

Prevalence and orthodontic management of missing permanent maxillary lateral incisor at a referral centre in Sabah

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Abstract

This was a cross-sectional study of the prevalence and orthodontic management of developmental missing permanent maxillary lateral incisor of patients referred for orthodontic treatment from year 2010 to 2020. The dental records of written case notes, radiographs, and study models that fulfilled the inclusion criteria were selected using systematic sampling and were assessed retrospectively. Sample were taken from every five dental records. Dental records that did not fulfil the inclusion criteria were substituted. Data taken were the demographic data, side of the missing maxillary lateral incisor, and the orthodontic management. All variables were analysed descriptively. The differences between orthodontic open space and orthodontic close space with respect of unilateral and bilateral missing permanent maxillary lateral incisor were tested using Fisher's exact test. From the total of 291 samples, there were 11 (3.78%) patients presented with missing permanent maxillary lateral incisor. The mean age of the patients was 17.46 ± 1.52 years. All 11 patients were females. There were six (54.55%) patients presented with bilateral missing permanent maxillary lateral incisor, while five (45.45%) were unilateral. From the unilateral group, there were three (27.27%) patients presented with right side missing permanent maxillary lateral incisor. Six (54.55%) patients were treated with orthodontic open space, while five (45.45%) patients were treated with orthodontic close space. In conclusion, the prevalence of missing permanent maxillary lateral incisor was 3.78%. All patients were females. More patients presented with bilateral missing permanent maxillary lateral incisor. The treatments provided were orthodontic open space and orthodontic close space.

Keywords: *hypodontia, lateral incisor, missing, orthodontic, prevalence*

Introduction

The permanent maxillary lateral incisor is the most common missing tooth (not including the third molars) (Fauzi *et al.*, 2019; Mani *et al.*, 2014; Nik-Hussein, 1989; Shakirah Said *et al.*, 2017) and can contribute to malocclusion (Caterini *et al.*, 2017). Two-thirds of the missing maxillary lateral incisor were unilateral, while the remaining one-third were bilateral (Arandi & Mustafa, 2018). A study on the Malaysian

population found that more missing teeth observed at the maxilla and on the right side (Fauzi *et al.*, 2019), although there was another study found that missing permanent maxillary lateral incisor were more commonly occurred on the left side (Arandi & Mustafa, 2018).

The prevalence of missing permanent maxillary lateral incisor varied among different regions and populations. The prevalence of missing permanent maxillary lateral incisor among orthodontic patients

Received:

8 February 2023

Revised:

22 April 2023

Accepted:

25 May 2023

Published Online:

31 July 2023

How to cite this article:

Lee, J. H. (2023). Prevalence and orthodontic management of missing permanent maxillary lateral incisor at a referral centre in Sabah. *IIUM Journal of Orofacial and Health Sciences*, 4(2), 132–139. <https://doi.org/10.31436/ijoh.s.v4i2.212>

Article DOI:

<https://doi.org/10.31436/ijohs.v4i2.212>

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was 3.77% (Sahoo *et al.*, 2019; Swarnalatha *et al.*, 2020). Meanwhile, the prevalence of missing permanent maxillary lateral incisor among hypodontia orthodontic patients were 26.5% (Acev & Gjorgova, 2014), 19.8% (Kim, 2011), and 17.8% (Gracco *et al.*, 2017; Zakaria *et al.*, 2021). However, the prevalence of missing permanent maxillary lateral incisor was found to be lower among non-orthodontic populations; 1.91% (Arandi & Mustafa, 2018), and 2.56% (Musaed *et al.*, 2019).

The treatment of missing permanent maxillary lateral incisor is challenging and complex, requiring very careful treatment planning, good communication with the patient, and coordinated interdisciplinary efforts of the orthodontist, periodontist, prosthodontist, and restorative dentist. The two orthodontic treatment options are open space with prosthetic replacement and close space with canine camouflage. Careful diagnosis and treatment plan are important because the spacing is available on the anterior part of the upper arch that affects the dental function and aesthetic. The decision whether to open space or to close space could be controversial (Gupta & Rauniyar, 2021). Both orthodontic close space and orthodontic open space with implant replacement produced similar well-accepted aesthetic results (Jamilian *et al.*, 2015). Other simpler treatment option is the maintenance of the retained primary teeth with composite build-up.

At the present, the two most recommended procedures for prosthetic replacement are the single-tooth implant and the fibre-reinforced resin-bonded bridge with a ceramic overlay (Dudney, 2008). Each available treatment has its own advantages, disadvantages, indications, and limitations. The treatment plan should not be influenced by the clinician's bias, but the patient's realistic expectation should be taken into consideration (Kavadia *et al.*, 2011). Other prosthetic option is the removable partial denture if patients preferred less complicated and less expensive treatment.

Patients with spaces closed by substituting permanent canines had significant healthier

periodontal tissues than patients with prosthetic replacement (Jamilian *et al.*, 2015; Nordquist & McNeill, 1975). Moreover, orthodontic space closure appeared to be reasonably stable and better accepted by the patients than prosthetic replacements. There was no difference in the prevalence of dysfunction and impaired temporomandibular joint function, but there was greater tendency of plaque accumulation and gingivitis development in subjects with prosthesis replacement (Robertsson & Mohlin, 2000). Infraocclusion greater than 1 mm was found in implant patients (Jamilian *et al.*, 2015).

Missing permanent maxillary lateral incisor can have a major impact on the dental and facial aesthetics from a very young age, which may affect the self-esteem and social well-being of the patient. This condition was often complicated by other dental anomalies associated with hypodontia, such as impacted teeth, microdontia, hypodontia of posterior teeth, delayed eruption, and taurodontism (Ministry of Health Malaysia, 2012).

The demand for orthodontic treatment is high due to its impact on both dental function and facial aesthetics. Knowledge and updates on the prevalence and orthodontic management of missing permanent maxillary lateral incisor are important to assist clinicians in early diagnosis and timely referral for interceptive treatment to prevent developing malocclusion. Therefore, the aim of this study was to assess the prevalence and orthodontic management of developmental missing permanent maxillary lateral incisor at a government orthodontic clinic in Kota Kinabalu, Sabah. The findings from this study may help us to know more of the needs of the community, to plan treatment, and also to serve as a baseline reference for future multicentre study for missing permanent maxillary lateral incisor.

Materials and Methods

This was a cross-sectional study of the available dental records of patients referred for orthodontic treatment from year 2010 to

2020 at a government orthodontic clinic in Kota Kinabalu, Sabah. Ethical approval for this study was obtained from the Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia and registered with the National Medical Research Register (NMRR-20-2316-56893).

The dental records consisted of written case notes, relevant radiographs (dental panoramic radiograph, periapical radiograph and upper standard occlusal radiograph), and study models that fulfilled the inclusion criteria, were recruited and assessed retrospectively by a researcher (LJH). The sample size for this study was estimated to be 156, with 0.03 (3%) precision based on 3.8% prevalence with at least one missing permanent maxillary lateral incisor in an orthodontic population by Sahoo *et al.* (2019).

The inclusion criteria were patients who have no previous orthodontic treatment before and presented with developmentally missing permanent maxillary lateral incisor. The exclusion criteria were patients who presented with congenital syndromes, genetic disorders and craniofacial deformities e.g. cleft lip and palate, the missing permanent maxillary lateral incisor was due to dental extraction or trauma, and inadequate evidence from the dental records, due to poor quality radiograph or study model to diagnose or to confirm the missing maxillary lateral incisor and previous treatment.

The patients' dental records were selected using systematic sampling. Sample were taken from every five dental records in the storage. Dental records that did not fulfil the inclusion criteria were substituted. Data taken were the demographic data (age, gender, and ethnic group), side of the missing maxillary lateral incisor, and the orthodontic management of the missing maxillary lateral incisor.

The data was entered into a standardised data collection form. All variables were analysed descriptively using Stata 15. The differences between orthodontic open space and orthodontic close space with respect of unilateral and bilateral missing permanent maxillary lateral incisor were tested using Fisher's exact test. The level of significance was set at 5% ($p < 0.05$).

Results

A total of 291 samples were taken from the dental records and assessed. There were 11 (3.78%) patients presented with missing permanent maxillary lateral incisor (Figure 1). The mean age of the patients with missing permanent maxillary lateral incisor at the time of referral, was 17.46 ± 1.52 years. All of the patients presented with missing permanent maxillary lateral incisors were females ($n=11$, 100.00%).

The ethnic groups with missing permanent maxillary lateral incisor were Kadazan Dusun ($n=2$, 18.18%), other Bumiputera Sabah (Bajau and Brunei) ($n=3$, 27.27%), Chinese ($n=4$, 36.36%), Malay ($n=1$, 9.10%), and other ethnicity ($n=1$, 9.10%) (Table 1). The prevalence of missing permanent maxillary lateral incisor was highest in other Bumiputera Sabah ($n=3$, 5.46%), followed by Malay ($n=1$, 4.76%), Chinese ($n=4$, 4.30%), and other ethnicity ($n=1$, 3.70%). Kadazan Dusun had the lowest prevalence of missing permanent maxillary lateral incisor ($n=2$, 2.11%) (Table 2).

There were six ($n=6$, 54.55%) patients presented with bilateral missing permanent maxillary lateral incisor, while the remaining five ($n=5$, 45.45%) were unilateral missing permanent maxillary lateral incisor. From the unilateral group, there were three ($n=3$, 27.27%) patients presented with right side missing permanent maxillary lateral incisor (Figure 2).

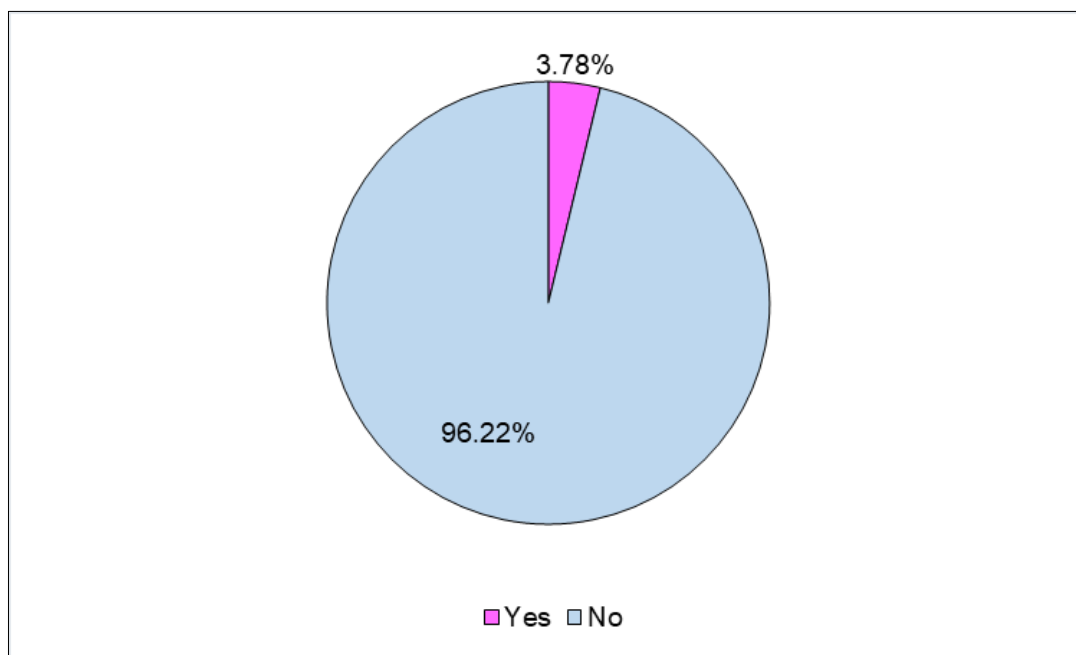


Figure 1. Prevalence of missing permanent maxillary lateral incisor.

Table 1. Demographic profile of the patients with missing permanent maxillary lateral incisor.

Variables		n (%)	Mean ± SE
Age		-	17.46 ± 1.52
Gender	Female	11 (100.00)	
	Male	0 (0.00)	
Ethnic groups	Kadazan Dusun	2 (18.18)	
	Bumiputera Sabah	3 (27.27)	
	Chinese	4 (36.36)	
	Malay	1 (9.10)	
	Other ethnicity	1 (9.10)	

Table 2. Prevalence of missing permanent maxillary lateral incisor among ethnic groups.

	Missing	Total sample	Prevalence (%)
Kadazan Dusun	2	95	2.11
Other Bumiputera Sabah	3	55	5.46
Chinese	4	93	4.30
Malay	1	21	4.76
Other ethnicity	1	27	3.70
Overall	11	291	3.78

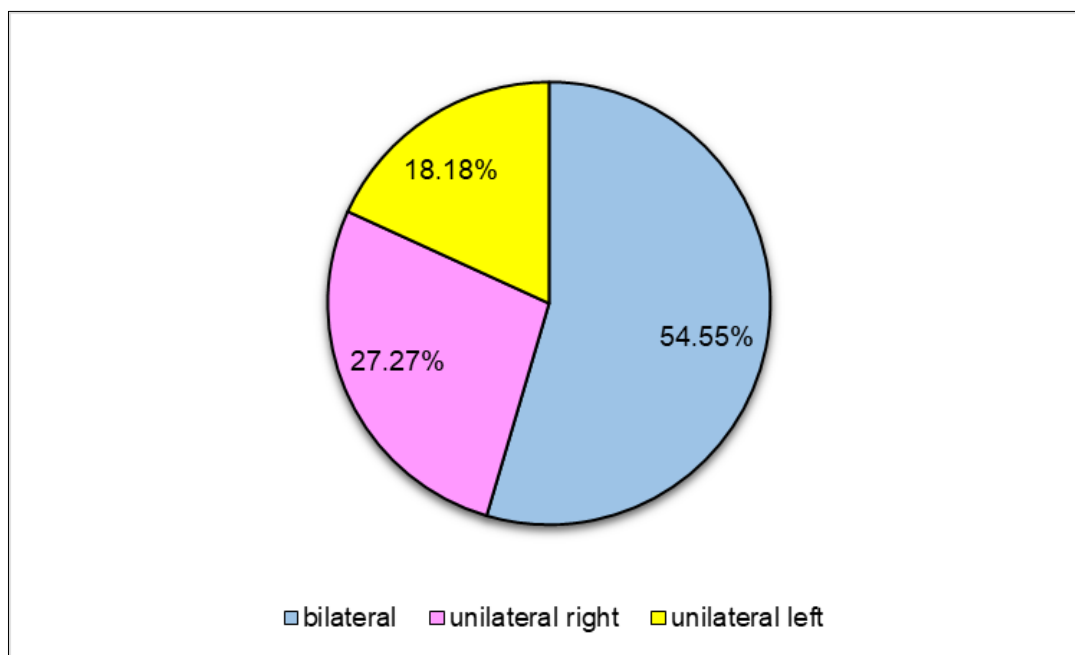


Figure 2. Pattern of missing permanent maxillary lateral incisor.

From the total of 11 patients who had missing permanent maxillary lateral incisor, six (n=6, 54.55%) patients were treated with orthodontic open space, while the remaining five (n=5, 45.45%) patients were treated with orthodontic close space. Among the patients with unilateral missing permanent maxillary lateral incisor, more than half of them (n=3, 60%) were treated with

orthodontic close space. In contrast, among the patients with bilateral missing permanent maxillary lateral incisor, more than half of them (n=4, 66.67%) were treated with orthodontic open space. These findings were not statistically significant, $p > 0.05$ (Table 3).

Table 3. Type of orthodontic management based on unilateral or bilateral missing permanent maxillary lateral incisor.

Type of management	Unilateral missing (%)	Bilateral missing (%)	Total (%)
Open space	2 (33.33)	4 (66.67)	6 (100.00)
Close space	3 (60.00)	2 (40.00)	5 (100.00)

Fisher's exact = 0.740

Discussion

In Malaysia, the three major ethnic groups are Malay (51.0%), Chinese (24.2%), and Indian (7.2%) (Nagaraj *et al.*, 2015). Meanwhile in Sabah, the largest ethnic group is Kadazan Dusun, which is about one-third of the total population. Chinese is the largest non-Bumiputera ethnic group in Sabah

(Kerajaan Negeri Sabah, 2023). In this study, the prevalence of missing permanent

maxillary lateral incisor was higher in Malay compared to Chinese, similar to a hypodontia study conducted in Peninsular Malaysia (Zakaria *et al.*, 2021). Other Bumiputera Sabah had the highest prevalence, whilst Kadazan Dusun had the lowest prevalence of missing permanent maxillary lateral incisor. However, there is no similar study done before on Sabah population. Therefore, these findings might serve as a baseline data for future hypodontia studies.

The prevalence of missing permanent maxillary lateral incisor in this study was same with the finding by Sahoo *et al.* (2019) and Swarnalatha *et al.* (2020). However, this finding was not comparable to other studies by Acev & Gjorgova, Kim, and Gracco *et al.* as their prevalences were determined from orthodontic patients with other missing teeth or hypodontia (Acev & Gjorgova, 2014; Gracco *et al.*, 2017; Kim, 2011).

All of the patients in this study who were presented with missing permanent maxillary lateral incisor were females. It seemed that congenitally missing teeth usually occurred more commonly in females than males (Alhaddad *et al.*, 2019; Kafantaris *et al.*, 2020; Rakhshan, 2015; Swarnalatha *et al.*, 2020; Zakir *et al.*, 2015).

There were more patients presented with bilateral missing permanent maxillary lateral incisor in comparison to unilateral missing permanent maxillary lateral incisor. From the unilateral group, more were presented with right side missing permanent maxillary lateral incisor. These findings were similar to other studies (Sahoo *et al.*, 2019; Swarnalatha *et al.*, 2020). It is important for the clinician to diagnose the missing lateral incisor, either bilateral or unilateral before planning for the treatment due to the differences in the spaces available to be managed.

Among the patients with unilateral missing permanent maxillary lateral incisor, more were treated with orthodontic close space. In contrast, among the patients with bilateral missing permanent maxillary lateral incisor, more were treated with orthodontic open space. There were more spaces to be managed in bilateral missing permanent maxillary lateral incisor. Therefore, orthodontic open space might be a more suitable treatment compared to orthodontic close space. However, besides localised spaces due to the missing permanent maxillary lateral incisor, other factors that might influence the treatment choice were the malocclusion and skeletal pattern (Sahoo *et al.*, 2019). There was no statistically significant association between orthodontic

close space and orthodontic open space in this study.

Treatment for missing permanent maxillary lateral incisor must be interdisciplinary to get the most predictable outcome (Gupta, 2022). It involved the orthodontics, prosthodontics, restorative, periodontics, and implantology. Interdisciplinary approach ensured good occlusion, natural smile and stable treatment outcome for the patients. From a prosthodontic and restorative study, the factors affecting the decision-making for missing permanent maxillary lateral incisor were patient's age at treatment commencement, individual characteristics of each clinical situation, and the clinician's preference (Kafantaris *et al.*, 2020). Nevertheless, the patient's preferences such as complexity and cost of treatment should be taken into consideration too.

This study provided knowledge of the prevalence, pattern, and orthodontic management of missing permanent maxillary lateral incisor, which are important for treatment planning. An interdisciplinary treatment, if done properly and timely, could prevent the patients from aesthetic and functional discrepancies that might reduce their self-esteem and social well-being and also to prevent developing malocclusion. The limitation for this study is the data taken from one government orthodontic referral centre in Sabah which lacks generalisability and the stability of the treatment outcomes were not assessed. For future studies, the author would like to suggest involvement of all government orthodontic referral centres in Sabah, for prospective cohort studies to follow up and to compare the stability of the treatment outcomes of orthodontic open space and orthodontic close space. The true prevalence among the population might be lower than this prevalence in orthodontic referrals.

Conclusion

The prevalence of missing permanent maxillary lateral incisor was low, at 3.78%. All of the patients with missing permanent

maxillary lateral incisor were females. More patients presented with bilateral missing permanent maxillary lateral incisor. The treatments provided at this centre were orthodontic open space and orthodontic close space.

Acknowledgement

The author would like to thank the Director General of Health Malaysia and the Principal Director of Oral Health Programme for the permission to publish this article.

Conflict of interest

The author declared no conflict of interests in this research.

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