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# Unerupted incisors—characteristic features and associated anomalies

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SUMMARY The aims of this study were to investigate the association of unerupted incisors with other dental anomalies and to indicate the aetiological and clinical relevance of such associations. Forty-one patients with unerupted incisors were examined. The group comprised 30 males and 11 females, ranging in age from 7 to 39 years. The patients were assessed for nine dental anomalies: hyperdontia, hypodontia, microdontia, enamel hypoplasia, infraocclusion of the primary molars and ectopia of the canines, premolars, first permanent molars, and second permanent molars. The patients were matched with respect to age and gender to 41 consecutively selected control subjects with similar selection criteria but no history of problems with incisor eruption. The prevalence rates of the dental anomalies in association with failure of eruption of incisors were compared to the reference rates in the control group by means of Pearson chi-square tests.

The results of this study revealed that unerupted incisors were more frequent in males than in females. A statistically significant association ($P = 0.006$) was found between unerupted incisors and other inherited dental anomalies, namely ectopic teeth, hyperdontia, and enamel hypoplasia.

Unerupted incisors may be considered part of a spectrum of inheritable dental anomalies.



## Introduction

Many articles in the dental literature describe the diagnosis and treatment of unerupted anterior teeth. The maxillary central incisor is, after the maxillary canine, the most common labially impacted unerupted tooth. Labial impaction of incisors accounts for 1–2 per cent of patients attending for orthodontic treatment (Crean *et al.*, 2000).

Maxillary incisors are the third most commonly impacted teeth in Caucasians, following the third molars and maxillary canines. They are more prevalent in Mongoloid races, suggesting that both hereditary and environmental factors may be implicated (Davis, 1987).

Heredity plays an important role in the appearance of dental anomalies. Supernumerary teeth are more likely to be present in affected relatives, although inheritance does not follow a simple Mendelian pattern. In 90 per cent of patients with hyperdontia, there exists a definite genetic influence to the incidence of supernumerary teeth (Stafne, 1932).

There also seems to be an association between tooth size and number, as hypodontia and microdontia often occur together and affect females more frequently than males (Baum and Cohen, 1971). Megadontia and supernumerary teeth have also been linked, with males being more commonly affected than females (Davis, 1987).

There is a spectrum of possible associations among various tooth anomalies, namely hypodontia, peg-shaped incisors, infraocclusion of primary molars, ectopic eruption of maxillary first permanent molars, and intraosseous displacement of maxillary canines (Bjerklin *et al.*, 1992; Baccetti, 1998).

Baccetti (1993), in a sample of 169 patients with inherited syndromes with tooth disturbances, found a 76.02 per cent prevalence of associated tooth anomalies. This suggests the possibility of a genetic relationship between the number, size, shape, and structural characteristics of the teeth.

The diagnosis, management, and treatment of unerupted incisors have previously been described (Munns, 1981; Jones and Husain, 1996). There are also papers on the association of various tooth anomalies (Hoffmeister, 1977; Baccetti, 1998), yet very little has been published on the association of unerupted incisors with other dental anomalies (Kobayashi *et al.*, 1999; Chaushu *et al.*, 2003). Therefore, the aim of this study was to investigate the association of unerupted incisors with other dental anomalies.

## Materials and methods

An existing database of patients with unerupted incisors (Betts and Camilleri, 1999) was used as a starting point for data collection. Further contemporary records of patients with unerupted incisors were obtained from the Dental Outpatients Department at St. Luke's Hospital, the School Dental Clinic at Floriana Health Centre and from private dental clinics.

The inclusion criteria for a unilateral unerupted incisor were an unerupted incisor, which was not palpable, and a contralateral incisor, which had been erupted for more than 6 months.

The inclusion criteria for bilateral unerupted incisors were unerupted upper central incisors if the upper lateral incisors had already erupted, unerupted lower central incisors if the lower lateral incisors had already erupted, unerupted upper lateral incisors if the upper first premolars had already erupted, and unerupted lower lateral incisors if the lower canines had already erupted.

Patients excluded from the study were those with a history of dentoalveolar trauma, cleft lip and/or palate, or craniofacial malformations.

The study group comprised 41 patients, 30 males and 11 females, ranging in age from 7 to 39 years. The mean age was 15.8 years with a standard deviation of ±7.7. The patients were matched with respect to age and gender to 41 consecutively selected control subjects with similar selection criteria but no history of problems with incisor eruption. The patients in the control group were those who attended for a dental check-up at the Dental Outpatients Department at St. Luke's Hospital, the School Dental Clinic at Floriana Health Centre and from private dental clinics.

All the patients in the study and control groups attended for a dental examination and were assessed visually by one examiner (AB), using a mouth mirror and under a good operating light. Dental histories and panoramic radiographs were available for all patients.

The number of erupted/unerupted incisors and the presence or absence of inheritable dental anomalies were recorded on a data collection form. The inheritable dental anomalies were further categorized into the following eight types:

1. Infraocclusion: when the distance between the affected teeth and the occlusal plane was more than 1mm.
2. Enamel hypoplasia: when at least one permanent incisor showed an enamel lesion that was not related to dental caries or trauma. This was diagnosed from clinical examination and intraoral photographs.
3. Presence of supernumerary teeth (hyperdontia): diagnosed from existing radiographs and at the clinical examination.
4. Hypodontia and microdontia (including peg-shaped lateral incisors): diagnosed by measurement of the affected teeth and from existing radiographs.
5. Ectopic second premolars: diagnosed at the clinical examination and from existing radiographs.
6. Ectopic eruption of the first permanent molars: when the first permanent molar is initially blocked from complete eruption by the adjacent primary second molar. This was diagnosed at the clinical examination and from existing radiographs.
7. Ectopic eruption of the second molars: when the second molar erupts but becomes trapped under the distal bulge of the first molar. This was diagnosed at the clinical examination and from existing radiographs.
8. Ectopic position of canines: diagnosed at the clinical examination and from existing radiographs.

Sixty-four patients were contacted to attend for a dental examination. Forty-three attended and all gave their consent to participate. Twenty-one patients failed to attend and were excluded from the study. Two patients who did not have panoramic radiographs available were also excluded. Ethical approval was granted by the University of Malta Research Committee.

**Statistical analysis**

The results were processed using the Statistical Package for Social Sciences Version 12.0 for Windows® (SPSS Inc., Chicago, Illinois, USA). Numerical data were summarized. The prevalence rates of dental anomalies in association with failure of eruption of the incisors were compared with the reference prevalence rates in the control group by means of Pearson chi-square tests.

Where the subject was too young to determine whether an anomaly was present, the data were entered as not available and processed as missing values.

**Results**

The data for the study group are given in Table 1. The prevalence of unerupted incisors was higher in males than in females, with a male:female ratio of 2.7:1. Eighty-three per cent of patients had one unerupted incisor and 17 per cent two unerupted incisors.

Ninety-five per cent of patients had an unerupted maxillary central incisor, 2 per cent an unerupted maxillary lateral incisor, and 2 per cent an unerupted mandibular lateral incisor. No patients had unerupted mandibular central incisors.

*Inheritable dental anomalies*

Of the study group of 41 patients with unerupted incisors, 31 (75.6 per cent) had an inheritable dental anomaly. Out of the control group of 41 patients, 1 (2.4 per cent) had an inheritable dental anomaly.

The prevalence of dental anomalies was found to be higher in patients with unerupted incisors and this was highly statistically significant ($P = 0.006$). Pearson correlation analysis also showed that the number of inheritable dental anomalies increased with the number of unerupted incisors ($P < 0.01$).

*Hypodontia and microdontia*

Pearson chi-square test did not show the presence of hypodontia and microdontia to be statistically significant within the study group ($P = 0.078$). Three patients (7.3 per cent) had missing or small teeth in the study group. No patients were affected in the control group.

*Infraocclusion of primary molars*

The presence of infraoccluded primary molars was not statistically significant ($P = 0.314$) in the study group.

*Enamel hypoplasia*

Of the study group of 41 patients with unerupted incisors, five (12.2 per cent) had enamel hypoplasia on one or more of the incisor teeth. In the control group, no patients had enamel hypoplasia.

**Table 1** Data of the patients with unerupted incisors showing the number of teeth affected by each anomaly.

| No. | Age at examination | Gender | Number of teeth | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Unerupted incisors | Missing teeth | Microdontic teeth | Infraoccluded primary molars | Ectopic teeth | Supernumerary teeth | Enamel hypoplasia |
| 1 | 13 | M | 2 | | 2 | | 2 | 1 | 4 |
| 2 | 14 | F | 1 | | | | | 1 | |
| 3 | 20 | M | 1 | | | | | | |
| 4 | 34 | M | 1 | | | | | 1 | |
| 5 | 10 | M | 2 | | | | n/a | 1 | |
| 6 | 11 | F | 1 | | | | 4 | | 2 |
| 7 | 12 | M | 1 | | | | | 1 | |
| 8 | 11 | M | 1 | | | | | 1 | |
| 9 | 18 | F | 1 | | | | 2 | | |
| 10 | 16 | M | 2 | | | | | 3 | |
| 11 | 12 | M | 1 | | | | | 1 | |
| 12 | 22 | M | 1 | | | | | 4 | 1 |
| 13 | 14 | M | 1 | | | | | | |
| 14 | 12 | M | 1 | | | 2 | 2 | | |
| 15 | 33 | F | 1 | | | | | | |
| 16 | 8 | M | 1 | | | | n/a | | |
| 17 | 15 | M | 2 | 1 | | | | 1 | |
| 18 | 10 | M | 1 | | | | n/a | | |
| 19 | 21 | F | 1 | | | | | 1 | |
| 20 | 11 | M | 1 | | | | 1 | 1 | |
| 21 | 13 | M | 1 | | | | | 1 | |
| 22 | 22 | F | 1 | | | | | | |
| 23 | 16 | M | 1 | | | | 1 | 1 | |
| 24 | 16 | M | 2 | | | | | 1 | |
| 25 | 21 | M | 1 | | | | | | |
| 26 | 21 | F | 1 | | | | | | |
| 27 | 40 | M | 2 | | | | | | |
| 28 | 26 | M | 1 | | | | | | 2 |
| 29 | 13 | M | 1 | | | | | | |
| 30 | 32 | F | 1 | | | | | 2 | |
| 31 | 10 | F | 1 | | | | n/a | 1 | |
| 32 | 10 | M | 1 | | | | n/a | 1 | |
| 33 | 24 | M | 1 | | | | | 2 | |
| 34 | 16 | M | 1 | | | | | 1 | |
| 35 | 12 | F | 1 | | | | | 1 | 2 |
| 36 | 12 | M | 2 | | | | | 1 | |
| 37 | 12 | M | 1 | | | | | 2 | |
| 38 | 25 | M | 1 | | | | | | |
| 39 | 13 | M | 1 | | | | 1 | | |
| 40 | 9 | F | 1 | | | | n/a | 1 | |
| 41 | 11 | M | 1 | 1 | | | | 1 | |

n/a, data not available.

The prevalence of enamel hypoplasia was found to be higher in patients with unerupted incisors and this was statistically significant ($P = 0.021$). The number of teeth with enamel hypoplasia increased with the number of unerupted incisors ($P < 0.01$).

*Ectopic teeth*

The ectopic teeth under investigation in this analysis were the canines and premolars. In the study group, seven patients (20.0 per cent) had ectopic teeth. While in the control group, one patient (2.9 per cent) had an ectopic tooth.

The prevalence of ectopic teeth was higher in patients with unerupted incisors and this was statistically significant ($P = 0.024$). Pearson correlation analysis showed that there was no statistically significant correlation between the number of ectopic teeth and the number of unerupted incisors ($P > 0.05$).

*Hyperdontia*

Twenty-six patients (63.4 per cent) in the study group had hyperdontia, with one exhibiting both hypodontia and hyperdontia. In the control group, no patients had supernumerary teeth.

The prevalence of hyperdontia was found to be higher in patients with unerupted incisors and this was highly statistically significant ($P < 0.001$). The number of supernumerary teeth increased with the number of unerupted

incisors and this correlation was statistically significant ($P < 0.01$). The prevalence of supernumerary teeth was higher in males than in females, with a male:female ratio of 2.7:1. The difference in gender distribution between the two groups was statistically significant ($P = 0.019$).

*Comparison of inheritable dental anomalies between subgroups with and without supernumerary teeth*

The data were analysed, using Pearson chi-square tests, in order to compare the prevalence of other inheritable dental anomalies between patients with and without supernumerary teeth.

The study group was divided into two subgroups:

1. Patients with unerupted incisors and supernumerary teeth;
2. Patients with unerupted incisors but no supernumerary teeth.

Twenty-six patients (63.4 per cent) in the study group had supernumerary teeth, while 15 (36.6 per cent) had no supernumerary teeth. These subgroups were compared with each other and with the control group. When supernumerary teeth were excluded, there was no significant difference in the number of other dental anomalies between the two groups. Both subgroups were also found to have a significantly higher prevalence of other inheritable dental anomalies when compared with the control group.

*Comparison of the gender distribution of patients with unerupted incisors, with and without supernumerary teeth*

In patients with unerupted incisors and supernumerary teeth, there was a significant gender bias towards males [19 males and 7 females ($P = 0.019$)]. In patients with unerupted incisors without supernumerary teeth, there was no significant difference between males and females.

## Discussion

This investigation has shown that unerupted incisors occur together with other inheritable tooth abnormalities. There is evidence of a significant association between unerupted incisors and enamel hypoplasia, hyperdontia, and other ectopic teeth. This is in concordance with other studies where significant reciprocal associations were found among five anomalies (aplasia of second premolars, peg-shaped lateral incisors, infraocclusion of primary molars, enamel hypoplasia, and ectopic eruption of the maxillary canines; Hoffmeister, 1977; Baccetti, 1998).

A dental disturbance that appears to be significantly associated with unerupted incisors is enamel hypoplasia. In this study, enamel hypoplasia was found in 12.2 per cent of the dentitions of the study group. This correlates well with the theories proposed by Baccetti (1998), who showed that generalized enamel hypoplasia is part of an inheritable developmental disturbance due to a general disturbance of tooth development structures.

A significant association has also been found between unerupted incisors and ectopic teeth. Ectopic teeth form part of a spectrum of inheritable dental anomalies (Bjerklin *et al.*, 1992; Peck *et al.*, 1994; Baccetti, 1998). In this study, no correlation was found between the number of ectopic teeth and the number of unerupted incisors nor was an association found between unerupted incisors and ectopic canines or ectopic premolars. However, it is reasonable to suppose that as the eruption process is common to all teeth, ectopic teeth have a common genetic origin. As the expression of inheritable dental anomalies is highly variable, eruption defects may present with different phenotypes for the same genotype (Townsend *et al.*, 2005).

Anomalous lateral incisors and hypodontia are often associated with ectopic canines (Becker *et al.*, 1981). In this study, hypodontia and microdontia were analysed together. However, there seems to be no significant association between hypodontia, microdontia, and unerupted incisors. Infraoccluded primary molars also form part of the spectrum of inherited dental anomalies. No association was found between unerupted incisors and submerged primary molars. However, 43.9 per cent of the patients in this study were over 15 years of age. Therefore, it is expected that most of the patients would have already lost any submerged primary molars and so this finding is not reliable.

Supernumerary teeth were found more commonly in males, with an overall male:female ratio of 2.7:1. Seventy-three per cent of the supernumerary tooth subgroup was, in fact, male. This is in agreement with the findings of Brook (1974).

The prevalence of hyperdontia in patients with unerupted incisors was 63 per cent. This is not a surprising finding as supernumerary teeth have been associated with unerupted teeth (Howard, 1967). There was also an association between the number of supernumerary teeth and the number of unerupted incisors. This occurred irrespective of whether the supernumeraries were adjacent to the unerupted teeth or not. The fact that 36 per cent of the group had no supernumeraries would imply that supernumerary teeth are not the primary cause of unerupted incisors. Delayed eruption of incisors occurs in a relatively small proportion of supernumerary cases (Nik-Hussein, 1990). The findings of the present study revealed a higher prevalence of unerupted incisors in males than in females. Analysis of gender in the subgroup without supernumerary teeth showed no significant difference between the genders, while that of the subgroup with supernumerary teeth was significant. It is possible that the supernumerary trait, more common in males, carries a greater tendency to failure of eruption. Supernumerary teeth are more prevalent in males (Davis, 1987) and missing teeth are more prevalent in females (Baum and Cohen, 1971). This raises the possibility of gender influencing expression of the gene or genes determining

the number of teeth, though each is not mutually exclusive. However, both traits seem to be associated with an increased prevalence of other inheritable dental anomalies.

When supernumerary teeth were excluded from the analysis of the main group, unerupted incisors were still found to be significantly associated with inheritable dental anomalies. Furthermore, the percentage of anomalies (excluding supernumerary teeth) in the supernumerary subgroup was similar to that in the non-supernumerary subgroup and both groups had a significantly higher prevalence than the controls. Thus, both unerupted incisors and supernumerary teeth seem to be associated with the presence of other inheritable dental anomalies. This is in contrast to an earlier study where no association between supernumerary teeth and other inherited dental anomalies was found (Baccetti, 1998).

Unerupted incisors are relatively uncommon. The small size of the groups resulted in reduced power and was a major limitation of the study. This lack of power may lead to major incorrect rejection of the null hypothesis (Type II error) and may well explain the lack of association with some anomalies. The existing records of patients with unerupted incisors are continually being updated, with a view to repeating the study with a larger sample size. This would give more robust evidence regarding any anomalies associated with unerupted incisors. Further research would also investigate the incidence of dental anomalies in family members of probands with unerupted incisors, to further explore the genetic basis of inheritable dental anomalies.

## Conclusions

The results of this study show that males present with more unerupted incisors than females, with a prevalence of 2.7:1.

Unerupted incisors occur together with other inheritable tooth abnormalities. There is evidence of a significant association between unerupted incisors and enamel hypoplasia, hyperdontia, and ectopic teeth.

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