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Retention of Mandibular Second Primary Molar in Adults: A radiographic study

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ABSTRACT: Each primary tooth undergoes a natural exfoliation process; however, in certain cases, the tooth may persist beyond its expected shedding time. This study was conducted to determine the prevalence and examine the status of retained deciduous molars through panoramic radiography in the Benghazi population. A total of 3,980 orthopantomographic radiographs (OPGs) obtained from patients attending Benghazi Dental Faculty Clinic were examined to determine the prevalence of retained deciduous mandibular second molars in adults and the main reasons for their persistence. Fourteen retained primary second molars were identified, comprising 10 cases in females and 4 in males. The prevalence was notably higher among females than males. The observed patterns revealed that bilateral retention was obviously more prevalent than unilateral retention, accounting for 57.1% of the cases. Among unilateral retention cases, a predilection for the left side was noted. Furthermore, the most common underlying cause of retention was the agenesis of the permanent successor equating to 95.5%. Although retention of the primary mandibular second molar in adulthood is uncommon, the findings of this study highlight the necessity of persistent patient and practitioner education regarding the long-term prognosis and optimal management options available including judicious preservation of the primary tooth when agenesis of its permanent successor is confirmed. Management of retained deciduous second molars can be challenging and requires careful clinical consideration.

KEY WORDS: Primary molars, retention, agenesis, ankylosis, root resorption.

I. INTRODUCTION

Retention of primary molars, also referred to as persistence, represents an uncommon developmental deviation characterized by prolonged existence of primary teeth beyond their physiologic exfoliation period. Despite its clinical relevance, the persistence of primary dentition has been addressed only in limited number of investigations [1–3]. The clinical decision-making process regarding the management of retained primary molars is multifactorial, relying on multiple variables such as the number and distribution of missing teeth, facial morphology, space requirements, skeletal pattern, patient age and expectations, and the structural integrity of the retained tooth [4]. Physiological root resorption, initiated by the eruptive pressure of permanent successors, is fundamental for normal exfoliation process. Interference with this mechanism frequently resulted in prolonged retention of the deciduous tooth, particularly in area of primary mandibular second molars. The increasing global incidence of hypodontia aligns with the rising prevalence of retained primary molars [5]. When the crown morphology, root configuration, and supporting alveolar bone are preserved, retained primary molars may remain functional throughout adolescence and even adulthood [6]. Nevertheless, the condition may predispose affected individuals to numerous complications including increased susceptibility to dental caries; loss of arch continuity resulting from mesial tipping or distal drifting of adjacent teeth; and localized periodontal disease affecting neighboring permanent teeth [7,8]. Tooth agenesis demonstrates a higher prevalence among females, and is predominantly idiopathic; however, it frequently follows an autosomal dominant inheritance pattern, rendering it one of the most common congenital anomalies in humans [11,12]. Epidemiological data indicate that the maxillary deciduous canine and mandibular second primary molar are the most frequently retained primary predecessors [13]. Aktan et al. (2011) further reported that retained primary teeth occur more frequently in the mandible than the maxilla, with the left side affected more often than the right [6]. Agenesis of the permanent premolar tooth germ constitutes the principal etiological factor underlying the retention of primary molars [14, 15], although environmental insults such as trauma, infection, and radiation, as well as syndromic conditions like ectodermal dysplasia, may also contribute [11,16]. Children missing one or more premolar tooth germs exhibit a markedly higher possibility of primary tooth persistence than those with fully developed premolar successors [17]. Infraocclusion represents one of the most clinically significant sequelae of retained primary mandibular second

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molars lacking its permanent successors. It is characterized by tooth's infraocclusal position, reflecting a failure to maintain vertical alignment with adjacent teeth [18]. Although various terms including arrested eruption, secondary retention, intrusion, and submerged tooth have been used, infraocclusion and submerged tooth remain the most widely accepted descriptors [20,19]. Management strategies for retained primary molars encompass a wide spectrum of approaches, including prosthodontic rehabilitation, autotransplantation, orthodontic space closure or augmentation for future implant placement, or observation when no functional or esthetic concerns exist [9]. Considerable attention has been directed toward retaining mandibular second primary molars as a therapeutic option in cases of premolar agenesis, with several studies evaluating their long-term clinical reliability [10]. Despite the available insights, there remains a paucity of data concerning the prevalence of retained primary molars in Libya, particularly within the eastern region. Therefore, the present study seeks to determine the prevalence of retained mandibular second deciduous molars among adult patients and to investigate the underlying causes of their retention and root condition of the affected teeth

II. METHODOLOGY

In this retrospective radiographical study, a total of 3,980 Orthopanoramic radiographs (OPGs) were examined, comprising 1,432 female and 2,548 male patients aged 15 years and above who attended the Oral Medicine and Radiology Department, Faculty of Dentistry, University of Benghazi. All OPGs were obtained using a Kodak 8000C digital panoramic system with exposure parameters of 73 kVp, 12 mA, and 13.9 seconds. The radiographs were collected and reviewed by the same examiner to determine the prevalence, location, and etiology of retained mandibular second primary molars. Ethical approval for this study was granted by the Faculty of Dentistry authorities. Written consent was not required, as the radiograph had been taken previously for diagnostic purposes by the patients' treating clinicians and were not specifically acquired for this study. A primary tooth was considered retained if it had not exfoliated and remained after their exfoliation time. Each radiograph was assessed individually, and variables recorded included patient gender, location of the primary tooth, agenesis or impaction of the permanent successor, and the condition of the root.

III. RESULTS

The study population included 3,980 subjects with a demographic distribution of 2,548 (64.0%) males and 1,432 (36.0%) females. Retained deciduous second molars were identified in 14 individuals, corresponding to an overall prevalence of 0.35%. Among these 14 cases, a total of 22 retained deciduous second molars were identified. A distinct female predominance was observed, with females comprising 10 of the 14 cases (71.4%) and a prevalence of (0.70%) within the whole sample. Males accounted for 4 cases (28.6%), corresponding to a prevalence of (0.16%) of the total sample (Table 1). The female-to-male ratio was 2.5:1, with a statistically significant association between gender and retention status (χ^2=7.56, p=0.006). The marked female predominance suggests gender-specific developmental or systemic factors
influencing primary tooth retention.

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Table 1: Descriptive statistics of the sample

Metric	count	Percentage (%)
Total sample size	3980	100%
Male cases	2548	64.02%
Female cases	1432	35.98%
Cases with retained teeth	14	0.35%
Male with retained teeth	4	0.16%
Female with retained teeth	10	0.70%
Unilateral retained tooth (left side)	6	42.86%
Bilateral retained tooth (left and right)	8	57.14%

The unilateral (left side) retention was observed in 6 cases (42.9%), while bilateral retention (involving both left and right sides) occurred in 8 cases (57.1%). Bilateral involvement was more frequent in females (60.0%) compared to males (50.0%) (Figure 1). The primary etiological factor identified was agenesis of the permanent successor, which accounted for (95.5% n=21) of the retained teeth. There was only one female case where the retention of the primary molar was attributed mainly to the malposition of the permanent successor (Figure 2).

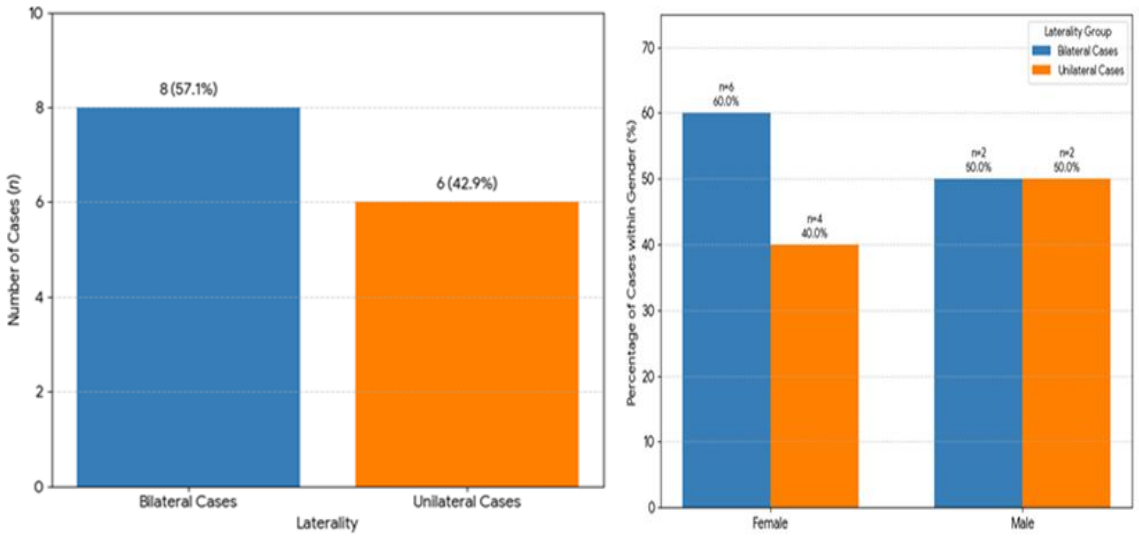

Figure 1: Distribution of retained teeth by side and gender

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Figure 2: Female case with bilateral retained deciduous molars
(Left side due to agenesis and right one due to malposition of permanent successor)

The evaluation of root status revealed that (18.2% n=4) of the teeth exhibited no resorption, (59.1% n=13) showed root resorption, while ankylosis was seen in (22.7% n=5) of the retained teeth (Figure 3). The most interesting finding was the distinct gender-specific etiological pattern as ankylosed teeth were predominantly observed in male cases (60% of male cases) compared to female (12.5%, n=2). Male patients exhibited a markedly different pattern, with ankylosed teeth and root resorption represented the primary finding associated with retained teeth (Figure 4, 5, 6).

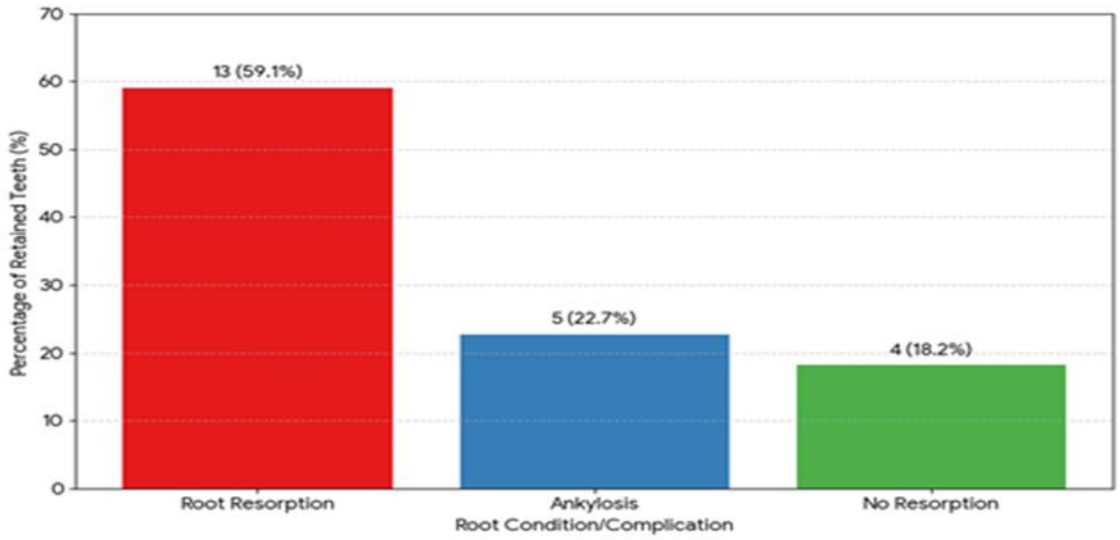

Figure 3: Distribution of main root conditions in retained deciduous molars

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Figure 4: Male case with left unilateral retention, (ankylosed)

Figure 5: Male case with left unilateral retention (ankylosed)

Figure 6: Male case with bilateral retention, left side Agenesis and right side ankylosed

Laterality-based analysis indicated that bilateral cases most commonly exhibited resorption (68.75%), while unilateral cases were predominantly ankylosed (50.0%). No root resorption was distributed similarly across bilateral and unilateral (18.8%) (16.7%) respectively **(**Figure 7). The findings of the current study underscore a significant female prevalence, a high frequency of bilateral retention specially in female cases, and distinct gender- and laterality-based etiological profiles. These results suggest that retained deciduous second molars represent a heterogeneous clinical entity influenced by sex-specific developmental factors, with bilateral cases potentially reflecting underlying systemic contributions.

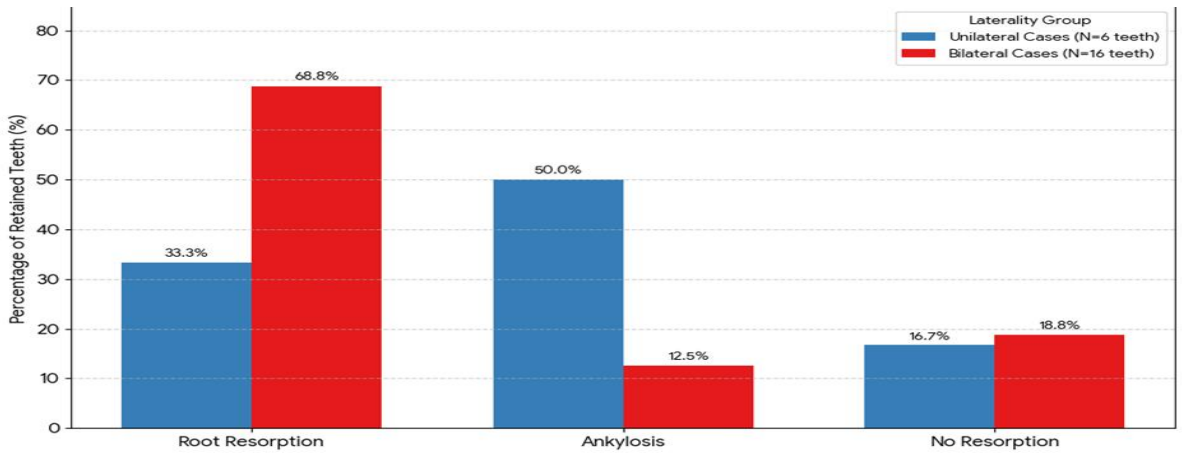

Figure 7. Distribution of root condition by laterality

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Case number	gender	presentation	laterality	cause
1	F	Unilateral	left	Agenesis /no resorption
2	F	Unilateral	left	Agenesis / ankylosed
3	F	Bilateral	Left Right	Agenesis/ no resorption Malposition of permanent
4	F	Unilateral	left	Agenesis/ no resorption
5	F	Bilateral	Left right	Agenesis/ root resorption Agenesis/ root resorption
6	F	Bilateral	Left right	Agenesis / no resorption Agenesis/ ankylosed
7	F	Unilateral	left	Agenesis/ root resorption
8	F	Bilateral	Left right	Agenesis/ root resorption Agenesis/ root resorption
9	F	Bilateral	Left right	Agenesis/ root resorption Agenesis/ root resorption
10	F	Bilateral	Left right	Agenesis/ root resorption Agenesis/ root resorption
11	M	Bilateral	Left right	Agenesis/ root resorption Agenesis/ root resorption
12	M	Unilateral	left	Agenesis/ ankylosed
13	M	Bilateral	Left right	Agenesis/ root resorption Agenesis/ ankylosed
14	M	Unilateral	left	Agenesis/ ankylosed

Table 2: The main characteristics finding of the retained cases:

Bilateral agenesis with root resorption was the most frequent finding, followed by unilateral left-sided agenesis. Ankylosis appeared in several cases, while malposition of the permanent successor was rare. Overall, developmental anomalies predominated across the cohort. The predominant features observed in the retained primary mandibular molars are summarized in Table 2.

Statistical Analysis

Descriptive statistical analysis was performed using SPSS for Windows, Version 20.0 (SPSS Inc., Chicago, IL, USA). The Chi-square test was applied to evaluate differences between male and female prevalence.

IV. DISCUSSION AND IMPLICATION

This retrospective radiographic study of patients from Benghazi city examined the persistence of primary molars to assess the prevalence and potential causes of their retention. Primary teeth that retain healthy crowns, roots, and surrounding alveolar bone can remain functional in the oral cavity for several years. Nevertheless, recent studies have indicated that retained primary teeth may play a significant role in the onset of various clinical complications, such as periodontitis and dental caries [21]. Furthermore, research has shown that in the absence of permanent successors, these teeth often exhibit root resorption and infraocclusion [4,22,23]. Previous meta-

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analysis studies have demonstrated that mandibular second premolar agenesis is among the most common forms of dental agenesis, with notable variations in prevalence across populations [23]. A low frequency of retained deciduous mandibular molars has been reported in earlier analyses [21], and this finding is consistent with the results of the current study, which corresponds to an overall prevalence of 0.35%. Moreover, this study demonstrates the congenital absence of permanent successor teeth as the most frequent cause of primary molars retention which accounts for 95.5% of the sample, and these findings are consistent with other radiographic-based studies [24-26]. Research consistently demonstrates that mandibular second primary molars are retained more frequently than their maxillary counterparts. Mohammed et al. (2018) identified these teeth as the most commonly preserved deciduous molars, largely due to the absence of permanent successors [27]. Their findings further emphasized that mandibular second primary molars exhibit a higher retention rate than maxillary molars, particularly in cases of bilateral agenesis. Likewise, Ooe et al. (2010) observed that retained molars often remain functional and asymptomatic into adulthood, although infraocclusion and tipping of adjacent teeth may occasionally occur [28]. These findings are in agreement with the results of the present study. In addition, different cross-sectional studies have reported that the most commonly retained primary tooth is the mandibular second primary molar, followed by the maxillary deciduous canine [6,15]. The findings of the present study are in line with those reported by Aktan et al. (2011) and Iraqi et al. (2019), who demonstrated that retention of primary teeth occurs more frequently in females than in males, with the left side being more commonly affected than the right [6,25]. Typically, primary molars exfoliate once approximately three-fourths of the root of the succeeding premolar has developed [18,27]. When a deciduous molar persists beyond this stage, it is considered over-retention. Several local factors may contribute to this condition, including malposition of the developing tooth germ, irregular root resorption, ankylosis, obstruction by supernumerary teeth, and agenesis of the permanent successor [8]. (Ankylosis of the primary molars represents the principal cause of infraocclusion. In the present study, four patients were identified with ankylosed primary molars, each case involving a retained tooth in infraocclusion or a submerged molar. Submerged primary molars negatively impact arch length integrity, most notably through the tipping of adjacent teeth and the gradual reduction of space in the area above the infraoccluded tooth [19]. Reports indicate that infraocclusion affects primary mandibular molars up to ten times more frequently than primary maxillary molars. In most cases, infraoccluded primary molars with developing premolars exfoliate in a normal sequence; however, when premolar successors are absent, exfoliation tends to occur at a slower rate [29]. Although relatively uncommon, evidence suggests that infraocclusion does not significantly influence the longevity of retained primary molars in instances of premolar agenesis, particularly among older patients[10]. In situations where permanent mandibular second premolars fail to develop; the retention of primary molars is essential for conserving alveolar bone volume and limiting bone resorption. Such preservation provides a favorable foundation for immediate implant placement during late adolescence [25].

Root resorption of primary molars was observed in the present study. In cases where a primary tooth demonstrates root resorption, caries, periodontal disease, or an unfavorable prognosis, extraction is often indicated, followed by prosthetic replacement to restore function and aesthetics [6]. The findings in this study indicated that the mandibular second molars, particularly those on both sides, were the commonly retained deciduous teeth, whereas the persistence of other primary teeth was uncommon. These observations align with earlier research, which has consistently reported a link between tooth agenesis and the continued presence of primary teeth [7, 11, 30, 31]

V. CONCLUSION AND FUTURE WORK

Retention of deciduous mandibular molars is commonly associated with agenesis of their permanent successors and may persist into adulthood without significant complications. Nevertheless, clinicians should remain aware of potential risks such as infraocclusion, ankylosis, and the development of malocclusion. Management should be individualized balancing function, aesthetics, and long-term stability of the occlusion. Maintaining the retained tooth is a viable option in many cases, especially when the tooth is healthy and the permanent successor is congenitally absent. Early diagnosis and regular clinical monitoring are essential to ensure optimal outcomes. Future studies should involve larger cohorts across multiple regions of Libya to capture potential geographic, socioeconomic, and ethnic variations in retention patterns. Expanding to rural and urban populations will strengthen generalizability. In addition, Incorporating panoramic radiographs and CBCT imaging will allow evaluation of root resorption, ankylosis, and alveolar bone changes associated with prolonged retention.

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