

## FREQUENCY AND PATTERN OF ANTERIOR CROSSBITE WITH PRIMARY AND MIXED DENTITION IN SCHOOL CHILDREN

Muhammad Noman<sup>1</sup>, Nayha Enver<sup>2</sup>, Gulsana Hashmi<sup>3</sup>, Aneeqa Yaqub<sup>4</sup>, Usman Zaheer<sup>5</sup>, Syed Suleman Shah<sup>6</sup>

### How to cite this article

Noman M, Enver N, Hashmi G, Yaqub A, Zaheer U, Shah SS. Frequency and Pattern of Anterior Crossbite With Primary and Mixed Dentition in School Children. J Gandhara Med Dent Sci. 2024;11(1): 3-6

**Date Submission:** 02-07-2023

**Date Revised:** 23-11-2023

**Date Acceptance:** 25-11-2023

<sup>1</sup>Senior Registrar Department of Orthodontics, Sharif Medical and Dental College, Lahore

<sup>2</sup>Demonstrator De'Montmorency College of Dentistry Lahore

<sup>3</sup>Senior Registrar, University College of Dentistry, University of Lahore

<sup>4</sup>Consultant, Department of Orthodontist

<sup>5</sup>Associate Professor, Department of Orthodontics, Lahore Medical and Dental College

### Correspondence

<sup>6</sup>Syed Suleman Shah, Demonstrator, Department of Orthopedic, Khyber College of Dentistry, Peshawar

☎: +92-336-6000056

✉: [drumarhussain@gmail.com](mailto:drumarhussain@gmail.com)

<https://doi.org/10.37762/jgmids.11-1.517>

### ABSTRACT

#### OBJECTIVES

To determine the frequency and pattern of anterior crossbite with primary and mixed dentition in School Children.

#### METHODOLOGY

A descriptive cross-sectional study was conducted at Sharif Medical and Dental College, Lahore. This study included 296 participants having either deciduous or mixed dentition, no history of orthodontic treatment, aged between 3-11 years, both genders and Pakistani nationals. Participants with a history of trauma, cleft lip/palate, or any craniofacial syndrome and systemic disease were excluded. Participant's age, gender, skeletal class, and anterior crossbite (ACB) were recorded. The Chi-square/Fisher exact test was run to compare ACB and their pattern among gender, age group, and skeletal class.

#### RESULTS

There is a relatively high rate of anterior crossbite in this population, which is about 10%. The females were 169(57.09%) and males were 127(42.91%). The mean age was  $6.92 \pm 1.68$  years. Overall, the ACB was present in 31(10.47%). The most common pattern of ACB was single incisor involvement ( $n=11$ , 35.48%) followed by two incisors ( $n=9$ , 29.03%), and the least was four incisors ( $n=5$ , 16.13%). The difference for ACB was statistically significant among skeletal classes ( $p<0.001$ ). The frequency of ACB was higher in skeletal class 1 ( $n=17$ , 54.84%) and in skeletal class 3 ( $n=13$ , 41.94%) than in class 2 ( $n=1$ , 3.23%).

#### CONCLUSION

The frequency of anterior crossbite is about 10%, which is relatively higher than in other populations. Most anterior cross bites are dental due to one or two incisor involvement, which can be corrected easily at the mixed dentition stage.

**KEYWORDS:** Crossbite, Mixed dentition, Underbite, Incisor

### INTRODUCTION

The anterior crossbite (ACB) is a malocclusion in which the maxillary anterior teeth are lingually positioned to the lower teeth.<sup>1</sup> If anterior crossbite can be seen in one or two teeth, it indicates severe crowding. It occurs when maxillary incisors, positioned somewhat lingually before their eruption, are pushed even more lingually due to lack of space. It can be a significant concern for patients and their parents due to aesthetic and functional problems.<sup>2</sup> If anterior crossbite and premature contacts are not resolved early, they become challenging to address later.<sup>3</sup> It can be functional, dental, skeletal, or a combination of these factors.<sup>4</sup> Functional ACB may result from a narrow maxilla, an edge-to-edge bite, or premature contact with the primary canine.<sup>5</sup> The dental anterior crossbite usually manifests as a single or two teeth crossbite. Dental anterior crossbite is usually treated with a removable appliance with simple tipping movement.<sup>6</sup>

Once positive overjet and overbite are achieved, it is usually self-retained without needing retention devices.<sup>7</sup> Skeletal anterior crossbite can be either due to genetic or developmental issues and involve discrepancy in the position of the maxilla or mandible or both jaws. In case of maxillary deficiency, the usual treatment is to promote maxillary growth with protraction extra-oral appliance before the age of 10 years.<sup>8</sup> Mandibular excess involved in skeletal anterior crossbite is challenging to treat early, and relapse commonly happens due to prolonged mandible growth. There are various causes of anterior crossbite, such as retained deciduous teeth, trauma to deciduous teeth resulting in the displacement of permanent tooth germs from their optimal position, supernumerary teeth, odontomas, and pathological conditions.<sup>9</sup> The greater the number of teeth involved in the crossbite, the greater the skeletal component is liable for its aetiology. Irrespective of the growth direction of both jaws and their functional or genetic involvements, the Angle Class III incisor

relationship should be treated early. Furthermore, early intervention in primary or mixed dentition is essential to avoid or reduce the severity of malocclusion and better therapeutic outcomes. The ultimate treatment option is usually orthognathic surgery.<sup>10</sup> The prevalence of anterior crossbite varies across populations due to variable aetiology and genetic factors. Its prevalence varies from 2 to 26.7%.<sup>2,11</sup> To our knowledge, there is no documented study on a pattern of anterior crossbite in our population. This study will highlight the burden of this malocclusion and alert clinicians to manage the treatable type of anterior crossbite to prevent its continuation into permanent dentition. This study aimed to determine the frequency and pattern of anterior crossbite in a Pakistani population with primary and mixed dentition.

## METHODOLOGY

This cross-sectional descriptive study was conducted at the Department of Orthodontics, Sharif Medical and Dental College, Lahore, from 1<sup>st</sup> July 2022 to 30<sup>th</sup> January 2023, on 296 participants using a non-probability consecutive sampling technique. The calculated sample size was 296 by open epi software at a 5% margin of error and 95% confidence level using the frequency of anterior crossbite to be 26.7% from the literature.<sup>11</sup> Ethical permission was obtained from the hospital ethical review committee (326-AD/PG/R/SMDC). The purpose and benefits of the study were explained to all of the participants guardians, and verbal consent was obtained. They made sure that their data would be confidential. The inclusion criteria were deciduous dentition without missing, no history of orthodontic treatment, age between 3-11 years, both genders and Pakistani nationals (parents having Pakistani NIC). Participants with a history of trauma, cleft lip/palate or any craniofacial syndrome and any systemic or metabolic disease were excluded. All participants fulfilling the inclusion criteria were invited to enrol in the study. The response rate was 100%. A detailed history and examination were done. Anterior crossbite was assessed under light illumination using a disposable mouth. The participants with lingually positioned maxillary teeth to lower incisal edges were labelled anterior crossbite (ACB). The pattern of ACB was assessed as involvement of one, two, three or four incisors in ACB. The skeletal class was labelled based on clinical appearance as class 1 (straight profile), class 2 (convex profile), and class 3 (concave profile). The data were analyzed in R programming.<sup>4,1,2</sup> The descriptive statistics in frequency with percentages for categorical and mean with SD for continuous variables were calculated. The Chi-square/Fisher exact test was run to compare ACB and

their pattern among gender, age group and skeletal class. The significance level was  $p < 0.05$ .

## RESULTS

The mean age of the study participants was  $6.92 \pm 1.68$  years, ranging from 3 to 11 years. Of the 296 participants, 169 (57.09%) were females, and 127 (42.91%) were males. The majority fell within the age range of 7-11 years ( $n=175$ , 59.12%), followed by 3-6 years ( $n=121$ , 40.88%). The anterior crossbite was present in 31 (10.47%). The most common pattern of the anterior crossbite was single incisor involvement ( $n=11$ , 35.48%) followed by two incisors ( $n=9$ , 29.03%) and the least was four incisors ( $n=5$ , 16.13%) (Fig 1 & Table 1). The frequency of anterior crossbite was not different statistically among genders ( $p=0.64$ ). The difference for anterior crossbite (ACB) was statistically significant among skeletal classes ( $p < 0.001$ ). The frequency of ACB was higher in skeletal class 1 ( $n=17$ , 54.84%) and in skeletal class 3 ( $n=13$ , 41.94%) than in class 2, with one case of single incisor in crossbite ( $n=1$ , 3.23%) (Table 2). In the skeletal class, mostly single incisors were involved in cross-bit ( $n=10$ , 90.9%). Two incisors ( $n=5$ , 55.56%), three incisors ( $n=3$ , 50%) and all four incisors ( $n=5$ , 100%) were more in skeletal class 3 than other classes. These results were statistically significant ( $p=0.011$ ) (Table 3).

Table 1: Frequency of Gender and Age Group

| Variable           | Characteristic | N (%)       |
|--------------------|----------------|-------------|
| Gender             | Female         | 169 (57.09) |
|                    | Male           | 127 (42.91) |
| Age group (Years)  | 3-6            | 121 (40.88) |
|                    | 7-11           | 175 (59.12) |
| Anterior crossbite | Absent         | 265 (89.53) |
|                    | Present        | 31 (10.47)  |

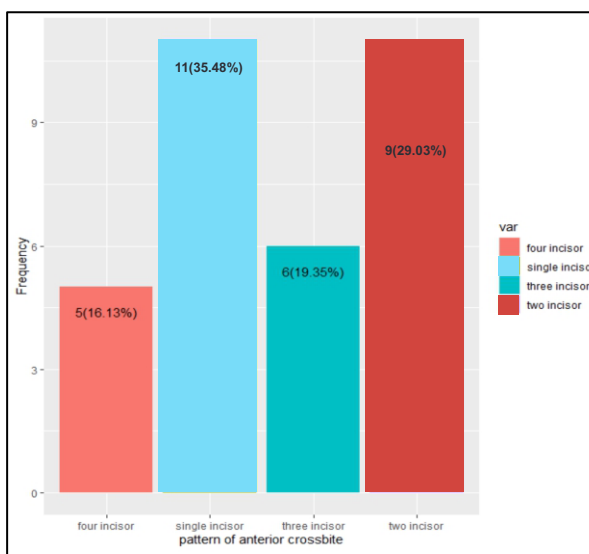


Figure 1: Pattern of Anterior Cross

**Table 2: Comparison of Anterior Crossbite among Gender and Skeletal Class**

| Variable       | Characteristic | Anterior Crossbite |                 | P - Value |
|----------------|----------------|--------------------|-----------------|-----------|
|                |                | Absent, N = 265    | Present, N = 31 |           |
| Gender         | Female         | 153 (57.74)        | 16 (51.61)      | 0.64*     |
|                | Male           | 112 (42.26)        | 15 (48.39)      |           |
| Skeletal Class | 01             | 0 (0.00)           | 17 (54.84)      | <0.001**  |
|                | 02             | 0 (0.00)           | 01 (3.23)       |           |
|                | 03             | 0 (0.00)           | 13 (41.94)      |           |
|                | No ACB         | 265(100.00)        | 0 (0.00)        |           |

Chi-square test\*, Fisher exact test\*\*, anterior crossbite

**Table 3: Comparison of Pattern of ACB among Various Skeletal Classes**

| The pattern of anterior crossbite | Skeletal Class |          |            | P- Value |
|-----------------------------------|----------------|----------|------------|----------|
|                                   | I, N=171       | II, N=11 | III, N=131 |          |
| Single incisor                    | 10 (90.9)      | 01 (9.1) | 0 (0.00)   | 0.011*   |
| Two incisors                      | 04 (44.44)     | 0 (0.00) | 05 (55.56) |          |
| Three incisors                    | 03 (50)        | 0 (0.00) | 03 (50)    |          |
| Four incisors                     | 0 (0.00)       | 0 (0.00) | 05 (100)   |          |

Fisher exact test\*, anterior crossbite

## DISCUSSION

The position and axial inclination of the upper and lower incisors contribute a significant role in the rest and dynamic smile aesthetics. In addition to providing esthetics, maxillary incisors guide anteriorly protrusive movements of the mandible, preventing posterior teeth from being stressed during protrusions and lateral movements. Correcting crossbite as early as possible, even in mixed dentition, is recommended to prevent potential interference with jaw growth and temporomandibular joint function, mainly when asymmetry factors are associated with functional shifts. If left untreated, it can cause permanent dental, skeletal, or soft tissue disharmonies or increase the likelihood of temporomandibular or neuromuscular imbalances at a later stage.<sup>12</sup> This study aimed to determine the frequency and distribution of anterior crossbite in patients with various skeletal classes. Our findings showed that 10.47% of patients have an anterior crossbite. The most common pattern of the anterior crossbite was single and two incisors involvement. Cases with all four incisors involved in ACB had a skeletal Angle Class 3 base relationship. Literature is scarce for anterior cross bite. Some ethnicities have a higher prevalence of anterior crossbite than others. Among Japan, the prevalence of skeletal class 3 with anterior crossbite was about 10%.<sup>13</sup> Another study in Sri Lanka on 721 participants reported that 26.7% had anterior cross bite. Their high prevalence of anterior crossbite can be due to genetic and ethnic factors.<sup>11</sup> De Lira et al conducted a study on the Brazilian population

of 702 participants and reported that the frequency of anterior crossbite was 2.14%.<sup>5</sup> Moraes et al conducted another study on the Brazilian population and found a 2.2% prevalence of anterior crossbite.<sup>14</sup> A systemic review by Litgurt et al in 2021, in which articles written in English, Dutch, French, German, Spanish, and Portuguese were included, suggested the prevalence of anterior crossbite was 7.8% (SD 6.5).<sup>15</sup> Another study done in Jeddah City among school children proposed that the prevalence of anterior crossbite (30%) and posterior unilateral crossbite (10%) was higher between children 9-12 years old.<sup>16</sup> In our study, single and two incisor involvement was more common than all incisor involvement in the anterior crossbite. Similar results were found in previous studies.<sup>1</sup> One or two incisors involved in a crossbite are due to dental malocclusion. Most of our participants were skeletal class 1 base relationships. Dental crossbite differentiation from the skeletal anterior cross is essential. The dental anterior crossbite should be treated as early as possible, while skeletal crossbite, mainly due to mandibular excess, is addressed when growth is over.<sup>17,18</sup> Our findings have implications, indicating that anterior crossbite is prevalent in a higher proportion. Early correction is feasible with minimal expenses and appliance wear. A policy should be established on the government's side to assess children for this type of malocclusion, aiming to prevent its adverse sequelae.

## LIMITATIONS

It is based on one centre, has a relatively small sample size, and is hospital-based. Further studies on this population with a large sample size and community-based population can explore this area more efficiently. Another limitation of the present study is that various diagnostics tools, such as diagnostic models and lateral cephalograms, could omit any discrepancies regarding diagnosing and measuring anterior crossbite, as younger patients' cooperation during clinical measurement can affect the results.

## CONCLUSIONS

The frequency of anterior crossbite is about 10%, which is relatively higher than other populations. Most anterior cross bites are dental due to one or two incisor involvement, which can be corrected easily at the mixed dentition stage. A policy should be established on the government's side to assess children for this type of malocclusion, aiming to prevent its adverse sequelae.

**CONFLICT OF INTEREST:** None

**FUNDING SOURCES:** None

## REFERENCES

- Inchingolo AD, Patano A, Coloccia G, Ceci S, Inchingolo AM, Marinelli G, et al. Treatment of Class III malocclusion and anterior crossbite with aligners: A. Case Rep Med. 2022;58(5):603-10.
- Amin E, Nazir R, Bangash AA. Prevalence of anterior crossbite and its relevance in class I and III malocclusions. Pak ARM Forc J. 2021;71(1):314-18.
- Hayati F, Aini H, Narmada IB. Management of a patient with angle class I malocclusion with anterior crossbite and maxillary central diastema caused by high attachment of the maxillary labial frenulum. Acta Med Philipp. 2021;55(8):827-32.
- Pellegrino M, Caruso S, Cantile T, Pellegrino G, Ferrazzano GF. Early treatment of anterior crossbite with eruption guidance appliance: a case report. Int J Environ Res Public Health. 2020;17(10):3587.
- De Lira ADLS, da Fonseca GHA. Anterior crossbite malocclusion: prevalence and treatment with affixed inclined plane orthodontic appliance. Braz J Oral Sci. 2019;18:e191502-e.
- Jorge JO, Corradi-Dias L, Flores-Mir C, Pordeus IA, Paiva SM, Abreu LG. Comparison between removable and fixed devices for nonskeletal anterior crossbite correction in children and adolescents: A systematic review. J Evid Based Dent Pract. 2020;20(3):101423.
- Khalaf K, Mando M. Removable appliances to correct anterior crossbites in the mixed dentition: a systematic review. Acta Odontol Scand. 2020;78(2):118-25.
- Shimada E, Kanetaka H, Yamauchi K, Takahashi T, Nochioka K, Igarashi K. Rationale and design for efficacy and safety evaluation of Bone-Anchored Maxillary Protraction (BAMP) for patients with unilateral cleft lip and palate with skeletal anterior crossbite: a single-arm, open-label, non-randomised prospective study protocol. BMJ Open. 2022;12(9):e061831.
- González Hernández EM, Plaza Ruiz SP, BARRERA CHAPARRO JP, BARRETO GÓMEZ LJ, RÍOS AGUDELO LM, ROJAS POLANCO EF. Aparatos funcionales preferidos por ortodoncistas en Colombia para tratar maloclusiones clases II y III. Univ Odontol. 2019 Jan 1;38(80).
- Le L, Ju-fang C, Xin H, Ru Y, Yu-lou T. A comparative study of tongue appliance combined with chin-cup and facemask in the treatment of anterior crossbite. Shanghai J Stomatol. 2021;30(4):429-33.
- Vithanaarachchi SN, Nawarathna LS. Prevalence of anterior cross bite in preadolescent orthodontic patients attending an orthodontic clinic. Ceylon Med J. 2017;62(3):189-92.
- Adly MS, Adly AS, Adly AS. Assessment of early orthodontic treatment on functional shifts by telemonitoring mandibular movements using a smart phone. J Telemed Telecare. 2020 Apr;26(3):150-60.
- Komazaki Y, Fujiwara T, Ogawa T, Sato M, Suzuki K, Yamagata Z, et al. Prevalence and gender comparison of malocclusion among Japanese adolescents: a population-based study. J World Fed Orthod. 2012;1(2):e67-72.
- Morais SPT, Mota ELA, Amorim LDAF. Factors associated with the incidence of malocclusion in the deciduous dentition of children in a public hospital cohort from Northeast Brazil. Fatores associados à incidência de maloclusão na dentição decídua em crianças de uma coorte hospitalar pública do nordeste brasileiro. Rev Bras Saude Mater Infant. 2014;14(4):371-82.
- De Ridder L, Aleksieva A, Willems G, Declerck D, Cadenas de Llano-Pérula M. Prevalence of orthodontic malocclusions in healthy children and adolescents: a systematic review. Int J Environ Res Public Health. 2022 Jun 17;19(12):7446.
- Ajwa N, Faya IS, Alasbali SH, Alrayes AO, Abdulmohsen A, Alsaif A et al. Occurrence of crossbite among school children in Jeddah city; an observational study. Annals Dent Spec;2022(Jan):10(1):59.
- Wiedel AP, Norlund A, Petrán S, Bondemark L. A cost minimization analysis of early correction of anterior crossbite-a randomized controlled trial. Eur J Orthod. 2016;38(2):140-5.
- Vasilakos G, Koniaris A, Wolf M, Halazonetis D, Gkantidis N. Early anterior crossbite correction through posterior bite opening: a 3D superimposition prospective cohort study. Eur J Orthod. 2018;40(4):364-71.

## CONTRIBUTORS

- Muhammad Noman** - Concept & Design; Data Acquisition; Drafting Manuscript; Critical Revision; Final Approval
- Nayha Enver** - Data Acquisition; Drafting Manuscript; Final Approval
- Gulsana Hashmi** - Data Acquisition; Data Analysis/ Interpretation; Critical Revision; Final Approval
- Aneeqa Yaquub** - Concept & Design; Drafting Manuscript; Final Approval
- Usman Zaheer** - Data Acquisition; Critical Revision; Final Approval
- Syed Suleman Shah** - Data Analysis/Interpretation; Drafting Manuscript; Supervision; Final Approval



LICENSE: JGMDS publishes its articles under a Creative Commons Attribution Non-Commercial Share-Alike license (CC-BY-NC-SA 4.0).

COPYRIGHTS: Authors retain the rights without any restrictions to freely download, print, share and disseminate the article for any lawful purpose.

It includes scholarly networks such as Research Gate, Google Scholar, LinkedIn, Academia.edu, Twitter, and other academic or professional networking sites.