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## Frequency of dentofacial asymmetries: A cross-sectional study on orthodontic patients

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## ORIGINAL ARTICLE

## FREQUENCY OF DENTOFACIAL ASYMMETRIES: A CROSS-SECTIONAL STUDY ON ORTHODONTIC PATIENTS

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**Background:** Correction of orthodontic asymmetries is crucial to achieve functional occlusion, aesthetics and stability of post orthodontic treatment results. To date valid frequency data of dentofacial asymmetries in Pakistani orthodontic patients do not exist to document orthodontic treatment need. The objectives of this study were to determine frequency of dento-facial asymmetries, severity of dental asymmetries and to determine difference in frequency of dentofacial asymmetries in mixed and permanent dentition. **Methods:** The sample of this cross-sectional study comprised of 280 patients (177 females and 103 males) with no history of previous orthodontic treatment having no craniofacial anomalies. Dento-facial asymmetries were assessed from pre-treatment records of patients. Descriptive statistics were used to determine frequency of dentofacial asymmetries and severity of dental asymmetries. Chi-square test was used to determine difference in frequency of dentofacial asymmetries in mixed and permanent dentition. **Results:** Seventy eight percent (219) of patients had noncoincident midlines, 67.5% (189) had mandibular midline asymmetry, 43.2% (122) had molar asymmetry, 15.7% (44) had mandibular arch asymmetry, 14.3% (40) had maxillary midline asymmetry, 13.6% (38) had maxillary arch asymmetry, 6.1% (17) had nose deviation, and 12.1% (34) had facial asymmetry and chin deviation. In most patients dental midlines were deviated from one another and from facial midline by  $\frac{1}{4}$  lower incisor widths, while molar asymmetry was found in most patients by  $\frac{1}{4}$  cusp width. Mandibular arch asymmetry was more frequent in permanent than mixed dentition ( $p=0.054$ ). **Conclusions:** Non-coincident dental midline is most commonly seen. Nose deviation is least commonly observed. Mandibular arch asymmetry is more frequent in permanent than mixed dentition

**Keywords:** Dentofacial, asymmetry, orthodontic, frequency

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## INTRODUCTION

Symmetry means similar arrangement in form and relationships of parts around a common axis of the body, whereas asymmetry means disproportion between two or more like parts. Any deviations from normal facial and dental proportions in homologous parts result in dentofacial asymmetry. Some degree of asymmetry does exist in normal face; it serves to characterize and to individualize esthetically pleasing face rather than to disfigure it. Minor asymmetry can only be detected by comparing homologous parts of the face.<sup>1</sup> Severt and Profit found clinically apparent facial asymmetry in 1/3 of the dentofacial deformity population, lower third of face was affected more frequently than upper and middle third of face.<sup>2</sup>

Asymmetrical malocclusion can be caused by an underlying skeletal or dental asymmetry. Skeletal asymmetry may be because of congenital anomalies such as hemifacial microsomia,<sup>3</sup> childhood condylar fractures,<sup>4</sup> unilateral condylar resorption,<sup>5</sup> hemimandibular hyperplasia,<sup>6</sup> condylar hypoplasia,<sup>7</sup> hemifacial atrophy,<sup>8</sup> inflammatory arthritic disease,<sup>9</sup> ankylosis,<sup>10</sup> neoplasia and fibrous dysplasia.<sup>11</sup> Dental asymmetries can be due to ankylosed teeth,<sup>12</sup> ectopic eruption of maxillary first permanent molar,<sup>13</sup>

congenitally missing teeth,<sup>14</sup> interproximal caries<sup>15</sup> and supernumerary teeth.<sup>16</sup>

Asymmetrical malocclusions are common orthodontic obstacles that are challenging to correct successfully. Optimal treatment outcomes are primarily based on early appreciation of the asymmetrical malocclusions, accurate diagnosis and treatment planning. Most investigators have described treatment strategies using asymmetrical mechanics,<sup>17</sup> asymmetrical extractions,<sup>18</sup> surgical correction of dentofacial asymmetries,<sup>19</sup> distraction osteogenesis<sup>20</sup> and use of orthodontic miniscrews in asymmetrical corrections.<sup>21</sup>

The impact of harmonized facial, maxillary and mandibular midlines to a successful orthodontic outcome and good facial equilibrium is undeniable. Although minor asymmetries are encompassed within the range of clinical acceptability, enormous skeletal and dental eccentricities from the facial midline can intensely detract from a pleasing aesthetic outcome. The point at which 'normal' asymmetry turns into 'abnormal' cannot be certainly demarcated and is often determined by the clinician's sense of balance and the patient's sense of imbalance.<sup>1</sup>

Uncorrected dentofacial asymmetries may have detrimental consequences; patients may have

compromised function, esthetics and stability. Results from a study by Sheats *et al*<sup>22</sup> indicate that among orthodontic patients, the most common asymmetry was mandibular dental midline deviation from the facial midline. This happened in (62%) of patients, followed, in descending order of frequency, by lack of dental midline coincidence (46%), maxillary midline deviation from the facial midline (39%), molar classification asymmetry (22%), maxillary occlusal asymmetry (20%), mandibular occlusal asymmetry (18%), facial asymmetry (6%), chin deviation (4%) and nose deviation (3%). Being so frequently seen disharmony, dentofacial asymmetry is of a major concern for an orthodontist.

To the best of our knowledge, till now valid frequency data of dentofacial asymmetries in orthodontic patients of Pakistani origin do not exist to document orthodontic treatment need. Hence, this study was designed to determine frequency of dentofacial asymmetries, severity of dental asymmetries and to determine difference in frequency of dentofacial asymmetries in mixed and permanent dentition in orthodontic patients of Pakistani origin.

## MATERIAL AND METHODS

This cross sectional study was conducted using data from pre-treatment orthodontic records of patients who visited the orthodontic clinics at the Aga Khan University Hospital, Karachi, Pakistan, from January 2006 to July 2012. The duration of this study was from July 2012 to September 2012. The present study primarily focused on the dentofacial asymmetries in orthodontic population. The inclusion criteria were subjects of Pakistani origin having dental and facial asymmetries with no history of previous orthodontic treatment. Patients with craniofacial anomalies were excluded. From a total of 735 records, the patients fulfilling the above mentioned criteria were included in the study. A non-probability purposive sampling technique was used. The study sample consisted of a total of 280 subjects.

To estimate the presence of the dental and facial asymmetry in these patients data were extracted from the initial clinical examination forms and diagnostic work ups. Symmetry judgments were made from the recorded findings of clinical examination and visual assessment of the frontal facial photographs and dental casts. For assessment of mandibular and maxillary arch asymmetry, lingual frenum and midpalatal suture were taken as a reference respectively. Sagittal molar relationships were visually evaluated from the dental casts and documented in one-quarter cusp increments for right and left molars. Asymmetrical deviations in molar

relationships were taken in to consideration irrespective of underlying occlusal anomaly.

The data collected were analysed using the Statistical Package for Social Sciences (SPSS version 19.00, Chicago, Inc.). Means and standard deviations for the age of the patients in mixed and permanent dentition groups were determined. Descriptive statistics were used to see frequency of the dento-facial asymmetries and to evaluate the severity of the dental asymmetries. For the purpose of investigating the difference in frequency of dento-facial asymmetries in mixed and permanent dentition, Chi-square test was applied. A *p*-value of less than or equal to 0.05 was considered to be statistically significant.

## RESULTS

Overall the sample size consisted of 280 subjects (177 females and 103 males). Out of 280 subjects 78 were in the mixed dentition group and 102 subjects were in the permanent dentition group. The mean age for the mixed dentition group was  $11.05 \pm 2.71$  years and for the permanent dentition group was  $18.62 \pm 7.92$  years.

Key results of this cross-sectional study showed that non-coincident dental midline is the most commonly seen asymmetry trait and nose deviation is the least commonly observed asymmetry trait. Statistically significant difference was found in frequencies of mandibular arch asymmetry between the mixed and the permanent dentition ( $p=0.054$ ).

Descriptive statistics were used to determine frequency of the dento-facial asymmetries. The most common asymmetry observed in the patients was non-coincident dental midlines. This happened in 78.2% (219) of the patients, followed, in descending order of frequency, by mandibular dental midline deviation from the facial midline 67.5% (189), molar classification asymmetry 43.2% (122), mandibular arch asymmetry 15.7% (44), maxillary midline deviation from the facial midline 14.3% (40), maxillary arch asymmetry 13.6% (38), facial asymmetry 12.1% (34), chin deviation 12.1% (34) and nose deviation 6.1% (17), as shown in table-1.

In order to evaluate the severity of dental asymmetries descriptive statistics were used. In majority of the patients dental midlines were deviated from one another and from the facial midline by  $\frac{1}{4}$  of the lower incisor width, while molar asymmetry was found in most of the patients by  $\frac{1}{4}$  of the cusp width. Hence, small asymmetries are common; however, large discrepancies are infrequent, as shown in table-2.

For the purpose of investigating the difference in frequency of dento-facial asymmetries in mixed and permanent dentition Chi-square test was applied. A statistically significant difference was

found in frequencies of the mandibular arch asymmetry ( $p=0.054$ ). Hence, mandibular arch asymmetry was found to be more commonly seen in permanent dentition than in the mixed dentition.

Other than that, no statistically significant difference was found in frequencies of other asymmetry traits, as shown in table-3.

**Table-1: Frequency of dentofacial asymmetries**

Asymmetry trait	Frequency
Lack of midline coincidence	78.2% (219)
Mandibular midline deviation from facial midline	67.5% (189)
Molar asymmetry	43.2% (122)
Mandibular arch asymmetry	15.7% (44)
Maxillary midline deviation from facial midline	14.3% (40)
Maxillary arch asymmetry	13.6% (38)
Frontal facial asymmetry	12.1% (34)
Chin deviation	12.1% (34)
Nose deviation	6.1% (17)

N=280

**Table-2: Severity of dental asymmetries**

Asymmetry trait	Severity of asymmetries				
	¼ lower incisor width	½ lower incisor width	¾ lower incisor width	Full lower incisor width	Total
Maxillary midline asymmetry from facial midline	11.8% (33)	2.5% (7)	0%	0%	14.3% (40)
Mandibular midline asymmetry from facial midline	51.8% (145)	13.2% (37)	1.8% (5)	0.7% (2)	67.5% (189)
Non-coincident dental midlines	57.5% (161)	16.4% (46)	3.2% (9)	1.1% (3)	78.2% (219)
	<b>1/4cusp</b>	<b>1/2cusp</b>	<b>3/4cusp</b>	<b>Full cusp</b>	
Molar asymmetry	27.1% (76)	12.5% (35)	2.5% (7)	1.4% (4)	43.2% (122)

N=280

**Table-3: Difference in frequencies of dentofacial asymmetries in mixed and permanent dentition**

Asymmetry trait (N=280)	Mixed dentition (n=78 )	Permanent dentition (n=202)	p-value
Mandibular midline deviation from facial midline	65.3% (51)	68.3% (138)	0.832
Maxillary midline deviation from facial midline	8.9% (7)	16.3% (33)	0.282
Lack of midline coincidence	67.9% (53)	32.6% (66)	0.145
Maxillary arch asymmetry	17.9% (14)	11.8% (24)	0.291
Mandibular arch asymmetry	8.9% (7)	18.3% (37)	0.054*
Frontal facial asymmetry	6.4% (5)	14.3% (29)	0.068
Molar asymmetry	38.6% (30)	45.5% (92)	0.794
Chin deviation	6.4% (5)	14.3% (29)	0.068
Nose deviation	5.1% (4)	6.5% (13)	0.681

N=280, Chi-square test,  $p$ -value  $\leq 0.05^*$

## DISCUSSION

The clinical impact of coordinated facial, maxillary and mandibular midlines to a successful orthodontic result and good facial equilibrium cannot be denied. Therefore the clinical significance of this research was to highlight the importance of dento-facial asymmetry during orthodontic diagnosis and treatment planning. Without data on prevalence and severity it has not been possible to evaluate alternate causes for asymmetries and their predictability.

Study conducted by Sheats *et al*<sup>22</sup> on orthodontic population at Virginia Commonwealth University, showed that mandibular midline deviation from the facial midline and non-coincident dental midlines were the most repeatedly seen asymmetry traits. Moreover, the results of their study revealed that nose deviation was the unusually seen asymmetry trait; this is in coincidence with the

results of the present study. The study conducted by Sheats *et al*<sup>22</sup> further showed that maxillary occlusal asymmetry was found slightly more frequent than the mandibular occlusal asymmetry. The total prevalence of the maxillary occlusal asymmetry and the mandibular occlusal asymmetry was 20% and 18% respectively. In contrast, this study demonstrated that mandibular arch asymmetry was slightly more common than maxillary arch asymmetry. The total prevalence of the maxillary arch asymmetry and the mandibular arch asymmetry was 13.6% and 15.7% respectively. Overall maxillary and mandibular occlusal asymmetry is slightly less in Pakistani orthodontic population.

The study conducted by Behbehani<sup>23</sup> in a large population based sample of adolescent Kuwaitis found molar asymmetry in 29.7% of his sample with more than 95% falling in the mild category. This

study found molar asymmetry in 43.5% of the orthodontic patients with more than 95% falling in the mild category. This shows that although small asymmetries are common, large discrepancies are infrequent.

Murshid *et al*<sup>24</sup> conducted a study to evaluate the distribution of occlusal anomalies in a sample of Saudi adolescents in Jeddah city; they found that non coincident dental midlines were seen in 24% of their sample. Borzabadi and Eslamipour<sup>25</sup> conducted a study to determine the prevalence of malocclusions and occlusal traits, in an Urban Iranian population; they found non coincident dental midlines in 23.7% of their sample. In contrast, this study found non coincident dental midlines in 67% of the sample. This large difference in frequencies could be because their study was large population based where as our study was restricted on orthodontic patients.

The present study being a retrospective cross-sectional study had several limitations. The technique of assessing asymmetrical traits was particularly weak at times, especially in the assessment of Co-Cr shifts. The Co-Cr data were either not collected or not explored, leading to the likelihood that some asymmetries may have caused from unrevealed functional shifts. Exact analysis of Co-Cr is compulsory to illuminating the likely sources of asymmetries. Furthermore, visual assessment of the maxillary and mandibular midline deviation from the facial midline is a subjective task. Minor variation in examiner's position relative to the patient can impact one's finding. Being a retrospective nature of this study, important information on validity and reliability was not available. Moreover, the present study was implemented only on orthodontic population, therefore this frequency data cannot be applied on generalized Pakistani population.

## CONCLUSIONS

The current exploration delivered data that can be used to guesstimate the occurrence of dento-facial asymmetries in Pakistani orthodontic population. The following conclusions were drawn:

- Mandibular midline deviation from the facial midline & non-coincident midlines are most commonly seen asymmetry traits
- Nose deviation is least commonly seen asymmetry trait
- Mandibular arch symmetry is more frequently seen in permanent than in mixed dentition

## RECOMMENDATIONS

- To acquire more accurate data on the prevalence of orthodontic asymmetries, a large study on community basis would need to be performed through valid and reliable measures of asymmetry traits of concern and calibration of the surveyors.

- As correction of the dentofacial asymmetries is crucial in order to achieve maximum possible functional occlusion, aesthetics and stability of results attained at the end of orthodontic treatment. Further research needs to be carried out to scrutinize the most commonly involved etiological factors.

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## ERRATA

1.

### ORIGINAL ARTICLE

#### VAGINAL BREECH DELIVERY: STILL A SAFE OPTION

**Sadia Habib, Shazia Riaz\*, Nasreen Abbasi\*\*, Attiya Ayaz\*\*, Attiya Bibi, Zahida Parveen**

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#### VAGINAL BREECH DELIVERY: STILL A SAFE OPTION

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2.

### ORIGINAL ARTICLE

#### LECTURES IN MEDICAL EDUCATION: WHAT STUDENTS THINK?

**Tajammal Mustafa, Zerwa Farooq\*, Zunaira Asad\*\*, Rabbia Amjad\*, Iffat Badar\*\*\*, Abdul Majeed Chaudhry<sup>†</sup>, Mohammad Amer Zaman Khan<sup>††</sup>, Farida Rafique**

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The Editors regret this inadvertent error!