Malocclusions and perceptions of attractiveness, intelligence, and personality, and behavioral intentions

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Introduction: In this study, we explored how others perceive persons with normal occlusion or different malocclusions (open bite, deepbite, underbite, overjet, crowding, and spacing). The objectives were to investigate (1) how occlusion affects others' perceptions of attractiveness, intelligence, and personality, and their desire to interact in personal and professional settings, and (2) whether these assessments are affected by the target person's sex or the respondent's characteristics. **Methods:** Survey data were collected from 889 patients or accompanying adults (46% male, 54% female; age range, 18-90 years) who evaluated target photos that had been manipulated to display either a normal occlusion or 1 of 6 malocclusions. **Results:** The ratings of attractiveness, intelligence, conscientiousness, agreeableness, and extraversion differed significantly depending on the occlusion status depicted. Persons with normal occlusion were rated as most attractive, intelligent, agreeable, and extraverted, whereas persons with an underbite were rated as least attractive, intelligent, and extraverted. Female targets were rated more positively than male targets. Younger respondents and more educated respondents were more critical in their evaluations than were older and less educated respondents. **Conclusions:** Occlusion status affects a person's perceptions comprehensively. Subjects with normal occlusion were rated the most positively. (Am J Orthod Dentofacial Orthop 2011;140:669-79)

The National Health and Nutrition Examination Survey III from 1988 to 1991 showed that 57% to 59% of adults had some degree of malocclusion, and only 35% had well-aligned mandibular incisors.[1] More specifically, the data showed that 50% of adults had an excessive overjet, 48% had a deepbite, 6% had a negative overjet or underbite, and 3% had an anterior open bite.[1] Although 2 decades have passed since these data were collected, they still are the most current prevalence data concerning malocclusions among adults in the United States.[2] As evidenced by the prevalence of adults with persistent orthodontic treatment needs, malocclusion is unlikely to self-

correct with time, and the complexity can even increase with age.[3] Despite this trend toward increased orthodontic treatment need with age, adults seeking orthodontic treatment comprise only 15% to 25% of all orthodontic patients.[4,5] Because of these significant percentages, it is important to comprehensively understand how malocclusion might influence others' perceptions and behavioral intentions to interact with adults with malocclusion.[1,6,7]

Prior research showed that a person's attractiveness has a significant effect on others' perceptions of that person. Attractive people were considered to be more intelligent and socially competent, to have a more positive personality,[6,8-10] to have better social interactions, and to receive more favorable professional ratings.[6,11,12] Research also explored the role of malocclusion in determining overall facial attractiveness,[12,13] as well as determined how orthodontic treatment need might affect a person's sense of self-worth.[6,8,14-16] These findings suggested that adolescents and adults with malocclusion might have a decreased sense of self-worth, and that their general attractiveness, social acceptability, ability, and personality were judged more negatively.[6,8,9,12,14-16] In 1985, Shaw et al[13] showed that malocclusion was influential enough to affect

several personality ratings including intelligence, friendliness, and popularity. Therefore, not only do malocclusions reduce the overall facial attractiveness ratings of others,[8,12] but also malocclusions can lead to psychosocial disadvantages and adverse social reactions that affect patients' lives.[17-22] Negative perceptions have been associated with several malocclusions including crowding, deepbite greater than 7 mm, anterior open bite, overjet greater than 9 mm, and underbite ("intention bite"), which has been associated with the perception of an aggressive personality.[6,12,23]

A comprehensive analysis of the effects of malocclusion on perceptions must go beyond merely considering ratings of attractiveness and intelligence to thoroughly understanding how malocclusions affect perceptions of a person's personality traits as well as behavioral intentions to interact with a person. A personality trait is a temporally stable, cross-situational individual difference. One widely accepted model of personality traits is the 5-factor model.[24-27] The 5 factors described in this model were the result of factor analyses of self-reports and other reports of personality-related adjectives. This theory postulates that the 5 factors of extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience comprehensively describe personality differences.[21,22,24,25] Research showed that these factors can be considered to be universal because they have been found in studies in 6 languages as diverse as German and Chinese.[28] This theory was therefore used to determine which personality characteristics would be included in this study.

In addition to the effects of malocclusion on person perceptions and behavioral intentions, we also explored how the sex of the depicted persons with different malocclusions would shape others' perceptions. Earlier research showed that females were judged more severely by others, and that a female with an unattractive dental region had a particular disadvantage compared with males.[12,13] In addition, observer characteristics might also play a role in how a person is perceived. With regard to observer sex and attractiveness ratings, the research findings were inconsistent. Although some authors found that women were more critical, others concluded that men were more concerned with attractiveness and therefore judged more harshly.[29-31] However, some researchers reported that the observer's sex had little effect on the ratings given.[12,13] In addition to sex, other observer characteristics evaluated were ethnicity or race, age, income, educational background, and previous history of orthodontic treatment.

Our objectives in this study were to explore (1) how different malocclusions influence others' perceptions of attractiveness, intelligence, and personality characteristics (extraversion, agreeableness, conscientiousness, neuroticism, and openness) and behavioral intentions to interact in personal and professional settings; (2) whether male and female targets are rated differently when they have normal occlusion vs different types of malocclusion; and (3) whether observer characteristics such as sex, ethnicity or race, age, income, education level, and history of previous orthodontic treatment shape person perceptions and behavioral intentions.

MATERIAL AND METHODS

This study was approved by the Institutional Review Board for the Health Sciences at the University of Michigan, Ann Arbor. The project consisted of 2 pilot studies and 1 quasi-experimental study.

The objectives of the pilot studies were to identify photos of 2 male and 2 female subjects of average attractiveness. Their photos should not be rated too extremely by observers. Faces of average attractiveness were used in the actual experiment to prevent bottom and ceiling effects of ratings.

Data from 101 dental students (51 men, 50 women) were collected for the first pilot study, and data from 29 female dental hygiene students and 104 dental students (56 men, 48 women) were collected for the second pilot study. The second pilot study was conducted because only 1 female photo in the first pilot study was assessed as having average attractiveness.

The pilot data were collected at the end of regularly scheduled classes. The students were informed about the study and volunteered to respond anonymously to a short survey by rating the attractiveness of the depicted students.

The respondents received a 5.5 × 8.5-in booklet that contained frontal facial photographs of 17 persons in the first pilot study and 19 persons in the second pilot study. The photos used in the second pilot study were 16 of the photos from the first pilot study plus 3 additional female photos. One original female photo from the first pilot study was excluded from the second pilot study for logistical reasons. The cover page of the booklet instructed the respondents to rate the attractiveness of each photo on a scale from 1 (unattractive) to 10 (attractive). The facial photos, taken with a white background, showed the nonsmiling faces of white female and male students between the ages of 20 and 30 years who did not wear any glasses or adornments. Each portrayed person had consented to have the photographs taken, altered as needed, and used in the study.

Data were collected from 889 regularly scheduled patients or their accompanying adults at a dental school

clinic. Participants had to be able to understand written English and were 18 years of age or older. The participants' average age was 54.2 years (SD, 17.1; range, 18-90 years), and 46% were male and 54% female. Whereas 84% of the participants were European Americans, 8% were African Americans, 2% were Hispanic or Latino, and 6% were from other backgrounds. Table 1 provides an overview of their background characteristics.

Regularly scheduled patients or accompanying adults were informed about the study on arrival in a waiting area. Adults who consented to participate completed the survey, placed it in an envelope, and returned it anonymously. The respondents spent approximately 10 minutes responding to the survey. They received a free parking voucher as a token of appreciation.

Based on the results of the 2 pilot studies, photos of 2 male and 2 female subjects were identified as the target persons and used in the experimental study. The photos were selected based on the average attractiveness ratings and the fact that they were not rated too extreme by the respondents in the pilot study. Each target person was photographed smiling from a frontal and a three-quarters view. Once these 2 views were obtained, the area inside the borders of the lips was modified (Adobe Photoshop, San Jose, Calif) to show a normal occlusion and 6 malocclusions (open bite, deepbite >7 mm, underbite, overjet >9 mm, crowding, and spacing) for each of the 4 target persons (Figs 1 and 2). For malocclusions that included a skeletal discrepancy, such as severe overjet and underbite, the photographs were also altered to reduce and increase the projection of the chin, respectively.

Each participant received only 1 of the 28 possible versions (4 photos × 7 variations) of the survey to avoid drawing too much attention to the occlusion status and to prevent memory from affecting the ratings of the second set of photos. The survey consisted of 3 sections on 3 stapled sheets of paper, printed on the front and back. The cover page included brief instructions on how to respond to the survey. The first part of the survey (pages 3 and 5) asked the respondents to evaluate the frontal and three-quarters view photographs (printed in color on pages 2 and 4, opposite the questionnaire items) and to rate the photographs on 7-point answer scales for 43 adjective pairs. These adjective pairs were carefully chosen by the researchers with the dependent measures (attractiveness, intelligence, and the 5 personality factors) in mind. Concerning assessing ratings of the 5 personality factors, these 5 factors were chosen based on a well-accepted personality theory.[22-25] However, the authors of this 5-factor model did not develop a standardized instrument for assessing others' personalities. The adjective pairs used in this study were therefore selected

Table I. Respondents' background characteristics	
General characteristics	*Frequencies*
Sex (n)	
Male	405 (46%)
Female	484 (54%)
Age (y)	
Mean/range/SD	54.2/18-90/17.1
Ethnicity or race (n)	
European American	706 (84%)
African American	64 (8%)
Hispanic or Latino	17 (2%)
Other	52 (6%)
Education (y)	
Mean/range/SD	13.4/2-30/3.0
Monthly income	
No income	35 (4%)
<$1000	169 (20%)
$1001-$3000	344 (41%)
>$3001	295 (35%)
Patient had braces: yes	97 (11%)

based on the materials used in an earlier study by Inglehart and Boone[32] for rating health care providers. Because of this process, each of the 5 personality factors was assessed with a different number of adjective pairs because the authors of the original study had included varying numbers of items to measure each factor. The second part of the survey asked the respondents to indicate on a 7-point answer scale (1, "not at all," to 7, "very much") how much they agreed with 10 statements about their behavioral intentions to interact with the depicted person in personal and professional settings. The final section of the survey assessed the respondents' background characteristics (sex, age, ethnicity or race, years of education, and income) and their experiences related to orthodontic treatment.

Statistical analysis

The data were analyzed with SPSS software (version 17.0; SPSS, Chicago, Ill).[33] Descriptive statistics were used to provide an overview of the respondents' characteristics and the frequencies and average responses to the adjective pair questions and the behavioral intention questions. A factor analysis was used to analyze the factor structure of the 42 adjective pairs and a second factor analysis to analyze the factor structure of the 10 behavioral intention items to identify which items could be combined to construct indexes. The answers to the adjective pair "attractive/unattractive" were not included in this analysis because the answers to this single item served as the indicator of the respondents' attractiveness ratings. The reliability of the indexes was determined with Cronbach alpha reliability coefficients. The
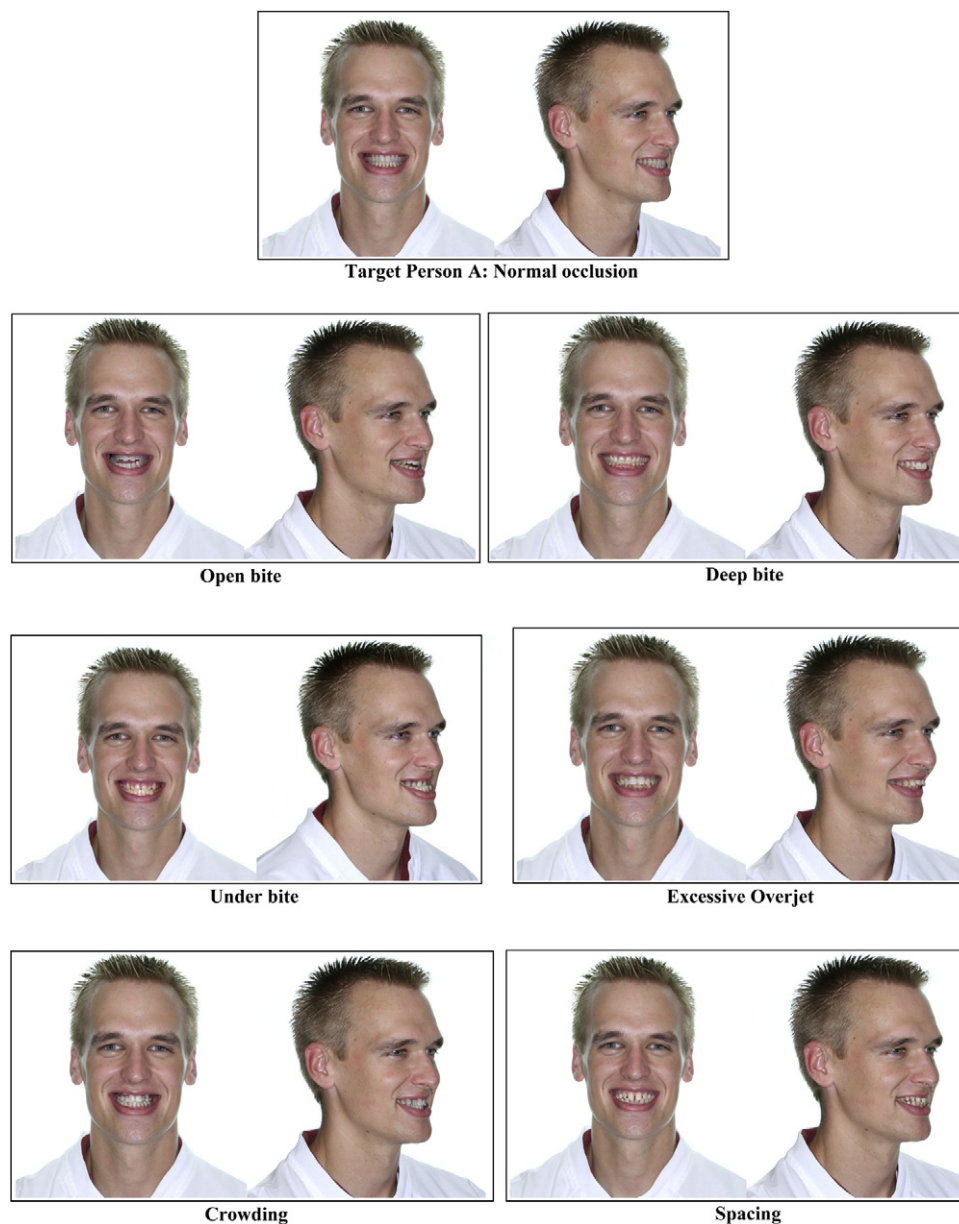
Fig 1. Sample set of male photographs.

responses of different groups of respondents were compared with univariate analyses of variance (ANOVA). In addition to reporting the significance level of the main effect of "type of occlusion," post hoc comparisons were used to analyze whether the average ratings under the condition of "normal occlusion" differed significantly from the average ratings of each of the 6 conditions of "malocclusion." A *P* value less than 0.05 was considered statistically significant.

To identify the adjective pairs that could be used to construct indexes for the dependent variables of target

person's attractiveness, intelligence, and the 5 personality descriptors of neuroticism, extraversion, agreeableness, conscientiousness, and openness, a factor analysis (extraction method, principal component analysis; rotation method, varimax) was conducted with all adjective pairs except the pair "attractive/unattractive." This adjective pair was used as the attractiveness indicator. The results of the factor analysis showed that the remaining 42 adjective pairs loaded, as predicted, on 6 factors. The responses to the items loading on each of these 6 factors were averaged to create indexes, which
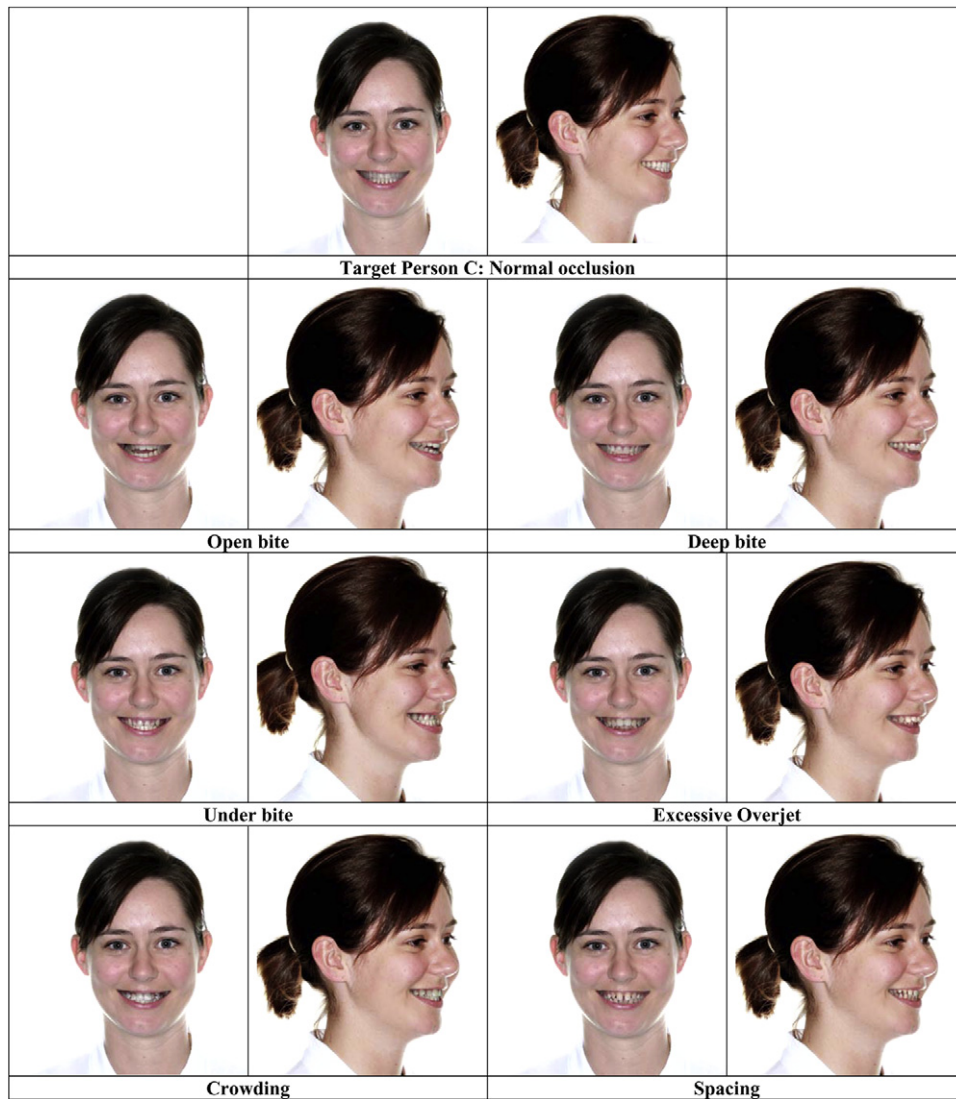
Fig 2. Sample set of female photographs.

can be interpreted as the 5 personality factors and an intelligence factor. Four items (eg, "unintelligent /intelligent" and "dumb/knowledgeable") loaded on a factor interpreted as the "intelligence" factor (reliability: Cronbach alpha = .808), 16 items (eg, "dishonest/trustworthy" and "lazy/disciplined") loaded on the "conscientiousness" factor (alpha = .928), 5 items (eg, "undesirable/desirable" and "not hygienic/hygienic") on the "agreeableness" factor (alpha = .849), 7 items (eg, "depressed/positive" and "angry/happy") on the "neuroticism" factor (alpha = .838), 3 items ("unimaginative/creative" and "not artistic/artistic") on the "openness" factor (alpha = .618), and 3 items ("introverted/outgoing" and "shy/confident") on the "extraversion" factor (alpha = .708).

A second factor analysis (extraction method, principal component analysis; rotation method, varimax) was conducted with the 10 items used to assess the respondents' behavioral intentions concerning interactions with the depicted persons. This factor analysis showed that all 10 items loaded on 1 factor. The items were therefore combined into 1 index called "behavioral intentions" (alpha = .959).

RESULTS

A central objective of this study was to determine whether a target person would be perceived differently if his or her photo displayed a normal occlusion or a malocclusion. Table II shows that the attractiveness and

Table II. Average ratings of faces with normal occlusion vs those with malocclusions

| Characteristics* | Normal occlusion n = 126 | Malocclusions | | | | | | P† |
		Open bite n = 121	Deepbite n = 132	Underbite n = 121	Overjet n = 133	Crowding n = 125	Spacing n = 123	
Attractiveness	5.43	4.79	5.22	4.60	4.71	4.94	4.72	<0.001 a, c, d, e, f
Intelligence	5.43	5.04	5.26	4.91	5.17	5.12	4.97	0.01 a, c, e, f
Personality traits								
Conscientiousness	5.18	5.21	5.02	4.92	5.20	5.08	4.86	0.047 c, f
Agreeableness	4.36	4.04	4.15	4.00	3.93	4.15	3.92	0.039 a, c, d, f
Neuroticism	2.50	2.56	2.55	2.84	2.77	2.67	2.73	0.179
Lack of openness	3.42	3.47	3.53	3.63	3.46	3.40	3.66	0.512
Extraversion	5.21	4.91	4.87	4.61	4.79	4.92	4.77	0.019 b, c, d, f
Behavioral intention								
Index: desire to interact	4.75	4.65	4.51	4.25	4.54	4.42	4.37	0.089

*Scores ranged from 1 (lowest expression) to 7 (highest expression) of the characteristic; †In addition to reporting the significance of the main effect of the factor "occlusion status" in the univariate ANOVA, the results of post hoc comparisons are also reported. A significant difference between the mean in the condition "normal occlusion" and the mean in the respective condition of malocclusion is represented by the letters: *a*, difference between normal occlusion and open bite; *b*, difference between normal occlusion and deepbite; *c*, difference between normal occlusion and underbite; *d*, difference between normal occlusion and overjet; *e*, difference between normal occlusion and crowding; *f*, difference between normal occlusion and spacing.

intelligence ratings of the depicted persons with normal occlusion and the 6 malocclusions differed significantly. The target persons with normal occlusion were rated as most attractive and most intelligent, and the target persons with an underbite were rated least positively. Concerning the ratings of the 5 personality dimensions, the data showed that the assessments of the target persons' conscientiousness, agreeableness, and extraversion differed significantly. The targets with normal occlusion were evaluated as most extraverted and most agreeable and conscientious. Target persons with an underbite were rated as the least extraverted, and target persons with generalized spacing received the worst ratings of conscientiousness and agreeableness.

Concerning the observers' intentions to interact with the target persons, Table II shows that the intentions to interact with the person with an underbite were again the most negative.

In addition to reporting the significance level of the main effect "type of occlusion," Table II also reports the findings of post hoc comparisons that analyzed whether the responses in the condition "normal occlusion" differed significantly from the average ratings of each of the 6 conditions of "malocclusion." The post hoc comparisons of the differences between normal occlusion and open bite were significant for the ratings of attractiveness, intelligence, agreeableness, and tentatively for extraversion (*a* in the last column of Table II).

Concerning the average responses under the condition "deepbite," the post hoc comparisons showed that only the extraversion ratings differed significantly from these ratings under the condition "normal occlusion" (*b* in the last column of Table II). However, the average ratings under the condition "underbite" did differ significantly from the average ratings under the condition "normal occlusion" (*c* in the last column of Table II) as did the average ratings under the condition "spacing" (*f* in the last column of Table II). In addition, the post hoc comparisons of the attractiveness, intelligence, agreeableness, and extraversion ratings under the condition of "overjet" (*d* in the last column of Table II), and the attractiveness, intelligence, and extraversion ratings under the condition "crowding" (*e* in the last column of Table II) differed significantly from these average ratings in the condition "normal occlusion."

The second objective was to investigate whether the target person's sex would affect observers' perceptions of the target persons and their behavioral intentions. Table III shows that the main effect "sex" was significant for all dependent variables other than the personality characteristic "extraversion." Women were on average more positively evaluated than men. Women were rated as more attractive, more intelligent, more conscientious, less neurotic, and more open to experiences, and the observers desired more strongly to interact with women compared with men.

Table III. Average ratings of male and female targets with different occlusions

| Characteristics* | Target sex | Normal occlusion | Malocclusions | | | | | | P (sex) P (interaction)† |
			Open bite	Deepbite	Underbite	Overjet	Crowding	Spacing	
Attractiveness	Male	5.19	4.57	5.14	4.21	4.41	4.54	4.69	<0.001
	Female	5.68	5.00	5.31	4.97	5.05	5.33	4.76	0.442
Intelligence	Male	5.35	4.89	5.22	4.59	4.94	4.81	4.80	<0.001
	Female	5.51	5.18	5.31	5.20	5.45	5.43	5.13	0.386
Personality traits									
Conscientiousness	Male	4.82	5.05	4.90	4.66	4.78	4.93	4.55	<0.001
	Female	5.58	5.36	5.16	5.15	5.70	5.22	5.19	<0.055
Agreeableness	Male	4.17	3.88	4.16	3.73	3.63	4.03	3.85	<0.001
	Female	4.58	4.19	4.15	4.25	4.28	4.26	4.00	0.292
Neuroticism	Male	2.63	2.70	2.57	3.04	2.99	2.80	2.84	<0.001
	Female	2.36	2.41	2.53	2.64	2.49	2.54	2.62	0.813
Lack of openness	Male	3.55	3.49	3.57	3.71	3.74	3.69	3.80	<0.001
	Female	3.29	3.45	3.47	3.55	3.13	3.10	3.52	0.323
Extraversion	Male	5.27	4.86	4.86	4.51	4.70	5.00	4.74	0.591
	Female	5.15	4.97	4.89	4.71	4.89	4.84	4.81	0.888
Behavioral intention									
Index: desire to interact	Male	4.45	4.36	4.31	3.77	4.17	3.90	4.07	<0.001
	Female	5.05	4.93	4.76	4.68	4.98	4.96	4.69	0.538

*Scores ranged from 1 (lowest expression) to 7 (highest expression) of the characteristic; †The first P value in each cell refers to the significance level for the main effect of sex, and the second P value in each cell refers to the significance level of the interaction effect between sex × malocclusion.

Table IV. Average ratings of malocclusions by younger vs older respondents

| Characteristics* | Age (y) | Normal occlusion | Malocclusions | | | | | | P (age) P (interaction)† |
			Open bite	Deepbite	Underbite	Overjet	Crowding	Spacing	
Attractiveness	<55	5.22	4.39	4.98	4.40	4.12	5.02	4.41	<0.001
	≥55	5.59	5.08	5.41	4.80	5.08	4.83	5.12	<0.001
Intelligence	<55	5.43	4.72	5.16	4.87	5.06	5.09	4.84	0.030
	≥55	5.39	5.25	5.32	5.04	5.23	5.11	5.08	0.660
Personality traits									
Conscientiousness	<5	4.98	5.01	4.78	4.77	5.25	5.13	4.80	0.006
	≥55	5.35	5.39	5.23	5.12	5.17	4.97	4.90	0.125
Agreeableness	<55	4.26	3.94	4.02	3.91	3.84	4.16	3.85	0.066
	≥55	4.41	4.12	4.28	4.12	3.98	4.08	4.02	0.957
Neuroticism	<55	2.53	2.50	2.62	2.83	2.80	2.58	2.66	0.499
	≥55	2.52	2.58	2.53	2.90	2.74	2.77	2.86	0.940
Lack of openness	<55	3.12	3.52	3.67	3.75	3.74	3.21	3.64	0.426
	≥55	3.52	3.41	3.44	3.46	3.31	3.58	3.78	0.117
Extraversion	<55	5.16	4.91	4.68	4.62	4.35	4.77	4.79	0.038
	≥55	5.23	4.94	4.96	4.69	5.04	5.00	4.70	0.290
Behavioral intention									
Index: desire to interact	<55	4.64	4.35	4.42	4.28	4.60	4.49	4.29	0.225
	≥55	4.81	4.87	4.54	4.32	4.51	4.30	4.50	0.555

*Scores ranged from 1 (lowest expression) to 7 (highest expression) of the characteristic; †The first P value in each cell refers to the significance level for the main effect of age, and the second P value in each cell refers to the significance level of the interaction effect between age × malocclusion.

The third objective focused on whether observers with different characteristics varied in their evaluations of adults with different occlusions. The effects of the observers' sex, ethnicity or race, age, income, educational level, and history of previous orthodontic treatment were assessed. ANOVA tests with "type of occlusion" and each of these observer characteristics as the second factor were conducted to explore this third objective. The results showed that the respondents' sex had no impact on their ratings of the targets with the different occlusions, nor did their ethnicity or race, income, or previous history of orthodontic treatment. However,

Table V. Average ratings of different malocclusions by respondents with fewer vs more years of education

Characteristics*	Education (y)	Normal occlusion	Malocclusions						P (education) P (interaction)†
			Open bite	Deepbite	Underbite	Overjet	Crowding	Spacing	
Attractiveness	1-12	5.47	4.85	5.24	4.64	4.87	4.94	4.95	0.165
	≥13	5.37	4.72	5.19	4.52	4.58	4.94	4.57	0.972
Intelligence	1-12	5.59	5.12	5.38	5.17	5.28	5.34	5.19	<0.001
	≥13	5.26	4.92	5.14	4.74	5.08	4.99	4.77	0.976
Personality factors									
Conscientiousness	1-12	5.23	5.41	5.28	4.98	5.40	5.09	5.00	0.001
	≥13	5.11	5.06	4.83	4.86	5.05	5.04	4.77	0.724
Agreeableness	1-12	4.39	4.29	4.33	4.02	4.04	4.37	4.02	0.003
	≥13	4.30	3.79	4.01	3.97	3.86	3.99	3.89	0.696
Neuroticism	1-12	2.37	2.57	2.50	2.73	2.63	2.57	2.71	0.067
	≥13	2.65	2.52	2.63	2.95	2.88	2.74	2.73	0.923
Lack of openness	1-12	3.36	3.26	3.32	3.63	3.26	3.01	3.67	<0.001
	≥13	3.56	3.64	3.74	3.63	3.66	3.65	3.67	0.303
Extraversion	1-12	5.32	4.85	4.86	4.87	4.81	4.73	4.87	0.496
	≥13	5.09	5.01	4.82	4.42	4.76	5.07	4.72	0.311
Behavioral intention									
Index: desire to interact	1-12	4.68	4.89	4.49	4.23	4.64	4.68	4.62	0.042
	≥13	4.77	4.41	4.47	4.36	4.48	4.23	4.18	0.339

*Scores ranged from 1 (lowest expression) to 7 (highest expression) of the characteristic; †The first *P* value in each cell refers to the significance level for the main effect of education, and the second *P* value in each cell refers to the significance level of the interaction effect between education × malocclusion.

when the responses of younger respondents (<55 years of age) were compared with those of older respondents (≥55 years), several significant results were found. As can be seen in Table IV, older respondents rated the target persons as more attractive, more intelligent, more conscientious, and more extraverted. In addition, the observers' level of education also affected some ratings. Table V shows that the observers with less education (high school diploma or less, 1-12 years of education) were less critical than the observers with more than a high school education (≥13 years of education) in their evaluations of the targets. Less educated respondents rated the targets as more intelligent, more conscientious, more agreeable, and more open than did respondents with 13 or more years of education. In addition, less educated respondents generally reported a stronger average desire to interact with the target persons overall than did the more educated respondents.

DISCUSSION

We analyzed whether the same target person is perceived differently depending on the type of occlusion exhibited, and whether the target person's occlusion status affects observers' desire to interact with this person. Prior research demonstrated that the ratings of a person's attractiveness depended on this person's occlusion status.[7,8,12] Shaw et al[13] even showed that occlusion affected some additional ratings related to intelligence

and personality. However, our research went beyond previous studies in 3 ways. First, with the target persons presented not only frontally, but also from a three-quarters view, the observers could have a more realistic appreciation of the effects of the various malocclusions. This three-quarters view could be interpreted as more representative of a "social view" of others than a lateral view. Second, we took a comprehensive approach to assessing person perception by including a complete set of personality characteristics as dependent variables as well as behavioral intention assessments. The personality characteristics were carefully selected based on the well-accepted 5-factor model of personality, which ensures a comprehensive assessment of the depicted person's personality.[25-28] Third, a quasi-experimental approach was used to explore whether different malocclusions affect person perceptions and behavioral intentions.[34] For this purpose, the photos of 2 male and 2 female faces of average attractiveness were consistently manipulated to show the depicted persons with a normal occlusion and with the 6 malocclusions. This design allowed every aspect of the photos to remain constant, while only manipulating the occlusion status when asking subjects to rate the faces. This procedure ensured that all characteristics other than malocclusion status were consistent and thus allowed assessment of the effects of the malocclusion status on person perceptions and behavioral intention ratings. These stimuli were then randomly assigned to subjects. This procedure

made the analysis of the first objective concerning the effects of the different types of occlusion a quasi-experimental study. However, by including analyses concerning the effects of certain subject characteristics such as sex and age, the effects of several measured variables were explored as well.

The results showed that the ratings of target persons with a normal occlusion were in general most positive compared with the ratings of the same persons whose photos had been manipulated to show one of the 6 malocclusions. The photos showing the target persons with normal occlusion were evaluated as most attractive, most intelligent, most agreeable, most extraverted, and very conscientious. Whereas these results concerning person perception confirm prior research findings, they go beyond those findings by taking a comprehensive analysis of the situation.[6,8,9,12,14] They analyze the complexity of person perceptions by including the 5 well-established personality factors, and they explore the differences in person perceptions of 6 types of malocclusion.

The findings also showed that persons with certain malocclusions such as an underbite were viewed as least attractive, least intelligent, and least extraverted, and that persons with generalized spacing issues were rated as least conscientious and least agreeable. Additionally, we took a first attempt at measuring behavioral intentions. The data showed that the differences in the behavioral intention ratings were not significant. However, it would be interesting to conduct further research on the impact of malocclusion on actual behavior.

In addition to the occlusion and malocclusion statuses of the target person, the target person's sex had a significant influence on person perceptions and behavioral intentions overall. Female target persons were in general perceived more positively compared with male target persons; this was previously found by some other researchers.[23] However, this was a main effect, and there was no interaction effect with the target persons' sex and their occlusion status. No matter whether target persons had a normal occlusion or a malocclusion, female targets were perceived more positively on average than were male targets. This finding contradicts some earlier studies that showed that female subjects were judged more severely by others, and that a female with an unattractive dental region was at a particular disadvantage compared with males.[12,13] However, 2 crucial differences between earlier findings and our findings were (1) that the target photos in this research showed the male and female targets in white clinic coats, thus identifying them as dentists or clinicians in general; and (2) that the respondents were dental patients. Future research should explore whether these facts affect attractiveness and personality ratings.

Finally, the analyses of the effects of observer characteristics on person perceptions and behavioral intentions showed that, although the observers' sex, ethnicity or race, income, and prior experiences with orthodontic treatment did not affect these outcomes, their age and education level significantly affected some evaluations. Older subjects ($\geq$55 years) were in general less critical than younger subjects (<55 years), and less well-educated subjects (<12 years of education) were less critical than subjects with more education ($\geq$12 years). Concerning the effects of age, additional analyses showed that it was a life-span developmental process and not merely a function of younger subjects differing from older subjects. Correlational analyses showed that the observers' age was significantly correlated with the attractiveness ratings (r = .23; P <0.001), the intelligence ratings (r = .12; P <0.001), several personality ratings (conscientiousness: r = .13; P <0.001; desirableness: r = .12; P <0.001; extraversion: r = .12; P <0.001), and behavioral intentions (r = .08; P = .02). The older the observers were, the more positively they rated the targets on all of these dimensions. This finding should be considered in the context that decisions in the workplace such as whether to hire and promote employees might be made by older and more educated supervisors; this would put employees with malocclusions potentially at a less serious disadvantage in the workplace. However, if employers are older, these effects would not be as detrimental compared with employers who are younger.

This study had some limitations. First, concerning the target photos, only photos of European American targets in their 20s were used. Further research could explore whether age and ethnicity of targets affect person perceptions and behavioral intentions to interact. Second, this study was conducted in the United States, and it is unclear how much the US media culture might have affected these findings. Cross-cultural studies could explore whether this effect is a general or a culturally determined outcome. Third, by having each subject rate only 1 photo, individual idiosyncrasies in responding to photos could not be explored; this increased the error variance of the responses. If the subjects had rated several photos, individual differences in responses could have been considered in the analyses. Fourth, this study was an initial step to exploring the role of malocclusion for social interactions. Using a survey to assess behavioral intentions to interact with a person can be seen as quite valuable because research showed that behavioral intentions are the best predictors of actual behavior.[35,36] However, an experimental study in a behavioral setting could be helpful in determining the actual effects of malocclusion on social interactions in private and work-related settings.

Finally, it might be worthwhile to reflect on the difference between statistically significant differences and clinically significant findings in regard to the results. Because the reported statistical differences are mostly in the positive range of responses, one might question to which degree a person's malocclusion might affect others' responses in real-life interactions. Although this question of external validity of findings is a general issue for all quasi-experimental studies, these findings can clearly be seen as a first step to show the changes in others' perceptions when patients receive orthodontic treatment and change their appearance after treatment. It would be interesting to conduct future research that explores changes in person perceptions of patients before and after they received orthodontic treatment in a longitudinal study.

CONCLUSIONS

Occlusion status has a significant influence on how adults perceive and evaluate other adults. Malocclusions affect ratings of attractiveness, intelligence, and personality, as well as behavioral intentions to interact with others. Judgments that are negatively influenced by the effects of malocclusion might leave those without a normal occlusion at a social disadvantage and professionally handicapped. Although the targeted person's sex did affect perceptions and behavioral intentions in general, it did not interact with the malocclusion status to affect ratings of attractiveness, intelligence, personality, and behavioral intentions to interact with the target persons. Two observer characteristics—age and level of education—did affect some overall ratings. Older observers were more generous in the attractiveness and intelligence ratings as well as in the ratings of the target person's conscientiousness and extraversion than were younger observers. Less educated persons rated the depicted persons' intelligence, conscientiousness, agreeableness, and lack of openness less harshly than observers with a higher level of education.

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