Agensis of Permanent Maxillary Lateral Incisors among the Non-Syndromic Libyan Orthodontic Patients' Subpopulation

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Abstract

Study Design: This cross-sectional descriptive study was done following the Strengthening of the Reporting of Observational Studies in Epidemiology (STROBE).

Objectives: The study was performed to determine the prevalence of the Maxillary Lateral Incisors (MLI) agenesis in Libyan orthodontic patients.

Sample and Methods: The pre-treatment orthodontic records of 1570 Libyan healthy female and male patients (11-35 years old) in the archive of the department of orthodontics Faculty of Dentistry, University of Benghazi and three private orthodontic clinics in Benghazi city were screened. Due to one or more exclusion criteria, e.g., case of clefts, or insufficient recording, 403 records were excluded. The raw data were collected from pre-treatment records (history sheets, dental casts and panoramic radiographs) of 1167 patients; 337 males (28.9%) with a mean age of 16.13 years and 830 females (71.1%) with a mean age of 17.28 years. The overall mean age was 16.95 years. Congenital absence of maxillary lateral incisors was noted. The collected data were summarized and statistically analyzed using SPSS® Version 20.

Results: The prevalence of maxillary incisors in the Libyan orthodontic patients is 2.6% (1.1% unilateral agenesis, 1.5% bilateral agenesis). The prevalence of MLI agenesis among females is 2.6% and in males was 1.5%.

Conclusion: The prevalence of MLI agenesis among the Libyan orthodontic patients seems to be lower than that of Far East populations and comparable to the prevalence of MLI agenesis in the Caucasians, however, it is relatively close to prevalence recorded in the Middle East regions.

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Keywords

Maxillary Incisors; Dental Agenesis; Dental Anomalies

Introduction

The congenitally missing tooth is referred to as a tooth that is detected neither clinically nor radiographically, provided that it has not been extracted [1]. Dental agenesis is one of the most common dental developmental abnormalities that can affect any tooth and can be seen in any human population or race [2,3]. Excluding wisdom tooth, the lower 2nd premolar is the most common congenitally missing tooth, followed by maxillary 2nd premolar and the permanent Maxillary Lateral Incisors (MLI) that could be unilateral or bilateral (Fig. 1) [4-7]. Nevertheless, some investigators considered MLI is the second most common missing tooth after the wisdom tooth [8-11]. Stamatiou and Symons (1991) postulated that among the Caucasians, permanent MLI is of a higher incidence of agenesis [12]. Yuko Fujita, et al., highlighted that several investigators who advocated that the prevalence of MLI agenesis among Asian communities is more than other communities [3,13-15]. This assumption has been attributed to the unique anthropological characteristics of Mongoloids [3]. The prevalence of Maxillary Lateral Incisors (MLI) agenesis varies among races and populations from 3.5 % to 8.8% [1,6,16-20]. It also shows variability in gender distribution [21].

Agenesis of a tooth occurs when its germ has not differentiated or has not differentiated enough to develop mature dental tissues [1,22,23]. Agenesis of any tooth is owed to several conditions including heredity, syndrome, environmental, genetic and evolution [22,24-26]. Moyers and others predicted that future-wise humans will have neither lateral incisors nor 3rd molars just as the agenesis of the fourth molars [3,17,23,27]. The notion that is anecdotally advocated by others [3]. On the other hand it has been explained by some investigators that due to evolution, the maxillary lateral incisors reduce in size becoming conical and smaller before disappearing [28,29]. Furthermore, the multi-factorial model has been claimed as the main player in this context [30]. Polder, et al., found that several variables determine the occurrence of malformation and agenesis of the maxillary lateral incisors including race, sex and the continent of origin [4]. Association between peg-shaped MLI and agenesis has been advocated, the more severe hypodontia the smaller the formed teeth [29]. This study was performed to investigate the prevalence of agenesis the Maxillary Lateral Incisors (MLI) among Libyan orthodontic patients, 11-35 years old age group.

Material and Methods

Study design and participants: this investigation was a descriptive, retrospective and cross-sectional study, which was designed and performed in accordance with the Strengthening the

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Reporting of Observational Studies in Epidemiology (STROBE) [31]. The pre-treatment orthodontic records of 1570 Libyan healthy female and male patients (11-35 years old) were screened. The records were obtained from the patients' archives in the Department of Orthodontics, Faculty of Dentistry, University of Benghazi and also from three private orthodontic clinics in the city. Eligibility: Because of incomplete information or/ and exclusion criteria, 337 records were dropped from the sample (Fig. 1). Out of 1570 patients' records, 1167 records (830 female patients' files and 337 male patients' files) were eligible to be included in the sample (Table 1).

Inclusion Criteria

- Libyan orthodontic patient
- Age group from 11 to 35 years old age

Exclusion Criteria

- Age below 11 or over 35 year's old age
- Any craniofacial abnormality including cleft lip and palate
- History of orthodontic treatment
- History of trauma to the maxillary anterior region
- Any dental treatment for upper lateral incisor(s)
- Deficient information or missing pre-treatment diagnostic data such as OPG

Data Collections and Reliability of Measurements

All the pre-treatment study models and OPGs of all participants were examined by both investigators. inter-examiner calibration and Intra-examiner calibration which was done in 14 days, were performed using Kappa statistics, which revealed strong agreements for both intra and inter-examiner Kappa values that were 0.89 and 0.81 respectively.

Statistical Analysis

The collected data were summarized and analyzed using the Statistical Package for Social program (SPSS version 20 IBM®, USA). Descriptive statistical methods were applied to reveal the distribution of MLI agenesis among the sample. The Chi-square test was used to test the distributions of the age among the two genders in the sample and the pattern of missing (agenesis) MLI site wise and gender-wise.

Ethical Issue

Examinees' dental records were screened and data were collected under permissions that were obtained with the consent.

Figure 1: Flow-chart of sample selection.

Gender	Frequency	Percent
Female	830	71.1
Male	337	28.9
Total	1179	100

Table 1: Gender distribution.

Results

Out of 1167 patients' pre-treatment orthodontic records, 830 (71.1%) were for female patients who were with an average age of 17.288 years old and 337 (28.9%) were for male patients who were with an average age of 16.133 years old, the difference in the mean age of females and males' examinees is found to be statistically insignificant ($p > 0.05$). The overall average of the ages was 16.954 years old (Fig. 2 and Table 1). The overall prevalence of MLI agenesis was 2.6% (22 female examinees and 8 male examinees have had at least one permanent maxillary incisor congenitally missing). The prevalence of unilateral agenesis MLI was 1.1% that constituted by 13 examinees, 5 left MLI agenesis that was all females (0.4%) and 8 right MLI agenesis (0.7%). Agensis of the right MLI was found in 5 female participants and 3 male participants representing, collectively, 0.7% of the whole sample size. Bilateral MLI agenesis prevalence was 1.5% (18 patients: 13 females, 5 males) (Table 2 and 3). However, the Chi-square test revealed these differences in the prevalence of MLI agenesis among the two genders

of examinees and among left and right sides of the maxilla is a statistically insignificant difference ($p > 0.05$) (Table 4).

The association between agenesis of the maxillary lateral incisor(s) and other regional and remote dental anomalies particularly palatally displaced or impacted permanent maxillary canine has been evaluated in this study finding 2 participants who have bilateral missing MLIs suffered from palatally impacted permanent maxillary canines. On the other hand unilateral right or left MLI showed no associated regional or remote dental anomalies, instead, there were 74 participants with regional and remote anomalies and they have intact permanent maxillary lateral incisors. The Chi-square test indicated no statistical association between MLI agenesis and other dental anomalies ($P > 0.05$) (Table 5 and 6).

Figure 2: Unilateral maxillary lateral incisor agenesis and bilateral Maxillary Lateral Incisors (MLI) agenesis.

Mli By Quadrant	Frequency	Percent	Cumulative Percent
No agenesis	1136	97.3	97.3
Unilateral Right MLI agenesis	8	0.7	98
Unilateral Left MLI agenesis	5	0.4	98.5
Bilateral MLI agenesis	18	1.5	100
Total	1167	100	

Table 2: Distribution of MLI agenesis according to the maxillary quadrants.

	Frequency		Total
	Female	Male	
No agenesis	807 (97.3%)*	329 (97%)*	1136 (97.1%)*
12 agenesis	5 (0.6%)*	3(.8%)*	8 (0.7%)*
22 agenesis	5(0.6%)*	3(.8%)*	8 (0.7%)*
12 and 22 agenesis	13(1.5%)*	5(1.4%)*	18 (1.5%)*
Total	830(100%)*	337(100%)*	1167 (100%)*
*percentage of the value in the cell to the total of the column the cell belongs to.			

Table 3: Site of agenesis versus gender cross tabulation.

	Value	df	Asymp. Sig. (2-Sided)
Pearson Chi-Square	2.334	3	0.506*
Likelihood Ratio	3.698	3	0.296*
N Of Valid Cases	1167		
*P > 0.05%			

Table 4: The Chi-Square tests results of testing the association between the MLI agenesis and the gender of the patient and the site of agenesis.

	Other Dental Anomalies						Total
	No Anomalies	Regional Canine Impaction or Platal Displacement	Regional Canine Impaction + Regional Anomalies	Regional Canine Impaction + Remote Anomalies	Regional Anomalies	Remote Anomalies	
12 and 22 Present	1062	28	2	2	36	6	1136
12 Agenesis	8	0	0	0	0	0	8
22 Agenesis	5	0	0	0	0	0	5

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12 and 22 Agenes is	16	2	0	0	0	0	18
Total	1091	30	2	2	36	6	1167

Table 5: Site of agenesis versus other dental anomalies cross tabulation.

	Value	df	asympt. sig. (2-sided)
Pearson Chi-Square	3.223	5	0.666*
Likelihood Ratio	3.803	5	0.578*
N of Valid Cases	1167		
*P > 0.05%			

Table 6: The Chi-Square tests results of testing the association between the MLI agenesis and the other dental anomalies.

Discussion

Maxillary lateral incisors play a magnificent role in smile esthetics since their presence, size, shape and position can affect the harmony of teeth appearance while smiling. Not only smile aesthetics affected by maxillary lateral incisors, but also the facial charm and appearance are affected [32]. Besides dental anthropologists, almost all dental disciplines are concerned with maxillary lateral incisors [1]. The prevalence of agenesis and malformation of the maxillary lateral incisors in humankind varies among populations and communities [1,17-19]. Since there was a scarcity of investigations among Libyans, particularly those who are seeking improvement of their smile facial appearance, this investigation performed on those sorts of patients who attended main four orthodontic clinics in Benghazi aiming to estimate the prevalence of MLI agenesis establishing epidemiological data that helps in acknowledgment of treatment need.

Screening of the files of the patient in the targeted population (orthodontic patients in Benghazi city) was performed according to the above-mentioned inclusion and exclusion criteria to secure the reliability of the data obtained from the sample. Investigation and collecting the raw data from the examinees' records was done by both investigators who were subjected to intra and inter-examiner calibrations whose reliability Kappa test values were 0.89 and 0.81 respectively, indicating a strong level of agreement and reliability [33].

Though the prevalence of bilateral MLI agenesis (1.5%) was a little bit higher than agenesis of right and left unilateral MLI (1.1%). This result agrees with that of Stamatiou J and Symons AL [12]. The overall prevalence of MLI agenesis (1.5%) among the Libyan orthodontic subgroup was found low. This finding of low MLI agenesis prevalence goes with results of several Middle Eastern populations; in the context of the issue, Abu-Hussein, et al., concluded that the prevalence of MLI agenesis is as low as 1.1% in the Arabas population in Israel [34]. They also found that the prevalence of MLI agenesis is more common in females, while in this study the difference in the prevalence of MLI agenesis between the two genders was found to be insignificant. Even the comparison between MLI agenesis in the right and left side of the maxilla resulted in insignificant variability. Al-Hummayani FM concluded that the prevalence of MLI agenesis in Saudi Arabian Female students is lower than the prevalence in the Caucasian race [18]. She also noted that agenesis of MLI is less common than peg-shaped anomaly in MLI among the sample of her study. On the contrary, there are noticeable differences in the prevalence of MLI agenesis between this study and several other studies that were performed on far Eastern countries, however, the results of this study are close and comparable to the prevalence of MLI agenesis in several Western countries (1.11% - 2.00%) in which the Caucasian race is predominant [1,35,36]. According to Muller, et al., MLI agenesis forms 46.4% of missing teeth in American people. This study agrees with the study of Stamatio Symons who revealed that bilateral agenesis of MLI is more frequent than unilateral agenesis, however, this study found no significant difference [12,37]. They found the prevalence of bilateral agenesis in a Caucasian population was 2.2%, which more than the prevalence found in this result (1.5%). This difference can be based on racial and anthropological variations [14,15,38].

Fujita Yuko, et al., found, on the contrary, the prevalence of MLI agenesis was 7.3% among Japanese young patients and they revealed a significant difference in the MLI agenesis prevalence between males and female young Japanese subgroup [3]. Besides, they found that unilateral MLI agenesis, particularly the right MLI, is more prevalent than bilateral MLI agenesis. The obvious difference between MLI agenesis prevalence in this study and other serval studies done in the Middle East/North Africa regions and that done in the Far East regions of the Glob is justified by the racial difference between the strikingly anthropologically and somatically different populations [30].

Association between MLI agenesis and other anomalies such as palatally displaced/impacted neighbouring canine or any other developmental dental anomalies could not be detected in the present study. In other words, this study found no association between unilateral or bilateral MLI agenesis and any other developmental dental anomalies. Instead, almost all examinees who had development anomalies other than MLI agenesis their maxillary lateral incisors were normally present in their anatomical position (Table 5). This finding contradicts the idea stating that because MLI agenesis is believed to under the control of genes Garib DG, et al., concluded

that there is a frequent association between MLI agenesis and other dental anomalies extracting this conclusion from a study done on 126 patients with at least one MLI agenesis [26,39]. The contradiction in conclusions can be owed to various reasons including different target population, sample source and size. In the present study, the examinees were both kinds of patients those who have MLI agenesis and those whose maxillary lateral incisors were present and intact. In the same context, Pinho, et al., Magnusson and Nieminen, et al., advocated unilateral agenesis of MLI is often associated with a developmental malformation (e.g.: peg-shaped or microdontia) of the contralateral MLI [1,40,41]. This theory has not been proofed in the present study.

Conclusion

- The prevalence of Maxillary incisors in the Libyan orthodontic patients is 2.6% (1.1% unilateral agenesis, 1.5% bilateral agenesis)
- The prevalence of MLI agenesis among females is 2.6% and in males was 1.5%
- The prevalence of MLI agenesis among the Libyan orthodontic patients seems to be lower than that of Caucasians and Far East populations
- The difference in the prevalence of MLI agenesis gender-wise and site-wise is statistically insignificant
- There is no association between MLI agenesis and any other dental anomalies in the Libyan orthodontic patients
- Determination of the prevalence of any MLI agenesis is considered non-uniform and variable depending on the race and population being under investigation

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