RESEARCH ARTICLE

SUPERNUMERARY TEETH REVIEW OF AETIOLOGY, SEQUELAE, DIAGNOSIS AND MANAGEMENT. PART II.

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Abstract

The mechanism by which supernumerary teeth arise is not yet known, and there may be different aetiological explanations for different types of supernumeraries. Many theories have been suggested to explain how this anomaly occurs in the dentition. With difficulties in obtaining sufficient embryological evidence on supernumerary teeth development, any theory concerning their formation remains hypothetical. Abnormalities in dentition can be caused by supernumerary teeth. Anterior supernumerary teeth can cause more serious problems than posterior supernumeraries, wherein the most frequent complaint is one of aesthetics. The most common sequelae of supernumerary teeth are displacement of teeth of the normal series, crowding and rotation of the normal teeth in the affected region, development of an abnormal median diastema, interference with occlusal development or orthodontic mechanics during orthodontic treatment, delay or failure of eruption of associated permanent teeth and gemination or fusion. Early diagnosis and detection of supernumerary tooth is crucial to avoid or minimize such complications including both clinical and radiographic examination. There are two choices of treatment of supernumerary teeth namely removal or maintenance of the supernumerary tooth, with periodic follow-up. The treatment of choice will depend on several factors such as associated pathology and/or abnormality, age of the patient and degree of dental development of the neighbouring permanent teeth, and location and type of the supernumerary tooth.

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Main text:-
Aetiology of supernumerary teeth:-
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occurs in the dentition. With difficulties in obtaining sufficient embryological evidence on supernumerary teeth development, any theory concerning their formation remains hypothetical.

**Atavism:**
This evolutionary theory has been suggested on the basis of remote ancestors of man having forty-four teeth (the dental formula of the typical mammalian dentition being \(3 \ 4 \ 1 \ 3 \ | \ 3 \ 1 \ 4 \ 3\)) and during the evolutionary process twelve teeth have been lost in recent man. Thus, on the view of the atavistic theory the incidence of supernumerary teeth represents a reversion to the dentition of ancestral creatures and recurrence of forms of teeth which have become extinct. This aetiological explanation for the occurrence of supernumerary teeth has been adopted by some authors.\(^1\)\(^2\) This theory has been disproved by the absence of the supernumerary cuspid in the mammalian dentition and the fact that supernumerary teeth are also found in the deciduous dentition. In addition, malformed supernumerary teeth cannot be accounted for by atavism.

**Aberrations during embryological formation:**
Embryological formation is a long process during which the maxillofacial complex undergoes different stages of development to give rise to the normal facial and dental characteristics. However, a disruption might occur in one or more of these stages throughout embryological formation, giving rise to one or more developmental anomalies, including supernumerary teeth. Different theories have been suggested to explain the development of supernumerary teeth with the developmental process as a possible cause. These include:

**Excessive growth of the dental lamina:**
Hyperactivity of the dental lamina is the most common proposed theory for aetiology of supernumerary teeth.\(^3\)\(^-\)\(^8\) The factors which are involved in inciting such hyperactivity are essentially unknown. Tensions within the jaws, as well as the mobility of particular facial processes, may cause division of the dental lamina.\(^8\) Local influences such as inflammation, scaring, abnormal pressure and disturbed relationships between cells may cause this dental hyperplasia.\(^9\) An interaction between developing tooth germs may influence the occurrence of supernumerary teeth. For example, in some mice the first molar tooth germ is smaller than a certain threshold size, at a critical time, which seems to allow a proliferation of the dental lamina to develop into a supernumerary tooth.\(^10\)

The excessive growth of the dental lamina occurs in different sites, giving rise to different types of supernumerary teeth which differ from each other according to their proximity to the normal tooth buds. It has been suggested that additional buds are more likely to occur in the broad spaces between normal tooth buds.\(^11\)\(^12\)

Some types of supernumerary teeth such as supernumerary premolars, which are considered to be members of a ‘post-permanent’ dentition, have been suggested to occur as accessory buds from the dental lamina on the lingual aspect.\(^2\) This has been supported with the observation that these teeth were mostly found late in development, and either lie impacted below the roots of the erupted normal premolars which were usually in good alignment, or erupt lingual to them.

Stafne\(^13\) advocated Black’s theory that the ameloblasts control the formation of the dentine germ and subsequently the enamel organ. According to this theory, a supernumerary tooth could be produced as a result of an occasional accessory proliferation of the dental lamina. This is usually of similar shape of the neighbouring teeth.

Gardiner\(^3\) has reviewed in detail the aetiology of supernumerary teeth. He favoured the theory that suggests distomolars are derived from additional budding of the distal extenuation of the dental lamina at its end, which has also been proposed by Gorlin and Goldman.\(^14\) Further support to this theory has been made by Fisher.\(^15\) He reported a bilateral existence of six maxillary impacted supernumerary molars which, after surgical extraction, proved to be of recognizable morphology and occurred at the end of the normal series.

Foster and Taylor\(^16\) proposed that conical mesiodens develops from an offshoot of the dental lamina. Almeida et al.\(^17\) stated that the wide variation found in the morphology of mesiodentes could be more logically explained by their origin from the hyperactivity of the dental lamina.
Proliferation of remnants of the dental lamina:-
At the final stages of the development of the tooth germ, most of the epithelial cells of the dental lamina break up and disappear. Some of these cells however remain and form groups (pearls or islands), called “gland of Serres”, that may develop into a tooth germ of a supernumerary tooth, as a result of an unknown stimulating mechanism.\textsuperscript{3,6}

Stafne\textsuperscript{13} stated that the remnants of the epithelial cord may become active and produce extra teeth that are more likely to be of conical shape. Histological studies on animals (rats and mice) showed that epithelial remnants proliferating in the interseptal areas, and originating primarily from Hertwig’s sheath, may be transformed into differentiating cells when stimulated by trauma.\textsuperscript{18-22} Ranta and Ylipaavalniemi\textsuperscript{53} reported two cases of initiation of the formation of supernumerary mandibular premolars shortly after the occurrence of jaw fractures, suggesting therefore that traumatic injury of the jaws may be considered as a cause of supernumerary tooth formation.

Dichotomy of the tooth germ:-
Occurrence of supernumerary teeth has been ascribed to a dichotomy of tooth buds.\textsuperscript{3,24} This theory of the origin of supernumerary teeth has gained some credibility from Berkovitz and Thomson’s study\textsuperscript{25} which involved observations on the aetiology of supernumerary upper incisors in the albino ferret. Further support for this theory came from clinical findings that supernumerary teeth were more likely to occur in cases that had supernumeraries in the primary dentition.\textsuperscript{25-28} Depending on this interpretation, a tooth germ may divide, forming another germ.\textsuperscript{5,29} Such splitting could result from some external interference not directly related to the process of tooth formation itself.\textsuperscript{30,31} This division may be equal, resulting in a supplemental supernumerary tooth,\textsuperscript{32} or unequal resulting in a malformed supernumerary. The latter may explain the formation of the conical type of supernumerary tooth.\textsuperscript{4} Almeida\textsuperscript{17} favoured the dichotomy hypothesis for the supplemental premolars. However, Shafer et al.\textsuperscript{7} did not favour the possibility of the splitting tooth bud as the origin of a supernumerary tooth, arguing that in most cases, associated permanent teeth are normal in all respects.

If a supernumerary tooth is the result of the splitting of a tooth germ, we would expect the developmental stage of this supernumerary tooth to be approximately the same as that of the normal tooth which the supernumerary tooth is thought to have originated from. This appears not to be the case in many instances. For example, it has been found that there is an orderly variety of different stages of dental development of the supernumerary teeth found in the premolar region compared to the erupted premolars, from the enamel cap through to a fully developing supernumerary tooth.\textsuperscript{33} Thus, late developing supernumeraries, occasionally found in the premolar region, cannot be accounted for by dichotomy of the tooth bud phenomenon. So, it may be that different supernumeraries have different aetiologies even for those teeth which have been found in the same region.

Heredity:-
Genetic factors were considered to be important in the aetiology of supernumerary teeth.\textsuperscript{7,13,34,35} In a survey of 200 patients with supernumerary teeth, Stafne\textsuperscript{13} found that there was a definite genetic involvement in 90 percent of his cases.

A familial disposition has been demonstrated in ten out of twenty-three cases.\textsuperscript{36} In a more extensive familial study, Brook\textsuperscript{37} reported that supernumerary teeth were present more frequently in the first-degree relatives of affected children than in the general population, suggesting a significant genetic component in the aetiology. Full responsibility of genetic factors for the occurrence of supernumerary teeth has been concluded by Foster\textsuperscript{38} excluding any effect of environmental variables.

A number of cases of familial occurrence and case reports of twins and siblings with supernumerary teeth have been reported\textsuperscript{39-43} providing more support to the genetic involvement in the aetiology. According to this theory, supernumerary teeth result from mutant genes. This is supported by the observation of a greater frequency of supernumerary teeth found in association with facial and dental anomalies such as cleidocranial dysostosis,\textsuperscript{44-47} cleft lip or cleft palate,\textsuperscript{48} Fabry’s disease,\textsuperscript{49} and Gardine’s syndrome.\textsuperscript{50} The bilateral presence of supernumerary teeth suggests that they may be controlled by a mutant gene.\textsuperscript{51} The occurrence of supernumerary teeth in most cases as an isolated dental finding was thought to be attributed to multi-genetic aetiology.\textsuperscript{52} The possibility of an autosomal dominant inheritance with a lack of penetration has also been proposed,\textsuperscript{29,33,34} although this is yet to be substantiated. The possibility of a sex-linked mode of inheritance has been referred to, because there is a greater frequency of supernumerary teeth in males than in females.\textsuperscript{55}
From the information available it seems that supernumerary teeth have strong genetic evidence for their aetiology, but do not appear to follow a simple Mendelian pattern. On the other hand, environmental factors may also have an effect.

**Progress zone:**
The progress zone theory, supplemented by a model, suggests that supernumerary teeth result from the hypermitotic potential of the elongating ends (progress zones) of the dental lamina in every tooth series or class.\(^{56-58}\) Thus, depending on this explanation of the origin of supernumerary teeth we would expect that the supernumerary teeth to occur as extra structures at the ends of incisor, canine or molar tooth classes. According to Lumsden “gradation in shape and size in the individually sequentially initiated elements of a series are expression of intrinsic time-dependent alterations in the growing cell population which form them”. In an attempt to explain the shape of mammalian teeth, Osborn\(^{56}\) in his model suggested that tooth class (i.e. incisor, canine and molar) results from cellular proliferation anteriorly and posteriorly from an original stem cell mass or stem progenitor. He has proposed that gradients in shape and size are attributable to the cell ancestry of the primordial tissue. Primordia that forms later develops from cells that have undergone more divisions than those that develop earlier. He suggested that gradients in tooth shape can be ascribed to a gradient in initial growth rates of successive primordia, which results from a decrease in growth rate of a clone of cells as it grows posteriorly. Hence, depending on this model the determination of tooth shape and size is intrinsic to a tooth class. This is contrary to that which has been proposed by Butler’s Field Theory\(^{59}\) which suggests that an extrinsic source, a morphogenetic gradient, determines the size and shape of teeth. Schwartz\(^{58}\) found that the occurrence of supernumerary teeth could be explained by either a progress zone or an interstitial budding model of tooth differentiation. Thus, evolutionary changes in tooth number could be interpreted by differences in potential within the context of normal development and the regulation of development, rather than the results of major developmental revolutions. It appears that the development of supernumerary molars may be clarified depending on this theory.

**Unified aetiologic explanation:**
A unified aetiology for anomalies of tooth number and size has been proposed.\(^{37}\) This is based on a multifactorial model that has a continuous scale, with thresholds related to tooth number and size. The position of any of the dental anomalies on this scale is determined by a combination of both genetic and environmental factors. This single model has explained the frequency, aetiology and associations of four dental anomalies (microdontia, hypodontia, megadontia and supernumerary teeth).

The model (see Figure 2.1) accounts for the sex differences in tooth size, the higher prevalence of hypodontia and microdontia in females, and the higher prevalence of supernumerary teeth and megadontia in males. It considers effects on the whole dentition, as this appears to behave as a single developmental system. This is in accordance with the finding stated by Bailit\(^{60}\) that when a third molar is congenitally absent, the permanent dentition is 13 times more likely to have hypodontia than the population prevalence. Similarly, others have shown that hypodontia of the third molars is associated with a higher incidence of hypodontia of the other teeth and delay eruption of the second molars.\(^{61-63}\) This model, which includes anomalies of tooth number and size, is based on experimental results and explains the presence of supernumerary teeth as well as other anomalies.

**Figure 1:** A unified aetiology for anomalies of tooth number and size Brook (1984), with an underlying scale of continuous variation for tooth number and size.

![Diagram of tooth anomalies](image)
Sequelae and consequences of supernumerary teeth:-
Abnormalities in dentition can be caused by supernumerary teeth. Anterior supernumerary teeth can cause more serious problems than posterior supernumeraries, wherein the most frequent complaint is one of aesthetics. Certain effects on the dentition can be attributed to specific types of supernumeraries. The most common sequelae of supernumerary teeth are listed below.

Malocclusion:-
Malocclusion has been reported as a common finding in cases with supernumerary teeth.\textsuperscript{64-67} Such teeth in the anterior region have a greater effect on the occlusion than those of the premolar and molar regions, because premolar and molar supernumeraries usually develop after most permanent teeth have erupted, and many of these unerupted supernumeraries are discovered as an incidental finding on routine radiographic examination.\textsuperscript{43}

Displacement of teeth of the normal series:-
Supernumerary teeth may cause different degrees of displacement of adjacent teeth.\textsuperscript{68} The most frequent supernumerary tooth to do so is the mesiodens. Indeed, this is the most common clinical complication encountered in orthodontics.

Macphee\textsuperscript{69} in his study of the incidence of erupted supernumerary teeth in 4,000 school children, found 5 cases (0.125\%) with malposition of the teeth that could be directly attributed to the presence of supernumerary teeth. Out of 100 non-cleft palate supernumerary tooth patients treated at the Sheffield Dental Hospital, 42 patients were found to have bodily displacement of the normal teeth.\textsuperscript{3} The explanation of this condition is that a supernumerary tooth developing adjacent to the crown of the normal permanent tooth on the dental lamina or tooth bud, displaced the crown of the normal tooth from its normal path of development. A supernumerary tooth, when erupting buccally, may cause lingual deflection of an incisor, that may then erupt in a rotated or cross-bite relationship.

Crowding and rotation of the normal teeth in the affected region:-
Erupted supplemental teeth are the most frequent supernumerary tooth types to cause crowding of the adjacent teeth. In 100 supernumerary tooth patients in Sheffield who had been examined by Gardiner\textsuperscript{3}, 21 had supernumerary teeth accompanied with the rotation of the central incisors.

Development of an abnormal median diastema:-
Midline supernumerary teeth can result in developing a median diastema.\textsuperscript{70} Thus, a suspicion of the presence of supernumerary teeth should be considered where a marked median diastema or rotations in the premaxilla exist.\textsuperscript{5} Ferguson et al.\textsuperscript{68} investigated the simultaneous occurrence of supernumerary teeth and diastemata. Their survey included full-mouth radiographs of 353 patients aged 16 years or older. They found two supernumerary teeth (an incidence of 0.57\%) and 36 diastemata (an incidence of 10.20\%), but no associated occurrence of the two conditions was reported in the same patient. This finding is likely to be related to the low number of supernumerary teeth seen. A more suitable approach would be to investigate diastemata in supernumerary teeth patients.

Possible effects during orthodontic treatment:-
Supernumerary premolar teeth tend to commence their development later than teeth of the normal series. Therefore, they might develop during the orthodontic treatment. Progress or end of treatment radiographs may show a developing supernumerary tooth which may not have been present on pre-orthodontic radiographs. These late forming supernumeraries may interfere with occlusal development or orthodontic mechanics, such as space closure (delayed or prevented) and root torque (resulting in resorption of adjacent roots).

Delay or failure of eruption of associated permanent teeth:-
Another common complication that might arise from the presence of extraneous teeth is the delayed eruption or impaction of the other teeth.\textsuperscript{66,71,72} Upper central incisors are the teeth most frequently found to be impacted due to the presence of supernumeraries, particularly those of tuberculate type.\textsuperscript{75}

Gardiner\textsuperscript{3} found that 28 percent of the supernumerary tooth patients in Sheffield were found to have delayed eruption of the upper permanent incisors. Thirty nine percent of 80 consecutive supernumerary tooth cases at the Eastman Dental Hospital, London, have been reported to have a failure of incisor eruption.\textsuperscript{76} A similar proportion (42\%) has been recorded by DiBiase.\textsuperscript{77} Howard\textsuperscript{72} reported the delayed eruption of incisors in 60 percent of supernumerary tooth patients. There is an association between a delayed eruption of normal teeth and some supernumerary features like
tuberculate type, odontome, large size, absence of or incomplete root formation and vertical direction.\textsuperscript{5,6,16,72,77-79} Bergström\textsuperscript{4} reported 13 impacted permanent teeth in 9 children out of 2,589 school children examined. Eight cases were due to the presence of supernumeraries. Nazif et al.\textsuperscript{5} surveyed 50 cases of patients with impacted supernumerary teeth. They found 30 percent of the sample had impacted eruption of permanent teeth, in particular in the maxillary anterior region.

Delayed eruption of maxillary permanent central incisors due to the presence of supernumerary teeth may result in an arch-length inadequacy because of the mesial movement of the lateral incisors.\textsuperscript{75} In addition, prolonged delayed eruption of the central incisors can cause underdevelopment of the dentoalveolar ridge of these teeth resulting in a complete failure of eruption.

**Gemination or fusion:**
The terminology concerning fused teeth is somewhat contradictory and the difficulty of distinguishing between gemination and fusion is evident.\textsuperscript{7} However, most authors agree that “fusion” is a union between normal teeth and “gemination” is a union between a normal tooth and one or more supernumeraries. Geminations occur in two forms, mesially or distally, resulting in displacement of the adjacent teeth and bucco-lingually, resulting in a maloclusion in the opposing jaw.

Gardiner\textsuperscript{7} reported on 3 out of 100 cases of supernumerary tooth patients with gemination or fusion of permanent teeth. A similar number was found in the permanent teeth of 8,500 schoolchildren examined by Tinn.\textsuperscript{8} There is a significant delay in the eruption of the permanent teeth (particularly maxillary central incisors) when these teeth erupt before the permanent teeth.\textsuperscript{84} Interestingly, a dilaceration of the roots of the adjacent teeth has been reported.\textsuperscript{87} The increased incidence of dental caries has even been reported in the adjacent teeth. This is due to the creation of plaque-retaining regions inaccessible to oral hygiene.\textsuperscript{88} Other complications may be seen when supernumerary teeth arise in unusual places such as the nasal cavity. In such cases, symptoms like obstruction, headache, nasal discomfort, rhinitis caseosa, epistaxis and purulent rhinorrhea may be prevented by the surgical removal of intranasal teeth.\textsuperscript{93,94}

**Other consequences:**
Supernumerary teeth may also cause other consequences such as: cystic lesions that may develop around the crowns of the unerupted supernumeraries, similar to unerupted normal teeth,\textsuperscript{13,65,66,82,83} subacute pericoronitis,\textsuperscript{84} gingival inflammation,\textsuperscript{85,86} periodontal abscesses,\textsuperscript{13,87,88} odontomas, ameloblastoma formation in the walls of the follicle,\textsuperscript{89} and fistulae. Also, they may cause absorption of the roots of the adjacent permanent teeth\textsuperscript{90-92} or their own roots when they erupt before the permanent teeth.\textsuperscript{51} Interestingly, a dilaceration of the roots of the adjacent teeth has been reported.\textsuperscript{87} The increased incidence of dental caries has even been reported in the adjacent teeth. This is due to the creation of plaque-retaining regions inaccessible to oral hygiene.\textsuperscript{88} Other complications may be seen when supernumerary teeth arise in unusual places such as the nasal cavity. In such cases, symptoms like obstruction, headache, nasal discomfort, rhinitis caseosa, epistaxis and purulent rhinorrhea may be prevented by the surgical removal of intranasal teeth.\textsuperscript{93,94}

**Diagnosis of supernumerary teeth:**
Early diagnosis of supernumerary teeth is crucial to avoid or minimize complications that might arise from their presence. Both clinical and radiographic examination is necessary for detecting the presence of any supernumerary teeth.\textsuperscript{6,95} Clinically, a significant delay in the eruption of the permanent teeth (particularly maxillary central incisors) could be an important sign pointing to the suspicion of the existence of one or more unerupted supernumerary teeth.\textsuperscript{96} Often it is noticed that the adjacent teeth are tilted towards the space of the impacted teeth, or if these are highly placed, the neighbouring teeth may close the space by bodily movement. To localize clinically the position of the unerupted buccally positioned supernumerary tooth, palpation of the affected area is an important procedure in determining the location of the unerupted tooth.

Supernumerary teeth in the permanent dentition are more likely to be unerupted; those erupted are much less frequent than those in the primary dentition (25% versus 73%).\textsuperscript{13,36,97,98} Full radiographs are therefore extremely important in diagnosing the majority of permanent supernumeraries. Radiographs can show any supernumerary tooth in the anterior maxillary region from as early as the newborn period to adulthood. In addition, radiographs are essential in confirming the position of the supernumerary tooth and its relation to the neighbouring teeth, and the distance of the unerupted permanent teeth to the occlusal plane. It is important to localize the position of the
impacted supernumerary tooth before surgical removal. The parallax technique is a well known method for this localization, also called the horizontal shift technique. In this technique, two radiographs of the same object are taken from two different horizontal angles, but at the same vertical dimension. If the impacted tooth is located palatally to the reference tooth, it will move in the same direction as X-ray source, whereas it will move in the opposite direction if it is situated labially.

**Management and treatment:**

Undoubtedly many patients who have supernumerary teeth, especially in the anterior region, often seek treatment, because of the abnormality of the appearance of these teeth and their consequences. There are two choices of treatment of impacted supernumerary teeth with some controversy regarding the optimal treatment time and modality.

**Removal of the supernumerary tooth:**

It is generally recommended that supernumerary teeth are extracted and especially so if they are erupted. In a situation where the supernumerary tooth causes problems or complications are anticipated, early extraction is recommended. DiBiase advocated monitoring conical teeth because they are more likely to erupt early, but early removal of other forms of supernumeraries, like the tuberculate type which is unlikely to erupt and frequently delays the eruption of the adjacent teeth, is recommended. Munns mentioned that the earlier the removal of a supernumerary tooth causing complications, the better the prognosis. Self-correction of severely rotated and impacted mandibular permanent incisors was attributed to the early removal of the causative supernumerary tooth by Nuvvula et al. Others were unable to show any differences between early and late removal of the supernumeraries in the prognosis of the adjacent permanent teeth. Particular care should be taken however when surgical removal of a supernumerary tooth occurs during the primary dentition period, because of the risk of displacing the permanent tooth during the operation. However, whilst some authors advise immediate removal of supernumerary teeth following the diagnosis of their presence, others advocate to delay their extraction until the root development of the central and lateral incisors has completely occurred, at about the age of eight to ten years. Munns mentioned that the earlier the surgical removal of the unerupted anterior supernumerary teeth to be from 6.1 to 7.0 years to avoid associated complications. The risks of early removal of unerupted supernumerary teeth must be considered. These mainly include damage to the adjacent teeth (e.g. the loss of vitality) and malformation of the root. In addition, such early surgical intervention could have a deleterious effect on the psychological condition of a young child, thus jeopardizing co-operation with future operative dental treatment.

Surgical removal of supernumeraries in the mandibular premolar region may cause serious damage to surrounding structures, including the inferior alveolar and mental nerves, the inferior border of the lower jaw and the roots of the adjacent teeth. In the maxilla complications may include perforation of the maxillary antrum, pterygomaxillary space or orbit. In addition, ankylosis of the adjacent teeth may occur if any damage to the dental follicle or enamel epithelium of the roots of the permanent teeth is sustained during the course of surgical removal. Sometimes, in the absence of any of the sequelae of the existence of the supernumerary teeth or when early surgical removal is risky, late removal can be carried out. In such cases of postponement of the surgical intervention, some undesirable effect might occur, e.g. limited eruptive forces of the adjacent teeth and subsequent mesial movement resulting in loss of the arch space in the anterior region, and a midline shift, and the possibility of the need for extensive surgical/orthodontic treatment.

For supplemental supernumerary teeth, it is difficult to distinguish the normal tooth from its supplemental twin. In such cases, if both teeth are equally well formed, the most displaced one should be selected for extraction.

**Maintenance of the supernumerary tooth, with a periodic follow-up:**

In cases where a supernumerary tooth could be “useful” for orthodontic reasons, or if it is found in a location where a surgical removal is quite dangerous and the supernumerary tooth does not interfere with eruption or orthodontic movement of the permanent dentition, or is not associated with any abnormality, maintenance of the supernumerary tooth in situ with a regular clinical and radiographic monitoring is advised. Such monitoring excludes any pathological change that might occur at a later date. In such cases where the teeth remain impacted, they may erupt later and disrupt the occlusion. In addition, cystic lesions or resorption of the adjacent teeth may occur. However, Bodinet stated that only 2 percent of impacted supernumeraries in the premolar region showed consequences. Thus, they could be left without the risk of the surgery.
Recurrence of supernumerary teeth has been mentioned by some authors.\textsuperscript{118-120} Morgan\textsuperscript{66} reported a case in which three supernumerary premolars reappeared five years later after extraction, along with additional teeth of the same type. Poytonet al.\textsuperscript{121} reported the re-occurrence of three mandibular supernumerary premolars, two on the left and one on the right, similar to the first set discovered, five years after removal of the first set, along with two left maxillary supernumerary premolars which were not present at the time when the first set of the mandibular supernumeraries were discovered. The mechanism underlying this is unknown.

If there is a need for orthodontic treatment, particular care should be taken in moving any permanent teeth dilacerated by supernumeraries. In mild cases the movement of these teeth can be done, but in severe cases the apical dilacerated portion of the root often resorbs during tooth movement.

Considering the delay or failure of eruption of the maxillary central incisors associated with the presence of supernumeraries, if the patient is young and the primary central incisors are overretained, the primary teeth should be extracted straight away (along with the supernumeraries if they inhibit the development of the permanent adjacent teeth), with a periodic follow up to observe any improvement in the development of the succedaneous teeth. A maxillary removable appliance should be fitted to maintain the space in the incisor region. In most cases (nearly 75\%), spontaneous eruption of the impacted teeth will occur following the removal of the supernumeraries.\textsuperscript{36,104,122-124} The time required for these impacted teeth to emerge may vary between sixteen months and three years.\textsuperscript{4,104,106} However, Hattab et al.\textsuperscript{124} stated that spontaneous eruption and alignment of the permanent central incisors occurs within six to eight months following early extraction of the supernumeraries, provided adequate arch-space is available and the impacted tooth is in a favourable (vertical) position. Different factors play a part in this variation reported. These include the type of supernumerary tooth, the position of the impacted teeth and to what extent they are displaced and inclined, the space available within the arch for them to erupt and the time of diagnosis and surgical intervention.\textsuperscript{16,104} Other factors, such as chronological age of the patient as well as status of the root (maturity, inclination and curvature), seem to have little effect.\textsuperscript{104} If, after a sufficient time (six months), no appreciable spontaneous eruptive movements of the impacted teeth have occurred (this is more likely to occur if they are close to their normal eruption path), then surgical exposure of the unerupted tooth crown should be undertaken. This will enhance the possibility of spontaneous eruption, in approximately 85 percent of cases.\textsuperscript{123} Orthodontic traction should be applied if spontaneous eruption does not occur after surgical removal,\textsuperscript{5} to bring the unerupted impacted tooth into proper alignment. One approach is to carry out surgical removal of the supernumerary tooth and exposure of the unerupted tooth at the same time, with or without applying a bonded attachment or ligature for orthodontic traction. The disadvantage of this approach is the difficulty of obtaining a good gingival margin, particularly in relation to the neighbouring teeth. For orthodontic traction, a force of about 1 to 2oz was advised rather than heavy forces for the adequate movement and a good gingival condition.\textsuperscript{110} Moreover, to have sufficient gingival tissue attachment, an apically repositioned flap is favoured in some cases rather than a window technique for exposing the crown of the impacted tooth.\textsuperscript{5} The orthodontic technique usually involves using an elastic ligature that is placed from an arch wire to a bracket directly bonded to the tooth.

Conclusions:

1. The mechanism by which supernumerary teeth arise is not yet known. However, many theories have been suggested to explain how this anomaly occurs in the dentition and there may be different aetiological explanations for different types of supernumeraries.

2. Anterior supernumerary teeth can cause more serious problems than posterior supernumeraries. The most common sequelae of supernumerary teeth are displacement of teeth of the normal series, crowding and rotation of the normal teeth in the affected region, development of an abnormal median diastema, interference with occlusal development or orthodontic mechanics during orthodontic treatment, delay or failure of eruption of associated permanent teeth and gemination or fusion.

3. Early diagnosis and detection of supernumerary teeth is crucial to avoid or minimize such complications including both clinical and radiographic examination.

4. There are two choices of treatment of supernumerary teeth namely removal or maintenance of the supernumerary tooth, with a periodic follow-up depending on several factors.
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