

## Prevalence of Peg-Shaped Permanent Maxillary Lateral Incisors, Among Non-Syndromic Libyan Orthodontic Patients

Mahfud F Mohamed<sup>1\*</sup> and Hawa Muadab<sup>2</sup>

<sup>1</sup>Associate Professor, Department of Orthodontics, Faculty of Dentistry, University of Benghazi, Libya.

<sup>2</sup>A Researcher and Tutor, Department of Orthodontics, University of Benghazi, Libya.

### \*Correspondence:

Mahfud F Mohamed, Assistant Professor, Department of Orthodontics, Faculty of Dentistry, University of Benghazi, Libya, Tel: 00281927633852

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### ABSTRACT

**Objectives:** This study was performed to investigate the prevalence of peg-shaped maxillary lateral incisors (PSMLI) among non-syndromic Libyan orthodontic patients and the effect of gender on the phenomenon.

**Methods:** Pretreatment orthodontic records of Libyan orthodontic patients were screened in the Department of Orthodontics, Faculty of Dentistry, University of Benghazi, and three private orthodontic clinics in the city. Records of 2500 patients (1778 females and 722 males) were investigated; patients' ages ranged from 11 to 35 years old. The records were checked by the two researchers, searching for unilateral or bilateral PSMLI. Descriptive statistical estimations (prevalence and statistical significance) of the collected raw data and the interexaminer reliability testing were performed using the Statistical Package for Social Sciences (IBM® SPSS® Statistics) version 26.

**Results:** Kappa values (K) =100% and 90% for intra-examiner and inter-examiner agreements respectively ( $P > 0.05$ ). The overall prevalence of PSMLI in this study was 7.4% (2.6% unilateral and 4.8% bilateral). Gender does not affect the overall prevalence ( $P > 0.05$ ). The difference in the percentages of unilateral and bilateral PSMLI was statistically insignificant ( $P > 0.05$ ). The prevalence of right-sided unilateral PSMLI among males was 1%, while it was 2.25% among females; the difference is statistically significant ( $p < 0.05$ ).

**Conclusion:** PSML in Libyan orthodontic patients is more prevalent than in some other populations. No effect of gender on the phenomenon except in the case of the right-sided unilateral PSMLI, which was more in females.

### Keywords

Peg-shaped maxillary lateral incisors, Prevalence in orthodontic patients, Non-syndromic dental anomalies, Libyan orthodontic patients.

### Introduction

Malformation of maxillary lateral incisor particularly peg-shaped tooth is a relatively common finding in human dentition; it varies between 0.6% to 9.9% among different populations [1-4]. According to Graanen Hans [5], the peg-shaped tooth is one where the cervical part is wider than the incisal part; this definition was put

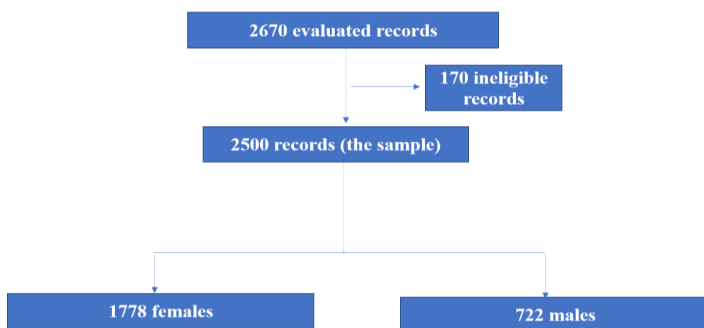
forward more than 60 years ago, though it is still valid and applied. Several investigators have attributed the aetiology of peg-shaped lateral incisors to genetic mechanisms [3,6,7], nevertheless, it has been explained by other investigators that it is due to evolution; in essence, the lateral incisor reduces in size to become conical and smaller before disappearing [3,8]. Furthermore, the multifactorial model has been claimed as the main player in this context [9-12]. Polder et al. [7] found that several variables determine the occurrence of peg-shaped maxillary incisors including race, sex, and the continent of origin. Since investigating such dental anomaly that has a considerable influence on dental esthetics and

on the treatment modalities that are provided to the community, the phenomenon has been explored among many populations. However, there is a scarcity of information that gives sound background on the developmental dental anomalies especially PSMLI in the geographical region of this country (Libya). Hence, this study was performed to investigate the prevalence distribution of developmental malformations of maxillary lateral incisors, particularly peg-shaped, among Libyan orthodontic patients. Besides, it was performed to explore the association between this prevalence and other dental anomalies in non-syndromic Libyan orthodontic patients (11-35 years old).

## Material and Methods

### Sample and Sampling Method

Out of 2670 pretreatment orthodontic records of Libyan healthy female and male patients that were screened, 2500 records were selected, following the below-mentioned inclusion criteria. The selected records belonged to patients under orthodontic treatment or the treatment was finished at the moment of sample selection (11-35 years old at the onset of treatment). Each pretreatment record should include at least a diagnostic file with, pretreatment OPG, and the study model; in addition to pretreatment intra-oral photographs if available. The records were obtained from the patients' archives in the Department of Orthodontics, Faculty of Dentistry, University of Benghazi, and other three private orthodontic clinics in the city. When exclusion criteria (mentioned below) were applied, 170 records were excluded from the sample because of invalidities such as missing important investigations like OPG, incomplete patient data, inconsistency between diagnosis and investigation findings, syndromic patients including cleft cases, etc. (Figure 1). The sample consisted of 1778 females (71.1%), and 722 males (28.9) making a total of 2500 orthodontics patients who were aged from 11 to 35 years old.



**Figure 1:** Flow chart of the sample selection.

### Inclusion Criteria

- I. Libyan orthodontic patient, 11-35 years old at the onset of treatment.
- II. A Patient presented with fully erupted permanent maxillary lateral incisor(s).
- III. No history of extraction of maxillary lateral incisors, trauma, or evaluation of one or more maxillary anterior teeth.
- IV. At least one maxillary permanent lateral incisor is clinically present

- V. Pretreatment records including at least the diagnostic file, OPG, and the study models.

### Exclusion Criteria

- I. Incomplete pretreatment records, where one or more essential diagnosis tools (the diagnostic file including intra-oral photos, OPG, and the study models) are missing/damaged
- II. Non-Libyan patients
- III. Missing both of maxillary permanent lateral incisors
- IV. History of extraction of both maxillary permanent lateral incisors
- V. History of trauma/avulsion of maxillary permanent lateral incisors
- VI. History of restorative reshaping/crowing of maxillary permanent lateral incisors
- VII. Cleft lip and palate and syndromic patients.

The selected pretreatment records were checked by the two investigators searching the following: Unilateral or bilateral Peg-shaped permanent maxillary lateral incisor (PSMLI). This had been looked for in the diagnosis file for detection, then it was checked in OPG for confirmation and finally examined on the study model for measurements. Once peg-shaped MLI presence is indicated in the pretreatment diagnostic file, OPG is examined to confirm the diagnosis since it could be an "odontoma" or a supernumerary tooth with a conical shape. Then measurements were done on the study models where the mesiodistal width of the cervical-one third compared with the mesiodistal width of the incisal-one third of MLI to confirm that the tooth is peg-shaped according to Graanen Hans [5]. The collected raw data were organized and tabulated in frequency tables for clarity and ease of handling.

### Statistical Analysis

Descriptive statistical estimations (prevalence and association) of the collected raw data and the interexaminer reliability testing were performed using the Statistical Package for Social Sciences (IBM® SPSS® Statistics) version 26.

### Reliability Testing

For the reliability of examiners, 105 records from the sample were examined and the diagnosis of peg-shaped MLI was made by the two examiners, who were the investigators themselves, twice and simultaneously in the two sets of examinations. The intra-examiner and inter-examiner kappa test for the agreement was performed using SPSS. The results indicated an excellent intra-examiner and inter-examiner agreement according to the Kapp test,  $K = 100\%$  and  $90\%$  respectively ( $P > 0.05$ ). (Table 1 a,b & c).

## Results

### Characteristics of the Sample

The sample ( $n = 2500$  pretreatment orthodontic records) was made up of 1778 records for female patients (71.1%) and 722 records for males (28.9%) (Figure 2). Participants ages ranged from 11 years to 35 years old ( $\bar{x} = 16.98$  yrs. old,  $s.d. = 5.51$  yrs. old) with evident skewed distribution towards younger ages for both genders (Figure

3, a and b). The difference between the age means was statistically significant ( $p < 0.05$ ) (Table 2), however, the effect size was 0.1 which is a minimal effect of the differences between the two means according to Jacob Cohen [13,14].

### The overall prevalence of PSMLI

There were 187 records (7.48%) that showed the presence of PSMLI in this study where 52 records were for males and 135 records for females (Table 2). The separate prevalence of PSMLI was 7.2% and 7.6% among males and females respectively (Table 2). This difference was statistically insignificant ( $P > 0.05$ ). There were 66 unilateral PSMLI (2.7%) and 121 bilateral PSMLI (4.8%), however, this difference in prevalence is statistically insignificant (Table 2).

**Table 1:** Intra and inter-examiner Kappa credibility tests.

#### a- Examiner 1 Intra-examiner credibility

Value		Asymptotic Standard Error	Approximate Tb	Approximate Significance
Measure of Agreement	Kappa 1.000	.000	10.247	.000
N of Valid Cases		105		

#### b- Examiner 2 Intra-examiner credibility

Value		Asymptotic Standard Error	Approximate Tb	Approximate Significance
Measure of Agreement	Kappa 1.000	.000	10.247	.000
N of Valid Cases		105		

#### a- Examiner 1 and Examiner 2 interexaminer credibility

Value		Asymptotic Standard Error	Approximate Tb	Approximate Significance
Measure of Agreement	Kappa .906	.066	9.283	.000
N of Valid Cases		105		

**Table 2:** Prevalence & statistical significance of peg-shaped maxillary lateral incisors among the two genders.

	Total n= 2500	Male nm =722	Female nf =1778	$\chi^2$ test	p	Sign.
Overall	187 (7.48 %)	52 (7.20 %)	135 (7.59 %)	0.113	0.737	Insig.
Bilateral	121 (4.84 %)	40 (5.54 %)	81 (4.55 %)	1.081	0.299	Insig.
Unilateral	66 (2.64 %)	12 (1.66 %)	54 (3.04 %)	3.77	0.052	Insig.
R. sided unilateral	47 (1.88%)	7 (0.97 %)	40 (2.25 %)	4.56	0.033	Sign.*
L. sided unilateral	17 (0.68%)	6(0.83 %)	11(0.62 %)	0.343	0.558	Insig.

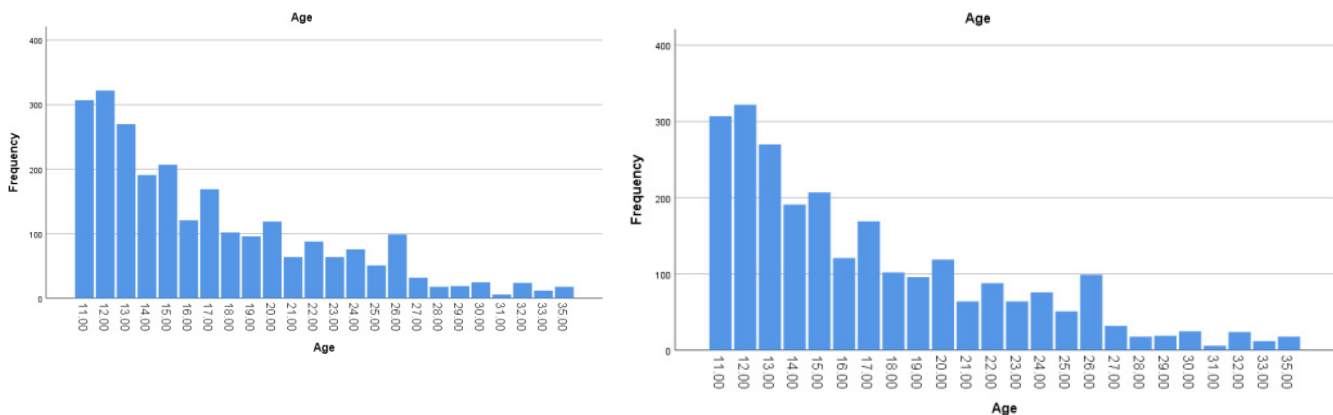
$\chi^2$  test = Person's Chi-square test **Insig.** = Statistically insignificant **Sign\*** = Statistically significant.

### Prevalence of bilateral PSMLI

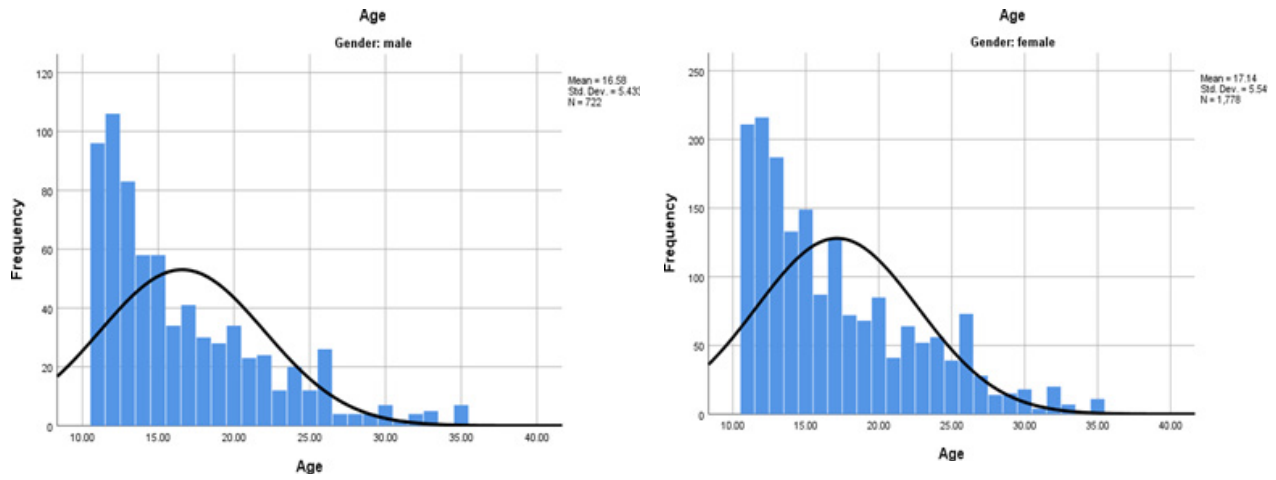
There were 121 records (40 for males, 81 for females) that showed bilateral PSMLI indicating a prevalence of 4.8% (Table 2, Figure 4). The prevalence among males was 5.54% while it was 4.55% among females, however, this difference was statistically insignificant ( $p > 0.05$ ) (Table 2, Figure 5).

### Prevalence of unilateral PSMLI

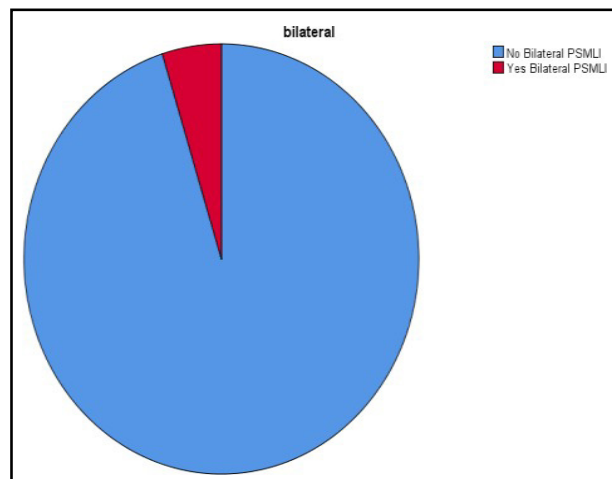
The prevalence of unilateral PSMLI was 2.64% where 66 records for 12 males (1.66%) and 54 records (3.04%) for females. It has been noticed that the odd ratio of male to female unilateral PSMLI is 1.85 i.e. males are more prone to have unilateral PSMLI. The prevalence of right-sided unilateral PSMLI among males was 1%, while it was 2.25% among females; the difference is statistically significant ( $p < 0.05$ ) (Table 3). The prevalence of left-sided unilateral PSMLI was 0.8% and 0.6% in males and females respectively which was statistically insignificant ( $p > 0.05$ ) (Table 3).



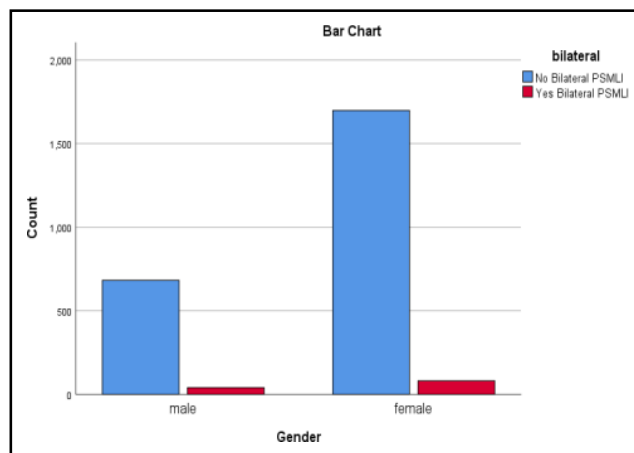
**Figure 2:** Characteristics of the sample.



**Figure 3:** Gender and age distribution of the sample note a positive skewness toward older age in both genders.



**Figure 4:** Overall bilateral PSMLI



**Figure 5:** Bilateral PSMLI in Males and Females

**Table 3:** Statistically significant difference between the prevalence of the right-sided PSMLI among the two genders.

Value		Approximate Significance	Exact Significance
Nominal by Nominal	Phi	.043	.034
	Cramer's V	.043	.034
N of Valid Cases		2500	

## Discussion

Since maxillary lateral incisors play a crucial role in the smile esthetics, this is evident if we consider the golden proportion (with the MLI is 62% of the width of the maxillary central incisor), the consonant smile arch where the incisal edges of the maxillary teeth follow the curvature of the lower lip, gingival smile line etc. [15,16]. MLI is mostly concerned with those who are interested in cosmetic dentistry such as orthodontists, prosthodontists, and periodontics [17]. Therefore, creating a database about the prevalence of MLI malformation provides insight into the epidemiology of this dental problem and establishes a basic awareness among the professionals and authorities helping to give the best possible management for such problems. Since information is scarce in regards to the prevalence of dental anomalies particularly peg-shaped lateral incisors in the Libyan population specifically in Benghazi city, this study can serve as a milestone in this context. Because the dwellers of Benghazi are a true mix of all Libyans from all over the nation, investigating such phenomenon on the *Benghazians* can give a clue on the states of the population in regards to the phenomenon under study.

It is generally maintained that orthodontic patients show a higher prevalence of dental anomalies, particularly the peg-shaped MLI [3,18,19] Mostly, patients suffering from peg-shaped maxillary incisors seek orthodontic treatment to solve their problem(s), hence most studies search orthodontic patients to figure out the prevalence or incidence of the congenital anomalies. Based on this fact this study investigated orthodontic patients in the age group who normally are interested in orthodontics with the completed formation of lateral incisors (11-35 years old). Orthodontic patients in the city of Benghazi receive orthodontic treatment mainly in the Department of Orthodontics in the Faculty of Dentistry, University of Benghazi, and several private orthodontic clinics, for this, the sample was picked up from the archives of the department and other three private clinics that have well-organized archives and the service is provided by orthodontists possess a qualification in the speciality.

The initially screened 2670 records were subjected to strict double-checking to exclude 170 records because of ineligibility; the study was performed on 2500 orthodontic patients' records. The authors were meticulous in the inclusion of records making sure that the peg-shaped is present and there is no miss-diagnosis of the case; they examined both the study models and the OPG of each member of the sample. To ensure the reliability of the examiners, the Kappa test for the agreement was performed and the results indicated excellent intra- and inter-examiner agreement (K=100% and K= 90% respectively) (Table 1).

## Prevalence of the phenomenon (PSMLI)

The overall prevalence of peg-shaped MLI varies depending on the population, race, geographic location, gender and even skeletal-dental occlusion on some occasions [20-23]. These differences support the theory of genetic influence on the aetiology of peg-shaped MLI, further, it has been noticed the prevalence is at the highest levels among Asians and is the lowest among Caucasians [24]. In a study carried out on several nationalities who were living in Saudia Arabia, Alhabib S et al. [20] postulated that the highest prevalence of peg-shaped MLI was found among Saudis, followed by Egyptians, and males were more prone to the phenomenon than females, except the Pakistanis who showed that the prevalence was significantly higher in males than females; nevertheless, Kifayatullah et al. in 2019 [25] found that the females showed a higher prevalence of the phenomenon than males in a study done on Pakistanis in their home country. This study showed an elevated prevalence of PSMLI among Libyan orthodontic patients, compared to findings of similar studies done on the closer populations such as Jordanians, Turkish, and Saudis [26-28].

Several studies supported the notion that environment and geographic location can play a considerable role in the aetiology of microdontia of maxillary lateral incisors along with genetics [3,20,21,24,29-31]. In this study, the overall prevalence of PSMLI was 7.4% (unilateral: 2.6%, bilateral: 4.8%), with no statistically significant difference between the two genders (Table 3). Other studies indicated different prevalences of PSMLI among females and males [32]. However, Yan HW and Sintian A, 2020, [33] concluded that the prevalence was higher in males than females. On the contrary, Kazanci F et al. [34] postulated that peg-shaped lateral is seen as more prevalent among female Turkish orthodontic patients, in addition, they revealed that PSMLI comes as the third most prevalent dental anomaly (2.12%) in the Turkish orthodontic population after hypodontia (4.74%) and teeth impaction (4.55%) [34]. The findings of this study regarding the effect of gender on the prevalence of PSMLI goes well with that of Nayak P and Nayak S [22] who found an insignificant difference in the occurrence of PSMLI among the males and females i.e. no effect from the gender on the prevalence of the phenomenon. Also, Jameel Kifayatullah et al, 2019, [25] concluded that despite those Pakistani females showing a higher prevalence of PSMLI than males, it was not significant. Hua F et al. [3] in their meta-analysis that investigated the prevalence of Peg-shaped MLI among different studies done on a different population, advocated that prevalence is variable according to gender, site of the tooth, ethnicity, population, geographical location and orthodontic condition of the persons under the study. In their study, they concluded that the overall prevalence was 1.8%, however, it is higher among Mangolains (3.1%), and in Blacks (1.5%) compared to white people (1.3%). In orthodontic patients, the prevalence was 2.7%, and the females were 1.35 times more likely than men to have peg-shaped MLI. This study agrees with some findings of Hua F et al. [3] and does not with other findings. This study found no gender effect on the prevalence, postulating insignificant differences in the overall prevalence of peg-shaped MLI between males and females. In regards to the site of anomaly, this study found that unilateral and

bilateral occurrence of peg-shaped MLI is statistically insignificant, which is in agreement with Hua F et al. [3] as well as the findings of Yan HW and Sintian [33] findings. On the other hand, the odd ratio of male to female unilateral PSMLI is 1.85 indicating that males are more susceptible to having unilateral PSMLI almost as twice as females. This finding has been shown by Alhabib S et al. [20].

### Association with Palatally Displaced or Impacted Maxillary Canine

As a posthoc finding, this study investigated the association between PSMLI and maxillary canine impaction. According to Peak L, Peck S and Attia I [23] and others [35-40], the maxillary canine could be the most variable tooth in a position, that is most frequently found displaced either palatal or buccal but less regularly seen displaced in the mesiodistal direction. Peak & Peak and Attia I [23] found a strong association between peg-shaped MLI and canine displacement referring to that as evidence of the genetic basis of such anomalies. This study found that this issue is interesting and further work will be done on it and published in a separate scientific paper.

### Conclusion

1. PSML in Libyan orthodontic patients is more prevalent than in some other populations.
2. No effect of gender on the phenomenon except in the case of the right-sided unilateral PSMLI, which was more in females.
3. A kind of association between the occurrence of peg-shaped permanent maxillary lateral incisors and ectopic placement of permanent maxillary canines.

### Recommendations

The researchers of this study advise carrying on investigating the prevalence of dental anomalies among the Libyan population since it has been found that the prevalence of peg-shaped maxillary lateral incisors is noticeably higher among the Libyans. In addition to investigating the association between PSMLI and other dental anomalies particularly ectopic displacement of permanent maxillary canines.

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