



# Supernumerary Premolars: A Literature Review

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## Abstract

Supernumerary premolars appear to be more common than previously estimated. The purpose of this report was to review most of the cases published in the dental literature since 1932. The authors found that supernumerary premolars occur 3 times more in males than in females, indicating a possible sex-linked inheritance, with the highest frequency of occurrence in the mandibular premolar region (74%). They are also the most common supernumerary teeth in the mandibular arch (7%), and their incidence is 1% (1 in 157)—much higher than previously reported. Maxillary supernumerary premolars were found to occur at a lower rate (26%). The possible mechanisms of development are described, with a localized hyperactivity of the dental lamina being the most widely accepted theory. Recurrence of supernumerary premolars after being surgically removed has been reported in 8% of the cases reviewed. Patients with a previous history of anterior conical or tuberculated supernumerary teeth at an early age have a 24% possibility of developing single or multiple supernumerary premolars at a later age. Early diagnosis and appropriate follow-up with panoramic radiographs is extremely important. Various treatment recommendations are also discussed. (*Pediatr Dent.* 2004;26:450-458)

**KEYWORDS:** SUPERNUMERARY TEETH, PREMOLARS, RADIOGRAPHIC

*Received December 18, 2003    Revision Accepted June 22, 2004*

Teeth formed in excess of the normal dental formula are defined as supernumerary. If such teeth closely resemble the adjacent teeth, they are classified as supplemental. On the other hand, if they present abnormal shape and size, they are termed rudimentary.<sup>1</sup> The most common supernumerary teeth, listed in order of frequency are the:

1. maxillary midline supernumeraries;
2. maxillary fourth molars;
3. maxillary paramolars (rudimentary supernumeraries that develop buccally or lingually to the maxillary molars);
4. mandibular premolars;
5. maxillary lateral incisors;
6. mandibular fourth molars;
7. maxillary premolars.<sup>2</sup>

The incidence of supernumerary teeth among the general population is fairly common—approximately 1 in every 110 children—and the ratio of prevalence in the maxilla to mandible is 8.2 to 1.<sup>2,3</sup> Supernumerary teeth can remain impacted for many years without clinical, pathologic, or orthodontic complications.<sup>4</sup>

It has been found that supernumerary premolars are more common than formerly estimated. This can be supported by the fact that 75% of these teeth are impacted, unerupted, and generally asymptomatic.<sup>2,5-7</sup> Supernumerary premolars occur more frequently in the mandible than in the maxilla, and the majority are of the supplemental type.<sup>2</sup> Where the site of these teeth has been reported, this is usually lingual to, or occasionally vertically below, the normal premolar teeth.<sup>7,8</sup> Supernumerary premolars may not become radiographically visible until the patient's normal premolars have erupted.

Multiple case reports describing supernumerary premolars have appeared in the literature. A summary of these cases is presented in Table 1.

The purpose of this report was to review the current literature regarding the incidence, possible mechanisms of development, diagnostic assessment, recurrence, complications, and treatment recommendations for supernumerary premolars.

## Incidence

The most comprehensive study of supernumerary teeth was published by Stafne<sup>2</sup> in 1932. He examined full-mouth

**Table 1. Summary of Case Reports of Supernumerary Premolars In Chronological Order**

Author(s)	Year	Country	Sex	Age	No. of cases	No. of teeth	Maxilla		Mandible	
							R	L	R	L
Bartleman <sup>10</sup>	1932	USA	M	18	1	10	2	2	3	3
Marre <sup>11</sup>	1940	USA	M	18	1	5			2	3
Adelstein <sup>12</sup>	1943	USA	M	14	1	2			1	1
Oehlers <sup>13</sup>	1951	England	M	24	1	9	3	1	3	2
Cowan <sup>14</sup>	1952	England	F	15	1	3	1		1	1
Oehlers <sup>15</sup>	1952	England	M	23	1	3			1	2
Wood <sup>16</sup>	1957	Jamaica	M	19	1	4			3	1
Jennings <sup>17</sup>	1957	USA	M	20	1	2				2
Isokawa <sup>18</sup>	1959	Japan	M	19	1	5			2	3
Hanratty <sup>19</sup>	1960	USA	F	16	1	7	2	1	2	2
Poyton et al <sup>5</sup>	1960	Canada	F	11	1	8		2	2	4
Stevenson <sup>20</sup>	1964	Scotland	M	12	1	8	3	2	2	1
Ruhlman and Neely <sup>21</sup>	1964	USA	M	14	1	5	2		2	1
Clark <sup>22</sup>	1966	England	M	23	1	6		1	2	3
Lin <sup>23</sup>	1967	Singapore	F	16	1	7	2	2	2	1
Robert <sup>24</sup>	1968	USA	M	21	1	7	1	1	3	2
Smith <sup>25</sup>	1969	USA	M	21	1	6	1	1	2	2
Price and Hoggins <sup>8</sup>	1969	England	M	18	5	6		1	3	2
			F	17		3			2	1
			M	11		4		1	1	2
			M	15		2			1	1
Bowden <sup>26</sup>	1971	England	F	13	3	1				1
			M	12		2			1	1
			M	13		2				2

Continued on page 452

radiographic surveys of 48,550 patients. A total of 500 supernumerary teeth were found, including 9 maxillary and 33 mandibular premolars (Table 2). According to these figures, premolars account for nearly 9% of all supernumeraries, with mandibular teeth representing 7% and maxillary teeth 2%.

Still<sup>40</sup> reported several cases of supernumerary premolars and indicated that, in Southern Nigeria, approximately 1 person in every 100 has 1 or more extra premolar teeth, being a fairly common condition in this country. Parry and Iyer<sup>41</sup> reported the appearance of 4 supernumerary premolars in a population of 2,000 orthodontic patients, indicating an incidence of 0.20%. Grahnen and Lindhal<sup>42</sup> reported a higher incidence of supernumerary premolars in 1,052 Swedish dental students (0.29%), representing 9% of the total number of teeth. Another study reported an even higher incidence (0.64%) in an orthodontic population of 1,100 patients.<sup>9</sup> This represented a prevalence of 1 in 157 patients (20%), more than twice as high as previ-

ously reported. A summary of the results of these investigations is presented in Table 3.

Several factors might explain the apparent discrepancy in the prevalence figures reported, such as differences in patient population samples, ages, ethnicities, radiographic techniques employed, and the possibility that supernumerary teeth may have been extracted before examination. According to these factors, the incidence may have been higher in previous reports and appears to be on the increase over the years.

#### Origin and inheritance

Gardiner<sup>43</sup> discussed 3 possible mechanisms that can give rise to supernumerary teeth in the premolar region (Figure 1). An abnormal proliferation of the dental lamina can be observed at A, that can give rise to a predeciduous type of supernumerary tooth. Although this may be a possible scenario, only one case was found in the literature reporting a supernumerary first primary molar together

**Table 1 continued from page 451**

Author(s)	Year	Country	Sex	Age	No. of cases	No. of teeth	Maxilla		Mandible	
							R	L	R	L
Winkler et al <sup>27</sup>	1972	USA	F	14	1	1			1	
Stevenson and Mc Kechnie <sup>28</sup>	1975	Scotland	M	10	1	6		1	2	3
Shah and Pauls <sup>29</sup>	1978	Canada	M	16	2	2	1	1		
			M	42	2			1	1	
Ranta and Ylipaavalniemi <sup>30</sup>	1981	Finland	M	11	2	3			1	2
			M	16	2			2		
Shapira and Haskell <sup>31</sup>	1981	USA	F	12	1	4			2	2
Becker et al <sup>32</sup>	1982	Israel	M	12	1	5	2	1	1	1
Trenouth and Bedi <sup>33</sup>	1983	England	M	9	1	1	1			
Turner and Hill <sup>7</sup>	1986	USA	M	10	1	1			1	
Kantor et al <sup>34</sup>	1988	USA	M	9	1	8	2	2	2	2
Breckon and Jones <sup>35</sup>	1991	England	M	11	1	2			1	1
Hattab et al <sup>36</sup>	1994	Jordan	M	17	1	2			1	1
Scanlan and Hodges <sup>37</sup>	1997	England	F	12	2	1				1
			M	13	4	1	1	1	1	
Cochrane et al <sup>38</sup>	1997	England	M	14	2	2			1	1
			F	14	2			2		
Saini et al <sup>39</sup>	2002	USA	M	5	7	1				1
			M	18	2			1	1	
			M	39	2			1	1	
			F	19	6	1	1	2	2	
			M	21	2				2	
			M	30	3				3	
Totals		Ratio M:F 3:1	37 M	Mean Age=16.4	49	183	26	22	65	70
			12 F				48		135	

with a supernumerary first premolar.<sup>33</sup> The presence of a primary supernumerary tooth indicates a significantly higher probability of a permanent supernumerary to develop, due to the fact that primary tooth buds normally produce an extension of the dental lamina for the formation of permanent teeth.<sup>44</sup>

A more frequent type of situation can be seen in B. Before development of the permanent tooth takes place, the dental lamina provides an additional follicle that gives rise to a supernumerary tooth. On the other hand, an extra tooth can develop from an extension of the dental lamina after the deciduous as well as the permanent follicles have been formed. This has been termed a postpermanent type of supernumerary tooth and can be seen in C.

Evidence of the development of postpermanent supernumerary teeth has been provided by several authors who reported partially developed extra premolars after normal premolars have completed their root formation.<sup>5,8,10-12,14,15,26,27,29,30,35-38</sup> These authors indicated that this theory is possible due to the fact that supernumerary premolar root

development is considerably delayed when compared with the corresponding teeth of the normal series. Additionally, this delay in development can vary from 7 to 10 years and the crown form is similar to that of the normal premolars.

Another possibility is that hyperdontia can be created by a split in the developing tooth bud, giving rise to an extra tooth (dichotomy). A complete, equal split of the bud would give rise to a supplemental tooth, while an unequal split would result in 1 normal tooth and 1 smaller tooth.<sup>1,45</sup>

Histological studies using rats and mice demonstrated that proliferating epithelial remnants in the interseptal areas, mainly from Hertwig's root sheath, may be transformed into differentiated cells when stimulated by trauma, giving rise to supernumerary teeth.<sup>46-48</sup> Ranta and Ylipaavalniemi<sup>30</sup> reported 2 cases of patients with a history of mandibular fractures in childhood who, several years later, developed multiple supernumerary premolars in the earlier fracture lines. The authors are of the opinion that these findings might be purely circumstantial. Based on the findings in animal studies, however, they point out the possibility of a

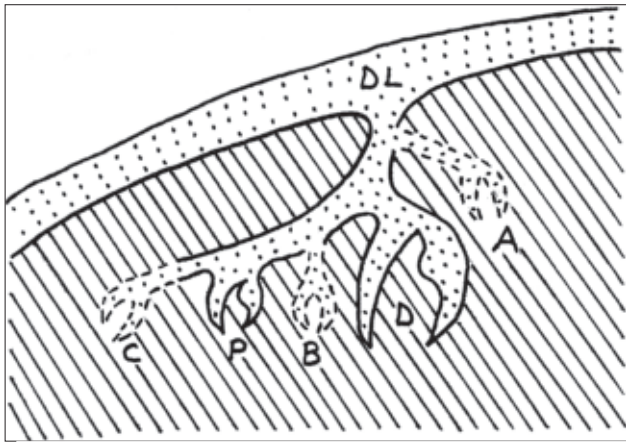


Figure 1. Possible mechanisms for development of supernumerary premolars. DL=dental lamina, D=primary tooth germ, P=permanent tooth germ.

cause-and-effect relationship between jaw fractures and supernumerary teeth formation. Although all theories are hypothetical in nature due to the inability to obtain sufficient embryologic material on the origin of supernumerary teeth, most literature supports the dental lamina theory.<sup>1</sup>

There are no satisfactory explanations regarding the modes of inheritance or genetic factors on supernumerary dental development. The prevalence of supernumerary teeth in relatives of affected subjects has been found to be much greater than that of the general population. There are several studies that support this theory.<sup>49-51</sup> This condition, however, does not appear to follow a simple mendelian pattern of inheritance. In reviewing the literature, only 2 cases of supernumerary premolars among siblings were found.<sup>37,52</sup> Of these cases, only 1 was positive for family history of supernumerary teeth, including a paternal grandparent, the father, and 2 brothers. Another case of supernumerary premolars at age 12, with a previous history of mesiodens at an earlier age, reported to have a female cousin with a similar intervention at age 7.<sup>32</sup>

Although an autosomal dominant trait has been suggested, the sex predilection of males over females has influenced several authors to indicate the possibility of a sex-linked inheritance.<sup>53-55</sup> Patients with cleft lip or palate have a high prevalence rate of 28% for supernumerary teeth, especially in the anterior region.<sup>56</sup> A high occurrence rate of 21% has also been reported in Gardner's syndrome, with multiple supernumerary teeth being a characteristic feature of this condition.<sup>57</sup> Jensen and Kreiborg<sup>58</sup> reported an even higher incidence in a large sample of patients with cleidocranial dysplasia, with a combined 35% for both the maxillary and mandibular anterior regions and a 27% for the combined premolar regions. A higher frequency for supernumerary mandibular premolars was also found to occur in these patients (15%).

#### Recurrence

Several authors have reported the recurrence of supernumerary premolars after being surgically removed. Poyton,

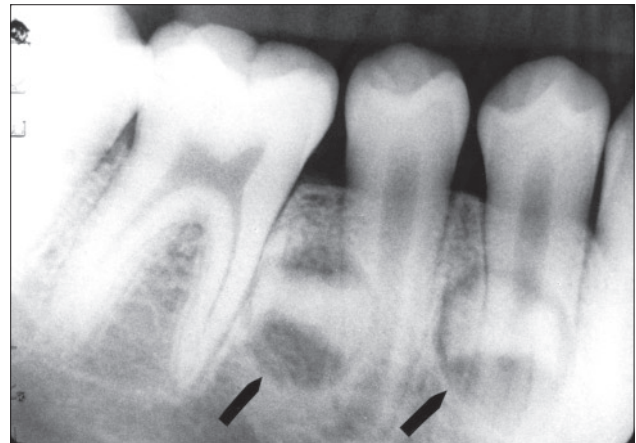


Figure 2. Supernumerary premolars in early stages of development (arrows).

Morgan, and Crouch<sup>5</sup> reported that 3 incompletely formed supernumerary premolars, which were removed at age 11, and later at age 16, had been replaced by 3 additional teeth of similar size, shape, and degree of development. In addition, 2 supernumerary premolars in the left maxilla were found that were not present at the initial examination. This case represents a total of 8 impacted supernumerary premolars seen and removed over a period of 5 years.

Stevenson and McKechnie<sup>28</sup> also reported a case of a 10-year-old male with 1 maxillary and 2 mandibular supernumerary premolars that were extracted. Several years later, recurrence of 3 supernumerary mandibular premolars was observed. Of these teeth, at least 2 were recurrent and 1 was a newly developed supernumerary premolar not shown in the original radiographs.

Shapira and Haskell<sup>31</sup> reported a case in which 3 supernumerary mandibular premolars were removed in a 12-year-old female. A year later, only 1 additional premolar was found to have recurred. Rubenstein et al<sup>9</sup> reported a case of 3 supernumerary premolars that were also removed in a 13-year-old female. Two years later, an extra premolar was discovered during a follow-up radiograph.

These authors did not give a possible explanation as to why these teeth may have recurred. It is possible that the crypts of supernumerary premolars could have been present earlier, but were not detected in the previous radiographs. Periapical radiographs may also miss some of the more apically developing supernumerary premolars.

It is often hypothesized that recurrence could be due to a portion of a follicle reactivating, but the fact that new supernumerary premolars appeared in different areas shows that this is not the case.<sup>5,28</sup> Another possibility is that, in these patients, the dental lamina is not resorbed completely and is reactivated at the time of crown completion of normal permanent teeth. Incomplete resorption of the dental lamina creates multiple supernumerary teeth, especially in the premolar region. This is the same mechanism found in patients with cleidocranial dysplasia.<sup>54</sup>

**Table 2. Incidence and Distribution of 500 Supernumerary Teeth<sup>2</sup>**

	Central incisors	Lateral incisors	Canines	Premolars	Paramolars	Fourth molars	Total
Maxilla	227	19	2	9	58	131	446
Mandible	10	0	1	33	0	10	54

**Table 3. Summary of Extensive Reports of Supernumerary Premolars**

Author(s)	Year	Country	Supernumerary premolars				Location	
			Patient sample	No. of cases	No. of teeth	Prevalence %	Maxilla	Mandible
Stafne <sup>2</sup>	1932	USA	48,550	NR*	42	0.09	9	33
Parry and Iyer <sup>39</sup>	1961	India	2,000	50	4	0.15	4	0
Grahnén and Lindhal <sup>40</sup>	1961	Sweden	1,052	3	6	0.29	0	6
Zvolanek and Spotts <sup>6</sup>	1985	USA	4,000	6	7	0.15	0	7
Rubenstein et al <sup>9</sup>	1991	USA	1,100	7	16	0.64	3	13

\*NR=not reported.

### Radiographic assessment

Without the use of radiographs, it is unlikely that the development of supernumerary premolars could be diagnosed (Figure 2). The ratio of unerupted supernumerary premolars to those that erupt is approximately 5 to 1, justifying radiographs as the only means for diagnosis.<sup>2</sup> Many practitioners have decreased the number and frequency of radiographs taken because of an increased public and professional concern over radiation.<sup>7</sup> The possibility of failure to diagnose supernumerary teeth, therefore, is increased considerably.

The fact that the majority of the cases reported in the literature were asymptomatic and discovered by means of periapical radiographs points out the importance of making a full-mouth survey, either with a panoramic radiograph or with a complete periapical series on all new patients.<sup>6</sup>

Bitewing radiographs are completely inadequate for diagnosis, since supernumerary premolars usually develop apically to their normal predecessors.<sup>9</sup> A more accurate diagnosis can be made from a panoramic examination repeated at 5-year intervals. A complete interpretation of each film is necessary to avoid diagnostic errors. Evidence of developing supernumerary crypts can be observed in the early stages of formation and can be easily misdiagnosed.<sup>7,38</sup> Since supernumerary premolars generally develop on the lingual side of the normal premolars, it is also possible that the crypts are already present, but are masked by the premolar roots, making detection on routine radiographs difficult.<sup>26,31</sup>

Several cases have been incidental findings on radiographs prior to orthodontic treatment.<sup>8,9,37,38</sup> Radiographs taken before orthodontic treatment, however, may fail to demonstrate any anomalies in tooth number, and late-forming supernumerary premolars may be found on

progress films or at the end of orthodontic treatment. Supernumerary premolars have been diagnosed with panoramic radiographs after 24 months of orthodontic treatment, although no detrimental effects were observed.<sup>35</sup>

During a 2-year period, Rubenstein et al<sup>9</sup> detected a much higher incidence of supernumerary premolars than previously reported, due to the fact that the 1,100 patients in their sample had panoramic radiographs available in preparation for and during orthodontic treatment. For this reason, while diagnosis of supernumerary premolars may have been made previously, a panoramic radiograph is indicated prior to the initiation of orthodontic treatment, a second panoramic examination should be made when active treatment is completed, and long-term follow-up is advised.<sup>32</sup>

### Complications

Dentigerous cyst formation and root resorption have been cited in the literature as frequent complications associated with supernumerary premolars. Dentigerous cysts were found to be a rare entity in a longitudinal study, however, with only 3 cases reported.<sup>59</sup> Dentigerous cysts associated with supernumerary teeth are rare and occur in 5% to 6% of all cases. The vast majority, about 90%, are associated with maxillary mesiodens.

With regard to root resorption, only one case has been documented of a supernumerary premolar causing rapid mesial root resorption of a mandibular right first permanent molar with subsequent loss of this tooth.<sup>60</sup> Bodin, Julin, and Thomsson<sup>61</sup> reported that only 2% of supernumerary premolars exhibited any pathological changes and indicated that these teeth should be left untreated rather than risk surgical damage.



Most problems associated with supernumerary premolars are due to their potential to interfere with normal occlusal development or with orthodontic mechanics such as: (1) crowding; (2) separation; (3) impaction or delayed eruption of permanent teeth; (4) malocclusion; (5) rotations; (6) retained deciduous teeth; (7) palatally displaced permanent canines; (8) abnormal eruption sequence; (9) compromised space closure; and (10) interference with root torque.<sup>5,6,11,15-18,31,32,34,35,37</sup>

### Treatment and timing of removal

Supernumerary premolars are indicated for surgical removal if any of the previously mentioned complications are found or anticipated during radiographic or clinical examination. In general terms, extraction of supernumerary premolars has been the recommended treatment choice, but the timing of surgical removal appears to be controversial. Removal of unerupted supernumeraries involves the risk of damage to adjacent structures, and a decision should be made whether to remove or monitor them.<sup>38</sup>

Early surgical intervention is recommended when the supernumerary is causing problems such as prevention of eruption or malposition of permanent teeth. Early diagnosis and treatment also permits an interceptive orthodontic approach and correction of arch crowding.<sup>33</sup>

Several authors recommend surgical removal of supernumerary premolars in conjunction with third molars.<sup>7,30,35,37,39</sup> They justify this option as a more conservative approach with minimal surgical trauma when the supernumeraries are developed to a point where extraction is facilitated. Others recommend that, if diagnosed, the supernumerary premolars should be extracted prior to orthodontic treatment.<sup>8,9,21,27,28</sup> On the other hand, most of the authors recommend that supernumerary premolars should be left in situ until further development allows for uncomplicated surgery with less damage to roots and adjacent structures.<sup>6,19,20,21,23,24,27,29,37-39</sup> Marre<sup>11</sup> and Hanratty<sup>19</sup> recommend surgical removal in 2 stages:

1. removal of the more developed supernumerary premolars is accomplished soon after diagnosis;
2. the remaining less-developed premolars are left in situ and removed later, when their roots are more developed, to avoid damage to adjacent structures and allow for bone regeneration.

Becker, Bimstein, and Shteyer,<sup>32</sup> recommend that supernumerary premolars be left untreated until the full permanent dentition has developed. Due to the fact that supernumerary premolars develop late in relation to the normal teeth, late treatment of the overall condition may be preferred and should involve orthodontic treatment of erupted as well as unerupted teeth. They indicate that late extraction of normal deciduous, permanent, and supernumerary premolars can be accomplished in one session, reducing treatment time considerably, as well as damage to adjacent structures and psychological trauma to the patient.

It is interesting that, in the 6 cases reported by Zvolanek,<sup>6</sup> only 2 underwent surgery to remove the supernumerary

premolars. One case was kept under observation, since there was no radiographic evidence of complications. In the remaining 3 cases, the patients refused to have their supernumerary premolars removed, indicating that they were not having surgery for a condition that was not causing an immediate problem. The patients and guardians should always be informed of the potential complications that untreated teeth can produce within a short period of time, especially if there is the need for orthodontic treatment.

### Discussion

Multiple supernumerary teeth without any associated systemic condition or syndromes have been reviewed by Yusof.<sup>62</sup> It was found that there was a predilection for non-syndrome multiple supernumerary teeth to occur in the mandible (61%). When analyzed according to specific locations for both the maxilla and mandible, there was a predominance of multiple supernumerary teeth to occur in the premolar area (62%), with the highest frequency of occurrence in the mandibular premolar region (45%).

The present literature review found a male-to-female ratio of 3 to 1, a mean age of 16.4, an occurrence rate of 26% for supernumerary maxillary premolars, and an extremely high occurrence rate of 74% for supernumerary mandibular premolars.

While Yusof's study<sup>62</sup> evaluated 11 cases of non-syndrome multiple supernumerary teeth involving the anterior, premolar, and molar regions, this study consisted of a much larger case sample involving the premolar regions exclusively. Historically, the premolar region has been cited as the most frequent site for supernumerary teeth to occur in the mandibular arch (7%).<sup>2</sup>

It is interesting to point out that none of the cases reported in this review had a history of any systemic disorder responsible for multiple supernumerary teeth. A unique feature in this review is that, in 12 cases (24%) of the total sample, including the 3 cases reported by Bowden,<sup>26</sup> there was a previous history of a conical or tuberculated supernumerary mesiodens in the maxillary anterior region, that were surgically removed at an earlier age or that there were still present at the time of diagnosis.<sup>10,12,14,21,25,28,32,35,36</sup> Patients exhibiting this particular characteristic should be closely monitored, with radiographs taken on a routine basis. A good group for early radiographic diagnosis of supernumerary premolars is from 12 to 14 years of age.

A comprehensive clinical and radiographic examination is also indicated on all patients with supernumeraries in the maxillary anterior or premolar regions and with the possibility of their occurrence among siblings or relatives. It would have been interesting to find out if the African cases reported by Scanlan and Hodges<sup>37</sup> were siblings from Nigeria, since it has been reported that, in this country, the incidence of supernumerary premolars is approximately 1 in every 100.<sup>40</sup>

A review of these case reports also shows that supernumerary premolars commonly occur in several regions of the same mouth, and that the finding of one clearly indicates radiographic examination of the remaining premolar regions.<sup>26</sup>

With regard to the etiology of supernumerary premolars, it is obvious that the dental lamina has reacted in excess to some extent. This can be substantiated due to the fact that the location for such teeth is usually on the lingual side of the arch or vertically below the normal premolar teeth. This influence may be genetic, since supernumerary premolars as well as premolar hypodontia occur frequently in the mandibular arch. It is also interesting to point out that hyperdontia has a strong predilection for males and hypodontia is more frequent in females.<sup>63</sup> This finding suggests a possible sex-linked inheritance.

No other single radiographic projection provides a more comprehensive evaluation of the overall state of dental development than the panoramic radiograph. It is especially valuable in examining: (1) the presence or absence of teeth; (2) abnormal eruption patterns; (3) anomalies of tooth development; (4) space adequacy; (5) abnormal resorption of primary teeth; (6) TMJ problems; (7) mandibular fractures; (8) postsurgical assessment; (9) post-traumatic healing; (10) serial extraction problems; and (11) orthodontic pretreatment and posttreatment appraisal.<sup>64,65</sup>

The procedure's simplicity, the patients acceptance of the technique, the wide scope of the radiographic examination, and the ability to reveal anatomic structures in an accurate relationship are some of the reasons panoramic radiography is useful in pediatric dentistry.

Pediatric dentists who have used the panoramic radiographic technique routinely for a period of time have discovered condylar fractures, traumatic cysts, and anomalies that might have gone undetected with the routine periapical series of radiographs.<sup>66</sup>

In a study by Neal and Bowden<sup>67</sup> more than 25% of panoramic radiographs showed significant findings for orthodontic diagnosis and treatment planning. On this basis, they concluded that all panoramic films examined were of value in assessing the developing occlusion. These are probably some of the reasons why panoramic radiographs are used more frequently in pediatric dentistry today than 30 to 40 years ago.

Finally, early radiographic diagnosis with panoramic radiographs is extremely important, since a large percentage of supernumerary premolars remain impacted, unerupted and are generally asymptomatic. Additionally, the fact that this condition appears to be on the increase over the years and that premolars are the most common supernumerary teeth in the mandibular arch clearly justifies this approach.

### Conclusions

1. Supernumerary premolars occur 3 times more in males than in females and nearly 3 times more in the mandible than in the maxilla; they are also the most frequent supernumeraries in the mandibular arch and their incidence (0.64%) is much higher than previously reported.

2. Recurrence of supernumerary premolars, after surgical removal, was reported in 8% of the total sample.
3. Patients with a previous history of supernumerary teeth in the anterior region have a 24% possibility of developing supernumerary premolars at a later age.
4. Full radiographic and panoramic surveys are extremely important for diagnosis and should be taken periodically as well as for long-term follow-up.
5. Treatment basically involves the following options:
  - a. extraction of the supernumerary premolar;
  - b. extraction in conjunction with third molar removal;
  - c. maintenance of the supernumerary in situ with appropriate clinical and radiographic follow-up.

### References

1. Primosch RE. Anterior supernumerary teeth-assessment and surgical intervention in children. *Pediatr Dent*. 1981;3:204-215.
2. Stafne EC. Supernumerary teeth. *Dental Cosmos*. 1932;74:653-659.
3. Schulze C. Incidence of supernumerary teeth. *Dent Abstr*. 1961;6:23.
4. Solares R. The complications of late diagnosis of anterior supernumerary teeth: Case report. *J Dent Child*. 1990;57:209-211.
5. Poyton GH, Morgan GA, Crouch SA. Recurring supernumerary mandibular premolars. *Oral Surg Oral Med Oral Pathol*. 1960;13:964-966.
6. Zvolanek JW, Spotts TM. Supernumerary mandibular premolars: Report of cases. *J Am Dent Assoc*. 1985;110:721-723.
7. Turner C, Hill CJ. Supernumerary mandibular premolar: The importance of radiographic interpretation. *J Dent Child*. 1986;53:375-377.
8. Price C, Hoggins GS. A category of supernumerary premolar teeth. *Br Dent J*. 1969;126:224-228.
9. Rubenstein LK, Lindauer SJ, Isaacson RJ, Germane N. Development of supernumerary premolars in an orthodontic population. *Oral Surg Oral Med Oral Pathol*. 1991;71:392-395.
10. Bartleman FC. Supernumerary teeth. *Dental Cosmos*. 1932;74:1028.
11. Marre JM. Supernumerary teeth. *J Am Dent Assoc*. 1940;27:212-214.
12. Adelstein CS. Supernumerary teeth. *Am J Orthod*. 1943;29:654-657.
13. Oehlers FAC. A case of multiple supernumerary teeth. *Br Dent J*. 1951;90:211-212.
14. Cowan GA. Delayed development of supernumerary premolars. *Br Dent J*. 1952;92:126.
15. Oehlers FAC. Post permanent premolars. *Br Dent J*. 1952;93:157-158.
16. Wood IF. Supernumerary premolars: Report of a case. *Br Dent J*. 1957;103:313-314.

17. Jennings JK. Multiple supernumerary impacted mandibular bicuspid. *J Am Dent Assoc.* 1957;55:877-878.
18. Isokawa S, Ozaki, T. Supernumerary teeth. *Oral Surg Oral Med Oral Pathol.* 1959;12:730-731.
19. Hanratty WJ. Odontectomy of seven impacted supernumerary bicuspid. *J Am Dent Assoc.* 1960;61:80-82.
20. Stevenson W. Supernumerary teeth: Report of a case. *Br Dent J.* 1964;116:37-38.
21. Ruhlman DC, Neely AR. Multiple impacted and unerupted supernumerary teeth: Report of a case. *Oral Surg Oral Med Oral Pathol.* 1964;17:199-203.
22. Clark A. Multiple supplemental premolar teeth: A case history. *Br Dent J.* 1966;121:133.
23. Lin TY. Seven supernumerary premolars: Report of a case. *Br Dent J.* 1967;123:437-438.
24. Robert JC. Supernumerary teeth. *Oral Surg Oral Med Oral Pathol.* 1968;25:577-578.
25. Smith JD. Hyperdontia: Report of case. *J Am Dent Assoc.* 1969;79:1191-1192.
26. Bowden DEJ. Post permanent dentition in the premolar region. *Br Dent J.* 1971;131:113-116.
27. Winkler BA, Jung EL, Lesser GV. Supernumerary mandibular bicuspid: Report of a case. *N Y State Dent J.* 1972;38:556-557.
28. Stevenson W, Mc Kechnie AD. Recurring supernumerary teeth: Report of a case. *Oral Surg.* 1975;40:76-80.
29. Shah RM, Pauls V. Supernumerary premolars: Report of two cases. *J Can Dent Assoc.* 1978;44:114-115.
30. Ranta R, Ylipaavalmiemi P. Developmental course of supernumerary premolars in childhood: Report of two cases. *J Dent Child.* 1981;48:385-388.
31. Shapira Y, Haskell BS. Late developing supernumerary premolar. *J Clin Orthod.* 1981;15:571.
32. Becker A, Bimstein E, Shteyer A. Interdisciplinary treatment of multiple unerupted supernumerary teeth: Report of a case. *Am J Orthod.* 1982;81:417-422.
33. Trenouth MJ, Bedi R. Supernumerary primary first molar and first premolar: Clinical report. *Pediatr Dent.* 1983;5:214-216.
34. Kantor ML, Bailey S, Burkes JE. Duplication of the premolar dentition. *Oral Surg Oral Med Oral Pathol.* 1988;66:62-64.
35. Breckon JJW, Jones SP. Late forming supernumeraries in the mandibular premolar region. *Br J Orthod.* 1991;18:329-331.
36. Hattab FN, Yassin OM, Rawashdeh MA. Supernumerary teeth: Report of three cases and review of the literature. *J Dent Child.* 1994;61:382-393.
37. Scanlan PJ, Hodges SJ. Supernumerary premolar teeth in siblings. *Br J Orthod.* 1997;24:297-300.
38. Cochrane SM, Clark JR, Hunt NP. Late developing supernumerary teeth in the mandible. *Br J Orthod.* 1997;24:293-296.
39. Saini T, Keene JJ, Whetten J. Radiographic diagnosis of supernumerary premolars: Case reviews. *J Dent Child.* 2002;69:184-190.
40. Still WHR. A short study of supernumerary teeth in Southern Nigeria. *Br Dent J.* 1945;79:215-217.
41. Parry RR, Iyer VS. Supernumerary teeth amongst orthodontic patients in India. *Br Dent J.* 1961;111:257-258.
42. Grahnen H, Lindhal B. Supernumerary teeth in the permanent dentition: A frequency study. *Odont Revy.* 1961;12:290-294.
43. Gardiner JH. Supernumerary teeth. *Dent Pract Dent Rec.* 1961;12:63-73.
44. Nazif MM, Ruffalo RC, Zullo T. Impacted supernumerary teeth: A survey of 50 cases. *J Am Dent Assoc.* 1983;106:201-204.
45. Shaefer WG, Hine MK, Levy MK. *A Textbook of Oral Pathology.* 4th ed. Philadelphia: WB Saunders Co;1983:47-50.
46. Saarenma L. The origin of supernumerary teeth. *Acta Odontol Scand.* 1951;9:293-303.
47. Wentz FM, Weinmann JP, Shour I. Morphology and incidence of epithelial remnants in the molar region of the rat. *J Dent Res.* 1948;27:753.
48. Kerley MA, Kollar EJ. Supernumerary tooth formation in the mouse molar transplants. *J Dent Res.* 1977;56:1344.
49. Stafne EC. Supernumerary upper central incisors. *Dental Cosmos.* 1931;73:976-980.
50. Mc Kibben DR, Bready LJ. Radiographic determination of the prevalence of selected dental anomalies in children. *J Dent Child.* 1971;28:390-398.
51. Brook AH. A unifying aetiological explanation for anomalies of human tooth number and size. *Arch Oral Biol.* 1984;29:373-378.
52. Mercuri LG, O'Neill R. Multiple impacted and supernumerary teeth in sisters. *Oral Surg Oral Med Oral Pathol.* 1980;50:293.
53. Bruning LJ, Dunlap L, Megerle ME. Report of supernumerary teeth in Houston, Texas school children. *J Dent Child.* 1957;24:98-105.
54. Saito T. A genetic study on the degenerative anomalies of deciduous teeth. *Jpn J Hum Genet.* 1959;4:27-30.
55. Tay F, Pang A, Yuen S. Unerupted maxillary anterior supernumerary teeth: Report of 204 cases. *J Dent Child.* 1984;51:289-294.
56. Millhon JA, Stafne EC. Incidence of supernumerary and congenitally missing lateral incisor teeth in eighty one cases of harelip and cleft palate. *Am J Orthod.* 1941;37:599-604.
57. Ida M, Nakamura T, Utsunomiya J. Osteomatous changes and tooth abnormalities found in the jaw of patients with adenomatous coli. *Oral Surg.* 1981;52:2-11.
58. Jansen BL, Kreiborg S. Development of the dentition in cleidocranial dysplasia. *J Oral Pathol Med.* 1990;19:89-93.
59. Lustmann J, Bodner L. Dentigerous cysts associated with supernumerary teeth. *Int J Oral Maxillofac Surg.* 1988;17:100-102.



60. Sian JS. Root resorption of first permanent molar by a supernumerary premolar. *Dent Update*. 1999;26:210-211.
61. Bodin I, Julin P, Thomsson M. Hyperdontia I. Frequency and distribution of supernumerary teeth among 21,609 patients. *Dentomaxillofac Radiol*. 1978;7:15-17.
62. Yusof WZ. Non syndrome multiple supernumerary teeth: Literature review. *J Can Dent Assoc*. 1990;56:147-149.
63. Silverman NE, Ackerman JL. Oligodontia: A study of its prevalence and variation in 4032 children. *J Dent Child*. 1979;46:470-477.
64. Davis JM, Law DB, Lewis TM. *An Atlas of Pedodontics*. 2nd ed. Philadelphia: WB Saunders Co; 1981:123-133.
65. Braham RL, Morris ME. *Textbook of Pediatric Dentistry*. 2nd ed. Baltimore: Williams & Wilkins; 1985:305-307.
66. Mc Donald RE, Avery DR. *Dentistry for the Child and Adolescent*. 4th ed. St Louis: CV Mosby Co; 1983:149-150.
67. Neal JJ, Bowden DEJ. The diagnostic value of panoramic radiographs in children aged nine to ten years. *Br J Orthod*. 1988;15:193-197.

## ABSTRACT OF THE SCIENTIFIC LITERATURE



### COMPARISON OF MANDIBULAR LOCAL ANESTHETIC TECHNIQUES IN CHILDREN

This article describes a study which tested the hypothesis that using infiltration/intrapapillary injection was less effective as a dental pain control method than inferior alveolar block/long buccal infiltration anesthesia in children. The study sample consisted of 101 5- to 8-year-old healthy children who required a pulpotomy and stainless steel crown placement. A 2-group, randomized, blinded, controlled design was employed using 2% lidocaine, 1:100,000 epinephrine, with all subjects receiving 40% nitrous oxide. The primary outcome assessments were the self-reported level of pain by each subject using the color analogue scale (CAS) and a 3-category dentist measurement scale of effective, partially effective, and ineffective used by the 2 operators/investigators to rate the overall effectiveness of the pain control. Preoperative assessments of each subject's dental fear were determined using the Dental Subscale of the Children's Fear Survey Schedule. A third investigator employing a computer algorithm to randomly assign the type of injection administered equal amounts of local anesthesia to all subjects without the operator being present.

The CAS was employed at 4 stages of treatment: (1) following the injection; (2) rubber dam clamp application; (3) pulpal amputation; and (4) the overall visit. The operators/investigators rated the pain control effectiveness after treatment completion and surmised the type of injection the child had received. *T* tests were used to compare the 2 injection routes and also rate the effects of preoperative dental anxiety in relation to the CAS scores.

The investigators found no significant difference in pain control effectiveness between those subjects receiving infiltration/intrapapillary injections and those receiving inferior alveolar block/long buccal infiltrations. The results were similar for subjects self reporting (CAS) and those for whom dentist/operator ratings were used. The results were also the same for both anxious and less-anxious children.

**Comments:** This study's results were consistent with 2 previous studies, which found no difference in pain control between the 2 routes of anesthesia administration. The use of nitrous oxide, which increases the pain threshold, may have affected the subjects' ability to accurately assess the level of pain experienced, thus altering the CAS scoring and the dentist measurement scales. This resulted in higher scores being recorded by both groups. Those subjects who needed additional local anesthesia to complete treatment (9%) should have been rated as ineffective, rather than reassessment after adequate anesthesia was achieved. This also resulted in higher overall ratings. Since the study was conducted in a private practice, no evidence was cited regarding controlling the environment to ensure constant conditions for all subjects and investigators. In summary, this clinical study further confirmed the equal pain control effectiveness of either route of anesthetic administration, especially when used in conjunction with nitrous oxide. **ET**

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Naidu S, Loughlin P, Coldwell SE, Noonan CJ, Milgrom P. A randomized controlled trial comparing mandibular local anesthesia techniques in children receiving nitrous oxide oxygen sedation. *Anesth Prog*. 2004;51:19-23.

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