

Radiographic Assessment of Pattern and Distribution of Anomalies in Tooth Number among Ghanaian Patients

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Abstract

Background: Hypodontia is one of the prevalent anomalies in the developing dentition. Together with hyperdontia, they are more common in the permanent than in the primary dentition and may occur in isolation or as a feature as a syndrome. Although asymptomatic, they may cause functional, aesthetic and psychological problems.

Objectives: The purpose of this study was to assess the distribution and pattern of abnormalities of tooth number in the permanent dentition of patients attending the University of Ghana Dental School Clinic, Accra.

Materials and Method: In this study, a total of 79 panoramic radiographs of subjects aged 8-16 years were studied and examined for hypo and hyperdontia. The data was recorded and then analysed using SPSS-16.0 version.

Results: Hypodontia (70.9%) was more common than hyperdontia (29.1%). There were 120 congenitally missing teeth in 56 panoramic radiographs. Congenitally missing teeth were more common in females (53.6%) than in males (46.4%). When comparing the maxilla to the mandible, a greater number of congenitally missing teeth were found in the maxilla (56.7%) and in the right side of both jaws (53.3%). The most observed hypodontia type was mild to moderate hypodontia (two to five missing teeth). The third molars were the most congenitally missing teeth (33.3%) followed by mandibular second premolars and the maxillary lateral incisors with identical frequencies of 15.8%. Next came the maxillary second bicuspid (14.2%), the mandibular central incisors (9.2%) then the maxillary first premolar (4.2%) in decreasing frequencies. The missing teeth were mostly bilateral (62.5%). There were a total of 44 supernumerary teeth. Similar to congenitally missing teeth, there was a higher frequency of supernumerary teeth found in females (56.5%), in the maxilla (59.1%) and in the right side of the jaws (54.5%).

Most supernumerary teeth were observed in the premolar region (40.9%, n=18) and there were more commonly unilateral

Conclusion: In this population, hypodontia was more common than hyperdontia. Both congenitally missing teeth and supernumerary teeth tended to occur more commonly in females, in the maxilla and on the right side of the jaws.

Upon the exclusion of third molars, the most frequent congenitally missing teeth were the mandibular second premolars and the maxillary lateral incisors.

The most frequent supernumerary teeth were paramolars associated with premolars and mesiodens were the least frequent.

Key words: hypodontia, hyperdontia, pattern, distribution, Ghana

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Introduction

Iterations in tooth number occur **A** usually during the initiation or dental lamina stage of dental development. The alteration may produce extra teeth (hyperdontia) also known as supernumerary

teeth or congenitally missing teeth (hypodontia). Nonsyndromic tooth agenesis of the permanent teeth is the most common developmental dental anomaly.¹ The prevalence varies from 3% to 8.5%, excluding the third molars.^{2,3} Although values as low as 0.3% in Jerusalem and as high as 36.5% in a Caucasoid population have been recorded.⁴ The prevalence of hypodontia in the primary dentition has been reported as approximately 1%⁵.

Congenitally missing teeth may be classified as single tooth absence or mild to moderate hypodontia if two to five teeth are missing. The terms partial oligodontia and severe or advanced hypodontia are synonymously used

and refer to the congenital absence of six or more teeth, excluding the third molar.

Many studies have found the second premolars and/or upper lateral incisors to be the most frequently missing teeth.^{5,6,7} However, Chung reported the second premolars and the mandibular lateral incisors as the most frequently absent teeth in his study.⁸

Supernumerary teeth are named according to their shape or position. By shape they are classified as Conical, tuberculate, supplemental or odontomes. By virtue of position, those between the central incisors are mesiodens. Those occurring among the premolars and molars are paramolars while those distal to the molars are distomolars. They are usually associated with other syndromes such as Gardner's syndrome and Cleidocranial dysostosis and cleft lip and palate,^{2,9,10} although they also occur in isolation. The prevalence of hyperdontia in the permanent dentition is reported to vary between 0.1% and 3.8% and its prevalence in the primary dentition is found to be 0.3% - 0.8%.⁵ Although the etiology of hyperdontia is unknown, there is familial tendency.^{5, 9} Mesiodens have been reported as being the most frequently seen supernumeraries (47-67%) of the general population with distomolars being the least prevalent (26%).^{11,12}

Abnormalities in tooth number may be detected clinically or in radiographic images. Apart from the third molars that tend to be diagnosed after ten years of age, other absent permanent teeth can be diagnosed after six years of age. In general, the deciduous and permanent dentition are clinically visible at age three and 12-14 respectively.¹³

Although missing and supernumerary teeth are asymptomatic in most cases, they may lead to malocclusion and unsightly aesthetics causing social and psychological problems. Function may also be detrimentally affected.^{14, 15} The missing teeth may also cause mastication and occlusal disturbances.¹⁶

Supernumerary teeth may lead to stagnation and caries formation.

The effects of congenitally missing teeth depend largely on the amount of crowding that would have existed had the dentition been complete. The absence of a tooth may sometimes leave a space or help to relieve crowding and permit alignment of the remaining teeth. Treatment planning is influenced by whether the arch is crowded or not. Extraction of deciduous teeth, provision of a removable or fixed prosthesis, orthodontics or a combination of two or more of these usually results in satisfactory treatment.

Supernumerary teeth may be left well alone if they have no detrimental effect on the occlusion. If they erupt, they may be extracted. Most tuberculate, inverted conical and odontomes tend not to erupt and may have to be extracted surgically. The optimal timing of the surgical extraction is however debatable. Early intervention (before six years) would afford the normal erupting teeth the best opportunity to erupt in their normal positions but there may be damage to the adjacent developing teeth. Delayed treatment may decrease the eruption potential of the normal erupting teeth and cause displacement and rotations in the dentition.¹⁷ It has been suggested that mesiodens be extracted when the lateral incisors are just beginning to erupt.¹⁸ Early diagnosis is essential to ensure effective, simpler treatment planning and early intervention to improve aesthetics and function and prevent complications.

This study was conducted to determine the characteristics and pattern of hypodontia and hyperdontia using panoramic radiographs of 8-16 year olds attending the University of Ghana Dental School Clinic, Accra.

Subjects and Methods

This study was carried out on 79 pretreatment panoramic radiographs which showed either hyperdontia or hypodontia. The radiographs were of patients who visited the Department of Orthodontics and Paedodontics Clinic of the University of Ghana Dental School. The serial

panoramic radiographs were taken from 2007-2012 and retrieved from the folders of patients that were 8-16 years of age since within this age range all permanent tooth germs are observable in radiographs.

All radiographs were analysed by a single researcher using an x-ray viewer. The variables included gender, age, jaw affected (maxilla or mandible) and side of the jaws affected (left or right).

A tooth was considered as congenitally missing when it could not be identified or discerned radiographically on the basis of calcification and there was no evidence of extraction.^{3,13} Hypodontia was grouped as single tooth absence, mild to moderate (two to five missing teeth) and severe/oligodontia if six or more teeth were missing. Hyperdontia was grouped simply by the number of supernumerary teeth.

Patients with any systemic anomaly, especially cleft lip/palate, were excluded. This is because in such conditions tooth development has been tends to be delayed.

The data was analysed using SPSS-16.0 version.

Results

The majority of the 79 panoramic radiographs studied showed hypodontia (70.9%, n=56). Hyperdontia was observed in 29.1%, n=23 radiographs. (Table 1) The mean age of the subjects was 11.91 years.

Table 1 Distribution of hyperdontia and hypodontia in the understudied sample

	n	%
Hypodontia	56	70.9
Hyperdontia	23	29.1
Total	79	100.0

Hypodontia

A total of 120 congenitally missing teeth were observed in 56 panoramic radiographs and these included the third molars. Hypodontia was more common in females (53.6%, n= 30) than in males (46.4%, n=26).(Table 2)

This was however not statistically significant. (P>0.05)

Table 2 Distribution of congenitally missing teeth based on sex

	Females	Males	Total
n	30	26	56
%	53.6	46.4	100.0

Sixty-eight teeth were missing in the maxilla representing 56.7% of the total number of missing teeth. Fifty-two teeth were missing in the mandible representing 43.3%. There were more congenitally missing teeth on the right side (53.3%, n=64) than on the left side

Table 3 Distribution of congenitally missing teeth based on dental arch and side of jaws

	Mandible	Maxilla	Total	Right	Left	Total
n	68	52	120	64	56	120
%	56.7	43.3	100.0	53.3	46.7	100.0

(46.7%, n=56) of both dental arches. (Table 3) However the differences in frequencies in the maxilla and mandible and on the left and right sides of the jaws were not statistically significant. (p>0.05)

The third molars were the most common congenitally missing teeth (33.3%, n=40), with a higher frequency in the maxilla (60% = 24 teeth) than in the mandible (40% = 16 teeth). (Fig 1)

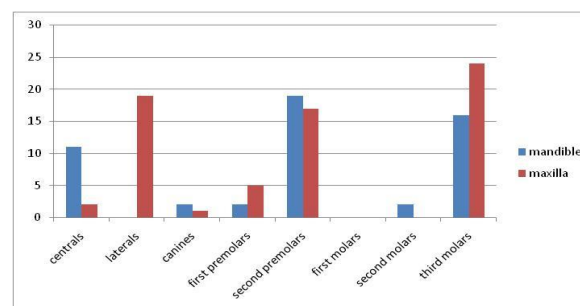


Figure 1: Distribution of subjects according to number of missing and supernumerary teeth in this understudied population

An equal number of mandibular second premolars and maxillary lateral incisors were seen to be absent (15.8%, n=19). These were followed by the maxillary second premolars (14.2%, n=17), the mandibular centrals (9.2%, n=11) and the maxillary first premolar (4.2%, n=5) in decreasing frequencies. Next were the maxillary centrals, mandibular canines, mandibular first premolars and mandibular second molars all of equal

frequencies(1.7%, n=2).

Of the congenitally missing teeth, maxillary canines had the least frequency of 0.8%. The mandibular lateral incisors, the first molars and the maxillary second molars were present in all the radiographs.(Fig 1)



Fig.1 shows missing bicuspid and one lateral incisor

The most observed hypodontia type was mild to moderate hypodontia (two to five missing teeth) in 34 panoramic radiographs(60.7%), followed by single tooth absence in 21 panoramic radiographs (37.5%) and then oligodontia in only one radiograph(1.8%). (Table 4)

Table 4 Distribution of subjects based on the type of hypodontia in this understudied population

	n	%
Single tooth absence	21	37.5
Mild to moderate hypodontia (2 - 5)missing teeth	34	60.7
Severe hypodontia (six or more missing teeth)	1	1.8
Total	56	100

The missing teeth were mostly bilateral in 35 (62.5%) radiographs and were unilateral in 21 (37.5%) radiographs.(Table 5)

Table 5 Distribution of hypodontia based on laterality

	n	%
Unilateral	21	37.5
Bilateral	35	62.5
Total	56	100.0

Hyperdontia

Over twenty-nine percent (n=23) of the panoramic radiographs showed supernumerary teeth.



Fig.2 OPG shows unerupted paramolar teeth

There were a total of 44 supernumerary teeth seen in these radiographs. The frequency of supernumerary teeth was higher in females (56.5%, n=13) than in males (43.5%, n=10).(Table 6)

Table 6 Distribution of Hyperdontia based on sex

	Females	Males	Total
n	13	10	23
%	56.5	43.5	100.0

There was also higher frequency in the maxilla (59.1%, n=26) (Table 7)than in the mandible (40.9%, n = 18). A higher number of supernumeraries were seen on the right (54.5%, n=24) than on the left (45.5%, n=20) of the jaws. (Table 7) These were however not significant statistically. (p>0.05)

Table 7 Distribution of Hyperdontia based on dental arch and side of jaws

	Mandible	Maxilla	Total	Right	Left	Total
n	18	26	44	24	20	44
%	40.9	59.1	100	54.5	45.5	100

Most of the supernumerary teeth were observed in the premolar region, that is the paramolars (40.9%,n=18) followed by those distal to the third molars known as distomolars (31.8%, n=14), supplemental supernumerary teeth and odontomes (11.4%, n=5) were equally distributed. Mesiodens (1.7%, n=2) were the least observed. (Table 8)

Table 8 Frequency of supernumerary teeth based on the supernumerary tooth type

Supernumerary	n	%
Mesiodens	2	1.7
Paramolars	18	40.9
Distomolars	14	31.8
Odontomes	5	11.4
Others(spplemental Laterals)	5	11.4
Total	44	100.0

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Majority of radiographs (69.6%, n=16) radiographs showed single supernumerary teeth. (Table 9)

Table 9 Distribution of supernumerary teeth based on number of supernumerary teeth found in radiographs of this study

	n	%
Single supernumerary tooth	16	69.6
Two supernumerary teeth	2	8.7
Three supernumerary teeth	2	8.7
Four supernumerary teeth	1	4.3
Five or more supernumerary teeth	2	8.7
Total	23	100.0

They were found to be bilateral in six radiographs and more commonly unilateral in 17 radiographs. (Table 10)

Table 10 Distribution of hyperdontia according to laterality

	n	%
Unilateral	17	73.9
Bilateral	6	26.1
Total	23	100.0

Discussion

Disturbances during the morphodifferentiation stage of tooth formation may result in abnormalities of tooth eruption, shape, size or number. The cause of abnormalities in tooth number is largely unknown. Suggested causes include infections during pregnancy and childhood, hormonal dysfunction which may be inherited, and various environmental factors.^{19,20} Popular among these are genetic causes and an evolutionary trend toward fewer teeth.^{19,21}

Animal studies suggest that, teeth are congenitally missing when the cell mass of an undeveloped tooth germ falls below a critical size.^{19,22} Growth and morphogenesis are regulated by growth factor genes expressed in the epithelial and mesenchymal tissues.²³ Any aberrations in these genes could lead to hypodontia.

Dental anthropology suggests humans have evolved from homodonty to heterodonty and this correlates with functional adaptation.

Teeth and teeth-bearing bones evolve together. The reduction in tooth number is concomitant with the reduction in jaw size in human evolution and is believed to be a continuing evolutionary trend.^{24,25}

Missing teeth are characteristically asymptomatic. However they may cause masticatory and verbal dysfunctions. They may also affect aesthetics, leading to social and psychological problems.

Studies by Nordgarden et al in Norway²⁶ and Endo et al in Japan³ concluded that hypodontia occurs more frequently in females than in males, which is similar to the result in this study. Relative to their male counterparts, females tend to have smaller jaws. Studies^{25,27,28} in monkeys and homo sapiens have shown that over the years there has been a tendency towards a shortened maxillomandibular skeleton and the number of teeth decrease proportionally. This may explain why hypodontia is seen more in women.

There were a higher number of missing teeth on the right than on the left but this result was not statistically significant. Endo in Japan³ announced that missing tooth pattern was similar on the right and left of the dental arches.

Coincident with other studies,^{6, 29,30} there were more missing teeth in the maxilla than the mandible. Although some studies^{31, 32} found that there were more teeth missing in the mandible than in the maxilla, the difference was not significant.

The most frequently missing teeth in this study are the maxillary third molars. This was also seen in a study by Silva Meza in Mexico. Most previous studies excluded the third molars due to the diverse and erratic pattern of its formation and calcification. These studies^{33,34,35} found the most frequently missing teeth to be the second mandibular premolars and the maxillary laterals. Upon exclusion of the third molars from this study, the most frequently missing teeth were the mandibular second premolars and the maxillary lateral incisor in

equal measure.

Svinhufvud et al³⁶ suggested that certain areas of embryonic fusion during tooth development are more susceptible to epigenetic influences and hence agenesis. For example the most frequently missing or variably sized tooth in the maxilla is the lateral incisor. And this develops in the area of the embryonic fusion between the lateral maxillary and medial nasal processes.

In the mandible, permanent tooth agenesis occurs most frequently in the area of the second premolar and the area where the two lower central incisors develop. Here the fusion of the two mandibular processes is required to form the midline of the future mandible. This midline region is likely to be another fragile site. Hence, where there was doubt, missing lower incisors were counted as lower central incisors.

In their study on the clinical features of hypodontia and associated dental anomalies, Kirzioglu et al.,³² reported that the majority of the hypodontic patients are in the mild to moderate group and that bilateral hypodontia is more common than unilateral form. This was coincident with this study where mild to moderate hypodontia group was the most common and missing teeth were frequently bilateral. This was also in accordance with study by Ikay et al.⁵

Many supernumerary teeth usually do not erupt and remain impacted. They are usually discovered during routine radiographic examinations or in pretreatment radiographs of orthodontic patients. Although usually asymptomatic, they may affect tooth movement during orthodontic treatment. They also cause several pathologies such as delayed eruption, tooth displacement and rotations, crowding, root resorption and caries of adjacent teeth and also cystic formation.

In this study, hyperdontia was seen in 29.1% of the radiographs studied. Just like hypodontia it was commoner in females than in males, though there was no significant difference. It

is postulated that isolated cleft palate tends to be more common in females than in males because transposition of the palatal shelves occur later in females than in males. There is, thus, greater opportunity for the effects of environmental insults. Cleft lip and palate has been found to be associated with single and multiple supernumerary teeth. This may account for the increase prevalence of supernumeraries in females. Rajab et al reported that hyperdontia occurs more frequently in males than in females.⁹

Previous study reported that single supernumeraries occur in 79-86% of cases, double supernumeraries in 12-23% of cases, and multiple supernumeraries in less than 1% of cases and especially multiple supernumerary teeth occur very rare without any syndrome and systemic disease.^{2,9} In this study, single supernumeraries were observed in majority (69.5%) of the radiographs. Followed by an equal proportion (8.7%, n=2) of radiographs that had two, three and then five or more supernumerary teeth respectively. One radiograph had four supernumerary teeth and was in the minority (4.3%).

Various studies reported that supernumerary teeth are most common in maxillary anterior region as mesiodens. These include studies by Rajab et al,⁹ Gabris et al¹¹ and Fernandez et al¹².

However studies on supernumeraries by Menardia-Pejuan et al.,³⁷ and Barrett et al³⁸ reported that mesiodens is seen commonly in paediatric populations and supernumerary teeth are seen frequently in maxillary posterior region for adult populations. In accordance with these studies, the most common supernumeraries were those found in the premolar region with the majority in the maxilla. Mesiodens that are not inverted will usually erupt and early intervention will boost confidence and self esteem. It is likely that most mesiodens had already been extracted resulting in the low incidence of mesiodens in this study. Coincident with this study, Altug Atac et al,²⁹ found mesiodens in only two radiographs.

Supernumerary teeth were found more on the right (54.5%, n=24) than on the left (45.5%, n=20) and this was not significant statistically. They were seen to occur more unilaterally than bilaterally.

Hypodontia and hyperdontia though usually asymptomatic may cause aesthetic, functional and psychological problems. It is therefore essential to recognize these disorders.

Treatment usually requires interdisciplinary approach. Orthodontic or prosthodontic treatments may be recommended. Maxillofacial surgeons may extract unerupted supernumerary teeth surgically. It is important to undertake periodic clinical and radiographic examinations for early diagnosis and prompt appropriate treatment modalities to minimize the effects of these abnormalities. Conflicting results when compared to other studies could be due to racial differences, different sampling techniques and diagnostic criteria. Further studies are needed to contribute to the Orthodontic literature of our West African region.

Conclusion

This study revealed that, congenitally missing teeth were the more common abnormality in tooth number than supernumerary teeth. This study detected that both hypodontia and hyperdontia tended to occur more in females than males, in the maxilla than the mandible and on the right side of the dental arches than on the left. Hypodontia occurred more bilaterally while hyperdontia occurred more unilaterally.

Upon exclusion of wisdom teeth, the most congenitally missing teeth were the mandibular second premolars and the maxillary lateral incisors in equal number. Mild to moderate hypodontia was most commonly seen.

Supernumeraries associated with premolars (paramolars) were the most frequently seen, followed by distomolars. Mesiodens were the least supernumerary teeth seen.

Contributors

Kakraba Quarshie C. was responsible for acquisition, analysis and interpretation of the data. Dr Newmann-Nartey was responsible for the concept, design and final approval for the study while Amoah revised the paper for the important intellectual content.

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