



ETIOLOGY OF MIDLINE DIASTEMA IN PATIENTS PRESENTING TO NISHTAR INSTITUTE OF DENTISTRY, MULTAN

Zainab Ahmed^{1✉}, Zubair Hassan Awaisi¹, Zubair Ahmed¹

ABSTRACT

OBJECTIVE: To find the different etiological factors underlying a midline diastema which will help in effective orthodontic correction by enabling the practitioner to adopt the most appropriate mechanics.

METHODS: This descriptive cross-sectional study was conducted at the Department of Orthodontics, Nishtar Institute of Dentistry, Multan, from 01-08-2020 to 01-02-2021. A sample of 165 patients was analyzed according to age, gender, presenting various occlusal traits, and relevant diastema findings to assess the underlying etiology of the maxillary midline diastema. Cases with a midline diastema of >0.5 mm were documented with examination including clinical intra-oral examination and orthopantomograms and upper occlusal radiographs. Examinations were done by the same observer to reduce human error and were cross-checked by a superior to minimize the possibility of error. The data was analyzed using SPSS version 20.0.

RESULTS: Dental anomalies (n=113, 68.6%) was the most frequent cause of maxillary midline diastema. Dental anomalies were observed in both females (n=77/112; 68.8%) and males (n=36/53; 67.9%). Common dental anomalies included tooth/arch size discrepancies (n=58, 51.3%), abnormal occlusal patterns (n=37; 32.7%) and missing teeth (n=18 15.9%). Other contributing factors for maxillary midline diastema observed were abnormal maxillary arch structure (n=30; 18%), physical impediments (n=18; 11%), muscular imbalances (n=3; 1.8%) and pernicious habits (n=1; 0.6%). Common causes of physical impediments were fleshy labial frenum 10/18; 55.6%) and supernumerary tooth (n=8/18; 44.4%).

CONCLUSION: Maxillary midline diastema was common in both genders and was associated with multiple etiologies of which dental anomalies, abnormal maxillary arch structure and physical impediments were highly prevalent.

KEYWORDS: Diastema (MeSH); Etiology (MeSH); Dental anomaly (Non-MeSH); Frequency (MeSH); Tooth/arch size discrepancy (Non-MeSH); Maxillary incisors (Non-MeSH); Malocclusion (MeSH)

THIS ARTICLE MAY BE CITED AS: Ahmed Z, Awaisi ZH, Ahmed Z. Etiology of midline diastema in patients presenting to Nishtar Institute of Dentistry, Multan. Khyber Med Univ J 2022;14(3):169-72. <https://doi.org/10.35845/kmu.2022.2.1987>.

I: Department of Orthodontics, Nishtar Institute of Dentistry, Multan, Pakistan

Cell #: +92-324-5234181

Email: yanagimeyryn@yahoo.com

Date Submitted: September 09, 2021

Date Revised: June 23, 2022

Date Accepted: July 25, 2022

customs, individuals without a diastema may go to great lengths to have it fashioned through cosmetic dentistry, whilst others because they find it aesthetically displeasing would rather opt for its closure. Perception varies a great deal across the different races. In Africa, maxillary midline diastema is regarded as a sign of beauty, especially in the females.^{11,12} Beauty therefore is a subjective experience and our perception of it is influenced heavily by cultural ideas and societal norms.

Angle specified that the diastema "always creates an unpleasant appearance and interferes with speech depending on its width".¹³ Andrews was of the view that interdental diastemas should be absent and that all contacts should be tight.¹⁴ For the effective treatment of midline diastemas, a thorough evaluation of the underlying etiology, pathogenesis, and diagnosis is essential. No sole cause has been recorded as the etiology of a midline diastema rather, it is believed to be a multifactorial phenomenon. Moyers (1988)¹⁵ in his study of 82 patients presenting with maxillary midline diastema reported it to be a multifactorial phenomenon citing a number of underlying causes. Researchers now believe that multiple factors contribute to a midline diastema including oral habits, soft tissue imbalances, physical impediments, dental anomalies, dental/skeletal disharmonies, as well as normal dentoalveolar development as proposed by Becker,¹⁶ Edwards,¹⁷ Steigman,⁴ Clark,¹⁸ Bishara¹⁹ and Campbell.¹⁰

There is a lack of local studies exploring

INTRODUCTION

The etymology of the word diastema dates it back to the Greeks, meaning "interval or space".¹ A diastema is defined as a space between consecutive teeth.² If this space exists between the maxillary centrals; which it has been reported to occur more frequently so, is called the central, median or midline diastema.³⁻⁷ This space can be a physiological growth occurrence during the primary and mixed dentition stages and generally disappears by the time the maxillary

canines erupt into occlusion.^{3,8} However, for some individuals this spontaneous closure fails to occur and its continued presence through adult life is considered an esthetic or malocclusion problem.^{9,10}

Mankind not only has a vast biological variation but an extensive cultural diversity also exists across the globe, hence there exist divergent outlooks of diastema. The aesthetic significance of it differs with respect to culture, age group and ethnicity. Identifying with their respective cultural and societal

TABLE I: DISTRIBUTION OF VARIOUS CAUSES OF MAXILLARY MIDLINE DIASTEMA IN THE SAMPLE

Etiology	Frequency (n=165)	Percentage
Dental anomalies	113	68.6%
Abnormal maxillary arch structure	30	18%
Physical Impediments	18	11%
Muscular imbalances	3	1.8%
Pernicious habits	1	0.6%

TABLE II: GENDER DIMORPHISM AMONGST THE DIFFERENT ETIOLOGIES OF MAXILLARY MIDLINE DIASTEMA

Etiologies of maxillary midline diastema	Gender		Total (n=165)
	Female (n=112)	Male (n=53)	
Dental anomalies	77 (68.1%)	36 (31.9%)	113 (68.5%)
Abnormal maxillary arch structure	22 (73.3%)	8 (26.7%)	30 (18.2%)
Physical Impediments	11 (61.1%)	7 (38.9%)	18 (10.9%)
Muscular imbalances	2 (66.7%)	1 (33.3%)	3 (1.8%)
Pernicious habits	0	1 (100%)	1 (0.6%)

the various causative factors underlying the unaesthetic maxillary median diastema. This study aims to bring to light not only the different etiological factors underlying a midline diastema, but to also explore their frequencies in different age groups and to evaluate the gender dimorphism in the local community. It is anticipated that the information might help educate the clinician to formulate an effective diagnosis and help adopt a targeted approach when devising effective mechanics for the orthodontic correction of maxillary diastemas

METHODS

The study encompassed a sample of 165 patients presenting to the outdoor department of Orthodontics, Nishtar Institute of Dentistry Multan from 01-08-2020 to 01-02-2021. This study was approved by the ethics committee of Nishtar Institute of Dentistry, Multan. All subjects gave informed consent.

The sample was selected following consecutive non-probability sampling technique. The ages of patients included ranged from 10 to 30 years. The exclusion criteria omitted patients with a history of prior orthodontic treatment or extractions, children with physiological diastemas, and patients with evidence of supragingival calculus and active periodontal disease, giving a pure sample with a true diastema. Cases with a midline diastema of more than

0.5mm were documented with examination including history, clinical intra-oral examination and orthopantomograms and upper occlusal radiographs. The examinations were done by the same observer to reduce human error and were cross checked by a superior to further minimize the possibility of error.

The possible etiologies analyzed were grouped into the following categories with the frequency of each subcategory noted:

1. Dental anomalies (tooth/arch size discrepancies, microdontia of lateral incisors, congenitally missing teeth, impacted canines, abnormal occlusal patterns)
2. Abnormal maxillary arch structures (excessive skeletal growth).
3. Presence of physical impediments (supernumeraries, enlarged labial frenum, midline pathologies)
4. Muscular imbalances (macroglossia, tongue thrust)
5. Pernicious habits (digit sucking, lower lip biting)

The data collected was analyzed using SPSS version 20.0

RESULTS

Of the 165 patients examined, 112 (67.9%) were females and 53 (32.1%) were males. Dental anomalies (n=113,

68.6%) was the most frequent cause of maxillary midline diastema. Common dental anomalies included tooth/arch size discrepancies (n=58, 51.3%), abnormal occlusal patterns (n=37; 32.7%) and missing teeth (n=18 15.9%).

Other major contributing factors for maxillary midline diastema observed were abnormal maxillary arch structure (n=30; 18%), and physical impediments (n=18; 11%) [Table I]. Common causes of physical impediments were fleshy labial frenum (n=10/18; 55.6%) and supernumerary tooth (n=8/18; 44.4%).

The frequency for each possible etiology was calculated along with gender dimorphism (Table II). Dental anomalies were observed in both females (n=77/112; 68.8%) and males (n=36/53; 67.9%). Out of 30 cases of abnormal maxillary arch structure 22 (73.3%) were females and 8 (26.7%) were males

DISCUSSION

Esthetics of anterior teeth is a common presenting complaint amongst patients seeking orthodontic aid. Upon investigation of different etiologies causing a maxillary midline diastema, our study found dental anomalies to be the major causative factor with a frequency of 68.6% followed by excessive skeletal growth presenting as abnormality of the maxillary arch with a frequency of 18%. Physical impediments like supernumeraries and fleshy labial frenum showed an occurrence of 11% when evaluated as a causative factor for the maxillary median diastema, muscular imbalances and the practice of pernicious habits causing a diastema in the maxillary anterior region were documented to be 1.8% and 0.6% of the sample respectively.

A cross sectional study in Brazil revealed anterior midline diastema to be the highest self-perceived need for orthodontic treatment among different malocclusions.²⁰ The presence of a midline diastema holds an undeniable importance when considering smile esthetics. A video analytic study investigating the influence of maxillary midline diastemas that impact the

perception of dentofacial esthetics concluded that diastemas equal to or greater than 1 mm negatively affected dentofacial esthetics.²¹ A study in the Spanish patients recorded the lowest threshold of acceptance for diastema among a number of dental anomalies evaluated.²²

When public view regarding the variations found in anterior teeth were assessed in a study amongst web users from different countries, diastema was reported to be notoriously unesthetic.²³ The perception of diastemas however is a controversial subject when it comes to different societal norms as it is celebrated as a sign of beauty in some parts of the globe while strongly rejected in others. In Africa, especially amongst the females the maxillary midline diastema is considered an emblem of beauty.¹¹

The etiology of the midline diastema is believed to be multifactorial. A number of dynamics contributing to it include oral habits, soft tissue imbalances, physical impediments, dental anomalies, dental/skeletal disharmonies, abnormal maxillary arch structure as well as normal dentoalveolar development, our study displayed results consistent with these studies.¹⁶⁻¹⁹ Other causes for the development of maxillary midline diastema have been described in the literature, which encompass increased overbite of anterior teeth or pathologic teeth migration as a consequence of underlying periodontal disease.²⁴

In the present study dental anomaly (68%) was the most prevalent factor recorded in association with the maxillary midline diastema, of which tooth/arch size discrepancies had the highest percentage of occurrence (51.3%) in which peg laterals were the major reported discrepancy recorded with a higher predilection in females as compared to their male counterparts. Abnormal occlusal patterns including cases with deranged incisal inclinations, increased overbite and excessive overjet comprised a 32%. While 16% of the dental anomalies reported were congenitally missing teeth. Spacing in the anterior teeth was a significant factor in other studies conducted on Caucasians and south Asian populations

which was consistent with our results.²⁵ Of the 165 patients 18% had abnormal maxillary arch structure with excessive skeletal growth being the contributing factor to their median diastema.

An 11% of the sample presented with physical impediment as the major contributing factor to their diastema, of which 44% of the time a supernumerary tooth was found to be the cause, while 55% were caused by a fleshy labial frenum. Muscular imbalances and pernicious habits comprised 1.8% and 0.6% of the sample respectively

CONCLUSION

The present study conducted amongst the local population group revealed different frequencies of various causative factors of midline diastema. Maxillary midline diastema was common in both genders and was associated with multiple etiologies of which dental anomalies, abnormal maxillary arch structure and physical impediments were highly prevalent. Dental anomalies with a frequency of 68.6% emerged to be the leading cause of this esthetic complain

REFERENCES

1. Azzaldeen A, Muhamad AH. Diastema closure with direct composite: architectural gingival contouring. *J Adv Med Dent Sci Res* 2015;3(1):134.
2. Abu-Hussein M, Watted N, Abdulgani A. An Interdisciplinary Approach for Improved Esthetic Results in the Anterior Maxilla Diastema. *IOSR J Dent Med Sci* 2015;14(12):96-101. <http://dx.doi.org/10.9790/0853-1412896101>
3. Dewel BF. The labial frenum, midline diastema, and palatine papilla: A clinical analysis. *Dent Clin North Am* 1966;175-84.
4. Steigman S, Weissberg Y. Spaced dentition: an epidemiologic study. *Angle Orthod* 1985;55(2):167-76. [https://doi.org/10.1043/0003-3219\(1985\)055%3C0167:sd%3E2.0.co;2](https://doi.org/10.1043/0003-3219(1985)055%3C0167:sd%3E2.0.co;2)
5. Nainar SH, Gnanasundaram N. Incidence and etiology of midline diastema in a population in south India (Madras). *Angle Orthod* 1989;59(4):277-82. [https://doi.org/10.1043/0003-3219\(1989\)059%3C0277:iaeomd%3E2.0.co;2](https://doi.org/10.1043/0003-3219(1989)059%3C0277:iaeomd%3E2.0.co;2)
6. Richardson ER, Malhotra SK, Henry M, Little RG, Coleman HT. Biracial study of the maxillary midline diastema. *Angle Orthod* 1973;43(4):438-43. [https://doi.org/10.1043/0003-3219\(1973\)043%3C0438:bsotmm%3E2.0.co;2](https://doi.org/10.1043/0003-3219(1973)043%3C0438:bsotmm%3E2.0.co;2)
7. Brunelle JA, Bhat M, Lipton JA. Prevalence and distribution of selected occlusal characteristics in the US population, 1988-1991. *J Dent Res* 1996;75(2_suppl):706-13. <https://doi.org/10.1177/002203459607502s10>
8. Huang WJ, Creath CJ. The midline diastema: a review of its etiology and treatment. *Pediatr Dent* 1995;17(3):171-9.
9. Ferguson MW, Rix C. Pathogenesis of abnormal midline spacing of human central incisors. A histological study of the involvement of the labial frenum. *Br Dent J* 1983;154(7):212-8. <https://doi.org/10.1038/sj.bdj.4805043>
10. Campbell PM, Moore JW, Matthews JL. Orthodontically corrected midline diastemas: A histologic study and surgical procedure. *Am J Orthod* 1975;67(2):139-58. [https://doi.org/10.1016/0002-9416\(75\)90066-4](https://doi.org/10.1016/0002-9416(75)90066-4)
11. Azzaldeen A, Nezar W, Muhamad AH. Direct bonding in diastema closure high drama, immediate resolution: a case report. *Int J Dent Health Sci* 2014;01(4):430-5.
12. Umanah A, Omogbai AA, Osagbemi B. Prevalence of artificially created maxillary midline diastema and its complications in a selected Nigerian population. *Afr Health Sci* 2015;15(1):226-32. <https://doi.org/10.4314/ahs.v15i1.29>
13. Angle EH. Treatment of Malocclusion of the Teeth: *Angle's*

- System. Greatly Enl. and Entirely Rewritten, with Six Hundred and Forty-One Illustrations. 1907, SS White Dental Manufacturing Company; Philadelphia.
14. Andrews LF. The six keys to normal occlusion. *Am J Orthod* 1972;62(3):296-309. [https://doi.org/10.1016/s0002-9416\(72\)90268-0](https://doi.org/10.1016/s0002-9416(72)90268-0)
 15. Moyers RE. Handbook of orthodontics. Year Book Medical Pub; 1988. ISBN: 978-0815160038
 16. Becker A: The median diastema. *Dent Clin North Am* 1978;22:685-710.
 17. Edwards JG. Soft-tissue surgery to alleviate orthodontic relapse. *Dent Clin North Am* 1993;37(2):205-25.
 18. Clark JD, Williams JK. The management of spacing in the maxillary incisor region. *British J Orthod* 1978;5(1):35-9. <https://doi.org/10.1179/bjo.5.1.35>
 19. Bishara SE. Management of diastemas in orthodontics. *Am J Orthod* 1972;61:55-63. [https://doi.org/10.1016/0002-9416\(72\)90176-5](https://doi.org/10.1016/0002-9416(72)90176-5)
 20. Kaieda AK, Bulgareli JV, Cunha IP, Vedovello SA, Guerra LM, Ambrosano GM et al. Malocclusion and dental appearance in underprivileged Brazilian adolescents. *Braz Oral Res* 2019;33:e014. <https://doi.org/10.1590/1807-3107bor-2019.vol33.0014>
 21. Chaves PRB, Karam AM, Machado AW. Does the presence of maxillary midline diastema influence the perception of dentofacial esthetics in video analysis? *Angle Orthod* 2021;91(1):54-60. <https://doi.org/10.2319/032020-200.1>
 22. Bolas-Colvee B, Tarazona B, Paredes-Gallardo V, Arias-De Luxan S. Relationship between perception of smile esthetics and orthodontic treatment in Spanish patients. *PLoS One* 2018;13(8):e0201102. <https://doi.org/10.1371/journal.pone.0201102>
 23. Rosenstiel SF, Rashid RG. Public preferences for anterior tooth variations: a web-based study. *J Esthet Restor Dent*. 2002;14(2):97-106. <https://doi.org/10.1111/j.1708-8240.2002.tb00158.x>
 24. Gkantidis N, Kolokitha OE, Topouzelis N. Management of maxillary midline diastema with emphasis on etiology. *J Clin Pediatr Dent* 2008;32(4):265-72. <https://doi.org/10.17796/jcpd.32.4.j087t33221771387>

AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

ZaA: Concept and study design, analysis and interpretation of data, drafting the manuscript, critical review, approval of the final version to be published.

ZHA: Analysis and interpretation of data, drafting the manuscript, approval of the final version to be published.

ZuA: Acquisition of data, drafting the manuscript, approval of the final version to be published

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

Authors declared no conflict of interest

GRANT SUPPORT AND FINANCIAL DISCLOSURE

Authors declared no specific grant for this research from any funding agency in the public, commercial or non-profit sectors

DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request



This is an Open Access article distributed under the terms of the Creative Commons Attribution-Non Commercial 2.0 Generic License.