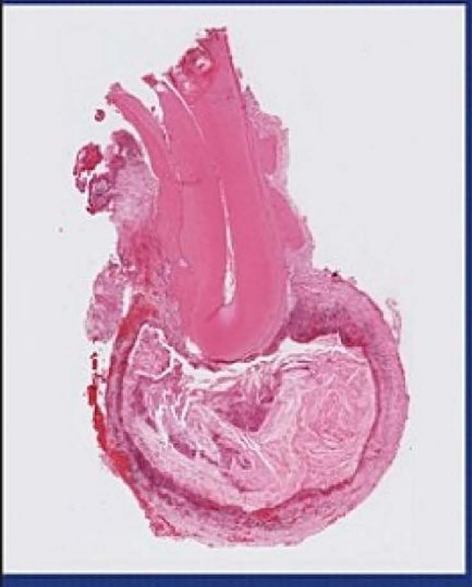
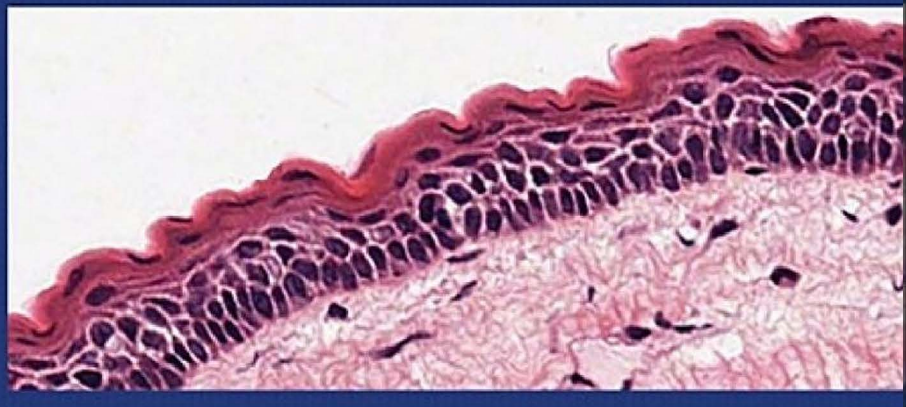
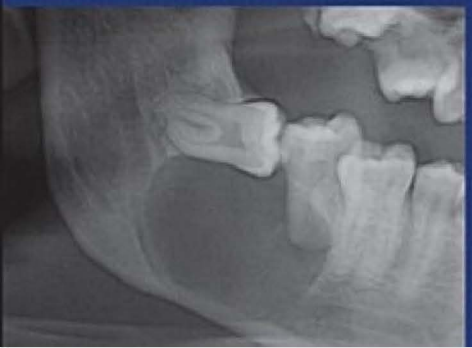
Fifth Edition

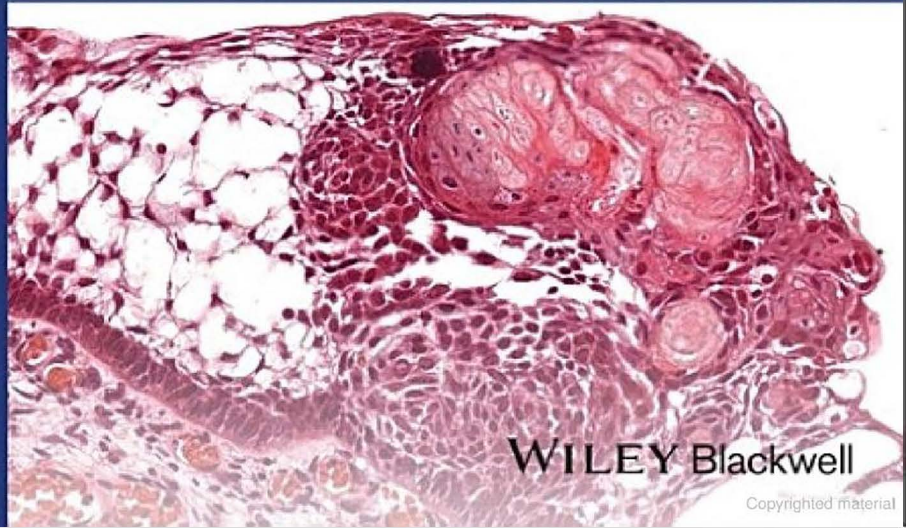
Shear's Cysts of the Oral and Maxillofacial Regions

Paul M. Speight









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Shear's Cysts of the Oral and Maxillofacial Regions

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Fifth Edition

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Mervyn Shear

1931–2017

Contents

Preface to the Fifth Edition *viii*
Foreword *x*
Acknowledgements *xi*

1 Classification and Frequency of Cysts of the Oral and Maxillofacial Regions *1*

2 General Considerations *6*

3 Radicular Cyst *20*

4 Inflammatory Collateral Cysts *47*

5 Dentigerous Cyst *62*

6 Eruption Cyst *83*

7 Odontogenic Keratocyst *87*

8 Lateral Periodontal Cyst and Botryoid Odontogenic Cyst *140*

9 Gingival Cysts *155*

10 Glandular Odontogenic Cyst *164*

11 Calcifying Odontogenic Cyst *182*

12 Orthokeratinised Odontogenic Cyst *201*

13 Nasopalatine Duct Cyst *214*

14 Nasolabial Cyst *230*

15 Cysts of the Salivary and Minor Mucous Glands *237*

16 Surgical Ciliated Cyst *262*

17 Pseudocysts of the Jaws: Simple Bone Cyst and Stafne Bone Cavity *270*

18 Developmental Cysts *288*

Bibliography *309*
Index *357*

Preface to the Fifth Edition

It is an honour to have prepared this fifth edition of Mervyn Shear's classic text on cysts of the maxillofacial regions. This edition is dedicated to his memory and I am grateful to the publishers for agreeing to make the book eponymous and have his name in the title. Mervyn Shear wrote the first edition in 1976 in an attempt to record, in a single volume, all published knowledge on the subject. Subsequent editions were published after 7 years (1983), 9 years (1992), and 15 years (2007), and each continued to attempt to be a comprehensive record of the literature. I was first honoured in this venture when I was asked to assist Professor Shear in the preparation of the fourth edition that was published in 2007. Even as we wrote it, we realised that the task was getting more difficult because of the massive proliferation of new publications. The text was lengthened considerably, but the extra information was additive and we soon realised that it was no longer possible to continue to try to present a definitive account of the entire literature. Feedback from colleagues, and in particular students, reported that the book had become too detailed and that much of the research reviewed had little relevance to the day-to-day practicalities of diagnosis and management of cysts.

We agreed that a new approach was needed and in late 2012 I was able to meet with Mervyn at his home near Cape Town. At that time he was no longer able to participate in a new edition, but together we outlined a basic plan for the changes that we felt were necessary. This new fifth edition is a complete rewrite of the book, but still maintains the basic aim of providing an understanding of the pathogenesis of each cyst type as well as recording the clinical, radiological, and histological features. The overall aim is to assist pathologists and clinicians in making a correct diagnosis and informing management, but we also wanted to make the book more accessible to students and trainees at all levels, as well as to non-specialist clinicians and general pathologists faced with an individual lesion that requires diagnosis and management. This new edition maintains the same basic layout, but is restructured to present the most common lesions first. Each chapter now includes more detailed histopathology with more photomicrographs and sections on radiological or histological differential diagnosis. There are also more detailed discussions of the historical aspects of the classification and naming of cysts that I hope will be of general interest, but also provide some context for the global variation in terminology and explain why there may be so much confusion in the literature about some cyst types. We agreed not to include, and to remove, detailed accounts of research findings that do not advance our understanding of the pathogenesis or assist in diagnosis. The applies especially to the odontogenic keratocyst, where there has been a massive increase in publications in the last two decades, but little of relevance to the practicalities of routine diagnosis and treatment.

At the outset, I had aimed to reduce the number of references and especially to remove references to some of the 'old' literature that current students and trainees may not appreciate as relevant. In the final outcome about 250 references have been removed, but about 450 new references have been added. I hope that all these are relevant and helpful. Many younger students may be surprised to find that I have retained many 'old' papers, including some landmark studies going as far back as the early 1900s, but also studies carried out in the two to three decades after 1950. Many of these papers are freely available online and report unparalleled observational studies that will never be repeated, but are invaluable because of their original detailed observations relating to the pathogenesis and histological features of many of the cyst types.

As in all previous editions, I have attempted to produce a book that is useful to students and trainees at all levels, but also to practising clinicians, whether specialists or general practitioners. Because the final diagnosis of most

lesions lies in the hands of a pathologist, I have enhanced the sections on pathology, histological features, and differential diagnosis, and hope this will assist non-specialist pathologists as much as oral and maxillofacial pathologists. I have made greater use of subsections, so that information is more accessible, allowing the reader to rapidly 'dip in' to the book to find the information they need. In this respect, the book may be a useful bench book for the diagnostician, as well as a gripping read for the keen student.

Foreword

It is an honor to acknowledge and welcome the fifth edition of *Cysts of the Oral and Maxillofacial Regions*, or in today's vernacular, *Cysts of the Oral and Maxillofacial Regions* 5.0. The oral and maxillofacial region, because of its anatomic complexity, is home to a variety of cysts and tumors unique to this site. Many of these arise from the epithelial components that form our teeth and are known as odontogenic cysts. Many of these cysts have proved to be more biologically complex than originally thought as the molecular pathogenesis has been investigated and reported. This has blurred the distinction between cysts and cystic neoplasms and the significance of the molecular landscape characterizing some of these cysts is widely and energetically debated today.

The evolution of *Cysts of the Oral and Maxillofacial Regions* has been remarkable: first edition (1976), second edition (1983), third edition (1992), fourth edition (2007), fifth ed (2022); from a concise text focusing on clinical/radiographic features and standard histologic descriptions illustrated in black and white, to an exhaustive review of every aspect of these cystic lesions richly illustrated in color. Some of the historical literature has been eliminated, particularly where it lacked clinical relevance. The current literature is extensively recorded, as is the diversity of the histologic spectrum, including immunohistochemical phenotypes and molecular/genetic alterations. Two of the world's most experienced and respected oral pathologists are responsible for this text. The text was initiated by Professor Mervyn Shear from Johannesburg, and Professor Paul Speight of the UK joined as a co-author in 2007, and he currently continues the legacy of this major contribution.

Cysts of the Oral and Maxillofacial Regions has become the definitive source of information about this complex group of lesions. No other contribution covers this topic more extensively and accurately than this text and there is something here for everyone. Clearly it is applicable for students, both predoctoral and postgraduate, as well as to radiologists, pathologists, researchers, surgeons, and other clinicians.

As scientific inquiry has exploded in recent years and the publication interval of the WHO series of classification of tumors has been shortened significantly, so too is it likely that the sixth edition of this text might be just over the horizon. But a lot has been learned since 2007, and detailed description and analysis of this new knowledge are finally available. One of the primary functions of a textbook is not just to convey what is new, but to analyze what has been published and then condense and summarize that information with an aim toward diagnostic and clinical relevancy. Professor Speight has done a masterful job of condensing our knowledge of these cysts into a readable and relevant format. This text is a must for anyone involved in the diagnosis and treatment of cysts of the head and neck. Improving our understanding of this group of lesions improves the quality of care we can provide our patients. And ultimately, that is what it's all about.

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Acknowledgements

This edition is dedicated to the memory of Mervyn Shear, who must first be acknowledged for his research and scholarship over many years that laid the foundations for all the editions of this book. For this edition I specifically acknowledge Mervyn's support and permission to restructure the book and to undertake a complete rewrite of the text, with an increased emphasis on some basic principles and on histopathology and differential diagnosis that may broaden the scope of the book, making it more accessible to a wider range of students and clinicians.

As in previous editions, we have relied heavily on the support and assistance of colleagues and on the research and scholarship of our predecessors. In particular, I would like to draw attention to a number of outstanding giants of the subject on whose shoulders we stand, and who are heavily cited in the text or with whom, over many years, we have shared and discussed cases: Mario Altini, Jerry Bouquot, Roger Browne, Roman Carlos, Geoff Craig, Ricardo Gomez, Robert Gorlin, Malcolm Harris, Jos Hille, Fumio Ide, Ivor Kramer, TieJun Li, Hans Philipsen, Jens Pindborg, Finn Prætorius, Peter Reichart, Paul Stoelinga, Takashi Takata, Paul Toller, Willie van Heerden, Pablo Vargas, and John Wright. Some of these are no longer with us, some I have never met, but most have become good friends and colleagues.

For the preparation of this fifth edition I would like to thank my colleagues, past and present, in the Unit of Oral and Maxillofacial Pathology, University of Sheffield, for their patience, for many discussions and critical comments on the text, and for their assistance in retrieving and photographing cases. Daniel Brierley, Geoff Craig, Lisette Collins, Paula Farthing, Keith Hunter, and Ali Khurram have commented freely on my thoughts and ideas about cysts and have also provided assistance in finding appropriate cases for the illustrations. Chris Franklin and Adam Jones have allowed me access to their data on the incidence of cysts and oral biopsies.

Many colleagues have selflessly provided clinical pictures, radiographs, and photomicrographs, and a number of publishers have allowed us to reproduce figures that have been previously published. For this we are very grateful, and each has been acknowledged in the relevant figure legends.

A major aim of this new edition was to broaden the readership and make the text more accessible to students, trainees, and non-specialist pathologists and clinicians. A number of colleagues have been kind enough to read early drafts of chapters and freely provided very helpful and constructive comments that have facilitated this aim: Daniel Brierley, Lisette Collins, Paula Farthing, Ali Khurram, Liam Robinson, Willie van Heerden, and John Wright.

I am also especially grateful to my colleague and friend Professor John Wright, who very kindly agreed to write the forward to this edition.

1

Classification and Frequency of Cysts of the Oral and Maxillofacial Regions

CHAPTER MENU

Classifications, 2

Cysts of the Jaws, 2

- Odontogenic Cysts, 2
  - Odontogenic Cysts of Inflammatory Origin, 3
  - Odontogenic Cysts of Developmental Origin, 3
- Non-odontogenic Cysts and Pseudocysts, 3
  - Non-odontogenic Cysts of the Jaws, 3
  - Pseudocysts of the Jaws, 3

Cysts of the Salivary and Minor Mucous Glands, 3

- Cysts of the Major and Minor Salivary Glands, 3
- Cysts of the Maxillary Sinus, 3

Developmental Cysts of the Head and Neck, 3

Frequency of Cysts of the Oral and Maxillofacial Regions, 4

There is no single satisfactory classification of cysts of the head and neck region. In part this is because terminology varies across the world, but also because classification systems may be developed to serve different purposes. Some authors have tried to subdivide lesions into multiple variants based on histological or clinical features, but this has little clinical utility in terms of planning management. Detailed classifications that include variants are nevertheless useful for research, and occasionally a reported variant may eventually emerge as a new entity. A well-known example of this is the reporting of an orthokeratinised variant of the odontogenic keratocyst (Wright 1981), which over time was shown to have distinctive clinicopathological features and is now recognised as an entity – the orthokeratinised odontogenic cyst. Other variants, however, such as the bay or pocket variant of the radicular cyst, have little bearing on clinical management and are of academic interest only. There is a tendency for classifications to be overcomplicated by pathologists, who often describe subtle histological variations as new 'entities'. The most useful classifications should be simple, should use globally recognised terminology, and should be easy to use and relevant for clinicians who treat the lesions. A straightforward uniform nomenclature facilitates communication between clinical specialties and enables precise reporting of lesions for statistical and research purposes.

International standards for classifications were first developed by the World Health Organization (WHO), which set up a global project for the histological classification of tumours in 1952 (reviewed by Sobin 1971). The project involved collecting samples of lesions that were reviewed by groups of international experts, who agreed a uniform nomenclature and established practical and clinically relevant diagnostic criteria. The first classification of cysts of the jaws was published in 1971 in *Histological Typing of Odontogenic Tumours, Jaw Cysts and Allied Lesion*s (Pindborg and Kramer 1971). This first edition was deliberately inclusive and provided a comprehensive classification of jaw lesions so that all neoplasms and cysts of the odontogenic tissues could be considered in context, allowing pathologists and clinicians to make an informed diagnosis. The second edition, published in 1992, also included cysts of the jaws (Kramer et al. 1992), but the third edition (Barnes et al. 2005) omitted cysts and restricted the

Shear's Cysts of the Oral and Maxillofacial Regions, Fifth Edition. Paul M. Speight.

classification to tumours and a range of 'tumour-like' lesions. Subsequently, the fourth (El-Naggar et al. 2017) and fifth editions (WHO 2022a, b) have included the odontogenic cysts and have restored the status of the book as a complete classification of lesions of the odontogenic tissues.

It is important to note that the WHO classifications still maintain the original principles of simplicity, relevance, and a uniform and well-recognised terminology. Thus the WHO books should be regarded as a guide to terminology, definitions, and diagnostic criteria. They are not comprehensive and do not include detailed considerations of variants, unusual features, or differential diagnosis. In this book we have adopted a simple working classification of the odontogenic cysts using the WHO terminology. We do not include detailed subdivisions or variants in the classifications, but in each chapter we discuss terminology and classification, and include details of variants of each lesion where this might have a bearing on diagnosis or management.

A further consideration is the use of the term 'cyst', which still causes disagreement and some controversy. In pathology dictionaries and general pathology textbooks, a cyst is usually defined as a closed capsule, cavity, or sac-like structure that may be empty or have fluid or semi-fluid contents. There is no requirement for a defined lining. Most contemporary oral pathology textbooks, however, choose to define a cyst as a pathological cavity *lined by epithelium*. Cyst-like spaces not lined by epithelium have been described as pseudocysts and diagnostic terms such as 'cavity' have been used. Kramer (1974) defined a cyst as 'a pathological cavity having fluid, semifluid or gaseous contents and which is not created by the accumulation of pus'. He discussed the terminology and was bemused by the requirement for an epithelial lining, stating that he was puzzled by 'the definition that demands an epithelial lining' and said: 'I am not sure how, or why, the presence of an epithelial lining became included in the definition: clearly it creates difficulties, because so many lesions that have been accepted for generations as "legitimate" cysts must now be termed pseudocysts, or false cysts, or "cysts" in quotation marks'.

The requirement for an epithelial lining probably became enshrined in oral pathology because the vast majority of cysts of the oral and maxillofacial tissues are odontogenic in origin and are lined by epithelium. Thus, the use of alternative terms such as 'pseudocyst' or 'cavity' clearly distinguishes cystic lesions without epithelium from odontogenic cysts. Although we recognise the term pseudocyst for lesions that are not lined by epithelium (see Chapter 17), we also agree with Kramer and suggest that 'cyst' can be used as a diagnostic term for lesions that are clinically or radiologically cystic. This is in keeping with common usage and understanding among clinicians and radiologists. For example, most clinicians, especially paediatric dentists, use the term cyst to describe mucoceles, whether they have an epithelial lining or not, and we therefore retain the diagnostic term *mucous extravasation cyst* for the non-epithelial lined cystic lesion caused by spillage of mucus into the tissues (see Chapter 15). Similarly, we are content to use the well-recognised diagnostic term *simple bone cyst* for the non-epithelial lined bone cavity that clinically and radiologically presents as a cystic lesion (Chapter 17). It should be noted that the definition of cyst does not include a cavity caused by an accumulation of pus, which is defined as an abscess.

In this book we do not attempt to suggest a definitive classification of cysts of the oral and maxillofacial regions, but we divide them into *cysts of the jaws*, *cysts of the salivary and minor mucous glands*, and *developmental cysts of the head and neck*. We discuss cysts that are specific to the maxillofacial regions, and cysts that are not peculiar to these regions are not included unless they have distinctive features that must be considered in the differential diagnosis. Cystic neoplasms such as unicystic ameloblastoma are not included either, although the possibility of a neoplastic origin of some of the odontogenic cysts is considered.

Our classification is intended to be simple and to be particularly useful to pathologists and clinicians who must share and understand definitions and terminology. Many other classifications have been published and may well be perfectly satisfactory. Although readers may use any classification they find valuable as an aid to memory and understanding, they are encouraged to facilitate communication by using the WHO terminology and definitions (WHO 2022a, b).

Classifications

In this edition of the book, the cysts are classified under three broad categories:

Cysts of the jaws

- Odontogenic cysts (Chapters 3–12)
- Non-odontogenic cysts (Chapters 13, 14, 16, and 17)

Cysts of the salivary and minor mucous glands (Chapter 15)

Developmental cysts of the head and neck (Chapter 18)

Cysts of the Jaws

Odontogenic Cysts

The odontogenic cysts have been divided into cysts of inflammatory origin and cysts of developmental origin. These are convenient categories, since it is clearly understood that the inflammatory odontogenic cysts arise as a result of proliferation of odontogenic epithelium driven by chronic inflammation, resulting from either pulpitis or pericoronitis. The pathogenesis of the developmental cysts is less well understood, however, and in some cases there is

evidence for a neoplastic origin. The pathogenic mechanisms involved in cyst development are discussed in Chapter 2, and details for each cyst type are presented in each chapter. Although these categories are widely used, they are not definitive, since some cysts classified as developmental may have an inflammatory origin. In particular, a variant of dentigerous cyst may be inflammatory in nature (see Chapter 5). In each category the cysts are listed in order of their approximate frequency (Tables 1.1–1.3).

Odontogenic Cysts of Inflammatory Origin

Radicular cyst
- Residual cyst

Inflammatory collateral cysts
- Paradental cyst
- Mandibular buccal bifurcation cyst

Odontogenic Cysts of Developmental Origin

Dentigerous cyst
- Eruption cyst

Odontogenic keratocyst

Lateral periodontal cyst
- Botryoid odontogenic cyst

Gingival cyst of adults

Gingival cyst of infants

Glandular odontogenic cyst

Calcifying odontogenic cyst

Orthokeratinised odontogenic cyst

Non-odontogenic Cysts and Pseudocysts

Non-odontogenic cysts of the jaws are mostly developmental in origin and arise from vestigial epithelial remnants of ductal structures or from inclusions at the line of fusion of the palatal shelves. The nasolabial and mid-palatal raphe cyst actually occur in the soft tissues, but are so closely apposed to the maxillary bone that they are included in the classification of jaw cysts. The surgical ciliated cyst is included here because it arises within the alveolar bone of the maxilla. Pseudocysts are not epithelial lined, but are included because they are important in the radiological differential diagnosis of cystic jaw lesions. As discussed above, we are content to use 'cyst' as a diagnostic term for the simple bone cyst, since this is clearly understood and widely used by clinicians who recognise that they present clinically and radiologically as a cystic lesion. Stafne bone cavity is neither a cyst nor a pseudocyst, but is an anatomical anomaly causing an indentation of the mandible that appears as a cystic lesion on radiology or imaging. It is often included in classifications and we include it here because of its importance in the radiological differential diagnosis of cystic lesions. Osteoporotic bone marrow defects are controversial lesions, but they present as cystic radiolucencies and must also be considered in the differential diagnosis.

Non-odontogenic Cysts of the Jaws

Nasopalatine duct cyst

Nasolabial cyst

Mid-palatal raphe cyst of infants (Epstein pearls)

Surgical ciliated cyst

Pseudocysts of the Jaws

Simple bone cyst

Stafne bone cavity

Osteoporotic bone marrow defects

Cysts of the Salivary and Minor Mucous Glands

Cysts affecting the salivary and minor mucous glands of the head and neck are common and may be developmental or reactive in nature. Retention and extravasation cysts (mucoceles) are the most common and may arise at any site associated with minor glands that are found throughout the submucosa of the upper aerodigestive tract and paranasal sinuses. Here we include cystic lesions of the major salivary glands as well as cysts associated with minor glands of the oral cavity and maxillary sinus. Ranula is included as a separate lesion because it has distinctive and specific clinical features and problems of management. Cystic neoplasms are not included. Intraoral lymphoepithelial cysts are included in this category even though their origin is uncertain. Some arise from intraoral tonsillar tissue, while others appear to be associated with dilated ducts of minor salivary gland.

Cysts of the Major and Minor Salivary Glands

Mucoceles
- Mucous extravasation cyst
- Mucous retention cyst
- Ranula

Salivary duct cyst (of the major glands)

Intraoral lymphoepithelial cyst

Lymphoepithelial cysts of the parotid gland

Polycystic disease of the parotid gland

Cysts of the Maxillary Sinus

Mucoceles

Retention cyst

Pseudocysts

Developmental Cysts of the Head and Neck

These cysts are mostly congenital and are usually present at birth, although some may grow slowly and not become clinically apparent until later in childhood or adolescence. The majority arise from epithelial

remnants entrapped during fusion of the facial processes or due to incomplete obliteration of the branchial clefts or pouches.

Dermoid and epidermoid cysts
Cysts of foregut origin
- Heterotopic gastrointestinal cyst
- Bronchogenic cyst

Branchial cleft cysts
Thyroglossal duct cyst
Nasopharyngeal cyst
Thymic cyst

Frequency of Cysts of the Oral and Maxillofacial Regions

Frequency statistics differ from incidence studies in that they are not standardised against known population data, such as age, sex, and ethnicity. For data to be comparable between populations and internationally, age-standardised incidence rates per 100 000 are compared with a standard world population. Incidence data are a requirement for all national cancer registries, but most benign lesions, including cysts, are not registered and thus incidence data is not available for the odontogenic cysts. Epidemiological data are therefore presented as the relative frequency of each cyst type as a proportion of the total number of cysts encountered within a population, or of the total number of specimens received. This gives clinicians an estimate of the likelihood of encountering these lesions in everyday practice.

Frequency studies are rarely based on the general population, but are usually derived from archival records of diagnoses made in a hospital department, usually pathology departments. While these provide useful data on the behaviour and treatment of different diseases, they are of limited use in international comparative studies. Table 1.3 shows the wide variation in the frequency of the three most common odontogenic cysts in different parts of the world. Almost without exception, these data are derived from retrospective analyses of pathology records and the frequency of each cyst type may depend on local protocols for patient referral and management, or even on individual pathologists' criteria for diagnosis. For example, a high frequency of radicular cysts may reflect a high caries rate in the local population, or a high rate of referral of periapical lesions. Conversely, a low frequency of radicular cysts may arise if the local practice is not to submit periapical lesions for histological analysis. In Chapter 4 we discuss the very low frequency of paradental cysts in some countries, where the lesion does not seem to be recognised as an entity and is therefore not diagnosed.

Tables 1.1 and 1.2 present our experience of the frequencies of jaw cysts in South Africa and the United Kingdom. Although the actual frequencies vary, the relative frequencies and the rank order of the lesions are very similar. In these studies, and in all studies worldwide (Table 1.3), the most common odontogenic cyst is the radicular cyst, followed by dentigerous cyst and then odontogenic keratocyst. The nasopalatine duct cyst is the most common non-odontogenic cyst and in some studies has a similar frequency among all jaw cysts to the odontogenic keratocyst (Table 1.1). All the other cyst types are relatively rare.

These data show the relative frequency of each cyst as a proportion of all cyst types, but do not allow a clinician to determine how likely it is that they will encounter a cyst in everyday practice. Jones and Franklin (2006a) reviewed over 44 000 histologically diagnosed oral and maxillofacial lesions in adults over a 30-year period. Their data show that all the cyst types described in this book represent about 20% of all biopsies received (n = 8354). Odontogenic cysts were by far the most commonly encountered (n = 6052) and the overall most common cyst type in the maxillofacial regions was the radicular cyst. They found 3793 radicular cysts (including residual cyst), representing 8.6% of all biopsy specimens received.

Table 1.1 Distribution of 3481 jaw cysts according to diagnosis.

	n	% of group	% of all cysts
Odontogenic cysts			
Radicular/residual cyst	1825	60.6	52.4
Dentigerous cyst	599	19.9	17.2
Eruption cyst	27	0.9	0.8
Odontogenic keratocyst (including orthokeratinised odontogenic cysts)	355	11.8	10.2
Inflammatory collateral cysts	109	3.6	3.1
Calcifying odontogenic cyst	28	0.9	0.8
Lateral periodontal cyst	24	0.8	0.7
Gingival cyst of adults	21	0.7	0.6
Unclassified	18	0.6	0.5
Glandular odontogenic cyst	6	0.2	0.2
	3012	**100.0**	
Non-odontogenic cysts			
Nasopalatine duct cyst	404	86.1	11.6
Simple bone cyst	35	7.5	1.0
Nasolabial cyst	21	4.5	0.6
Surgical ciliated cyst	5	1.1	0.1
Mucosal cyst of maxillary antrum	4	0.9	0.1
	469	**100.0**	
Total	**3481**		**100.0**

Source: Data courtesy of Prof. M. Shear, University of Witwatersrand.

Dentigerous cysts represented 2.5% (n = 1081) of all biopsies, and odontogenic keratocyst was 1.3% (n = 591). By comparing these data to other commonly encountered lesions, a clinician can estimate the likelihood of encountering a cyst. Common diagnoses included 6458 cases of fibrous hyperplasia (14.7%), 2973 cases of lichen planus (6.8%), and 1901 epulides (4.3%; fibrous epulis, pyogenic granuloma, or giant cell epulis). During the same period, there were 3547 periapical granulomas, showing that the frequency of periapical granulomas (8.1%) and radicular cysts (8.6%) is similar. This was also suggested by Koivisto et al. (2012), who reviewed 9723 radiolucent lesions associated with the teeth (dentigerous cysts and lesions in the ramus were excluded) and found that 73% were periapical granulomas or cysts. There were 3215 (33.1%) radicular cysts and 3931 (40.4%) periapical granulomas. The next most common lesion was the odontogenic keratocyst (8.8%; n = 857).

Among other cyst types, Jones and Franklin (2006a) found that the most common were mucoceles (3.9%; n = 1720), while all other cysts were rare (less than 1.0%).

These data show that cysts are relatively common and that the most commonly encountered are the radicular cyst, dentigerous cyst, and mucoceles. They also suggest that when a periapical radiolucency is seen, about 50% will be a radicular cyst and 50% will be a periapical granuloma. Details of the frequency and incidence of each cyst type are illustrated and discussed in the following chapters.

Table 1.2 Distribution of 7121 odontogenic cysts in a United Kingdom population.

Cysts	n	%
Radicular cyst	3724	52.3
Residual cyst	573	8.0
Dentigerous cyst	1292	18.1
Eruption cyst	15	0.2
Odontogenic keratocyst (including orthokeratinised odontogenic cysts)	828	11.6
Inflammatory collateral cysts	402	5.6
Unclassified odontogenic cysts	210	2.9
Lateral periodontal cyst	28	0.4
Calcifying odontogenic cyst	21	0.3
Gingival cyst of adults	16	0.2
Glandular odontogenic cyst	11	0.2
Gingival cyst of infants	1	0.0
Total	**7121**	**100.00**

Source: Data from Jones et al. (2006).

Table 1.3 Frequency (%) of the three most common odontogenic cysts in selected case series with a wide geographical distribution.

References	Country	N	Radicular cyst[a]	Dentigerous cyst[b]	Odontogenic keratocyst	Other	Males (%)
Daley et al. (1994)	Canada	6847	65.2	24.1	4.9	5.8	NR
Mosqueda-Taylor et al. (2002)	Mexico	856	42.1	33.0	21.5	3.4	53.1
Meningaud et al. (2006)	France	695	58.2	22.3	19.1	0.5	65.0
Jones et al. (2006)	UK	7121	60.3	18.4	11.6	8.1	55.9
Ochsenius et al. (2007)	Chile	2944	61.9	18.5	14.3	5.3	52.8
Grossmann et al. (2007)	Brazil	2812	63.0	26.1	7.4	3.5	50.0
Tortorici et al. (2008)	Italy (Sicily)	1273	84.5	11.4	1.3	2.8	53.9
Ali (2011)	Kuwait	196	52.6	26.0	15.3	6.1	57.6
Sharifian and Khalili (2011)	Iran	1227	45.8	24.7	19.4	10.1	57.1
Ramachandra et al. (2011)	India	252	50.3	22.4	27.4	NI	61.2
Manor et al. (2012)	Israel	285	56.1	28.8	8.0	7.0	59.7
Soluk Tekkesin et al. (2012b)	Turkey	5003	65.6	10.6	20.9	2.9	57.6
Tamiolakis et al. (2019)	Greece	5165	73.2	14.8	8.4	3.6	61.5
Bhat et al. (2019)	India	125	60.8	22.4	13.6	3.2	67.9
Kammer et al. (2020)	Brazil	406	53.4	14.0	15.0	17.5	56.7
Aquilanti et al. (2021)	Italy	2150	57.0	23.5	13.0	6.5	63.3

N, total number of odontogenic cysts – frequencies are proportions of odontogenic cysts only; NI, not included – proportions only given for the three main cyst types; NR, not reported.

[a] Data for radicular cyst includes residual cysts.

[b] Data for dentigerous cyst includes eruption cysts.