A sixteen year sample of surgically treated supernumerary teeth

**ABSTRACT**

**Introduction** Supernumerary teeth represent a numerical dental anomaly in which more teeth than the norm are present in the dentition. A sixteen year sample of supernumerary teeth has been reviewed in order to analyse epidemiological data, morphological and topographic features of these teeth, especially of those located in the praemaxillary region.

**Materials and methods** All cases in which supernumerary teeth were surgically treated from 1991 to 2006 at the Oral Surgery Unit of the “Sapienza” University of Rome have been reviewed.

**Results** 118 Caucasian subjects with supernumerary teeth have been reviewed in the range of age comprised between 5 and 42 years: 191 SNTs were collected, 136 from the upper jaw and 55 from the mandible. In the maxilla the incisor region was more frequently involved (67.65%), while in the mandible the one most frequently involved was the premolar region (69.1%). Conoid was the most frequent type of supernumerary teeth. Uneruption of the contiguous teeth, in the buccal-lingual dimension as well as in the mesiodistal one. Particular cases are those defined as mesiodens, paramolars and distomolars [Salcido-Garcia et al., 2004].

**Conclusion** In the upper incisor area, the extraction of SNT is mandatory as early as they are diagnosed, especially if they are tuberculated, infundibuliform and incisiform-shaped teeth caused uneruption of permanent teeth more frequently than the other morphological types of supernumerary teeth.

**Keywords:** Computed tomography; Unerupted permanent teeth; Surgical extraction.

**Introduction**

Supernumerary teeth or supernumeraries (SNT) represent a numerical dental anomaly in which more teeth than the norm are present in the permanent as well as, less frequently, in the primary dentition.

The aetiopathogenesis of SNT is still controversial; several theories have been proposed in the past, as already reviewed by Gardiner in 1961, although an anomalous division of tooth germ in an early phase of its development and above all a localised hyperactivity of the dental lamina, due to genetic or teratogenic stimuli, seem to be the two more accepted hypotheses [Saarenmaa, 1950].

Morphological and topographic criteria are usually followed to classify SNT.

From a morphological point of view they are classified as conoids, tuberculated, infundibuliform and supplemental [Foster and Taylor, 1969; Gardner, 1961].

Conoid teeth have a grossly conical (peg-shaped) crown with a smooth surface and they are always smaller than the normal contiguous teeth; their root is quite squat, more frequently curved than straight.

Tuberculated teeth, also called cuspidate, humped or tuberous, also have a conical crown but occlusally they are characterised by tubercles or cusps, variable in number and height and separated by more or less deep grooves. Crown size is larger than that one of conoids, but it is only bigger than that one of normal contiguous teeth. These SNT, however, never look like normal multicusp teeth, usually their root is not formed and when present, it is squat or curved.

Infundibuliform teeth present a deep groove in the crown, starting from the occlusal surface that let it looks like a funnel.

Supplemental teeth are morphologically similar to those of the normal series in the site where the SNT are located. The latter are therefore classified as incisiform, premolariform and molariform, while caniniform teeth are a very rare occurrence.

Finally, SNT that cannot be included in one of these morphological types are usually classified as mis-shaped or odontome-like formations.

As to the location, SNT can be classified on the ground of their position in relation to the neighbouring normal teeth, in the buccal-lingual dimension as well as in the mesiodistal one. Particular cases are those defined as mesiodens, paramolars and distomolars [Salcido-Garcia et al., 2004].

Mesiodens are peg-shaped SNT that usually appear between the two maxillary central incisors or near the midline; they can be erupted or unerupted, variously inclined and positioned in relation to the incisors.

Paramolars are SNT located along side a normal molar in a buccal or lingual position and usually molariform.

Distomolars are SNT located distally to the third molar; they are also called ninth and tenth teeth, they are molariform and usually remain unerupted.

Multiple SNT are often found in several complex systemic diseases like cleidocranial dysplasia [Cooper et al., 2001], Down’s syndrome [Chow and O’Donnel, 1997], Gardner’s syndrome [Wijn et al., 2007; Wolf et al., 1986], cleft palate [Lai et al., 2009], Ellis-van Creveld syndrome [Hattab et al., 1998], Fabry-Anderson syndrome [Regattieri and Parker, 1973], Ehlers-Danlos syndrome [Meiamed et al., 1994] and others.

Non-syndromic multiple SNT (at least 5 teeth for each case) have been sometimes reported in the international literature [Yusof, 1990].

The clinical importance of SNT is strictly related to the pathological sequelae they determine on the normal teeth.
such as delayed or ectopic eruption, diastemas, rotation or inclination and root resorption [Day, 1964; Gardiner, 1961]; they can also develop into a cystic or inflammatory process.

A sixteen year sample of SNT was reviewed in order to analyze epidemiological data, morphological, topographic and clinical features of these teeth, especially of those located in the premaxillary region.

Materials and methods

All cases in which SNT were surgically treated at the Oral Surgery Unit of the “Sapienza” University of Rome from 1991 until 2006 were reviewed.

Clinical and radiographic information have been retrospectly collected from patients’ records regarding sex and age, number of SNT in each subject, their site in relation to each morphological tooth group, their eruption degree, position, and morphology, any local associated pathologies, including all eruptive and positional anomalies of the contiguous normal teeth, as well as any possible associated systemic conditions and diseases.

Clinical information (physical examination, vitality tests) as well as radiographic exams performed (orthopantomography, occlusal x-ray, periapical x-ray, computerised tomography, latero-lateral teleradiography) were re-examined.

Finally, type of anaesthesia (general or local), side of surgical approach (buccal, lingual or crestal), flap design (envelope flap or release incisions provided flap) and ostectomy for crown exposure (if it was carried out or not) were reviewed.

The standard statistical software package SPSS (Version 16.0 for Windows XP) was used for descriptive statistical analysis.

Results

A total of 118 Caucasian subjects with SNT were reviewed in the examined period; the age of the subjects was comprised between 5 and 42 years with only one exception of 61 years (Fig. 1). Seventy-three patients were males and 45 were females (Fig. 1).

Seventy subjects exhibited only one SNT (59.32%), two SNT were present in 38 subjects (32.2%), three SNT in 7 subjects (5.94%) and more than 3 SNT were present in only 3 cases (2.54%), with 6, 7 and 11 SNT respectively.

A total of 191 SNT were collected, 136 in the upper jaw and 55 in the mandible (Table 1). Table 2 describes the relative distribution of SNT in the upper and lower jaws.

No systemic diseases, in which multiple SNT are frequently seen, have been found in the present patient series.

A higher incidence of SNT in the incisor region was found in the upper jaw (67.65%), while in the mandible the premolar region was the most frequently involved (69.1%). Table 3 shows the SNT distribution by morphological type, eruption state (erupted or not erupted), position in the buccal-lingual dimension and degree of root formation (complete, half or absent).

Eight morphological types of SNT were found. As it can be seen (Table 2), conoid is the most frequent type of SNT, it is more frequently not erupted, lingually/palatally positioned and its root almost always completely formed. On the contrary the caniniform shape is the less frequent (only two teeth in a single patient) and in tuberculated SNT the roots were never completely formed.

The most commonly associated pathologic condition is the uneruption of the contiguous permanent teeth (Table 3), which has been found in 81 out of the 191 SNT (40 patients, 42.4%) and that was sometimes associated with the persistence of the homologue primary tooth (13 cases). In particular, tuberculated (86.20%), infundibuliform (80%) and incisiform teeth (70%) were more frequently associated with uneruption of permanent

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Site distribution of SNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPPER MAXILLA</td>
<td></td>
</tr>
<tr>
<td>Number of SNT</td>
<td>15</td>
</tr>
<tr>
<td>% in each site</td>
<td>11</td>
</tr>
<tr>
<td>Aggregated %</td>
<td>18.35</td>
</tr>
<tr>
<td>LOWER JAW</td>
<td></td>
</tr>
<tr>
<td>Number of SNT</td>
<td>11</td>
</tr>
<tr>
<td>% in each site</td>
<td>20</td>
</tr>
<tr>
<td>Aggregated %</td>
<td>89.7</td>
</tr>
</tbody>
</table>
teeth, while molariform teeth less frequently caused this eruption disturbance (11.11%) (Table 4).

Regarding the radiographic diagnosis, from 1991 to 1997, all patients (49 cases) were studied only with conventional radiographs and in 21 of them an occlusal view (19 cases) or a lateral-lateral view (2 cases) were used to define where the SPN were located on the lingual-buccal plane. On the other hand, from 1998 to 2006, in only 43 of the 69 patients, the lingual/buccal position of the SPN had to be determined: in 10 of them a Computerised Tomography (CT) with Dentascan Software was used, while conventional radiographies were taken in the remaining 33 cases.

Periapical films, often more than one film for each case, were used in 49 out of the 118 cases to study the anatomy of SPN and the relationship with the contiguous teeth on the mesiodistal plane.

In all cases SNT were extracted; in 85.34% of cases a surgical flap was performed and in only 21.46% of these release incisions were made. Forty-five patients were treated under general anaesthesia; 35 of them were between 5 and 12 years. In 8 of the 10 patients over 12 years old, general anaesthesia was used to treat more areas at once (6 cases) or because of the presence of a lesion associated with SNT (1 cyst and 1 odontoma).

In the upper incisor area, 92 SNT were found in 65 subjects; 21 teeth were mesiodens and 71 were equally distributed on right and left sides; 56 out of the 92 SNT were located just near the normal position of the central incisors, 31 near the right one and 25 near the left one; 40 out of the 92 SNT were conoids, 28 tuberculated, 10 incisiform and 10 funnel-shaped; the remaining 4 were mis-shaped. Of the 21 mesiodens 19 were conoids and 2 were infundibuliform.

Incisiform, funnel-shaped and tuberculated teeth were quite exclusive of the incisor area since only 1 tuberculated was found in a different area (left upper canine).

In 24 out of the 65 subjects with SNT in the premaxilla, eruption of incisors was found (36.9%). In only 8 patients conoids were involved in permanent incisors retention or impaction; in 6 patients at least 2 SNT were present in the same area and in half of these cases another morphological type of SNT was associated with the conoid.

In all cases of tooth retention in the upper incisor area, SNT were located palatally or just in the middle of the alveolar ridge. The only exception is 1 case in which all four permanent incisors were impacted: the right ones associated with a palatally located conoid; the left ones associated with a buccally located conoid.

In only 7 out of the 24 patients with permanent incisor impaction, the bracketing of unerupted teeth was performed after SNT extraction and adequate exposure of the permanent tooth crown. In 3 patients a guide alveolectomy was carried out after SNT extraction, and in the remaining 14 patients only the complete exposure of the crown edge of the impacted tooth for about 2–3 mm

### Table 2 - STN by morphological type, buccal-lingual position, eruption state and degree of root formation.

<table>
<thead>
<tr>
<th>Morphology</th>
<th>Eruption state</th>
<th>Position</th>
<th>Degree of root formation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not erupted</td>
<td>Erupted</td>
<td>Lingual Buccal Middle Complete Half Absent</td>
</tr>
<tr>
<td>Conoids</td>
<td>70</td>
<td>36.68</td>
<td>61 9 53 10 7 54 5 11</td>
</tr>
<tr>
<td>Premolariform</td>
<td>41</td>
<td>21.5</td>
<td>36 5 32 4 7 26 2 13</td>
</tr>
<tr>
<td>Tuberculated</td>
<td>29</td>
<td>15.4</td>
<td>26 3 21 1 7 0 9 20</td>
</tr>
<tr>
<td>Molariform</td>
<td>18</td>
<td>9.4</td>
<td>15 3 18 14 2 2</td>
</tr>
<tr>
<td>Incisiform</td>
<td>10</td>
<td>5.24</td>
<td>8 2 8 2 5 5</td>
</tr>
<tr>
<td>Infundibuliform</td>
<td>10</td>
<td>5.24</td>
<td>9 1 7 1 2 3 4 3</td>
</tr>
<tr>
<td>Mis-shaped</td>
<td>11</td>
<td>5.7</td>
<td>8 3 8 3 11</td>
</tr>
<tr>
<td>Caniniform</td>
<td>2</td>
<td>1.04</td>
<td>2 2 2</td>
</tr>
<tr>
<td>Total n.</td>
<td>191</td>
<td>100%</td>
<td>163 28 131 19 41 104 22 65</td>
</tr>
<tr>
<td>Total %</td>
<td>100%</td>
<td>85.34%</td>
<td>14.66% 68.58% 9.96% 21.46% 54.45% 11.52% 34.03%</td>
</tr>
</tbody>
</table>

### Table 3 - SNT-related/associated pathologies.

<table>
<thead>
<tr>
<th>Pathologies</th>
<th>N. of cases out of 191 SNT</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uneruption of permanent teeth</td>
<td>81</td>
<td>42.4</td>
</tr>
<tr>
<td>Persistence of deciduous teeth</td>
<td>13</td>
<td>6.8</td>
</tr>
<tr>
<td>Cysts</td>
<td>7</td>
<td>3.6</td>
</tr>
<tr>
<td>Malposition of permanent teeth</td>
<td>7</td>
<td>3.6</td>
</tr>
<tr>
<td>Root resorption of permanent teeth</td>
<td>2</td>
<td>1.04</td>
</tr>
<tr>
<td>Fusion with a permanent tooth</td>
<td>2</td>
<td>1.04</td>
</tr>
<tr>
<td>Dilaceration</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>Odontoma</td>
<td>1</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### Table 4 - SNT by morphological type and uneruption of contiguous permanent teeth.

<table>
<thead>
<tr>
<th>SNT type</th>
<th>N. of SNT out</th>
<th>SNT with uneruption of contiguous permanent teeth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conoids</td>
<td>70</td>
<td>29.62% 34.28</td>
</tr>
<tr>
<td>Tuberculated</td>
<td>29</td>
<td>30.86% 86.20</td>
</tr>
<tr>
<td>Infundibuliform</td>
<td>10</td>
<td>9.87% 80</td>
</tr>
<tr>
<td>Incisiform</td>
<td>10</td>
<td>8.64% 70</td>
</tr>
<tr>
<td>Premolariform</td>
<td>41</td>
<td>12.34% 24.4</td>
</tr>
<tr>
<td>Molariform</td>
<td>18</td>
<td>2.5% 11.11</td>
</tr>
<tr>
<td>Bad-shaped</td>
<td>11</td>
<td>6.17% 45.45</td>
</tr>
<tr>
<td>Caniniform</td>
<td>2</td>
<td>0.0% 0.0</td>
</tr>
<tr>
<td>Total</td>
<td>191</td>
<td>42.4%</td>
</tr>
</tbody>
</table>

out of the 92 SNT were conoids, 28 tuberculated, 10 incisiform and 10 funnel-shaped; the remaining 4 were mis-shaped. Of the 21 mesiodens 19 were conoids and 2 were infundibuliform.

Incisiform, funnel-shaped and tuberculated teeth were quite exclusive of the incisor area since only 1 tuberculated was found in a different area (left upper canine).

In 24 out of the 65 subjects with SNT in the premaxilla, eruption of incisors was found (36.9%). In only 8 patients conoids were involved in permanent incisors retention or impaction; in 6 patients at least 2 SNT were present in the same area and in half of these cases another morphological type of SNT was associated with the conoid.

In all cases of tooth retention in the upper incisor area, SNT were located palatally or just in the middle of the alveolar ridge. The only exception is 1 case in which all four permanent incisors were impacted: the right ones associated with a palatally located conoid; the left ones associated with a buccally located conoid.

In only 7 out of the 24 patients with permanent incisor impaction, the bracketing of unerupted teeth was performed after SNT extraction and adequate exposure of the permanent tooth crown. In 3 patients a guide alveolectomy was carried out after SNT extraction, and in the remaining 14 patients only the complete exposure of the crown edge of the impacted tooth for about 2–3 mm
was performed.

In all these 24 patients the eruption of the impacted permanent tooth was obtained.

No cases of tooth impaction or any other incisor eruptive anomalies were present in the case of inverted SNT (4 teeth), that are those turned upside-down with the crown directed towards the nasal cavities. Three out of these 4 inverted teeth were conoids (2 mesiodens and 1 located palatally with respect to tooth 8) and 1 was infundibuliform. In 3 of these cases the root was completely formed while in the fourth one (a conoid) the root was only half of the total length and the patient was a 33-year-old woman.

Discussion

In the present study, SNT were more frequently found in the age range comprised between 5 and 20 years (89 out of the 118 patients) (Fig. 1) with a male:female ratio of about 1.6:1, slightly lower than that reported by most authors [Day, 1964; de Oliveira Gomes et al., 2008; Di Biase, 1969; Foley, 2004; Koch et al., 1995; Mason et al., 2000; Rajab and Hamdan, 2002; Von Arx, 1992] and slightly higher than that reported by Montenegro et al. [2006] and Salcido-García et al. [2004].

As to the location, the upper jaw was more involved for the upper incisor area as well as other authors have often in the upper incisor area where SNT were more represented the most frequently interested area (58.11%) of the 118 patients) (Fig. 1) with a male:female ratio of 1.6:1 and the cases with more than one SNT are about 40% of the total number of cases; this percentage is higher than those reported by other authors [Nazif et al. [1983] 14%, Bryan et al. [2005] 20%, Von Arx [1992] 22%, Montenegro et al. [2006] 22.5%, Rajab and Hamdan [2002] 23%, Leyland et al. [2006] 26%, Tay et al. [1984] 34.31% and Liu [1995] 35.7%.

As to the eruption of the contiguous permanent teeth, the results are in agreement with those of other authors [Koch et al., 1986; Leco-Berrocal et al., 2007; Leyland et al., 2006; Mason et al., 2000; Montenegro et al., 2006; Nazif et al., 1983].

Actually, tuberculated, infundibuliform and incisiform teeth caused uneruption of permanent teeth more frequently than other morphological types of SNT (Table 4). Only Tay et al. [1984] reported a very low incidence of permanent tooth uneruption (9.6%). Uneruption of permanent teeth occurred, however, more frequently in relation to conoids (29.62%) and tuberculated (30.86%), which were the more frequent types of SNT, and more often in the upper incisor area where SNT were more frequently found (about 48% of the entire study sample), and where conoids and tuberculated represented about 74% of the total number of SNT in that area.

Particular considerations are therefore to be made just for the upper incisor area as well as other authors have
already made [Bryan et al., 2005; Day, 1964; Foley, 2004; Foster and Taylor, 1969; Högeström and Andersson, 1987; Leyland et al., 2006; Tay et al., 1984].

In the present study, incisor uneruption has been found frequently associated to SNT in this area with a percentage (36.9%) comprised between those found by Day [1964] (38.75%) and Di Biase [1969] (42%) and that found by Von Arx [1992] (34.51%).

According to previous studies [Foster and Taylor, 1969; Mason et al., 2000], conoids were rarely involved in permanent incisor retention or impaction (only 8 patients) and almost always when at least two SNT were present in the same area (6 patients) and in half of cases when another morphological type of SNT was associated with the conoid.

Eruption anomalies of permanent incisors seemed not to occur in the case of inverted SNT (4 teeth). This can be related to the fact that when a SNT develops in the direction opposite to the normal teeth, it cannot interfere with their eruption. However, it is noteworthy that in 2 of the present 4 cases a cystic lesion was present: a follicular cyst in one case and a follicular keratocyst in the other one, the latter in a 33-year-old woman. This could mean that a high risk of follicle change in the long run is associated with SNT persistence in the area.

As concerns the radiographic diagnosis, it is noteworthy that over the years the techniques have progressively changed from conventional radiographic investigations and tomographic studies to computerised tomographic studies, often with Dentascan Software, so that diagnostic tools are nowadays considerably improved [Jacobs, 2000; Kim and Ruprecht, 2002]. However, in most of the patients treated from 1998 to 2006 (59 patients), clinical examination only (26 patients) and conventional radiographs (33 patients) were sufficient to program the surgery.

As to the treatment, all SNT were extracted, inverted mesiodens included, although particular considerations have to be made just in relation to the latter. As they usually do not cause tooth eruption anomalies, they could be left in place, although the possible cystic development of the follicle suggests their early surgical extraction or at least their close radiographic follow-up until the contiguous permanent teeth will have their root completed. This kind of management does not aim to avoid that the surgical procedure interferes with the normal dental skeletal growth, because the early extraction of SNT does not impair the prognosis for the adjacent teeth, as other authors [Högeström and Andersson, 1987; Nazif et al., 1983] already stated. Delayed SNT removal, however, aims to avoid general anaesthesia or deep sedation, often necessary because of frequent poor compliance in children under 10 years of age [Koch et al., 1986], although Högeström and Andersson [1987] stated that performing surgery at an early age does not increase the risk for dental anxiety in children. Actually in the present study, only 35 (58.3%) out of 60 patients under 13, and 29 out of 51 patients under 11 were treated under general anaesthesia just because of poor compliance.

Finally it is noteworthy that in all cases with permanent tooth retention in the upper incisor area (24), the recovery of the unerupted teeth was always obtained, so the treatment chosen was always effective. The evaluation of this outcome was not an aim of the present study but the choice of surgical treatment to use is critical in the management of impacted or displaced permanent teeth due to SNT because it depends on several factors such as patient’s age, number of SNT, morphology, position and eruptive state, as well as any local associated pathology.

Conclusion

As in the upper incisor area SNT frequently cause tooth retention, their extraction is mandatory as early as they are diagnosed, especially in the case of tuberculated, infundibuliform and incisiform, if they are located palatally or just in the middle of the ridge and if more than one SNT is present.

References


Leyland L, Bata P, Wong F, Llewelyn R. A retrospective evaluation of the eruption of impacted permanent incisors after extraction of
Liu JF. Characteristics of premaxillary supernumerary teeth; a survey of 112
Mason C, Azam N, Holt RD, Rules DC; A retrospective study of unerupted
maxillary incisor associated with supernumerary teeth. Brit J Oral
Melamed Y, Berkai G, Frydman M. Multiple supernumerary teeth (M SNT) and
23(2): 88-91.
Montenegro PF, Castellón EV, Berini Aytés L, Escoda CG. Retrospective study
of 145 supernumerary teeth. Med Oral Patol Oral Cir Bucal 2006; 11:
339-44.
Nazif MM, Ruffalo RC, Zullo T. Impacted supernumerary teeth: a survey of 50
Rajab LD, Hamdan MAM. Supernumerary teeth: review of the literature and
Regattieri LR, Parker JL. Supernumerary teeth associated with Fabry-
432-3.
Saarenmaa L. The origin of supernumerary teeth. Acta Odont Scand 1950; 9:
293-303.
Salcido-Garcia JF, Ledesma-Montes C, Hernández-Flores F, Pérez D, Garçés-
Ortiz M. Frecuencia de dientes supernumarios en una población
Tay F, Pang A, Yuen S. Unerupted maxillary anterior supernumerary teeth:
Von Arx T. Anterior maxillary supernumerary teeth: A clinical and radiographic
Wijn MA, Keller JJ, Giardiello FM, Brand HS. Oral and maxillofacial
manifestations of familial adenomatous polyposis. Oral Dis 2007;
13:360-5.
Wolf J, Järvinen HJ, Hietanen J. Gardner’s dentomaxillary stigmata in patients
410-6.
Yusof WZ. Non-syndrome multiple supernumerary teeth: literature review. J