



ORIGINAL ARTICLE

Descriptive epidemiology of dental malocclusion in Najran patients seeking orthodontic treatment



Bandar Alyami

Department of Preventive Dentistry, Faculty of Dentistry, Najran University, Najran PO box 1988, Saudi Arabia

Received 6 April 2020; revised 10 September 2020; accepted 5 October 2020

Available online 17 October 2020

KEYWORDS

Crowding;
Malocclusion;
Overbite;
Overjet;
Spacing

Abstract *Background:* Untreated malocclusion can lead to compromised aesthetic function, depression, and low self-esteem. The aim of this study was to evaluate dental malocclusion in Najran, Saudi Arabia as no data existed before.

Method: This was a retrospective study analyzing the casts of all patients in Najran, Kingdom of Saudi Arabia, seeking orthodontic management for malocclusion between 2017 and 2019.

Measurements: The consultant orthodontist is the single investigator involved in collecting the details of demographics followed by molar relationships, overjet, overbite, crowding and spacing using digital caliper on each dental cast. Data were analyzed using IBM SPSS Statistics for IOS Version 25 (Armonk, NY: IBM Corp).

Results: A total of 326 patients sought treatment for different types of malocclusion. There were 143 males and 183 females with an M:F ratio of 1:1.3. Age ranged from 6 to 55 years with a mean SD of 22.6 ± 8.98 . The prevalence for Class I, II and III malocclusions at 95% CI was (0.76 (0.757, 0.774)), 0.251 (0.243, 0.260) and 0.529 (0.519, 0.539) respectively. Fifty-one (15.6%) patients had reversed overjet, 65 (19.9%) reduced overjet, and 86 (26.4%) increased overjet. One hundred and sixty-four (50.3%) cases of reduced overbite and 99 (30.4%) cases of deep overbite were also observed. Tooth size arch length discrepancy were noticed with crowding and spacing in 83 (26.4%) and 71 (21.8%) patients, respectively.

Conclusions: This study has shown the prevalence of Class I, Class II, and Class III malocclusion to be 72.7%, 11.6% and 15.6% respectively. Increased over jet and crowding was demonstrated in more patients, though it is not statistically significant.

© 2020 The Authors. Production and hosting by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Studies have shown that malocclusions have damaging effects on maxillofacial development, leading to poor oral health-related quality of life (OHRQoL) (Dimberg et al., 2015; Sun et al., 2018). In addition, it can end in compromised esthetic function leading to psychological problems like depression,

E-mail address: bsalyami@nu.edu.sa

Peer review under responsibility of King Saud University.



Production and hosting by Elsevier

<https://doi.org/10.1016/j.sdentj.2020.10.002>

1013-9052 © 2020 The Authors. Production and hosting by Elsevier B.V. on behalf of King Saud University.

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

anxiety, and low self-esteem (Dimberg et al., 2015; Kolawole et al., 2014; Scapini et al., 2013).

The etiology of malocclusion has been reported to be multifactorial; involving environmental and genetic factors (Moreno Uribe and Miller, 2015). Environmental factors include non-nutritive sucking habits that involve pacifiers, digits or objects, and mouth breathing (Larsson, 1994; Nihi et al., 2015; Wagner and Heinrich-Weltzien, 2015). Children with pacifiers or digit and/or object sucking habits are more likely to develop anterior open bite, increased overjet anterior displacement of the maxilla, and posterior crossbite (Góisa et al., 2008). Mouth breathing commonly seen in children with enlarged adenoids have been associated with crossbite and anterior open bite (Góisa et al., 2008). On the genetic side, craniofacial candidate genes SNAI3 (associated with severely concave to convex facial profiles) and TWIST1 (associated with short to long mandibular bodies) have been identified (da Fontoura et al., 2015). Furthermore, single nucleotide polymorphism (SNP) found within genes FGFR2, EDN1, TBX5, and COL1A1 were found to be associated with skeletal malocclusion, especially Class II malocclusion (da Fontoura et al., 2015).

Based on these findings and limited evidence from previous studies, we aimed to construct a study that evaluated dental malocclusion in Najran, a south-western city of Saudi Arabia.

2. Methods

2.1. Design

This was a retrospective study analyzing the casts of all patients seeking orthodontic management of malocclusion between 2017 and 2019.

2.2. Methods

The pattern of dental malocclusion was retrospectively reviewed in a Specialized Private Orthodontic and Research Center (Dalma Clinics), Najran, Kingdom of Saudi Arabia. Study casts of all patients seeking orthodontic management of malocclusion were used for analysis. The consultant orthodontist involved (after intra-examiners calibration) in collecting the details of demographics followed by molar relationships, overjet, overbite, crowding, and spacing using digital caliper on each dental cast as defined below:

2.3. Measurements

Classification of molar relationship was based on Angle's classification (Angle, 1899). Angle's classification is an internationally recognized classification, widely used in the epidemiological of malocclusion (Angle, 1899). Overjet was measured as the horizontal distance between the upper and lower incisors at the point of greatest severity and was categorized as: normal (1–2 mm), increased (>2 mm), reduced (<1 mm) reverse overjet (<0 mm). We measured overbite as the vertical overlap between the maxillary and mandibular central incisors and categorized as: normal (1–2 mm), increased (>2 mm) and reduced (<1 mm). Analysis of crowding for both arches was performed and categorized as: mild (1–3 mm),

moderate (4–6 mm) and severe (>6 mm). We recorded spacing as either present or absent (Proffit, Fields, Larson, & Sarver).

2.4. Statistical analysis

Data were analyzed using IBM SPSS Statistics for IOS Version 25 (Armonk, NY: IBM Corp) and results presented as simple frequencies and descriptive statistics. Pearson's Chi-square was used to assess the association and level of significance among categorical variables such as patient's age group, gender and types of malocclusion with $p \leq 0.05$ considered as statistically significant.

3. Results

A total of 326 patients sought management for different types of malocclusion. There were 143 males and 183 females with a M:F ratio of 1:1.3. Age ranged from 6 to 55 years with a mean SD of 22.6 ± 8.98 . Age group distribution according to gender of patients is shown in Table 1. The majority of patients were in Class I molar relationships [95% CI] (0.768 (0.759, 0.776)), followed distantly by Class III [95% CI] 0.541 (0.531, 0.550) although not statistically significant ($p = 0.761$). Only 38 cases [95% CI] (0.249 (0.241, 0.258)) presented with Class II molar relationship (Table 2). Age groups 11–20 and 21–30 years have the highest distribution frequency of all Class I, Class II and Class III molar relationship cases (Table 2).

We observed 164 (50.3%) patients with reduced overbite and 99 (30.4%) with increased overbite in the study population. With respect to overjet, we noted 51 (15.6%) had reversed overjet, 65 (19.9%) cases of reduced overjet and 86 (26.4%) cases of increased overjet (Fig. 1). We found tooth size arch length discrepancy with crowding and spacing in 83 (26.4%) and 71 (21.8%) subjects respectively (Fig. 2). Spacing occurred in 71 (21.8%) patients in both jaws. In terms of severity of crowding, most cases (50.5%) were moderate crowding (Fig. 3).

4. Discussion

This study investigated the malocclusion patterns in Najran, Saudi Arabia revealing the following findings: a majority of the patients were in Class I molar relationships [95% CI] (0.768 (0.759, 0.776)), followed distantly by Class III [95%

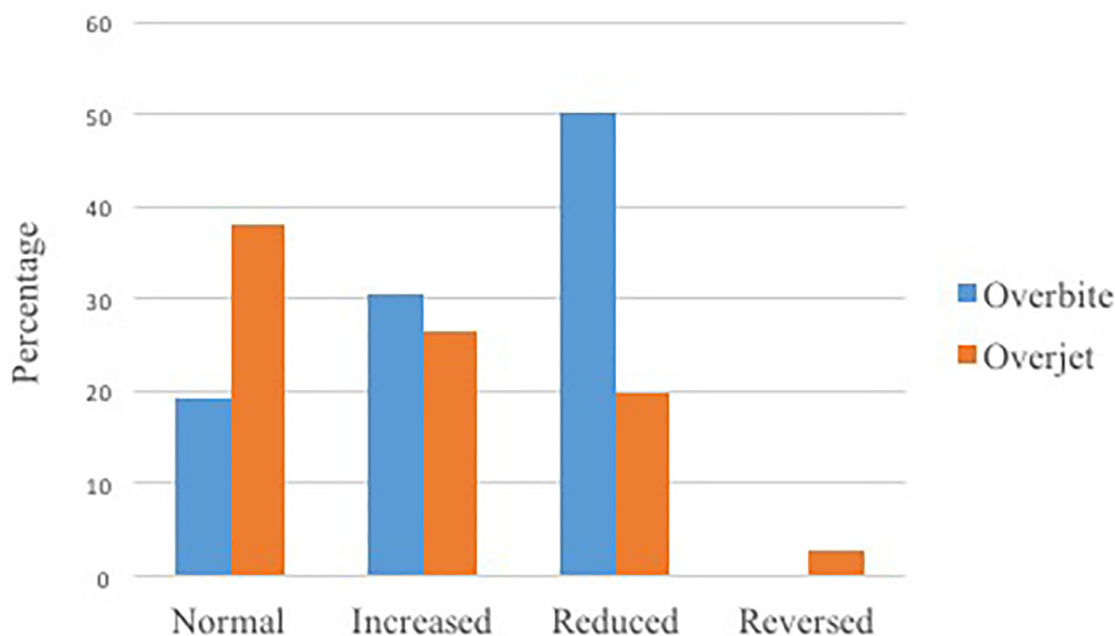
Table 1 Distribution of age-group of patients according to sex.

Age-group (years)	Sex		Total (%)
	Male (%)	Female (%)	
1–10	8 (2.4)	8 (2.4)	16 (4.9)
11–15	23 (7.1)	36 (11.0)	59 (18.1)
16–20	32 (9.8)	48 (14.7)	80 (24.5)
21–25	29 (8.9)	29 (8.9)	58 (17.8)
26–30	25 (7.7)	27 (8.3)	52 (16.0)
> 30	26 (8.0)	35 (10.7)	61 (18.7)
Total	143 (43.8)	183 (56.2)	326 (100.0)

$\chi^2 = 2.600$, $df = 5$, p value = 0.761.

Table 2 Distribution of molar relationship according to sex and age group of patients.

	Molar relationship			Total (%)	Statistics
	Class I (%)	Class II (%)	Class III (%)		
Sex					
Male	102 (31.3)	20 (6.1)	21 (6.4)	143 (43.9)	$\chi^2 = 1.402$, df = 2, p value = 0.496
Female	135 (41.4)	18 (5.5)	30 (9.2)	183 (56.1)	
Total	237 (72.7)	38 (11.6)	51 (15.6)	326 (100.0)	
Age group (years)					
1–10	11 (3.4)	2 (0.6)	3 (0.9)	16 (4.9)	$\chi^2 = 8.108$, df = 10, p value = 0.618
11–15	42 (12.9)	7 (2.1)	10 (3.1)	59 (18.1)	
16–20	56 (17.2)	10 (3.1)	14 (4.3)	80 (24.5)	
21–25	41 (12.6)	4 (1.2)	13 (4.0)	58 (17.8)	
26–30	39 (11.9)	9 (2.8)	4 (1.2)	52 (15.9)	
> 30	48 (14.7)	6 (1.8)	7 (2.1)	61 (18.7)	
Total	237 (72.7)	38 (11.6)	51 (15.6)	326 (100.0)	

**Fig. 1** Graph showing the distribution of overbite and overjet.

CI] 0.541 (0.531, 0.550). We observed increased overbite in 30.4%, while only 26.4% of the study population showed increased overjet.

The prevalence of malocclusion has been reported to vary among regional populations and likewise among various genders and age groups. In Saudi Arabia, several authors reported the prevalence of malocclusion in the central, eastern and northern parts of the country (Aldrees, 2012; AlQarni et al., 2014; Gudipani et al., 2018; Hassan et al., 2014). Currently, no descriptive data on the prevalence of malocclusion in Najran, southern border region of KSA exists, however there has been a progressive increase in the number of patients seeking orthodontic treatment. The justification for the current research is the lack of published reports on the distribution of dental malocclusion traits among the Najran population.

Literature searches show a high percentage of individuals have less than ideal occlusion with reported incidence varying between 39% and 93% (Al-Ibrahim et al., 2010; Jacobson and Lennartsson, 1996; Thilander et al., 2001). With this high reported incidence, untreated cases of malocclusion will lead to increase in the rates of temporomandibular joint disorders and dental caries (Zakirulla, 2012). Our study has reported a prevalence rate of 72.7% for Class I, 11.6% for Class II and 15.6% for Class III, showing Class I to be more prevalent followed by Class III and then the least predominant Class II. This finding is similar to most studies where most patients were in Class I malocclusion (Al-Emran et al., 1990; Jamilian et al., 2014; Thilander et al., 2001). However, a Turkish study and a few others found Class II was more predominant followed by Class I and Class III respectively (Bilgic et al., 2015; Josefsson

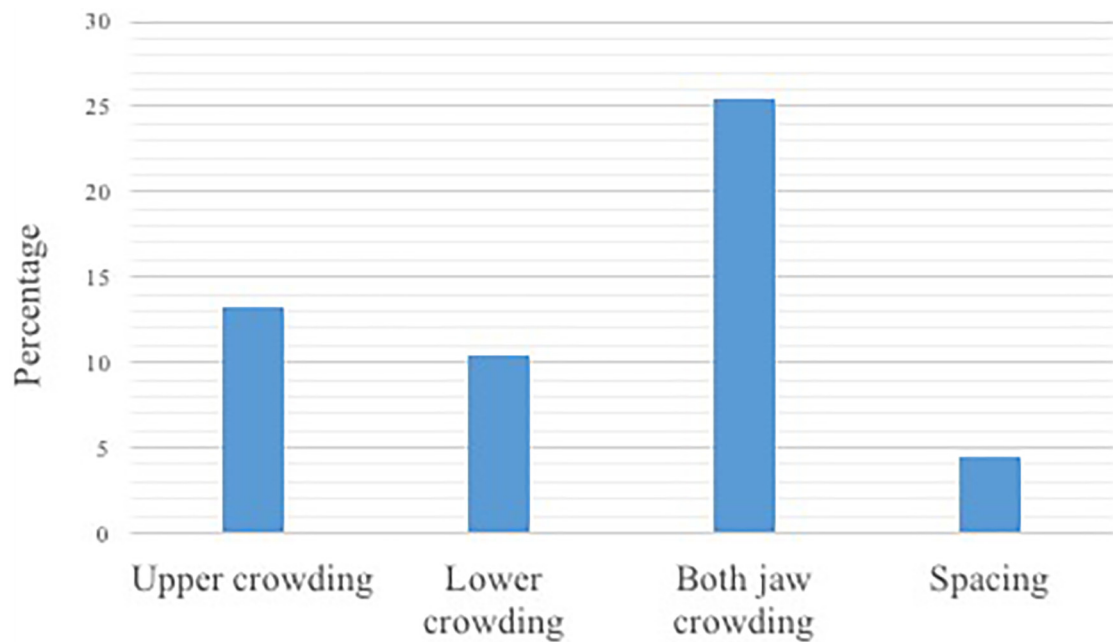


Fig. 2 Graph showing the distribution of tooth-arch discrepancy.

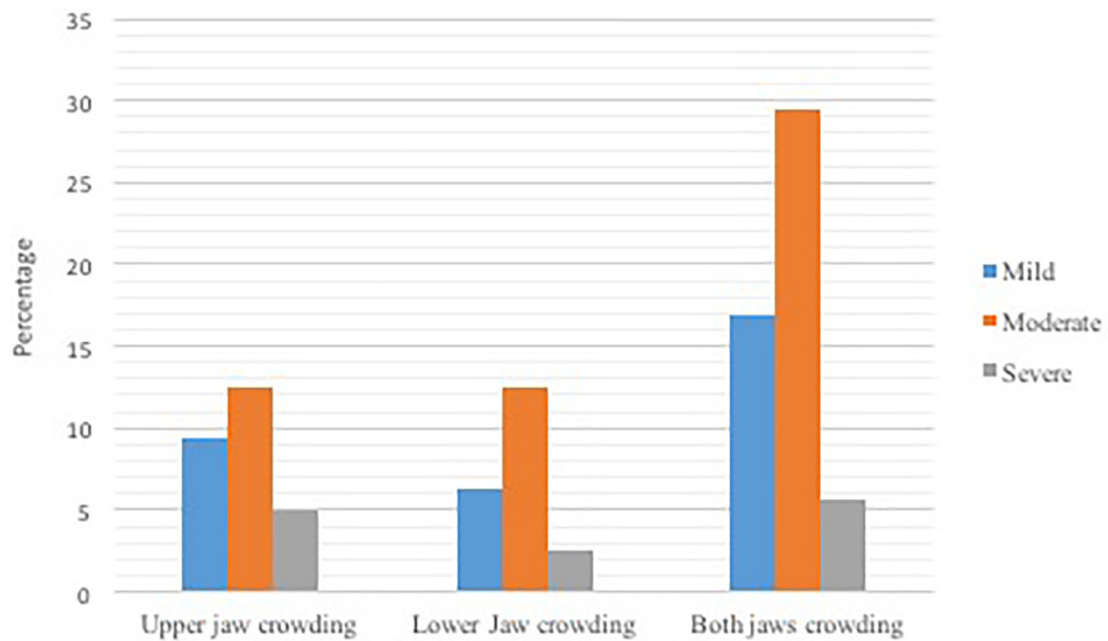


Fig. 3 Graph showing the severity of crowding.

et al., 2007; Perillo et al., 2010; Thilander et al., 2001). These variations could be partly explained by the genetic background regarding craniofacial development. Another important finding from our study is the prevalence of Class III directly following that of Class I. Literature searches showed that despite some studies reporting higher Class I malocclusion, it was directly followed by Class II as the most prevalent. In Saudi Arabia, similar findings where Class III prevalence was higher than that of Class II has been reported (Asiry, 2015). The cases of Class III malocclusions in Saudi Arabia need further evaluation to determine if there is any genetic trace.

Most of our patients had normal overjet (38.0%) followed closely by patients having increased overjet (26.4%), while very few had reversed overjet (15.6%). Overjet has been defined as the extent of horizontal (anterior-posterior) overlap of the maxillary central incisors over the mandibular central incisors and shows how proclined the maxillary incisors were (Proffit et al.). Normal value ranged between 2 and 4 mm. Our findings have been similar to that reported in Iranian populations (Borzabadi-Farahani et al., 2009; Jamilian et al., 2014) and other areas of Saudi Arabia (Asiry, 2015). Other studies have also reported high prevalence of normal overjet (Ajayi, 2007; Mtaya et al., 2009; Nadim et al., 2014). Despite studies report-

ing high prevalence of both overjet and overbite, our study has observed a contrary trend. We detected high prevalence of reduced overbite (Fig. 2). Overbite is the extent of vertical (superior-inferior) overlap of the maxillary central incisors over the mandibular central incisors. The normal overbite is considered to be 2–3 mm, or approximately 20–30% of the height of mandibular incisors (Proffit et al., 2006). Further epidemiological study is required to investigate the true pattern overbite in the Najran population.

Crowding was the most common occlusal anomaly seen in our study with 83 (26.4%) cases occurring in both jaws, 43 (13.2%) cases in the upper arch and 34 (10.4%) cases in the lower arch. Spacing was the second most common, a finding similar to other studies (Asiry, 2015; Jamilian et al., 2014; Perillo et al., 2010). Furthermore, higher prevalence of crowding and spacing have been reported among Saudi patients (Asiry, 2015) as compared to those reported in Nigerians (12%) (Ajayi, 2007) and Tanzanians (14.1%) (Mtaya et al., 2009). On the contrary, other countries like Kuwait (Behbehani et al., 2005) and Nepal (Shrestha and Shrestha, 2013) have reported higher prevalence of crowding and spacing as compared to the Saudi population. In the current study, crowding in both jaws was more frequent which is contrary to observation reported among other Saudi patients where crowding was more prevalent in the upper maxillary arch (Asiry, 2015).

The study has some limitations; measurements were performed by a single operator although after inter-examiners calibration. Nevertheless, this study will serve as a reference point for future studies.

5. Conclusion

Following this hospital-based study, the frequency of Class I, Class II and Class III molar relationship was found to be 72.7%, 11.6% and 15.6% respectively. We observed increased overjet and crowding in participants, though results were not statistically significant. Females had more dental anomalies compared with males.

Ethical statement and conflict of interest

The author declared that this study is carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans and animals.

The author also disclosed that there is no conflict of interest.

References

- Ajayi, E.O., 2007. Prevalence of malocclusion among school children in Benin City, Nigeria. *JMBR* 7, 5–11.
- Al-Emran, S., Wisth, P.J., Boe, O.E., 1990. Prevalence of malocclusion and need for orthodontic treatment in Saudi Arabia. *Commun. Dent Oral Epidemiol.* 18 (5), 253–255.
- Al-Ibrahim, H.M., Telfah, H.D., Hyasat, A.N., 2010. Frequency of malocclusion in an orthodontically referred Jordanian population. *JRMS* 17, 19–23.
- Aldrees, A.M., 2012. Pattern Of skeletal and dental malocclusions in Saudi orthodontic patients. *Saudi Med. J.* 33, 15–20.
- AlQarni, M.A., Banihuwaiz, A.H., Alshehri, F.D., Alqarni, A.S., 2014. Evaluation of malocclusion in subjects reporting for orthodontic treatment among Saudi population in Asser region. *J. Int. Oral Health* 6, 42–46.
- Angle, E.H., 1899. Classification of malocclusion. *Dental Cosmos* 41, 248–264.
- Asiry, M.A., 2015. Occlusal status among 12–16 year-old School Children in Riyadh, Saudi Arabia. *J. Int. Oral Health* 7 (5), 20–23.
- Behbehani, F., Ártun, J., Al-Jame, B., Kerosuo, H., 2005. Prevalence and severity of malocclusion in adolescent Kuwaitis. *Med. Princ. Pract.* 14 (6), 390–395. <https://doi.org/10.1159/000088111>.
- Bilgic, F., Gelgor, I.E., Celebi, A.A., 2015. Malocclusion prevalence and orthodontic treatment need in central Anatolian adolescents compared to European and other nations' adolescents. *Dental Press J. Orthod.* 20 (6), 75–81.
- Borzabadi-Farahani, A., Borzabadi-Farahani, A., Eslamipour, F., 2009. Malocclusion and occlusal traits in an urban Iranian population. An epidemiological study of 11- to 14-year-old children. *Eur. J. Orthod.* 31 (5), 477–484.
- da Fontoura, C.S.G., Miller, S.F., Wehby, G.L., Amendt, B.A., Holton, N.E., Southard, T.E., Allareddy, V., Moreno Uribe, L.M., 2015. Candidate gene analyses of skeletal variation in malocclusion. *J Dent Res* 94 (7), 913–920.
- Dimberg, L., Arnrup, K., Bondemark, L., 2015. The impact of malocclusion on the quality of life among children and adolescents: a systematic review of quantitative studies. *Eur. J. Orthodont.* 37 (3), 238–247.
- Góis, E.G.O., Ribeiro-Júnior, H.C., Vale, M.P.P., Paiva, S.M., Serranegra, J.M.C., Ramos-Jorge, M.L., Pordeus, I.A., 2008. Influence of nonnutritive sucking habits, breathing pattern and adenoid size on the development of malocclusion. *Angle Orthodontist* 78 (4), 647–654.
- Gudipani, R.K., Aldahmeshi, R.F., Patil, S.R., Alam, M.K., 2018. The prevalence of malocclusion and the need for orthodontic treatment among adolescents in the northern border region of Saudi Arabia: an epidemiological study. *BMC Oral Health* 18 (1). <https://doi.org/10.1186/s12903-018-0476-8>.
- Hassan, A.H., Hassan, M.H., Linjawi, A.I., 2014. Association of orthodontic treatment needs and oral health-related quality of life in Saudi children seeking orthodontic treatment. *Patient Prefer Adherence* 8, 1571–1579.
- Jacobson, S., Lennartsson, B., 1996. Prevalence of malocclusion and awareness of dental appearance in young adults. *Swed. Dent. J.* 20, 113–120.
- Jamilian, A., Darnahal, A., Damani, E., Talaiepour, M., Kamali, Z., 2014. Prevalence of orthodontic treatment need and occlusal traits in schoolchildren. *Int. Schol. Res. Notices* 2014, 1–5.
- Josefsson, E., Bjerklín, K., Lindsten, R., 2007. Malocclusion frequency in Swedish and immigrant adolescents—influence of origin on orthodontic treatment need. *Eur. J. Orthodont.* 29 (1), 79–87.
- Kolawole, K.A., Agbaje, H.O., Otuyemi, O.D., 2014. Impact of malocclusion on oral health related quality of life of final year dental students. *Odonto-Stomatologie Tropicale* 37 (145), 64–74.
- Larsson, E., 1994. Artificial sucking habits: etiology, prevalence and effect on occlusion. *Int. J. Orofacial Myol.* 20, 10–21.
- Moreno Uribe, L.M., Miller, S.F., 2015. Genetics of the dentofacial variation in human malocclusion. *Orthod. Craniofac. Res.* 18, 91–99.
- Mtaya, M., Brudvik, P., Astrom, A.N., 2009. Prevalence of malocclusion and its relationship with socio-demographic factors, dental caries, and oral hygiene in 12- to 14-year-old Tanzanian schoolchildren. *Eur. J. Orthodont.* 31 (5), 467–476.
- Nadim, R., Aslam, K., Rizwan, S., 2014. Frequency of malocclusion among 12–15 years old school children in three sectors of Karachi. *Pak. Oral Dent J.* 34, 510–514.
- Nihi, V.S.C., Maciel, S.M., Jarrus, M.E., Nihi, F.M., Salles, C.L.F.d., Pascotto, R.C., Fujimaki, M., 2015. Pacifier-sucking habit duration and frequency on occlusal and myofunctional alterations in

- preschool children. *Braz. Oral Res.* 29 (1). <https://doi.org/10.1590/1807-3107BOR-2015.vol29.0013>.
- Perillo, L., Masucci, C., Ferro, F., Apicella, D., Baccetti, T., 2010. Prevalence of orthodontic treatment need in southern Italian schoolchildren. *Eur. J. Orthodont.* 32 (1), 49–53.
- Proffit, W., Fields, H., Larson, B., Sarver, D. *Contemporary Orthodontics*, 6th ed. Elsevier, Mosby.
- Scapini, A., Feldens, C.A., Ardenghi, T.M., Kramer, P.F., 2013. Malocclusion impacts adolescents' oral health-related quality of life. *Angle Orthodont.* 83 (3), 512–518.
- Shrestha, S., Shrestha, R.M., 2013. An analysis of malocclusion and occlusal characteristics in Nepalese orthodontic patients. *Orthod. J. Nepal* 3 (1), 19–25. <https://doi.org/10.3126/ojn.v3i1.9272>.
- Sun, L., Wong, H.M., McGrath, C.P.J., 2018. Association between the severity of malocclusion, assessed by occlusal indices, and oral health related quality of life: a systematic review and meta-analysis. *Oral Health Prev. Dent* 16 (3), 211–223.
- Thilander, B., Pena, L., Infante, C., Parada, S.S., de Mayorga, C., 2001. Prevalence of malocclusion and orthodontic treatment need in children and adolescents in Bogota, Colombia. An epidemiological study related to different stages of dental development. *Eur. J. Orthod.* 23, 153–167.
- Wagner, Y., Heinrich-Weltzien, R., 2015. Occlusal characteristics in 3-year-old children – results of a birth cohort study. *BMC Oral Health* 15 (1). <https://doi.org/10.1186/s12903-015-0080-0>.
- Zakirulla, M., 2012. Malocclusion in deciduous dentition of Saudi children: a cross-sectional study. *Bangladesh J. Med. Sci.* 11 (4), 343–346. <https://doi.org/10.3329/bjms.v11i4.12608>.