation and extent, as well as referral for definitive surgical management and histopathologic confirmation.[9] In summary, evaluation of odontogenic cysts is an exercise in contextual diagnosis: vitality testing and dental history are decisive for inflammatory cysts; eruption status and tooth association guide suspicion for developmental cysts; and imaging morphology, lesion extent, and effects on adjacent structures help prioritize differential diagnosis and determine urgency for referral, biopsy, and definitive management.[1][2][5][6][8][9][10][12][13]

Treatment / Management

Management of odontogenic cysts is guided by a combination of lesion etiology (inflammatory versus developmental), association with tooth vitality or impaction, anatomic extent, proximity to vital structures, recurrence potential, and the patient's overall restorative and functional needs. Because radiographic appearances overlap among cyst subtypes and may mimic odontogenic tumors, definitive treatment planning should ideally follow clinicoradiographic correlation and histopathologic confirmation after removal. Across most entities, the goals of therapy are elimination of the cystic lining to prevent persistence or recurrence, resolution of infection or inflammation when present, preservation of adjacent teeth and supporting bone when feasible, and restoration of function with appropriate follow-up surveillance. For periapical cysts, first-line therapy is typically non-surgical endodontic treatment (root canal therapy) because the pathogenesis is closely linked to pulpal necrosis and apical infection. By disinfecting and sealing the root canal system, the inflammatory stimulus driving the periapical lesion is removed, allowing periapical healing to occur. In many cases, resolution of symptoms and radiographic healing follow appropriate endodontic therapy, particularly when the lesion represents a periapical granuloma or a small cystic lesion responsive to removal of the etiologic source. However, if the tooth remains symptomatic, if a persistent periapical radiolucency fails to regress over an appropriate follow-up interval, or if canal anatomy, procedural complications, or extraradicular infection limit the success of conventional root canal therapy, surgical endodontic therapy becomes indicated. Surgical endodontic management typically involves apicoectomy (resection of the root apex) combined with curettage of the periapical lesion, thereby removing the apical delta and infected tissues while mechanically eliminating the cyst lining. This approach is associated with reliable bone regeneration and resolution of the lesion in appropriately selected cases. When the tooth has poor prognosis for restoration, persistent symptoms despite therapy, extensive structural compromise, or when endodontic retreatment is not feasible, extraction is indicated. Importantly, extraction should be accompanied by curettage or enucleation of the socket to remove residual cystic epithelium and reduce the risk of developing a residual cyst. Outcomes data underscore the role of surgery in refractory disease: overall, surgical endodontic therapy has been reported to result in approximately 95% bone healing, compared with 66% for non-surgical treatment.[15] These figures emphasize that while conservative endodontic therapy remains a rational first step, surgical intervention provides a higher likelihood of predictable osseous healing when conservative measures fail.[15]

Residual cysts are managed primarily through enucleation, because the lesion persists in an edentulous area and lacks an etiologic tooth source that can be treated endodontically. Complete removal of

the cystic lining is essential to prevent continued expansion, secondary infection, or recurrence. Enucleation is typically curative when performed thoroughly, and it also provides tissue for histopathologic assessment to confirm diagnosis and exclude alternative pathology that can present as radiolucency in edentulous bone. Treatment of paradental cysts is determined by the involved tooth and its functional value, as well as the lesion's location and local periodontal status. When the cyst is associated with a first or second molar, management commonly involves enucleation while preserving the tooth when feasible, followed by healing and periodontal reassessment. In contrast, when the cyst is associated with a third molar, particularly if the molar is partially impacted or has limited functional importance, extraction is often the treatment of choice, typically combined with removal of cystic tissue to eliminate the inflammatory focus and reduce recurrence risk. This tooth-specific strategy reflects the practical balance between lesion eradication and long-term dentition preservation. For dentigerous cysts, management classically involves extraction of the associated impacted tooth followed by curettage and enucleation of the cyst lining.[1] This approach addresses both the cystic process and its anatomic substrate (the follicle surrounding the unerupted tooth), and it reduces the risk of persistence. In selected circumstances—particularly in younger patients where eruption potential exists or where removal of the impacted tooth would be highly morbid—marsupialization or decompression may be considered in broader practice to reduce lesion size before definitive surgery, but the core management described remains extraction with enucleation and curettage.[1] In all cases, histopathologic evaluation is important because dentigerous cysts can resemble other lesions radiographically.

Eruption cysts are typically self-limiting and often require no intervention, as they tend to rupture spontaneously when the tooth erupts.[8] Management is therefore usually conservative, centered on reassurance, observation, and maintenance of oral hygiene. If symptomatic—such as when discomfort, feeding difficulty, or recurrent trauma occurs—unroofing of the cyst can be performed to relieve pressure and facilitate eruption, thereby reducing inflammatory discomfort.[8] This minor procedure should be considered only when clinically necessary, given the lesion's usual tendency toward spontaneous resolution. Lateral periodontal cysts are generally treated with curative enucleation, which is sufficient in most cases because these lesions are typically well-circumscribed and localized.[6] However, the botryoid odontogenic cyst variant may demonstrate a multilocular configuration and can be more challenging to eradicate completely; therefore, curettage in conjunction with enucleation is often recommended to reduce the likelihood of residual epithelial islands and recurrence.[6] Because LPCs often occur adjacent to vital teeth, surgical planning should emphasize preservation of periodontal support and careful avoidance of iatrogenic root damage. Odontogenic keratocysts (OKCs) require a more nuanced management strategy because of their recognized recurrence tendency and potential for extensive anteroposterior spread within cancellous bone. Treatment selection is influenced by lesion size, location, cortical perforation, proximity to neurovascular structures, and prior recurrence history. Smaller OKCs may be treated with enucleation, often combined with peripheral osteotomy to remove a thin margin of adjacent bone and achieve healthier bony boundaries, thereby reducing the chance that satellite cysts or epithelial remnants remain. Larger lesions may be approached through marsupialization to decrease intracystic pressure and reduce lesion volume before definitive removal, or through resection in extensive, recurrent, or anatomically destructive cases. Given the recurrence risk, patients require structured clinical and radiographic follow-up after treatment to detect early recurrence and intervene promptly.[14] This prolonged surveillance is a defining component of OKC management rather than an optional adjunct.[14]

In contrast, orthokeratinizing odontogenic cysts are typically managed with surgical excision, which is generally curative, and they demonstrate a low recurrence rate compared with OKCs. This difference in recurrence behavior reinforces the importance of accurate histopathologic distinction between orthokeratinizing cysts and OKCs, because follow-up intensity and patient counseling may differ substantially even when radiographic appearances overlap. Finally, glandular odontogenic cysts (GOCs) are commonly treated with enucleation and curettage, reflecting the need for thorough removal of the cyst lining and associated epithelial plaques.[2] However, because GOCs can behave aggressively and may recur, resection may be necessary in extensive cases, particularly when lesions are multilocular, show cortical perforation, or exhibit significant root displacement and resorption. Regardless of the operative approach, close follow-up is essential, with periodic imaging to confirm stability and to identify recurrence early.[2] This emphasis on surveillance aligns with the lesion's potentially infiltrative behavior and the clinical consequences of delayed recurrence detection. Overall, effective management of odontogenic cysts depends on matching treatment intensity to lesion biology: addressing infection sources with endodontic therapy for inflammatory apical lesions, performing definitive enucleation where curative, escalating to adjunctive techniques or resection for lesions with higher recurrence potential, and ensuring histopathologic confirmation and long-term radiographic monitoring when clinically indicated.[1][2][6][8][14][15]

Differential Diagnosis

Establishing an accurate differential diagnosis for odontogenic cysts is essential because many jaw radiolucencies share overlapping radiographic morphologies, and several odontogenic tumors can mimic cystic lesions in early stages. Differentiation relies on integrating tooth vitality, lesion location (periapical, pericoronal, lateral root surface, or edentulous region), patient age, clinical symptoms, and imaging characteristics such as border definition, cortication, internal septation, relationship to the cementoenamel junction, and effects on adjacent teeth (displacement or resorption). Because many entities are indistinguishable by radiography alone, definitive diagnosis often requires histopathologic confirmation, particularly for lesions that are large, recurrent, multilocular, scalloped, or associated with impacted teeth. For a periapical cyst, the primary differential considerations include periapical granuloma, early periapical cemento-osseous dysplasia, and periapical scar. A periapical granuloma is a common inflammatory lesion at the root apex of a non-vital tooth and can appear radiographically identical to a small periapical cyst; clinical correlation with vitality testing and follow-up after endodontic therapy is often used to infer the diagnosis, although histology is definitive. Early periapical cemento-osseous dysplasia can also present as a periapical radiolucency, but it typically involves vital teeth and may later evolve into mixed or radiopaque stages, making serial imaging and vitality testing critical. A periapical scar may remain as a persistent radiolucency after endodontic surgery or healing, often asymptomatic and stable over time, requiring correlation with procedural history and lack of progression. For a residual cyst, the differential broadens because lesions occur in edentulous bone and cannot be anchored to a current tooth apex. Important alternatives include unicystic ameloblastoma, odontogenic keratocyst, glandular odontogenic cyst, and lateral periodontal cyst. Unicystic ameloblastoma may appear as a unilocular radiolucency and can be mistaken for a benign cyst, yet it carries different surgical implications and recurrence potential. Odontogenic keratocyst may also present as a well-defined radiolucency in the posterior mandible and can persist or recur, making it a key consideration in any cyst-like lesion. Glandular odontogenic cyst, though rare, is clinically important due to potential aggressive behavior and recurrence risk. Lateral periodontal cyst may be considered if the lesion is positioned in a characteristic interradicular location, although it is less typical in purely edentulous sites; careful localization and history help refine this distinction [14][15].

For a paradental cyst, the differential includes periapical cyst, dentigerous cyst, residual cyst, and lateral radicular cyst. Because paradental cysts are inflammatory and often associated with molars, they can resemble periapical pathology if the lesion is near the root region, and they may also mimic dentigerous cysts when partially erupted teeth create a pericoronal radiolucency. Residual cyst is considered when prior extraction history exists. Lateral radicular cyst enters the differential when a lesion is positioned along the lateral aspect of the root and inflammatory etiologies are plausible, emphasizing the importance of periodontal probing and vitality testing to establish whether the lesion is primarily endodontic, periodontal, or pericoronal. For a dentigerous cyst, key differentials include hyperplastic dental follicle, odontogenic keratocyst, and ameloblastoma. A hyperplastic dental follicle can produce a pericoronal radiolucency but is typically smaller and may not demonstrate the same expansion behavior; measuring the follicular space and evaluating lesion progression can be informative. Odontogenic keratocyst may mimic a dentigerous cyst when it envelops an impacted tooth, and ameloblastoma—particularly unicystic variants—may present similarly, making histopathology essential when radiographic and clinical findings suggest a more aggressive process. For an eruption cyst, differentials are primarily soft-tissue lesions of infancy and childhood, including Epstein pearls, Bohn nodules, and gingival cyst. Epstein pearls and Bohn nodules are common neonatal inclusion cysts that appear as small white or yellow nodules in the oral cavity and generally resolve spontaneously. Gingival cysts may present as localized swellings, and careful assessment of timing, location, and relationship to an erupting tooth helps distinguish eruption cysts from these benign neonatal entities. For a lateral periodontal cyst, the principal differential includes odontogenic keratocyst, glandular odontogenic cyst, and gingival cyst. OKC can present as a well-defined radiolucency and may occur near roots, while glandular odontogenic cyst may also show unilocular or multilocular radiolucency and may behave more aggressively. Gingival cysts enter consideration particularly when lesions are superficial or when soft tissue components overlap clinically; radiographic localization between roots and confirmation of tooth vitality are central to narrowing the diagnosis [14][15].

For an odontogenic keratocyst, the differential typically includes ameloblastoma, dentigerous cyst, and orthokeratinizing odontogenic cyst. Ameloblastoma can be multilocular and expansile, resembling a keratocyst radiographically, while dentigerous cyst overlaps when an impacted tooth is involved. Orthokeratinizing odontogenic cyst is particularly important because it can resemble OKC clinically and radiographically but differs in histologic features and recurrence behavior, making pathologic distinction critical. For an orthokeratinizing odontogenic cyst, key differentials include dentigerous cyst, OKC, and ameloblastoma. The overlap is especially common in posterior mandibular lesions associated with impacted teeth, where all three

entities may present as well-demarcated radiolucencies. This reinforces that definitive diagnosis depends on histopathologic features, particularly the keratinization pattern and basal cell morphology. For a glandular odontogenic cyst, important differentials include OKC, dentigerous cyst, and botryoid cyst. OKC and dentigerous cyst overlap due to similar radiographic presentation, while the botryoid cyst variant may enter the differential when multilocularity or a "grape-like" architecture is suspected. Because glandular odontogenic cysts may be aggressive and recur, distinguishing them from these alternatives is clinically consequential for surgical planning and follow-up intensity [14][15].

Prognosis

The prognosis of odontogenic cysts is strongly influenced by their inflammatory versus developmental origin, biologic behavior, completeness of surgical removal, and the extent of local bone involvement at presentation. In most patients, odontogenic cysts carry a favorable outlook, particularly when detected early and treated definitively with appropriate endodontic therapy, extraction with curettage, or complete enucleation. Nevertheless, prognostic heterogeneity is clinically significant: while many cysts have low recurrence rates and heal predictably, certain entities—most notably odontogenic keratocysts and glandular odontogenic cysts—require long-term surveillance because recurrence can be common and may necessitate repeated surgery. Consequently, prognostic counseling should be individualized, reflecting the lesion subtype, treatment modality, and patient-specific risk factors. Periapical cysts generally have a good prognosis after appropriate management, particularly when the etiologic source (pulpal necrosis and infection) is eliminated by endodontic therapy or extraction. Prognostic variables include the identity and strategic importance of the tooth, the size of the lesion, the degree of cortical and cancellous bone involvement, and the patient's response to initial therapy.[2] Smaller lesions and those treated promptly often demonstrate predictable osseous healing, whereas larger lesions may take longer to remodel and can leave residual radiographic changes that require follow-up interpretation.

Residual cysts typically have an excellent prognosis. Because they are treated by surgical enucleation, recurrence is uncommon when the cystic lining is removed completely. The key prognostic determinant is adequacy of excision; if remnants persist, the lesion may recur or persist radiographically, but appropriately treated residual cysts should not recur and are expected to heal well. Paradental cysts likewise have an excellent prognosis. Available clinical observations indicate no reported recurrence when these lesions are managed appropriately, reflecting their localized inflammatory nature and the effectiveness of complete removal in conjunction with management of the associated tooth and periodontal environment.[13] Prognosis is especially favorable when the offending inflammatory stimulus is addressed and the local periodontium is rehabilitated. Dentigerous cysts carry an excellent prognosis when treated appropriately, typically through extraction of the associated impacted tooth with curettage and enucleation. Their recurrence rate is generally low; however, recurrence can occur when removal is incomplete, particularly if the cyst lining is not fully eliminated at the time of surgery.[7] Prognosis is best when the lesion is identified before extensive expansion, minimizing tooth displacement, root resorption, and cortical thinning, and when definitive histopathologic confirmation excludes mimicking lesions with different biologic behavior. Eruption cysts have a good prognosis and are frequently self-limiting, as the erupting tooth often perforates the cyst and permits spontaneous resolution. Because many cases resolve without intervention, prognosis is generally excellent, with clinical monitoring and reassurance commonly sufficient. When unroofing is required due to symptoms or persistent swelling, outcomes remain favorable. Lateral periodontal cysts demonstrate a good prognosis with a very low recurrence rate after enucleation.[6] Because these lesions are usually small and well-circumscribed, complete excision is typically curative. Prognostic counseling should still emphasize the need for histologic confirmation and routine follow-up radiographs, especially when the lesion is multilocular or consistent with the botryoid variant.

In contrast, odontogenic keratocysts have a favorable to fair prognosis because recurrence is a major defining concern. Recurrence rates have been reported in a wide range—approximately 20% to 62%—depending on lesion characteristics and treatment technique.[10] Conservative approaches such as enucleation can carry recurrence rates reported as high as 56%, underscoring the persistence potential of residual epithelial rests and satellite cysts.[10] Aggressive treatment modalities, including resection, have been associated with very low or absent recurrence in some reports, but they carry increased morbidity and therefore require careful case selection.[10] Regardless of the chosen intervention, close clinical and radiographic follow-up is recommended because recurrences may occur late and can be clinically silent.[11][16] Orthokeratinizing odontogenic cysts have a good prognosis, with recurrence rates reported as low as 2%.[11] This favorable outlook is clinically important because orthokeratinizing cysts can resemble OKCs radiographically; thus, accurate histopathologic diagnosis meaningfully changes prognostic counseling and follow-up intensity. Glandular odontogenic cysts have a favorable to fair prognosis due to a relatively high recurrence rate, often cited around 20% to 30%.[9] The potential for multiple recurrences is clinically significant, and long-term follow-up is strongly recommended, particularly for

large, multilocular lesions or those showing cortical perforation or root resorption.[9] Given this recurrence behavior, prognosis is best framed not only in terms of survival or malignant transformation (which is not the usual concern), but in terms of the likelihood of repeated surgical interventions and the importance of sustained surveillance.

Complications

Complications associated with odontogenic cysts depend on cyst subtype, lesion size and duration, anatomic location, and the nature of the intervention used for treatment. Many odontogenic cysts are uncomplicated when treated appropriately, but complications can arise from untreated lesion expansion (bone destruction, tooth displacement, root resorption) or from incomplete excision (persistence and recurrence). Additionally, postoperative sequelae—such as delayed bone fill, residual radiolucency, or periodontal compromise—may occur and should be discussed with patients as part of informed consent. From a risk-management standpoint, the most clinically consequential "complication" across several cyst types is misdiagnosis, where a more aggressive lesion is presumed to be a simple cyst; this risk reinforces the importance of histopathologic confirmation. Periapical cysts do not typically lead to major complications after excision when management is complete and the etiologic tooth source has been addressed. However, two clinically relevant sequelae may occur. First, a residual cyst can develop if curettage is incomplete at the time of extraction, leaving epithelial remnants that persist in the socket. Second, a periapical scar can develop when the healing defect fills with collagenous tissue rather than bone, leaving a stable residual radiolucency despite clinical resolution.[16] These are not necessarily adverse clinical outcomes, but they may complicate radiographic interpretation and require longitudinal follow-up to document stability. Residual cysts, when left untreated, can continue to expand and cause progressive bone destruction, potentially placing adjacent teeth at risk through loss of bony support, displacement, or secondary infection. Once surgically removed, residual cysts generally do not present with significant complications and have low to negligible recurrence when excision is complete. The principal clinical concern is delayed detection, particularly in edentulous regions where lesions may enlarge silently.

Paradental cysts are commonly associated with pericoronitis and deep periodontal pockets, and the inflammatory environment can damage local periodontal tissues as the lesion expands.[5] This periodontal involvement is a practical complication because it can compromise long-term tooth support if not treated in a timely manner. Following removal, paradental cysts typically do not recur and rarely present additional complications, especially when associated plaque-retentive factors and periodontal inflammation are controlled.[5] Dentigerous cysts can cause significant bony destruction through expansion, and their complications are mainly related to mass effect: displacement of adjacent teeth, resorption of neighboring roots, cortical thinning, and, in large lesions, risk of pathologic fracture.[5] Despite these risks, once removed with appropriate curettage and enucleation, dentigerous cysts typically do not present ongoing complications and have a low recurrence rate.[7] The key clinical message is that earlier diagnosis minimizes the extent of bony and dental displacement, thereby reducing procedural complexity and recovery time. Eruption cysts are often self-limiting and generally occur without complications.[8] When symptomatic, they may cause feeding discomfort or localized inflammation, but these issues typically resolve as the tooth erupts or after minor unroofing. Long-term sequelae are uncommon. Lateral periodontal cysts generally do not cause complications after removal and rarely recur after excision. When lesions are larger, mild root displacement or localized alveolar expansion may occur preoperatively, but postoperative healing is typically straightforward. The botryoid variant may require more extensive curettage due to its multicystic nature, and incomplete removal could predispose to recurrence, which is a functional complication insofar as it necessitates additional surgery.

Odontogenic keratocysts are distinguished by their recurrence potential, making recurrence itself the most clinically significant complication. Because recurrent OKCs may be asymptomatic, failure to maintain follow-up can allow lesions to enlarge, resulting in progressive bone destruction, tooth displacement, and potential neurosensory involvement. If recurrence occurs, additional surgery is often required, and repeated procedures may cumulatively compromise jaw integrity and complicate future restorative plans. Orthokeratinizing odontogenic cysts have a low recurrence rate and generally do not present complications after complete excision. Their main clinical relevance is diagnostic: misclassification as OKC may lead to unnecessary anxiety and overly intensive surveillance, while accurate diagnosis supports more reassuring counseling. Glandular odontogenic cysts carry a high recurrence risk (approximately 20% to 30%), and the potential for multiple recurrences is an important complication that can expose patients to repeated surgeries and cumulative morbidity.[2][9] Because some lesions can be locally aggressive, delayed recurrence detection may result in more extensive bony involvement and more complex surgical requirements. For these reasons, close interval and long-term follow-up are essential, and recurrence management may require escalation of surgical strategy in select cases.[2][9]

Patient Education

Patient education is a core component of odontogenic cyst management because prevention, early detection, and adherence to follow-up materially influence outcomes. Education should be tailored to the cyst's pathogenesis: inflammatory lesions are largely mitigated by caries prevention and timely management of pulpal disease, while developmental cysts are not fully preventable but can be detected early through routine examinations and appropriate imaging of delayed eruption or impacted teeth. Across all types, transparent discussion of findings, differential diagnosis, recommended interventions, and expected outcomes enhances patient engagement, reduces anxiety, and promotes adherence—particularly for lesions that require long-term surveillance due to recurrence risk. For periapical cysts, which are inflammatory, deterrence strategies prioritize oral hygiene, caries prevention, and routine dental visits to detect decay or pulpal pathology early. Patients should be counseled that untreated caries or trauma can lead to pulpal necrosis and subsequent apical lesions, and they should understand the rationale for endodontic therapy or extraction when infection is established. Discussing the clinical and radiographic findings in understandable terms, outlining treatment options, and clarifying expected healing timelines is essential, particularly because radiographic resolution may lag behind symptom improvement.[2] When lesions fail to respond to initial therapy, patients should be prepared for the possibility of surgical intervention and the reasons it improves predictability. For residual cysts, education should emphasize that these lesions can develop after incomplete removal of a prior inflammatory cyst during extraction. Routine dental visits and periodic imaging—especially before prosthodontic work or implants—support early detection. Patients should be made aware of radiographic findings and counseled on the importance of biopsy or excision to confirm diagnosis and rule out other lesions that may mimic residual cysts in edentulous regions.

For paradental cysts, which are also inflammatory, patient counseling again stresses oral hygiene and professional dental care, including radiographic assessment when localized swelling, pericoronitis symptoms, or deep periodontal pockets are present. Patients should understand that recurrent inflammation around molars can contribute to cyst formation and that early intervention prevents periodontal damage and reduces the likelihood of more extensive surgery. For dentigerous cysts, deterrence is not directed at causation but at early identification and appropriate management of impacted or delayed-eruption teeth. Patients should receive a clear explanation of the imaging findings and an evidence-informed differential diagnosis, along with discussion of management options that typically include extraction of the impacted tooth with biopsy to exclude other cystic or neoplastic entities.[7] Counseling should include reassurance that surgical removal usually results in complete resolution, while also noting that incomplete enucleation or curettage can predispose to recurrence.[7] For eruption cysts, education focuses on reassurance. Patients and caregivers should be informed that these lesions are developmental, often self-limiting, and most commonly resolve spontaneously as the tooth erupts. They should also be advised on signs that warrant re-evaluation, such as persistent swelling, pain, fever, or interference with feeding, and they should understand that minor unroofing can be performed if symptomatic.[8]

For lateral periodontal cysts, which are developmental, patients should be informed that the lesion is typically benign and treatable with conservative excision. Education should emphasize the importance of removal to establish a definitive diagnosis and prevent lesion enlargement, followed by routine follow-up imaging to document healing. This approach balances reassurance with appropriate vigilance. For odontogenic keratocysts, education is especially important because the lesions are developmental, often asymptomatic, and associated with a high recurrence rate. Patients should be told that excision is required and that, even after treatment, close and long-term clinical and radiographic follow-up is necessary to detect recurrence early.[11][16] Clear explanation of recurrence risk, the rationale for prolonged surveillance, and the consequences of missed follow-up (silent enlargement and more complex surgery) improves adherence. If multiple lesions are present, patients should be counseled about the need for evaluation for syndromic associations. For orthokeratinizing odontogenic cysts, counseling can be more reassuring because excision is usually curative and recurrence is rare.[11] Patients should still understand the need for histologic confirmation and postoperative follow-up but can be guided toward an expectation of permanent resolution with appropriate management. For glandular odontogenic cysts, patients should be informed that, although developmental, these lesions have a comparatively high recurrence potential. Counseling should include discussion of treatment options, the rationale for curettage or more extensive surgery in select cases, and the importance of close long-term follow-up due to the possibility of multiple recurrences.[2][9] Shared decision-making is essential: patients should be encouraged to ask questions and should receive realistic expectations about surveillance and the potential need for additional procedures if recurrence occurs.[2][9]

Enhancing Healthcare Team Outcomes

Optimal outcomes in patients with odontogenic cysts depend on coordinated preventive care, timely diagnosis, appropriate referral pathways, and definitive treatment with histopathologic confirmation. Because odontogenic cysts span inflammatory and developmental etiologies, the

interprofessional dental team—including general dentists, dental hygienists, endodontists, oral and maxillofacial surgeons, periodontists, and oral and maxillofacial pathologists—plays complementary roles in reducing disease burden and improving patient-centered outcomes. Preventive strategies led by primary dental providers and hygienists—such as caries control, periodontal maintenance, and patient education—reduce the incidence of inflammatory cysts and decrease the likelihood of late-stage presentations that demand extensive surgery. Routine clinical and radiographic examinations are fundamental to early detection, particularly because many developmental cysts and some inflammatory lesions remain asymptomatic. Timely imaging of delayed eruption, impacted teeth, or unexplained radiolucencies enables earlier intervention, minimizing bony destruction, tooth displacement, and surgical complexity. When lesions appear atypical, demonstrate rapid growth, show multilocularity or scalloping, or are associated with significant root resorption or neurosensory changes, immediate referral to appropriate specialists is warranted for comprehensive evaluation, biopsy, and management planning. This escalation pathway helps avoid undertreatment of aggressive entities and reduces recurrence by ensuring complete removal when indicated. Treatment spans a continuum from observation (as with many eruption cysts) to definitive surgical excision, endodontic therapy, and, in select cases, more aggressive approaches for high-recurrence lesions. Across this spectrum, the oral pathologist's role in confirming diagnosis is pivotal, because prognosis, follow-up intensity, and counseling differ markedly between lesions with similar radiographic appearances, such as OKC versus orthokeratinizing odontogenic cyst. Close collaboration between the treating surgeon or endodontist and the pathology team supports appropriate margin assessment, interpretation of recurrence risk, and development of a surveillance plan. In high-recurrence entities, structured recall systems and clear communication to patients about follow-up expectations help prevent loss to follow-up and allow early detection of recurrence before extensive bone loss occurs. Ultimately, most odontogenic cysts possess low malignant potential and respond well to appropriate care. Strengthening outcomes therefore depends on consistent preventive dentistry, systematic radiographic surveillance, timely specialist referral for atypical lesions, definitive treatment with histologic confirmation, and patient-centered education that promotes adherence and long-term monitoring when required.[2][6][7][9][11][13][16]

Conclusion:

Odontogenic cysts constitute a diverse group of jaw lesions that, while generally benign, pose significant diagnostic and therapeutic challenges due to their overlapping clinical and radiographic features. The cornerstone of effective management lies in accurate classification, which cannot rely solely on imaging but requires histopathologic confirmation. Inflammatory cysts, such as periapical and residual types, typically respond well to endodontic therapy or surgical enucleation, whereas developmental cysts—including dentigerous, lateral periodontal, and keratinizing variants—necessitate removal of associated teeth and complete excision of the cyst lining. Among these, odontogenic keratocysts and glandular odontogenic cysts warrant special attention because of their aggressive behavior and high recurrence potential, underscoring the need for adjunctive surgical techniques and structured long-term follow-up. Early detection through routine radiographic screening and timely intervention minimizes complications such as bone destruction, tooth displacement, and pathological fracture. Ultimately, a multidisciplinary approach involving general dentists, oral surgeons, and pathologists ensures accurate diagnosis, appropriate treatment planning, and improved patient outcomes. Preventive strategies, patient education, and adherence to follow-up protocols remain critical components of comprehensive care for individuals affected by odontogenic cysts.

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