

A retrospective evaluation of the eruption of impacted permanent incisors after extraction of supernumerary teeth

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Aims. Delayed eruption of teeth may be caused by the presence of one or more supernumerary teeth. The purpose of this study was to evaluate findings, predisposing factors and differentiate different techniques used that affect the outcome following removal of supernumerary teeth. A comprehensive literature review was also undertaken.

Methods. A longitudinal retrospective study was carried out at the Royal Liverpool Children's Hospital. A total of 120 patients were identified from the general anaesthesia records that had supernumeraries extracted. Only 43 cases had delayed eruption of teeth caused by supernumeraries. The pre and post extraction record data collected were the gender, radiographic assessment, position of the supernumerary, age at time of referral and extraction of the supernumerary, age at time of eruption of the impacted tooth and the orthodontic and surgical management.

Results. The mean age of referral was 9.1 years with a male to female ratio of 4.4:1. There was a greater predilection for supernumeraries to be on the left side and be positioned palatally. Tuberculate type supernumeraries were the most frequent followed by the conical type. Spontaneous eruption of the impacted tooth occurred in 49% of cases. Eruption of the impacted tooth within eighteen months following removal of the supernumerary was observed in 91% of cases. The chronological age and space availability were the two factors that were critical in determining if eruption was spontaneous following removal of the supernumerary.

Conclusions. The findings of this study reiterates the fact that given early referral, sufficient space and time, the majority of teeth prevented from erupting by a supernumerary tooth would erupt spontaneously following removal of the supernumerary alone. Randomized multi-centre prospective studies are suggested.

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INTRODUCTION:

Dental practitioners are often confronted with marked delay in eruption of permanent maxillary incisors.¹ The lack of eruption could be due to a number of causes,² however the most common cause cited for delayed eruption is the presence of a supernumerary tooth in the pre-maxillary region.³⁻⁵ This

often poses unique diagnostic and managerial concerns for the dental practitioner.

The prevalence of supernumeraries is reported to be between 0.3-0.8% in the primary and 1.5-3.5% in the permanent dentition, of which 90-98% occurs in the maxilla with a particular predilection for the premaxilla.⁶⁻⁸ Though there is no significant sex distribution in primary teeth, males are affected approximately twice as frequently as females in the permanent dentition. A sex ratio as high as 5.4:1 favoring males, have been reported.⁹ Only about 25% of the maxillary anterior supernumeraries erupt into the mouth.¹⁰ The inheritance of supernumeraries does not follow a simple Mendelian pattern, but case reports suggest a familial tendency.¹¹ The most common syndromes associated with supernumerary teeth are cleft lip and palate, Cleidocranial Dysostosis and Gardner's syndrome. Less common developmental disorders associated with supernumerary teeth are Fabry Andersons syndrome, Ellis-Van Creveld syndrome, Ehler Danlos syndrome, Incontinentia pigmenti and Tri-Rhino-Phalangeal syndrome.¹²

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Factors believed to cause supernumerary teeth include: atavism, a throwback to the simian dentition, hypergenesis of the epithelial cord, heredity and developmental defects like cleft or multifactorial inheritance.^{8,13,14} Most literature supports the dental lamina hyperactivity theory.¹⁵⁻¹⁷

There are many classifications of supernumerary teeth.¹⁸⁻²¹ Morphologically the types of supernumeraries that occur include: supplemental (incisiform), rudimentary (conical, tuberculate, molariform) or odontomas. Though some authors believe that the tuberculate type is more commonly associated with delayed tooth eruption while the conical type is associated more with displacement, others have found no such correlation.^{5,8,18,22} Odontomas may prevent the eruption of teeth in a third of compound odontoma cases and half of the complex odontoma cases. Early removal of odontomas and histopathological examination to rule out the neoplastic elements is recommended.²³

Supernumerary teeth may erupt, remain impacted or appear inverted, and may assume an ectopic position or an abnormal eruptive path.²⁴⁻²⁶ They can precipitate problems like crowding, displacements, delayed eruption, diastemas, rotations, cystic lesions and resorption of adjacent teeth. Supernumerary teeth may occur singularly, multiplarily and unilaterally or bilaterally.²⁷⁻³⁰ Maxillary midline supernumeraries are the most common, followed by maxillary laterals, mandibular third premolars, mandibular fourth molars and maxillary premolars.³¹⁻³⁴

Detection of supernumerary teeth is achieved with a thorough clinical examination and routine radiological examination. The radiographic examination is important in deciding when to intervene, especially when removal of supernumerary teeth or odontomas is required.³⁵⁻³⁸ Localization can be done with either the horizontal shift or vertical shift techniques. An occlusal radiograph and lateral or posterior-anterior cephalogram are helpful when the supernumerary is significantly high or deep relative to adjacent erupted teeth.²² Approach to the management of the delayed eruption of a tooth due to a supernumerary can be any one of the following three:³

- a. No exposure-conservative management by removal of the supernumerary only.
- b. Closed exposure-removal of the supernumerary tooth together with the bone overlying the unerupted tooth with or without placement of a bonded attachment for orthodontic traction and replacement of the flap.
- c. Open exposure-removal of the supernumerary and exposure of the unerupted tooth in all cases, with or without placement of a bonded attachment for orthodontic traction.

In many centers the treatment protocol is to extract the supernumerary tooth and maintain adequate space to allow for spontaneous eruption.^{3,37-40} In other centers, a surgical exposure and bonding of a bracket and chain at the same visit is the preferred method.^{8,22,41} Though this approach is fail safe with no further surgical procedure required, the disadvantage is that it may result in poor attached gingival margin as well as a discrepancy in the gingival levels between the exposed tooth and its neighbors.³⁹ The dental practitioner is therefore torn between these opposing viewpoints with no clear guidelines supporting the most appropriate approach for each patient. Taking into consideration this dilemma, this present retrospective study was designed.

MATERIALS AND METHODS

A retrospective study was carried out at the Royal Liverpool Children's Hospital. The records of all patients who had surgical extraction of supernumerary teeth under general anesthetic between 1997-2000 were scanned. All syndromic patients or those with systemic reasons for delayed tooth eruption were excluded (e.g. cleidocranial dysostosis, oral-facial-digital syndrome, gardeners syndrome, cleft lip/palate, etc). The personal details of the patients, the number, type, location (assessed by vertical or horizontal parallax technique) of the supernumeraries were recorded. The data were transferred to MS Excel for descriptive analysis. The present retrospective study attempts to evaluate:

1. Sex predilection, number, type and location of supernumerary causing delay in tooth eruption.
2. Predisposing factors for orthodontic intervention.
3. Eruption potential with respect to the three different surgical interventions.

Spontaneous eruption was defined as eruption of the impacted tooth with no orthodontic traction required for eruption. Non-spontaneous eruption group required orthodontic traction or space management.

RESULTS:

Study sample

Of the 120 records, 49 cases fulfilled the selection criteria but six patients were excluded due to incomplete records and follow up. The final study comprised of 43 patients (35 males and 8 females), with a male to female ratio of 4.4:1. The mean age of referral was 9.1 years, with an age range of 4.4-14 years (Fig 1).

The supernumerary

A total number of 56 supernumeraries were extracted in the 43 patients. The number of patients with one supernumerary was 32 (74%), with two were 9 (21%) and three were 2 (5%). A single unerupted

tooth was the most common presentation with 35 patients (81%), while 8 (19%) had delayed eruption of two teeth. The type, side and position predilection of the supernumeraries are described below;

a. Type of supernumerary

The tuberculate type was the most common (n=23, 53%), followed by the conical (n=15, 35%), and the odontoma (n=5, 12%) types. In the conical type group, 7% of the supernumeraries were inverted.

b. Anterior- Posterior position of the supernumerary

There was a tendency for the supernumerary to be positioned more palatally (n= 31, 72%) with the remaining (n=10, 23%) and (n=2, 5%) in the buccal and the transalveolar positions respectively. No trend was detected between the type of supernumerary and their positions (Fig 2).

c. Side predilection

The distribution of the supernumeraries was 20 patients (47%) on the left side, 11 patients (25%) on the right and 12 (28%) in the midline. There was a

greater predilection for the supernumeraries to be positioned on the left side. The conical type of supernumeraries was mostly in the midline, whereas the tuberculate type had no side preference (Fig 3).

Time taken for tooth to erupt

The number of impacted teeth that erupted within one year of extraction of the supernumerary were 74%, 17% between 1-1 1/2 years and 9% more than 1 1/2 years. All of the patients who had spontaneous eruption of the impacted tooth, erupted within eighteen months. Non-spontaneous eruption was influenced by various factors, which included space availability and varied responses to orthodontic traction (Table 1).

TABLE 1. Shows times taken for the tooth to erupt and eruption potential

	0-6 months	7-12 months	13-18 months	over 19 months
Spontaneous eruption	12	6	3	0
Not Spontaneous eruption	5	9	4	4

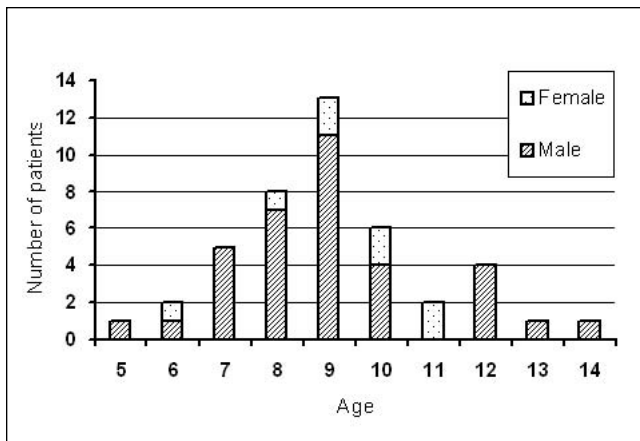


Figure 1. Age distribution of the patients at the time of referral

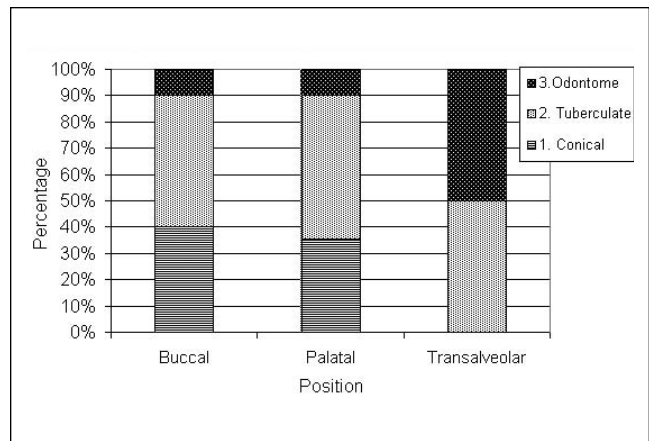


Figure 2. Shows the distribution of the type and position of the supernumeraries

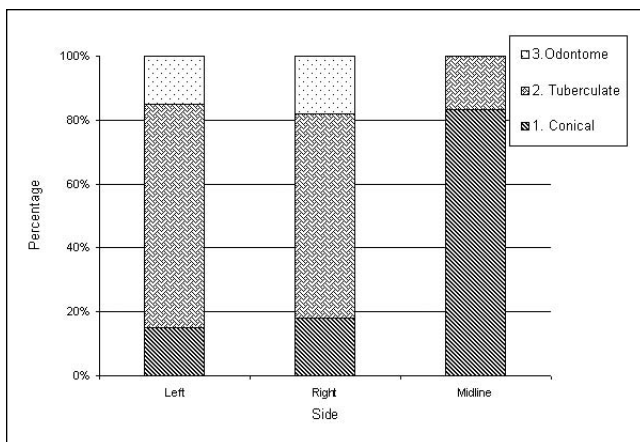


Figure 3. Shows the type of supernumerary and side predilection

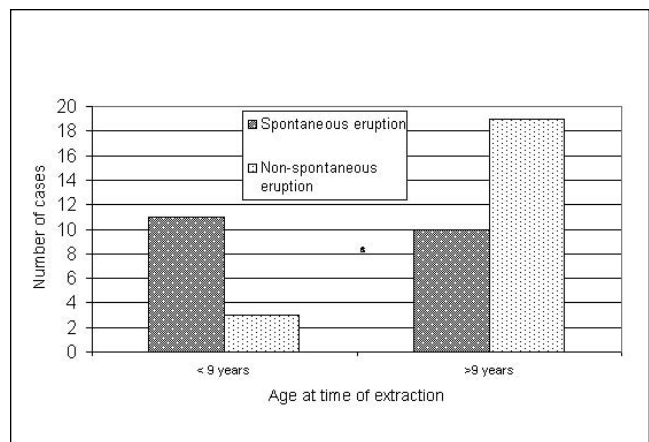


Figure 4. Shows the chronological age and eruption potential

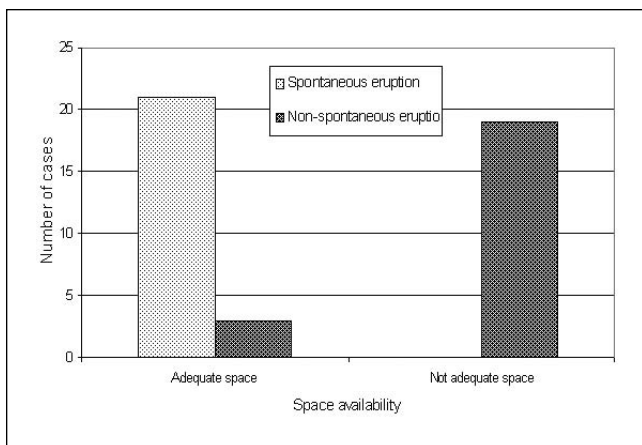


Figure 5. Shows space availability and eruption potential

2. Time of extraction and eruption potential

The mean age at time of extraction of the supernumerary was 9.7 years with an age range 4.6-15.8 years. In the spontaneous eruption group, the mean age at the time of extraction was 8.9 years, whereas in the non-spontaneous group, the mean age was 10.5 years. Figure 4 shows that unerupted permanent teeth were more likely to erupt spontaneously if the supernumerary teeth were extracted before the age of 9 years (P = 0.007) with an odds ratio of 7.0 (95% CI = 1.57 – 30.87).

Space and eruption potential

All the patients that had spontaneous eruption of the unerupted tooth had adequate space (Fig. 5). Of the 22 cases in which there was no spontaneous eruption, only 3 patients had adequate space. Of the remaining 19 cases, the permanent teeth in 4 patients erupted spontaneously once space was created orthodontically. The other 15 patients required a combination of orthodontic space management and traction.

Surgical technique

Forty-two percent of the patients had closed exposure with attachment of a gold bracket/chain. Fifty-one percent had extraction of the supernumerary tooth only (no exposure), whereas the remaining 7% had the supernumerary removed with an open exposure technique. Figure 6 shows a high percentage of the permanent teeth erupted within 12 months for the closed (78%) and no (77%) exposure groups. The number of cases in the open exposure group was too few to be compared. The association between the eruption potential and the type of supernumerary teeth for each of the surgical techniques are summarized Table 2.

Cases that required re-exposure

Three patients needed a second surgical procedure under general anaesthesia. There was no trend between the need of second procedure and the previous surgical

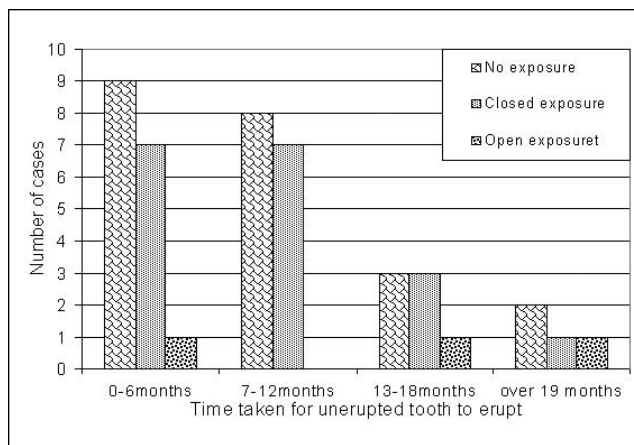


Figure 6. Shows time taken for the tooth to erupt with the different surgical methods

Table 2: Shows the eruption potential for each of the surgical techniques and the type of supernumerary tooth associated

No Exposure Cases (Total cases = 22)		
Type of Supernumerary	Spontaneous Eruption	Non-spontaneous eruption
Tuberculate	8	6
Conical	4	2
Odontome	2	0
	14	8

Closed Exposure Cases (Total cases = 18)		
Type of Supernumerary	Spontaneous Eruption	Non-spontaneous eruption
Tuberculate	3	5
Conical	1	6
Odontome	1	2
	5	13

Open Exposure Cases (Total cases = 3)		
Type of Supernumerary	Spontaneous Eruption	Non-spontaneous eruption
Tuberculate	1	0
Conical	1	1
Odontome	0	0
	2	1

technique. All of these cases had inadequate space and two had conical type of supernumerary. One patient who had a tuberculate type of supernumerary had to have the unerupted tooth extracted because of ankylosis.

DISCUSSION:

The study comprised of 120 patients where extraction of supernumerary teeth was performed. The number of

patients in other studies^{4,5,7,8,9,18,19,24,25,45} on supernumeraries varied from 50-204. Only two studies^{9,18} in the literature had a larger study sample. A total of 49 of the 120 cases presented with delayed eruption of teeth, thus the percentage of cases associated with delayed tooth eruption was 40.8%. This is comparable with other studies (Tay et al⁹ 26%, DiBiase¹⁸ 42%, Howard⁴ 60%, Billberg and Lind⁴² 36%, Day²⁴ 39%, Greg and Kinirons⁵ 54% Nazif⁷ 30%, Foster and Taylor¹⁹ 55%, Zilberman⁴⁵ 52% and Gardiner²⁴ 28%). The male to female ratio for the presence of a supernumerary was 2:1 and the ratio for occurrence of delayed tooth eruption was 4.4:1. The male to female ratio reported by most authors for occurrence of delayed tooth eruption were lower except Tay et al⁹ 5.4:1 (Di Biase¹⁸ 2:1; Foster and Taylor¹⁹ 3:2; Zilberman et al⁴⁵ 2.5:1 and Greg and Kinirons⁵ 2:1). This reflects the general pre-dominant male predilection to have supernumeraries associated with unerupted teeth.

The average number of supernumerary teeth per person was 1.3, which is similar to other findings.^{5,7,9,18,19,25} There was also agreement with the number of patients presenting with one supernumerary (74%), with two (21%) and more than two (5%) in comparison to findings of other authors. Zilberman et al⁴⁵ found that in his sample of patients, 74% had one supernumerary, 23% had two and 3% had more than two supernumeraries. However Tay⁹ reported that 66% of his cases had one supernumerary and 34% had two supernumeraries causing delayed eruption of teeth. Howard⁴ and Di Biase¹⁸ stated that if more than one supernumerary is causing the impaction of the incisors, the chance of spontaneous eruption of the incisor is enhanced, however no such correlation was found in the present study.

Tuberculate supernumeraries were the most frequent type found to be associated with unerupted teeth followed by the conical type. In our study, 53% were tuberculate, 35% conical and 12% odontomas. This was very similar to findings by Mitchell³ and Mason et al.⁸ On the other hand, findings by Koch,⁴³ Zilberman⁴⁵ and Patchett et al²² do not correlate with this as more conical type supernumeraries were found to be associated with unerupted teeth; 56%, 61% and 50% respectively. These findings could be due to error in interpretation of radiographs. The same supernumerary tooth can appear conical in an occlusal view and yet be a tuberculate tooth in a periapical view. It is therefore recommended that for reliable classification of the type of supernumerary, direct inspection of the extracted supernumerary is necessary. The type of supernumerary did not appear to be a determining factor whether eruption was spontaneous or not spontaneous.

The position of the supernumerary teeth on one of the sides was 72% (47% on the left, 25% on the right) and 28% in the midline. This follows the general norm that supernumerary teeth are associated with one of the central incisors in 74% of the cases whilst only

15.3% are true mesiodens.⁹ In our sample there was a greater predilection for the supernumerary to be on the left side. The position of the supernumerary therefore did not influence the eruption potential of the impacted tooth. According to Di Biase¹⁸ and Greg and Kinirons⁵ vertically oriented supernumeraries and those in the central incisor position were frequently associated with delay while the inverted types and those between the centrals were less frequently associated with delay.

In this study, spontaneous eruption occurred in 49% of cases with 91% of impacted teeth erupting within eighteen months. Literature indicates that majority of the teeth impeded by a supernumerary erupt within 3 years once the supernumerary is removed from their path of eruption.^{4,6,26,35,36} Burke,³⁶ Ravn,⁶ Howard⁴ and Witsenburg and Boering⁴⁴ have reported 39%, 19.7%, 76% and 54% spontaneous eruption of the impacted after removal of the supernumeraries. Bodenham³⁵ found 79% spontaneous eruption rate in 20 months while Munns²⁶ noted that in all cases spontaneous eruption occurred within 3 years if partial exposure was done. Mason et al⁸ found that all incisors exposed with or without bonding at the initial operation erupted without further intervention.

The optimal timing of surgical removal of unerupted anterior supernumerary teeth is often conjectural. An atraumatic careful surgical procedure is important to prevent any damage to the developing roots, which could result in dilacerations and further impede eruption. The delayed approach recommends intervention upon apical maturation of the incisors at around 8-10 years.^{3,7,20} However it is argued by some authors that early intervention is preferable to take advantage of the spontaneous eruption potential of the permanent incisors and to prevent anterior space loss and midline deviation⁴⁹. In our study, the spontaneous eruption of teeth occurred predominantly in an earlier age (mean age 9.7 years), two years earlier than the non spontaneous group (mean age 11.7 years). (Fig. 6)

Three patients required a re-exposure who had undergone extraction of the supernumerary with no exposure, closed exposure and open exposure techniques respectively. Therefore, in this study, the surgical technique used did not seem to influence whether the patients required a second general anesthesia. All these cases were associated with inadequate space. The patient who was managed with no exposure underwent a second general anesthesia had to have the unerupted tooth extracted because of poor prognosis (ankylosis). This tooth was associated with a tuberculate type supernumerary. The patient who had a closed exposure required a re-bond of gold bracket and chain (Table 5). Theoretically, the following factors have been reported as responsible for the failure of eruption of permanent upper incisors after removal of obstructive supernumerary teeth⁴⁴:

1. Lack of eruptive potential related to the amount of root formation of the impacted tooth when the supernumerary was removed; to a certain extent this feature is related to the age of the patient at that time.
2. Insufficient space.
3. Scar formation or removal of a part of the gubernaculum following a traumatic surgery to remove the supernumerary.
4. Marked displacement of the apex of the impacted tooth, as suggested by Howard.⁴

Mason et al⁸ observed that more immature teeth (Cvek group 1, 2 and 3) erupted spontaneously after removal of the supernumerary compared to mature teeth (Cvek group 4 and 5). Only more superficial teeth can be treated by exposure without bonding and these are likely to be more mature teeth in terms of root development with less distance to travel than those more deeply placed and immature. Although the status of root development was not considered in the present study, the chronological age did relate with the spontaneous eruption of the impacted tooth.

The amount of space available is critical. Spontaneous eruption occurred in all cases that had adequate space. Non-spontaneous eruption occurred in 86% of cases with inadequate space. In the 19 cases that had inadequate space, orthodontic space management/traction was required. In four cases, spontaneous eruption occurred once adequate space was created. It is important that space is maintained and in case the space has been lost efforts need to be made to regain the space.

It is impossible to evaluate the effects scarring caused by the surgical technique used to expose the tooth. The drawback associated with bonding a gold bracket or chain in the first instance is that supporting bone needs to be removed to expose the unerupted tooth sufficiently for an attachment to be placed.⁴⁹ This may result in poor gingival margin and discrepancy of the gingival level between the exposed tooth and its neighbor on eruption. In addition, the cases in which orthodontic traction were applied; it is impossible to evaluate the effect of scarring on the eruptive potential. It could however be argued that placing a gold bracket and chain will reduce the risk of a young child having to have a second general anesthetic procedure therefore increasing morbidity.

The study has lacunae in terms that no assessment of the stage of root development, degree of crowding or initial displacement of the permanent incisors was measured. An accurate assessment of these factors would be valuable but this was not possible as this was a retrospective study and relied on documented findings.

CONCLUSIONS

It is important for the dentist to be aware of the causes of unerupted teeth and consider the proper timing for referral and surgical intervention. A good prognosis depends on a multidisciplinary team approach for diagnosis and treatment planning by the paediatric dentist, surgeon and an orthodontist working in tandem. The study reiterates the fact that given sufficient space and time (1-1 1/2 years), the majority of the teeth prevented from erupting by a supernumerary tooth would erupt spontaneously following removal of the supernumerary alone. Such an approach may also prevent the development of mal alignment.

In cases where spontaneous eruption fails to occur, it is important to recognize the cause. The factors which were responsible for non spontaneous eruption are the space availability and chronological age. There is a need for a multicentre randomized prospective study to help obtain definitive pre-operative markers to assist, which cases would eventually require orthodontic bonding taking into consideration the stage of root development, degree of crowding or initial displacement of the permanent incisors.

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Why do women stop breastfeeding? Findings from the Pregnancy Risk Assessment and Monitoring system

Indu B. Ahluwalia et al. *Pediatrics*. 116,1408-1412, 2005

There is no doubt that breastfeeding is beneficial for the infants as well as the parents. It makes children healthier physically and emotionally and reduces or eliminates the cost of formula and formula related gadgets.

The authors found that 32% never breastfed their babies, 4% stopped at week 1, and 13% stopped the first month. Only half continued for over 4 weeks and of those, 31% stopped between the second and the 6 months postpartum.

53% of the black women did not initiate breastfeeding, followed by 30% of white women. Older mothers tended to start and breastfed longer than women younger than 25 years.

Others less likely to not breastfeed their babies included, not married mothers, with less than high school education, who smoked and delivered low birth weight infants.

The major reasons cited by mothers to not initiate breastfeeding included, individual reasons, household responsibilities, using medications, smoked.

The major reasons cited by mothers for stopping breastfeeding included sore, cracked or bleeding nipples, their perception of not producing enough milk and babies having difficulties to eat.