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Impact of malocclusion traits on the quality of life, anxiety, and depression among the Mongolian population

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Abstract: The purpose of our population-based cross-sectional study was to assess the association between malocclusion and the quality of life (QoL), anxiety, and depression. The study was conducted between July and October 2020 in Mongolia. Clinical examinations were carried out by orthodontists. Using a millimeter ruler, excessive and reverse overjet were recorded as abnormal. Crowding was recorded for the incisor and posterior segments of each jaw. Anterior diastema was diagnosed when there was a space of at least 1 mm between incisors in either arch. Facial profile (straight, convex, and concave) was determined by vision using soft tissue reference points. Each participant completed the World Health Organization Quality of Life (WHO-QoL-BREF) and the Hospital Anxiety and Depression Scale (HADS), and an orthodontic questionnaire. The study consists of 436 participants aged between 13 and 65 years (mean age = 39.6±14.8), the majority were females, 297 (68.1%). The prevalence of malocclusion, in general, was 371 (85.1%). In terms of the prevalence of the malocclusion traits: abnormal overjet was 245(56.2%), crowded dentition was 118 (27.1%), and diastema was 75 (17.2%). Participants with malocclusions had increased depression scores ($p = 0.008$). Participants with diastema had decreased QoL in physical and social domains ($p = 0.022$, $p = 0.020$). Moreover, reverse correlations were found between depression scores and QoL in psychological, social, and environmental domains in the population with malocclusion traits ($p = 0.035$, $p = 0.0039$, $p = 0.002$). We found that the prevalence of malocclusion was 85.1% in the general population. Participants with malocclusion have decreased QoL, which is associated with increased depression scores.

Keywords: Malocclusion; Quality of Life (QoL); Anxiety; Depression; Abnormal overjet (excessive and reverse overjet); Diastema (spaced dentition); Crowding (crowded dentition); Facial profile (Concave, Convex and Straight)

Introduction

Malocclusion is not only one of the most common disorders in the world, but it is also one of the main factors influencing QOL (Alhammadi et al., 2018; Grando et al., 2008; Shaw et al., 2007; WHO, 2010). This is because malocclusion impacts multiple aspects of our lives, including not only the functional (e.g.,

chewing food) and the social (e.g., smiling and laughing), but the psychological (e.g., anxiety and depression regarding one's dental and facial appearances) aspect as well(Kenealy et al., 2007; Liu et al., 2009). WHO characterizes malocclusion as the most significant oral health problem following dental caries and periodontal disease (Alhammadi et al., 2018). Its etiology is considered different amongst individuals due to varying genetic, environmental, and ethnic factors (Bilgic et al., 2015). However, it is generally believed that its prevalence has increased since prehistoric times (WR, 2000).

In terms of social acceptance, malocclusion has traditionally caused individuals' alienation (Johal et al., 2007; Macgregor, 1970). To whichever degree it may be, social separation may result, to some extent, in hindrances to forming friendships and romantic relationships. Moreover, there is a social tendency to view people with malocclusions as less trustworthy, intelligent, and successful; and more violent and anti-social (Araki et al., 2017). On the other hand, society tends to evaluate people with comparatively normal dental and facial appearances as good-looking, more intelligent, desirable as friends, and less likely to behave aggressively (Liu et al., 2009). Furthermore, people with unaesthetic occlusal traits are frequently victims of teasing, name-calling, and harassment from a young age (Liu et al., 2019). As a result of being teased during these formative years, these individuals tend to lose their sense of self-confidence and personal value in social interactions; thereby, further separating themselves from others (Mathes & Kahn, 1975).

As for the impact on function, the effects of malocclusion on speech formation and chewing capacity renders it as having a stronger and longer-lasting impact on QoL than other more prevalent oral diseases, such as dental caries and gingivitis (Neto et al., 2017).

The association between malocclusion and QoL has been previously studied in several countries, including Australia, Brazil, Korea, New Zealand, Taiwan, and the United Kingdom. However, the association between malocclusion and QoL is still considered inconclusive for the most part due to the heterogeneity of the population sample (Liu et al., 2009; Zhang et al., 2006). In Mongolia, Araki et al. studied the association between malocclusion and QoL among Mongolian adolescents in 2017 (Araki et al., 2017). Overall, they did not find a significant association between malocclusion and QoL; however, they found specific malocclusion traits, such as increased overjet and deep bite, to be associated QoL (Araki et al., 2017). The purpose of our population-based cross-sectional study was to assess the association between malocclusion and the quality of life (QoL), anxiety and depression.

Materials and Methods

The Brain Science Institute at the Mongolian National University conducts a nationwide multicenter, interdisciplinary, prospective, population-based cohort study to investigate brain-related disorders in the general population of Mongolia (Mon-TimeLine). The current population of Mongolia is 3,305,576 based on the latest United Nations data, of which half of them live in Ulaanbaatar, the capital city, and the remaining half live in 4 rural regions. The cohort consists of 64 sampling centers including 30 primary health centers of 8 districts in Ulaanbaatar and 34 primary health centers of 4 rural regions in Mongolia. Primary health centers provide health care services to all individuals within certain geopolitical units where the entire population is registered by name, age, gender, education, employment, and household income.

Data were collected during a nationwide epidemiological survey from July and December 2020. The study sample included 436 participants (139 males and 297 females) aged 13 – 65 years. The study met the Institutional Review Board and Ethics Committee of the Mongolian National University of Medical Sciences (approval number 2020/3-05). Informed consent was obtained, and the voluntary nature of the questionnaire was explained to all participants.

Participants who met the following criteria were included in the study: age between 13-65 years, permanent dentition with no remaining deciduous teeth and who met the following criteria were excluded from the study: craniofacial deformities, temporomandibular disorder, missing more than 8 teeth and orthodontically treated before the study.

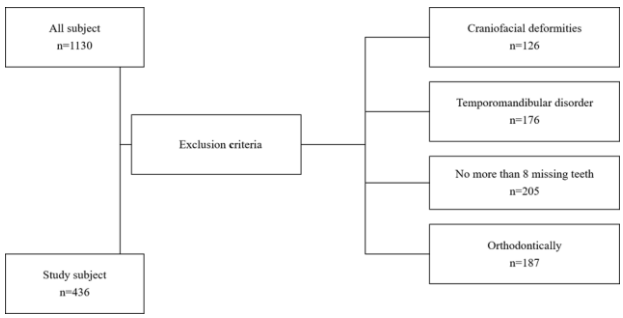

Figure 1. Exclusion criteria flowchart of the study

Data collection consisted of two parts: self-reported assessment and orthodontic assessment. For the self-reported assessment, participants were asked to fill out the WHO-QoL-BREF questionnaire in order to determine the QoL. This questionnaire contains 26 questions that consist

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of physical, psychological, social, and environmental components. It also scores on two facets related to overall QoL and general health. QoL is defined by the WHO "as an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns" (World Health Organization. Division of Mental, 1996). Apart from the WHO-QoL-BREF questionnaire, HADS questionnaire was also used to ascertain the corresponding influence of malocclusion traits on anxiety and depression.

For the orthodontic assessment, each examination took place with the participant seated in designated chairs within a standard and quiet classroom, using mouth mirror, probe and portable lighting. Clinical examinations were carried out by a trained orthodontist, with each examination taking around 30 minutes per person. Following malocclusion traits were studied: Abnormal overjet (excessive/ reversed), Diastema (spaced dentition), Crowding. Using a millimeter ruler to assess overjet, values between 0 and 2.5 mm were considered normal. Excessive and reverse overjet considered as abnormal overjet. Crowding was recorded for the incisor and posterior segments of each jaw. Anterior diastema was diagnosed when there was a space of at least 1 mm between incisors in either arch. Facial profile (straight, convex, and concave) was determined by vision using soft tissue reference points. Findings were recorded on the questionnaire and examination sheet.

The Statistical Package for the Social Science (SPSS) computer software for Windows was employed for data analysis. Mann-Whitney U and Kruskal Wallis H tests were used to evaluate the socio-demographic characteristics. The association between malocclusion traits and the total scores of QoL was compared using Bivariate Correlation. Spearman's Rho correlation was used to evaluate association between psychological disturbances of malocclusion traits and QoL.

Results

In total, 1130 people were randomly selected for the study. Following the exclusion criteria 694 people were excluded (Fig.1) due to craniofacial deformities (126), temporomandibular disorders (176), missing more than 8 teeth (205), and had orthodontic treatment (187).

Table 1 shows the distribution of the socio-demographic characteristics of our study. Age group, gender, marital status, current residency, and income were stratified by malocclusion traits. Our study comprised a total of 436 participants who completed the study questionnaire and examinations. The largest age group was 30 – 39 years 92 (21.1%), with a mean age of 39.6 (□14.8). Of the 436 participants, 371 (85.1%) comprised of at least one of the malocclusion traits, 297 (68.1%) were female, and 139 (31.9%) were male. The majority of the participants were married 292 (67%), had a middle school or below education level 191 (43.8%), were residents of Ulaanbaatar city 252 (57.8%), and were in the low-income level group 261 (59.9%). The majority of the participants who had malocclusions were also in the 30 - 39 age group 82 (89.1%), female (253, 85.2%), married 248 (84.9%), with a middle school (or below) education level (161, 84.3%), residing in Ulaanbaatar 218 (86.5%), employed 197 (87.9%), and from the lower-income level group 220 (84.3%).

As can be seen from Table 1, participants with malocclusions had increased depression score (p=0.008) compared to those in the non-malocclusion group.

Table 1. Demographic characteristics of malocclusion

Characteristics	Total (n=436)	Malocclusion (n=371)	No Malocclusion (n=65)	*P*
	n (%)	n (%)	n (%)	
Age group				
<19	58(13.3)	50(86.2)	8(13.2)	0.366
20-29	63(14.4)	56(88.9)	7(11.1)	
30-39	92(21.1)	82(89.1)	10(10.9)	
40-49	88(20.2)	68(77.3)	20(22.7)	
50-59	91(20.9)	77(84.6)	14(15.4)	
>60	44(10.1)	38(86.4)	6(13.6)	
Gender				
Male	139(31.9)	118(84.9)	21(15.1)	0.936
Female	297(68.1)	253(85.2)	44(14.8)	
Marital status				
Married	292(67)	248(84.9)	44(15.1)	0.894
Never married	95(21.8)	84(88.4)	11(11.6)	
Others[#]	49(11.2)	39(79.6)	10(20.4)	
Education				
Middle school and below	191(43.8)	161(84.3)	30(15.7)	0.826
Associate's degree	106(24.3)	92(86.8)	14(13.2)	
Bachelor's degree	139(31.9)	118(84.9)	21(15.1)	
Current residence				
Ulaanbaatar	252(57.8)	218(86.5)	34(13.5)	0.332
Rural area	184(42.2)	153(83.2)	31(16.8)	
Employment				
Student	63(14.4)	55(87.3)	8(12.7)	0.230
Pensioner	100(22.9)	80(80)	20(20)	
Unemployed	49(11.2)	39(79.6)	10(20.4)	
Employed	224(51.4)	197(87.9)	27(12.1)	
Income				
< 175$	261(59.9)	220(84.3)	41(15.7)	0.455
175-525	168(38.5)	144(85.7)	24(14.3)	
> 525$	7(1.6)	220(84.3)	41(15.7)	
Vital function, mean ±*SD*				
Temperature	36.4±0.3	36.4±0.3	36.4±0.3	0.946
Heart rate	78±11.1	78.4±11.0	76.8±11.4	0.258
Systol press	125.3±22.0	124.8±22.0	127.8±22.3	0.306
Diastol press	79.1±13.9	78.9±13.8	80.3±14.6	0.452
HADS scale, mean ±*SD*				
Anxiety	5.6±3.2	5.7±3.2	4.9±3.0	0.452
Depression	5.4±2.8	5.5±2.8	4.6±2.6	0.008
WHOQOL-BREF, mean ±*SD*				
Physical	53.8±12.6	53.8±12.7	54.0±11.8	0.905
Psychological	66.2±12.5	66.1±12.5	67.2±12.8	0.507
Social	69.3±16.1	69.4±16.3	68.8±14.9	0.795
Environment	68.4±14.1	68.4±14.2	68.1±13.1	0.852

[#]Others included re-married, co-habiting, separated, divorced, and widowed.

Demographic characteristics of the 436 study participants are summarized in Table 1. The mean age of 39.6±14.8 years (range 13-65 years). The proportion of

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females was higher than that of males with ratio of 3:1 (78% female). All the statistically significant variables including age, gender, marital status, employment, and place where live were in anxiety group($p<0.05$). No statistically significant differences were detected among depressive group participants. Prevalence of class I malocclusion was 272 (62.4%), class II malocclusion was 118 (27.1%) and class III malocclusion was 46 (10.6%) (Fig 2).

From Figure 2, we can see in our population sample, the prevalence of malocclusion, in general, was 371 (85.1%). In terms of the prevalence of the various malocclusion traits: abnormal overjet was the most common 245 (56.2%), followed by crowded dentition 118 (27.1%), and with spaced dentition 75 (17.2%). (Fig. 2)

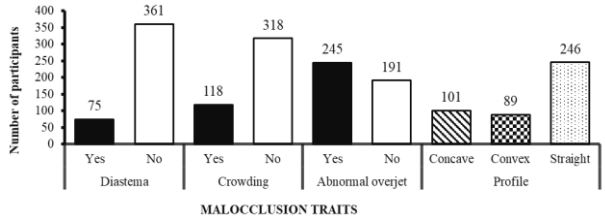

Figure 2. Prevalence of malocclusion traits

Table 2 shows the association between malocclusion traits and QoL score, as well as its four domains. In the participants with diastema the mean score and SD of the each of the four domains (physical, psychological, social and environmental) were 50.76(SD=14.73), 65.72(SD=14.03), 64.89(SD=18.24) and 65.54(SD=15.37), respectively.

Table 2. Correlation malocclusion traits and QoL

		Total n=436	WHOQOL-BREF			
			Physical	Psychological	Social	Environment
Diastema	Yes	75(17.2)	50.8±14.7	65.7±14.0	64.9±18.2	65.5±15.4
	No	361(82.8)	54.4±12.0	66.3±12.2	70.2±15.4	67.0±13.7
	p		**0.022***	0.702	**0.020***	0.55
Correlation coefficient			0.112*	0.005	0.111*	0.079
Crowding	Yes	118(27.1)	55.4±12.8	67.1±13.0	67.7±18.8	68.5±15.1
	No	318(72.9)	53.2±12.5	65.9±12.4	69.9±14.9	68.4±13.7
	P		0.111	0.362	0.187	0.941
Correlation coefficient			-0.075	-0.041	0.043	0.006
Abnormal overjet	Yes	245(56.2)	54.1±13.0	65.8±12.4	70.6±15.1	68.7±14.1
	No	191(43.8)	53.4±12.1	66.8±12.7	67.7±17.1	67.9±14.1
	P		0.539	0.402	0.064	0.56
Correlation coefficient			-0.033	0.050	-0.081	-0.025
Profile	Concave	101(23.2)	53.3±11.1	64.9±11.2	69.7±13.0	69.1±11.5
	Convex	89(20.4)	54.0±14.8	65.3±13.8	67.5±17.1	67.2±15.7
	Straight	246(56.5)	53.9±12.2	67.1±12.5	69.8±16.8	68.5±14.4
	P		0.7	0.11	0.77	0.85
Correlation coefficient			0.015	0.079	0.015	-0.020

Mean score of anxiety and depression scale and SD were 5.79(3.55) and 4.93(2.75). In no diastema group, these scores were 54.41(SD=11.98), 66.33(SD=12.21), 70.24(SD=15.43), 68.96(SD=13.74), 5.52(SD=3.11) and 5.49(SD=2.73), respectively, and had statistically significant in physical and social domains (p=0.022, p=0.020). (Table 3)

Statistical analysis of malocclusion and mental distress are presented in Table 3. The prevalence of anxiety subscale in subjects with Class I malocclusion was 67(24.6%), Class II malocclusion was 31 (26.3%), Class III malocclusion was 5(10.9%). The association anxiety subscale with Class III malocclusion had statistically significant meaning (p=0.03). Depressive subscale in subjects with Class I malocclusion was 7(2.6%), Class II malocclusion was 4(3.4%) and Class III malocclusion was 1(2.2%). Depressive subscale and malocclusion didn't have significative statistical meaning. Based on the HADS-T cut-off score of 15, mental distress was observed in 180 (69.2%) in Class I malocclusion subjects, 88 (74.6%) in Class II malocclusion subjects, and 24 (52.2%) in Class III malocclusion subjects. Subjects with Class III malocclusion were associated with mental distress while subjects who were of younger age (p=0.03).

Table 3. Correlation malocclusion traits and Anxiety and Depression

		Total n=436	Anxiety	Depression
Diastema	Yes	75(17.2)	5.79±3.55	4.93±2.75
	No	361(82.8)	5.52±3.11	5.49±2.73
	p		0.54	0.11
Crowding	Yes	118(27.1)	6.20±3.10	5.97±2.58
	No	318(72.9)	5.33±3.18	5.19±2.84
	P		0.11	**0.007**
Abnormal overjet	Yes	245(56.2)	5.58±3.06	5.37±2.96
	No	191(43.8)	5.54±3.34	5.43±2.55
	P		0.9	0.827
Profile	Concave	101(23.2)	1.26±0.54	5.39±2.53
	Convex	89(20.4)	1.40±0.61	6.04±3.11
	Straight	246(56.5)	1.25±0.54	5.17±2.78
	P		0.36	0.39

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

As reported in Table 4, significant negative correlations were found in Spearman's correlation coefficient for depression and anxiety measures with QoL. Moreover, significant negative correlations were found between psychological health, social relationships, and environmental domain and malocclusion in general, as well as with the individual malocclusion traits (-

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.401**; -.458** (** Correlation is significant at the 0.01 level (2-tailed).

Table 4. Association between psychological disturbances of malocclusion traits and QoL

		Anxiety	WHOQOL scale		
	Depression	Physical	Psychological	Social	Environment
Malocclusion	Anxiety	-.090	-.149**	-.213**	-.312**
	Depression	.016	-.143**	-.212**	-.310**
Diastema	Anxiety	-.140	-.301**	-.217	-.401**
	Depression	-.111	-.350**	-.422**	-.458**
Crowding	Anxiety	.030	-.160	-.344**	-.320**
	Depression	-.069	-.115	-.281**	-.223*
Profile concave	Anxiety	-.133	-.216*	-.258**	-.414**
	Depression	.061	-.041	-.250*	-.215*
Profile convex	Anxiety	-.130	-.151	-.208*	-.299**
	Depression	-.062	-.137	-.296**	-.360**
Overjet	Anxiety	-.096	-.167**	-.234**	-.315**
	Depression	.018	-.176**	-.226**	-.382**

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Discussion

The study at hand is the first nationwide study in Mongolia that aimed to assess the impact of malocclusion in general, as well as select malocclusion traits, on the QoL among the Mongolian population. Firstly, our study confirmed that malocclusion is a highly prevalent problem in Mongolia, with 85.1% of our participants exhibiting at least one of the malocclusion traits. In terms of the prevalence of the various malocclusion traits: overjet was the most common, followed by crowded dentition, and with spaced dentition coming in last. A statistically significant difference between the prevalence of crowding was found amongst the age groups, with crowding being most prevalent amongst the <19 years of age group. This is in line with other studies that have also found varying levels of high prevalence of malocclusion within their study populations, ranging up to 93% (Lew et al., 1993; Proffit et al., 1998; Tang, 1994; Thilander & Myrberg, 1973). Interestingly, the majority of the participants with malocclusion were those with a middle school or below education level. Although the Mongolian Dental Association advises parents to bring their child in for an orthodontic assessment at 7 years of age, traditionally, many parents bring their children in – and start orthodontic treatment – around the time when the child is in middle school. This, coupled with the fact that the level of education is seen to correlate with the understanding of how appearances can influence a person's success in today's society, could explain this finding. More than half of the participants who had malocclusions were also those from the low-income level group. This is in line with the fact that orthodontic treatment is a relatively expensive treatment procedure that historically has alluded those without significant disposable income. Although this trend is changing, with most Mongolians – even those who cannot comfortably afford expensive dental procedures – realizing the importance of undergoing orthodontic treatment for future personal and professional success.

Participants with malocclusion scored almost 1 point higher on the HADS depression scale compared to those in the non-malocclusion group. Moreover, significant negative correlations were found between psychological health and malocclusion in general, diastema, concave facial profile, and dental overjet; while significantly negative correlations were found between social relationships and environmental domain and malocclusion in general, as well as all of the individual malocclusion traits. However, no significant correlation was found between physical health and malocclusion, or any of the individual malocclusion traits. This is in tandem with previous studies that have shown that psychological stress and depression are significantly correlated with malocclusion (Ekuni et al., 2011; Zhang et al., 2012).

The presence of a spaced dentition was found to have a statistically significant impact on the QoL. This confirms previous findings in relation to spaced dentition, which states that people who are unhappy with their dental appearances may have a weakened sense of self-concept and reduced physiological functioning. In addition, and perhaps more importantly, they also offer a strong mark in support of undesirable influence on person and atmospheres (Agou et al., 2008). However, our findings are interesting considering that previous studies have tended to be hospital-based rather than population-based, with most of the hospital-based studies showing a significant impact of malocclusion on the QoL (O'Brien et al., 2007); while those that were population-based tended to report statistically insignificant associations between the QoL and malocclusion (Silva et al., 2016).

Although our cross-sectional study fulfills its objectives, as our research questions were primarily concerned with identifying an association between malocclusion and QoL, rather than outcomes of treatment; it would be interesting for future studies to assess the participants' own subjective perceptions regarding their malocclusion and how they perceive their dentofacial appearance impacts their QoL and the direction of causality between malocclusion.

Conclusion

Malocclusion is highly prevalent in Mongolia (85.1%), with overjet being the most common malocclusion trait. The majority of the participants with malocclusion were those with a middle school (or below) education level and had low-income levels. Malocclusion is associated with depression and significantly impacts the QoL.

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Author's Contributions

G.G., and Ts.J. conceived and designed the experiments; E.T., Z.B, Z.G. and G.T. performed the experiments; Z.B., E.T. and G.T. analyzed the data; Ts.J and G.G. contributed reagents/materials/analysis tools; Z.B., E.T., Z.G. and G.T. wrote the paper. All authors interpreted the data, approved the final version of the manuscript, and agree to be accountable for all aspects of the work.

Conflict of Interest Statement

The authors declare that they have no conflicts of interest to disclose.

Data Availability Statement

Data are available upon request to corresponding author.

Ethics

This study was conducted in accordance with the principles of the Declaration of Helsinki. The Mongolian National University of Medical Sciences IRB approved the study (protocol #2020/03-05). Written informed consent was obtained from all participants.

References

Agou, S., Locker, D., Streiner, D. L., & Tompson, B. (2008). Impact of self-esteem on the oral-health-related quality of life of children with malocclusion. Am J Orthod Dentofacial Orthop, 134(4), 484-489. https://doi.org/10.1016/j.ajodo.2006.11.021

Alhammadi, M. S., Halboub, E., Fayed, M. S., Labib, A., & El-Saaidi, C. (2018). Global distribution of malocclusion traits: A systematic review. Dental Press J Orthod, 23(6), 40 e41-40 e10. https://doi.org/10.1590/2177-6709.23.6.40.e1-10.onl

Araki, M., Yasuda, Y., Ogawa, T., Tumurkhuu, T., Ganburged, G., Bazar, A., . . . Moriyama, K. (2017). Associations between Malocclusion and Oral Health-Related Quality of Life among Mongolian Adolescents. Int J Environ Res Public Health, 14(8). https://doi.org/10.3390/ijerph14080902

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. https://doi.org/10.1590/2177-6709.20.6.075-081.oar

Ekuni, D., Furuta, M., Irie, K., Azuma, T., Tomofuji, T., Murakami, T., . . . Morita, M. (2011). Relationship between impacts attributed to malocclusion and psychological stress in young Japanese adults. Eur J Orthod, 33(5), 558-563. https://doi.org/10.1093/ejo/cjq121

Grando, G., Young, A. A., Vedovello Filho, M., Vedovello, S. A., & Ramirez-Yanez, G. O. (2008). Prevalence of malocclusions in a young Brazilian population. Int J Orthod Milwaukee, 19(2), 13-16. http://www.ncbi.nlm.nih.gov/pubmed/18686678

Johal, A., Cheung, M. Y., & Marcene, W. (2007). The impact of two different malocclusion traits on quality of life. Br Dent J, 202(2), E2. https://doi.org/10.1038/bdj.2007.33

Kenealy, P. M., Kingdon, A., Richmond, S., & Shaw, W. C. (2007). The Cardiff dental study: a 20-year critical evaluation of the psychological health gain from orthodontic treatment. Br J Health Psychol, 12(Pt 1), 17-49. https://doi.org/10.1348/135910706X96896

Lew, K. K., Foong, W. C., & Loh, E. (1993). Malocclusion prevalence in an ethnic Chinese population. Aust Dent J, 38(6), 442-449. https://doi.org/10.1111/j.1834-7819.1993.tb04759.x

Liu, B. C., Lee, I. C., Lo, L. J., & Ko, E. W. (2019). Investigate the oral health impact and quality of life on patients with malocclusion of different treatment needs. Biomed J, 42(6), 422-429. https://doi.org/10.1016/j.bj.2019.05.009

Liu, Z., McGrath, C., & Hagg, U. (2009). The impact of malocclusion/orthodontic treatment need on the quality of life. A systematic review. Angle Orthod, 79(3), 585-591. https://doi.org/10.2319/042108-224.1

Macgregor, F. C. (1970). Social and psychological implications of dentofacial disfigurement. Angle Orthod, 40(3), 231-233. https://doi.org/10.1043/0003-

3219(1970)040<0231:SAPIOD>2.0.CO;2

Mathes, E. W., & Kahn, A. (1975). Physical attractiveness, happiness, neuroticism, and self-esteem. J Psychol, 90(1st Half), 27-30. https://doi.org/10.1080/00223980.1975.9923921

Neto, A., Mourão, R., Sousa, R., Vajgel, B., & Cimões, R. (2017). The Impact Of Malocclusion On Quality Of Life And Life Satisfaction. International Archives of Medicine, 10. https://doi.org/10.3823/2492

O'Brien, C., Benson, P. E., & Marshman, Z. (2007). Evaluation of a quality of life measure for children with malocclusion. J Orthod, 34(3), 185-193; discussion 176. https://doi.org/10.1179/146531207225022185

Proffit, W. R., Fields, H. W., Jr., & Moray, L. J. (1998). Prevalence of malocclusion and orthodontic treatment need in the United States: estimates from the NHANES III survey. Int J Adult Orthodon Orthognath Surg, 13(2), 97-106. http://www.ncbi.nlm.nih.gov/pubmed/9743642

Shaw, W. C., Richmond, S., Kenealy, P. M., Kingdon, A., & Worthington, H. (2007). A 20-year cohort study of health gain from orthodontic treatment: psychological outcome. Am J Orthod Dentofacial Orthop, 132(2), 146-157. https://doi.org/10.1016/j.ajodo.2007.04.009

Silva, L. F., Thomaz, E. B., Freitas, H. V., Pereira, A. L., Ribeiro, C. C., & Alves, C. M. (2016). Impact of Malocclusion on the Quality of Life of Brazilian Adolescents: A Population-Based Study. PLoS One, 11(9), e0162715. https://doi.org/10.1371/journal.pone.0162715

Tang, E. L. (1994). The prevalence of malocclusion amongst Hong Kong male dental students. Br J Orthod, 21(1), 57-63. https://doi.org/10.1179/bjo.21.1.57

Thilander, B., & Myrberg, N. (1973). The prevalence of malocclusion in Swedish schoolchildren. Scand J Dent Res, 81(1), 12-21. https://doi.org/10.1111/j.1600-0722.1973.tb01489.x

WHO. (2010). What is the burden of oral disease? Oral disease burdens and common risk factors. https://www.who.int/oral_health/disease_burden/global/en

World Health Organization. Division of Mental, H. (1996). WHOQOL-BREF : introduction, administration, scoring and generic version of the assessment : field trial version, December 1996. In. Geneva: World Health Organization.

WR, P. (Ed.). (2000). Contemporary Orthodontics (3rd ed.).

Zhang, L., Liu, X., Zheng, G. J., Zhou, L., Lin, D. Y., Wang, X. D., & He, H. (2012). Eysenck personality and psychosocial status of adult patients with malocclusion. Asian Pac J Trop Med, 5(2), 151-156. https://doi.org/10.1016/S1995-7645(12)60015-7

Zhang, M., McGrath, C., & Hagg, U. (2006). The impact of malocclusion and its treatment on quality of life: a literature review. Int J Paediatr Dent, 16(6), 381-387. https://doi.org/10.1111/j.1365-263X.2006.00768.x