Original Article

Perception and attitude of Mongolians on malocclusion

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Background/purpose: This study assessed the perception and attitude of Mongolians on malocclusion and compared the perceptions with researchers' perceptions on malocclusion, and this study aimed to determine factors influencing the self-perception of laypeople.
Materials and methods: In addition, we evaluated the correlation between the subjective and objective perceptions of participants. In a random sample of 133 people (39.8% men and 60.2% women) aged 18—55 years, subjective perceptions were assessed using a questionnaire (oral aesthetic subjective impact scale), and objective perceptions were assessed using 10 intraoral frontal photographs of the aesthetic component of index of orthodontic treatment need (AC-IOTN) and six intraoral lateral photographs of the aesthetic component of lateral occlusion (AC-LO).
Results: A significant association was observed between participants' self-perception and researchers' ratings ($P < 0.001$). The appearance of teeth was significantly correlated with participants' self-rating by using AC-IOTN and AC-LO. Most people (74%) believed that well-aligned teeth improve the overall facial appearance. Sex, monthly income, and education level significantly influenced the self-perception of participants on malocclusion.
Conclusion: Patients' perception and attitude cannot be overlooked because they are some of the crucial aspects of the entire treatment.
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Introduction

Studies regarding the perception and attitude of people on malocclusion have mostly involved Europeans,[1−14] and few studies have involved Asians.[15−17] No study has addressed the perception of Mongolians on malocclusion. Over the years, several indexes have been developed to help orthodontists to classify malocclusion according to treatment priority, such as Brook and Shaw's index of orthodontic treatment need (IOTN),[18] Mandall's oral aesthetic subjective impact scale (OASIS),[3] and dental aesthetic index (DAI) introduced in 1989.[19]

The IOTN that was developed by the Swedish Dental Health board incorporates an aesthetic component (AC) and a dental health component (DHC).[18,20] The AC consists of 10 colored intraoral photographs that represent dental attractiveness, whereas DHC consists of five grades of treatment need based on malocclusion traits. The IOTN is used in patient education and administration of public health services. The OASIS consists of five questions concerning the perceptions of others and themselves, such as questions regarding behavior related to the dental appearance and majorly subjective perception of patients.

Most of the studies have involved children and teenagers, and few have involved adults.[2,6,13,16,21] However, the perception of adults is more constant and reliable than that of children. In addition, treatment decisions are practically made by adults, including caregivers and parents.[9,22]

Sex broadly influences self-perception regarding occlusal irregularities.[2−4,7,14] Some studies have indicated that age,[7,14,23] ethnicity,[24] socioeconomic status,[3,13] residential areas,[25] and previous orthodontic treatment[8,11] can affect perceptions on malocclusion. Knowledge of perception and attitude of people on malocclusion can be used to design treatment, educate patients, conduct public health surveys, communicate with patients, and better understand patients' opinions.

This study aimed to assess the perception and attitude of Mongolians on malocclusion, compare it with researchers' perception on malocclusion, and determine the factors influencing the self-perception of laypeople. In addition, we aimed to determine the correlation between the subjective and objective perceptions of participants.

Materials and methods

This study was approved by the Institutional Review Board (IRB) of Taipei Medical University Hospital (approval No. MNUMS IRB 2020/3−04). Data were collected from 133 people at the Department of General Dentistry of Taipei Medical University Hospital from July to August 2019. The participants' mean age was 32.87 ± 8.99 years (range 18−55 years; Table 1); 60.2% and 39.8% of the participants were females and males, respectively. Before data collection, informed consent was obtained from each participant and a brief introduction was provided to all study participants. Data were obtained only from participants who provided written consent and were aged 18−65 years. Patients who were also orthodontists or dental professionals were excluded from the study. None of the participants had previous or ongoing orthodontic treatment.

Table 1 Participant characteristics (n = 133).

Characteristics	Frequency (%)
Age group (years)	
18−25	31 (23.3)
25−35	40 (30.1)
36−45	49 (36.8)
46−55	12 (9)
Mean	32.87
Standard deviation	8.99
Sex	
Male	53 (39.8)
Female	80 (60.2)
Education	
Less than high school	1 (0.8)
High school	33 (24.8)
College	12 (9)
University	79 (59.4)
Higher than university	8 (6)
Occupation	
Student	5 (3.8)
Business	12 (9)
Professional	27 (20.3)
Service work	34 (25.6)
Labor	31 (23.3)
Others	6 (18)
Monthly income	
<500$	60 (45.1)
500−800$	32 (24.1)
800−1000$	12 (9)
>1000$	6 (4.5)
None	23 (17.3)
Religion	
Buddhist	56 (42.1)
Christian	3 (2.3)
Islam	1 (0.8)
None	57 (42.9)
Others	16 (12)

A questionnaire, consisting of four sections, was used to collect data from participants. The first section included demographic characteristics, namely education level, religion status, occupation, and monthly income.

In the second section, the subjective need for orthodontic treatment, satisfaction with dental appearance, and social impact were determined using the OASIS[3] with three additional questions. The original OASIS involved five questions regarding the concern and disadvantages perceived by participants because of their dental appearance. Our research team added three more questions for a more precise understanding of perception and attitude of laypeople on malocclusion. The three questions added were related to the treatment need, satisfaction with dental appearance, and the importance of well-aligned teeth. Participants recorded their response to each question on a 100-mm lined visual analog scale by putting a cross on the line.[26]

The third and fourth sections were related to participants' objective perception and attitude on malocclusion. The objective perception and attitude were measured using 10 frontal intraoral photos of the AC of the IOTN (AC-IOTN), which

was described by Brook and Shaw in 1989[18] (Fig. 1). The grades of photographs indicate three treatment groups: grades 1—4 indicate no or slight treatment need; grades 5—7 indicate moderate treatment need; and grades 8—10 indicate severe treatment need. Participants were asked to select the photograph that best represented the attractiveness of their dental appearance. AC-IOTN concerns the frontal view of occlusion and has limitations regarding the identification of the malocclusion type; therefore, our research team developed a new index of the aesthetic component of lateral occlusion (AC-LO) (Fig. 2) for assessing patients' objective perception more precisely. The intraoral photos for AC-LO were chosen from the initial photo files of the Orthodontic Department of Taipei Medical University Hospital, namely normal bite, end-to-end bite, class III malocclusion, class II malocclusion, deep bite, and open bite, that were difficult for participants to identify in AC-IOTN. Participants were asked to choose one of the six lateral intraoral photos that best represents their own occlusion.

After data collection, the researcher obtained frontal and lateral intraoral photos of each participant for comparing subject's self-perception of malocclusion and researcher's perception of malocclusion. To establish inter-examiner reliability, two more examiners scored all participants' dental occlusion by using AC-IOTN and AC-LO.
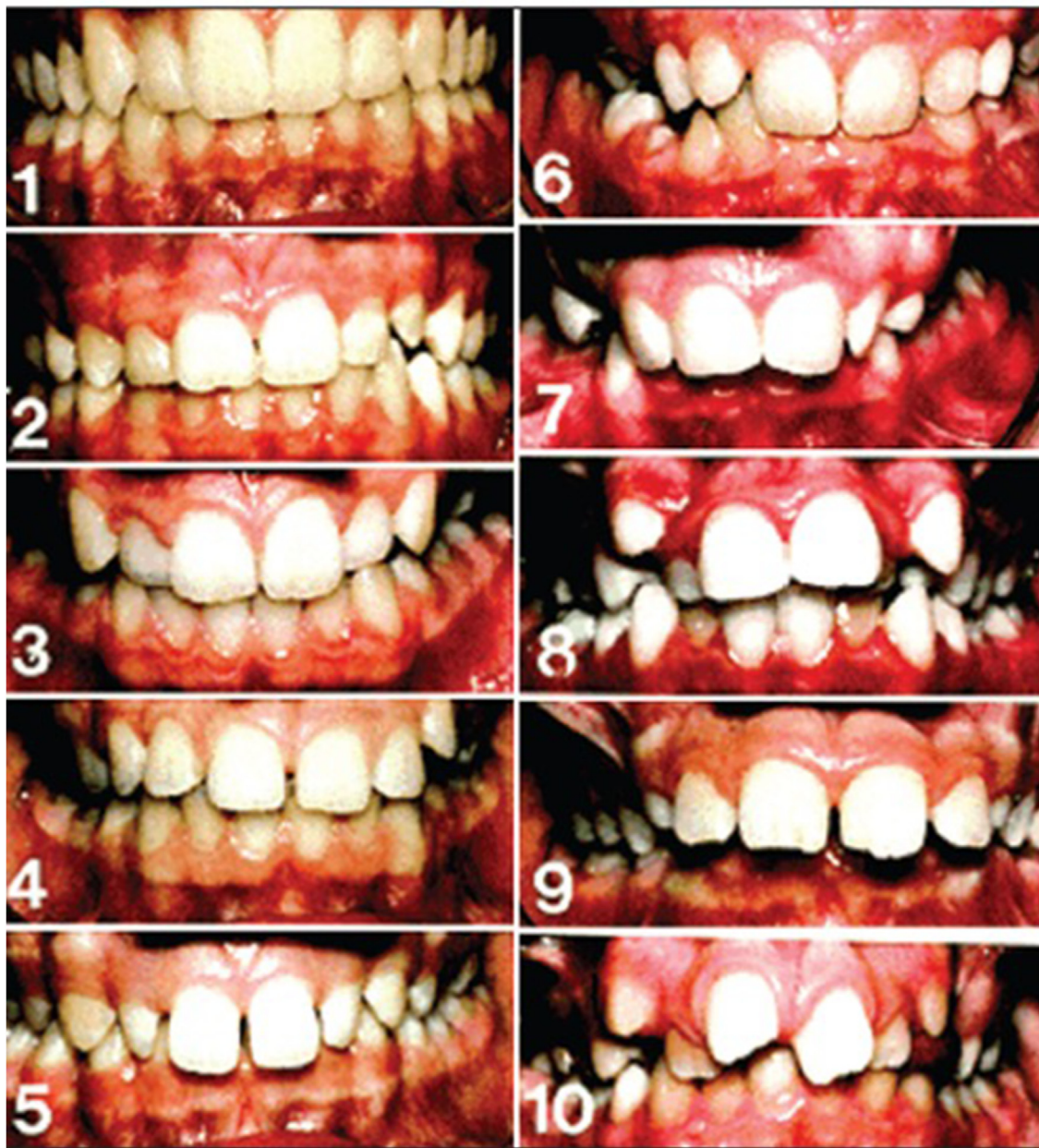
Figure 1 The 10 frontal intraoral photos used for measuring the aesthetic component of the index of orthodontic treatment need.[18]

Figure 2 Six lateral intraoral photos used for measuring the aesthetic component of lateral occlusion.

Statistical analysis

Data were analyzed using SPSS software (version 19.0, SPSS, Chicago, Illinois, USA). Descriptive statistics were used to provide an overview of participants' demographic characteristics and their responses to the modified OASIS questions. A chi-square test was performed to determine the relationship between researchers' perception and participants' self-perception. Pearson correlation analysis was used to study the correlation between the subjective and objective perceptions of participants. To study the effect of dependent variables (age, sex, education, occupation, monthly income, and religion) on self-perceived aesthetics, multivariate regression analysis was performed. The kappa statistic was used to analyze inter-examiner reliability for AC-IOTN and AC-LO. A P value of <0.05 was considered statistically significant.

Results

In total, 53 men (39.8%) and 80 women (60.2%) with a mean age of 32.87 years were evaluated. None of the participants had received orthodontic treatment. The age, sex, education level, occupation, monthly income, and religion status distribution of the study sample are presented in Table 1.

Table 2 presents the total sample and scores for the AC-IOTN index as rated by researchers and participants. According to the AC, a higher proportion of participants needed slight or no treatment according to the researchers (98.5%) and subjects (94.7%). Approximately 3% of the participants perceived that they required moderate or borderline orthodontic treatment. In addition, 0.8% of the participants could not be categorized into any of the grades by the researchers and participants. A significant difference was observed between participants' self-perception (participants' AC) and researchers' ratings (researchers' AC), particularly for the slight or no treatment need category ($P < 0.001$).

Normal bite was self-reported by 44.4% of the participants according to AC-LO, whereas the researchers who reported 37.6% of the participants had normal bite (Table 3).

Class II malocclusion was found in 26.3% of the participants. Seven participants perceived that they had Class III malocclusion. A significant correlation was observed between the researchers' and participants' ($P < 0.001$) perceptions on normal bite and deep bite categories.

Table 4 shows the frequencies of the questions on OASIS with three additional questions, and Table 5 shows the correlation between OASIS and the additional questions on the subjective perception and objective perception measured using AC-IOTN and AC-LO. The questions 1—7 of OASIS were correlated with AC-IOTN, whereas questions 1, 3, 6, and 7 were correlated with AC-LO. The mean percentage of participants whose responses aligned with question 1 (How do you feel about the appearance of your teeth?) was 56%, and this question showed a significant correlation with AC-IOTN and AC-LO ($P < 0.001$ and $P = 0.008$, respectively). Furthermore, 40% of the participants perceived that they needed orthodontic treatment (question #6), which was significantly correlated with AC-IOTN ($P < 0.001$) and showed a weak correlation with AC-LO ($P = 0.031$). The concern of well-aligned teeth (question #8) was admitted by 74% of the participants, which was not correlated with AC-IOTN and AC-LO.

Table 6 shows the results of multivariate logistic regression analysis. Sex was a statistically significant factor for the perception on oral aesthetic by using AC-IOTN ($P = 0.027$). Furthermore, the results revealed that there were no significantly correlated factors with the responses on AC-LO. Moreover, the results showed that responses to the initial questions of the OASIS were not correlated with any of the demographic characteristics. However, the additional questions showed significant correlations with sex, education, religion, and monthly income (with the P-values ranging from 0.011 to 0.001).

For AC-IOTN, inter-examiner reproducibility between the three examiners was weak, with kappa values ranging from 0.271 to 0.275. This might be because the examiners' experience, years of work, and culture were different, and the second and third examiners' perceptions were stricter when evaluating participants' frontal dentition. For AC-LO, inter-examiner reliability between the three examiners was strong, ranging from 0.569 to 0.623. In this part, examiners

Table 2 Distribution and correlation of AC-IOTN grades among participants and researchers.

Treatment need	AC-IOTN grade	AC-IOTN (Subjects)		AC-IOTN (Researcher)		X^2	P-value
		n	%	n	%		
No/slight need	1	72	54.1	46	34.6	197.4	0.001***
	2	32	24.1	57	42.9		
	3	17	12.8	21	15.8		
	4	5	3.8	7	5.3		
	Subtotal	126	94.7	131	98.5		
Moderate/borderline need	5	2	1.5	0	0	5.00	0.467
	6	2	1.5	0	0		
	7	0	0	1	0.8		
	Subtotal	4	3	1	0.8		
Severe need	8	2	1.5	0	0	—	—
	9	0	0	0	0		
	10	0	0	0	0		
	Subtotal	2	1.5	0	0		
Unregistered cases		1	0.8	1	0.8		

$n = 133$; AC-IOTN, the aesthetic component of index of orthodontic treatment need.
***$P < 0.001$.

Table 3 Distribution and correlation of AC-LO grades among participants and researchers.

AC-LO grade	AC-LO (Subjects)		AC-LO (Researcher)		R^2	P-value
	n	%	N	%		
A (Normal bite)	59	44.4	50	37.6	0.004	0.000***
B (End to end)	22	16.5	26	19.5	0.798	0.873
C (Class III)	7	5.3	5	3.8	0.912	0.810
D (Class II)	37	27.8	35	26.3	0.237	0.900
E (Deep bite)	8	6	17	12.8	0.015	0.000***
F (Open bite)	0	0	0	0	—	—

AC-LO, the aesthetic component of lateral occlusion.
$P < 0.001$***.

Table 4 Responses to questions on the oral aesthetic subjective impact scale with three additional questions.

Questions	%
1. How do you feel about the appearance of your teeth?	56
2. Have you found that other people have commented on the appearance of your teeth?	30
3. Have you found that other people have teased you about the appearance of your teeth?	18
4. Do you try to avoid smiling because of the appearance of your teeth?	29
5. Do you ever cover your mouth because of the appearance of your teeth?	22
6. Do you think you need orthodontic treatment?	40
7. Are you satisfied with the way your teeth look?	60
8. Do you consider well-aligned teeth important for overall facial appearance?	74

might differ in rating participants with class II malocclusion and deep bite malocclusion due to almost coinciding lateral intraoral photos.

Discussion

In this study, the perception and attitude of Mongolians on malocclusion were evaluated by randomly selecting laypeople aged 18–55 years. This study was conducted at the Department of General Dentistry of Taipei Medical University Hospital, which generally treats patients with a wide range of social backgrounds. The sample did not represent the entire Mongolian population but provided an overview of the Mongolian population. Intraoral photographs were used by the research team to rate dental attractiveness. The validity of using dental photographs in representing dental attractiveness has been previously confirmed.[27]

Table 5 Correlation between the OASIS with three additional questions and assessment grades of participants.

	OASIS	IOTN-AC (Participants) P-value	AC-LO (Participants) P-value
1	Appearance of the teeth	0.000[c]	0.008[b]
2	Other people's comment	0.000[c]	0.181
3	Teased about teeth	0.000[c]	0.077
4	Hide smiling	0.000[c]	0.355
5	Mouth covering	0.003[b]	0.270
6	Treatment need	0.000[c]	0.031[a]
7	Satisfaction with dental appearance	0.002[b]	0.046[a]
8	Importance of the well-aligned teeth	0.177	0.480

OASIS, oral aesthetic subjective impact scale; AC-IOTN, the aesthetic component of index of orthodontic treatment need; AC-LO, the aesthetic component of lateral occlusion.
[a] Correlation significant at the level of 0.05.
[b] Correlation significant at the level of 0.01.
[c] Correlation significant at the level of 0.001.

Table 6 Correlation between demographic characteristics and assessment indexes as assessed using a multivariate regression analysis.

Factors	P-value					
	Age	Sex	Education	Occupation	Religion	Income
IOTN-AC	0.622	0.027[a]	0.805	0.695	0.126	0.817
AC-LO	0.064	0.305	0.304	0.058	0.537	0.831
OASIS						
Appearance of the teeth	0.192	0.742	0.846	0.390	0.343	0.150
Other people's comment	0.327	0.616	0.409	0.251	0.248	0.572
Teased about teeth	0.645	0.481	0.681	0.355	0.550	0.691
Hide smiling	0.154	0.353	0.304	0.648	0.684	0.371
Mouth covering	0.568	0.244	0.365	0.921	0.811	0.241
Treatment need	0.183	0.011[b]	0.837	0.737	0.036[a]	0.858
Satisfaction with dental appearance	0.569	0.299	0.752	0.821	0.266	0.029[a]
Importance of the well-aligned teeth	0.609	0.181	0.001[c]	0.103	0.313	0.137

OASIS, oral aesthetic subjective impact scale; AC-IOTN, the aesthetic component of index of orthodontic treatment need; AC-LO, the aesthetic component of lateral occlusion.
[a] Correlation significant at the level of 0.05.
[b] Correlation significant at the level of 0.01.
[c] Correlation significant at the level of 0.001.

According to AC-IOTN, a significant difference existed between researchers' perception and participants' self-perception. Both the researchers and participants tended to have similar perceptions regarding the need for slight or no treatment but differed in their perceptions regarding moderate and severe treatment. This result was consistent with that of previous studies, which have found that participants were critical regarding their occlusion appearance.[3,11,23,25] However, these findings did not correspond with those of several studies.[2,7,20,28,29] The results of the present research showed that Mongolians had a lower need (5.3%) of treatment than did Pakistanis (20.7%) and Peruvians (13%).[6,21]

Due to limitations of AC-IOTN, our research team developed a new index AC-LO. AC-IOTN shows dentition only from the front, which made it difficult for participants to differentiate between some occlusions, and it was not sensitive enough to detail all malocclusion types. AC-LO can help participants to identify their malocclusion irregularities, such as a reverse overjet, open bite, and excessive overjet. The findings in this investigation regarding AC-LO suggest that this index is a valid and uncomplicated tool for measuring the perception of dental attractiveness, and it can compensate for the shortcomings of AC-IOTN. However, this index needs further modifications and improvements to better understand the perception and attitude of participants. As shown in Table 3, participants' perceptions regarding normal bite and deep bite were significantly correlated with those of the researchers' perception, indicating that participants have difficulty in differentiating

between normal and deep bites among various occlusion types. This explains that for Mongolian people, identifying normal bite is difficult, and other dental features such as straight teeth without spacing or crowding makes participants believe that they have a normal bite. Furthermore, the deep bite sample size of this research is small, and thus further investigation is needed to confirm the results of this study. Same as researchers, participants could identify end-to-end, class III, and class II occlusions with AC-LO better than with AC-IOTN.

The OASIS with three additional questions was used to assess the self-perception of participants. In response to the question "How do you feel about the appearance of your teeth?" the mean percentage of the participants who expressed satisfaction in this study was 56%, which was contradictory to that in the previous studies,[13] which reported a low percentage of participants with satisfaction. Although the majority of the participants had normal occlusion, half of them were unsatisfied with their dental appearance; this indicates that besides normal occlusion, other factors may affect the satisfaction of people. Most participants (74%) perceived the importance of well-aligned teeth for the overall facial appearance. This question regarding the importance of well-aligned teeth was a modification of the question mentioned in the previous studies.[23,30] Previous studies have shown the percentages of 55.8% and 85%, respectively, which were inconsistent with the percentage in this study. The reasons for these discrepancies may be attributed to differences in the age of participants, as well as cultural differences. Hence, the overall OASIS mean score was identical to that of few studies on the self-perception of adult subjects.[6,8,13]

Our study results showed that a significant correlation existed between subjective and objective assessments. This explained that participants perceive not only the importance of aesthetic features of dental appearance but also the consequences of the dental appearance and reactions of others toward an individual. This observation was consistent with the results of studies on the perception of laypeople on malocclusion.[3,6,23] Our findings revealed that the responses of seven questions significantly correlated with AC-IOTN, whereas the responses of four questions correlated with AC-LO. This explained that participants' objective and subjective perceptions were associated more with the response to frontal intraoral photos than the response to lateral intraoral photos, and this may be because participants see their dentition in the mirror only from the front side on a daily basis.

In the current study, multivariate regression analysis revealed that sex was the only factor that significantly influenced the self-perceived aesthetics of participants by using AC-IOTN, which was consistent with the results of the previous studies.[2,3,7,14] No other factor, except sex, was correlated with participants' self-perception. Participants appeared to have a general perception and attitude on malocclusion, regardless of their ethnicity, age, occupation, education level, and monthly income. However, there were no significantly influenced factors on the self-perceived aesthetics of participants by using AC-LO. To confirm these results, further investigations with larger sample sizes are needed. Apparently, no factor was significantly correlated with the initial questions of the OASIS. This indicates that the opinions of the society, self-esteem, and the appearance of teeth are not influenced by demographic factors because most of the participants belonged to the slight or no treatment need category and were adults. Conversely, several factors significantly affected the responses to the additional questions. People's perception regarding the importance of well-aligned teeth was strongly correlated with their education level. This may be because with the increasing education level, people perceive well-aligned teeth as being more important. Our data revealed that factors other than the education level were not correlated with the importance of dental aesthetics. This indicates that participants' perception regarding the importance of well-aligned teeth is not based on sex and other influencing factors, which is consistent with the results of the previous studies.[23,30,31] Our findings suggest that monthly income is related to the satisfaction with dental appearance. However, the previous studies regarding people's satisfaction with dental appearance have not indicated a correlation of satisfaction with monthly income or household income.[2,23,32] The low correlation of dental appearance satisfaction with monthly income requires further exploration in larger population samples. Sex and religion were significantly related to participants' perceived treatment need. In contrast to sex, religion was not a broadly studied factor. In our study, the majority of the participants were not religious, and religion was correlated with treatment need. This may be because of the freedom to believe in any of the various religions practiced in Mongolians, which may affect participants' perception of treatment need.

Future research should involve more laypeople with a wide range of socioeconomic backgrounds to represent the Mongolian population. Moreover, factors such as orthodontic treatment availability in rural areas, treatment cost, shape and color of teeth, and impact of social features may play a significant role in an individual's self-perception, and this needs to be further investigated. AC-IOTN could be modified to improve evaluation regarding patients' self-perception because patients with reverse overjet and open bite malocclusions found it to be difficult to select 1 of the 10 intraoral photographs.[33]

We conclude that Mongolians' perception and attitude on malocclusion are different from those of the researchers. Sex, education level, and monthly income significantly influence people's self-perceived dental appearance. Most people believe that well-aligned teeth are crucial for the overall facial appearance. The three self-assessment scales were significantly correlated. The results of this study will help Mongolian orthodontists to plan the treatment design and will provide them with a better understanding of their patients' perception and attitude regarding malocclusion.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

Acknowledgments

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