ORIGINAL ARTICLE

Jefferson da Rocha Tenório[1]
José Victor Lemos Ventura[1]
Marcela Lopes de Andrade[1]
João Pedro Silva Contreiras[1]
Marina Binimeliz[1]
Israel Leal Cavalcante[1,2]
Juliana de Noronha Santos Netto[1]
Fábio Ribeiro Guedes[1]
Mariana Villarroel-Dorrego[3]
Claudia Patricia Peña-Vega[4]
Juan Pablo Rodríguez-Mora[4]
Karina Cordero-Torres[5]
Richard Ahumada-Ossandón[5]
Roberto Gerber-Mora[6]
Gerhilde Callou Sampaio[7]
Isabella Bittencourt do Valle[8]
José Alcides Almeida de Arruda[1]*
Bruno Augusto Benevenuto de Andrade[1]

Clinicopathological characterization of 317 odontomas: a collaborative Latin American study

Abstract:

Objective: The present study aimed to evaluate the clinicopathological features of odontomas diagnosed at five oral diagnostic services across Latin America. **Methods:** A retrospective cross-sectional study (2000–2024) was conducted, including institutions from five Latin American countries (Brazil, Venezuela, Colombia, Chile, and Costa Rica). Data from 317 odontoma cases were analyzed, including patient sex, age, anatomical site, clinicopathological subtype, and the presence of associated odontogenic lesions. **Results:** The median age at diagnosis was 16 years (range: 4–83 years), with a slight male predominance (52.7%, n=167). The anterior maxilla was the most commonly affected site (39.9%). Compound odontomas represented the majority of cases (65.9%). Notably, 24 cases (8.7%) were associated with other odontogenic lesions, most frequently dentigerous cysts (6.6%, n=21). **Conclusion:** This multicenter study highlights that odontomas in a Latin American population predominantly affect the maxilla, are primarily diagnosed in younger individuals, and most commonly present as the compound subtype.

Keywords: Fibro-odontoma; Jaws; Odontogenic tumors; Odontoma.

INTRODUCTION

Odontomas are odontogenic hamartomas composed of both epithelial and mesenchymal tissues, incorporating the soft and hard components of teeth. Traditionally classified into two types — compound and complex — odontomas are among the most frequently encountered odontogenic tumors in clinical dental practice[1,2].

The reported prevalence of odontomas varies

Statement of Clinical Significance
This series analyzed 317 cases of odontomas diagnosed in the past at five oral diagnostic centers in Brazil, Venezuela, Colombia, Chile, and Costa Rica. Odontomas predominantly occurred in the maxilla, were most frequently diagnosed in younger individuals, and were most commonly classified as the compound subtype.

[1]Universidade Federal do Rio de Janeiro, School of Dentistry, Department of Oral Diagnosis and Pathology – Rio de Janeiro (RJ), Brazil.
[2]Universidade de Fortaleza, Department of Dentistry – Fortaleza (CE), Brazil.
[3]Universidad Central de Venezuela, School of Dentistry – Caracas, Venezuela.
[4]Universidad Nacional de Colombia, School of Dentistry, Service of Oral and Maxillofacial Pathology – Bogotá, Colombia.
[5]Universidad de Valparaíso, School of Dentistry, Department of Oral Pathology and Diagnosis – Valparaíso, Chile.
[6]Oroclínica – San José, Costa Rica.
[7]Universidade de Pernambuco, School of Dentistry, Department of Oral and Maxillofacial Surgery and Pathology – Recife (PE), Brazil.
[8]Universidade Federal do Espírito Santo, Department of Pathology – Vitória (ES), Brazil.
***Correspondence to:** Email: alcides_almeida@hotmail.com
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significantly across studies worldwide, likely due to differences in diagnostic practices, referral rates, and study methodologies. For instance, odontomas constituted 4.1% of odontogenic tumors in a Nigerian study[3], 9.4% in an Indian study[4], and up to 44.7% in a Chilean study[5]. In most reports, odontomas rank among the three most common odontogenic tumors. Notably, they are the most frequent odontogenic tumors in pediatric populations, accounting for 49.3% of odontogenic tumors in children and adolescents[6]. However, their true prevalence may be underestimated due to the straightforward nature of their diagnosis, which can discourage referral for anatomopathological examination[7].

Compound odontomas are characterized by the formation of multiple rudimentary tooth-like structures, predominantly affecting children and adolescents, and can interfere with dental eruption. These lesions most commonly occur in the anterior maxilla[8]. While clinical and radiographic assessments are often highly suggestive of the diagnosis, histopathological analysis is crucial to rule out any associated odontogenic lesions. In contrast, complex odontomas present as amorphous masses of dental tissue and are typically found in the posterior mandible of young individuals[8].

Given the variability in reported frequencies of odontomas across studies in Latin America[5,9-11] and ongoing discussions on their molecular aspects and associations with syndromes (e.g., familial adenomatous polyposis, Schimmelpenning syndrome, odontoma-dysphagia syndrome, and encephalocraniocutaneous lipomatosis)[2], this study provides data on the clinicopathological characteristics and occurrence of odontomas across five oral diagnostic services in Latin America.

MATERIAL AND METHODS

This collaborative retrospective cross-sectional study analyzed data on odontomas diagnosed at five oral diagnostic services across Latin America: the Department of Oral Diagnosis and Pathology, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil (2000–2024); the School of Dentistry, Universidad Central de Venezuela, Caracas, Venezuela (2012–2024); the School of Dentistry, Universidad Nacional de Colombia, Bogotá, Colombia (2016–2024); the Department of Oral Pathology and Diagnosis, School of Dentistry, Universidad de Valparaíso, Valparaíso, Chile (2019–2024); and Oroclínica, a private diagnostic center in San José, Costa Rica (2019–2024). The study was approved by the local research Ethics Committees (No. 18-23/57829 and No. 7.487.001), and Material Transfer Agreements were established to formalize the collaborative framework. This study was conducted in full compliance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines[12]. All procedures adhered to the principles outlined in the Declaration of Helsinki.

Five authors, previously calibrated through a consensus process, extracted data from clinical records, including patient sex, age, anatomical site, clinicopathological type, and the presence of associated odontogenic lesions. When available, radiographic examinations, including cone beam computed tomography, were reviewed to improve diagnostic detail. Records with insufficient histopathological information were excluded from the analysis.

For diagnostic evaluation, 4-µm-thick sections were obtained from paraffin-embedded tissue blocks and stained with hematoxylin and eosin (H&E). All cases were diagnosed based on the 2022 World Health Organization Classification of Odontogenic and Maxillofacial Bone Tumors (5th edition)[8]. Cases with insufficient histopathological information (e.g., severely fragmented or poorly preserved tissue samples) were excluded from the study.

Data were tabulated and analyzed descriptively using Microsoft Office Excel 2019 (Microsoft®, Redmond, WA, USA).

RESULTS

A total of 317 odontoma diagnoses were recorded across the participating services, with 153 (48.3%) from Brazil, 105 (33.1%) from Venezuela, 25 (7.9%) from Costa Rica, 18 (5.7%) from Colombia, and 16 (5.0%) from Chile. There was a slight male predominance (n=167; 52.7%), and the median age at diagnosis was 16 years (range: 4–83 years). Children and adolescents (0–19 years) were the most affected age group (n=197; 62.3%). The maxilla was the most commonly affected site, accounting for 56.3% (n=178) of cases, with a preference for the anterior region (n=126; 39.9%). Compound odontomas were the most prevalent clinicopathological subtype, representing 65.9% (n=209) of the sample. Twenty-six cases were associated with other odontogenic lesions, with dentigerous cyst being the most frequently reported (n=2; 6.6%) (Table 1).

Radiographically, all cases of compound odontomas exhibited varying amounts of radiopaque structures resembling rudimentary teeth. In contrast, complex odontomas appeared as homogeneous radiopaque masses with a well-defined internal architecture, displaying densities ranging from dentin/cementum to enamel. Both subtypes consistently exhibited a narrow, well-defined radiolucent margin surrounding the internal opacities (Figure 1).

Macroscopic evaluation of surgical specimens revealed denticles of varying morphologies in compound odontomas, while complex odontomas appeared as stony, amorphous masses (Figure 2).

Microscopically, compound odontomas contained multiple denticles composed of enamel matrix, tubular dentin, and pulp, arranged in a tooth-like structure within a fibrous connective tissue stroma. Complex odontomas were predominantly composed of mature tubular dentin, arranged in a disorganized manner, interspersed with pulp-like tissue, enamel matrix, and remnants of odontogenic epithelium (Figure 3).

Table 1. Clinicodemographic data, anatomical locations, and associated lesions of odontomas.

Variables	n (%)
Sex (n=317)	
Male	167 (52.7)
Female	150 (47.3)
Age (median, mean, SD, and range) (n=316)	16; 20.9 (±13.4); 4–83
0–19 years	197 (62.3)
20–59 years	112 (35.4)
≥60 years	7 (2.3)
Anatomical site (n=316)	
Maxilla (NS)	22 (7)
Maxilla (anterior)	126 (39.9)
Maxilla (posterior)	30 (9.5)
Mandible (NS)	26 (8.2)
Mandible (anterior)	56 (17.7)
Mandible (posterior)	56 (17.7)
Clinicopathological type (n=317)	
Compound	209 (65.9)
Complex	104 (32.8)
Mixed (compound and complex)	4 (1.3)
Associated lesions (n=317)	
Dentigerous cyst	21 (6.6)
Calcifying odontogenic cyst	5 (1.6)
Absent	291 (91.8)

SD: standard deviation; NS: not specified.

DISCUSSION

Odontomas are among the most frequently encountered odontogenic lesions in routine dental practice. Despite their prevalence, multicenter collaborative studies that rigorously examine their clinicopathological characteristics remain relatively scarce. The present series synthesizes data from five oral diagnostic services across Latin America, offering valuable epidemiological contributions into nature and occurrence of these lesions. Our findings regarding demographic distribution concur with a recent European multicenter study analyzing 127 cases of odontoma[13]. The cited study reported a slight male predominance (55%) and a mean age of 22 years, which are consistent with our observations. Moreover, the anterior and premolar regions of the maxilla were the most commonly affected sites, corroborating trends observed in our study[13].

Odontomas are typically asymptomatic and are often detected incidentally during routine radiographic examinations, particularly in cases of delayed tooth eruption. However, clinical records in the present study lacked sufficient detail to confirm these associations. Findings from a German multicenter study[14] provide valuable context: among 45 odontomas evaluated, 11 were associated with delayed eruption, four presented with pain, and two with swelling. In addition, odontomas were frequently located near adjacent teeth, leading to tooth extractions in 14 cases[14]. Similarly, a large cone-beam computed tomography-based study of 87,590 subjects reported an odontoma prevalence of 0.65%, with a higher occurrence in younger individuals, particularly those under 19 years old[15]. The study also documented the frequent association between odontomas and impacted teeth, emphasizing the role of three-dimensional imaging in their early detection and management[15]. Another study on 242 odontomas found that 38.8% were associated with clinical findings, primarily tooth impaction and delayed eruption, while 3.3% were linked to dentigerous cysts, reinforcing the need for detailed radiographic and histopathological evaluation[16]. These findings underscore the importance of early diagnosis and meticulous surgical planning to preclude complications and optimize treatment outcomes.

All cases in our study were classified according to the 5th edition of the WHO classification of odontogenic and maxillofacial bone tumors[8]. This edition reclassifies previously distinct entities, such as ameloblastic fibro-odontoma and ameloblastic fibrodentinoma, as

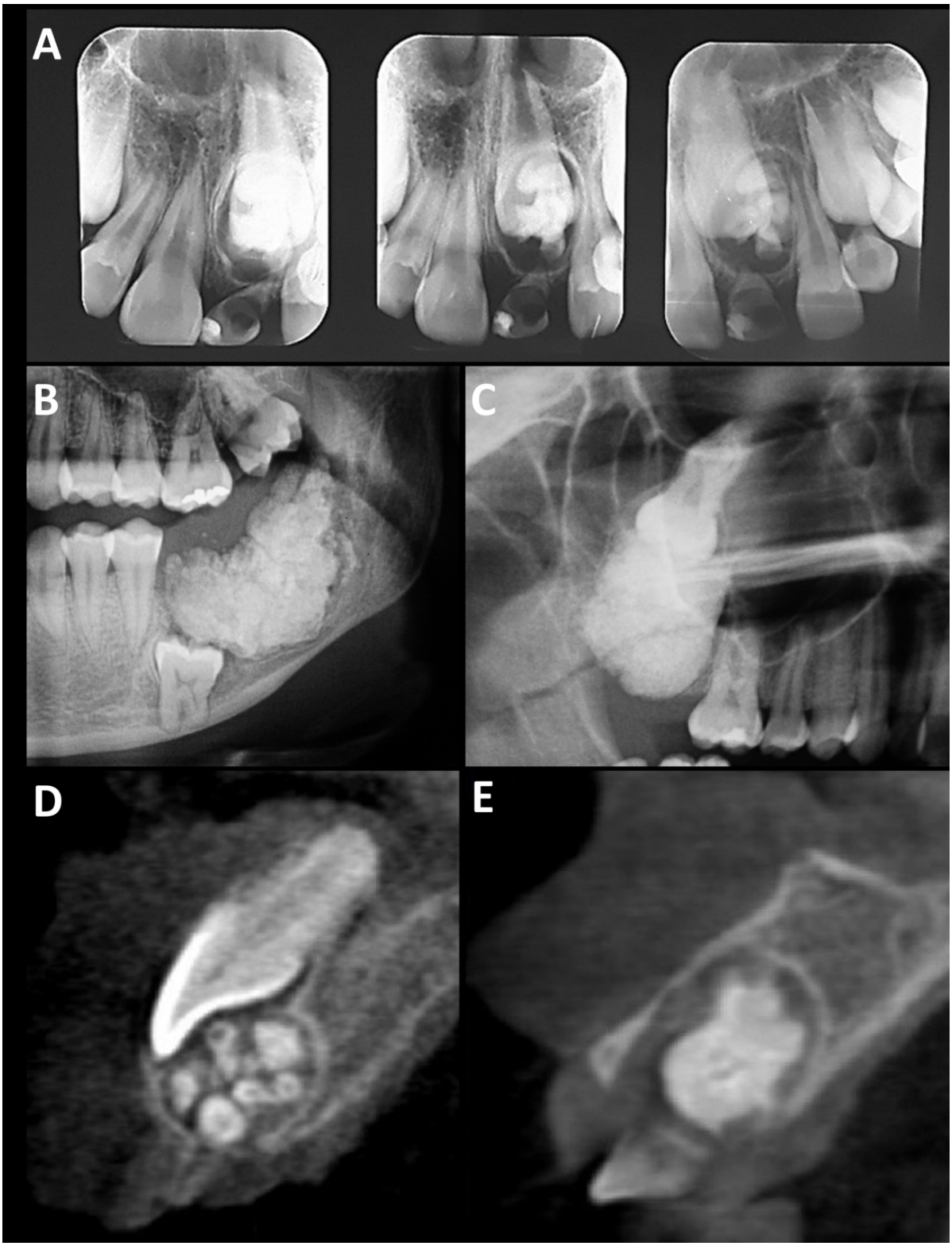

Figure 1. Radiographic features of odontomas. (A) Periapical radiograph showing a compound odontoma obstructing the eruption of the permanent maxillary left central incisor. The denticles appear as clusters of radiopaque structures surrounded by a radiolucent halo. (B-C) Cropped panoramic radiographs showing complex odontomas as well-defined, radiopaque masses with irregular shapes, located in the posterior regions of the gnathic bones and associated with dental impaction. In (B), the lesion obstructs the eruption of tooth 36 and extends toward the mandibular base. In (C), the lesion is closely associated with tooth 17, the maxillary sinus, and the inferolateral boundary of the orbit. (D) Parasagittal cone beam computed tomography (CBCT) image of a compound odontoma showing multiple hyperdense structures with densities resembling enamel and dentin, surrounded by a narrow, well-defined hypodense margin in the palatal region of the upper left central incisor. (E) Parasagittal CBCT section showing a hyperdense, amorphous image in the anterior maxilla, characteristic of a complex odontoma.

developing odontomas[8]. Emerging molecular evidence has challenged the traditional classification of odontomas, with studies identifying the presence of the *BRAF* p.V600E mutation in the mesenchymal component of certain lesions, suggesting that some odontomas may represent true neoplasms rather than hamartomas[17]. Additionally, a recent comprehensive review highlighted the association between odontomas and genetic syndromes, including Gardner syndrome and Otodental syndrome[18]. These syndromes involve distinct genetic alterations, such as *APC* mutations in Gardner syndrome and chromosomal deletions in Otodental syndrome, and their clinical presentation frequently includes multiple odontomas[18]. However, a limitation of our study is the lack of genetic evaluation, which precludes definitive conclusions regarding potential syndromic associations. Future investigations incorporating molecular screening and genetic analysis could provide a more comprehensive understanding of the underlying pathogenesis of odontomas in both isolated and syndromic contexts.

Nearly 8% of odontomas in our study were associated with other odontogenic lesions, predominantly dentigerous cysts, followed by calcifying odontogenic cysts. Hybrid odontogenic lesions — characterized by the coexistence of histopathological features from multiple odontogenic lesions — pose significant diagnostic challenges, particularly when relying solely on clinical or radiographic findings. These lesions may emulate other odontogenic cysts or tumors, increasing the

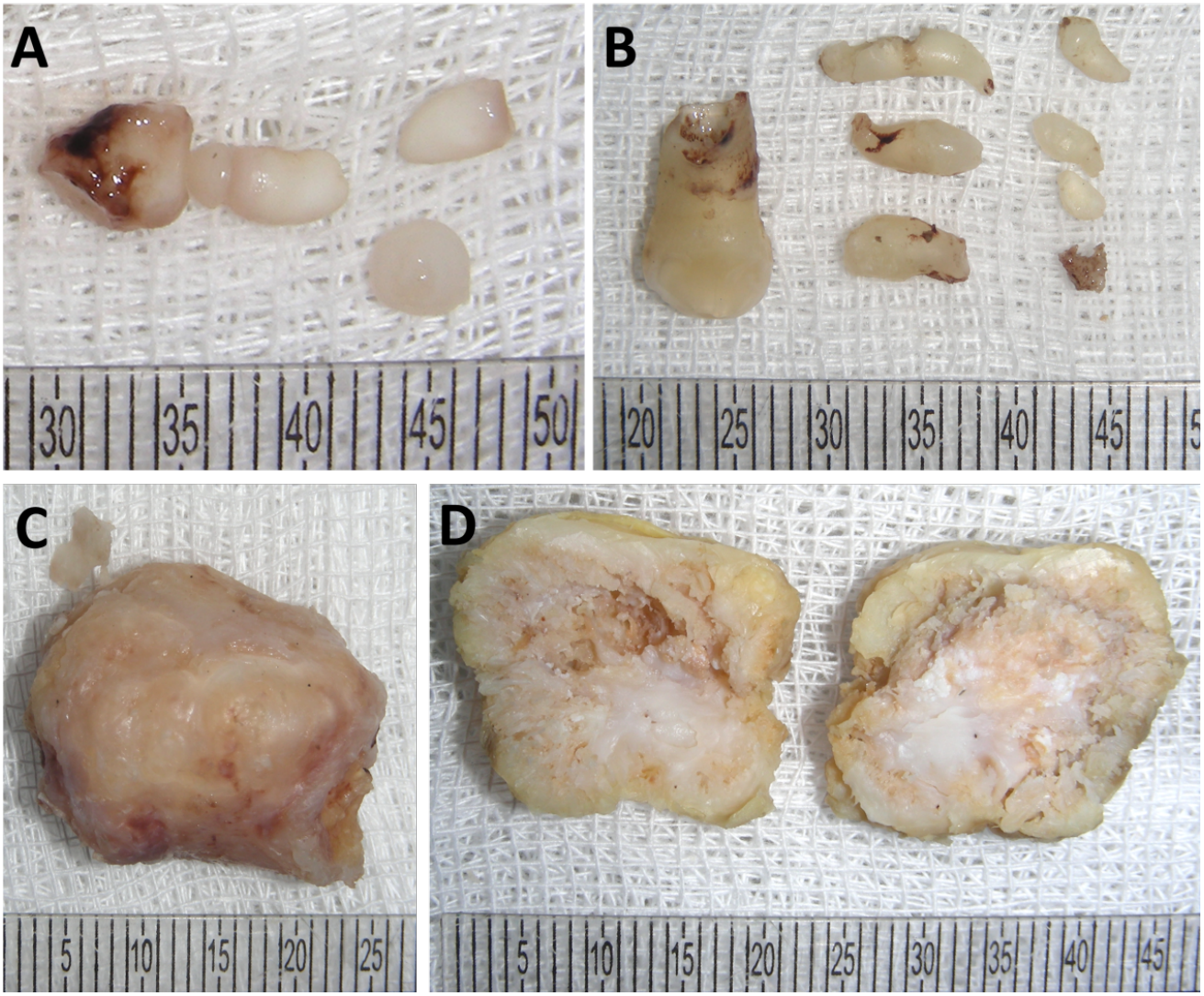

Figure 2. Macroscopic features of odontomas. (A-B) Specimens of compound odontomas exhibiting multiple malformed, tooth-like structures of varying sizes and shapes. (C) A surgical specimen of a complex odontoma demonstrating an irregular surface, stony consistency, and brownish coloration. (D) Sectioned specimen revealing a cut surface with a white and brown appearance, irregular shape, and uneven texture.

risk of misdiagnosis and inappropriate management. Accurate diagnosis requires comprehensive histopathological evaluation, as overlapping features can obscure the true nature of the lesion. A systematic review of 147 publications identified 203 hybrid odontogenic lesions, with odontomas most commonly associated with calcifying odontogenic cysts (18.2%), while associations with dentigerous cysts ranked fifth (5.9%)[19]. Neumann et al.[20] identified odontomas as the most frequent synchronous odontogenic tumors (33.3% of cases), often occurring in a single jaw, with bifocal and multifocal pattern observed in similar proportions, particularly among adolescents without sex predilection. These findings, however, highlight the complexity of odontogenic lesions and reinforce the importance of a multidisciplinary diagnostic approach to prevent misinterpretation and ensure appropriate treatment.

While the retrospective nature of this study limits detailed insights into treatment and follow-up, its findings provide a valuable contribution to the understanding of odontogenic lesions in Latin America. This collaborative effort reinforces the importance of integrating clinicopathological and molecular data to advance the characterization and management of odontomas.

CONCLUSION

This multicenter study revealed that odontomas are more commonly located in the maxilla and are frequently diagnosed in younger individuals, with compound odontomas being the most prevalent subtype. Among associated hybrid lesions, dentigerous cysts were the most common. These findings underscore the

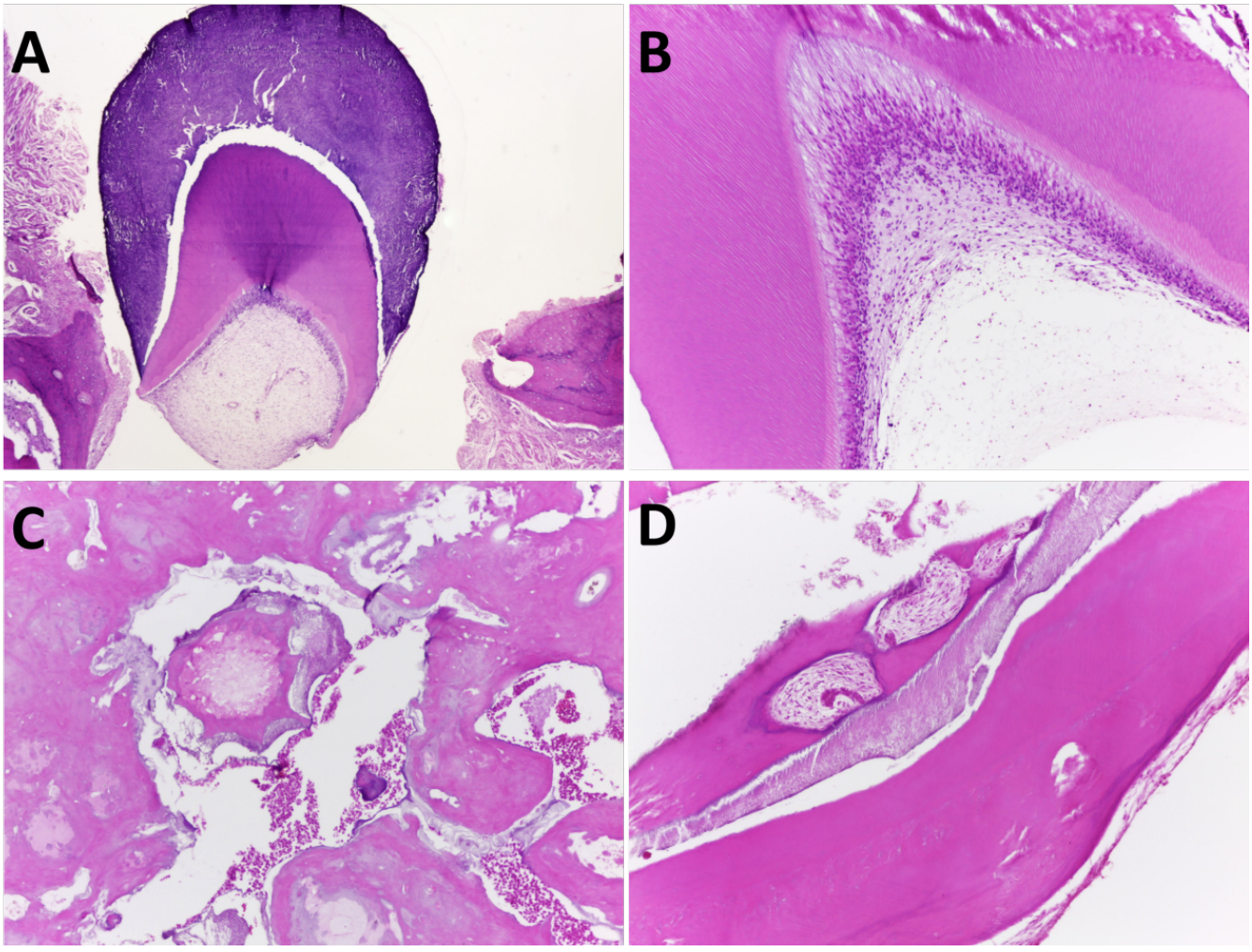

Figure 3. Histopathological features of odontomas. (A-B) Compound odontoma showing enamel matrix, dentin, and dental pulp organized into structures resembling a single-rooted tooth. (C-D) Complex odontoma showing amorphous formations of dentin and enamel matrix (hematoxylin and eosin staining: A, 40×; B-C, 100×; D, 400× magnification).

importance of early diagnosis, precise classification, and comprehensive histopathological evaluation to ensure optimal management.

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AUTHORS' CONTRIBUTIONS

JRT: conceptualization, data curation, formal analysis, investigation, methodology, project administration, writing – original draft, writing – review & editing. JVLV: data curation, investigation, writing – original draft. MLA: data curation, investigation, writing – original draft. JPSC: data curation, investigation, writing – original draft. MB: data curation, investigation, writing – original draft. ILC: data curation, investigation, writing – original draft. JNSN: investigation, resources, writing – review & editing. FRG: investigation, resources, writing – review & editing. MVD: investigation, resources, writing – review & editing. CPPV: investigation, resources, writing – review & editing. JPRM: investigation, resources, writing – review & editing. KCT: investigation, resources, writing – review & editing. RAO: investigation, resources, writing – review & editing. RGM: investigation, resources, writing – review & editing. GCS: conceptualization, methodology, supervision, writing – review & editing. IBV: conceptualization, methodology, supervision, writing – review & editing. JAAA: conceptualization, methodology, supervision, validation, writing – review & editing. BABA: conceptualization, data curation, formal analysis, methodology, supervision, validation, visualization, writing – review & editing.

CONFLICT OF INTEREST STATEMENT

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