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The inflammatory paradental cyst: a critical review of 342 cases from a literature survey, including 17 new cases from the author's files

H. P. Philipsen[1], P. A. Reichart[2], I. Ogawa[3], Y. Suei[4], T. Takata[3]

[1]*Edif El Condór, Guadalmina Alta, Spain,* [2]*Department of Oral Surgery and Dental Radiology, Charité, Universitätsmedizin Berlin, Germany,* [3]*Department of Oral Maxillofacial Pathobiology, and* [4]*Department of Oral Maxillofacial Radiology, Hiroshima University Hospital, Japan*

BACKGROUND: A total of 325 cases of inflammatory paradental cysts (IPCs) and 17 own cases were reviewed. Although known since 1930, the IPC is still unrecognized by many clinicians. The IPCs show a relative frequency of 0.9–4.7%. The majority of cysts occur distally or distobuccally to vital, permanent mandibular molars with a history of pericoronitis (IPC/3rd mandibular molar alone accounts for 64.9%). Radiologically, the cyst appears as a well-defined, semilunar unilocular radiolucency.

MATERIALS AND METHODS: Cases of inflammatory paradental cysts and related lesions were retrieved from a worldwide literature survey. In addition, 17 new cases from the files of the authors have been added.

RESULTS: The mean ages for patients with IPC/1st, 2nd and 3rd mandibular molars are 8.7, 17.4 and 27.6 years, respectively. The male:female ratio was 1 : 0.9 for IPC/1st and 2nd mandibular molars, and 1 : 0.4 for 3rd mandibular molar.

CONCLUSION: Reduced enamel epithelium, cell rests of Malassez and remnants of the dental lamina stimulated by inflammation are thought to play a role in the pathogenesis of IPC. Histological features are indistinguishable from those of the inflammatory, periapical (radicular) cyst.
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Introduction

The most recent 'WHO Histological Typing of Odontogenic Tumours' (1) includes in the classification of odontogenic cysts for the first time *two* categories of inflammatory cysts: the conventional *radicular* (apical and lateral) and the *paradental* (inflammatory collateral, mandibular infected buccal) *cyst.* The paradental cyst is defined as '*a cyst occurring near to the cervical margin of the lateral aspect of a root as a consequence of an inflammatory process in the periodontal pocket. A distinctive form of the paradental cyst occurs on the buccal and distal aspects of erupted mandibular molars, most commonly the third molars, where there is an associated history of periodontitis*'. The purpose of this study, based on cases retrieved from a worldwide literature survey supplemented with a series of own cases, was to gain more insight into this cystic jaw lesion still unrecognized by many clinicians.

A thorough literature survey disclosed that Hofrath (2) as early as 1930, reported on several cases of jaw cysts located distally to 3rd mandibular molars that showed clinical signs of pericoronitis. The author named this type of cyst '*marginale Weisheitzahncyste*'. The clinical, radiological and histological description by Hofrath of the 'marginal wisdom tooth cyst' leaves no doubt that it fulfils the criteria of a *paradental cyst* as defined today. Interestingly, some Japanese authors (3–5) use as an alternative to the term paradental cyst even today the designation 'Hofrath's mandibular cyst'. The latter term has, however, never been in use in 'Western' publications.

Main (6, 7) is usually but according to the above information – not correctly – credited for in 1970 having first described a 'hitherto unrecognized jaw cyst' occurring alongside a vital tooth involved in chronic pericoronitis. He suggested at the time the term *inflammatory collateral cyst*. Main classified it as a dental cyst together with the radicular and residual cysts. The findings were based on a total of eight cases, seven arose in relation to 3rd mandibular molar teeth and the remaining case occurred alongside a partially erupted maxillary permanent canine.

The clinicopathological features were detailed by Craig in 1976 (8) when he reported the first significant series consisting of 49 cysts in 48 patients. All cysts occurred in relation to partly erupted 3rd mandibular molar teeth. Whereas the term suggested by Main indicated the role of inflammation, it did not emphasize the odontogenic association with respect to either histogenesis or anatomical

Correspondence: Peter A. Reichart, Charité, Campus Virchow Klinikum, Universitätsmedizin Berlin, Zentrum für Zahnmedizin, Abt. für Oralchirurgie und zahnärztliche Röntgenologie, Augustenburger Platz 1, 13353 Berlin, Germany. Tel.: +49 30 45 056 26 02. Fax: +49 30 45 056 29 01. E-mail: peter-a.reichart@charite.de
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location. As a consequence, Craig proposed the term *paradental cyst* as being more appropriate, and this designation is still in common use today.

In 1983, Stoneman & Worth (9) published an article entitled '*The mandibular infected buccal cyst – molar area*', describing 'an uncommon cystic lesion always situated on the buccal surface of a mandibular molar after partial or complete eruption. The cyst has been recognized over a period exceeding 20 years', although the authors did not refer to Main's and Craig's studies. The study by Stoneman and Worth focussed on cysts associated with 1st and 2nd permanent molars of the mandible but the authors added that '*three cases involved the third molar, and some examples are shown in Figures 14 and 15*'. Thus, the cases described by the authors are *not* restricted to cysts associated with 1st and 2nd permanent molars but involve *all* three mandibular molars, a fact that has not been fully recognized by subsequent authors.

Taxonomy

The following list of taxonomic proposals covers terms used since the cyst was first described in 1930:

- *Marginale Weisheitzahncyste* (2)
- *Inflammatory collateral cyst* (6)
- *Paradental cyst* (8)
- Craig's cyst (*several authors post-1976*)
- *Mandibular infected buccal cyst – molar area* (9)
- *Inflammatory lateral periodontal cyst* (10)
- *Inflammatory paradental cyst* (11)
- *Inflammatory paradental cyst in the globulomaxillary (GM) region* (12)
- *Mandibular infected buccal cyst (paradental cyst)* (13)
- *Paradental (inflammatory collateral, mandibular infected buccal) cyst or inflammatory paradental cyst* (1)
- *Paradental cyst of the mandibular 1st molar* (14)
- *Buccal bifurcation cyst* (15, 16)
- *Cystis paradentalis* (17)
- *Quiste mandibular infectado bucal (vestibular)* (18)
- *Eruption pocket cyst (pericoronitis-associated eruption pocket cyst)* (19)
- *Hofrath's (mandibular) cyst* (3–5)

The present authors in this review have chosen to use the term suggested by Vedtofte & Prætorius (11) as we agree that *inflammatory paradental cyst* (IPC) is the most appropriate term since inflammation is an important aspect of the cyst development, and the cyst is located adjacent to a 'tooth', which in fact should be correctly interpreted as adjacent to the *root* of the tooth – *not* the crown (19).

Material

The data upon which this review is based were retrieved from a worldwide survey of published single case reports (3–5, 14, 17, 18, 20–36), smaller (2–10 cases) (6, 9, 12, 13, 16, 37–42) and larger series (11 cases and over) (8,11,15,43–46) of IPCs, in total 325 cases. In addition, we report 17 new cases from our files in the Oral Pathology Departments in Berlin, Germany and Hiroshima, Japan, respectively. The clinical criteria for accepting reported cases of IPC were: *fully or partly erupted teeth in direct contact with the cyst. The involved tooth should have a vital pulp as evaluated by electrometrical testing and by radiographical examination. Cysts with a pericoronal relationship to a completely impacted tooth evaluated from a radiograph were disregarded to avoid confusion with dentigerous cysts*.

An increasing number of authors of recent publications agree that the cysts under discussion irrespective of localization represent variations of the same entity, the *inflammatory paradental cysts*, a view that we strongly support. The variations in clinical appearance, although minor, dictate that for the time being it seems feasible to consider the two main groups of cysts separately: those associated with 1st and 2nd permanent molars of the mandible (IPC/1st and 2nd mandibular molars), and those associated with the 3rd mandibular molar (IPC/3rd mandibular molar). The very rare IPCs occurring in the GM region lend themselves to a separate account (see the section under IPC/GM of this survey).

The material retrieved comprises 110 unilateral cases of the variant IPC/1st and 2nd mandibular molars and one case of IPC/2nd maxillary molar (bilateral occurrence was observed in 26 patients giving a total of 135 cysts), and 222 unilateral cases of the type IPC/3rd mandibular molar (with bilateral cysts occurring in 9 patients giving a total of 231 cysts). To these figures may be added 10 cases of unilateral IPCs in the GM region. The details of the 17 new cases reported by the present authors are summarized in Table 1.

Clinical and radiological features

IPC/1st and 2nd mandibular molars

Inflammatory paradental cysts in this location generally produce few symptoms and minimal signs. Discomfort, buccal swelling, moderate pain, tenderness, painful occlusion, and in some cases, suppuration and mild extraoral swelling have, however, been described, as have palpable enlarged submandibular lymph nodes. As buccal swelling

Table 1 Summary of 17 IPC cases from the authors files

Case no.	*Age (year)*	*Gender*	*Tooth involved*[*]
1	47	Male	46
2	32	Male	37
3	16	Female	37
4	40	Male	37
5	12	Male	37
6	18	Female	48
7	24	Female	48
8	30	Male	38
9	21	Female	38
10	36	Male	38
11	23	Female	48
12	26	Female	48
13	46	Male	48
14	41	Male	48
15	20	Male	48
16a[**]	20	Male	48
16b			38
17a[**]	24	Male	48
17b			38

[*]Designation of permanent teeth according to the FDI two-digit system.
[**]Case nos. 16 and 17 both showed bilateral occurrence of IPC.

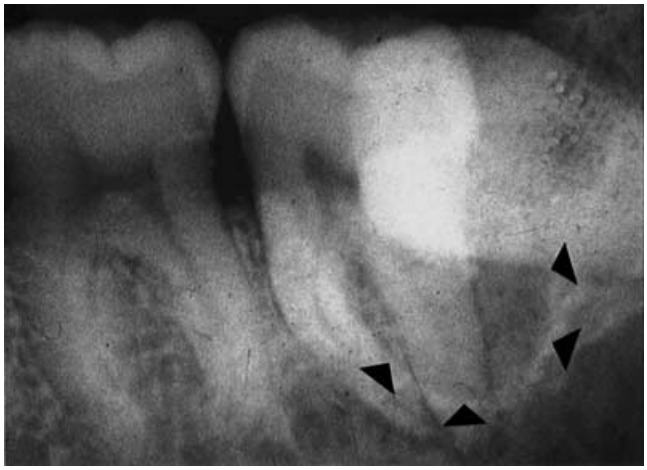

Figure 1 Intraoral radiograph revealing an IPC/2nd mandibular molar (37) showing the cystic lesion overlying the roots (arrows, case 4; Table 1).

occurs very rarely in cases involving the 2nd mandibular molar, this feature is important in diagnosing IPC in the 1st molar area in children.

At the time of surgery, the cysts are found on the *buccal* aspect of the molar, which is usually but not invariably fully erupted. The teeth are vital as evaluated by electrometrical vitality testing. The involved molar is usually tilted so that the root apices are adjacent to the lingual cortex with the crown showing buccal tipping. Deep periodontal pockets are often found on the buccal aspect of the molar.

Radiographs of which occlusal views are most useful for demonstration of the features of this variant of IPCs show a radiolucency extending to various degrees over the buccal *radicular* aspect of the molar (Figs. 1 and 2). A fine radiopaque concave or saucer-shaped line defines its lower limits, producing a U-shaped radiolucent lesion that appears superimposed upon the root. The periodontal ligament space and the lamina dura are usually intact and continuous around the root. A periosteal reaction, seen as a single or multilayered (laminated) deposition of new bone, resulting in one or several parallel opaque layers, is often present.

Examined clinically and radiographically, the IPC/1st and 2nd mandibular molars may have similarities with osteomyelitis. Wolf & Hietanen (13) thought that the IPC may also be the cause of osteomyelitis. They referred to a publication by Lichty et al. (21) under the title of 'Garré's osteomyelitis', where the clinical, radiographical and microscopical features strongly suggest that the osteomyelitis had originated from IPC/1st and 2nd mandibular molars. Thompson et al. (29) demonstrated the value of using magnetic resonance imaging (MRI) in the diagnosis of these cysts, but the authors pointed out that the cost of using this imaging modality should restrict the use to problem cases.

IPC/3rd mandibular molar

A partially or fully erupted vital 3rd molar is in direct contact with the cyst in a distal or disto-buccal location. Rarely, mesial locations have been observed (43), whereas a lingual location of the cyst seems non-existing. There is a history of pericoronitis with one or often more episodes of acute pain, swelling, trismus and halitosis. A communication from the periodontal pocket to the cyst is frequently found. Bony expansion is not commonly present. The size of the cyst varies with most lesions measuring 10–15 mm in diameter.

Radiographs that preferably should include pantomographs, periapical as well as occlusal films reveal a well-demarcated, unilocular radiolucency on the distal or disto-buccal aspect of the involved tooth (Figs. 3 and 4). The radiolucent semilunar, crescent, or flame-shaped area is often superimposed over the root of the 3rd molar and the radiolucency may mimic periapical pathology. However, on closer inspection, the periodontal ligament space is intact. Colgan et al. (46) found in their material of 15 cases of IPC/3rd mandibular molar a striking correlation between the location of the cyst and the angle of impaction of the 3rd molar. The cyst was located on the mesial aspect of the two acutely mesioangular teeth, buccal to the two vertically situated teeth and distal or disto-buccal to the remaining

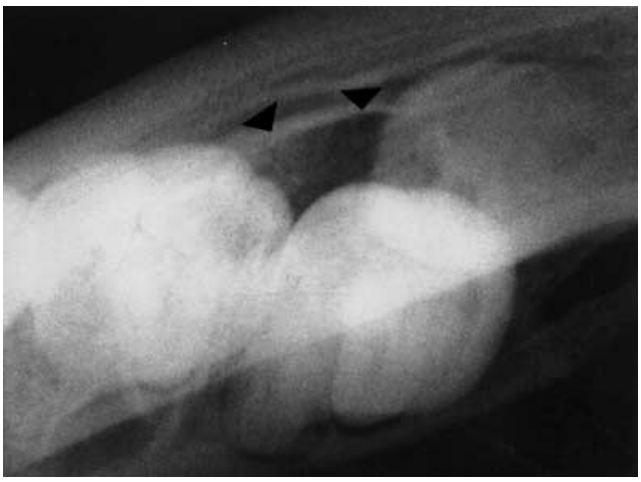

Figure 2 The occlusal view shows the cystic lesion (arrows) to be located buccally to 37 anterior to the crown of the horizontally retained 38 (case 4; Table 1).

Figure 3 Panoramic radiograph showing a characteristic IPC distal to the vertically retained 38. The cystic lesion is attached to the amelo-cemental junction. The right angle of the mandible reveals a large radiolucency (dentigerous cyst) involving the crown of the embedded 48.

Figure 4 Typical IPC distal to 48 with a semilunar-shaped radiolucency (case 16a; Table 1). This case showed bilateral occurrence of IPC (38, 48).

11 teeth. Preservation of the follicular space around the tooth distinct from the cyst itself (so-called Colgan's sign) was clearly seen in nine cases and was considered a useful diagnostic sign.

IPC/GM

The literature survey has retrieved only 10 cases (Table 3) of this rare 'variant': two single cases (6, 34) and a small series of eight cases (12).

According to the report by Vedtofte & Holmstrup (12; see Table 3), the eight cases of IPC/GM fulfilled the following criteria: the cyst was located intraosseously between the roots of a fully erupted lateral incisor and canine as evaluated from a radiograph, the pulp of the adjacent teeth was vital, and histology of the cyst showed a non-keratinized, squamous epithelial lining with heavy inflammatory reaction of the connective tissue capsule. The authors found a communication from the periodontal pocket of the associated teeth in three of the eight cases. Five of the eight patients were asymptomatic and were diagnosed incidentally from a radiograph. The IPC/GMs showed well-defined radiolucencies located between the diverging roots of the permanent canine and lateral incisor with a size varying between 14 mm × 10 mm and 23 mm × 14 mm.

Thus, the lesions described by Vedtofte & Holmstrup (12) may be categorized as 'GM cysts', a clinical diagnosis that appropriately has been described by Shear (47) as 'a relic of an earlier period'. A variety of cysts like the keratocyst, and calcifying odontogenic cyst as well as benign tumours such as odontogenic myxoma, adenomatoid odontogenic tumour can occur as well-demarcated radiolucent lesions in the permanent lateral incisor-canine region of the maxilla. The present authors concur with Vedtofte & Holmstrup (12) that the IPC/GMs show some similarities to the clinical features of the IPCs/1st and 2nd permanent molar of the mandible, in particular. Therefore, it cannot be excluded that IPC/GM may be regarded as yet another 'member of the IPC-family'. The IPC/GM cases are exceptional in that IPCs in all other locations occur in association with teeth having multiple cusps (permanent molars).

IPC/2nd maxillary molar

Among the 27 cases of IPCs presented by Vedtofte & Prætorius (11), 1 case was located on the buccal aspect of a 2nd maxillary molar in an 18-year-old patient. No further details were given. Cases with this location have not subsequently been reported.

Epidemiological data

Data from published studies where all case details are available (symptoms, age, gender, location, radiographic findings, and histology) were very restricted. In fact, only 42% of IPC/1st and 2nd permanent molar cases and 21% of cases of IPC/3rd permanent molars could be used as basis for detailed evaluations.

When reference in the following is made to IPC cases, it refers to *patient cases and* not to number of cysts unless specifically indicated.

Prevalence, incidence or relative frequency

Data on incidence and prevalence of IPCs are not available. The reported relative frequency figures (percentage of IPCs in relation to all odontogenic cysts accessioned over a given period) vary between 0.9 and 4.7%. Table 2 summarizes available data.

Age

The age range of patients with *IPC/1st mandibular molars* varies for males ($n = 24$) between 5 and 47 years and for females ($n = 12$) between 6 and 11 years, with a mean age of 9.0 and 8.1 years, respectively (Fig. 5).

The corresponding age range for *IPC/2nd mandibular molars* varies for males ($n = 8$) between 10 and 40 years and

Table 2 Relative frequency of IPCs

Author (ref. no.)	*Site of IPC not specified (cases)*	*IPC/3rd molar (cases)*	*IPC/1st, 2nd and 3rd molars (cases)*
(8)		4.7% (48)	
(45)			4.3%[a]
(43)			2.5% (47)
(47)	3% (78)[b]		
(46)		1.6% (15)[c]	
(44)			0.9% (25)[d]
(40)	0.8% (3)		

[a]Material comprised 3 IPC/1st and 2nd mandibular molars and 51 IPC/3rd mandibular molar.

[b]Shear (47) differentiated between inflammatory collateral cysts (ICCs) and paradental cysts. The ICC is arising in the periodontium of an erupted tooth as a result of an inflammatory process in a periodontal pocket. The ICC showed a frequency of 0.5%, and paradental cyst a frequency of 2.5%. As the ICC and the paradental cyst can be considered one and the same lesion, the relative frequency of IPCs amounts to 3.0%. The relative frequency figures given above may be compared with corresponding figures (47) for some well-known odontogenic cysts: radicular cyst, 52.3%; dentigerous cyst, 16.6%; and odontogenic keratocyst, 11.2%. Several authors have indicated that the true frequency of IPC is likely to be substantially greater. Either the cyst has not been recognized or is recorded as a lateral dentigerous (follicular) cyst.

[c]IPCs accounted for 25% of lesions *related to 3rd mandibular molars*, which make IPCs the second most common cyst after dentigerous cysts at this site.

[d]Material comprised 13 IPCs/1st and 2nd mandibular molars and 12 IPCs/3rd mandibular molar.

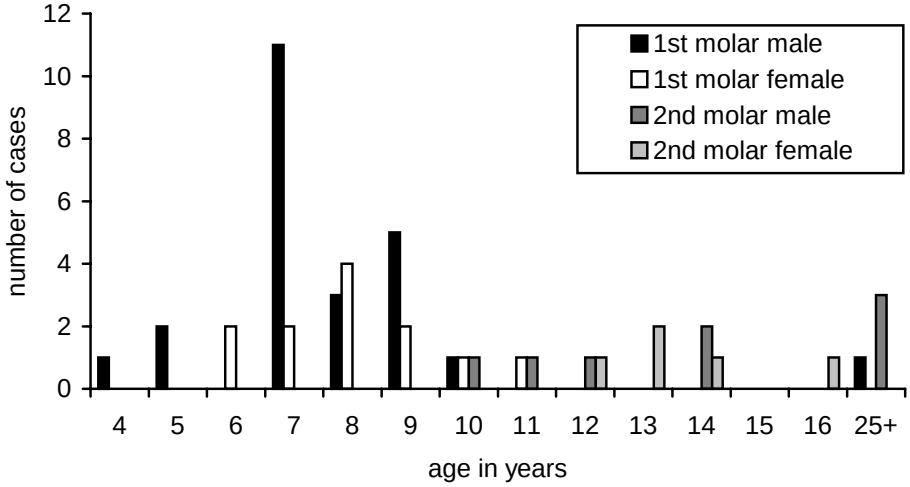

Figure 5 Age distribution – IPC/1st and 2nd mandibular molars ($n = 49$).

for females ($n = 5$) between 12 and 16 years, with a mean age of 19.8 and 13.6 years, respectively (Fig. 5).

The age range of patients with *IPC/3rd mandibular molars* varies for males ($n = 24$) between 20 and 47 years and for females ($n = 18$) between 18 and 47 years, with a mean age of 29.8 and 24.7 years, respectively (Fig. 6).

Gender

Based on data for *IPC/1st and 2nd mandibular molars* (males, $n = 48$; females, $n = 39$), the male:female ratio is 1 : 0.9.

For *IPC/3rd mandibular molars* (males, $n = 72$; females, $n = 30$), the male:female ratio was 1 : 0.4. Thus, there is a male preponderance in the IPC/3rd mandibular molar group, for which no satisfactory explanation can be offered at this moment in time.

For *IPC/GM*, the male:female ratio was 8 : 1 (see Table 3).

Location

It is characteristic that IPCs occur only in restricted areas of the jaw bones, predominantly associated with the roots of teeth with multiple cusps. The majority of cysts (61.4%) published so far are associated with the 3rd mandibular molar. The remaining cysts (38.6%) have been found associated with either the 1st or 2nd, mandibular permanent molars (35.9%), and exceptionally, associated with maxillary permanent incisors/canines ('globulomaxillary' variant, 2.7%).

Bilateral location of IPCs

Of 110 cases of IPC/1st and 2nd mandibular molars, including one case of IPC/2nd maxillary molar, 26 cases (23.6%) occurred bilaterally (22 IPCs/1st mandibular molar and 4 IPC/2nd mandibular molar). In the IPC/3rd mandibular molar cases (222 in all), only nine cases (4.1%) were diagnosed as occurring bilaterally (Fig. 5). In one reported series of IPCs (15), the number of bilateral cases amounted to 12 out of 32 (37.5%). In 10 cases, the second (subclinical) contralateral IPC was noted on radiographs and confirmed at the time of surgery. It is therefore generally recommended that the contra-lateral tooth should be carefully evaluated for a second lesion. Martinez-Conde et al. (27) suggested that

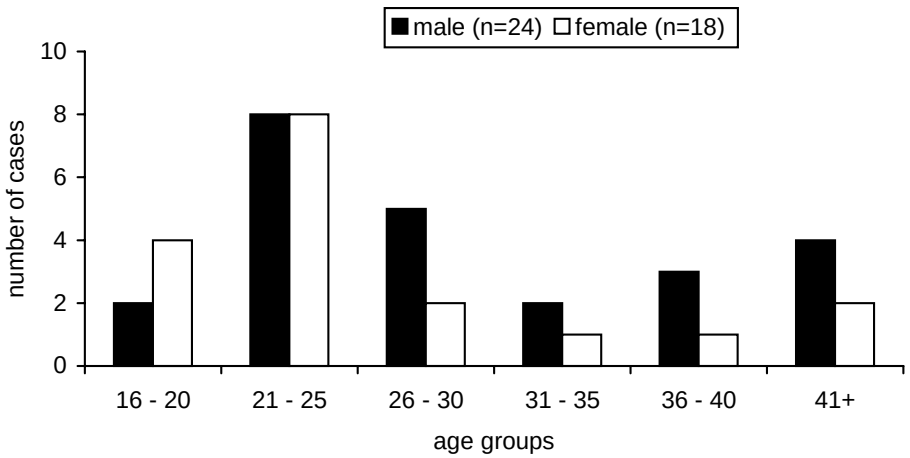

Figure 6 Age distribution – IPC/3rd mandibular molar ($n = 42$).

Table 3 Summary of cases of IPC/GM

		Age groups (decades)		*Gender*	
Author (ref. no.)	*No. of cases*	*10–19*	*40–49*	*Male*	*Female*
(6)	1	n.i.	n.i.	n.i.	n.i.
(12)	8	7*	1*	7	1
(34)	1	1		1	

n.i., No information available.
*Mean age = 18.8 years.

the frequent appearance of bilateral cases may indicate a developmental origin. However, the evidence is speculative at best.

Pathogenesis

The pathogenesis of IPC remains unclarified. Inflammation in the superficial part of the periodontium (pericoronitis) of erupting teeth seems to play a major role in stimulating odontogenic epithelium present in the region to proliferation. The origin of the lining of IPCs has been debated at great length.

Direct proof of origin from any particular source is lacking, but circumstantial evidence suggests that the reduced enamel epithelium and the epithelial rests of Malassez merit consideration. Other hypotheses for the origin include the crevicular epithelium and epithelial remnants of the dental lamina. Craig (8) suggested that either the cell rests of Malassez or the reduced enamel epithelium (early epithelial attachment) might provide the cells of origin. He and later Ackermann et al. (43) favoured the latter source. Ackermann et al. (43) found in their study that the rests of Malassez always appeared inactive. They argued that if the Malassez rests were responsible for the development, IPCs should be equally distributed around the root surface. Serial sections of IPC/3rd mandibular molar indicated that the development of the IPC may follow hyperplasia and cystic change in the reduced enamel epithelium.

Craig (8) observed in 20 of 28 cases where the associated teeth were available for study that the buccal root surface revealed a developmental enamel projection or spur extending from the amelocemental junction towards the bifurcation. He suggested that the presence of an extension of reduced enamel epithelium over the enamel projection might be the source, and could explain the buccal location of the cyst.

Most authors believe that the cyst associated with 1st and 2nd mandibular molars of infants is an inflammatory paradental cyst and that it is no longer seen as tenable to regard the former cyst as a distinct pathological entity. The difference in clinical presentation of IPCs between the child and adult patient can be explained by a different host response to infection and inflammation. The histopathology of the cysts is identical.

All published studies indicate that the association between the IPC and a partly or fully erupted tooth whether 1st, 2nd or 3rd permanent molar, offers strong support for an odontogenic origin of the cyst. In addition, the histopathological features described (see the section under Histopathological finding) are also consistent with an origin from odontogenic epithelium. Fowler & Brannon (38) were of the opinion that IPC is most likely a variant of the dentigerous cyst, a suggestion supported by Lindh & Larsson (24). Colgan et al. (46) observed opposing maxillary molar teeth in 13 of their 15 reported cases, which they believed could point to a role for food impaction in the development of the IPC. The resultant inflammatory process in the soft tissue leads, according to these authors, to occlusion of the opening of the pocket in the pericoronal soft tissues, further leading first, to accumulation of fluid within the obstructed pocket, and second, to cystic expansion.

Pathology

Macroscopy

Only cases of IPC/3rd mandibular molar allow a description of the macroscopy as removal of the molar (including attached soft cystic tissue) is the recommended treatment of choice for this variant. Both Craig (8) and Fowler & Brannon (38) reported that the IPC is attached to the root surface covering the bifurcation. The cyst-like soft tissue is attached to the amelocemental junction or extends for variable distances along the root surface (Fig. 7).

Microscopy

Histopathological findings

The IPC is classified as an odontogenic cyst of inflammatory origin, and thus has a counterpart in the periapical, radicular cyst, from which the IPC cannot be distinguished histologically. The lining consists of hyperplastic, non-keratinized, spongiotic stratified squamous epithelium (Fig. 8). The fibrovascular connective tissue capsule is the seat of an intense chronic or mixed inflammatory cell infiltrate. Other histological findings are foci of haemosiderin pigment and cholesterol clefts, features that are consistent with those of inflammatory cysts. In three of the 15 cases of IPC/3rd mandibular molar reported by Colgan et al. (46), the cysts were lined by a thin, stratified epithelium with basal budding

Figure 7 Extracted molar (48) with IPC attached to the amelo-cemental junction as seen in Fig. 4.

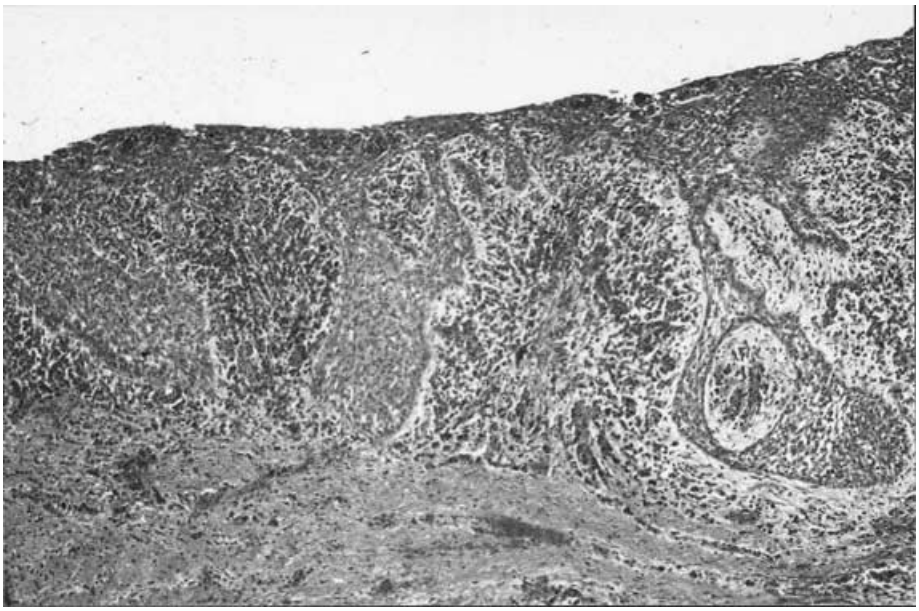

Figure 8 Photomicrograph of an IPC lined by cyst epithelium of varying thickness and severe subepithelial infiltration by immunocompetent cells (H&E, ×80).

and oedematous pale-staining superficial layers, which according to the authors resembled that described in unicystic ameloblastoma. Fowler & Brannon (38) noted that two of the six cases exhibited giant cell hyaline angiopathy, a histological feature seen in periapical granulomas (47).

Differential diagnosis

Several suggestions as to differential diagnosis have been put forward over the years: the lateral radicular cyst (if the tooth proves non-vital), severe localized periostitis, odontogenic keratocyst, lateral dentigerous cyst that persists after eruption, squamous odontogenic tumour, giant cell tumour (giant cell granuloma) and histiocytosis X. As regards the lateral dentigerous cyst, Colgan and coworkers (46) proposed that the presence of Colgan's sign (the preservation of the distal follicular space in a radiograph) is a useful diagnostic feature to distinguish an IPC from a lateral dentigerous cyst because it indicates that most of the follicle is not involved in the process of cyst development.

Recommended treatment, spontaneous regression and recurrence

Enucleation of the IPC and extraction of the tooth is the recommended treatment for IPC/3rd mandibular molar, whereas IPC/1st and 2nd mandibular molars are treated by enucleation of the cyst alone with preservation of the associated tooth. Provided that the lesion is completely removed, recurrence is encountered extremely rarely (11, 29). David et al. (16) showed, based on three cases of IPC/1st mandibular molar, that at least some cases seem to be 'self-limiting'. Microtrauma, including periodontal probing, may cause the cyst to depressurize followed by spontaneous healing. However, the authors refrained from giving guidelines on which cysts need to be watched, and which required surgical treatment.

Conclusion

If knowledge about the IPC is to be increased, if only of academic interest, several issues disclosed by the present survey need to be addressed in future studies.

The term IPC originally suggested by Vedtofte & Prætorius (11) covers cases of IPC/1st and 2nd mandibular molars (mandibular infected buccal cyst, and buccal bifurcation cyst) as well as IPC/3rd mandibular molar. Of the terms listed earlier (see the section under Taxonomy), lateral periodontal cyst, suggested by Main (10), should definitely be avoided to prevent confusion between IPC and the developmental lateral periodontal cyst.

As pointed out by Craig (8), Fowler & Brannon (38) and Brannon & Fowler (49), and recently reiterated by Slater (19), the IPC/3rd mandibular molar principally occurs buccal and/or distal to the root (*not* the crown) of the erupting 3rd molar, a view that we fully support. If the term IPC or paradental cyst is not entirely appropriate, Slater (19) suggested a new designation: 'eruption pocket cyst' or 'pericoronitis-associated eruption cyst'. In order not to introduce even more confusion by proposing yet another term, the designation IPC should suffice, provided that the term inflammatory *paradental* cyst be interpreted as an inflammatory *para-radicular* cyst associated with a vital tooth.

Irrespective of the location of the IPC, the associated tooth must be partly or fully erupted. Completely embedded or impacted teeth with a pericoronal cystic lesion are disregarded for the reasons mentioned above. Although a vital pulp of the involved tooth (evaluated by electrometrical testing) by most authors is regarded as an important diagnostic criterion, it is far from all published reports that have

recorded this finding or performed the vitality test. If the vitality test suggests a non-vital pulp, the diagnosis of a *lateral radicular cyst* should be considered rather than an IPC. However, pulp vitality tests are not finally diagnostic, but require to be interpreted in the light of other clinical findings. Occasionally, they can be frankly misleading. For these reasons, Lim & Peck (31) suggested that the vitality of the involved tooth should not be a diagnostic criterion of the IPC, a viewpoint that needs further consideration.

Although this survey covers a total of 342 cases of IPCs, only less than half of the reported IPC/1st and 2nd mandibular molars and one-fifth of the IPC/3rd mandibular molar cases contained all the epidemiological details that enable an in depth evaluation. Therefore, more studies are needed on single as well as series of cases, provided that they are presenting all relevant information.

As shown in Table 2 of this survey, frequency figures for IPCs/1st and 2nd mandibular molars are still lacking as opposed to the figures for IPCs/3rd mandibular molar.

Association with mandibular molars seem to be a characteristic clinical feature of the IPC. It is still not known why eruption of teeth with multiple cusps in conjunction with pericoronitis, at the time when the tooth crown penetrates the oral mucosa, triggers the development of IPCs in particular. Only one case of a maxillary (2nd) molar with an associated IPC has been reported (11). The occurrence of IPC/GM region (6, 11, 34) also needs confirmation from further studies. Stoneman & Worth (9) have offered an explanation why the buccal aspect of a permanent mandibular molar so frequently is the site of IPC development. The mesio-buccal cusp is the first during the phase of eruption to break through the oral mucosa and be exposed to the oral environment.

The origin of the epithelial lining of the IPC is still speculative. A histological study of a substantial series of undoubted cases of IPCs (in this context only IPC/3rd mandibular molar cases are relevant) sectioned in continuity with the 3rd molar, is likely to disclose important aspects of this unsolved issue.

With regard to IPC/3rd mandibular molar, authors agree that removal of the molar with enucleation of the cyst is the treatment of choice. As to IPC/1st and 2nd mandibular molars, the favoured treatment is enucleation of the cyst *with* preservation of the associated molar. However, there is a need for more clinical studies investigating the long-term outcome of the latter treatment. Lastly, more observations of spontaneous regression as reported by David (16) and Gomez et al. (30) for IPC/1st and 2nd mandibular molars might possibly solve the question about the conservative management of these cysts 'with an expectant watchful inactivity'.

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