

# THE PREVALENCE OF MALOCCLUSION AND ORTHODONTIC TREATMENT NEED IN A SAMPLE OF SYRIAN CHILDREN

***Ayhab B. Alatrach, BDS, MDS***

Post-Graduate Student, Department of Orthodontics,  
School of Dentistry, Beirut Arab University.

***Fayez K. Saleh, BDS honors, MDS, PhD, Dip Med Edu.***

Emeritus Professor and Former Chairperson,  
Department of Orthodontics, School of Dentistry, Beirut Arab University

***Esam Osman, BDS, MDS, PhD***

Professor and Dean, School of Dentistry, Beirut Arab University

---

## Abstract

Knowledge of a population's epidemiological situation is vital in planning and provision of dental health services. The present study was undertaken to determine the prevalence of malocclusion and orthodontic treatment need in Syrian children. A randomly selected sample of 200 Syrian children aged between 8 and 13 years was collected from three different public schools in Damascus. For each participant, the records were a pair of dental study casts and a frontal intra-oral photograph. Firstly, Angle's classification was used to classify malocclusion and the treatment need was assessed utilizing the Aesthetic Component (AC) and the Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN). The treatment demand was also evaluated in association with gender and the connection between the two components of IOTN was statistically ascertained. The results of the study showed that more than one third of the subjects in the sample were in moderate to great need for orthodontic treatment. No significant difference in treatment need was found between genders and a statistically significant association was expressed between the two components of IOTN.

---

**Keywords:** Children, Malocclusion, Prevalence, Dental Health, IOTN/DHC, IOTN/AC

## **Introduction**

The severity of malocclusion and its influence on oral functions and facial aesthetics is becoming a great concern to health authorities and families as well.

Angle (1899) classified the malocclusion according to the relative position of the mandibular first permanent molar into class I at which the molar relationship is normal (buccal groove of the mandibular first molar is in line with the mesiobuccal cusp of the maxillary first molar but there is/are abnormalities within the arch like crowding, spacing ...etc.) and class II or distocclusion where the lower first molar is posteriorly positioned relative to upper molars. Class II can be further subdivided into division I where the upper incisors are proclined and division II where the upper central incisors are retroclined and lateral incisors are overlapping the centrals. Class III is the third classification and characterized by more anterior position of the lower molars relative to upper molars.

It was recognized almost immediately, however, that there were deficiencies in the Angle system (1899). One of the most severe critics was the fact that Angle's (1899) methods does not recognize the relationship of teeth to the facial profile and it does not assess the wide differences in the character of certain malocclusions which have the same distomesial occlusion of the buccal teeth. Furthermore, although malocclusion is a three dimensional problem, in the Angle(1899) system only anteroposterior (Sagittal) deviations were taken into consideration and that it does not take into account the possibility of arch-length problems neither does it indicate the complexity of the problem , and that it did not include a diagnosis.

Despite limitations, Angle's (1899) classification is still applicable, reliable and widely used in academic settings and epidemiological studies worldwide.

Due to certain drawbacks in Angle's classification (1899), Occlusal indices were often developed to augment this method and to standardize the criteria through which judgments are made in the profession, and allow individuals with the greatest need to be assigned priority when orthodontic resources in the public dental health services are limited and when treatment availability is unevenly spread, similarly, individuals with little need for treatment can be safeguarded from the potential risks of unnecessary treatment.

Oral health planners in any country are often called upon to estimate the orthodontic problems and treatment need in their communities by measuring certain occlusal features that if untreated may lead to functional impairment and aesthetic dissatisfaction.

Historically orthodontic diagnosis has been taught and practiced as a descriptive, qualitative subject. However, to get information about the

prevalence of malocclusion and to quantify the severity of various features of malocclusion, several indices have been proposed [(Massler et al., 1951); (Summers CJ, 1966); (Salzmann JA, 1968); and (Linder-Aronson S, 1974)].

An orthodontic index is a numerical scale that is derived by scoring specific features of malocclusion to objectively assess some parameters and render descriptive terms to be transferred into numerals that exactly assess the severity of malocclusion and provide information about the difficulty of the case (Grainer RM, 1967).

There are five main types of occlusal indices, namely Angle's (1899) classification, epidemiological indices, treatment need indices, treatment outcome indices and treatment complexity indices.

Occlusal indices have been used to

1. Identify patients with treatment need.
2. Prioritize their treatment needs.
3. Useful tool in epidemiological studies.

Massler and Frankel (1951) made the initial attempt to develop a quantitative method of assessing malocclusion. Van Kirk and Pennell (1959) proposed the malalignment index (Van Kirk et al, 1959), which involved the quantitative grading of tooth displacement and rotation and was a step forward in this field. The more commonly used indices include the occlusal index (Summers CJ, 1966), The Treatment Priority Index (Grainer RM, 1967) and the Handicapping Malocclusion Assessment (Salzmann JA, 1968), all of which were developed in the 1960s. These indices were designed to assess malocclusion severity in a quantitative manner and orthodontic treatment need would be graded accordingly.

The Swedish National Board for Welfare Index (Linder-Aronson, 1974) was developed to determine whether or not a patient's malocclusion falls within the scope of treatment in the Swedish public dental service.

Brook and Shaw (1989) developed the Index of Orthodontic Treatment Need (IOTN) to assess the need for orthodontic treatment. The index incorporates an Aesthetic Component (AC) (Brook and Shaw, 1989) and a Dental Health Component (DHC) (Brook and Shaw, 1989). In the Dental Health Component; occlusal traits were defined and placed in five grades, with clear cut-off points. The DHC facilitates a synthesis of the current evidence of the deleterious effects of malocclusion. The Aesthetic Component (AC) (Brook and Shaw, 1989) consists of ten colour photographs showing different levels of dental attractiveness and it assesses the attractiveness of the dentition.

Richmond et al (1992) developed The Peer Assessment Rating (PAR) (Richmond et al, 1992) Index to measure the severity of dental malocclusion and the author indicated that the index is applicable at any developmental stage and at any stage of treatment, and also to an individual's pre- and post-

treatment study casts, indicating the degree of improvement as a result of orthodontic intervention and, therefore, the success of treatment.

Different ethnic groups have variable occlusal traits; it is not only prevalence and severity of malocclusion that fluctuates, but also the awareness, need for treatment and demand differ according to socio-economic and cultural status of the population.

Ingervall (1974) assessed the occlusal status of 18-year old Swedish populations and their desire for orthodontic treatment and found that the frequency of awareness of occlusal anomalies was generally low and as many as 60% were judged by the orthodontist to be in need for such treatment ,and in half of these individuals the need was considerable.

El-Hadary and Aboul-Azm (1977) evaluated malocclusion according to Angle's (1899) system in a sample of 600 Egyptian male adults [18 years old in average] and the results clarified that class I was present in 52% while 8% and 4% of them had class II and III respectively.

Kapila (1983) examined 417 Kenyan school children [13-20 Years] and reported malocclusion in 39% of the sample.

El-Mangoury and Moustafa (1990) studied the occlusal variation among the Egyptian adults in a sample of 501 subjects [aged between 14 and 24 years] according to Angle's (1899) classifications. The author recorded that 34.3% of them showed normal occlusion while 65.5% showed malocclusion and Angle's (1899) classes I, II, III represented 33.3%, 21%, and 11.3% respectively.

Burgersdijk et al. (1991) investigated the prevalence of malocclusion and orthodontic treatment need in Dutch population and found that severe crowding of mandibular teeth existed in about 15%, Angle's (1899) class II in 28%, increased overjet in 23%. Regarding the treatment need he found that 39% of the population was in need and only 14% were not in need.

Abou Affan et al. (1990) assessed malocclusion in a sample of 635 Sudanese children using Bjork (1954) registration method and observed that the majority of children [78%] had Angle's (1899) class I followed by class II [11%] and class III [3%]. The author reported a high prevalence of median diastema reaching a percentage of 18% of the total sample.

Holmes and Burden (1994) evaluated the prevalence of orthodontic treatment need among 955 British school children using the Index of Orthodontic Treatment need (IOTN) (Brook and Shaw, 1989) and he reported that 34.8% of the children were categorized in grades (1 or 2, no or little need respectively) and 33.2% in grade 3 (moderate need) while 32% were categorized in grades 4 or 5 (great or very great treatment need, respectively).

El Tang (1994) carried out a study to determine the prevalence of malocclusion and treatment need among 108 Hong Kong male dental school

students using the Occlusal Index (Summers CJ, 1966).It was found that 41.7% needed early orthodontic treatment and 24.1% needed comprehensive orthodontic therapy to correct major malocclusions.

Sari et al. (2007) assessed the severity of malocclusion and orthodontic treatment need among 556 Turkish males utilizing the Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN) (Brook and Shaw, 1989) and the results clarified that 47% of subjects had definite need for orthodontic treatment, severe contact point displacement was the most frequently encountered trait constituting about 14%.

In the light of the above reviews and since no previous epidemiological study on Syrian children had been conducted, this justifies the need for such research project to provide the Syrian health authorities with reliable data about the occlusal status of Syrian children and their need for treatment according to IOTN (Brook and Shaw,1989).

## **Materials and Methods**

Thorough orthodontic examination was carried out for 200 Syrian children (100 males and 100 females) aged between 8 and 13 years studying at three different public schools in Damascus, Syria.

Children with previous orthodontic treatment, severe systemic diseases, trauma or surgeries that might change occlusal scheme were all excluded from the sample.

After initial examination, upper and lower alginate impressions were taken and a wax-bite registration was used to mount each cast in centric occlusion. The impressions were poured within 30 minutes to maintain dimensional stability with white improved stone producing replicas of both arches and with the help of wax-bite registration both jaws were held in centric occlusion.

For each child, an intraoral frontal photograph was taken using a digital camera [Sony Corporation , Japan] with macrolense and ring flash from a fixed distance (30 cm according to manufacturers' instructions).

For each participant the need for orthodontic therapy was determined using the aesthetic component (AC) and the Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN) (Brook and Shaw, 1989)

## **Calibration of Examiners**

The examiner was calibrated and trained in the use of IOTN (Brook and Shaw, 1989).

### Measurement Errors

In order to ensure the accuracy and reproducibility of the records ; the measurements were repeated twice by the examiner at one week interval according to the nearest 0.5 mm and the average of the two values was used after excluding major discrepancy greater than 0.5 mm.

### Index of Orthodontic Treatment Need (IOTN)

The Index of Orthodontic Treatment Need (IOTN) (Brook and Shaw, 1989) attempts to rank malocclusion in terms of significance of various occlusal traits for an individual's dental health and perceived aesthetic impairment. Its purpose is to identify those individuals who would most likely benefit from orthodontic treatment.

The index incorporates an Aesthetic Component (AC) (Brook and Shaw, 1989) and a Dental Health Component (DHC) (Brook and Shaw, 1989).

### Aesthetic Component

The aesthetic component (Brook and Shaw, 1989) consists of a scale of ten colour photographs showing different levels of dental attractiveness of prospective patients and it can be rated by the examiner with reference to this scale. Grade 1 represents the most and grade 10 the least attractive arrangements of teeth.

Judgment of photographs will be graded according to the following scale.

Grade	The level of need for orthodontic therapy
1 to 4	Little or no need
5 to 7	Moderate or borderline need
8 to 10	Great or very great need

### Dental Health Component

The DHC (Brook and Shaw, 1989) facilitates a synthesis of the current evidence for the deleterious effects of malocclusion. The DHC (Brook and Shaw, 1989) records the various occlusal traits of a malocclusion that would increase the morbidity of the dentition and surrounding structures. There are five grades; grade 1 'no need for treatment' to grades 4 and 5 'needs treatment'. Cleft palate, severe overjets greater than 9 mm would fall into grade 5. Displacements of less than 1 mm would fall into grade 1.

### Statistical Analysis

All the data was collected and entered into the statistical package for social sciences program for statistical analysis (version 17, SPSS, Chicago

I11), gender differences in orthodontic treatment need were compared by using the Chi-Square test. Kappa statistics were used to analyze the agreement between the DHC and AC of IOTN (Brook and Shaw, 1989) and any P-value less than 0.05 was interpreted as statistically significant.

## **The Results**

### **Prevalence of some types of malocclusion in males, females and the entire sample**

As shown in table 1 and figure 1 , normal occlusion was recorded in 38.5% of the whole sample [40% of males and 37% of females], class I malocclusion was found in 30% [27% in males, 33% of females], class II division I in 16% [17% of males, 15% of females], class II division II in 3.5% [3% of males , 4% of females] and class III registered in 12% [13% of males , 11% in females] (Angle E,1899).

Regarding occlusal anomalies (Table 1, Figure 1), the most prevalent feature was partial eruption, tipping or teeth impaction occurring in 25.5% of the sample, tooth absence (13.5%), impeded eruption of teeth (3%),tooth supernumeraries (2%) and submerged deciduous teeth in (1.5%) of the sample.

### **The Distribution of the Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN)**

As shown in table 2 and figure 2 determining the Dental Health Component (DHC) (Brook and Shaw,1989) showed that 40.5% had little or no need (39% of males and 42% of females), moderate need in 21.5% (20%, 23% in males and females respectively), great and very great need was recorded in 38% (41% of males,35% of females).

There were no significant differences in the treatment need according to the dental health component (DHC) (Brook and Shaw, 1989) between boys and girls [P value = 0.63].

### **The Distribution of the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN)**

Figure 3 and Table 3 shows that determining the perceived need for orthodontic treatment in the AC of the IOTN (Brook and Shaw, 1989) revealed that 50% of students were in little or no need (48% of males, 52% of females), moderate need was recorded in 39.5% (39% of males, 40% of females), great need was seen in 10.5% (13% of males, 8% of females).

There was no significant relationship between gender and treatment need according to the AC of IOTN (Brook and Shaw, 1989) (P value = 0.51).

## **Relationship between Dental Health Component (DHC) and Aesthetic Component (AC) of the IOTN**

It was shown that the (little/No Need) group according to IOTN/DHC (Brook and Shaw,1989) represented 40.5% of the sample, while little or no need for treatment need according to IOTN/AC (Brook and Shaw,1989) represented 50% of the total sample.

Borderline or moderate need according to IOTN/DHC (Brook and Shaw, 1989) represented 21.5%, on the other hand, 39.5% of the sample was found to be in moderate need according to IOTN/AC (Brook and Shaw, 1989).

Severe need for orthodontic therapy was seen in 38% of the subjects in the IOTN/DHC (Brook and Shaw, 1989); only 10.5% of subjects were regarded in great need in the IOTN/AC score (Brook and Shaw, 1989).

A statistically significant association (P value = 0.0001) was found between the two components of the IOTN (Brook and Shaw, 1989) as shown in table 4 and figure 4.

## **Discussion**

The present study was designed to assess the prevalence of malocclusion and orthodontic treatment need in Syrian children thus providing baseline data about malocclusion in Syrians in order to help health care planners providing the necessary services in the near and far futures.

The rate of normal occlusion observed in this study was 38.5%, Class I was reported in 30%, Class II division I in 16%, class II division II in 3.5%, and finally class III in (12%) (Angle E, 1899) [Figure 1, Table1].

The results showed that 38.5% of the sample had normal occlusion (Angle E, 1899). When the findings were compared with similar studies, the British (Goose et al, 1991) had the highest percentage of normal occlusion [67.3%], followed by white Americans (Tipton et al, 1991) [51%], Lebanese (Saleh, 1999) [40.3%], Indians (Grewe et al, 1988) [34.5%], Egyptians (El-Mangoury et al, 1990) [34.3%] and Swedish (Ingervall B, 1974) [10%].

The prevalence of class I malocclusion (Angle E, 1899) in the Syrian sample was 30%. Compared to other ethnic groups, the Swedish (Ingervall B, 1974) had [83%], Indians (Grewe et al, 1988) [53%], Lebanese (Saleh, 1999) [35.5%], Egyptians (El-Mangoury et al, 1990) [33.3%], white Americans (Tipton et al, 1991) [26%] and then the British (Goose et al, 1991) [13.7%].

Class II Division I (Angle E, 1899) was found in 16% of the sample in this study .Similarly, Class II division I was reported to represent 16.9% in Lebanese (Saleh FK, 1999), 16.7% in Egyptians (El-Mangoury et al, 1990) and 16.7% in white Americans (Tipton et al, 1991).



Class II division II (Angle E, 1899) comprised 3.5% of the sample in this study. 2.2% prevalence was reported in Lebanese (Saleh, 1999), 4.79% in Egyptians (El-Mangoury et al, 1990) and 2.7% in white Americans (Tipton et al, 1991).

Class III malocclusion (Angle E, 1899) represented 12% of the sample. In Lebanese (Saleh, 1999) it was 5.1%, in Egyptians (El-Mangoury et al, 1990) [10.9%], Indians (Grewe et al, 1988) [2.9%], [9.5%] in white Americans (Tipton et al, 1991), [4%] in Swedish (Ingervall B, 1974) and 2.9% in British (Goose et al, 1991).

Table 5 on page 18 summarizes some malocclusion prevalence studies performed on different populations and from variable age groups.

According to IOTN/DHC (Brook and Shaw, 1989) results, 38% of subjects were in great need, 21.5% were in moderate need, 40.5% were in little or no need for orthodontic treatment [Table 2, Figure-2].

The results obtained from this study are similar to the results of Ucuncu and Ertugay (2001) who studied orthodontic treatment need in 500 Turkish school children and found great need in 38.8%, moderate need in 24% and little or no need in 37.2%.

In the UK, Brook and Shaw (1989) examined orthodontic treatment need on 333 school children and came with results similar to our findings, 32.7% for great need and 35.1% for little/no need.

On the contrary, Burden and Holmes (1994) distinguished that only 21-24% of the population were in the great need category when DHC (Brook and Shaw, 1989) was assessed for 1829 British School children, similarly, Mandall's (1999) research on 14-15 years old school children in Manchester showed 48%, 34% and 18% for no need, moderate need and great need for treatment respectively.

Various results on IOTN (Brook and Shaw, 1989) had different results which were possibly due to differences in sample size and research methods.

Table 6 on page 19 summarizes the results of some other similar studies in different countries.

Assessment of orthodontic treatment need based on the Aesthetic Component (AC) of IOTN (Brook and Shaw, 1989) showed that only 10.5% had definite need, 39.5% in moderate need, 50% in little/no need [Table 3, Figure 3].

The results obtained were not in agreement with other studies like Brook and Shaw (1989), Richmond et al. (1992), Ucuncu and Ertugay (2001) at which great need according to the aesthetic component (AC) (Brook and Shaw, 1989) were 31.4%, 47% and 36.8% respectively evaluated for the referred population.

However, Burden and Holmes (1994), Mandall's et al. (1999), Hassan (2004), Hamdan (2004), and Marami (2009) showed similar results in their studies indicating that what determines individual's need for orthodontic treatment is based on alteration and irregularity of anterior segments and the majority of subjects will fall into the no need/little need group [AC = 1-4], (Brook and Shaw, 1989).

Our study showed that there was a significant relation between the objective need represented by the Dental Health Component of the Index of Orthodontic Treatment Need (IOTN/DHC) (Brook and Shaw, 1989) and perceived need represented by the Aesthetic Component of the Index of Orthodontic Treatment Need (IOTN/AC) (Brook and Shaw, 1989), [P value = 0.0001], [Table 4 and Figure 4].

Souames et al (2006) and Kerosuo et al (2004) found similar results and indicated that there was a significant relation between the two components of IOTN (Brook and Shaw, 1989).

In the studies by Hassan (2004) and by Soh and Sandham (2004), no significant association was observed between subjective [IOTN/AC] (Brook and Shaw, 1989) and objective needs [IOTN/DHC] (Brook and Shaw, 1989) which contradicts the findings of this study.

The present investigation showed no statistically significant relationship between genders in the need for orthodontic treatment according to IOTN/DHC (Brook and Shaw, 1989) [P value = 0.63] as shown in table 4 and figure 4, these results concur the findings of Ucuncu et al. (2001), Manzanera et al. (2009) and Souames et al. (2006) while other researchers like Dias et al. (2009) and Dzemicic et al. (2012) pointed out to difference in treatment need between males and females in IOTN/DHC (Brook and Shaw, 1989) category disagreeing with the findings of this study.

In accordance with the studies of Ucuncu and Ertugay (2001) and Souames et al (2006), the present investigation did not observe any statistically significant difference in orthodontic treatment need between males and females in the Aesthetic component of the IOTN (Brook and Shaw, 1989) [P value = 0.51] as seen in table 4 and figure 4, nevertheless, Sidlauskas et al. (2009) found a statistically significant difference between genders with increasing age in IOTN/AC (Brook and Shaw, 1989)

The discrepancy that might be observed in some individuals in treatment need between the DHC and the AC of IOTN (Brook and Shaw, 1989) might be attributed to the fact that malocclusion traits like missing teeth; crossbites of posterior teeth, partially erupted, tipped or impacted teeth (classified by DHC of IOTN (Brook and Shaw, 1989) as definite need for orthodontic treatment) does not always have an aesthetic impact.

## **Conclusion**

In light of the above results of the study, the following conclusions may be drawn;

1. Malocclusion is widespread among Syrian children and more than 60% have some form of occlusal anomaly.
2. Orthodontic treatment need among Syrian children through IOTN (Brook and Shaw, 1989) was very substantial.
3. There was no significant difference in the distribution of malocclusion classes between boys and girls neither was any significant difference in the treatment need for each gender.
4. Many of the children in the category of little need according to AC of IOTN (Brook and Shaw, 1989) had a need for treatment on dental health ground (IOTN/DHC) (Brook and Shaw, 1989) although their esthetic impairment did not fall into the most severe grades, this reflects the fact that occlusal traits such as ectopic teeth, deep traumatic overbites or cross-bites have dental health implications but do not attract a high aesthetic component score.
5. The conditions of oral health in Syrian children is deteriorating due to lack of any population preventive programs, curative-oriented dental policy , poor socio-economic status and a change in living conditions during the war.
6. The results of this study provide baseline data on the orthodontic treatment needs of 8-13 years old Syrian children which will help to decide on treatment priorities and planning for community dental health resources and since treatment need scores based on IOTN (Brook and Shaw,1989) was very high , it is necessary to develop and implement preventive measures.

## **References:**

- Abou Affan A.H, Wisth P.J and Boe O.E (1990): Malocclusion in 12-year-old Sudanese Children, *Odonto Stomatol Trop.* 13(3):87-93.
- Angle EH, (1899), Classification of malocclusion, *Dent Cosmos*, 41(18):248-63; 350-7.
- Bjork A, Krebs AA, Solow B (1954), Memorandum on Orthodontic Services. British Dental Association Pub., 1-12.
- Brook PH and Shaw WE,(1989), The development of an index of orthodontic treatment priority. *European Journal of orthodontics*, 11:309-20.
- Burden D J, Holmes A (1994). The need for orthodontic treatment in a child population of the United Kingdom. *European Journal of Orthodontics*; 16: 395–399.

- Burgersdijk R, Truin GJ, Frankenmolen F , Kalsbeek H ,Van't Hof M and Mulder J(1991) .Malocclusion and orthodontic treatment need in 15-74 years old Dutch adults. *Community Dent Oral Epidemiol.* , 19(2):64-67.
- Cons N.C, Jenny J, Kohout F.J. (1986).DAI: The Dental Aesthetic Index. College of Dentistry, University of Iowa, Iowa city, IA, USA.
- Daniels C. and Richmond S. (2000).The development of the Index of Complexity, Outcome and Need (ICON). Department of Dental Health and Development, University Dental Hospital NHS Trust, Health Park, Cardiff., *Journal of Orthodontics*, 27(2):149-162.
- Dias PF and Gleiser R. Orthodontic treatment need in a group of 9-12 –year-old Brazilian school children (2009). *Brazil Oral Research* Apr-June; 23(2): 182-9.
- Dzemidzic Vildana, Alisa Tiro , Lejla Redzepagic-Vrazlica , Enita Nakas. The need for orthodontic treatment among 12-14 years old Bosnian school children (2012). *Acta Stomatol Croat*; 46(2):105-110.
- El-Hadary ME and Aboul-Azm SF. (1977): Malocclusion in male young adults. *Tanta Med J*; 5:337-346.
- El-Mangoury NH, Mostafa YA (1990). Epidemiologic Panorama of Dental Occlusion. *Angle Orthod*; 60(3):207-14.
- El Tang (1994).The prevalence of malocclusion amongst Hong Kong male dental students, *British Journal of Orth*; 21:57-63.
- Grainer RM. (1967). Orthodontic treatment priority index. National Centre for Health Service. Public Health Service Pub no (1000). Vital and Health statistics; Series II. No 25, Washington, United States Department of Health, Education and Welfare.
- Grewe JM et al. (1988). Prevalence of malocclusion in Cheppewa Indian children. *Journal of dental research*; 47: 302-05.
- Goose DH, Thomson DJ, Winter FC (1991). Malocclusion of schoolchildren in the west midlands. *British dental journal*; 102:174-8.
- Hamdan AM (2004). The relationship between patient, parent and clinician perceived need and normative orthodontic treatment need .*Eur J Orthod*; 26:265-271.
- Hannuksela A (1977). Prevalence of malocclusion and the need for orthodontic treatment need in 9-year old Finish schoolchildren ; *Proc Finn Dent Soc.* ; 73(1):21-6.
- Hassan AH (2004). Orthodontic Treatment Need in the western region of Saudi Arabia, a research report. *Head Face Med*.2, PMID: 16420691.
- Holmes M. (1992) .The prevalence of orthodontic treatment need. *British Journal of Orth*; 19:177-183.
- Ingervall B (1974). Prevalence of dental and occlusal anomalies in Swedish conscripts, *Acta Odontol Scand.*, 32:83-92.

- Kapila S (1983). Distribution of malocclusion an African and Asian children in some Nairobi schools. *Odont Stompt. Trop.*, 6:209-214.
- Kerosuo H, Alenezi S, Kerosuo E , Abdulkarim E (2004). Association between normative and self-perceived orthodontic treatment need among Arab high school students. *AM J Orthod Dentofacial Orthop* ; 125 : 373-78.
- Kerosuo H, Laine T, Kerosuo E, Ngassapa D and Honkala E. (1988). Occlusal status among a group of Tanzanian urban school children. *Community Dent Oral Epidem*, 16:306-309.
- Linder-Aronson S. (1974). Orthodontics in the Swedish Public Dental Health System, *Trans Eur Orthod Soc.*,p. 233-240.
- Mandall N.A, JF McCord, A.S Blinkhorn, H.V Worthington, K.D O'Brien (1999). Perceived aesthetic impact of malocclusion and oral self-perception in 14-15 years old Asian and Caucasian children in greater Manchester. *Eur J Orthod*; 21:175-83.
- Manzanera D , Montiel Company JM , Almerich-Silla JM ,Gandia JL (2009). Orthodontic treatment need in Spanish school children, an epidemiologic study using the index of orthodontic treatment need (IOTN). *Euro J Orthod* ; 31(2):180-3.
- Marami Anahita,Parviz Padisar , Zahra Mohammadi and Roya Nasseh (2009).The use of Orthodontic Treatment Need Index (IOTN) in a referred Iranian Population. *Research Journal of Biological Science*; 4: 438-443.
- Massler M. and Frankel J (1951). Prevalence of malocclusion in children aged 14 to 18 years. *Am J. Orth.*, 37: 751-768.
- Myrberg Nils, Thilander Birgit (1973). The prevalence of malocclusion in Swedish schoolchildren; *European journal of oral science*; 81(1):12-20.
- Richmond S et al (1992).The development of the PAR Index (Peer Assessed Rating): Reliability and Validity. *European Journal of Orthodontics*, 14:125-139.
- Saleh FK (1999).Prevalence of malocclusion in a sample of Lebanese school children: an epidemiological study. *Eastern Mediterranean Health Journal*, 5
- Salzmann JA (1968). Handicapping malocclusion assessment to establish treatment priority. *Am J Orthod*; 54(10):749-69.
- Sari E, Kurtulmus and Boyacioglu H. (2007). The orthodontic treatment need and malocclusion prevalence in Turkish adult males. *Balkan Military Medical Review*, 10:107-113.
- Sidlauskas Antanas ,Baubiniene Daina ,Miseviciene Irena (2009).The need for orthodontic treatment among 10-11 and 14-15-year old Lithuanian schoolchildren. *Kaunas University Medical school Publications*; 45(10).
- Soh J and A Sandham (2004).Orthodontic Treatment need in Asian Adult Males. *Angle Ortho*; 74:769-773.
- Souames M, Bassigny F, Zenati N, Riordan PJ, Boy-Lefevre ML (2006).Orthodontic treatment need in French schoolchildren: an

epidemiological study using the Index of Orthodontic Treatment Need. Euro J Orthod; 28(6):605-9.

Steigman S, Kawar M, Zilberman Y (1983). Prevalence and severity of malocclusion in Israeli Arab urban children 13 to 15 years of age. American Journal of Orthodontics, 84: 337–343.

Summers CJ (1966).A system for identifying and scoring occlusal disorders. The occlusal Index [PhD dissertation], University of Michigan Publications., An Arbor, Michigan, USA.

Tipton RT, Rinchuse DJ (1991).The relationship between static occlusion and functional occlusion in a dental school population; 17:57-63.

Ucuncu N, Ertugay E (2001). The use of Index of Orthodontic Treatment Need (IOTN) in a school population and a referred population. J Orthod; 28:45-52.

Van Kirk LK, Pennell E (1959). Assessment of malocclusion in population groups. Am J Orth.; 45(10):752-8.

Wheeler T T, McGorray S P, Yurkiewicz L, Keeling S D, King G J (1994). Orthodontic treatment demand and need in third and fourth grade schoolchildren. American Journal of Orthodontics and Dentofacial Orthopedics, 106: 22–33.

Table 1 (Fisher exact test was used instead of X<sup>2</sup>)  
Illustrations

Malocclusion type		Male N	Female N	All N	X <sup>2</sup> P value
Angle's classification	Normal Occlusion	40	37	77	1.15 0.89
	Class I	27	33	60	
	Class II, division 1	17	15	32	
	Class II, division 2	3	4	7	
	Class III	13	11	24	
Tooth absence		13	14	27	0.04 0.84
Supernumerary		0	4	4	0.12
Partially erupted, tipped or impacted		32	22	54	2.54 0.11
Impeded eruption of teeth		5	1	6	0.21
Submerged deciduous		1	2	3	1.00

Grades of IOTN/ DHC	Male N (%)	Female N (%)	All N (%)
1 (No Need)	4	5	9
2 (Little Need)	35	37	72
3 (Borderline/ Moderate Need)	20	23	43
4 (Great Need)	38	29	67
5 (Very Great Need)	3	6	9
<b>Total</b>	100	100	100
<b>X<sup>2</sup></b>	2.59		
<b>P value</b>	0.63		

Table2

Grades of IOTN/ AC		Male N (%)	Female N (%)	All N (%)
<b>Little or No Need</b>	1	0	2	2
	2	14	10	24
	3	15	12	27
	4	19	28	47
	All	48	52	100
<b>Moderate or Borderline Need</b>	5	20	15	35
	6	13	19	32
	7	6	6	12
	All	39	40	79
<b>Great or very great need</b>	8	7	4	11
	9	5	4	9
	10	1	0	1
	All	13	8	21
<b>Total</b>		100	100	200
<b>X<sup>2</sup> ¶</b>		1.36		
<b>P value</b>		0.51		

Table 3

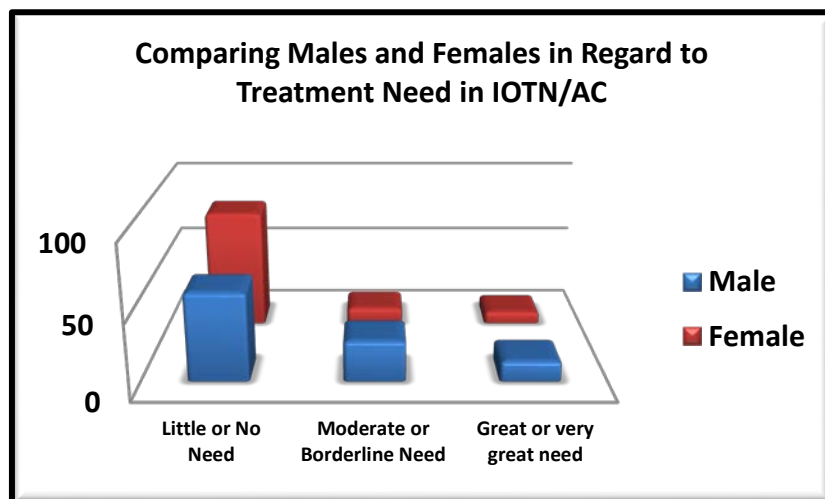


Figure 1

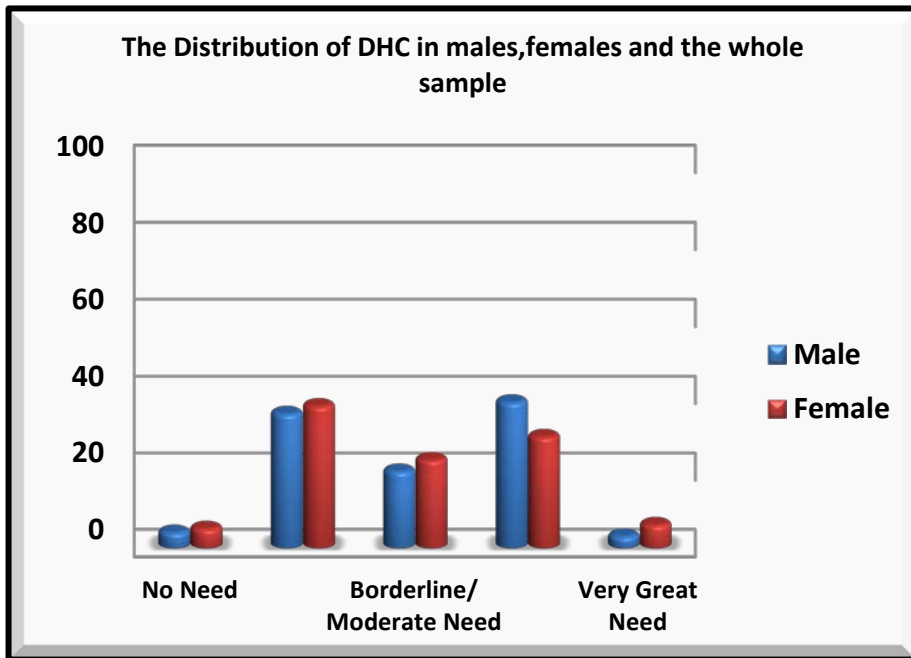


Figure 2

IOTN (AC) Grading	IOTN (DHC) Grading N (%)					Total	
	No Need Grade 1	Little Need Grade 2	Borderline/Moderate Need Grade 3	Great Need Grade 4	Very Great Need Grade 5		
Little or No Need	Grade 1	0	2	0	0	0	2
	Grade 2	4	13	6	1	0	24
	Grade 3	4	12	8	2	1	27
	Grade 4	0	27	12	8	0	47
Moderate or Borderline Need	Grade 5	1	12	3	18	1	35
	Grade 6	0	6	6	18	2	32
	Grade 7	0	0	3	8	1	12
	Grade 8	0	0	2	7	2	11
	Grade 9	0	0	3	5	1	9
	Grade 10	0	0	0	0	1	1
Total	9	72	43	67	9	200	
X <sup>2</sup> P value	113.56 <0.0001*						

Table 4



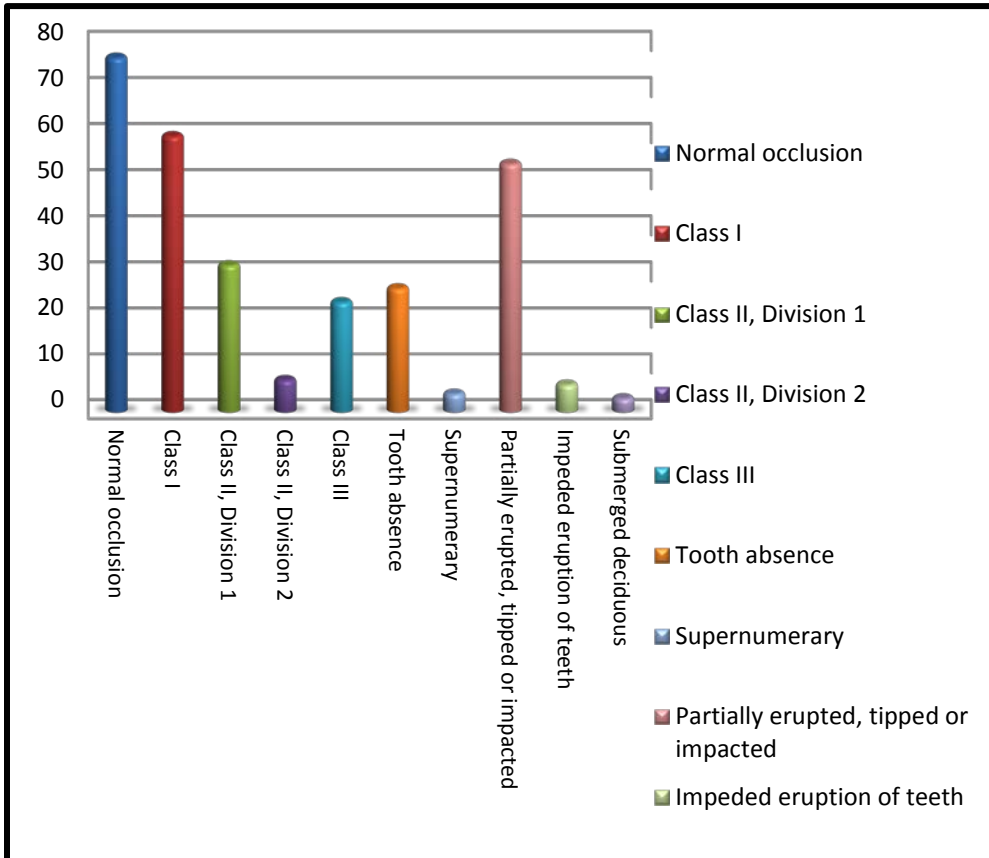


Figure 3

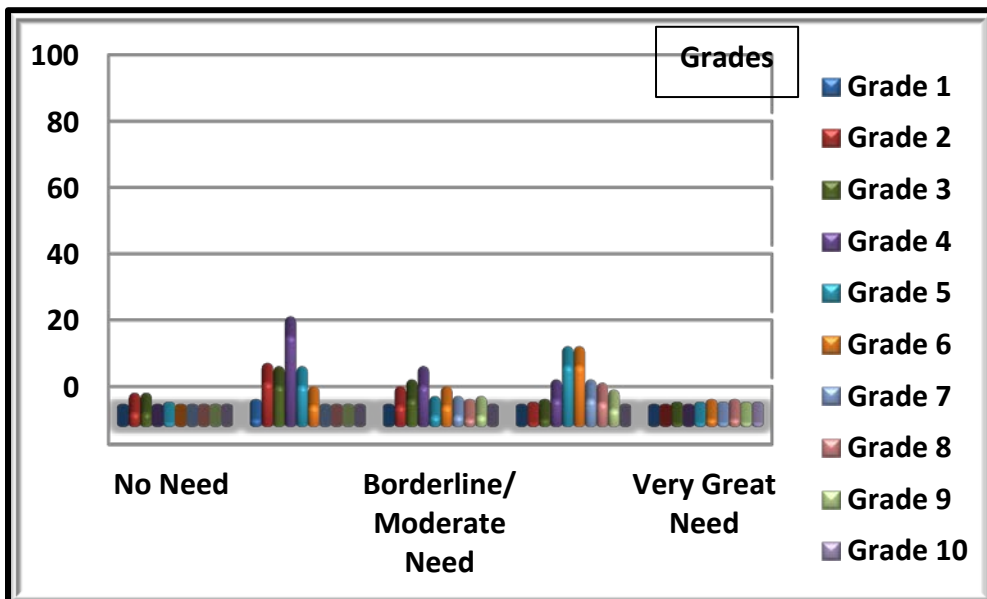


Figure 4

Author	Ethnic Group	Sample		Occlusion				
		Size	Age (Years)	Normal Occlusion	Class I	Class II Div. I	Class II Div.II	Class III
Saleh (1999)	Lebanese	851 (446M,405F)	9-15	40.3%	35.5%	16.9%	2.2%	5.1%
El-Mangoury and Mostafa (1990)	Egyptian	501	18-24	34.33%	33.30%	16.17%	4.79%	10.90%
Grewe et al. (1988)	Indian	651	9-14	34.5%	53%	9.6%		2.90%
Massler and Frankel (1951)	White Americans	2758 (1238M,1520F)	14-18	21.2%	50%	16.17%	2.7%	9.5%
Tipton and Rinchuse (1991)	White Americans	101 (57M,44F)	18-32	51%	26%	16%		7%
Goose et al. (1991)	British	2956	-	67.3%	13.7%	16.1%		2.9%
Ingervall (1974)	Swedish	301	18	10%	83%	3%		4%
Alatrach [ Present Study]	Syrian	200	8 -13	38.5%	30%	10%	3.5%	10.5%

Table 5

Author	Population	Subjects		Registration	Need
		Number	Age		
		Ingervall (1974)	Swedish		
Myrberg and Thilander (1973)	Swedish	5459	7-13	Swe NBH	73.8% (All) 34% (Moderate) 11% (Great)
Haanuksela (1977)	Finnish	1200	9	Swe NBH	60.2% (All) 18% (Moderate) 25.6% (Great)
Holmes (1992)	British	955	12	IOTN	33% (Moderate) 32% (Great)
Steigman et al (1983)	Israeli Arab	803	13-15	HMAR	80% (All) 30% (Moderate) 12% (Great)
Burden and Holmes (1994)	British	1920	11-12	IOTN	33% (Great)
Wheeler et al. (1994)	American	3696	9-10	Exam.	47% (White) 35% (Black) 40% (Others)
Shaw et al. (1989)	British	333	11-12	IOTN	33% (Great)
Alatrach [Present Study]	Syrian	200	8-13	IOTN	40.5% (No/Little ) 21.5% (Moderate) 38.5% (Great)

Table 6 [Swe NBH = Swedish National Board Health, IOTN = Index of Orthodontic Treatment Need,HMAR = Handicapping Malocclusion Assessment Rate]