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The Prevalence of Peg-shaped Maxillary Permanent Lateral Incisors in the Turkish Population

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Abstract

Aim The development of human dentition is influenced by a complex interplay of diverse factors spanning epigenetic, environmental, physical, chemical, biological, and genetic realms. Variations in the morphology and dimensions of upper lateral incisors have been documented, commonly resulting in a reduction in mesiodistal size, a phenomenon often referred to as "peg-shaped laterals". This study aimed to explore the prevalence of peg-shaped maxillary permanent lateral incisors while investigating potential correlations with gender and laterality.

Material and method The study comprised 1076 Turkish individuals, aged between 18 and 75, who sought treatment at the Istanbul University Restorative Dentistry Clinic. Prior to examination, participants provided voluntary consent by completing consent forms. To ensure precision and consistency, all examinations were conducted by a single clinician with a minimum of twenty years of clinical experience. Patient selection adhered to predefined inclusion and exclusion criteria. Anamnestic data, encompassing age, gender, past dental history, general health status, and intraoral examination findings, were documented. Examinations focused on the anterior region, specifically between the maxillary canine teeth.

Results Peg-shaped incisors were noted in 7.2% of cases (n=77), with 54 cases being unilateral and 23 bilateral. Among the cases, 7.4% (n=52) were observed in females and 6.7% (n=25) in males. A total of 97 peg-shaped incisors were identified in both left and right maxillary lateral incisors.

Conclusion The research took place in Istanbul, Türkiye, a cosmopolitan metropolis. Expanding such investigations to various regions within Türkiye would yield a richer and more comprehensive dataset, enhancing the study's significance.

Keywords Anatomical shape, Dental anomaly, Maxillary lateral incisors, Peg-shaped laterals, Prevalence study

Introduction

A smile is considered significant all over the world, especially for young adolescent patients, for whom having teeth that are different from their peers might cause them to become embarrassed. Having a peg lateral at the eruption stage, may result in imperfection and smaller size compared to other anterior teeth, which might cause anxiety and disappointment in the patient. Human dentition is affected by multilevel, diverse and multidimensional interferences, which are epigenetic, peripheral such as physical, chemical, and biological or genetic, stemming from metabolic factors, inheritance and mutations. A combination of peripheral and genetic agents causes these malformations in some cases (1). Morpho-differentiation phase begins in utero or the first year of life. If endocrine disturbances occur during this phase, they affect the size and form of the crown of teeth. Disturbances in morpho-differentiation may affect the form of the tooth in terms of size and shape without any obstruction of the activity of ameloblasts and odontoblasts, and the function of the tooth, resulting in a normal structure but a peg-shaped or malformed tooth with dentine and enamel (2,3).

Alterations in the morphology and dimensions of upper lateral incisors have been documented, with a prevalent observation being a decrease in the mesiodistal dimension (2). This often results in the characterization of such teeth as "peg-shaped laterals" or simply "peg laterals" (3). Graham defined a peg-shaped tooth presenting as the cervical span of the suit crown being longer than the incisal mesiodistal breadth, and which is usually a maxillary adult lateral incisor (4). There is a diastema between adjacent teeth in mesial and digital surfaces because of a peg-shaped crown whose form is converged incisally. Because of the peg-shaped laterals, the central incisors drift distally into malposition, and this causes the presence of a diastema to shift to the midline region of central incisors (5). Mesiodistal width of a lateral is a lot smaller in some compared to average width and does not present the characteristic pointed peg form, in which case they are plainly called “small lateral incisors” (3). This difference in width leads to periodontal, orthodontic and aesthetic problems for the patients (3).

According to some studies, transposed teeth, taurodontism, peg-shaped incisors and supernumerary teeth may occur in subjects with tooth agenesis (6-10). On the other hand, some studies assert that the formation of peg laterals is related to ge-

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netic mechanisms. These studies claim that the flawed gene can be expressed divergently through indistinct teeth (11,12). According to Granat and Chapelle, a tooth decreases in volume and changes into a conic shape before disappearing due to the evolution within a species (13). Brooke says that distinct dental anomalies are the result of any inconsistency between the cellular and molecular components during tooth development (14). These dental anomalies may also be observed as morphological and structural changes or alterations in the number of teeth. Different dental anomalies, like over retained deciduous teeth, poly-diastema and canine transposition may result in peg laterals (15).

Many researchers have reported different frequencies of peg-shaped lateral incisors. They varied dramatically from 0.6% (16) to 9.9% (17). The incoherence in their results could be attributed to variations in original races of populations and ethnic groups, and the differences in sampling methodologies (18-20). Peg-shaped lateral teeth are usually smaller than healthy teeth. The occurrence frequency of peg-shaped maxillary lateral incisors has been observed to be higher than the occurrence frequency of other developmental malformations of teeth (17). Studies reported that the existence of maxillary peg-shaped lateral incisors was on either the left or right side of the jaw. Bilateral presence of peg-shaped lateral incisors is a rare case (21,22).

The occurrence frequency of developmental dental anomalies in the Turkish population has been studied several times (23-28) by different researchers. However, there was not a study directly aimed at the investigation of the prevalence of peg-shaped lateral incisors in the Turkish population. Therefore, this study was conducted with the purpose of investigating the prevalence of peg-shaped maxillary permanent lateral incisors and possible associations with race, sidedness, and sex.

Material and Methods

Approval for the clinical trial was obtained from the Istanbul University Faculty of Dentistry Ethics Committee (protocol number: 2016/16). The study was conducted in full accordance with the World Medical Association Declaration of Helsinki. 1076 Turkish patients aged 18 to 75, who were admitted to Istanbul University Restorative Dentistry Clinic between May and October 2016, were included in this study. Each patient provided informed written consent, and the patients signed the Ethics Committee form at the beginning of the study. A general and systemic anamnesis was obtained from the patients. The details pertaining to age, gender, past dental records, overall health status, and intraoral examination findings of the participants were meticulous,sly recorded on dedicated anamnesis papers. In order to guarantee the attainment of precise and uniform outcomes, all patients underwent examination conducted by a solitary clinician possessing a minimum of two decades of clinical expertise (O.Y.). Participants fitting the exclusion criteria listed below were exempted from the study.

The examination process for each patient was carried out in the same unit with the help of a hand mirror and a probe under the dental chair light. The anterior region spanning between the right and left canine teeth on maxillary was examined. In order to facilitate the diagnosis of the presence of the anomaly, the acquired data were supported by intraoral periapical and panoramic radiographic images, which were taken before the examination. During the examination of each patient's mouth, the peg-shaped size was marked as "1" and normal shaped sizes were marked as "0". Digital calipers were used to accurately measure crown widths.

The peg-shaped qualities of the incisors were determined based on the following inclusion criteria (29): 1) Peg-shaped crown: the teeth take a convergent shape towards the margin of incisal. The crown feature is outside the standards for crown length from mesial to distal, and the morphology is distorted. 2) Curtailed crown size: although the size of the crown distal from the mesial is less than 5.5 millimeters, normal morphology is observed.

The participants were evaluated according to the exclusion criteria used by Guttal et al. and Albashaireh et al. (29,30): 1) Patients with a mesial-distal size of the teeth greater than 5.5 millimeters. 2) Patients having missing teeth due to congenital an unrecognized method of extraction history in the anterior region between the right and left canines on maxilla. 3) Crowned or restored incisor teeth. 4) Pediatric age group (<18 years). 5) Patients diagnosed with a syndrome such as Down syndrome, ectodermal dysplasia, etc. 6) Patients with cleft lip and palate.

All gathered data were transferred to a digital environment and prepared for analysis (Excel 2017; Microsoft Office, Microsoft corporation, USA). NCSS (Number Cruncher Statistical System) 2007 (Kaysville, Utah, USA) program was used for statistical analysis. The Mann Whitney U test was used to compare two groups of non-normal distribution variables. Pearson Chi-square and Fisher's Exact test were used to compare qualitative data. Significance was assessed at $p < 0.05$.

Results

The total of 1076 cases was made up of 702 (65.2%) females and 374 (34.8%) males (Figure 1). The participants presenting the cases consisted of patients within the age range of 18 to 75 years with an average of 33.7 ± 12.3 years (Table 1).

Table 1: Distribution of Demographic Characteristics

Age (years)	**Min-Max (Median)**	18-75 (33)
	Mean±Sd	33.70 ±12.30
Gender; n (%)	**Female**	702 (65.2)
	Male	374 (34.8)

The age of female participants ranged from 18 to 73, with an average of 33.68± 12.33 years, while the age range of the male participants was between 18 and 75, with an average of 33.74± 12.26 years. Peg-shaped incisors were observed in 7.2% of the cases (n=77). Of these cases, 54 were found to be unilateral while 23 were bilateral. Peg lateral syndrome was found in 7.4% of female cases (n=52) and 6.7% of male cases (n=25); this was not considered a statistically significant difference with respect to gender (Table 2). The number of patients that presented peg-shaped maxillary lateral incisors was 75, and two patients had maxillary canines which were peg-shaped (Table 2). In addition, peg-shaped lateral incisors were equally distributed as unilateral (22 left, 29 right; 51 teeth in total) or bilateral (34 teeth). Maxillary canines diagnosed as peg-shaped were bilateral in one case and unilateral in the other (Firgure-2). The

percentages of observed peg shaped incisors were 0.2% (n=2) in left maxillary canines, 4.2% (n=45) in left maxillary lateral incisors, 4.8% (n=52) in right maxillary lateral incisors, and 0.1% (n=1) in right maxillary canines, whereas peg-shaped incisors were not detected in the maxillary central incisors (Table 2).

Table 2: Evaluation of the Presence of Peg Lateral Syndrome in the Anterior Teeth by Gender

		Gender		Total (n=1076)	p
		Female (n=702)	Male (n=374)		
Peg Lateral Syndrome	13	1 (0.1)	1 (0.3)	2 (0.2)	[a]1.000
	12	30 (4.3)	15 (4.0)	45 (4.2)	[b]0.838
	11	0 (0)	0 (0)	0 (0)	-
	21	0 (0)	0 (0)	0 (0)	-
	22	33 (4.7)	19 (5.1)	52 (4.8)	[b]0.782
	23	1 (0.1)	0 (0)	1 (0.1)	[a]1.000
Total Peg lateral syndrome status	No	650 (92.6)	349 (93.3)	999 (92.8)	[b]0.661
	Yes	52 (7.4)	25 (6.7)	77 (7.2)	
Frequency of Peg Lateral syndrome	Min-Max (Median)	0-2 (0)	0-2 (0)	-	[c]0.695
	Mean±Sd	0.09±0.35	0.09±0.37	-	

[a]Fisher's Exact Test, [b]Pearson Chi-Square Test, [c]Mann Whitney U Test

Discussion

Developmental dental anomalies are relatively common. A lot of genetic factors such as specific syndromes and environmental factors such as cancer therapy, cytotoxic medications, traumatic dental injuries, radiation and dioxin might affect and arrest tooth development (31,32). Several kinds of issues ranging from ectodermal and mesenchymal factors may cause the initiation, the morphogenesis and the differentiation. The initiations may present in the number and region of teeth. The morphogenesis may occur as size, type, and shape of teeth, including dimensions and cusp number. The differentiation may be observed in tooth structure in the dentine, and enamel mineralization and formation (14).

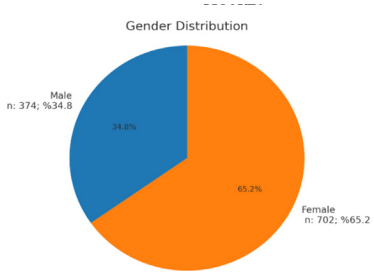


Figure 1: Gender distribution

The locution microdontia (microdentism, microdontism) designates the condition displaying abnormally small teeth (33). Microdontia is chiefly divided into three types (35,36): 1) True generalized microdontia: all of the teeth are smaller than normal. 2) Relative generalized microdontia: normal teeth exist on an abnormally large jaw. 3) Localized microdontia: involving only a single tooth.

Microdontia can include different tooth morphologies and contours. The most mentioned example of localized microdontia is a maxillary lateral incisor which is called "peg lateral". The characteristic peg-shape is explained as a crown diameter that decreases markedly from cervical margin to incisal edge at the anterior teeth in the primary or permanent dentition. The average mesio-distal width of maxillary lateral incisor is 6.6 millimeters, ranging between 5 and 9 millimeters (32). It is usually about 2 millimeters narrower mesio-distally and two millimeters shorter cervico-incisally than the central incisor (3). The average mesio-distal width of peg-shaped lateral is less than 5.5 millimeters (3).

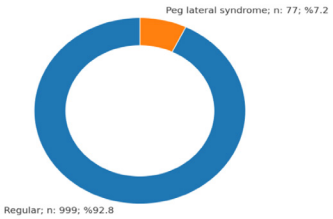
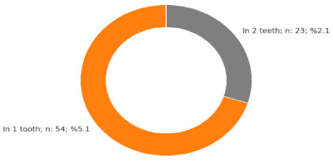


Figure 2: Total Peg Lateral Syndrome status



The sample size of prevalence studies is significant in determining the real score. In previous studies, the sample sizes were dramatically different, either relatively small or too large (34,35). Having a too small sample size might have compromised the representativeness of the underlying population. Contrarily, if the sample size was too large (over 10,000), it might have caused the possibility of overlooking affected subjects, and thus, underestimating the prevalence rates.

Several investigators have reported different frequencies of peg-shaped lateral incisors 18 to 20. In this study, the prevalence of peg-shaped lateral incisors was found in 7.2% of the cases. According to the meta-analysis conducted, the prevalence of peg laterals worldwide is 1.8%, which translates to nearly one in every 55 people (36). According to previous studies, the prevalence of peg laterals is 5.1% in China (37), 3.1% in Mongoloid people (36), 1.5% in black people and 1.3 in white people (36, 38). Hua et al. say that the prevalence for white people in Europe (1.2%) was also slightly higher than the North American white people (0.9%) (38). In this study, the prevalence of peg-shaped lateral is 7.2%, which is higher than white people in Europe. However, another study by Celikoglu reported a much higher percentage (20.2%) for the frequency of peg laterals in a Turkish population (7). Most researchers think that this variation could stem from a specific difference among ethnic groups. The difference may also be attributed to genetic variations.

In a previous study by Gupta SK et al., 1123 individuals were examined. A total of 11 male and 18 female subjects (2.58%) had unilateral or bilateral peg-shaped teeth (39). The number of individual subjects included in their study was nearly the same as this study, where 52 females and 25 males were observed to have peg laterals. This represents a higher frequency of peg laterals then the one observed by Gupta SK et al. (38).

The reported prevalence of the sidedness characteristic of peg-shaped teeth also varied in the literature. In the present study, 54 of the peg-shaped laterals were unilateral (5.1%), and 23 of them were bilateral (2.1%), which is incompatible with the results acquired in

the study conducted by Amin (3). This rate is higher than the findings of Gupta SK et al. and Hua et al. (38,39). Even though unilateral peg laterals were more common in most studies (17,39), bilateral peg shaped teeth were more common in several others (40,41). Celikoglu found that unilateral peg laterals had a higher frequency of occurrence than bilateral in the Turkish population (7).

In contrast to the data gathered in our study, Hrdlicka (42) found that there was a slight propensity for left sided peg laterals, similarly Meskin and Gorlin (41) identified a 2-to-1 ratio favoring left sided peg-shaped teeth. According to the findings achieved in this study, the occurrence frequency of left sided peg laterals (4.4%) did not present a statistically significant difference from the frequency of right sided peg laterals (4.2%). The nearly equal expression of bilateral and unilateral peg laterals, as well as the tendency to occur on the left side, is not fully understood yet.

According to this study, the presence of peg laterals present a slightly higher frequency in females (7.4%) than in males (6.7%), which does not reflect a statistical meaningful difference. The results reported by several other studies concluded that the frequency of peg laterals was higher in females than in males (3-7). On the other hand, another study also reported that there was not a significant difference between the genders in terms of the frequency of peg laterals (11). Such results may have been impacted by the differences among the study sample and socio-demographic variables. In a previous study, the authors have stated that microdontia displays a strong correlation with hypodontia (43). Additionally, Antunes et al. suggested that tooth agenesis and peg-shaped lateral incisors could perchance have the same genetic background (44). In the present study, none of the patients presented hypodontia. Studies of a wider range may contribute different results to this issue. The results achieved in this study were not similar to the results of other studies conducted in Türkiye (23-28), and some differences were observed in certain aspects which could have been due to genetic differences and the differences in the methods, place, sample selection procedures in the study and racial factors.
In terms of limitations, the focus was exclusively on peg-shaped teeth in the maxillary anterior region. Other dental anomalies in different jaws, regions, or teeth could have been examined as well. Enlarging the sample size of the study by including different cities in Türkiye is recommended to support and confirm the data indicating the prevalence of peg-shaped lateral incisors.

Conclusion

In conclusion, peg-shaped lateral teeth were identified in 7.2% of the patients, and it was determined that this anomaly is more frequently observed in females compared to males. This study elucidates the prevalence of peg-shaped lateral incisors within the Turkish population and serves as a means to raise clinicians' awareness in better understanding the frequency of this dental anomaly.

Declarations

Author Contributions: *Conception/Design of Study- O.Y., M.Y.U., M.D.; Data Acquisition- O.Y.; Data Analysis/Interpretation- O.Y., M.Y.U.; Drafting Manuscript- O.Y., M.Y.U.; Critical Revision of Manuscript- O.Y., M.Y.U., M.D.; Final Approval and Accountability- O.Y., M.Y.U., M.D.; Material and Technical Support- O.Y., M.Y.U., M.D.; Supervision- M.D.*

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