Epidemiology and aetiology of malocclusion among Syrian paediatric patients

M. ALKILZY*·***, A. SHAABAN**, M. ALTINAWI**, CH. H. SPLIETH*

ABSTRACT. Aim The knowledge of the distribution and causes of malocclusion in early childhood can prevent such malocclusions and their consequences and possibly to reduce complex orthodontic treatment. Methods All children (n = 234; 116 male, 118 female, age 2-16) who presented with occlusal or functional problems at the Department of Paediatric Dentistry at Damascus University (1995-1999) were classified according to the type and causes of malocclusion and the subsequent orthodontic treatment. Results 57.3% of the malocclusions affected the anterior-posterior plane, 12.4% the vertical, and 35.9% the transverse. Most of the malocclusions had causes which could be modified by preventive or interceptive efforts: thumb sucking (5.12%), infantile swallowing (3.84%), mouth breathing (0.85%), tongue thrusting (1.7%), delayed exfoliation of a primary tooth (3.41%), premature loss of a primary tooth (9.82%), delayed eruption of a permanent tooth (2.13%), or an impacted tooth (6.41%). The subsequent early orthodontic treatment consisted of space maintainers (26%), removable (40.9%), functional (11.9%), or fixed appliances (21.2%). Conclusion These data stress the importance of early orthodontic diagnosis in paediatric practice. Malocclusion in this Syrian sample could be treated to a great extent with preventive or interceptive orthodontics, which required only simple appliances and techniques.

KEYWORDS: Malocclusion, Early orthodontic treatment, Children.

Introduction
Caries and dysgnathia or malocclusion are the most prevalent reasons for dental treatment in children. Surveys from different countries indicate that the orthodontic treatment need in adolescents ranges between 25 to 30% [De Muniz, 1986; Masztalerz, 1989; Burden and Holmes, 1994; O’Dowling and O’Mullane, 1995]. The knowledge of the distribution and causes of malocclusion in early childhood can prevent such malocclusion and its consequences and make it possible to reduce the complexity of orthodontic treatment. Numerous studies have shown that early recognition of developing malocclusions and subsequent uncomplicated orthodontic procedures have several advantages and can minimise or eliminate future costly treatment [Onyeaso, 2004a; Karaiskos et al., 2005; Vakiparta, 2005; Castaner-Peiro, 2006]. Only a few studies found no relevant differences between early and late treatment of some severe malocclusions, such as skeletal open bite [Cozza et al., 2005]. In spite of contentious discussion on early vs. late orthodontic treatment [Gottlieb et al., 2004; Hsieh et al., 2005; Mew, 2005], it seems clear that the early treatment improved the patients’ self-esteem and reduced negative social experiences [O’Brien et al., 2003].

In a thorough analysis of the reasons of dysgnathia, Schopf [1981] showed in a German sample that 44.3% of the etiological factors of malocclusion were exogenous, such as caries in primary teeth, loss of first permanent molar, habits, and trauma, 35.3% were not attributable, and only 20.3% had a clear genetic origin. This calls for early diagnosis by paediatricians and family dentists.

The aim of this investigation was to determine the distribution and causes of malocclusion in a Syrian sample and how they could be preventively and interceptively treated.
Methods

All children (n = 234; 116 male, 118 female) who presented with malocclusion at the Department of Paediatric Dentistry at Damascus University (1995-1999) were divided into 5 age groups (2-5 years, 6-8, 9-11, 12-14, and 15-16 years). The children came mostly on their own/their parents’ accord or they were referred to the University Clinics by private practice dentists. A few patients were referred by the University Clinics. Children and their parents were interviewed for a complete medical and dental history including the reason of the visit, dental trauma, orofacial habits (thumb sucking, lip biting etc.) and breathing habits (nose, mouth, open lips).

The patients’ records contained separate, standardised sheets for the diagnosis of malocclusion and early orthodontic treatment procedures. Records reported the following.

Clinical examination for:
- determination of facial symmetry and profile;
- dentition (number of teeth, dental abnormalities, teeth eruption chronology);
- soft tissues examination: position, size and attachment of tongue, lips, and ligaments;
- occlusal relationship and functional examination such as relaxed closure of lips, anterior and side movements of mandible, swallowing (interdental or palatal position of tongue), and breathing (blockage of nose).

Radiographic examination and cephalometric analysis according to diagnostic and treatment need

Cast models analyses such as: dental arch and palate form, overlap and overjet, and Nance analysis.

Due to the lack in cooperative ability in the 2-5 year age-group patients, X-rays and cast models were performed only when necessary for diagnosis or treatment, especially in alterations of tooth number, eruption time or skeletal dysgnathia.

Using the 3-dimensional occlusion analyses [Kahl-Nieke; 2001], the occlusal relationship was classified according to the plane which was affected by malocclusion:
- anterior-posterior plane (molar and canine relationship, increased overjet, frontal cross bite);
- vertical plane (open and deep bite);
- transversal plane (lateral cross bite, buccal non-occlusion).

Multiple registrations of planes were allowed. In addition, the most likely causes of malocclusion were classified based on the medical and dental history, facial and dental examinations, radiographic examinations, and interviews with the parents and discussed with the senior staff through the patient’s examination, then registered in the patient’s sheet. Causes were classified as trauma, thumb sucking, infantile swallowing, mouth breathing, tongue thrusting, hyperdontia, hypodontia, delayed exfoliation of a primary tooth, premature loss of a primary tooth, delayed eruption of a permanent tooth, and an impacted tooth. Multiple registrations of causes were allowed for an individual case. Finally, the subsequent orthodontic treatments were registered as space maintainers, simple removable appliances, functional appliances, and fixed appliances.

The examinations, diagnoses, treatment plans, and follow-ups were made by postgraduate students under supervision of the department’s senior staff.

Results

The age distribution of the sample showed that the majority of the children were between 9 and 14 years of age, with no relevant differences between males and females (Table 1).

The majority (57.3%) of the malocclusions affected the anterior-posterior plane, 12.4% the vertical plane, and 35.9% the transverse plane. In 4.6% of the children, malocclusion affected more than one plane.

The most common causes of malocclusions were: premature loss of a primary tooth (n = 23; 9.82%), impacted teeth (15; 6.41%), thumb sucking (12; 5.12%), hypodontia (10; 4.27%), hyperdontia (9; 3.84%), infantile swallowing (9; 3.84%), delayed exfoliation of a primary tooth (8; 3.41%), trauma (5; 2.13%), delayed eruption of a permanent tooth (5; 2.13%), tongue thrusting (4; 1.7%), mouth breathing (2; 0.85%) (Fig. 1).

The subsequent preventive or interceptive orthodontic treatments were mostly simple removable appliances such as expansion screws, space regainers and retainers, bite planes, and springs (40.9%), followed by space maintainers (26%), fixed appliances

<table>
<thead>
<tr>
<th>Age groups</th>
<th>Distribution</th>
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<tbody>
<tr>
<td>2-5 years</td>
<td>9 (3.8%, 4 males, 5 females)</td>
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<tr>
<td>6-8 years</td>
<td>44 (18.8%, 23 males, 21 females)</td>
</tr>
<tr>
<td>9-11 years</td>
<td>86 (36.8%, 41 males, 45 females)</td>
</tr>
<tr>
<td>12-14 years</td>
<td>87 (37.2%, 45 males, 42 females)</td>
</tr>
<tr>
<td>15-16 years</td>
<td>8 (3.4%, 3 males, 5 females)</td>
</tr>
</tbody>
</table>

Table 1 - Age and gender distribution of Syrian children with malocclusion (total n = 234, 116 males, 118 females).
such as distal jet appliances and coil springs (21.2%), and functional appliances such as oral screen and lip bumpers (11.9%).

**Discussion**

The Department of Paediatric Dentistry at Damascus University mostly treats children and adolescents with average and below-average socio-economic status from Damascus city and its surroundings. The patients were either referred by dentists to the Department of Paediatric Dentistry or they came directly because of caries treatment or occlusal or functional complaints, resulting in a very broad spectrum of patients. Thus, the study sample should be approximately representative for paediatric patients in Syria with a slight overrepresentation of severe cases and higher caries prevalence.

In contrast to prevalence studies which assess the percentage of subjects with malocclusion or oral dysfunction in a community [Hensel and Splieth, 1998; Onyeaso, 2004a,b; Tausche et al., 2004; Abu Alhaija et al., 2005; Karaiskos et al., 2005], in this study only children with already diagnosed malocclusions were included in order to determine which are the most common cases seen in paediatric dentistry clinics and whether they could have been treated preventively.

The standardised sheets for the occlusal and functional examination findings and supervision by six permanent staff members ensured a consistent quality of the data. The robust criteria for the diagnosis of malocclusions and related causes, and the subsequent treatment should guarantee a high validity of the findings.

The 5 age groups reflect the phases of dentition from primary to early and late mixed dentition and, finally, the permanent dentition. Most of the patients with malocclusion were between 9 and 14 years old (73.9%). These malocclusions and their causes - such as caries or habits - may have existed earlier, but children were introduced to the orthodontists when parents or the referring dentist noticed clear abnormalities. This stresses the importance of periodical screenings of children in kindergartens and schools for caries and orthodontic treatment needs. A prospective study from Vakiparta et al. [2005] stresses the importance and the benefit of early diagnosis of orthodontic treatment need and early orthodontic treatment between 8 to 12 years of age. They found that of the 29 children with definite treatment need at age 8 and subsequent early treatment, only 2 had further treatment need at the age of 12 years. Of the 38 children with no treatment need at age 8, 28 remained in this category and only 2 children developed definite need for treatment at 12 years of age. In this study, there were no relevant differences in gender distribution of the children with malocclusion, also in every age group. Many studies concluded no significant gender differences among school children with malocclusion (Frazao et al., 2002; Onyeaso, 2004; Onyeaso and Onyeaso, 2006; Rwakatema et al., 2006; Ngom et al., 2007), furthermore Rwakatema et al. (2006) reported no significant gender difference in either the overall prevalence of malocclusion or in the occurrence of different occlusal traits. Onyeaso and Onyeaso (2006) observed only statistically higher prevalence of supernumerary teeth in males, but not of all the other various occlusal/dental needs. Therefore, in this study, the gender differences in the prevalence

![Fig. 1 - Distribution of main classifiable causes for malocclusions in %](image-url)
of every occlusal trait have not been studied.

Most malocclusions affected the anterior-posterior and transverse planes (57.3% and 35.9%, respectively), which can easily be treated with preventive and simple orthodontic treatment. Only 12.4% of malocclusions are confined to the vertical plane, such as open and deep bites, which often require complex orthodontic treatment.

Premature loss of a primary molar was the most frequent single cause of malocclusion, which correlates with the high prevalence of caries in Syria. Beiruti et al. [1985] found that caries prevalence in 5-year-olds in Damascus was 77% in 1985 and 74% in 1991 [Beiruti and Hussein, 1996], with mean dmft scores of 5.2 and 4.6, respectively. The mean DMFT score of 12-year-old-children showed a fluctuating pattern ranging from 1.4 to 2.5. These dmft and DMFT scores consisted mainly of the d component (80-90%) [Beiruti and Helderman, 2004], indicating a lack of dental treatment which can result in a mesial drift of molars and secondary crowding.

Årtun et al [2005] found that two-thirds of the dental traumas in adolescent Arab populations occurred at age 10 years or later, which explains in addition to the dmft and DMFT data the concentration of malocclusion among 9 to 14 year olds.

Schopf [1981] traced the causes of malocclusions of a German sample in exogenous factors (44.3%) such as caries on a primary tooth (22.9%). Malocclusions of genetic origin comprised 20.3%, and the remaining 35.3% were difficult to classify. In this Syrian sample, exogenous factors (trauma, thumb sucking, infantile swallowing, mouth breathing, tongue thrusting and premature loss of a primary tooth due to caries), which accounted for 23.46%, were more important than the genetic ones (hyperdontia, hypodontia, and delayed exfoliation of a primary tooth) which were 11.52%. 8.54% were classified as mixed exogenous and genetic origin (delayed eruption of a permanent tooth and an impacted tooth), but the origin of most malocclusions (56.48%) was difficult to determine indicating a mixed multifactorial origin. Although Schopf [1981] recruited his sample at an orthodontic department and the present study was performed at a paediatric department, the pattern of distribution is very similar with clearly more exogenous than genetic origins. Even the prevalence of exogenous factors seems to be comparable: habits and dental trauma were found in the German sample in 18.5% and 11.1%, respectively, and in Syrian sample in 11.51% (the sum of thumb sucking, infantile swallowing, mouth breathing and tongue thrusting) and 2.13%.

Onyeaso [2003] found that 60.5% of cases which presented for treatment at the orthodontic unit of a university college hospital needed one form of preventive and interceptive treatment, extraction of retained primary teeth, use of simple removable orthodontic appliances, or oral habit-breaking appliances. By comparison, the great majority of the Syrian sample (79%) could also be treated with preventive and interceptive treatment with simple orthodontic appliances and techniques as: space maintainers (26%), functional appliances (11.9%) such as wood tab, habit breakers, oral screen, and simple removable appliances (40.9%) such as expansion screws, space regainers and retainers, bite planes and springs.

**Conclusion**

These data stress the importance of orthodontic screening diagnostics in paediatric practice, especially from age 9-14. The most important known reason for malocclusion was the premature loss of primary teeth. Malocclusions of this Syrian sample could be treated mostly with preventive or interceptive orthodontics which required only simple appliances and techniques.

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**References**


