Original Research
Oral Pathology

Clinicopathologic analysis of oral dermoid and epidermoid cysts: a Brazilian multicenter study

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Abstract: Dermoid cysts (DCs) and epidermoid cysts (ECs) are uncommon developmental cysts affecting the oral cavity. This study aims to evaluate patients with oral DCs and ECs and their demographic and clinicopathologic features. A retrospective descriptive cross-sectional study was performed. A total of 105,077 biopsy records of oral and maxillofacial lesions from seven Brazilian oral pathology centers were analyzed. All cases diagnosed as oral DCs and ECs were reviewed, and clinical, demographic, and histopathological data were collected. The series comprised 32 DCs (31.4%) and 70 ECs (68.6%). Most of the DCs occurred on the floor of the mouth (n = 14; 45.2%) of women (n = 17; 53.1%) with a mean age of 34.6 ± 21.6 years. All DCs were lined partially or entirely by stratified squamous epithelium (100%). Chronic inflammatory cells, melanin pigmentation, multinucleated giant cell reaction, and cholesterol clefts were observed in the fibrous capsule . Most of the ECs affected the labial mucosa (n = 20; 31.7%) of men (n = 39; 56.5%) with a mean age of 48.0±19.8 years. Microscopically, most ECs (n = 68; 97.1%) were lined entirely by stratified squamous epithelium. Two cysts (2.9%) showed areas of respiratory metaplasia. Chronic inflammatory cells, melanin pigmentation, multinucleated giant cell reaction, and cholesterol clefts were also observed in the fibrous capsule. Conservative surgical excision was the treatment of choice in all cases. Oral DCs and ECs are uncommon and often clinically misdiagnosed lesions. Clinicians should consider DCs and ECs in the differential diagnosis of soft tissue lesions in the oral cavity, mainly located on the floor of the mouth and labial mucosa.

Keywords: Dermoid Cyst; Epidermal Cyst.

Introduction

Epidermoid cysts (ECs) and dermoid cysts (DCs) are considered developmental cysts that belong to the group of congenital cutaneous cysts occurring in any location of the body.[1,2] Although these lesions are commonly observed in the head and neck region, oral ECs and DCs are uncommon, accounting for less than 1% of all lesions in the oral cavity.[2] Given the non-specific clinical appearance and similarity to various oral lesions, clinicians and dentists may face some challenges in recognizing

these conditions.[3] Thus, accurate diagnosis requires histopathological evaluation.[3,4]

Histologically, DCs are lined by stratified squamous epithelium containing cutaneous adnexa such as sebaceous glands, hair follicles, and sweat glands in the fibrous capsule.[2,3,5] When cutaneous adnexal structures are absent, these cysts are called ECs.[2,3,5-9]

Currently, few large well-documented series of oral DCs and ECs have been reported in the English language literature,[1,2,7] and some of them address only clinical characteristics.[1,7] Thus, this study aimed to report the clinicopathologic features of 102 DCs and ECs affecting the oral cavity in a Brazilian multicenter study – the largest series ever reported in the literature. Also, we provide a comprehensive discussion emphasizing the etiopathogenesis and clinical and morphological features of these unusual oral cysts.

Methodology

Study design and sampling

Cases diagnosed as ECs and DCs were retrieved from seven Brazilian oral and maxillofacial pathology centers: Department of Biosciences and Oral Diagnosis, School of Biosciences, São Paulo State University (Unesp) (Southeast region); Department of Oral Surgery and Pathology, School of Dentistry, Universidade Federal de Minas Gerais (UFMG) (Southeast region); School of Dentistry, State University of Rio de Janeiro (Southeast region); Department of Dentistry, Federal University of Goiás (UFG) (Midwest region); Department of Dentistry, University of Fortaleza (Northeast region); Department of Dentistry, Tiradentes University (Unit) (Northeast region); and Department of Dentistry, State University of Paraíba (UEPB) (Northeast region). The study was approved by the Ethics Committee of the State University of Paraíba (UEPB) (Protocol nº 56048322.7.0000.5187).

Patient age, sex, skin color, symptoms, anatomical location, size, color, consistency, treatment performed, recurrence, and the principal clinical diagnosis were obtained from clinical records and evaluated. Only those cases affecting the oral cavity were selected and included in the present study. ECs and DCs located in the skin of the perioral region were excluded. Recurrence was determined by a new histopathological diagnosis of ECs and DCs in the same anatomical location and same patient.

Morphological evaluation

Histopathological analysis was performed under a light microscope (Olympus CX31, Olympus Japan Co., Tokyo, Japan). Five-micrometer hematoxylin and eosin-stained sections were obtained from each case. Seven oral pathologists re-evaluated the histopathological features of the lesions. The lining epithelium (squamous stratified, intestinal epithelium, and respiratory epithelium) was assessed. The presence of hair follicles, hair, sweat glands, sebaceous gland, and salivary glands was analyzed for dermoid cysts. Other features in the cystic capsule, such as neural tissue, smooth and striated muscle, adipose tissue, bone, cartilage, and inflammatory infiltrate, were also investigated. Cholesterol crystals, hyaline ring granulomas (HRGs), multinucleated giant cell reaction, Meissner corpuscles, Pacinian corpuscle, and melanin pigmentation were also evaluated.

Analysis

Descriptive and quantitative data analysis was performed using Statistical Package for the Social Sciences for Windows 20.0 (SPSS, Inc., Chicago, USA). Continuous variables were expressed as mean, median, and standard deviation (SD). Categorical variables were defined as the absolute number of cases and percentage values. The chi-square test and Fisher's exact test were used to evaluate the association between clinical and demographic characteristics, adopting a p-value of ≤ 0.05 and a 95% confidence interval. The Student's t-test was used to compare the means between the two groups (dermoid cyst vs. epidermoid cyst).

Results

A total of 105,077 surgical specimens had been received at the studied centers; of these, 32 (0.03%) had been diagnosed as DCs and 70 (0.07%) as ECs. The demographic and clinical data are summarized in Table 1.

Table 1. Clinical and demographic features of 102 oral dermoid and epidermoid cysts.

Clinical aspects	Dermoid cysts (n = 32)		Epidermoid cysts (n = 70)		p-value
	n	(%)	n	(%)	
Sex					
Female	17	53.1	30	43.5	
Male	15	46.9	39	56.5	0.3976[a]
M:F ratio	1:1.1	-	1.3:1	-	
NI	-		1	-	
Age (years)					
0–9	2	6.7	4	6.2	
10–19	7	23.3	6	9.2	
20–29	3	10	9	13.8	
30–39	1	3.3	10	15.4	
40–49	6	20	11	16.9	
50–59	7	23.3	15	23.1	
60–69	2	6.7	4	6.2	
70–79	1	3.3	5	7.7	
80–89	1	3.3	1	1.5	
NI	2	-	5	-	
Mean (±SD)	34.6 ± 21.6	-	48.0 ± 19.8	-	< 0.0001[b]
Range	2–83	-	0–87	-	
Skin color/ethnicity					
White	8	32	26	52	
Brown	12	48	15	30	
Afro-descendant	5	20	9	18	
NI	7	-	20	-	
Anatomical site					
Floor of the mouth	14	45.2	18	28.6	
Lip	9	29.0	20	31.7	
Tongue	3	9.7	2	3.2	
Buccal mucosa	2	6.5	17	27	
Retromolar trigone	2	6.5	2	3.2	
Alveolar ridge mucosa	1	3.2	1	1.6	
Palate	-	-	2	3.2	
Gingiva	-	-	1	1.6	
NS	1	-	7	-	
Color					
Yellowish	4	19.0	6	13.6	
White	2	9.5	8	18.2	
Normochromic	13	61.9	23	52.3	
Reddish	-	-	1	2.3	
Brown	2	9.5	3	6.8	

Continue

Continuation					
White-yellowish	-	-	3	6.8	
NI	11	-	26	-	
Consistency					
Firm	9	69.2	13	68.4	
Soft	4	30.8	5	26.3	
Fluctuant	-	-	1	5.3	
NI	19	-	51	-	
Symptomatology					
Asymptomatic	11	45.8	38	74.5	
Symptomatic	13	54.2	13	25.5	
NI	8	-	19	-	
Size (cm)					
Up to 2.2 cm	13	56.5	27	62.8	
> 2.2 cm	10	43.5	16	37.2	
Mean (±SD)	2.2 ± 2.1	-	1.7 ± 1.6	-	0.0635[b]
Range	0.2–8.0	-	0.2–6.0	-	
NI	9	-	27	-	
Treatment					
Conservative surgical excision	29	100	51	100	
NI	3	-	19	-	
Concordance between clinical and histopathological diagnosis					
Disagreement	47	72.3	22	75.9	
Agreement	18	27.7	7	24.1	
NI	5	-	3	-	

NS, Intraoral site not specified; NI, not informed; [a]Fisher's exact test.[b]Student's t-test.

Clinical features

Epidermoid cysts

Thirty-nine (56.5%) cases occurred in males and 30 (43.5%) in females, with a male-to-female ratio of 1.3:1. The mean age of the patients was 48.0 ± 19.8 years (range of 2–88 years). Patients between the fourth and sixth (n = 36, 55.4%) decades of life were the most affected. Only four lesions (6.2%) occurred in children (age ≤ 9 years). The labial mucosa was the most affected site (n = 20; 31.7%), followed by the floor of the mouth (n = 18; 28.6%) and buccal mucosa (n = 17; 27.0%). Other anatomical sites included the tongue (n = 2; 3.2%), retromolar trigone (n = 2; 3.2%), palate (n = 2; 3.2%), gingiva (n = 1; 1.6%), and alveolar ridge mucosa (n = 1; 1.6%) (Table 1).

Clinically, most ECs presented as well-circumscribed sessile papules or nodules, measuring from 0.2 to 6.0 cm (1.7 ± 1.6) and firm (n = 13; 68.4%) to soft (n = 5; 26.3%) in consistency. Most of the cases presented a normochromic (n = 23; 52.3%) or white (n = 8; 18.2%) coloration (Figure 1F). Most of them were asymptomatic (n = 38, 74.5%); however, some patients (n = 13; 25.5%) reported slight pain. The evolution time varied from 2 weeks to 6 years (mean: 10.3 ± 16.8 months).

Regarding the clinical diagnosis, only 27.7% of cases had been diagnosed as ECs (n = 18). Other presumptive diagnoses included sebaceous cyst (n = 21; 32.2%), DC (n = 8; 12.3%), lymphoepithelial cyst (n = 4; 6.2%), fibrous hyperplasia (n = 4; 6.2%), neurofibroma (n = 1; 1.5%), teratoid cyst (n = 1; 1.5%), and miliaria (n = 1; 1.5%). Clinical diagnostic hypotheses were not

mentioned in five cases. Treatment of all cases (n = 70; 100%) consisted of conservative surgical excision (excisional biopsy). Outcome information was available from 18 patients (25.7%), with clinical follow-up ranging from 4 to 36 months (mean 14.3 months); no cases developed local recurrence.

Dermoid cysts

DCs were slightly more prevalent in females (n = 17; 53.1%), with a mean age of 34.6 ± 21.6 years (range of 2–83 years) and a 1.1:1 female-to-male ratio. Patients in the second (n = 7; 23.3%) and sixth decades of life were most affected (n = 7, 23.3%). The floor of the mouth was the most affected site (n = 14; 45.2%), followed by the lip (n = 9, 29.0%). Clinically, most DCs presented as well-circumscribed firm swellings (n = 9; 69.2%) (Figure 1) with a normochromic coloration (n = 13; 61.9%). The lesions ranged from 0.2 to 8.0 cm (largest diameter), with an average of 2.2 (SD ± 2.1). The evolution time varied from a few weeks to 10 years (mean: 11.3 ± 17.9 months), and two were congenital (6.7%). Thirteen cases were symptomatic (54.2%); of these, eight were located on the floor of the mouth. Most of these cases reported difficulty speaking, chewing, or swallowing. Four patients had marked extraoral swelling of the submental and sublingual region, causing the development of a "double chin."

Regarding the clinical diagnosis, only 24.1% of the cases (n = 7) were diagnosed as DCs. Other presumptive diagnoses included EC (n = 10; 34.5%), sebaceous cyst (n = 5; 17.2%), lipoma (n = 3; 10.3%), mucocele (n = 1; 3.4%), fibrous hyperplasia (n = 1; 3.4%), lymphoid aggregates (n = 1; 3.4%), and lymphoepithelial cyst (n = 1; 3.4%). Clinical diagnostic hypotheses were not mentioned in three cases. Conservative surgical

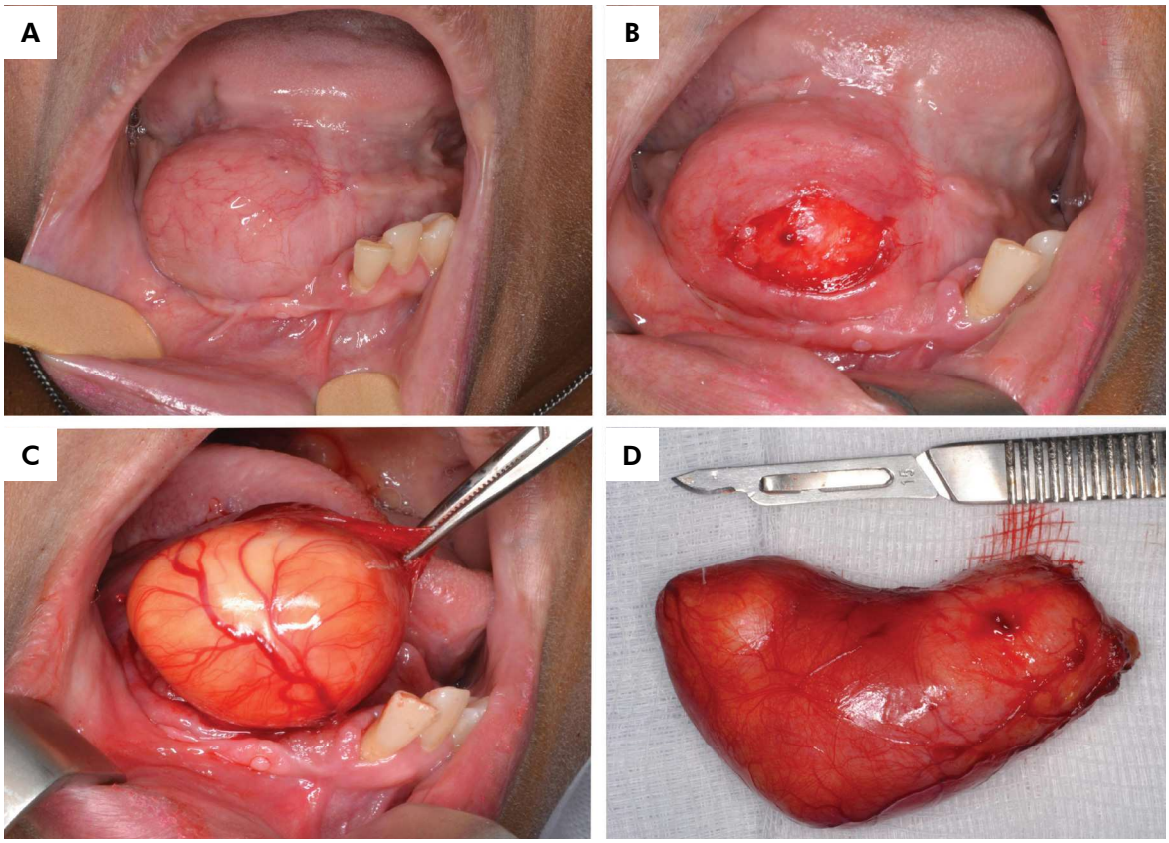

Figure 1. Clinical aspect of dermoid cyst on the floor of the mouth. (A) Intraoral view showing swelling on the floor of the mouth covered by normal-colored mucosa causing tongue elevation. (B) Intraoral incision performed for surgical removal of the lesion. (C) Intraoperative panoramic view of the cyst. (D) Gross aspect showing a well-circumscribed, solid oval mass with a reddish surface.

excision was the treatment of choice for all patients (n = 32; 100%). The follow-up period ranged from 1 to 38 months, with a mean of 14.0 months. No cases exhibited recurrence.

Pathologic features

On gross examination, most DCs and ECs were described as a well-demarcated cystic cavity ranging from gray to brown, usually filled with a yellowish keratin-like material. The histopathological features are summarized in Table 2 and illustrated in Figures 2 and 3.

Epidermoid cysts

Microscopically, most ECs (n = 44; 62.9%) were lined entirely by orthokeratinized stratified squamous epithelium, followed by parakeratinized squamous epithelium (n = 15; 21,4%). Nine cases (12.9%) showed parakeratinized and non-keratinized areas in the same lesion. Two cysts (2.9%) showed regions of respiratory metaplasia. Melanin pigmentation in the basal layer of the cystic epithelium was observed in 6 cases (8.6%). Desquamated epithelial cells and keratin debris (n = 52; 74.3%), amorphous eosinophilic material (n = 13; 18.6%), and inflammatory cells (n = 29; 41.4%) in varying amounts were present in the lumen of some cysts. Two cysts (2.9%) were located on the floor of the mouth and tongue, and several colonies resembling Actinomyces were observed.

Analysis of the fibrous capsule revealed a mixed inflammatory infiltrate in 59 (84.3%) cases. The intensity of the inflammatory infiltrate was mild in 49 (83.1%) cases, moderate in 6 (10.2%), and intense in 4 (6.8%). Multinucleated giant cell reaction and cholesterol clefts were observed in 4 (5.7%) and 9 (12.9%) cases, respectively. Also, six cases (8.6%) exhibited small, round, homogenous hyaline masses surrounding eosinophilic material associated with multinucleated giant cells compatible with hyaline ring granulomas (HRGs). Nerve fibers (n = 27; 38.6%), skeletal muscle fibers (n = 31; 44.3%), and minor salivary glands (n = 31; 44.3%) were observed in the vicinity of some cysts. None of the cases had smooth muscle, bone tissue, cartilage, hair follicle, or Pacinian and Meissner corpuscles associated with the cysts.

Dermoid cysts

Microscopically, most DCs (n = 22; 68.8%) were lined entirely by orthokeratinized stratified squamous epithelium, followed by parakeratinized squamous epithelium (n = 7; 21.9%). Two cases (6.3%) showed parakeratinized and non-keratinized areas in the same lesion. One cyst (3.1%) was partially lined by ciliated pseudostratified columnar epithelium (respiratory metaplasia). Melanin pigmentation in the basal layer of the cystic epithelium was observed in nine cases (28.1%). Intraluminal keratin debris and desquamated epithelial cells were seen in all cysts (n = 32; 100%).

Adnexal structures were also present in all cysts (n = 32; 100%). Sebaceous glands were present in 30 cases (93.8%). The sebaceous glands were commonly (n = 26; 86.7%) part of a pilosebaceous unit, consisting of the central hair follicle surrounded by a cluster of sebaceous glands. In some cases (n = 4; 13.3%), the sebaceous glands communicated directly with the cystic lumen. Morphologically, the sebaceous glands were mature and functional, capable of producing thick sebaceous material secreted into the cystic lumen. Intraluminal hair shafts (n = 6; 18.7%) and intramural hair (n = 15; 46.9%) were present in some cysts.

Eccrine glands were uncommon (n = 8; 25.0%). These were only seen in DCs localized on the floor of the mouth. Furthermore, structures of mesodermal origin were also seen in some cysts. These structures included smooth muscle fibers (arrector pili muscle) (n = 2; 6.3%), nerve fibers (n = 10; 31.3%), and adipose tissue (n = 13; 40.6%). Skeletal striated muscle fibers were frequently seen in the surrounding tissue (n = 18; 56.3%), but they were not directly associated with the cyst. None of the cases had bone tissue and cartilage. Dystrophic calcifications were observed in two cysts (6.3%). Five dermoid cysts were ruptured (15.6%). All of them were located on the floor of the mouth and exhibited a mixed inflammatory infiltrate ranging from moderate to intense in the cystic capsule with significant infiltration of macrophages and lymphocytes, most of them concentrated around the exposed hair follicles. Multinucleated giant cell reaction was observed in two of these cases. Three cases had negative images of cholesterol crystals (n = 3; 9.4%). Inflammatory cells were not seen in unruptured

Table 2. Morphological features of 102 oral dermoid and epidermoid cysts.

Morphological features	Dermoid cysts (n = 32)		Epidermoid cysts (n = 70)	
	n	%	n	%
Cystic lining epithelium				
Fully lined by parakeratinized stratified squamous epithelium	7	21.9	15	21.4
Fully lined by orthokeratinized stratified squamous epithelium	22	68.8	44	62.9
Partially lined by non-keratinized and parakeratinized squamous epithelium	2	6.3	9	12.9
Partially lined by ciliated pseudostratified columnar epithelium	1	3.1	2	2.9
Fibrous capsule				
Hair follicle				
Present	26	81.3	0	0.0
Absent	6	18.8	70	100.0
Sweat gland				
Present	8	25.0	0	0.0
Absent	24	75.0	70	100.0
Sebaceous gland				
Present	30	93.8	0	0.0
Absent	2	6.3	70	100.0
Salivary gland				
Present	15	46.9	31	44.3
Absent	17	53.1	39	55.7
Hair				
Present	21	65.6	0	0.0
Absent	11	34.4	70	100.0
Striated muscle				
Present	18	56.3	31	44.3
Absent	14	43.8	39	55.7
Smooth muscle				
Present	2	6.3	0	0.0
Absent	30	93.8	70	100.0
Neural tissue				
Present	10	31.3	27	38.6
Absent	22	68.8	43	61.4
Adipose tissue				
Present	13	40.6	24	34.3
Absent	19	59.4	46	65.7
Bone				
Present	0	0.0	0	0.0
Absent	32	100.0	70	100.0
Cartilage				
Present	0	0.0	0	0.0
Absent	32	100.0	70	100.0

Continue

Continuation

Chronic inflammatory cells				
Present	7	21.9	59	84.3
Absent	25	78.1	11	15.7
Melanin				
Present	9	28.1	6	8.6
Absent	23	71.9	64	91.4
Cholesterol crystals				
Present	3	9.4	9	12.9
Absent	29	90.6	61	87.1
Multinucleated giant cell reaction				
Present	2	6.3	4	5.7
Absent	30	93.8	66	94.3
Pacinian corpuscles				
Present	0	0.0	0	0.0
Absent	32	100.0	70	100.0
Meissner corpuscle				
Present	0	0.0	0	0.0
Absent	32	100.0	70	100.0
Hyaline ring granuloma				
Present	2	6.3	6	8.6
Absent	30	93.8	64	91.4

cysts. Minor salivary glands were observed in 15 (46.9%) cases in the vicinity of some cysts. None of the cases had bone tissue, cartilage, and Meissner or Pacinian corpuscles associated with the cysts.

Discussion

Oral ECs and DCs are uncommon lesions, accounting for about 0.07% and 0.03% of all lesions diagnosed at the pathology centers in the present investigation, respectively, in line with previous reports.[2] In our series, ECs (n = 70; 78.6%) were more frequent than DCs (n = 32; 31.4%), similar to the findings of previous studies conducted at other oral pathology centers.[10,11] However, a recent study has found no difference in prevalence between ECs and DCs.[2]

Our findings show that oral DCs and ECs occur at any age, affecting from newborns to older people.[2,10,11] Although previous studies have reported female predominance for both cysts,[2] in the current series, a slight male preponderance (58.2%), with a male-to-female ratio of 1.3:1, was observed for ECs. DCs showed no predilection for sex (1.1:1). However, differences were observed in the age distribution between these cysts (Table 1). ECs usually affected older patients, with peak prevalence between the fourth and the sixth decades of life (n = 36, 55.4%) and a mean age of 48.0 years. In contrast, DCs were more common in younger patients (mean age of 34.6 years), with an apparent bimodal distribution with one large peak (30.0% of cases) at age ≤19 years and the second peak in the fifth and sixth (43.3%) decades of life.

Regarding the anatomical site, the floor of the mouth was the most affected by DCs, followed by the lips and the tongue. The typical clinical presentation of DCs on the floor of the mouth is an asymptomatic slow-growing swelling in the midline covered by a normal-appearing mucosa.[3,7]

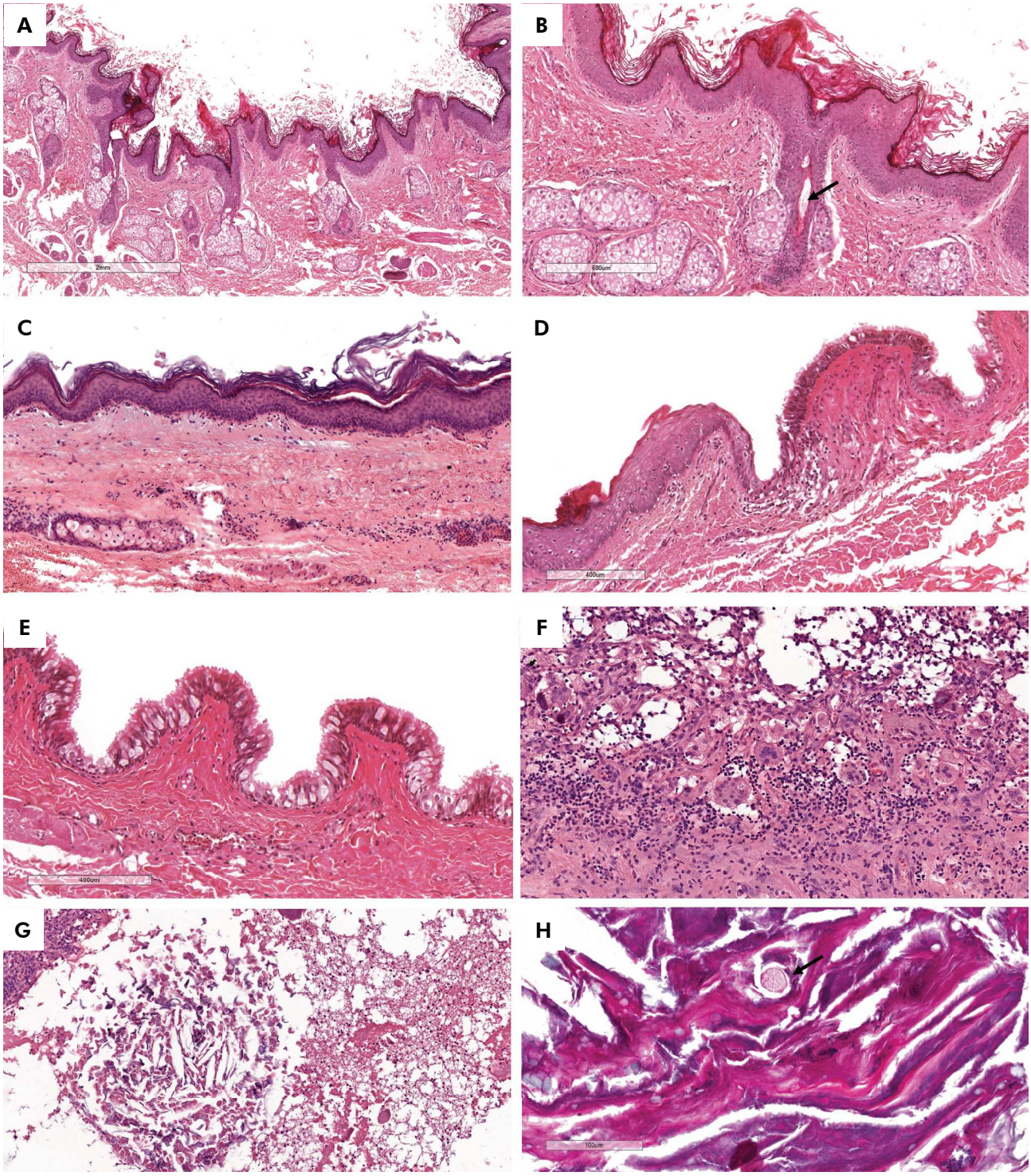

Figure 2. Histopathological features of oral dermoid cysts. (A) Cystic lesion lined by stratified squamous epithelium containing hair follicle, sweat gland, sebaceous gland, and adipose tissue in the fibrous capsule. (B) Detail of the pilosebaceous unit; central hair follicle surrounded by a cluster of sebaceous glands. Note that the sebaceous glands communicated directly with the cystic lumen and the presence of intramural hair shafts (arrow). (C) Dermoid cyst covered by orthokeratinized squamous epithelium. (D) Dermoid cyst partially lined by ciliated pseudostratified columnar epithelium. (E) Detail of ciliated columnar epithelium (respiratory epithelium) containing goblet cells. (F) Multinucleated giant cell reaction. (G) Negative images of cholesterol crystals. (H) Keratin debris and intraluminal hair shafts (arrow) in the cystic lumen (hematoxylin-eosin staining).

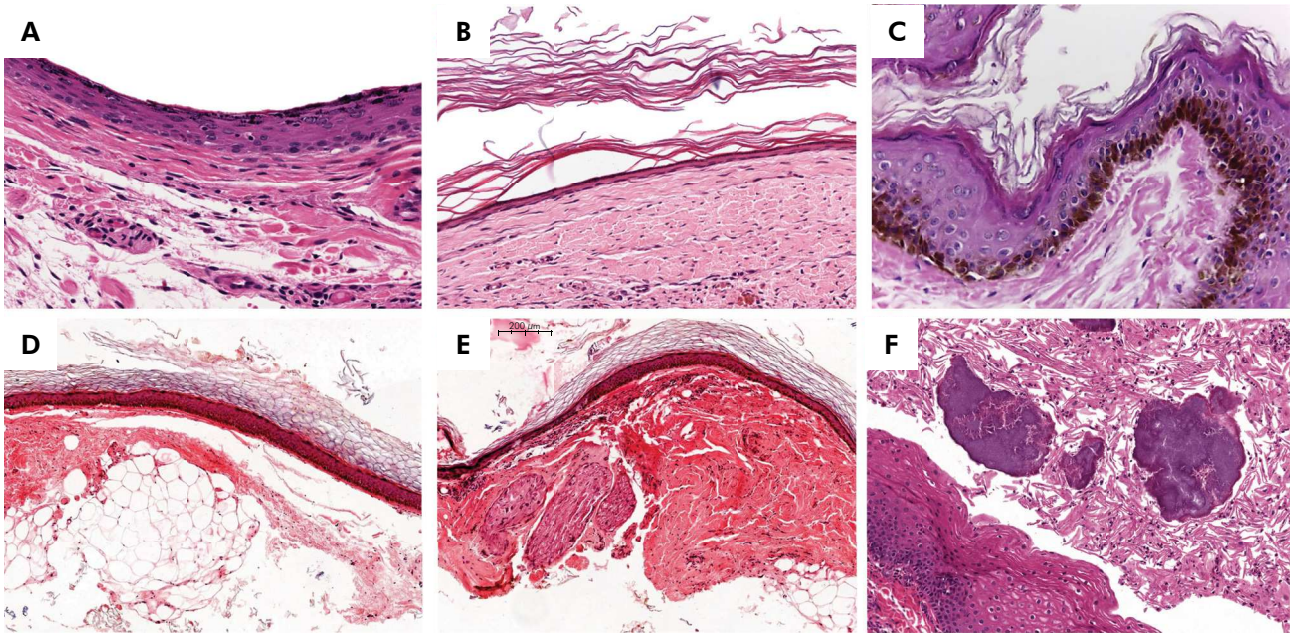

Figure 3. Histopathological features of oral epidermoid cysts. Cyst lined by non-keratinized (A) and orthokeratinized stratified squamous epithelium (B). Striking deposition of melanin in the basal layer of the cystic epithelium (C). Cystic capsule containing adipose tissue and (D) nerve fibers (E). Detail of colonies resembling Actinomyces observed in the cystic lumen of one of the epidermoid cysts (F). (Hematoxylin-eosin staining).

Nevertheless, the location of the cysts concerning the geniohyoid and mylohyoid muscles influences their clinical presentation. DCs above the geniohyoid muscle often present as a swelling in the sublingual region.[3,7] On the other hand, swelling in the submental or submandibular region is often seen when the cyst is located between or below the geniohyoid and mylohyoid muscles.[3,7,12] Other complaints include altered speech, problems with swallowing, phonation, breathing, and double-chin development, especially in large lesions.[3,12] Although most DCs are asymptomatic, pain is expected if there is a secondary infection.[3] In the current series, four patients with DCs on the floor of the mouth reported difficulty swallowing and breathing, probably due to the posterior expansion of the lesion in the submandibular space.

On the other hand, ECs were more frequent in the labial mucosa. They can affect, however, any site in the oral cavity.[2] As observed in our series, cysts in the retromolar region and palate are excessively rare, with only a few well-documented cases published in the literature.[13-15] The evolution time of both entities varies from diagnosis to treatment, ranging from months to years.

Due to the low prevalence and similarity of these cysts to several conditions of the oral cavity, DCs and ECs are often confused in clinical practice.[7,16] The differential diagnosis is broad and depends mainly on the affected site and includes developmental lesions (Fordyce granules), reactive/inflammatory conditions (ranula), calcified masses (tonsillolith and sialolith), neoplasms (lipoma, granular cell tumor), hemangiomas, lymphangiomas, and other cysts (branchial cleft cyst, thyroglossal duct cyst, or lymphoepithelial cyst).[3,7,16]

Recently, Misch et al. have reported a series of pediatric sublingual DCs and ECs in a 20-year institutional review.[7] Only two patients (15.4%) were accurately diagnosed based on clinical examination alone. In addition, the ranula was the most common primary imaging diagnosis (67%), even in patients who underwent preoperative imaging tests (magnetic resonance imaging, computed tomography and/or ultrasound). Although MRI is the most likely imaging modality to suggest the possibility of

a dermoid/epidermoid cyst, the hypothesis of a dermoid/epidermoid cyst was mentioned in only 25% of CT reports.[7] In the present study, only 27.7% (n = 18) and 24.1% (n = 7) of cases had initial clinical diagnostic hypotheses of ECs and DCs, respectively. These findings still demonstrate unawareness of these lesions among clinicians and emphasize the need to expand differential diagnoses of oral lesions and include dermoid and epidermoid cysts, mainly when located on the floor of the mouth and lips.

In some circumstances, imaging exams may be helpful during the clinical investigation to guide the diagnosis and treatment of these cysts. The ultrasonography typically shows a well-circumscribed tumor with mixed or pseudo-solid density.[3] However, compared with ultrasonography, computed tomography and magnetic resonance imaging (MRI) are more advantageous because they provide accurate information about the location and size of the lesion, facilitating surgical planning.[3] Also, fine-needle aspiration cytology (FNAC) may provide important diagnostic information on cystic lesions. Nevertheless, the definitive diagnosis can only be confirmed by morphological analysis.[3]

Microscopically, DCs and ECs are lined by parakeratinized or orthokeratinized stratified squamous epithelium. The cyst is referred to as epidermoid if no dermal attachments such as sweat glands, sebaceous glands, and/or hair follicles are observed on the cystic wall. If dermal attachments are present, the cyst is called DC. The lack of tissue from different germ layers, such as cartilage, helps differentiate them from teratoid cysts.[2,3,5,7,17] Although all DCs had been lined by stratified squamous epithelial lining, areas of the respiratory epithelium were observed in one case (3.1%). Although DCs may exhibit variability in epithelial types, areas of respiratory metaplasia are very uncommon.[2] Nonetheless, pathologists should be aware of these features and correlate them with clinical findings to establish an accurate diagnosis.

The morphological characteristics of the cystic capsule of DCs vary considerably. [2,17] In most cases, it is common to observe hair follicles and sebaceous glands, similarly to the current study. Sweat glands, salivary gland tissue, melanin pigments, hair, and cholesterol clefts may also be present.[2,17] Other cystic wall structures have also been described, such as Meissner and Pacinian corpuscles.[2] However, we did not detect these microscopic findings in the cases analyzed herein. Keratinous or sebaceous material may be present within the cystic lumen.[2] Due to cyst rupture, a foreign body giant cell reaction may be observed in the fibrous capsule due to cystic content spillage, which can cause damage to surrounding tissues and cystic structure,[17] as observed in some cases. Our findings demonstrate that the histopathological appearance of DCs and ECs is similar between the oral sites. This feature suggests that the oral site does not directly affect the morphological structure of these cysts.

Over the years, several theories have been suggested on the pathogenesis of these cysts. It has been suggested that DCs arise from trapped ectodermal elements during midline fusion of the first and second branchial arches between the third and fourth weeks of intrauterine life.[1,5] Other alternative theories propose that these cysts may arise from the tuberculum impar of His, which, with each mandibular arch, forms the floor of the mouth and the tongue.[18-21] Finally, another theory suggests that midline DCs and ECs may be a variant of thyroglossal duct cysts with a predominance of ectodermal elements.[18-21] In the present study, patients with DCs had a relatively younger mean age (36 years) than those with ECs ($p < 0.0001$). Also, DCs were frequently observed in the first and second decades of life (n = 9, 30.0%), supporting a possible congenital origin of these lesions. The relatively late diagnosis of some patients may be due to the fact that most DCs are asymptomatic and slow-growing.

Although it has been suggested that ECs are also congenital lesions, trauma has been suggested as an essential factor in its etiology. Implantation keratinizing epidermoid cysts have been reported in the oral cavity due to the traumatic implantation of epithelial remnants of the oral mucosa in the connective tissue[22,23] or the occlusion of a sebaceous gland duct. In the current series, we could not identify any apparent involvement of local trauma in most cases. However, three patients had a history of local trauma. These data lead to the conclusion that at least

a subset of ECs may have a reactive nature. Also, in the present study, ECs were most frequent among patients between the fourth and sixth decades of life, had limited size, and remained small over many years, supporting a possible reactive cause for the development of these cysts. Furthermore, ECs occurred mainly in the labial and buccal mucosae (58.7%), anatomical regions subject to trauma, corroborating this hypothesis.

Conservative surgical excision is the best treatment for these cysts, and the prognosis is excellent.[1-3] Depending on the extent and location of the lesion, surgical removal can be achieved through an extraoral or a transoral approach.[2,3,7] The intraoral approach is generally chosen for small sublingual cysts above the mylohyoid muscle. In contrast, the extraoral approach is preferred for large cysts between or below the geniohyoid and mylohyoid muscles.[2,3,7] In our study, there were no recurrences, which is expected for these cysts given that the presence of the fibrous capsule facilitates complete surgical enucleation.[2] Although malignant transformation is uncommon, some cases of carcinomas arising in the lining epithelium of DCs and ECs have been reported.[24-26]

Conclusions

In conclusion, DCs and ECs are uncommon lesions in the oral cavity. To the best of our knowledge, this is the largest case series of oral DCs and ECs with a detailed clinicopathologic analysis ever reported. Our findings are mostly consistent with those reported in the literature. Approximately half of the cases were clinically suspected as DCs and ECs, demonstrating clinicians' unfamiliarity with these cysts. This study illustrates the need to expand differential diagnoses of swellings in the oral cavity and to include DCs and ECs, especially on the floor of the mouth and labial mucosa.

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