

## Conference Paper

# Supernumerary Teeth: Review of the Literature with Recent Updates

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A supernumerary tooth (ST) is defined as any tooth or odontogenic structure that is formed from tooth germ in excess of usual number for any given region of the dental arch. They may be single or multiple and unilateral or bilateral in distribution and can occur in any region of the dental arch. These may occur in primary and permanent dentition. Supernumerary teeth are more frequent in males. They are classified based on form, morphology, location, and occurrence. Several hypotheses have been proposed to explain the occurrence of ST. However, combination of environmental and genetic factors has been proposed. Supernumerary teeth cause a range of complications like crowding, displacement, dilacerations, cyst formation, and so forth. Early identification and appropriate treatment plan should minimize the potential complications caused by ST.

## 1. Introduction

Supernumerary tooth (ST) is defined as “any tooth or odontogenic structure that is formed from tooth germ in excess of usual number for any given region of the dental arch” [1]. They may be unilateral or bilateral and single or multiple, in distribution, occur in any part of the tooth bearing areas in both dental arches, and may occur in primary and permanent dentition [2]. These ST could occur at any region of the dental arch and most commonly in premaxilla. There are several hypotheses which have been proposed to explain the occurrence of ST, and their etiology remains unclear [1, 3]. A combination of environmental and genetic factors has been proposed to explain ST occurrence [4]. Supernumerary teeth cause a range of complications varying from crowding to cyst formation. However, the position of ST is buccal or lingual or within the arch. Localization of ST plays a major role in diagnosis and treatment, especially if surgical intervention is needed [5]. Though, it is clear that early treatment can possibly prevent further complications, some authors anecdotally suggested that this approach is hazardous

due to possible risk of damage to the developing tooth germs. Location of ST must be established by different imaging techniques. Although, combinations of intraoral radiographs with panoramic radiographs are usually able to provide the required information, these procedures do not always provide sufficient information concerning the 3-dimensional (3D) relationship of the ST [1, 5, 6]. The purpose of the present paper is an overview on epidemiology, pathogenesis, classification, complications, diagnosis, and management of ST.

## 2. Epidemiology

The incidence of ST for males is higher than females [7–10]. Contrarily, Clayton [11] and Bäckman and Wahlin [12] reported more female predilection. Higher prevalence figures for ST were reported in Mongoloid groups than in other racial groups [13]. The conical ST in anterior region is the most common type of ST. The incidence, location, and morphology may vary depending on gender. Mitchell [14] reported that females are more commonly affected than males with a 2:1 ratio in permanent, while no significant difference was

found in primary dentition. It has also been reported that subphenotypes of ST also presented gender, where males are commonly affected in midline and premolar regions and incisor and canine regions were in females [8].

Several studies have reported that there is a racial difference in the incidence of ST. In primary dentition, the reported incidence was between 0.1% and 1.8% for Caucasians, where in Mongolian origin, 0.1% was reported for Japanese while the prevalence of ST for Chinese children in Taiwan was 7.8% [15] and 2.8% in southern Chinese [16]. In permanent dentition, the prevalence ranges from 0.4% to 2.1% for Caucasians while 2.4%, 3.4%, and 6% for southern Chinese [17], Japanese [13], and American Blacks [18]. van der Merwe and Steyn [19] reported a higher incidence of ST (7%) in a South African mining community of the skeletal remains. These different prevalence figures are reported on ST, probably due to the different populations investigated and whether the reported prevalence of ST is just a reflection of the variation in the diagnostic tools, assessment process, and sampling methods [20]. Most recently, Anthonappa and coworkers [21] reported that the prevalence of ST ranges from approximately 3 to 6% or even higher which is higher than previously reported prevalence in literature.

### 3. Pathogenesis

Various explanations were given by different authors on the development of ST to eccentricity during embryologic formation that consists of dichotomy of tooth germs, hyperactivity of the dental lamina, and remnants of epithelial cells. The etiology of ST may confirm genetic influences as ST are more frequently reported in relation to affected individuals. However, Brook [4] hypothesized that both environmental and genetic factors were responsible for the ST.

**3.1. Atavism.** Supernumerary teeth are the result of the reversion phenomenon or atavism. Atavism is a type of long-distance heredity or phylogenetic reversion and it is the reappearance of an ancestral condition or type. This phylogenetic process of atavism is an evolutionary throwback which has been suggested. Phylogenetic evolution has resulted in a reduction in both the number and the size of man's teeth and supernumerary premolars may be an atavistic appearance of the premolar region [22]. This hypothesis proposes a reversion to an ancestral human dentition that contained a larger number of teeth [23].

**3.2. Dichotomy.** Dichotomy means dividing of tooth bud into two teeth of equal size or one normal and one dysmorphic tooth with two equal or different sized parts. Division in the developing tooth bud can give rise to ST and a normal tooth was hypothesized based on this concept [24].

**3.3. Dental Lamina Hyperactivity.** The epithelial remnants are large enough that they are capable of exciting and controlling the development of the dental papilla. Remnants of the dental lamina can persist as epithelial pearls or islands, "rests of Serres" within the jaw. If the epithelial remnants are subjected to initiation by induction factors, an extra tooth

bud is formed resulting in the development of extra odontogenic structure [23]. A hyperactive dental lamina, where the localized and independent hyperactivity of dental lamina occurred, is the most accepted cause for the development of the ST [25]. Based on this theory, the lingual extension of an additional tooth bud leads to a eumorphic tooth, while the rudimentary form arises from proliferation of epithelial remnants of the dental lamina induced by pressure of the complete dentition [26].

**3.4. Genetic Factors.** There are plenty of reports to support the theory of familial tendency to ST with an increased number of ST evident in the relatives of those affected. Niswander and Sujaku [13] hypothesized that an autosomal recessive gene with less penetrance in females may lead to the formation of a ST in Japanese population. It has been reported that X-linked autosomal dominant mode only in females occurred over three generations where the remaining three males were not affected. Several case reports have reported on the occurrence of ST in siblings [27–29], twins [30–33], and family members [34–37].

**3.5. Associated Syndromes.** Supernumerary teeth have been reported in patients with syndromes such as Cleidocranial dysplasia [38], Ehlers-Danlos syndrome Type III [39], Ellis-Van Creveld syndrome [40], Gardner's syndrome [41], Gold-enhar syndrome [42], Hallermann-Streiff syndrome [43] Orofaciodigital syndrome type I [44], Incontinentia pigmenti [45], Marfan syndrome [46], Nance Horan syndrome [47], and Trichorhinophalangeal syndrome 1 [48] and also have been reported in conditions like cleft lip and/or palate.

### 4. Classification

Supernumerary teeth have been classified mainly based on their morphology, location, form, and number. Mitchell [14] classified ST based on form, conical, tuberculate, supplemental, and odontoma, and based on location, mesiodens, paramolar, and distomolar. Scheiner and Sampson [49] classified ST based on form, conical, tuberculate, supplemental, and odontoma, and based on location, mesiodens, paramolar, distomolar, and parapremolars. The mesiodens is located between the two central incisors and these are mostly in conical shape [50]. Distomolars are located distally to the third molar, while paramolars are located palatally or labially next to a molar [51]. However, ST classified based on morphology (conical, tuberculate, supplemental, and odontomes), location (mesiodens, paramolar, distomolar, and parapremolar), position (buccal, palatal, and transverse), orientation (vertical or normal, inverted, transverse, or horizontal) are shown in Figure 1.

Supernumerary teeth may occur in permanent and primary dentitions, and comparatively they are less frequent in the primary dentition. These extra teeth may occur as a unilateral or bilateral, single tooth or two or multiple teeth, and in the maxilla, the mandible, or both the arches. Subjects involving one or two ST most commonly are reported in premaxilla, and multiple ST tend to involve the mandibular premolar region [49]. Yusof [52] reported that 60.9%

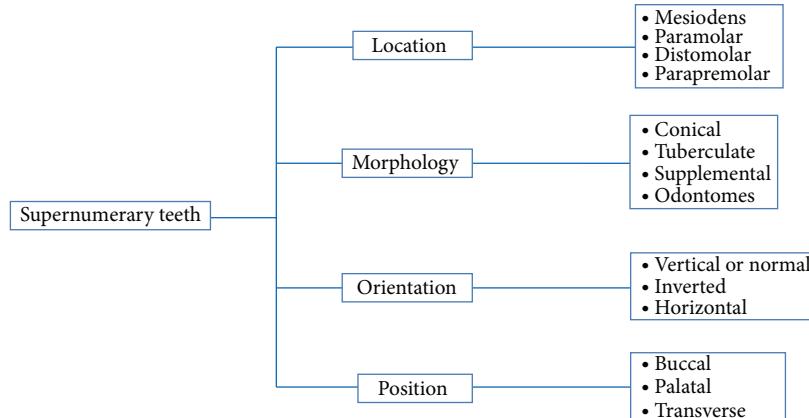


FIGURE 1: Classification of supernumerary teeth based on morphology, location, position, and orientation.

occurred in the mandible and among these 44.8% in the mandibular premolar region. Apart from the mesiodens, the majority of ST are reported in the maxillary incisor region (51.5%). In primary dentition, lateral incisor region is a common site of ST occurrence [53–55]. A slight difference in the occurrence of ST in permanent dentition is relative frequency of difference in the literature. Luten Jr.'s study [56] found that the frequency of maxillary lateral incisors, mesiodens, maxillary central incisors, and bicuspids was 50%, 36%, 11%, and 3%, respectively. Shapira and Kuftinec [57] reported the order of frequency as being maxillary central incisors, molars, and premolars, followed by lateral incisors and canines. Single ST occurs in 76 to 86% of cases, double ST in 12 to 23% of cases, and multiple ST in less than 1% [58].

## 5. Complications

Various complications may occur as the result of the presence of ST including crowding, delayed eruption, spacing, impaction of permanent incisors, abnormal root formation, alteration in the path of eruption of permanent incisors, median diastema, cystic lesions, intraoral infection, rotation, root resorption of the adjacent teeth, or even eruption of incisors in the nasal cavity and retained deciduous teeth [1, 59, 60].

**5.1. Midline Diastema.** Presence of erupted and unerupted mesiodens may cause midline diastema. A retrospective analysis showed 10% of cases with SNT cases exhibited midline diastema [61].

**5.2. Delayed or Failure of Eruption.** Supernumerary tooth is the common reason for the delayed or failure of eruption in premaxillary region [62]. Prevention or delayed eruption of associated permanent teeth [10, 63] and tuberculate ST are the possible reasons for failure of eruption of maxillary permanent incisors [64]. Supernumerary teeth in other locations may also cause failure of eruption of adjacent teeth.

**5.3. Displacement.** Displacement of the crowns of the adjacent teeth is a common feature in cases that associated

with ST [65]. The amount of displacement varies from a mild rotation to complete displacement [9]. Supernumerary teeth cause severely rotated incisors and sometimes remain unerupted. Self-correction and correct alignment may result in early removal of the causative ST [66].

**5.4. Crowding.** Any form of ST can cause this complication; erupted or unerupted supplemental ST most often leads to crowding [67].

**5.5. Root Resorption.** Root resorption of adjacent teeth sometimes leads to loss of tooth vitality [63].

**5.6. Alveolar Bone Grafting.** Secondary alveolar bone grafting may be compromised due to ST in patients with cleft lip and palate. Unerupted ST in the cleft site is normally removed at the time of bone grafting.

**5.7. Implant Site Preparation.** The presence of an unerupted ST in a potential implant site may compromise implant placement.

**5.8. Ectopic Position.** Ectopic eruption of ST has been reported, among these frequently reported in the nasal cavity.

Clinically, a white mass may be seen in the nasal area, radiographically appearing as a tooth-like radiopacity [68, 69].

**5.9. Late Forming Supernumerary Teeth.** Patients with a history of anterior conical or tuberculate supernumerary teeth at an early age have a 24% possibility of developing single or multiple supernumerary premolars at late age [2, 70].

**5.10. Root Abnormalities.** Dilaceration is a developmental anomaly in the tooth shape and its structure, which may happen as sharp bending of the tooth in either the crown or the root portion. Loss of tooth vitality has been reported in rare conditions.

**5.11. Cyst Formation.** It has been reported that cyst formation due to ST was observed in 11% of the cases where dentigerous cyst is common type [61, 71].

## 6. Diagnosis

It is essential to identify the presence of ST clinically and radiographically before a definitive diagnosis and management [5, 49]. Clinical complications such as midline diastema, displacement, delayed or failure of eruption, rotations, and impaction of teeth might leave a way of identification of ST. Identification and localization of ST are essential for the management if surgical intervention is needed. It has been reported that panoramic radiographs alone are not useful for the identification of ST [6]. It has also been reported that combination of radiographs is necessary in localization of ST. Vertical tube shift and horizontal tube shift techniques are commonly used techniques for localization of ST [72]. Most recently, Toureno and coworkers [73] proposed a guideline to locate and identify ST in two and three dimensions, which may reduce treatment errors and improve communication.

## 7. Management

Several authors have given different opinions for the management of ST, particularly timing of the removal of ST. Most of the authors have recommended the early intervention of ST. The treatment options for managing ST depend on their orientation and position, the age of the patient, and any associated complications. There are two common opinions for removal of ST as soon as they are identified [74]. Similarly, few authors reported that early identification and removal of ST [75, 76], in contrast to some authors which may suggest abrupt removal of ST, are not essential if there was no associated pathology [77]. Removal of ST is not always a treatment of choice; they may be reviewed if the tooth is not creating any problem. Högström and Andersson [66] suggested two different opinions where the ST should be removed as early as upon identification or should wait until complete root formation of adjacent teeth. The optimal time for surgical intervention, however, remains contentious [78]. It is very important to remove ST at a young age if it is damaging adjacent teeth or causing any other complication. Recently, Omer and colleagues [1] reported based on a retrospective analysis the ideal age of removal of ST 6 to 7 years. The majority of delayed permanent incisors erupt spontaneously if sufficient space is created at the time of removal of the ST and maintenance of postoperative space is needed. Permanent maxillary incisor teeth still remained unerupted with near complete apical formation; orthodontic bracket and chain may be used to facilitate orthodontic traction. In some cases based on angulations of impacted teeth caused by ST, orthodontic bracket and chain placed at the time of surgical removal ST may be essential for the eruption [79].

## 8. Conclusion

Supernumerary teeth are extra to normal complement in both dentitions. Males are predominantly affected by ST, which is common in permanent dentition. Supernumerary teeth may occur unilaterally or bilaterally, single or multiple, and at any region of the dental arch. Mesiodens are common

type of ST followed by supplemental premolars. A variety of complications were associated with ST which range from crowding to cyst formation. Early identification and proper treatment planning are essential for the management of ST. Furthermore, multidisciplinary approach is necessary for the management of ST if it is associated with complications.

## Conflict of Interests

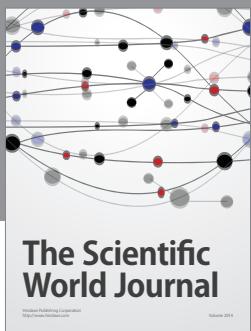
The author declares that there is no conflict of interests regarding the publication of this paper.

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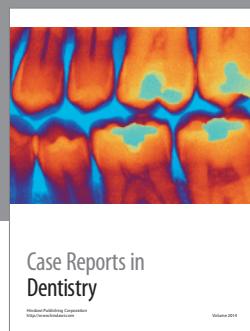
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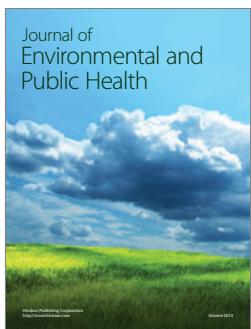
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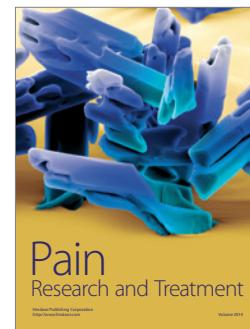
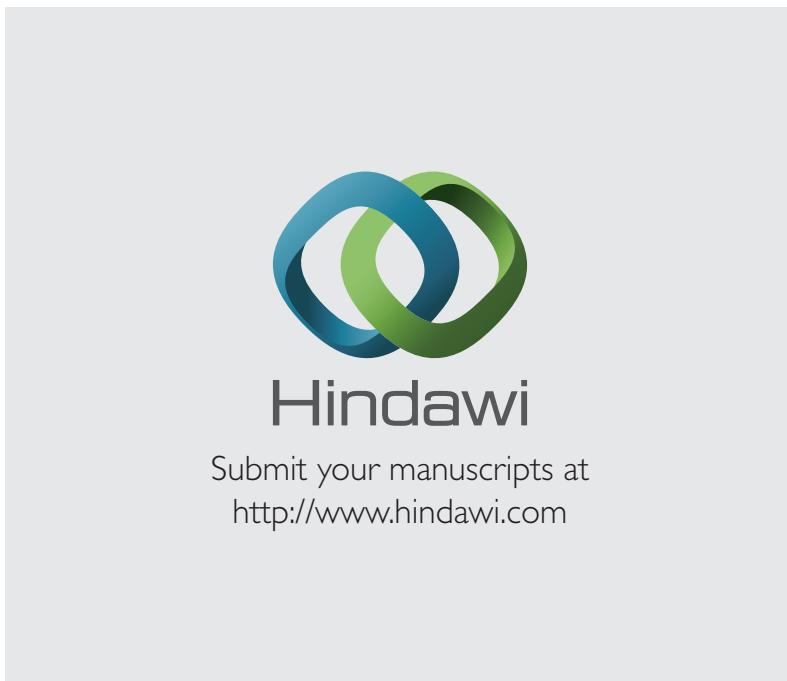
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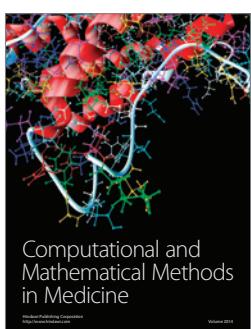
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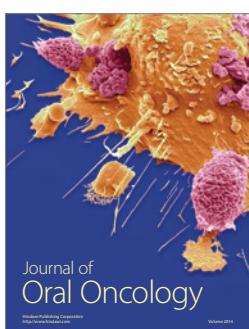
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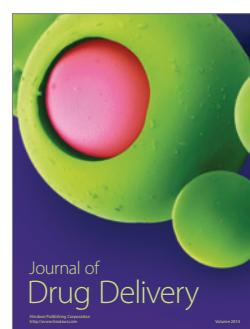
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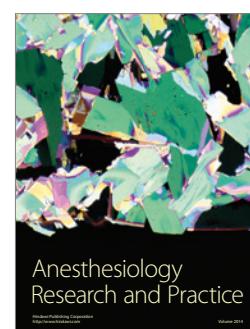
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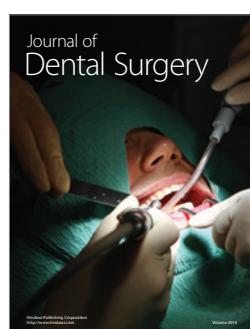
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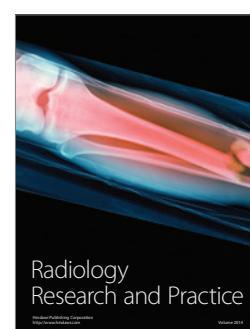
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