

## THE PATTERN OF MALOCCLUSIONS IN SAUDI ARABIAN PATIENTS ATTENDING FOR ORTHODONTIC TREATMENT AT THE COLLEGE OF DENTISTRY, KING SAUD UNIVERSITY, RIYADH

Khalid M. Al-Balkhi, BDS, MS\*, Ahmed A. Zahrani, BDS, MSc, DFM\*\*

تمت عدة بحوث في المجال الاحصائي لتقويم الأسنان على فئات مختلفة من سكان المملكة العربية السعودية، إلا أنه لم يتم عمل بحث احصائي من حيث النوعية التفصيلية لأشكال سوء الاطباق لحالات تقويم الأسنان التي هي تحت العلاج.

شمل هذا البحث دراسة ٦٤١ حالة تم علاجها في عيادات كلية طب الأسنان بجامعة الملك سعود، حيث تعتبر عيادات تقويم الأسنان في الكلية أكبر عيادات تقويم أسنان في المملكة العربية السعودية نظراً لتواجد عدد كبير من الأطباء الذين يقومون بتقديم الخدمات العلاجية في هذا المجال. تم الحصول على المعلومات المطلوبة من خلال ملفات المرضى والأمثلة الدراسية والأشعة البانورامية، ودراسة العديد من المتغيرات وهي: الجنس، العمر، نوعية سوء الاطباق، شكل وطول القوس السني، عدم تناظر القوس السني، مرحلة بزوغ الأسنان، قلع الأسنان غير المتناظر، اختلاف الخط الأوسط بين القوسين السنيين، الفرجة بين الثنيتين العلويتين، العضة المعكوسة.

### أظهرت الدراسة النتائج التالية:

كانت نسبة الذكور المعالجين (٤٧,٣) ونسبة الاناث المعالجات (٥٢,٧) من مجموع الحالات المعالجة. أما من ناحية العمر فكانت الغالبية العظمى من الحالات بين عمر ١١ - ١٦ سنة ونسبتهم (٤٤,٥) وبين العمر ١٧ - ٢٢ سنة كانت نسبتهم (٢٦) وبين العمر ٥ - ١٠ سنوات كانت نسبتهم (٢٠,٩).

بلغت نسبة حالات تراكب الأسنان (٤٩,٥) موزعة في المنطقة الأمامية بنسبة (٦٠,٦) والمنطقة الخلفية بنسبة (٣٩,٤). كما بلغت نسبة الحالات التي تحتوي على مسافات متباعدة بين الأسنان (٢٨,٦) موزعة في المنطقة الأمامية بنسبة (٦٢,١) والمنطقة الخلفية بنسبة (٣٧,٩). أما حالات القلع غير المتناظر فقد كانت نسبتها (٥٧,١) وعدم تناظر القوس السني بلغت نسبته (٦١,٣) وقد أظهرت الدراسة الاحصائية وجود علاقة قوية بين الاثنين. نسبة العضة المعكوسة في الحالات بلغ (٥٦,٣) موزعة في المنطقة الأمامية بنسبة (٤٩,٦) والمنطقة الخلفية بنسبة (٥٠,٥).

اختلاف الخط الأوسط بين القوسين السنيين بلغت نسبته (٣٠,٧) ونسبة وجود الفرجة بين الثنيتين العلويتين بلغ (٣٢,٨).

أما بالنسبة لشكل القوس السني فقد كانت الغالبية هي الشكل الطبيعي أو العادي بنسبة (٧٦,١) تلاها

Received 14/12/92; revised 13/02/93; accepted 08/12/93

\* Assistant Professor of Orthodontics, Department of Preventive Dental Sciences

\*\* Lecturer in Oral Surgery, Department of Biomedical Dental Sciences, King Saud University College of Dentistry, P.O. Box 60169, Riyadh 11545, Saudi Arabia

Address reprint requests to: Dr. K. Al-Balkhi

الشكل العريض بنسبة (٤, ١٤٪) والشكل الضيق بنسبة (٥, ٩٪) بالنسبة لمرحلة بزوغ الأسنان فقد مثلت حالات الأسنان الدائمة الغالبية العظمى بنسبة (٩, ٧٣٪) ومرحلة الأسنان المختلطة بنسبة (١, ٢٦٪) ولم توجد حالات أسنان لبنية.

بالنسبة لتنوع سوء الاطباق فقد مثل سوء الاطباق من الصنف الأولي نسبة (٣, ٦٩٪) تلاها سوء الاطباق من الصنف الثاني قسم أول بنسبة (٢, ١٢٪) ثم الصنف الثالث بنسبة (٨, ٩٪) ثم الصنف الثاني قسم ثاني بنسبة (٥, ٣٪) وأخيراً الصنف الثالث الوهمي أو الكاذب بنسبة (٧, ٣٪).

تم استنتاج مايلي من الدراسة :

معظم الحالات المعالجة كانت من فئة الشباب بوصغار السن مع زيادة طفيفة لعدد الاناث على عدد الذكور. حالات سوء الاطباق من الصنف الأول وحالات الأسنان الدائمة والشكل العادي للقوس السني وتراكب الأسنان والقلع غير المتناظر وكذلك عدم التناظر في شكل القوس السني كل هذه المظاهر كانت موجودة لدى غالبية المرضى المعالجين ووجد بالدراسة إن هناك علاقة احصائية قوية بين القلع غير المتناظر وعدم التناظر في شكل القوس السني.

ربما يكون وجود العضة المعكوسة وتراكب الأسنان وسوء الاطباق من الصنف الثالث أكثر الأسباب التي أدت إلى مراجعة المريض لعيادات التقويم أو تحويله من قبل الممارس العام لطب الأسنان إلى عيادات التقويم.

The prevalence of many orthodontic-related variables was investigated and analyzed in the largest orthodontic clinic in Saudi Arabia. The results of the study indicate that the majority of the orthodontic cases were young patients with females showing a marginally higher percentage than males. Class I molar relationship, permanent dentition, ovoid arch form, crowding, asymmetrical tooth extraction and asymmetrical arch were found most frequently. A very strong correlation was found between asymmetrical tooth extraction and the existence of dental arch asymmetry. Crossbite, crowding and class III molar relationship may be the principal reasons for patients to seek orthodontic treatment.

## Introduction

With the observed increasing number of Saudi patients seeking orthodontic treatment, a number of investigators have reported on the prevalence of malocclusion and need for orthodontic treatment in the Saudi Arabian population.<sup>1-3</sup> Others have reported on Saudi Arabian's cephalometric findings.<sup>4-6</sup> However, no reports have been published in regard to the distribution of the different malocclusal features in patients attending for orthodontic treatment. The latter is likely to be of importance not only for the successful planning of dental services, but also to orthodontic clinics and dental offices providing such care.

The purpose of this investigation was to determine the pattern of the different malocclusal features in Saudi patients attending for orthodontic treatment at the College of Dentistry, King Saud University, Riyadh.

## Materials and Methods

The study sample consisted of 641 Saudi patients attending for orthodontic treatment at the College of Dentistry, King Saud University. Data was collected from clinical examination charts, study models and orthopantomograms (OPC). The variables included sex, age, type of malocclusion, arch form, length and symmetry, stage of dentition, asymmetrical dental extractions, midline discrepancy, midline diastema and crossbite. The recording criteria were as follows:

1. The type of malocclusion, classified according to the method proposed by Angle.<sup>7</sup>
2. Arch form, classified as either long and narrow, average (ovoid), or wide and broad (square).<sup>8</sup>
3. Arch symmetry, analyzed with the use of a symmetrograph.<sup>9</sup>
4. Asymmetrical extraction, considered when

premature extraction of deciduous teeth or permanent teeth had taken place on one side of the dental arch only.

5. *Midline discrepancy*, considered when the maxillary and mandibular dental arch midlines did not coincide with one another.
6. *Midline diastema*, considered only when the measurement between the proximal surfaces of the maxillary central incisors was 0.5 mm or more.<sup>10</sup>
7. *Crossbite assessment*, based according to its location in the dental arch, whether anterior or posterior. Posterior crossbites were not differentiated into unilateral or bilateral.
8. *Arch length availability*, categorized according to available space for teeth in the arch. Crowding was considered if there was 2 mm or more dental arch insufficiency, and spacing if dental arch excess was 2 mm or more.<sup>11</sup> Between those two, the dental arch length was considered adequate. In cases of permanent dentition, the traditional brass wire method was used. However, for the mixed dentition cases, the Moyer's mixed dentition analysis utilizing the 75% level of prediction was used.<sup>9</sup>

All data collection and evaluation was performed by one examiner to avoid inter-examiner variability. The results were processed and analyzed by the use of Chi-square test and the correlation *t* test at a significance level of  $p < 0.05$ .

## Results

### Sex distribution

The distribution of females (52.7%) and males (47.3%) was marginally higher in the former but was not statistically significant ( $p > .1$ ).

### Age distribution [Fig. 1]

The age range of patients attending for orthodontic treatment was between 5 and 46 years. However, three major age-groups constituting the overwhelming majority of the patients (91.4%) were identified. Those between 11-16 years (44.5%) had the highest representation, followed by age-groups between 17-22 years (26%) and 5-10 years (20.9%). Adult patients over the age of 30 years constituted a very small percentage of patients seeking orthodontic treatment (total=3%).

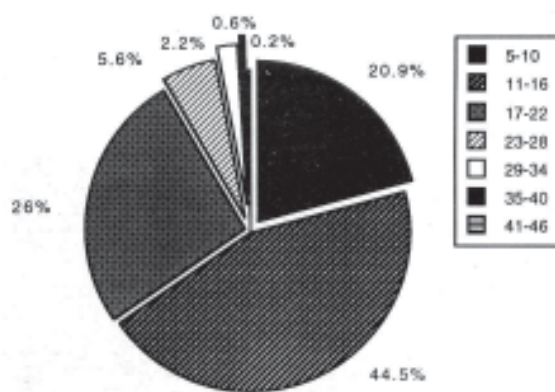


Figure 1. Malocclusion and age distribution.

### Arch length availability [Figs. 2 and 3]

Dental crowding was the most common finding in the arch length analysis (49.5%), distributed as anterior crowding (60.6%) and posterior crowding (39.4%). Arch length adequacy constituted 21.9%, whilst dental spacing or excess in arch length represented 28.6%. The latter was distributed as anterior spacing (62.1%) and posterior spacing (37.9%).

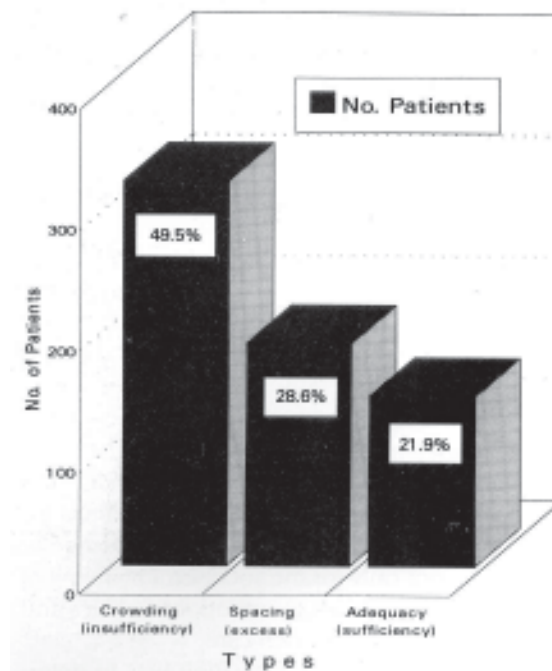


Figure 2. Frequency distribution of arch length availability.

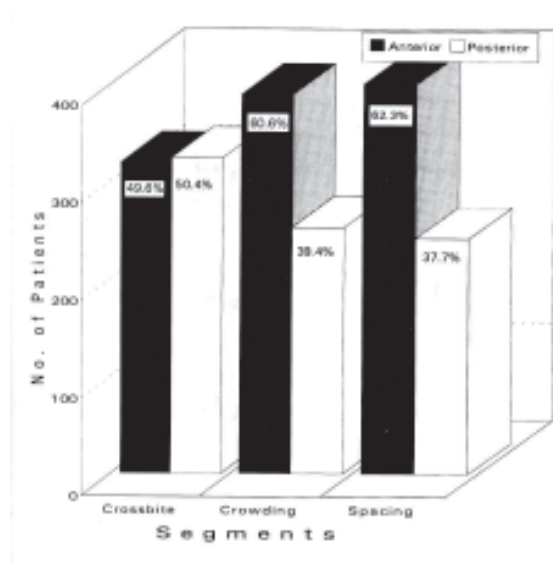


Figure 3. Frequency distribution of anterior/posterior arch length abnormalities.

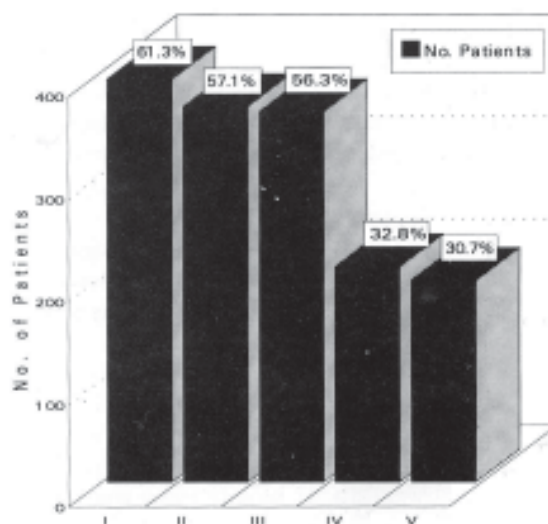


Figure 4. Frequency distribution of malocclusal abnormalities.

**Maiocclusal abnormalities [Figs. 3 and 4]**

High prevalence of asymmetrical tooth extraction (57.1%) and arch asymmetry (61.3%) were established. The two were significantly highly correlated ( $p < 0.05$ ). The prevalence of crossbite was also relatively high (56.3%) and almost equally distributed between the anterior region of the dental arch (49.6%) and the posterior region (50.5%). The prevalence of midline diastema and midline discrepancy were 32.8% and 30.7%, respectively. Utilizing the correlation *t* test, it was only the midline diastema which was found to be correlated to arch asymmetry, asymmetrical tooth extraction and crossbite (Table 1.)

**Arch form [Fig. 5]**

The most common type of dental arch form was the average or ovoid (76.1%), followed by the square or broad (14.4%) and, finally, the narrow or peaked (9.5%).

Table 1. Correlation analysis of malocclusion abnormalities.

	Asymmetric extraction	Crossbite	Midline discrepancy	Midline diastema
Arch asymmetry	.8194 <.05	.2885 <.05	.2167 <.05	.0017 >.05
Asymmetrical extraction	-	.2915 <.05	.2358 <.05	.0195 >.05
Crossbite	-	-	.2321 <.05	.0286 >.05
Midline discrepancy	-	-	-	.1402 <.05

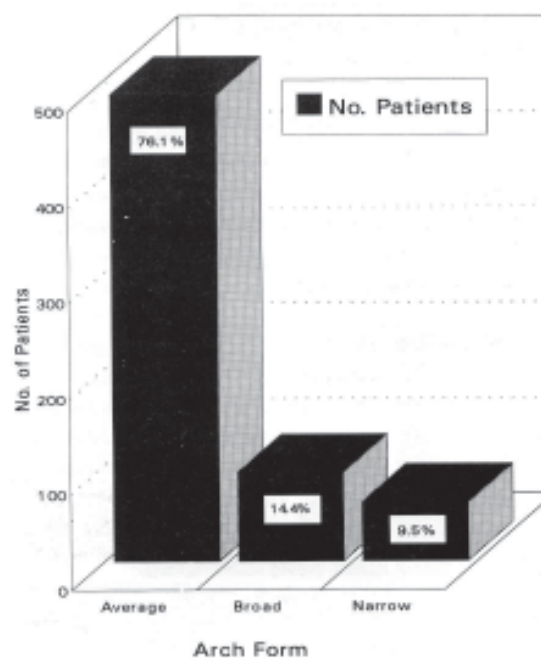


Figure 5. Frequency distribution of arch form.

**Dental stage [Fig. 6]**

Almost three quarters of the patients were in the permanent dentition stage (73.9%), the remainder in the mixed dentition stage. There were no patients in the deciduous dentition stage.

**Molar classification [Fig. 7]**

The most common type of malocclusion was Class I (69.3%), followed by Class II division 1 (12.2%), Class III (9.8%), Class II division 2 (5%) and pseudo Class III (3.7%).

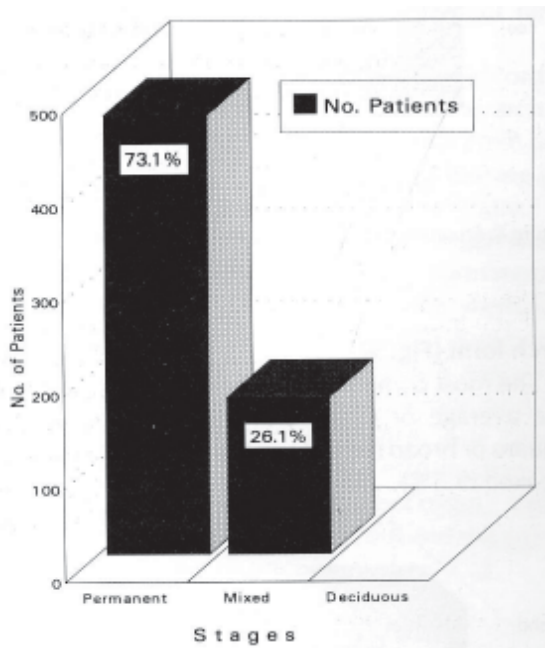
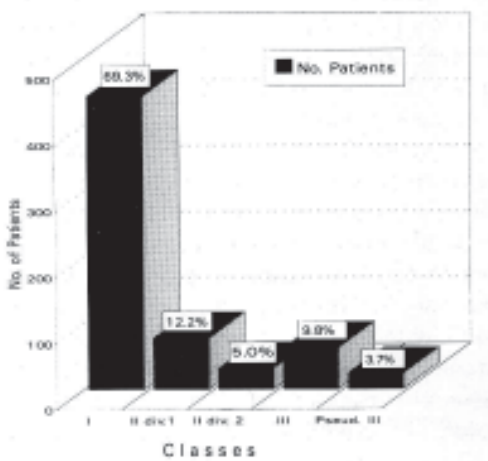


Figure 6. Frequency distribution of stages of dentition.



7. Frequency distribution of Angle's molar classification

**Discussion**

The College of Dentistry at King Saud University is the largest dental center in Saudi Arabia. It serves the community through two large polyclinics in the capital city, Riyadh. The orthodontic department has eight orthodontists and several supervised dentists and dental students treating orthodontic patients. The attending patients came from different parts of the Kingdom resulting in a total of more than three thousand active orthodontic cases.

The study sample represents, exclusively, patients treated in the orthodontic clinics of the College of Dentistry, Riyadh. Consequently, it seems reasonable to consider the data of this study as being representative of any orthodontic clinic or dental health center in Saudi Arabia.

**Sex distribution**

The lack of any significant difference ( $p>0.1$ ) between the number of female and male patients attending for orthodontic treatment may either indicate that the level of awareness and interest in obtaining such treatment is similar between both sexes, or our findings may be biased due to the cultural influences on females in the Saudi society. This is unlike the observation of Syono *et al*<sup>12</sup> where female patients showed more concern for correcting their dental malalignment while male patients were higher in their receptivity of orthodontic treatment.

**Age distribution**

The majority of patients who attended for orthodontic treatment were of the younger age-groups. This reflects the reality that youngsters are highly concerned about their appearance even if functional impairment is non-existent. The very small percentage of adult patients who attended could be explained, either by the fact that adult patients are not frequently referred for orthodontic treatment or that older patients are less concerned about the negative esthetic aspect of their dental malocclusion, and the need for orthodontic treatment.

It is worth mentioning that the management of the orthodontic problems of younger age-groups require not only the alignment of teeth, but also a variety of dental, skeletal and orofacial imbalances that accompany different growth patients. There-

fore, a clinician providing orthodontic treatment should have sound knowledge of orofacial growth and development as well as the necessary orthodontic skills to achieve not only tooth alignment but also orofacial structural balance. Furthermore, the young age-groups are usually afflicted with a high prevalence of dental caries.<sup>13,14</sup> This necessitates that the clinician should provide the maximum protection against dental caries and enamel hypocalcification by encouraging control in respect of the frequency of intake of refined carbohydrates, the use of fluorides and the maintenance of optimum oral hygiene.

#### **Arch length availability**

Almost half the patients attending for orthodontic treatment were found to have crowding or arch length insufficiency. The crowding was more commonly localized in the anterior arch segment than posteriorly, and this was in agreement with previous studies of the Saudi population.<sup>1-3</sup> Nevertheless, the percentage of crowding in this study was higher. The dental spacing or excess of space was less than the findings of Al-Emran *et al*<sup>2</sup> but slightly higher than what had been observed by Nashashibi *et al*<sup>1</sup>, although they were all in agreement that dental spacing was more common in the anterior segment. The significant differences ( $p < .005$ ) between crowding, spacing and arch adequacy suggest that crowding of the dentition could be a determinant for both the patients and the referring dentists to seek orthodontic treatment than dental spacing, despite- the fact that both dental crowding and spacing negatively affect the patient's appearance.

#### **Malocclusal abnormalities**

Data from a previous study on the prevalence of tooth loss in a Saudi population gave an indication of asymmetric tooth extraction.<sup>15,16</sup> The result of the present study confirms such an observation and showed a very strong correlation between asymmetrical extraction and the existence of dental arch asymmetry.

One-third of the sampled patients exhibited either maxillary or mandibular midline diastema, which was unexpectedly not correlated with asymmetrical extraction. The prevalence of midline discrepancy was much higher than that reported by Al-Emran *et al*<sup>2</sup> in Saudi children, but was exactly

similar to that reported by Nashashibi *et al*<sup>1</sup>.

Unlike previous reports, crossbite occurrence was much higher in this study and was almost equally distributed in the anterior and posterior segments. Such observation could indicate that the presence of crossbite may be a strong reason for both the patients and the referring dentists to seek orthodontic treatment as it is usually associated with mandibular shifts, of which patients and/or referring dentists are aware.

#### **Arch Form**

The findings of this study showed that all three types of arch form were predominant albeit the difference in frequency levels. Consequently, the best arch form wires should be the individualized or customized. This supports previous findings that there is no single universal ideal arch form applicable to all cases.<sup>17,18</sup>

#### **Stage of dentition**

Even though the age range of patients was 5-46 years, there was no deciduous dentition case recorded. In this study, the few five-year-old patients were in the mixed dentition stage. Data analyses of our findings and those of Al-Emran *et al*<sup>2</sup> showed no significant differences ( $p > .05$ ) between the different stages of dentition despite different age range.

#### **Molar classification**

The frequency distribution of Angle's types of malocclusion among the study sample was in close agreement with that reported by Al-Emran *et al*<sup>2</sup> and Nashashibi *et al*<sup>1</sup> but statistically different at high level ( $p > .0001$ ). The Class I molar relationship type was the most frequently observed and it was the most predominant feature of Saudi Arabian patients attending for orthodontic treatment. The next common was Class II followed by Class III. However, Class III was found more frequently in our sample than what had been reported elsewhere in other countries in respect of the Saudi population.<sup>1,2</sup> This may very well indicate that Class III malocclusion could be a strong reason for both the patients and the referring dentists to seek orthodontic treatment as it usually affects both function and esthetics of the orofacial structures negatively.

### Conclusions

The findings of this study might be considered to be applicable to any local orthodontic clinic or office. Both males and females showed similar interest in obtaining orthodontic treatment.

The majority of orthodontic patients were of the young age-groups, and a small percentage of older adult patients. This observation enforces the need for anti-caries measures, especially the use of fluoride for maximum dental protection, as well as the correction of not only tooth malalignment but also the orofacial skeletal and muscular imbalances.

Patients attending for orthodontic treatment displayed a high prevalence of the permanent stage of dentition, ovoid arch form, Class I molar relationship, crowding, asymmetrical tooth extraction, arch asymmetry and crossbite. Crowding, crossbite and Angle's Class III molar relationship seemed to be the most common reasons for patients to seek orthodontic treatment or for dentists to refer such cases to the orthodontists.

The results of this study does not, however, indicate the orthodontic treatment demand by the Saudi Arabian population at large due to our inability to differentiate between those who had been referred from those who were self-motivated to seek treatment.

### References

- Nashashibi IA, Darwish SK, El-Rasheed K. Prevalence of malocclusion and treatment need in Riyadh (Saudi Arabia). *Odontostomatol Trop* 1983;6:209-14.
- Al-Emran S, Wisth PJ, Boe OE. Prevalence of malocclusion and need for orthodontic treatment in Saudi Arabia. *Community Dent Oral Epidemiol* 1990;18:253-55.
- Jones WB. Malocclusion and facial types in a group of Saudi Arabian patients referred for orthodontic treatment: A preliminary study. *Br J Orthod* 1987;14:143-46.
- Nashashibi IA, Shaikh HS, Sarhan OA. Cephalometric norms of Saudi boys. *Saudi Dent J* 1990;2:52-7.
- Toms AP. Class III malocclusion: A cephalometric study of Saudi Arabians. *Br J Orthod* 1989; 16:201 -06.
- Shalhoub SY, Sarhan OA, Shaikh HS. Adult cephalometric norms for Saudi Arabia with a comparison of values for Saudi and North American Caucasians. *Br J Orthod* 1987;14:273-79.
- Angle EH. Malocclusion of the teeth. In: Moyers RE *Handbook of Orthodontics*. 4th ed. Chicago: Yearbook Med Publ Inc, 1988:186-88.
- Grebar TM. *Orthodontics principles and practices*. 3rd ed. Philadelphia:WB Saunders Co, 1972:207-10.
- Moyers RE. *Handbook of orthodontics*. 4th ed. Chicago: Yearbook Med Publ Inc, 1988:241.
- McVay RN, Latta GH. Incidence of the maxillary midline diastema in adults. *J Prosthet Dent* 1984;52:809-11.
- Bjork A, Krebs AA, Solow B. A method for epidemiological registration of malocclusion. *Acta Odontol Scand* 1964;22:27-41.
- Syono M, Tada W, Rokusya Y, Zuiki Y, Tensin S, Tabuchi T et al. Psychological study of questionnaire relating to dentition and orthodontic treatment. *Nippon- Kyosei Shika Gakkai-Zasshi* 1990;49:443-53.
- Farsi JM. Common causes of extraction of teeth in Saudi Arabia. *Saudi Dent J* 1992;3:101-5.
- Al-Sekait MA, Al-Nasser AN. Dental caries prevalence in primary Saudi schoolchildren in Riyadh District. *Saudi Med J* 1988;9:606-9.
- Al-Emran S. Prevalence of tooth loss in Saudi Arabian school children: An epidemiological study of Saudi male children. *Saudi Dent J* 1990;2:137-40.
- Nashashibi IA. The significance of loss of deciduous teeth in the etiology of malocclusion in Riyadh. *Odontostomatol Trop* 1986;9:89-96.
- Felton JM, Sinclair PM, Jones DL, Alexander RG. A computerized analysis of the shape and stability of mandibular arch form. *Am J Orthod Dentofacial Orthop* 1987;92:478-83.
- White LW. Individualized ideal arches. *J Clin Orthod* 1978;12:779-87.