

Prevalence, Characteristics, and Morphology of Supernumerary Teeth among Patients Visiting a Dental Institution in Rajasthan

Abstract

Context: Supernumerary teeth/tooth (ST) is a developmental anomaly of dentition. Variation in developmental and eruption pattern of ST can lead to the development of numerous complications in oral cavity. **Aim:** The aim of this study was to investigate prevalence, characteristics, and morphology of ST among patients visiting a dental institution in Rajasthan, India. **Materials and Methods:** During 1-year study, clinical examination of 9248 participants was performed. Morphology, type, location, number, position of eruption, state of eruption of ST, and associated complications were determined. Correlations between location of ST based on position of eruption, state of eruption, and associated complications were also determined using Chi-square test. **Results:** The frequency of presence of ST in the studied population was 0.63% (58 participants). In these 58 participants, eighty-two supernumeraries were found. Forty-six participants (79.32%) presented with one ST. Males were more affected than females (2.05:1), and the maxilla was the most commonly affected region. Among 82 identified supernumeraries, we noted highest incidence of parapremolars (39.02%) and conical morphology (46.35%). The most common position of eruption was normal (68.30%) and most of these 82 teeth were erupted in oral cavity (57.31%). These ST have led to various endodontic, orthodontic, periodontal, and other complications in the studied population. The relation of varying complications with different location of supernumerary was found to be highly significant ($P = 0.000$). **Conclusion:** ST are best detected and diagnosed by thorough clinical examination and radiographic investigation. Early detection and adequate treatment plan should eradicate the potential future complications caused by ST.

Keywords: Complications, incidence, supernumerary, tooth, unerupted

Introduction

Altered pattern of eruption of human dentition is characterized by modification in either number, morphology, location, type, position, eruption, or shape of teeth. Any alteration or disturbance with the stage of initiation may result in the development of supernumerary teeth/tooth (ST). A ST is one that is additional to the normal series of dentition resulting from the formation of teeth in excess of the normal number.^[1-4]

The frequency of presence of ST in permanent dentition varies from 0.1% to 3.6% in the general population.^[5] Familial tendency has been reported in the literature by Marya and Kumar and Gallas and García.^[6,7] The presence of ST may be part of various developmental disorders such as cleft lip and palate and cleidocranial dysostosis.^[8] They can be found in almost any region of the dental arch but occur more

frequently in the anterior maxilla. ST may occur singularly or in multiples; unilaterally or bilaterally; erupted or impacted; and in one or both jaws.^[3,9,10] While there is no significant sex distribution in primary ST, males are affected approximately twice as frequently as females in the permanent dentition.^[11-13] However, Mitchell^[14] reported that females are more commonly affected than males with a 2:1 ratio in permanent dentition.^[15]

The theories that have been suggested for their occurrence include “phylogenetic theory” (Smith, 1969), the “dichotomy theory” (Liu, 1995), a hyperactive dental lamina (Primosh, 1981; Brook, 1984), and a combination of genetic and environmental factors – unified etiologic explanation (Brook, 1984). Classification of ST can be on the basis of morphological forms and location in the dental arch. Morphological variations include conical, tuberculate, and supplemental teeth.^[16]

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Based on location in dental arch, ST can be classified as mesiodens, parapremolar, paramolar, distomolar, or supernumerary lateral incisor. Orientation of these teeth can be described as “normal/vertical,” “oblique,” “inverted,” or “transverse.”^[17]

Numerous complications may develop resulting from the presence of ST which include crowding, delayed or failure to eruption, impaction of permanent incisors, spacing, midline diastema, alteration in the path of eruption of permanent incisors, cystic lesions, rotation, root resorption of the adjacent teeth or even, intraoral infection, eruption of incisors in the nasal cavity, and retained deciduous teeth.^[2] Extraction of ST is sole treatment of choice; in case, they are involved in any dental or maxillofacial complication.

The aim of this study was to investigate these patterns of ST among patients visiting a dental institution and to review epidemiology, etiology, classification, diagnosis, complications, and management of ST.

Materials and Methods

This prospective clinical study was conducted on participants who reported or were referred to the department for treatment during March 2016 to February 2017. Diagnostic criteria for ST were established to be the tooth which is additional to the normal series and examined clinically or radiographically. These teeth were assessed for their location, morphology, number, state and position of eruption, and associated complications. Chi-square test was employed to compare and correlate location of ST based on the position of eruption, state of eruption, and associated complications. Ethical approval was obtained from the Institutional Review Board.

Results

Among the 9248 participants examined, 5734 were male and 3514 were female. Fifty-eight (0.63%) participants presented with 82 ST. The age of these 58 participants ranged from 12 to 70 years (mean age: 32.36 years). Out of these 58 participants, 39 were male (67.25%) and 19 were female (32.75%) with male-to-female ratio of 2.05:1 [Table 1]. Furthermore, out of 5734 males, 39 were having ST (0.68%), and out of 3514 females, 19 females (0.54%) were affected. In 42 participants, only maxilla was involved, only mandible was involved in 12 participants, and both jaws were involved in 4 participants.

Out of 58 participants:

- Seventeen participants had mesiodens, 16 participants had parapremolars, 10 participants had paramolars, 7 participants had distomolars, and 5 participants had supplementary lateral incisors. Two participants had parapremolar as well as paramolar. One participant had parapremolar and mesiodens [Table 2]
- Forty-six participants (79.32%) had only one ST, seven participants (12.06%) had two ST each,

two participants (3.45%) had three ST each, one participant (1.72%) had four ST, and two participants (3.45%) had six ST each [Table 3]

- Thirty-four participants (20 males and 14 females) had unilateral involvement, 14 participants (12 males and 2 females) involved midline, and 10 participants (7 males and 3 females) were bilaterally involved [Table 1]
- In 27 participants (46.55%), the presence of ST was surprisingly incidental finding on radiographic examination
- In 20 participants (34.48%), these ST lead to endodontic complications in adjacent permanent teeth such as caries (7 participants), root resorption (12 participants), and discoloration (1 participant). Orthodontic complications such as compromised esthetics (4 participants), spacing (4 participants), crowding (2 participants), restriction in orthodontic movement (3 participants), prevent eruption (3 participants), or displacement (2 participants) of adjacent tooth/teeth occurred in 18 participants (31.03%). Eight cases (13.80%) had periodontal problems such as poor oral hygiene (6 participants) and periodontitis of adjacent teeth (2 participants). Eight participants (13.80%) had other complications which include irritation to the tongue (4 participants), and one participant each was

Table 1: Gender and side distribution (58 participants)

Side involved	Gender		Total (%)
	Male	Female	
Unilateral	20	14	34 (58.62)
Bilateral	7	3	10 (24.13)
Midline	12	2	14 (17.25)
Total (%)	39 (67.25)	19 (32.75)	58

Table 2: Distribution/frequency of supernumerary teeth

Type	Frequency (58 participants), n (%)	Frequency (82 teeth), n (%)
Mesiodens	17 (29.31)	18 (21.95)
Distomolar	7 (12.06)	9 (10.98)
Parapremolar	16 (27.58)	32 (39.02)
Paramolar	10 (17.24)	17 (20.73)
Lateral incisor	5 (8.64)	6 (7.32)
Mixed	3 (5.17)	-
Total	58 (100)	82 (100)

Table 3: Number of supernumerary teeth present

Number	Frequency (58 participants) (%)
One	46 (79.32)
Two	7 (12.06)
Three	2 (3.45)
Four	1 (1.72)
Five	0 (0.00)
Six	2 (3.45)

diagnosed with maxillary sinusitis, dentigerous cyst, ossifying fibroma, and irritation to buccal mucosa and associated with ST. Rest four participants (6.89%) had no complication or problem with the presence of ST.

Out of 82 ST identified:

- Parapremolars (32) were most commonly present followed by mesiodens (18), paramolar (17), distomolar (09), and supernumerary lateral incisors (6) [Table 2]
- Thirty-eight teeth were conical in shape, 28 teeth were supplemental, and 13 teeth were tuberculated; however, morphology of 3 parapremolars was not defined. Out of 38 conical teeth, 17 were mesiodens and 10 were paramolars, and out of 28 supplemental teeth, 23 were parapremolars [Table 4]
- Forty-seven teeth were erupted in oral cavity while 35 teeth were unerupted and detected in radiographs. All supernumerary lateral incisors were erupted in oral cavity. Majority of mesiodens and paramolar were erupted in oral cavity; however, parapremolars were unerupted in majority of cases [Table 5]. However, the state of eruption was not significantly related to location of ST [Table 6]
- Considering the sagittal position, 56 teeth were in the normal position of eruption, 18 were in an oblique position, and 7 were transverse position of eruption. Only one supernumerary (mesiodens) was found in the inverted position of eruption. Majority of subphenotypes of ST were mostly having normal position of eruption [Table 7]. However, the position of eruption was not significantly related to the location of ST [Table 6].

Certain striking and distinctive significant features and findings of our study include:

- Subphenotypes of ST also presented gender preference: midline and premolar regions were more affected in males, while molar regions were more affected in females [Table 8]
- No family history or predilection was found in any of the participants. As the age ranged from 12 years to 70 years, all participants belonged to permanent dentition phase
- None of the participant was affected or diagnosed with any syndrome

- There was no case in which any permanent tooth/teeth were congenitally missing due to presence of ST
- Erupted ST led to orthodontic complications in majority of cases while unerupted ST led to endodontic complications in majority of cases [Table 9]. Eleven mesiodens caused orthodontic complications. Thirteen parapremolars and 13 paramolars caused endodontic complications each [Table 10]. The associated complications were significantly related to location of ST [Table 6]
- Two participants had three parapremolars each [Figure 1a and b, respectively]
- One participant had three erupted paramolars and one unerupted parapremolar (unerupted) [Figure 1c]
- One unerupted parapremolar in tooth bud stage was found in 12-year-old female whose morphology was also not well defined but was in normal position of eruption [Figure 1d]
- One participant had six parapremolars [Figure 1e]
- One participant had three parapremolar and three paramolar [Figure 1f]
- One participant had two unerupted parapremolars whose morphology was also not well defined and was present strangely in transverse position of eruption. These parapremolars led to development of ossifying fibroma of the right maxilla [Figure 2a and b]
- In one case, unerupted parapremolar was ectopically present within maxillary sinus and led to development of maxillary sinusitis [Figure 2c]
- One participant was diagnosed with dentigerous cyst of the anterior maxilla due to unerupted mesiodens, present palatally [Figure 2d].

Discussion

The presence of ST in dental arch is a notable developmental dental anomaly of morphogenesis and patterning.^[3] Numerous theories have been put forward to explain the development of ST. The “phylogenetic theory” states that ST develop as a result of the atavism or reversional phenomenon. Fourth molars or parapremolars may be an atavistic manifestation of the primitive dentition.^[18] However, atavism cannot explain the appearance of ST in the canine and midline regions. The “dichotomy theory” explains the development of ST as a result of dichotomy of the tooth bud in two parts of

Table 4: Morphology and location

Location	Morphology				Total (%)
	Conical	Tuberculated	Supplemental	Not defined	
Mesiodens	17	0	1	0	18 (21.95)
Distomolar	3	6	0	0	9 (10.97)
Parapremolar	5	1	23	3	32 (39.02)
Paramolar	10	6	1	0	17 (20.73)
Lateral incisor	3	0	3	0	6 (7.31)
Total (%)	38 (46.35)	13 (15.85)	28 (34.15)	3 (3.65)	82

equal or different sizes, which results in the formation of two teeth of equal size or one normal and one dysmorphic tooth, respectively.^[19] Another theory is the hyperactivity theory, which suggests that ST are formed as a result of local, independent, and conditioned hyperactivity of the dental lamina.^[20,21] Heredity may also play a contributory role in the occurrence of this entity. ST are seldom more

common in the relatives of affected individuals than in the general population. Niswander and Sujaku^[22] hypothesized that an autosomal recessive gene with less penetrance in females may lead to the development of ST. Till now, it is extremely difficult to establish a clear and precise etiology for ST formation.

The frequency of occurrence of ST in permanent dentition varies from 0.1% to 3.6% in the general population.^[3] According to Shilpa *et al.*, the prevalence rates of children with hyperdontia were 0.21%.^[23] In our study, we found a frequency of 0.63% in general population. Brook found that ST were present in 2.1% of permanent dentitions.^[24] Mason *et al.* reported that the incidence was around 1.5%–3.5% in the permanent dentition.^[25]

We found participants with multiple ST, representing almost one-fifth (20.68%) of the total affected cases. In literature, it has been reported that single ST occurs in 76%–86% of cases, double ST in 12%–23% of cases, and multiple ST in <1% of cases.^[26] Results in our study were also similar to those reported in the literature [Table 3]. We did not find any participant, who had multiple ST, suffering from any systemic disorder or syndrome such as cleft lip and palate, cleidocranial dysplasia, and Gardner syndrome. Young participants who have history of conical or tuberculate ST have a predilection of 24% for the development of multiple ST in premolar and molar regions at later age.^[27,28] The presence of ST may be part of developmental disorders such as cleft lip and palate (in 22.2% cases), Fabry-Anderson syndrome, cleidocranial dysostosis, Gardner’s syndrome, Goldenhar syndrome, Marfan syndrome, Ellis–Van Creveld syndrome (chondroectodermal dysplasia), Ehlers–Danlos syndrome Type III, incontinentia pigmenti, Hallermann–Streiff syndrome, orofacioidigital syndrome Type I, Nance–Horan syndrome, and trichorhinophalangeal syndrome.^[3,8,29,30]

Different morphological types of ST as described include conical, tuberculate, and supplemental, and based on location, they are classified as mesiodens, parapremolar, paramolar, distomolar, and supplemental lateral incisor. A conical ST is small, peg-shaped tooth with normal root morphology [Figure 3a]; a tuberculate ST is short, barrel-shaped, multi-cusped teeth with normal appearing crown and invaginated but rudimentary root [Figure 3b]. A supplemental ST is almost or nearly duplication of one of the teeth in normal series [Figure 3c]. The small peg-shaped conical ST usually presents as mesiodens. In most cases, the tooth is normally erupted. It may occasionally be present high into the palate in inverted [Figure 3d]

Table 5: State of eruption and location

Location	State of eruption		Total
	Erupted	Unerupted	
Mesiodens	12	6	18
Distomolar	5	4	9
Parapremolar	13	19	32
Paramolar	11	6	17
Lateral incisor	6	0	6
Total (%)	47 (57.31)	35 (42.68)	82

Table 6: Pearson correlation between parameters (variables)

Variables	Pearson χ^2	Significant
State of eruption and location of teeth	9.146	0.058
Position of eruption and location of teeth	12.436	0.411
Location of teeth and associated complications	52.477	0.000*

*Statistically significant

Table 7: Position of eruption and location

Location	Position of eruption				Total
	Normal	Oblique	Inverted	Transverse	
Mesiodens	13	2	1	2	18
Distomolar	5	4	0	0	9
Parapremolar	19	9	0	4	32
Paramolar	13	3	0	1	17
Lateral Incisor	6	0	0	0	6
Total (%)	56 (68.30)	18 (21.95)	1 (8.53)	7 (1.22)	82

Table 8: Gender and location

Location	Gender	
	Male	Female
Mesiodens	13	4
Distomolar	3	4
Parapremolar	11	5
Paramolar	6	4
Lateral incisor	4	1
Mixed	2	1
Total	39	19

Table 9: State of eruption and complications

State of eruption	Complications					Total
	Endodontic	Orthodontic	Periodontic	Others	Nil	
Erupted	7	13	7	5	3	35
Unerupted	13	5	1	3	1	23

Table 10: Location and complications

Location	Complications					Total
	Endodontic	Orthodontic	Periodontic	Others	Nil	
Mesiodens	2	11	-	4	1	18
Distomolar	1	2	3	-	3	9
Parapremolar	13	2	6	4	7	32
Paramolar	13	-	2	1	1	17
Lateral incisor	1	4	-	-	1	6
Total	30	19	11	9	13	82

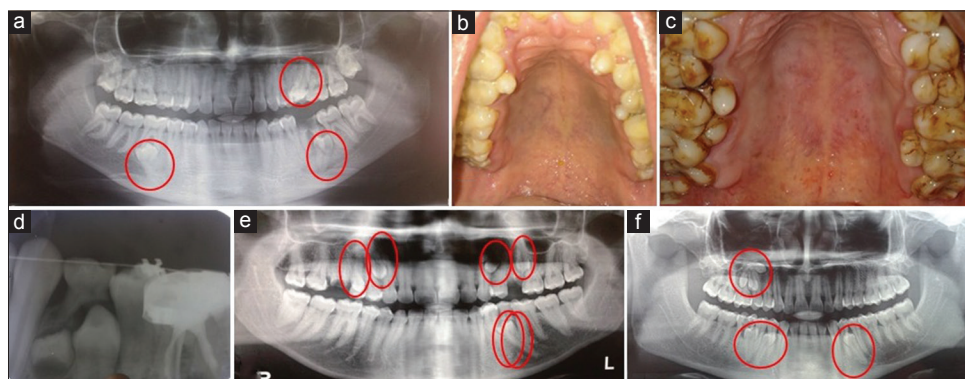


Figure 1: Multiple supernumerary teeth. (a and b) Three parapremolars each. (c) Three erupted paramolars. (d) Unerupted parapremolar in tooth bud stage. (e) Six parapremolars. (f) Three parapremolar and three paramolar

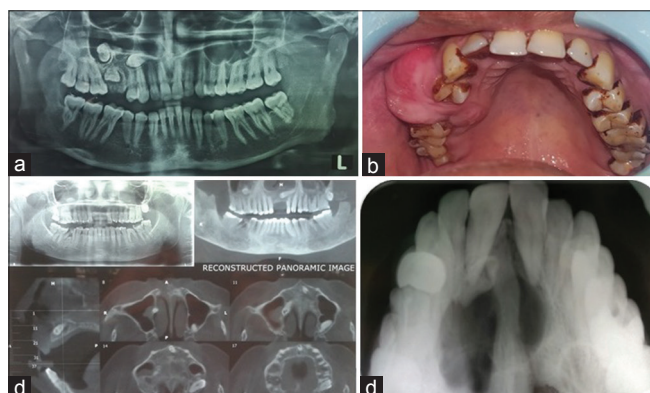


Figure 2: Pathologies associated with supernumerary teeth. (a and b) Ossifying fibroma. (c) Chronic maxillary sinusitis. (d) Dentigerous cyst

or transverse position [Figure 3e]. The most common supplemental tooth reported is the permanent maxillary lateral incisor [Figure 3f], but supplemental premolars [Figure 3c] and molars have also been reported.^[4] Nuvvula *et al.* reported a case of impacted maxillary permanent central incisors related to supplemental maxillary central incisors, with one of them showing an unusual talon cusp.^[31] However, in our study, parapremolars (23) outnumbered supplemental lateral incisors (3) in total supplemental ST (28) [Table 4].

A mesiodens is a ST present between the maxillary central incisors [Figure 3a]; a paramolar are those occurs buccally or palatally to erupted molars [Figure 3g],

while a distomolar is a fourth permanent molar which is usually placed either distal or distolingual to the third molar [Figure 3h]. A parapremolar [Figure 3c] lies buccal or palatal or lingual to premolars while a supernumerary lateral incisor is present between incisors or between lateral incisor and canine [Figure 3f].^[32-35] Shapira and Kuftevec reported the order of frequency of ST in permanent dentition as being maxillary central incisors, molars, and premolars, followed by lateral incisors and canines.^[36] The conical shape (46.35%) was the most frequently observed morphology in our study, followed by the supplemental (34.15%) and tuberculate (15.85%) shapes, which corroborates previous findings. Out of 82 ST identified, parapremolars (32) were most commonly present followed by mesiodens (18), paramolar (17), distomolar (9), and supernumerary lateral incisors (6).

Our study is also in accordance with the majority of the studies that describe maxilla as the most common site involved with ST.^[31] However, contradictorily, Yusuf reported 60.9% involvement of the mandible and to be more specific, 44.8% involvement of the mandibular premolar region.^[29] The presence of ST in both jaws in the same participant is very rarely reported in the literature. In our study also, in only four participants [Figure 1a, e and f], ST were present in both jaws. There is also gender predilection with the presence of subphenotypes of ST: midline and premolar regions are more affected in males, while incisor and canine regions are more affected in females.^[3,37] In our study, we noted that midline (13 participants) and premolar (11 participants) regions were more affected

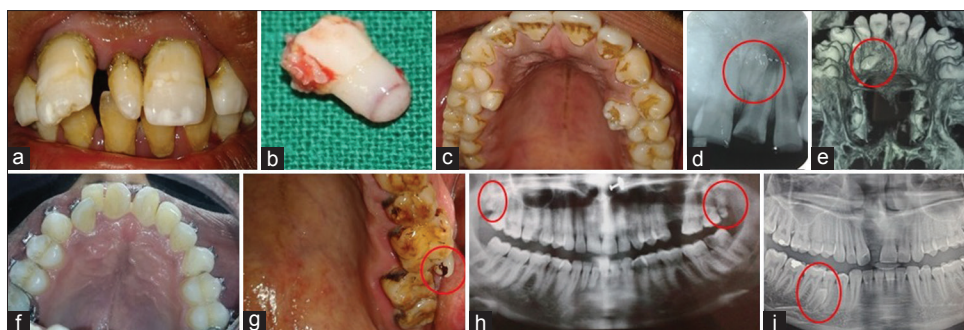


Figure 3: Varying locations and morphologies of supernumerary teeth. (a) Mesiodens (Conical ST). (b) Distomolar (Tuberculate ST). (c) Supplemental parapatremolars. (d) Inverted mesiodens. (e) Mesiodens in transverse position. (f) Bilateral supplemental lateral incisor. (g) Paramolar. (h) Distomolar - Bilaterally. (i) Impacted parapatremolar causing root resorption of permanent second premolar

in males; however, molar (8 participants) and premolar (5 participants) regions were more affected in females.

ST can lead to various odontogenic and maxillofacial complications. The presence of mesiodens is the most common cause for the delayed or failure of eruption of a maxillary central incisor or retention of the primary incisor. Ectopic eruption of mesiodens has also been documented, with rare presence in the nasal cavity.^[38,39] King and Lee reported a case where mesiodens erupted in the nasal cavity.^[40] A retrospective study by Asaumi *et al.* revealed that midline diastema was present in 10% of cases with ST.^[41] ST in other regions intraorally also may cause failure of eruption of adjacent permanent teeth. Nuvvula *et al.* reported the presence of three ST in the mandibular right permanent incisor area resulting in impacted permanent central and lateral incisors in a 14-year male patient.^[42] In our study, there were no cases in which there was delayed or failure of eruption of any permanent teeth due to the presence of ST. However, midline diastema was present in 8 cases out of 18 cases in which mesiodens were present [Figure 3a]. Erupted supplemental teeth often cause crowding. Supplemental lateral incisor/s may cause crowding in the maxillary anterior region [Figure 3f].

It has been reported that cyst formation due to impacted ST was found in 11% of the cases.^[41,43] Primosch also reported dentigerous cyst formation due to impacted ST in 4%–9% of cases.^[20] In our study also, we found one participant with dentigerous cyst of the anterior maxilla due to unerupted mesiodens, present palatally [Figure 2d]. Nonsyndromic multiple impacted ST have been reported to be associated with peripheral giant cell granuloma,^[44] florid cemento-osseous dysplasia,^[45] etc., We encountered a case of ossifying fibroma of the right maxilla associated with two unerupted parapatremolars [Figure 2a and b]. The ectopic development of ST has been reported in many locations including the nasal cavity, maxillary sinus, and chin. Erkmen *et al.* first described a case in which a ST ectopically erupted in the maxillary sinus in a 11-year-old boy.^[46] Saleem T *et al.* described a case of an ectopic, supernumerary molar tooth in the maxillary

antrum presenting with hemoptysis.^[47] We diagnosed maxillary sinusitis in 70-year-old female associated with unerupted parapatremolar, ectopically present in maxillary sinus [Figure 2c].

Root resorption of permanent tooth due to adjacent supernumerary can lead to loss of vitality of tooth [Figure 3i].^[2,48] We found 12 cases with root resorption of permanent adjacent teeth caused due to the presence of unerupted supernumeraries. ST may also lead to deposition of plaque and calculus as their presence may hamper proper toothbrushing. It may also cause subsequent development of periodontitis of either ST or adjacent tooth also. Abnormally erupted ST in dental arch may cause irritation to tongue or buccal mucosa. Occasionally, ST are not associated with any adverse effects and may be detected as a chance finding during radiographic examination.^[2]

The treatment options for managing complications occurring due to ST depend on their orientation, state of eruption, number, and position. There are two schools of thoughts for the extraction of ST. The delayed approach favors any intervention after apical maturation of the permanent teeth and opposes immediate removal of ST if there are no associated pathologies.^[49] The immediate approach recommends the removal of ST immediately after the initial diagnosis of their presence.^[20] Based on a retrospective analysis, Omer *et al.* reported that the ideal age of the removal of unerupted ST is 6–7 years.^[50] In our study, ST were extracted in 38 participants while affected permanent teeth were extracted in 2 participants to manage further complications. In 11 participants, both involved ST and affected permanent tooth were extracted. In three participants, no treatment was performed while four participants were not willing for any treatment.

Conclusion

ST are extra to normal complement in both dentitions. Males are predominantly affected by ST. ST may occur unilaterally or bilaterally and single or multiple and may involve any region of the dental arch. A range of complications is associated with ST which varies from

crowding to cyst formation and other pathologies. Early identification and proper treatment planning are very essential for the management of complications associated with ST.

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Conflicts of interest

There are no conflicts of interest.

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