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ORIGINAL ARTICLE



# Prevalence of dental anomalies in Trinidad and Tobago. A retrospective study

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**ABSTRACT**

**Background:** Dental anomalies entail an extensive range of disorders. This study aimed to ascertain the prevalence of several anomalies detectable on orthopantomograms and determine associations with ethnicity and gender.

**Methods:** A retrospective review of 581 orthopantomograms and patient files was conducted. The prevalence of various anomalies was determined and the differences with ethnicity and gender were calculated using the chi-square test.

**Results:** The study comprised 269(50.2%) males and 267 (49.8%) females with an age range of 5–16 years. 264(49.3%) participants were Afro-Trinidadians, 146(27.2%) were Indo-Trinidadians, and 126 (23.5%) were of mixed ethnicity.

The overall prevalence of dental anomalies was 75.2%. No statistically significant correlation was found between the occurrence of dental anomalies and gender. An association was found between ethnicity and missing canines, impacted molars and other impacted teeth, and microdontia. The mixed population had more anomalies. The impacted canine was the most prevalent anomaly. 44% of participants presented with one anomaly, and 24.81% of participants had two anomalies.

**Conclusion:** There was a high prevalence of dental anomalies in the Trinidad and Tobago population. There was an association with some anomalies and ethnicity and no association with gender. The presence of dental anomalies should be considered when assessing diagnosing and treatment planning patients in this country.

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Dental anomalies; prevalence; orthopantomograms; Trinidad and Tobago

## Introduction

Dental anomalies entail an extensive range of disorders that include differences in size, shape, numbers, exfoliations, and teeth eruptions.

Dental anomalies are a range of entities that arise due to the complex interactions of hereditary factors, environmental factors, and sometimes an unknown aetiology. The process is multifactorial, multilevel, and multidimensional [1]. Homeobox genes have been identified as the genes that control the odontogenic process and different mesenchymal regulatory molecules and their receptors [2].

Early detection allows ideal patient management and can lessen complications and the extent and complexity of the planned treatment [3]. Dental anomalies have real clinical significance and potential impact, can lead to malocclusion, breastfeeding problems, increased susceptibility to caries, post-eruptive tooth breakdown, non-eruption or delayed normal series teeth, occlusal interference, attrition, compromised aesthetics, mastication and speech difficulty, temporomandibular joint dysfunction, pain and ectopic teeth can lead to root resorption and periodontal problems [4]. Dental anomalies can range from ectopias to changes in structure, shape, hypodontia, and mild developmental delay [5].

It is not unusual to detect more than one dental anomaly in the same patient. Patterns of association have been reported in seven types of anomalies (palatal impacted canines, hypodontia of second premolars, supernumerary teeth, infraoccluded primary molars, enamel hypoplasia, narrow upper laterals and ectopic eruption of first molars). This has been shown in a study of untreated orthodontic patients from age 7–14 years. The study established a significant reciprocal association between five dental anomalies indicating a shared genetic basis. The study showed that 34% of the patients with a palatally displaced canine had conical shaped upper lateral incisors [6].

Trinidad and Tobago is a cosmopolitan society with a unique composition of people that epidemiologically has already demonstrated some distinctive characteristics because of its diverse genetic pool [7–10]. Therefore, it is thought that the degree of expression and prevalence of dental anomalies in this cosmopolitan society can provide vital information for clinical dentistry, genetic and phylogenic studies allowing for a better understanding of variations in the epidemiology of dental anomalies between and within different societies [11]. It is essential that practitioners are aware

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of the prevalence of these anomalies in their country. This would aid in the counselling of patients who may have anomalies and seek treatment.

The hypotheses for this cross-sectional study are:

(1) The Trinidad and Tobago population has a high prevalence of dental anomalies.
(2) Dental anomalies prevalence is not equivalent in all ethnic groups.
(3) In Trinidad and Tobago, dental anomalies have no gender predilection.
(4) There is an association between several anomalies.

This study aimed to ascertain the prevalence of several anomalies in child patients attending a teaching dental hospital and determine any associations with ethnicity and gender.

## Methods

This retrospective study was conducted at The University of the West Indies dental hospital, Child Dental Health Clinic (CDHC) in Trinidad and Tobago. The University dental hospital is the only one in the country [12,13]. Patients are accepted into the clinic mainly as walk-ins but also as referrals. This sample was from the pool of paediatric and orthodontic patients who attended the clinic and required an orthopantomogram (OPT).

Digital OPTs of 581 patients attending the CDHC from January 2016 to December 2019 were retrospectively examined by two investigators (T.H and E.C) for the presence of various dental anomalies. The ages of the patient ranged from 5 to 16 years.

All digital OPTs were taken with Gendex Orthoralix 9200 (Henry Schein USA), the magnification factor was 1.23. The OPTs were examined on the same computer screen with reduced lightning. These digital OPTs were stored in a computer. The radiographs contrast and density were adjusted using tools for enhancement on the computer.

Figure 1 is a flow diagram showing how radiographs were included in the study.

Ethical approval was obtained from the chief executive officer of the North Central Regional Health Authority in Trinidad and Tobago and the Institutional Review Board of The University of the West Indies (Ref: CEC142/03/16).

The inclusion criteria were: participants 5–16 years old, any gender and ethnicity with good quality OPTs. Exclusion criteria included: adult patients (>16 years old), deficient dental file(clinical notes and OPTs), history of previous orthodontic treatment, pathology other than caries, syndrome and craniofacial subjects (e.g., cleft lip and palate).

This study is reported according to STROBE guidelines [14].

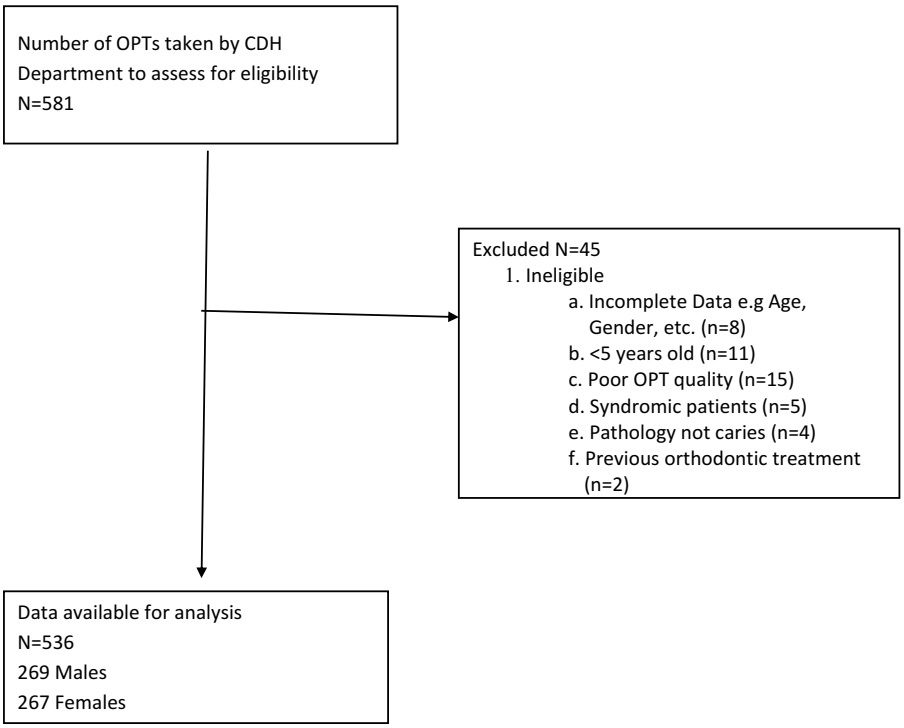


**Figure 1.** Flow diagram showing x-ray inclusion in study.

Patients' 5–16 years dental records and digital OPTs were inspected to identify dental anomalies. Information extracted from patient's records included: gender, ethnicity; age; the presence of anomalies.

The presence of 18 different anomalies was divided into consequential and non-consequential. A consequential anomaly is one of the diagnostic significance. In these cases, Interceptive Orthodontics would reduce the severity of the outcome or reduce the complexity of the orthodontic treatment (Table 1). Non-consequential dental anomaly refers to anomalies unaffected by an interceptive procedure (Table 2).

### Statistical analysis

Prevalence of dental anomalies was calculated using a statistical package (IBM SPSS Statistics for Windows version 27(IBM Corp., Armonk N.Y., USA)). The frequency of dental anomalies with gender and ethnicity was calculated. The chi-square test was used to test the difference between anomalies and gender, dental anomalies and ethnicity. Any p-value $< 0.05$ was considered significant. The Spearman rank correlation coefficient was used to ascertain correlations between different anomalies. R programming software using the COR function was used to tabulate rate of concordance of the two examiners

**Table 1.** Consequential anomalies, steps, actions or interventions.

| Consequential | Anomaly | Definition | Steps/actions/interventions that follow presence/reason for effectiveness of interceptive orthodontics |
|---|---|---|---|
| Anomaly in number | Hypodontia | A tooth was deemed congenitally missing when there is no radiographic evidence of development.<br><br>Exclusion-<br>a. The third molars are missing.<br>b. Tooth extraction for caries, periodontal disease, trauma or orthodontic treatment was not considered to be consistent with hypodontia.<br><br>Inclusion –<br>1. Hypodontia of first molars,<br>2. Hypodontia of second premolars<br>3. Hypodontia of canines<br>4. Hypodontia of lateral incisors | 1. Orthopantomograph required.<br>2. Interceptive orthodontics<br>With hypodontia of upper laterals extraction of C's encourage the permanent canines to erupt in the lateral position. Hypodontia of second premolars management with interceptive orthodontics depends on crowding. In a spaced arch the E is preserved in a crowded arch the E is removed when appropriate [49]. Extraction of E's at 9 years allow for maximum spontaneous space closure [50]. |
| | Hyperdontia | 5. Supernumerary teeth (A tooth was diagnosed as supernumerary when teeth were present in addition to the normal dentition [9]).<br>6. Odontoma (a radiopaque mass of dental tissue that has grown irregularly [8]) | 1. Orthopantomograph required.<br>2. Other X-rays to localize<br>3. Interceptive Interventions depend on position and type [51]<br>• Leave alone and monitor<br>• Removal. To allow incisor eruption tuberculate supernumeraries need to be removed [52].<br>• May need extraction of other teeth to create space. For instance, extraction of C's and creation/maintenance of space [53].<br>4. May need exposure and attachment of a bracket.<br>Prior to comprehensive orthodontic treatment surgical removal of supernumeraries is required to avoid resorption of roots |
| Exfoliation and eruption anomalies | Impaction | a tooth was deemed impacted when its path of eruption was hindered by persistent primary teeth, lack of space, odontomas, cyst or benign tumours,bone or an adjacent tooth<br>7. Impacted first molars<br>8. Impacted canines<br>9. impacted premolars<br>10. Any other impacted teeth | 1. Orthopantograph required.<br>2. Localize<br>3. Interventions options include<br>• Leave alone. But review biannually [54] for root resorption or cyst formation<br>• Interceptive Treatment<br>uncrowded mouths extraction of C's aged 10–13 years. This allows shorter eruption times and positional change. 78% of canines normalize in 1 year [54–57]. The greater the overlap with the lateral incisor the lower the chance of normalizing. |
| | Ectopic canines | | Same as above |
| | Transposition | interchange of two adjacent teeth by position [8] | 1.Orthopantograph required.<br>2. Interventions options include [58,59]<br>Leave alone and accept transposition.<br>Interceptive Orthodontics<br>With maxillary canine first premolar transpositions, to allow spontaneous correction extract C if premolar roots are distally angulated. With maxillary canine and lateral incisor transposition extract retained primary incisors. |

**Table 2.** Non-consequential anomalies.

| Non consequential | Anomalies | Definition |
|---|---|---|
| Anomaly in shape | Macrodontia | A disproportionately large tooth |
| | Microdontia | A disproportionately small tooth |
| | Fusion | Fusion of two crown parts was observed by visual examination. The teeth were recorded as fused teeth on the chart |
| | Germination | A dental phenomenon that appears when two teeth develop from one bud |
| | Taurodontism | The trunk of the tooth is elongated, the pulp chamber floor is apically positioned, and the roots are shortened [10]. |
| | Dilaceration | An abnormal bend in the root or crown of a tooth |

## Results

The study comprised 269(50.2%) males and 267 (49.8%) females with an age range of 5–16 years and a mean age of 10.88 years and standard deviation of 2.69. Forty-five radiographs were excluded from this study (Figure 1). 264(49.3%) participants were Afro-Trinidadians, 146(27.2%) were Indo-Trinidadians, and 126 (23.5%) were of mixed ethnicity.

No statistically significant association was found between gender and the occurrence of dental anomalies ($p > 0.05$) (Table 3). An association was found between ethnicity and absent canines, impacted first molars, other impacted teeth, and microdontia, with the mixed population having the most significant amount of anomalies $p < 0.05$. (Table 4). The most frequent anomalies were exfoliation and eruption anomalies (Figure 2).

**Table 3.** Overall prevalence of different anomalies and distribution of dental anomalies by gender.

| Dental anomalies | Males (n = 269) n% | Females (n = 267) n% | Total n = 536 n% | Level of significance (p value) |
|---|---|---|---|---|
| Hypodontia first molars | 3(1.1%) | 3(1.12%) | 6 (1.12%) | 0.993 |
| Hypodontia second premolars | 12(4.46%) | 22(8.24%) | 34 (6.34%) | 0.073 |
| Hypodontia canines | 2(0.74%) | 2(0.75%) | 4 (0.75%) | 0.996 |
| Hypodontia lateral incisors | 10(3.72%) | 16(5.99%) | 26(4.85%) | 0.220 |
| Impacted first molars | 74(27.51%) | 68(25.47%) | 142(26.49%) | 0.592 |
| Impacted canine | 85(31.6%) | 85(31.84%) | 170(31.72%) | 0.953 |
| Impacted premolar | 39(14.5%) | 48(17.98%) | 87(16.2%) | 0.275 |
| Impacted other | 11(4.09%) | 19(7.11%) | 30(5.6%) | 0.127 |
| Ectopic teeth | 16(5.94%) | 17(6.37%) | 33(6.16%) | 0.840 |
| Supernumerary teeth | 21(7.81%) | 16(5.99%) | 37(6.9%) | 0.407 |
| Microdontia | 12(4.46%) | 16(5.99%) | 28(5.22%) | 0.426 |
| Macrodontia | 2(0.74%) | 0(0%) | 2(0.37%) | 0.158 |
| Dilaceration | 0 | 0 | 0 | 0 |
| Taurodontism | 1(0.37%) | 3(1.12%) | 4(0.75%) | 0.312 |
| Odontoma | 2(0.74%) | 4(1.5%) | 6(1.12%) | 0.406 |
| Transposition | 5(1.86%) | 3(1.12%) | 8(1.49%) | 0.483 |
| Fusion | 0 | 0 | 0 | 0 |
| Germination | 1(0.37%) | 0 | 1(0.19%) | 0.319 |

**Table 4.** Distribution of dental anomalies by ethnicity.

| Ethnicity | Afro-Trinidadian n = 260 n% | Indo-Trinidadian n = 145 n% | Mixed-Trinidadian n = 125 n% | Total n = 536 n% | Level of significance (pvalue) |
|---|---|---|---|---|---|
| Absent first molars | 4 | 1 | 1 | 6 | 0.690 |
| Absent second premolars | 19 | 8 | 7 | 34 | 0.727 |
| Absent canines | 0 | 1 | 3 | 4 | 0.038 |
| Absent lateral incisors | 10 | 8 | 8 | 26 | 0.501 |
| Impacted molars | 57 | 27 | 58 | 142 | 0.000 |
| Impacted canine | 68 | 47 | 55 | 170 | 0.002 |
| Impacted premolar | 38 | 24 | 25 | 87 | 0.393 |
| Impacted other | 13 | 3 | 14 | 30 | 0.004 |
| Ectopic teeth | 15 | 6 | 12 | 33 | 0.162 |
| Supernumerary teeth | 21 | 8 | 8 | 37 | 0.614 |
| Microdontia | 16 | 2 | 10 | 28 | 0.036 |
| Macrodontia | 2 | 0 | 0 | 2 | 0.356 |
| Dilaceration | 0 | 0 | 0 | 0 | 0 |
| Taurodauntism | 1 | 1 | 2 | 4 | 0.429 |
| Odontomes | 4 | 0 | 2 | 6 | 0.321 |
| Transposition | 3 | 3 | 2 | 8 | 0.76 |
| Fusion | 0 | 0 | 0 | 0 | 0 |
| Germination | 1 | 0 | 0 | 1 | 0.597 |

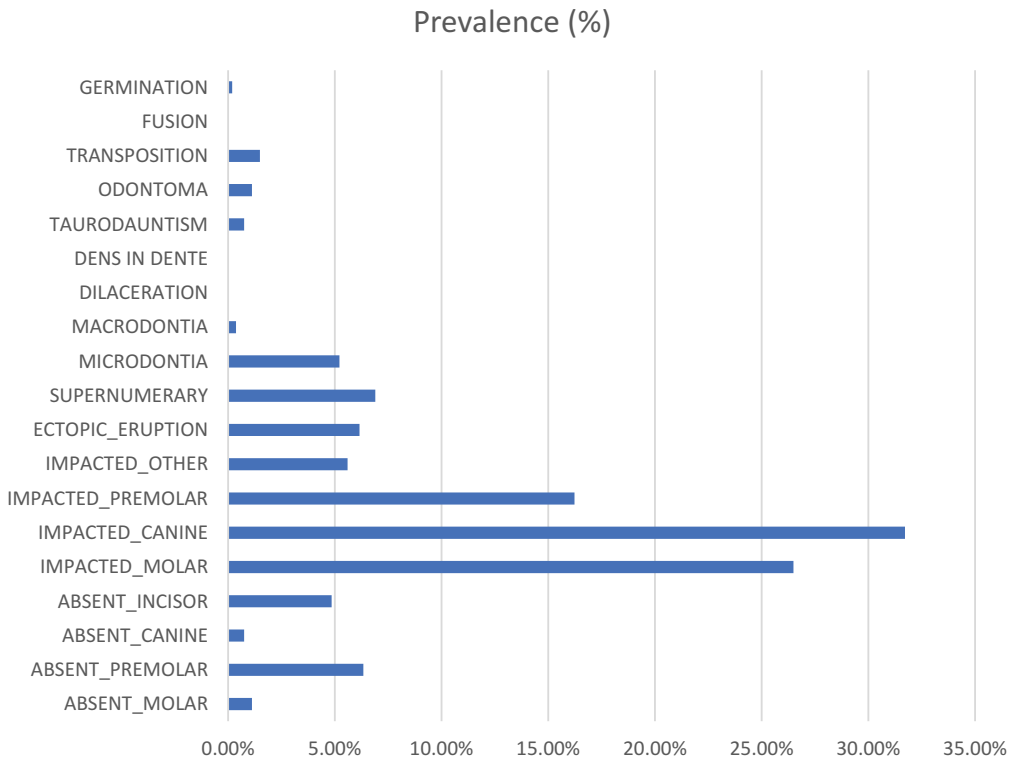


**Figure 2.** Showing prevalence of different anomalies.

**Table 5.** Prevalence of dental anomalies by sex in the sample.

| Variables | Males (n = 259)n% | Females (n = 274)n% | Total (n = 536) n% |
|---|---|---|---|
| No dental anomaly | 73(54.9%) | 60(45.1%) | 133(24.8) |
| One dental anomaly | 120 (50.85%) | 116(49.1%) | 236(44%) |
| Two dental anomalies | 56(43.8%) | 72(56.3%) | 128(23.9%) |
| More than 2 anomalies | 20(51.3%) | 19(48.7%) | 39(7.3%) |
| Total | 269(50.2%) | 267(49.8%) | 536(100%) |

Impacted canines were the most prevalent dental anomaly(31.7%), followed by impacted first molars (26.4%). The overall prevalence of dental anomalies was 75.2%. Among these participants, 236(44%) presented with one anomaly (Table 5). 128(23.9%) participants had two anomalies, and 39(7.3%) had more than two anomalies. The number of anomalies per participant in this sample ranged from 1 to 5 anomalies.

Number and prevalence of anomalies

Premolars were the most commonly missing tooth (6.34%), similar to other studies [3]. Anodontia was not observed in any of the cases.

Thirty-seven participants (6.9%) presented with supernumerary teeth. The gender distribution for these anomalies was not found to be statistically significant, $p > 0.05$.

Shape anomalies

Thirty-five participants exhibited shape anomalies. The most common shape anomaly was microdontia (5.2%).

Exfoliation and eruption anomalies

The impacted canine was the most prevalent exfoliation and eruption anomaly (31.7%).

With ethnicity, there was an association with absent canines, impacted molars, impacted canines, other impacted teeth and microdontia $p < 0.05$

Association between anomalies

Table 6 shows the association found and their respective values, $p < 0.05$. Hypodontia of premolars was associated with hypodontia of canines, lateral incisors, impacted molar and microdontia. With hypodontia of the first molar, the prevalence of hypodontia of premolars was 33.3%, indicating a reciprocal relationship between the two.

Rate of Concordance

Table 7 shows the rate of concordance. There was good agreement between both examiners except for impacted molars.

**Table 6.** Associations between different anomalies.

| Anomaly | Associated anomalies | Spearman Correlation | Respective p-values | Respective Prevalence |
|---|---|---|---|---|
| Hypodontia of first molars | Hypodontia of premolars | 0.12 | 0.006 | 33.33% |
| Hypodontia of premolars | Hypodontia of canines, Hypodontia of lateral incisor, impacted molars, Microdontia | 0.16,0.16,-0.12,0.15 | <0.05, <0.05, 0.005, 0.010, 0.001 | 5.88%, 17.65%, 5.88%, 17.65% |
| Absent incisor | Impacted canines | −0.10 | 0.023 | 11.54% |
| Impacted molars | Impacted other | −0.09 | 0.035 | 2.11% |
| Impacted canine | Impacted premolar, Impacted other, Ectopic teeth | 0.10, 0.10, −0.12 | 0.018, 0.027, 0.004 | 21.76%, 8.82%, 1.76% |
| Impacted other | Supernumerary, odontoma, Transposition | 0.09,0.13, 0.10 | 0.030, 0.003, 0.016 | 16.67%, 6.67%, 6.67% |
| Supernumerary teeth | Macrodontia | 0.10 | 0.016 | 2.70% |

**Table 7.** Showing rate of concordance between two examiners.

| Dental Anomaly | Rate of Concordance (%) |
|---|---|
| ABSENT PREMOLAR | 86.01 |
| ABSENT CANINE | 100.00 |
| ABSENT INCISOR | 91.23 |
| IMPACTED MOLAR | 44.40 |
| IMPACTED CANINE | 57.33 |
| IMPACTED PREMOLAR | 68.93 |
| IMPACTED OTHER | 61.08 |
| ECTOPIC ERUPTION | 50.21 |
| SUPERNUMERARY | 90.29 |
| MICRODONTIA | 70.20 |
| MACRODONTIA | 100.00 |
| DILACERATION | * |
| DENS IN DENTE | * |
| TAURODAUNTISM | 60.85 |
| ODONTOMA | 62.78 |
| TRANSPOSITION | 56.21 |
| FUSION | * |
| GERMINATION | 100 |

*Due to the standard Deviation is 0

## Discussion

The aetiology of dental anomalies is a combination of genetics and environmental. The dental characteristics have a polygenetic nature and the homeobox genes involved include MSX1, MSX2, Dlx (distal-less), orthodontical, goosecoid and Shh (sonic hedgehog) Pax9 (paired box gene 9) [2]. Any disruption of regulatory molecules or gene mutation may result in a dental anomaly.

The high prevalence, associations and variations with ethnicity in this study demonstrate the importance of this type of epidemiological study. There has been no previous study on the epidemiology of dental anomalies in this multiethnic society (this population is composed of 35.43% East Indian descent, 34.22% African descent, 22.82% Mixed ethnicity, 0.59% Caucasian, 0.30% Chinese, 0.11% Indigenous, 0.06% Portuguese,0.08% Syrian/Lebanese, 0.17% other ethnic groups [8]).

This information can therefore inform community-based primary dental care facilities when to provide interceptive treatment, especially to communities that cannot afford comprehensive dental treatment. There can be screening for these anomalies in primary health care facilities, and interceptive treatment can alleviate the morbidity of anomalies in groups that cannot afford comprehensive orthodontic appliance therapy.

Orthodontic treatment can be more complicated if the presence of dental anomalies is not considered; therefore, investigations into the absence or presence of dental anomalies should be undertaken at the diagnosis stage and carefully considered at treatment planning [11]. Table 1 shows that consequential dental anomalies, once present, have several steps and interventions to follow. Therefore, early detection reduces the complexity of planned treatment and complications during treatment [3]. Moreover, the presence of anomalies may cause orthodontic and maxillofacial deformity [15,16]. This study utilized OPTs as they are beneficial for screening for dental anomalies that may otherwise go undetected [16]. The advantages of using OPTs are that they are easily tolerated due to their non-invasive profile, allow easy observation of anomalies, and provide information unavailable from clinical examination [17]. Noteworthy is that these X-rays are not ideal for diagnosis of taurodontism. An incorrect diagnosis of taurodontism may result due to distorted molar areas [18]. Some authors also suggest other x-rays are required for the diagnosis of dilacerations and other root anomalies [18–20]. As such prevalence of dilacerations in their study may have been under reported. The importance of pretreatment OPTs, however, cannot be underscored. These anomalies are very amenable to interceptive orthodontics. In developing countries, especially in poor and underserved communities, interceptive orthodontics might be all that can be offered. An OPT is therefore necessary for early detection.

This study is the first to assess the prevalence of several anomalies in this population. This study's objective was to ascertain the prevalence of dental anomalies and determine any association with gender and ethnicity.

The factors contributing to the percentage values of prevalence of dental anomalies in different countries are different diagnostic criteria, ethnic differences, and the amount and type of dental anomalies studied [21].

This study found an overall prevalence of dental anomalies to be 75.2%. This high prevalence has been reported by Thongudomporn in Australia, who reported that 74.77% of patients exhibited at least one dental anomaly [22]. This is noteworthy since Australia is also known to be a cosmopolitan society and, like Trinidad and Tobago, will have a very diverse genetic pool.

However, prevalence in other studies in less diverse populations has been reported as low as 26.6% in Nigerian children in a study done by Temilola [23]. Other studies reported the prevalence between 34% and 40% [24–26].

Due to the multitude of ethnicities and the mixing of ethnicities in Trinidad and Tobago, over 23% of the participants in our study reported being of mixed ethnicity. The findings of this study revealed no statistically significant association between gender and dental anomalies $p > 0.05$. This is in agreement with other study findings [25,27].

In this study, the most frequent anomalies were exfoliation and eruption anomalies, with the most frequent being impacted canines (31.7%). This was similar to other studies [3]. An association was found between ethnicity and absent canines, microdontia, impacted molars, canines, and other impacted teeth. The genetic link for several dental anomalies has been well established [28–30]. Differences in different populations have also been established [30].

The most frequently reported anomaly in most studies is tooth agenesis [4,11]. Depending on the population, the type of tooth varied [4]. In this study, hypodontia of the premolars was the most common congenitally missing tooth, which was similar to findings in Caucasian and European populations [31,32]. Of interest, in Japanese and Indian populations, the lateral incisor is the most commonly missing tooth [11,33].

Hypodontia of the premolars was associated with hypodontia of first molars, canines, lateral incisors, impacted molars and microdontia in this study. Hypodontia of lateral incisors has been associated with ectopic canines [34]. This study did not find such an association. However, the present findings agree with Peck's findings that the hypodontia of second premolars is more prevalent than the hypodontia of lateral incisors [35].

The literature shows supernumerary teeth prevalence between 0.2% and 3% [36–39]. This study found a prevalence of 6.9%. Again, this may be attributed to ethnic differences and diagnostic criteria. Like previous studies, supernumerary teeth were more common in boys than girls [11,40], but it was not statistically significant in this study. The most common dental anomaly associated with supernumerary teeth in this study was macrodontia.

The prevalence of microdontia was 5.2%. Other studies reported prevalence as low as 0.3% [38], others as high as 4.3% [41]. Again, these variations are due to diagnostic criteria used to classify and identify dental anomalies and ethnic and genetic factors. This inconsistency might also be due to the types of anomalies evaluated by studies.

Impacted canines were the most common anomaly of exfoliation and eruption in this study. Other studies reported ectopic canines as the most prevalent, ranging from 0.7% to 7% [11,25]. This study found a prevalence of ectopic teeth at 6.16%. The prevalence of taurodontism has been reported between 0.04% and 14.4% [3,4,15,42,43]. This study reported the prevalence of taurodontism to be 0.75% which was similar to several studies.

Papadopulos et al. meta-analysis reported a mean prevalence of transposition as 0.33%. A considerably higher prevalence was found in this population (1.49%). The higher prevalence could be explained by higher detection in 8-9-year-olds and some cases normalizing later on [3].

This study findings also showed associations between dental anomalies which supports hereditary factors in the aetiology of these anomalies. There was an association between hypodontia, microdontia, and impacted teeth. Supernumerary teeth showed an association with macrodontia, similar to findings in other studies [44,45]. Several studies have shown an association between hypodontia, microdontia, and ectopic canines [34,46]. However, according to Mukaka(2012) the Spearman's correlation in this study among these different anomalies was negligible [47]. Noteworthy Peck and Peck (1996) and Mossey et al (1994) reported that hypodontia and palataly displaced canine in their studies had a questionable association [34,48]. Therefore, general relations could be seen between these anomalies but any linear relationship was questionable.

Limitations of this study include

(1) The data were from a convenience sample of patients attending a Dental Hospital. This method of sampling could influence the results. The University dental hospital is the only dental hospital in the country. A larger enrolment of patients from general private practice may be more representative of the population.
(2) Archived files were assessed in this retrospective study. It is possible that higher detection rates, and a lower rate of selection bias would have been possible with a prospective study.

## Conclusion

This study showed a high prevalence of dental anomalies in the multiethnic society that is Trinidad and Tobago. There was no association found between gender and dental anomalies in this study, but there was an association between ethnicity and dental anomalies. An association was also found between different anomalies. A significant number of participants presented with two anomalies, and impacted canines were the most prevalent dental anomaly.

This study highlights the need for screening for consequential anomalies. The presence of these anomalies can determine the need for Interceptive Orthodontics. This study also highlighted the predictive capacity that the associations between certain anomalies enables. This would therefore improve the diagnostic value of these findings in Orthodontic clinical practice. The presence of some anomalies should alert the clinician to the possibility of finding additional possibly clinically invisible anomalies. Therefore, closer scrutiny would be indicated in cases where a particular dental anomaly manifests, especially in a patient from a particular ethnicity.

## Author contributions

Trudee Hoyte contributed to conception, design, data acquisition, performed all statistical analysis and drafted and revised manuscript. Erika Coppin contributed to design, data acquisition, interpretation. Anne Kowlessar contributed to data acquisition, interpretation, revised manuscript. Adilah Mahabir contributed to data acquisition, design, Anil Ali contributed to data acquisition, design Kevin Henry contributed to data interpretation, manuscript revision and Peter Mossey contributed to data interpretation, critically revised the manuscript.

## Ethical approval

Institutional Review Board* approval including approval number -The University of The West Indies institutional review board Ref: CEC142/03/16

## Disclosure statement

No potential conflict of interest was reported by the author(s).

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