A premaxilla with a supernumerary tooth indicating a developmental region with a variety of dental abnormalities: a report of nine cases

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Hansen L, Kjær I. A premaxilla with a supernumerary tooth indicating a developmental region with a variety of dental abnormalities: a report of nine cases. Acta Odontol 2004;62:30–36. Oslo. ISSN 0001-6357.

The aim of this study was to elucidate whether a premaxilla with a supernumerary tooth has additional dental abnormalities. The study does not include premaxillas with a mesiodens, only premaxillas with parasagittally located supernumerary teeth. Radiographs from eight children, followed from 1 year and 5 months to 11 years and 5 months in the municipal dental health service in Denmark, were analyzed. One patient was seen only once. Dental abnormalities recorded included: invaginations on permanent incisors, resorption of roots of incisors, curved roots of incisors, delayed eruption, and delayed formation of roots. The study shows that there are dental abnormalities within the premaxillary region where the supernumerary tooth is located. This indicates that, apart from the supernumerary tooth, a more widespread deviation from normal conditions including tooth malformation, arrested eruption, and root resorption occur within the premaxillary region. The most important outcome of this study is that in the region with a supernumerary tooth the adjacent incisor shows delayed eruption after surgical removal of the supernumerary tooth. The deviations in root morphology, including root resorption, are not limited to patients who have had orthodontic treatment, but patients who did not receive orthodontic treatment also revealed deviations in root morphology. Therefore the treatment outcome can be different from the expected outcome. □ *Development; dentition; eruption; resorption*

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The incidence of supernumerary teeth ranges from 0.1% to 3.8% (1–21). Studies have been primarily of Caucasian populations. Statistical surveys on supernumerary teeth have not included records of associated dental abnormalities. Populations such as the Chinese, Japanese, and Mongolians have higher incidences (>3% to 6.6%) and a sex ratio as high as 6.5:1 in favor of males (1, 8, 19, 22).

Traditionally, mesiodens has been characterized as a supernumerary tooth located in the maxillary midline (23). In a study on children from Jordan with supernumerary teeth, 89.6% of these were related to the premaxilla, and of these 25% were located in the midline (12). The sex ratio is around 2:1 in favor of males (1, 6, 7, 12, 15, 19, 20, 24). Most of the supernumerary teeth are located palatally to the incisors (6, 7, 11, 25). Patients with cleft lip and palate may have a prevalence of supernumerary teeth in the premaxilla as high as 10–70% (7, 11, 13, 26, 27), depending on the type of cleft and population.

Explanations put forward concerning the etiology of supernumerary teeth (7, 9, 10, 12, 16, 17, 21, 23, 25, 28) include the proposition that the supernumerary tooth is part of a third dentition or that it is a separate offshoot of the dental lamina. Both explanations require hyperactivity of the dental lamina. Others suggest the etiology to be associated with genetic and environmental factors (4, 12, 19, 23). It has also been suggested that the area with the supernumerary teeth is an incomplete manifestation of a cleft (16). Few studies distinguish between different locations of the supernumerary teeth in the premaxilla (1, 7, 9, 11, 12).

In this study we distinguish between two kinds of supernumerary teeth in the premaxilla; the mesiodens, which is located in close connection with the intrapremaxillary suture and the supernumerary tooth, which is located parasagittally in the ossified tissue of the premaxilla. In some reports the cases with supernumerary teeth are grouped according to incisal/apical orientation and to shape of the supernumerary tooth (1, 14–17, 25, 29).

It is a well-known fact that the premaxilla develops from the frontonasal neural crest cells, while the maxilla develops from the maxillary neural crest cells (30). When a supernumerary tooth is located parasagittally in the ossified premaxilla, it is likely that there are also other abnormalities in the premaxilla. The different origins of the maxillary regions are visualized by different nerve branches innervating the different jaw segments (Fig. 1). It has been documented that a deviation in the dentition can occur isolated in one segment and that it can be either congenital or acquired (31–33).

The aim of this study was to elucidate whether a premaxilla with a supernumerary tooth has additional dental abnormalities. The study does not include premaxillas with a mesiodens, but only premaxillas with parasagittally located supernumerary teeth.

Materials and methods

Materials from nine children without cleft lip and palate

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DOI 10.1080/00016350310008634

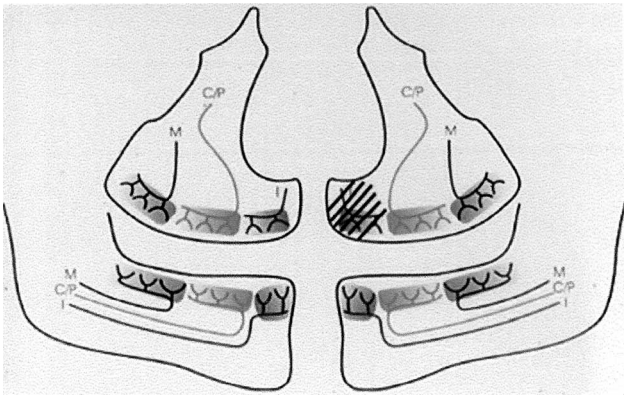

Fig. 1. Innervation in the jaw segments; the crossed area marks the premaxillary region originating from the frontonasal neural crest cells, while the rest of the maxillary region originates from the maxillary neural crest cells.

were gathered through a written invitation in a Danish journal for dentists primarily working in public clinics for children and adolescents. Here the dentists were invited to send in material from patients with supernumerary teeth in the premaxilla, but not including mesiodens. The participating dentists forwarded patient histories and radiographs.

In this study, we distinguished between material available from the first visit and material available from subsequent visits.

Dental films from the area with the supernumerary tooth existed in all nine children from the first visit. In most cases there was only one dental film from this first visit. In the following years (except one patient) several dental films were available from the region, including orthopantomograms from seven children. The 8 children were followed for a longer period of time, i.e. from 1 year and 5 months to 11 years and 5 months.

On all radiographs, dental abnormalities besides the supernumerary teeth were recorded. The adjacent tooth indicates the incisor located right next to the supernumerary tooth. The dental abnormalities considered were: late dental maturation, deviant root morphology including resorption, abnormal crown morphology, and arrested eruption. Both primary and permanent dentitions were considered.

Results

First visit

The premaxillary region. All the material forwarded presented one or two supernumerary teeth in the premaxilla. The supernumerary teeth were located palatal to the central incisors or palatal to the lateral incisors (Fig. 2A–C). Seven patients had one supernumerary tooth, and two had two supernumerary teeth. The age at the first visit ranged from 6 years and 6 months to 8 years and 9 months. The age of the 9th patient was 14 years and 3 months.

Eruption. On patients one to eight the supernumerary teeth had prevented eruption of the permanent incisors. On patient nine there was no prevention of eruption.

Dental morphology. The teeth in the premaxilla showed the following dental abnormalities on the first visit: curved roots of primary incisors, delayed formation, notching in the incisal edge of the primary incisor, broad crown of primary incisor, invaginations in permanent incisors, notching in the incisal edge of the lateral incisor, large crowns of permanent incisors, lack of resorption of a

Fig. 2. Dental radiographs from patients at the first visit, when a supernumerary tooth was diagnosed. A. Radiograph from a patient (case no. 8) aged 6 years and 10 months. The supernumerary tooth is located adjacent to 11. Lack of resorption of 51. Delayed eruption of 11. B. Radiograph from a patient (case no. 9) aged 14 years and 3 months. Supernumerary tooth located adjacent to 11. The root of 11 is short and rounded. C. Radiograph from a patient (case no. 4) aged 8 years and 5 months. Supernumerary tooth is located adjacent to 21. Delayed eruption of 21.

Table 1. Supernumerary teeth and associated dental abnormalities diagnosed on X-rays of the patients at the first examination

Patient	Age at first examination	Supernumerary		Other observations in the premaxilla
		No.	Tooth palatal position in regard to adjacent tooth	
1	6.6	1	11	52 curved. 11 delayed eruption.
2	8.9	2	11, 21	11, 21 delayed eruption. 21 delayed formation.
3	8.0	1	11, 12	11, 12 delayed eruption
4	8.5	1	21	21 delayed eruption. 62 notching in the incisal line. 12 notching in the incisal line.
5	6.6	1	11	11 delayed eruption
6	8.4	2	11, 21	11, 21 delayed eruption. 61 curved root. 12, 11, 21, 22 large crowns.
7	8.0	1	21, 22	21, 22 delayed eruption. Broad 61.
8	6.10	1	11	51 lack of resorption. 11 delayed eruption.
9	14.3	1	11	The supernumerary tooth has an irregular root contour. 11 short and rounded.

FDI notation used for identification of teeth. 6.6 means 6 years and 6 months.

primary incisor and for the ninth patient a short and rounded root was seen on the adjacent tooth. The results from analyzing dental films from the first visit are presented in Table 1.

Subsequent visits

The premaxillary region. After surgical removal of the supernumerary teeth, the adjacent tooth showed delayed eruption (Fig. 3). Four patients had orthodontic treatment within a year after surgery. The adjacent teeth from three patients who did not receive orthodontic treatment had not erupted to alignment.

Dental morphology. Four patients showed delayed formation of roots. One patient had pulp deviations of central incisors. Four patients showed various manifestations of

Fig. 3. Orthopantomogram from a patient (case no. 2) aged 9 years and 8 months. 11 and 21 show curved roots. 12 and 22 have invaginations. Delayed eruption of 21. The patient had the supernumerary teeth removed surgically 10 months previously.

invaginations on central and lateral incisors. Since the first visit, all adjacent teeth had developed abnormal morphology of roots (Fig. 4A–C).

Resorption. One case showed resorption of the supernumerary tooth (Table 2). Root resorptions were also recorded in cases that had not received orthodontic treatment. In one case resorption was observed even after the removal of fixed appliances (Fig. 5A, B).

Fig. 4. The figure illustrates different dental abnormalities in dentitions where a supernumerary tooth has been surgically removed. A. Radiograph from a patient (case no. 3) aged 11 years and 7 months. The root of 11 is short and curved. The patient has had the supernumerary tooth surgically removed and had orthodontic treatment. B. Radiograph from a patient (case no. 4) aged 9 years and 10 months. Root formation of 21 is delayed. 21 shows delayed eruption. The supernumerary tooth was surgically removed 1 year and 3 months earlier. C. Radiograph from a patient (case no. 6) aged 9 years and 10 months. 12, 11, 21, and 22 have large crowns and invaginations. 11 and 21 have short and rounded roots with blurred dental lamina. The supernumerary teeth have been surgically removed 4 months earlier.

The dentition in general

Orthopantomograms from two patients showed traces of an abnormal pattern of resorption outside the premaxillary area. One had ectopic eruption of a canine, which resorbed roots of the central and lateral incisors (Fig. 6A, B). The other had ectopic eruption of upper first permanent molars, which resorbed the crowns of the upper secondary primary molars, ectopic eruption of lower second permanent molar and lower second permanent molar with malformation of roots (Table 2).

The main results are that the adjacent incisors (those closest to the supernumerary teeth) show delayed eruption after surgical removal of the supernumerary teeth, and that deviations in root morphology, including root resorption, also occur in patients who have not received orthodontic treatment.

Discussion

The study showed that a supernumerary tooth located within the premaxilla is a deviation in the normal development of the dentition that does not occur in isolation. It is well known that the adjacent tooth has a deviant and often delayed eruption (8, 34), while the present study shows that in addition there are additional dental abnormalities including tendency to root resorption.

There are many case reports and some larger reports of supernumerary teeth, but few focus on associated dental abnormalities and to our knowledge none present a follow-up study of the condition. Few studies discuss the etiology behind the dental abnormalities, thus none distinguishes between different etiologies behind different locations of the supernumerary teeth in the jaws. Most of the larger statistical reports do not distinguish between mesiodens associated with the intrapremaxillary suture and a supernumerary tooth located within the ossified tissue of the premaxilla. One might imagine that the etiologies behind the two types of supernumerary teeth in the premaxilla are different, but this has not been elucidated in this study.

One question that arises is: why are there so many dental abnormalities within a limited area? In this connection it is worth looking at the embryological development of the premaxilla, which differs from that of the remaining maxilla. The neural crest cells forming the premaxillary region are originally cells found at the junction between neural plate and surface ectoderm. The cells migrate from the neural crest in the frontonasal process between the eyes to the premaxillary area thus playing a major role in the development of the anterior face and maxilla. In the facial region they interact with the local ectoderm and peripheral neural tissue, and in the dentition they form the dentine and pulp tissue of the

Table 2. Associated dental abnormalities diagnosed on follow-up examinations after removal of supernumerary teeth

Patient	Age at surgical removal of supernumerary teeth	Duration of orthodontic treatment	Age at last examination (years and month)	Roots of teeth in the premaxilla	Invaginations	Other observations
1	7.6	7.10–16.0	17.11	11 short and rounded. 12 short and curved. 21 short and rounded. 11 delayed formation.	12, 22	16, 26 ectopic eruption. 47 ectopic eruption and malformation of root.
2	8.10	9.7–10.6	12.8	11, 21 curved	12, 22	
3	8.1	9.1–10.6	11.7	11 short and curved		
4	8.7		9.10 (adjacent tooth is not fully erupted)	21 short. 21 delayed formation.	12, 22	21 delayed eruption
5	6.7		13.3	11 short		13 resorbs 12, 11. Pulp deviation 11, 21. 11 delayed eruption.
6	9.6		10.5 (adjacent tooth is not fully erupted)	11, 21 short and rounded, blurred lamina dura	12, 11, 21, 22	11, 21 delayed eruption
7	8.6	9.5–12.2	14.3	21 short and rounded. 22 curved. 21, 22 delayed formation.		
8	7.10		8.4 (adjacent tooth is not fully erupted)	11 short. 11 delayed formation.		11 delayed eruption

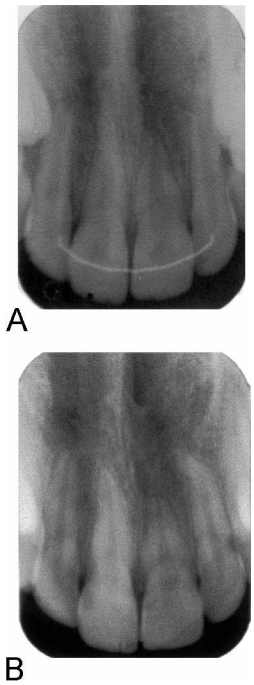

Fig. 5. Two radiographs from the same patient (case no. 7) after a supernumerary tooth located adjacent to 21 and 22 has been surgically removed. A. The patient has finished orthodontic treatment and is now aged 10 years and 3 months. Apparently, there are no deviations or marked shortness in root morphology. B. The patient is now aged 14 years and 3 months. Compared to the situation shown in Fig. 4A, the root of 21 is now markedly shorter than 11 and the root of 22 is curved. Orthodontic treatment has not been performed between the dates of the two radiographs.

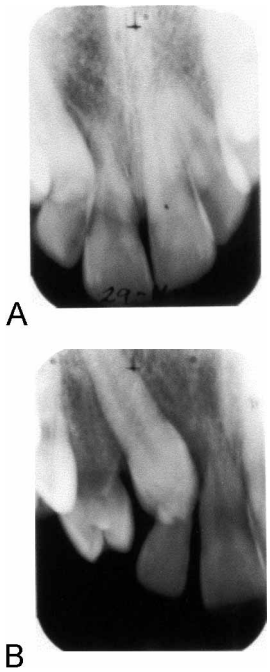

Fig. 6. Two radiographs from the same patient (case no. 5) aged 13 years and 2 months. The supernumerary tooth was located adjacent to 11 and was surgically removed at age 6 years and 7 months. The figure demonstrates ectopic eruption of 13. A. Mesial projection shows that 13 resorbs the root of 12. Pulp deviation occurs in 11. B. Distal projection shows that 13 also resorbs the root of 11. Pulp deviations occur in 11 and 21.

incisors. The neural crest cells to the remaining parts of the maxilla migrate in the maxillary processes from another region at the neural crest (30, 35, 36). It is suggested that the presence of supernumerary teeth in the premaxilla may be caused by deviations in the premigratory population of neural crest cells, as well as from disturbances in their normal migration, proliferation, and differentiation (13). Bearing in mind the different embryological development of the premaxilla and maxilla, it is logical to suppose that there can be deviations in the premaxillary region which do not occur in the remainder of the maxilla.

Saarenmaa (17) doubted that heredity was involved in the occurrence of supernumerary teeth. But there are several later reports on familial incidence of supernumerary teeth in more than one generation (20). McKibben & Brearley (9) in a study on 23 patients reported supernumerary teeth in 10 members of the immediate families. Brand et al. (37) reported on a case of twins, both of whom had supernumerary teeth. Brook (4) reported higher incidence of supernumerary teeth among first-degree relatives of probands. The pattern of heredity has not yet been thoroughly investigated, but case reports indicate some familial incidence.

The material received for this investigation is inhomogeneous, because of differences in the number of radiographs taken at the first visit. Moreover, the quality of the radiographs as well as of the X-ray projection differs. This makes a standardized evaluation of root length and shape of single-rooted teeth difficult. The supernumerary tooth is often diagnosed early by a single dental radiograph because it prevents eruption of the permanent incisor. The study has shown that the condition in addition to attention to the eruption also requires attention to dental malformations and resorption. Therefore treatment of the region can be both more time-consuming and more extensive than expected.

Conclusion

The most important outcome of this study is that in the region with a supernumerary tooth the adjacent incisor shows delayed eruption even after surgical removal of the supernumerary tooth. The deviations in root morphology, including root resorption, are not limited to patients who have had orthodontic treatment, patients who did not receive orthodontic treatment also revealed deviations in root morphology. Therefore the treatment outcome can be different from the expected one.

Acknowledgements.—The collaboration of the following collegues from the Dental Health Care Service in Denmark is acknowledged with thanks: Perline Funch, Silkeborg; Steen Pilemand, Allerød; Susanne Peronard, Taastrup; Inge-Merete Nicolaisen, Viby; Lise Rojek, Allerød; Jan Ribel, Nordborg; Hanne Hedeboe, Præstø; Karin Jepsen, Helsinge. The Danish National Research Foundation and the "IMK Almene Fond" supported this investigation with financial grants.

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Received for publication 29 September 2003
Accepted 5 December 2003