Occlusal traits and perception of orthodontic need in eighth grade students

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Psychosocial issues have long been implicated in the demand for orthodontic treatment.[1-13] Many researchers have investigated the relationship between self-perception of malocclusion and actual clinical status, and they generally concur that self-awareness and clinical status are moderately to poorly correlated.[2,14-19] However, these investigations have often looked only at individuals who have already concluded that they need orthodontic care and have presented at an orthodontic clinic or practice.[7,20,21] A self-selection bias may exist in such groups, and findings may not be applicable to the entire population. Furthermore, some studies are retrospective in nature and depend on responses from study participants,[11,22] again leading to the potential for bias because more severe malocclusion traits may be recalled more readily than less severe ones.

Recent studies of untreated subjects have evaluated adults in efforts to elucidate factors that motivate them to seek orthodontic treatment.[17,18,23-26] But are adolescents motivated by the same factors? An investigation of untreated subjects in this age group seemed warranted in order to study associations between clinically assessed traits of occlusion and subjects' self-perception of occlusion and the perceived need for treatment.

A study was undertaken in which eighth-grade public school children were queried about their perceived need for braces and concern for dental appearance. Clinical data on the subjects were also collected so that the relationship between self-perception and clinical status in a group of orthodontically untreated adolescents could be assessed.

Abstract

In 1994, 1155 eighth-grade students in Alachua County, Fla., were asked about self-perception of and level of concern for their occlusal status. Clinical assessments of orthodontic parameters were also recorded. Twenty-five percent of the students had a history of orthodontic treatment. Of the remaining students who had no history of orthodontic treatment, 74% reported satisfaction with the way their teeth looked, 64% expressed no perceived need for braces, and 57% were judged clinically to have optional or no orthodontic needs. Sex, soft tissue profile, overjet, anterior crowding, and molar classification were significantly associated with the perception of need for braces while race and overbite were not. Clinical judgment of orthodontic need differed significantly among levels of satisfaction with teeth. Eighth graders with no history of orthodontic treatment were generally satisfied with the appearance of their teeth and perceived less need for braces than clinicians.

Keywords

Malocclusion • Self-concept • Perceived need • Esthetics

Submitted: August 1995 **Revised and accepted:** May 1996 Angle Orthod 1998;68(2):107-114.

Table 1
Descriptive statistics and clinical features for students without previous orthodontic treatment.

Categorical variables		N	%
Sex:	Female	392	45.6
	Male	468	54.4
Race:	Black	371	43.2
	White	455	53.0
	Other	32	3.7
Soft tissue profile:	Class I	587	68.7
	Class II	240	28.1
	Class III	27	3.2
Overbite:	0 none	56	6.5
	1 >0 to 33%	428	49.7
	2 >33 to 66%	237	27.5
	3 >66 to 100%	121	14.1
	4 >100%	19	2.2
Orthodontic referral status:	Immediate need	49	5.7
	Soon	102	11.8
	Recommended	217	25.2
	Optional	220	25.6
	No need	273	31.7

Continuous variables	N	Mean	SD	Min.	Max.
Age (years)	857	14.35	0.53	12.67	16.31
Overjet (mm)	861	3.21	1.73	-5	11
PAR component of upper anterior crowding	859	2.02	2.38	0	15
PAR component of lower anterior crowding	859	1.43	2.04	0	13
PAR component total anterior crowding	859	3.45	3.63	0	25
PAR index combined	826	12.06	9.51	0	61
Molar class*, left (1/4 cusp units)	841	-0.25	1.21	-5	4
Molar class*, right (1/4 cusp units)	836	-0.18	1.20	-4	5

* Number of 1/4 cusp units deviation from Class I where numbers < 0 represent Class II deviations and numbers > 0 represent Class III deviations

Materials and methods

In the spring of 1994, the Department of Orthodontics at the University of Florida conducted orthodontic screening examinations on 1155 eighth-grade public school children at seven middle schools in Alachua County, Fla. Three orthodontists and one orthodontic resident assessed occlusal parameters by visual examination.[27] No radiographs were taken. Wax bite impressions were taken of all subjects for later calculation of the Peer Assessment Rating (PAR) index.[28] The following orthodontic parameters were recorded:

1. Soft tissue assessment of profile: Class I, II, or III
2. Overjet: measured to nearest mm
3. Overbite: estimated visually by thirds of incisor overlap categorized 0 to 4, with 0 = no overlap, 1 = 1/3 incisor overlap, etc.
4. Right and left molar classification: scored in one-quarter cusp increment deviations from Class I
5. Orthodontic referral status: immediately, soon, recommended, optional, or none
6. Maxillary and mandibular anterior crowding, scored by PAR index categories[28] that record crowding from the mesial contact of one canine to the mesial contact of the contralateral canine. Scores for each tooth range from 0 (0-1 mm discrepancy) to 5 (impacted tooth).

Additional variables considered for analysis included:

1. Total molar class discrepancy: a summary score combining right and left molar classifications based on the molar classification described above
2. Total anterior crowding: sum of upper and lower anterior crowding
3. PAR index, using combined weighting[29]

Note that overbite, crowding, right and left molar classification, and total molar class discrepancy were not expressed in mm but were classified by categories. Although raw data recorded right and left molar occlusions as Angle classes, the scoring system for total molar class discrepancy did not distinguish between Class II and Class III deviations. Demographic variables of age, sex, and race were also recorded.

Prior to collection of clinical data, each child was asked four questions and, where appropriate, two follow-up questions, regarding self-perception of occlusion and need for orthodontic treatment. Students who presented with braces or reported a history of orthodontic treatment were excluded from analysis. Data from the remaining children were analyzed to assess rela-

tionships among clinicians' findings and children's attitudes and perceptions toward their occlusion and need for braces.

Descriptive statistics were used to characterize the sample. Associations between students' perceptions, sex, and race were examined with chi-square tests of association. Relationships between clinical variables and perception variables were assessed using chi-square tests for categorical variables, Wilcoxon rank sum test for ordinal variables, and one-way analysis of variance for continuous variables. All statistical tests were two-sided, with p-values of less than 0.05 considered statistically significant.

To further investigate the relationship between perceived need for braces and clinical parameters, a logistic regression analysis was performed. Subjects responding "Yes, a little" and "Yes, a lot" were combined into the "Yes" category. In the first phase of modeling, clinical variables were considered for inclusion in the model using a forward selection procedure. Independent variables available for selection were: overjet, overbite, profile, molar class score (left and right), total molar class discrepancy, upper anterior crowding, lower anterior crowding, total anterior crowding, and sex.

In the second phase of modeling, the remaining perception variables (self-perception of need had already been designated the outcome variable) and the orthodontist's evaluation of orthodontic referral status were added to determine if these variables improved the clinical variable model, and, if so, whether the risks associated with the clinical parameters would change. Using the four clinical variables identified in the first phase of modeling, we tested for model improvement due to the inclusion of one or more of the three remaining perception variables (coded as yes/no) and the orthodontic referral status variable.

From the logistic regression analysis, an "odds ratio (OR)" or "relative risk" of increased perceived need for braces in the presence of a specific characteristic was estimated. Thus the likelihood that perceived need for braces was increased by the presence and/or severity of each of these characteristics (e.g., overjet, sex) could be assessed. For example, the "risk" for self-perceived need for braces may be increased by a specific amount (odds ratio) for girls compared with boys when sex is added to the logistic regression model. An OR = 1 for a specific variable of interest (characteristic) means that there is no association between that variable and the "risk" of self-perception of need for braces. An OR > 1 for a given variable implies an increased likelihood of perceiving a need for braces in the presence of that variable. For each unit-increase in the variable (e.g., crowding), the estimated odds of perceiving a need for braces increases by the size of the odds ratio. An increase in the variable of two units increases the likelihood of perceiving a need for braces by the square of the OR, a three-unit increase in the variable increases the likelihood of perceiving a need for braces by the cube of the OR, etc.

Results

One-quarter (26%) of the 1155 students who were initially screened gave a positive history of orthodontic treatment and were eliminated from further analysis. Thus, the final sample size was 861. The sample was 54%female, 46% male. Whites comprised 54% of the sample, blacks 43%, and other ethnic groups, primarily Hispanic and Asian, 4%. A summary of demographic and clinical parameters is displayed in Table 1.

Table 2 presents the results of the perception questions by sex and race. Almost two-thirds (64%) of the group expressed no self-perceived need for braces. One-fourth (26%) were not satisfied with the way their teeth looked. When the influence of sex and race was examined, females were significantly more likely than males to perceive a need for braces, less likely to be satisfied with dental appearance, and more likely to have a perception of increased overjet; race differences were not detected. Females expressed more concern than males for anterior crowding but not for increased overjet in those cases where there was a perception of "crooked teeth" or teeth that "stuck out." Again, race differences were not demonstrated.

The perception of need for braces ("Do you think you need braces?") was analyzed for its associations with the PAR index and the clinical variables of overjet, maxillary and mandibular anterior crowding, and molar classification. Values for the PAR index, overjet, maxillary and mandibular anterior crowding, and molar classification were significantly different between all pairwise comparisons among the three response levels ("No" vs. "Yes, a little"; "No" vs. "Yes, a lot"; and "Yes, a little" vs. "Yes, a lot"). Soft tissue profile was significantly associated with perception of need for braces (χ^2 p-value = 0.000) as was orthodontic referral status (Wilcoxon rank sum p-value = 0.0001). Overbite, however, was not a significant factor (Wilcoxon rank sum p-value = 0.3472).

Analysis of the influence of clinical variables

Table 2
Response distribution to questions on self-perception of orthodontic need

	N	% no	% yes, a little	% yes, a lot	Chi-square *p*-value
1. Do you think you need braces?					
Overall	858	64.34	23.43	12.24	
Female	389	56.04	29.31	14.67	<0.001
Male	468	71.15	18.59	10.26	
Black	370	63.78	24.59	11.62	0.669
White	454	64.76	22.91	12.33	
Other	32	65.63	15.63	18.75	
2. Are you satisfied with the way your teeth look?					
Overall	858	26.22	43.42	30.54	
Female	391	35.29	41.43	23.27	<0.000
Male	466	18.67	44.85	36.48	
Black	369	25.75	43.63	30.62	0.422
White	455	27.25	41.76	30.99	
Other	32	18.75	59.38	21.88	
3. Do you think your front teeth are crooked?					
Overall	858	70.28	22.61	7.11	
Female	390	67.69	24.87	7.44	0.310
Male	467	72.38	20.77	6.85	
Black	370	72.97	20.81	6.22	0.171
White	454	67.40	24.89	7.71	
Other	32	81.25	9.38	9.38	
4. If so, does this bother you?					
Overall	244	57.85	27.69	14.46	
Female	121	49.59	29.75	20.66	0.008
Male	121	66.12	25.62	8.26	
Black	94	61.70	24.47	13.83	0.845
White	142	54.93	30.28	14.79	
Other	5	60.00	20.00	20.00	
5. Do you think your teeth stick out?					
Overall	858	81.35	14.45	4.20	
Female	390	76.67	17.18	6.15	0.002
Male	467	85.22	12.21	2.57	
Black	370	79.46	15.68	4.86	0.708
White	454	82.82	13.66	3.52	
Other	32	81.25	12.50	6.25	
6. If so, does this bother you?					
Overall	148	51.35	29.05	19.59	
Female	82	46.34	30.49	23.17	0.328
Male	66	57.58	27.27	15.15	
Black	72	55.56	27.78	16.67	0.818
White	71	46.48	30.99	22.54	
Other	5	60.00	20.00	20.00	

and of the PAR index on satisfaction with appearance of teeth ("Are you satisfied with the way your teeth look?") revealed significant differences between response levels ("No"; "Yes, a little"; and "Yes, a lot") and the PAR index, overjet, and anterior crowding. No differences were detected for right and left molar class variables, unlike with the perception of need for braces. Orthodontic referral status differed significantly with level of satisfaction (Wilcoxon rank sum *p*-value = 0.0001), but associations with profile and overbite did not reach statistical significance (χ^2 *p*-value = 0.084 and Wilcoxon rank sum *p*-value = 0.2882, respectively).

Variables describing maxillary anterior crowding, mandibular anterior crowding, and total anterior crowding were analyzed for their influence on the perception of crooked front teeth. Table 3 presents the PAR scores for total anterior crowding. Subjects who perceived increased crowding in their anterior teeth had significantly greater crowding confirmed clinically. However, no differences in the severity of crowding between different levels of concern were detected when those children who perceived that their front teeth were crooked were asked how much they were bothered by it.

Overjet differed significantly among the three response groups for the question, "Do you think your teeth stick out?" (Table 3). Further analysis of those children who felt that their teeth stuck out revealed significant differences in severity of overjet between groups that were bothered "A little" and "A lot" by their overjet.

Of the 818 subjects with data available for the variables used in the logistic regression analysis, 35.8% reported a perceived need for braces. Variables selected, estimated odds ratios, and 95% confidence intervals are listed in Table 4. Interaction terms were also considered for inclusion; however, none of these significantly improved the model. Lack of fit was not detected (Hosmer-Lemeshow test, p=0.313).

Inclusion of each of the perception variables and orthodontist's assessment of orthodontic referral status significantly improved the model; additionally, an interaction term between total molar class discrepancy and total anterior crowding also significantly improved the model. The odds ratio estimate of less than one indicated that the joint effect of total molar class discrepancy and anterior crowding was less than the combination of their individual effects. The results of this analysis are presented in Table 4. Lack of fit was not indicated (Hosmer-Lemeshow, p=0.435).

Table 3
Associations between self-perception and clinical assessments of anterior crowding (combined upper and lower crowding PAR score) and overjet

Self-perception questions	Response levels "A lot"	"A little"	"No"	*p*-value (ANOVA)
Do you think your front teeth are crooked?	6.00 ± 4.92 (PAR score)	4.85 ± 4.19 (PAR score)	2.71 ± 2.89 (PAR score)	$p<0.05$ All response levels differ from one another
If so, does this bother you?	5.89 ± 5.08 (PAR score)	5.04 ± 4.23 (PAR score)	4.96 ± 4.27 (PAR score)	$p=0.53$
Do you think your teeth stick out?	5.08 ± 2.59 mm	4.04 ± 1.77 mm	2.97 ± 1.56 mm	$p<0.05$ All response levels differ from one another
If so, does this bother you?	4.90 ± 1.76 mm	3.67 ± 1.77 mm	4.38 ± 2.15 mm	$p<0.05$ "A lot" and "A little" differ from each other

Discussion

Three-quarters (74%) of those eighth-grade public school children examined in Alachua County, Fla. in the spring of 1994 had no previous history of orthodontic treatment. Of this untreated group, 57% were judged by a panel of examining orthodontists as having optional or no orthodontic needs, and 43% demonstrated clinical need for orthodontic treatment. Since this estimate excluded children who had previously sought orthodontic care, the actual prevalence of treatment need in this sample of eighth-graders was underestimated. These findings fall within the range of unmet need described in other recent investigations.[30-35]

While 57% of the subjects were classified as having no treatment need, 64% of the subjects judged themselves as having no need for braces. Recent studies of young adults have documented low demand for braces or low perceived need for orthodontic treatment in the presence of demonstrated clinical need.[24,36] Demographic factors that have been shown to be significantly associated with increased perception of and desire for orthodontic treatment include level of education,[36] socioeconomic status,[37] greater local prevalence of treatment,[24] and proximity of orthodontists.[37] One study suggested that those who had been previously treated orthodontically may have had their awareness of ideal occlusion enhanced by treatment and therefore are more cognizant of deviations from ideal.[26]

Slightly more than a quarter (26%) of our sample reported they were not satisfied with the appearance of their teeth. This is lower than Howell found in a recent survey of 13- to 17-year-old dental patients with no previous orthodontic treatment, where 42% expressed dissatisfaction with the appearance of their teeth.[34] Females in our study demonstrated more concern for appearance (35%) than males (19%), a finding consistent with previous studies.[8,15,19,22,25,37]

Self-perception questions were limited to the anterior teeth because previous studies have demonstrated that lay and public awareness of malocclusion is almost exclusively limited to the anterior dentition.[17,18,20,22,23,38] In general, the adolescents examined in this study were satisfied with the appearance of their teeth. It is noteworthy that 81% did not believe their front teeth stuck out, despite clinical evidence to the contrary. Previous studies have revealed that excess overjet is the most salient feature of malocclusion that influences perceived need for or demand for treatment.[20,22] However, Helm and coworkers found that only overjets in excess of 6 mm in females and 9 mm in males led to concern for dental appearance.[22] Because their study was retrospective in nature and relied on subjects' recall of self-perception of occlusal traits 15 years earlier, only the most extreme deviations may have been remembered. Holmes found in her study of 955 12-year-old children that 36.5% of those with overjets 6 to 9 mm expressed concern, while there was no apparent concern reported by subjects with overjets of 3.5 to 6 mm.[19]

Table 4
Logistic regression results for modeling of perceived need for braces

Variable	Odds ratio(estimate)	95% Confidence interval
Phase 1		
Overjet	1.159	(1.057-1.272)
Total anterior crowding	1.281	(1.215-1.352)
Molar class discrepancy	1.085	(1.000-1.178)
Sex (female)	2.513	(1.815-3.484)
Phase 2		
Overjet	1.042	(0.933-1.163)
Total anterior crowding	1.201	(1.112-1.297)
Molar class discrepancy	1.079	(0.932-1.249)
Sex (female)	1.709	(2.257-2.525)
Molar class discrepancy X total crowding	0.973	(0.949-0.998)
Happy with teeth	0.167	(0.107-0.261)
Teeth stick out	2.622	(1.602-4.290)
Crooked teeth	3.365	(2.239-5.058)
Orthodontic referral status*	0.682	(0.567-0.825)

*Coded from 1 (immediate need) to 5 (no need)

Our findings also suggest that excess overjet is well tolerated, but only 31 subjects presented with overjet greater than 6 mm, a sample size too small to draw inferences about extreme overjet.

Subjects' perceived need for braces was adequately explained by one statistical model using the variable of gender and the clinical features of overjet, anterior crowding, and total molar class discrepancy. The inclusion of total molar class discrepancy was somewhat surprising since, in general, patients are aware only of anterior occlusal traits.[17,18,20,22,23,38] If total molar class discrepancy were associated with the same variation explained by overjet, it would not have improved the model significantly. No explanation for inclusion of this variable was readily apparent, but it may reflect suggestions of orthodontic need that subjects had received from previous dental visits or earlier orthodontic screenings. The addition of the three remaining self-perception variables and orthodontic referral status further improved the model of perceived need for braces. The likelihood of perceiving need for treatment that was associated with the clinical variables remained similar (although their estimation was less precise due to the number of variables in the second model). In the first model a female subject was 2.51 times more likely to perceive a need for braces than a male subject for each increase in level of perceived need. Inclusion of the additional variables in the second model diminished the odds that female subjects would be more likely than males to perceive a need for braces from 2.51 to 1.71. This reduction in odds ratio was due to the sex differences that were observed in the responses to the three self-perception variables in the second model. With all other variables held constant, those who were satisfied with the way their teeth looked were one-sixth less likely to perceive a need for braces (odds ratio = 0.167) than those who were not happy with the way their teeth looked.

A particularly intriguing group in our study was the one with both the greatest satisfaction with appearance of teeth and also the highest perceived need for braces. Not only did this group have the highest self-perceived need for braces, but it was also characterized by the highest overjet and greatest total molar class discrepancy. Only nine subjects fell into this category, but such findings have been previously documented.[17,19,24,36] and lend support to Albino's sug-

gestion that the effect of dentofacial attractiveness on the formation of self-esteem may warrant re-evaluation.[8]

Continued investigation of personality traits and the development of self-concept in adolescents may elucidate the factors that create dissatisfaction with occlusion and perception of need for orthodontic treatment. Such research may help explain the often-observed discordance between clinical findings and demand for orthodontic treatment. However, the universal impression of clinicians that a patient's self-esteem does improve after orthodontic treatment may not be justified in the typical orthodontic patient. It is also possible that the standardized self-concept/self-esteem tests used thus far have not been administered at appropriate times or lack the sensitivity to identify improvements in self-esteem that accompany orthodontic treatment. Further investigation in this area may help clarify these issues.

Conclusions

Based on our study of 861 eighth grade students in public middle schools in Alachua County, Fla., we draw the following conclusions:

1. Sixty-four percent of untreated eighth grade students who were judged to have orthodontic treatment need reported no self-perceived need for braces.
2. Twenty-six percent of the individuals in this sample were not satisfied with the way their teeth looked.
3. Females demonstrated less satisfaction than males with the appearance of their dentition and were more likely to perceive a need for braces.
4. Racial differences in satisfaction with appearance of teeth or self-perceived need for braces were not detected.
5. Clinical parameters of overjet, anterior crowding, molar relationships, and soft tissue profile were significantly associated with perceived need for braces.
6. Psychosocial concerns appear to influence perception of need for braces and satisfaction with dental appearance.

Acknowledgments

This work was supported by NIH grant award DE08715.

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