Original Article

Extraversion and openness to experience moderate the relationship between orthodontic treatment need and oral health-related quality of life in adolescents: *A cross-sectional study*

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ABSTRACT

Objective: To investigate the effects of personality traits to moderate the relationships between orthodontic treatment need and oral health-related quality of life (OHRQoL) in adolescents.

Materials and Methods: A cross-sectional study was performed that included 230 subjects (125 girls and 105 boys) aged 11–14 years. Orthodontic treatment need was measured using the Index of Complexity, Outcome and Need (ICON). The Child Perceptions Questionnaire, the Basic Personality Traits Inventory (BPTI), and the Revised Life Orientation Test were used to assess the OHRQoL, basic personality dimensions, and dispositional optimism respectively. Potential moderation effects were evaluated with Spearman's correlations and multiple regression analyses.

Results: There were weak correlations between orthodontic treatment need and quality of life with social and emotional well-being dimensions ($r = 0.238$, $r = 0.296$ and $r = 0.209$). A moderating effect of extraversion was observed in the relationship between orthodontic treatment need and OHRQoL, emotional well-being, and social well-being (SWB) ($\Delta R^2 = 0.03$, $\Delta R^2 = 0.02$, and $\Delta R^2 = 0.04$, respectively). Openness to experience affected relationships between orthodontic treatment need and OHRQoL, and emotional well-being (EWB) ($\Delta R^2 = 0.03$ and $\Delta R^2 = 0.04$, respectively). In children with higher extraversion, the increase in ICON scores resulted in less increase in CPQ total, EWB, and SWB scores. In children with higher openness to experience, the increase influenced CPQ total and EWB scores similarly.

Conclusions: The relationship between orthodontic treatment need and quality of life is moderated by personality traits. Early adolescents with higher extraversion and openness to experience are less affected by increased orthodontic treatment need. (*Angle Orthod.* 2018;88:617–623.)

KEY WORDS: Oral health related quality of life; Malocclusion; Orthodontic treatment need; Personality; Optimism

INTRODUCTION

Accepted as a state of deviation but not a disease, malocclusion has diverse impacts on different individuals. Although some children suffer from even minor dental irregularities, others may not mind greater occlusal problems.[1] A conventional explanation for the disparities between clinical findings and their impacts on the quality of life can be found in the "Wilson and Cleary model," which theoretically links the biological and physiologic variables of the individual patient with the overall quality of life through the effects of environmental and individual characteristics.[2] According to this model, oral health-related quality of life (OHRQoL) of children with malocclusion is expected to take shape from the interactions of clinical, personal, and environmental factors.

The complex nature of OHRQoL research makes it necessary to understand the effects of these factors and to control them during clinical trials when patient-reported outcomes are to be assessed.[3–5] Indeed, there are several studies in the medical literature that were

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carried out to identify the effects of personality factors on the health-related quality of life for various disorders. More recently, orthodontic patients also became subject to this kind of research assessing the relationships between certain personality traits and OHRQoL. The results from those studies have shown that personality factors such as self-esteem, self-consciousness, or psychological well-being are associated with the OHRQoL in children with malocclusions.[3,5–9]

A popular approach to investigate personality is the five-factor model. The five-factor model is based on the study of trait adjectives people use to describe themselves or others,[10] the lexical hypothesis that indicates that every important individual difference has to be represented by an adjective in any given culture.[11] The method enables identification of the basic dimensions of personality, combining traits that are defined as consistently cognitive, emotional, and behavioral patterns.[12] Another personality factor shown to be related with general health-related quality of life is dispositional optimism. It is defined as the expectation that good things will happen. Optimism disposition produces different behavioral patterns and coping strategies against problems and is therefore regarded as an important personality factor.[13] However, only one published study was found on the comprehensive evaluation of personality traits[4] in adult orthodontic patients, whereas no published study was found investigating dispositional optimism in relation to OHRQoL in orthodontic patients.

The aim of this study was to investigate the possible moderation effects of the basic personality dimensions and dispositional optimism on the relationship between orthodontic treatment need and OHRQoL in adolescent orthodontic patients. The null hypothesis was that personality traits do not moderate the relationship between orthodontic treatment need and OHRQoL.

MATERIALS AND METHODS

All 11- to 14-year-old children who applied for orthodontic consultations at the department clinic of the Van Yüzüncü Yil University between April 17, 2014 and February 1, 2015 were asked to fill out the questionnaire. Children with mental problems, reading difficulties, or craniofacial conditions were excluded. Researchers checked the questionnaires and made sure all of the questions were answered before participants left the clinic. Age, gender, and sociodemographic data were recorded. A priori sample size estimation was not performed.

Description of the Questionnaire

The questionnaire used in the study was the Turkish version of the Child Perceptions Questionnaire 11–14[14,15] (CPQ 11–14) to assess OHRQoL. CPQ 11–14 was developed to be used in 11- to 14-year-old children with dental, oral, and orofacial problems. The questionnaire included 37 questions addressing the dimensions of oral symptoms (n = 6), functional limitations (n = 9), emotional well-being (n = 9) and social well-being (n = 13). Response options were; "0 = Never," "1 = Once/twice," "2 = Sometimes," "3 = Often," and "4 = Every day/almost every day." Higher CPQ 11–14 scores indicate worse quality of life.

The Basic Personality Traits Inventory (BPTI) was used to assess personality traits. This inventory was developed for the Turkish culture on the basis of a five-factor model of personality by Gençöz and Öncül.[16] However, the factor structure revealed six basic personality dimensions: extraversion, conscientiousness, agreeableness, neuroticism, openness to experience, and negative valence (negative self-attribution). The inventory consisted of 45 items and response options ranging from 1 (totally disagree) to 5 (totally agree).[16]

The last part of the questionnaire consisted of the revised version of the Life Orientation Test (LOT-R).[17] The LOT-R included eight statements and five response options ranging from "I agree a lot" to "I disagree a lot." The Turkish version of the scale was developed by Aydın and Tezer[18] and was revised by Türküm.[19] Higher LOT-R scores indicated higher optimism disposition.

Clinical Measures

Patients' objective orthodontic treatment needs were assessed using the Index of Complexity, Outcome and Need (ICON).[20] Esthetic assessment, amount of crowding or spacing in the upper arch, crossbites, overbite–open bite and anteroposterior relation of the buccal segments were graded in the orthodontic treatment need assessment using the ICON index.

Dental health status was recorded with the DMFT (decayed, missing, or filled teeth) index. The DMFT score was calculated for each subject as the sum of the decayed, missing, and filled teeth. Congenitally absent teeth were not included.

Ethical Approval

Ethical approval was granted by the Ethics Committee of the Van Yüzüncü Yil University, Faculty of Medicine. Assent was obtained from participants and informed consent from their guardians.

Statistical Analysis

Descriptive statistics (mean and standard deviation) were performed for each of the scales. Independent *t*-

tests were used to compare the main variables between genders. Moderation effects of personality traits on the relationship between orthodontic treatment need and OHRQoL were tested with Spearman's correlation coefficients and multiple regression. *P* values smaller than .05 were considered to be statistically significant. Statistical evaluation of the data and creation of the moderation plots were performed with the IBM SPSS Statistics software package ver. 21.0 (IBM Co., Armonk, New York, USA).

RESULTS

A total of 230 patients (125 girls and 105 boys) with a mean age of 12.48 ± 1.1 participated in the study. A post-hoc power analysis showed that 81% power was achievable in the models with an overall r^2 of 0.15 and an r^2 increase of 0.03 due to the moderator variable.

Descriptive statistics for orthodontic treatment need, OHRQoL and personality trait scores are summarized in Table 1. According to the independent *t*-test results, girls and boys had similar levels of orthodontic treatment need. However, girls had significantly higher levels of emotional well-being scores, indicating a worse emotional situation. When compared for personality traits, girls were found to be more agreeable, and boys were more open to experience and negative valence.

According to the intercorrelations (Table 2), orthodontic treatment need was weakly associated with total OHRQoL and its emotional and social well-being subscales. In addition, there were weak negative associations between orthodontic treatment need and extraversion and dispositional optimism. Modest to weak associations were observed between OHRQoL and some of the personality traits. Although extraversion, openness to experience, and dispositional optimism were negatively associated with much of the quality of life scores, neuroticism was positively associated with all subdimensions except for social well-being. On the other hand, conscientiousness (negatively) and negative valence (positively) had only very weak associations with the oral symptoms subscale. Agreeableness had no significant association with the OHRQoL.

For each of the dependent variables (OHRQoL and subdomains) ICON scores were tested to determine if they were significant predictors. According to the results, ICON scores significantly predicted overall quality of life, emotional well-being, and social well-being but did not predict oral symptoms and functional limitations. Therefore, moderation hypotheses were tested for overall OHRQoL, emotional well-being, and social well-being using multiple regression models. Before the regression analyses, the independent variables (ICON scores and personality traits) were mean centered as suggested by Aiken and West.[21] In the first step, gender, age, DMFT scores, and ICON scores were entered in the regression models along with each of the personality trait scores one at a time. In the second step, non-significant predictors (gender and age in all cases and DMFT score in one case) were eliminated and the interaction of the mean-centered ICON score and the mean-centered personality trait score was added into the models.

Models with significant moderation effects are shown in Table 3. These moderations are also illustrated (Figure 1) by testing the conditional effects of ICON scores on OHRQoL at three levels of personality trait scores: one standard deviation below the mean, at the mean, and one standard deviation above the mean. The results showed that ICON score was significantly related to CPQ 11–14 total, emotional well-being, and social well-being scores, and extraversion significantly moderated these relationships ($\Delta R^2 = 0.03$, $\Delta R^2 = 0.02$, and $\Delta R^2 = 0.04$, respectively). When these interactions were probed, it was observed that the effects of malocclusion severity on the OHRQoL, emotional well-being and social well-being were reduced when extraversion was one standard deviation above the mean (Figure 1). In addition, openness to experience moderated the relationship between malocclusion severity and OHRQoL with its emotional well-being dimension ($\Delta R^2 = 0.03$ and $\Delta R^2 = 0.04$, respectively). The probing resulted in findings similar to those of extraversion in which a one standard deviation increase in openness to experience resulted in a weaker association between the malocclusion severity and OHRQoL domains (Figure 1).

DISCUSSION

The main question of this study was whether the relationship between orthodontic treatment need and OHRQoL was moderated by personality traits or not. The null hypothesis was rejected. The results showed that, in the presence of high levels of extraversion or openness to experience, adolescents were less affected by their malocclusions. Neuroticism and dispositional optimism were also associated with the OHRQoL. However, neither had an impact on its relationship with orthodontic treatment need.

This study had two main limitations. First, the study sample consisted of orthodontic consultation patients at a single center. Therefore, the results may not be generalizable. Replication of this study in non-clinical samples of adolescents in different cultures could be beneficial. Second, the directions of the associations could not be certainly established because of the cross-sectional design of the study. Although person-

Table 1. Descriptive Statistics for the Main Variables (n = 230)

Variable	Mean (SD)	Mean Girls (SD) (n = 125)	Mean Boys (SD) (n = 105)
Orthodontic treatment need			
ICON	57.6 (21.7)	59.1 (22.0)	55.9 (21.3)
OHRQoL			
Oral symptoms	7.8 (3.4)	7.5 (2.8)	8.1 (4.0)
Functional limitations	8.7 (5.2)	8.4 (5.0)	9.0 (5.4)
Emotional well-being	12.3 (8.2)	13.3 (8.6)	11.0 (7.4)*
Social well-being	10.8 (7.9)	11.0 (8.3)	10.6 (7.4)
Total	39.5 (19.9)	40.1 (20.0)	38.7 (19.9)
Personality traits			
Extraversion	27.5 (6.1)	26.9 (6.4)	28.2 (5.7)
Conscientiousness	31.6 (5.1)	31.9 (5.1)	31.4 (5.1)
Agreeableness	35.2 (4.0)	35.7 (3.6)	34.5 (4.2)*
Neuroticism	23.0 (6.9)	23.3 (7.1)	22.6 (6.5)
Openness to experience	22.8 (4.0)	22.3 (4.2)	23.5 (3.7)*
Negative valence	11.4 (3.0)	10.9 (3.0)	12.1 (3.0)**
Dispositional optimism	17.4 (3.5)	17.5 (3.8)	17.2 (3.3)

* $P < .05$; *** $P < 0.01$.

ality traits are considered as stable and consistent characteristics,[22] controlled, longitudinal studies are necessary for definite conclusions.

Caspi et al.[23] summarized the possible sources of the associations between health and personality. According to the authors, personality traits may (1) directly affect health like bruxing; (2) affect health through behaviors like smoking, or (3) affect individual responses to clinical symptoms. According to the results of this study, the third statement by Caspi et al.[23] seems to apply to adolescent orthodontic patients as well. Wrosch and Scheier[22] also suggested that personality traits may have effects on the quality of life through their effects on people's reactions to certain situations. The current results were in accordance with this perspective along with the conceptualization of the quality of life by Wilson and Cleary, which was mentioned earlier.[2]

The moderation effect of personality traits on the relationship between malocclusion severity and OHRQoL was previously demonstrated by Agou et al.[3] The authors reported that self-esteem was a more salient determinant of the OHRQoL than objective measures of malocclusion in Canadian adolescents seeking orthodontic treatment. This finding is logically linked to the results of the current study considering the associations between self-esteem and the basic dimensions of personality, especially extraversion.[4] Extraversion is characterized by frequent experiences of positive mood and rejoice in social attention.[24,25] Indeed, the results showed that patients with high levels of extraversion were less affected by their malocclusions in terms of overall OHRQoL, emotional well-being, and social well-being.

Another significant moderator was openness to experience. In cases of high levels of openness to experience, patients' OHRQoL and emotional well-being were less affected by their malocclusion severity. According to McCrae and Costa, openness to experience, which is characterized by a broader and deeper

Table 2. Intercorrelations Between the Main Variables

	ICON	OS	FL	EWB	SWB	CPQ Total	E	C	A	N	O	NV	DO
Age	0.145*	0.063	0.038	0.131*	0.063	0.099	−0.021	−0.052	−0.078	0.067	−0.008	−0.119	−0.015
ICON		0.042	0.107	0.209**	0.296**	0.238**	−0.206**	0.036	0.014	−0.019	−0.123	0.084	−0.136*
Oral symptoms			0.589**	0.341**	0.355**	0.605**	−0.155*	−0.135*	−0.058	0.157*	−0.096	0.187**	−0.167*
Functional limitations				0.482**	0.509**	0.759**	−0.304**	−0.014	−0.050	0.168*	−0.235**	0.121	−0.184**
Emotional well-being					0.691**	0.866**	−0.193**	−0.071	0.086	0.235**	−0.191**	0.009	−0.252**
Social well-being						0.871**	−0.243**	0.096	0.061	0.099	−0.112	0.100	−0.152*
CPQ total							−0.280**	−0.018	0.036	0.206**	−0.200**	0.107	−0.240**
Extraversion								0.074	0.022	−0.166*	0.218**	−0.162*	0.286**
Conscientiousness									0.530**	−0.295**	0.398**	−0.072	0.419**
Agreeableness										−0.130*	0.405**	−0.025	0.313**
Neuroticism											−0.120	0.313**	−0.286**
Openness to experience												0.082	0.395**
Negative valence													−0.124
Dispositional optimism													1

* $P < .05$; *** $P < .01$; **** $P < .001$.

Table 3. Regression Models for the Significant Moderation Effects of Personality Traits on the Relationship Between Orthodontic Treatment Need and Quality of Life

	B	SE B	β	ΔR^2	ΔF
Dependent variable: CPQ total					
Step 1					
DMFT	2	2.2	0.2**	0.16	14***
ICON	0.14	0.06	0.15*		
Extraversion	−0.8	0.20	−0.25***		
Step 2					
ICON × extraversion	−0.04	0.01	−0.16**	0.03	6.9**
Dependent variable: CPQ total					
Step 1					
DMFT	2	0.63	0.19**	0.13	11.1***
ICON	0.17	0.06	0.18**		
Openness to experience	−0.72	0.31	−0.15*		
Step 2					
ICON × openness to experience	−0.04	0.01	−1.7**	0.03	7.42**
Dependent variable: Emotional well-being					
Step 1					
DMFT	0.63	0.26	0.15*	0.09	7.2***
ICON	0.06	0.03	0.15*		
Extraversion	−0.22	0.09	−0.17*		
Step 2					
ICON × extraversion	−0.01	0.01	−0.1*	0.02	4.7*
Dependent variable: Emotional well-being					
Step 1					
ICON	0.07	0.02	0.19**	0.07	8.7***
Openness to experience	−0.33	0.13	−0.16*		
Step 2					
ICON × openness to experience	−0.02	0.01	−0.2**	0.04	9.6**
Dependent variable: Social well-being					
Step 1					
DMFT	0.76	0.24	0.19**	0.15	13.7***
ICON	0.08	0.02	0.23***		
Extraversion	−0.27	0.08	−0.21**		
Step 2					
ICON × extraversion	−0.01	0.01	−0.2**	0.04	11.4**

* $P < .05$; *** $P < .01$; **** $P < .001$.

scope of awareness, is not directly related to well-being but may amplify positive or negative affect.[26] One possible explanation for the protective effect in the current results may be the success of open adolescents in adapting to their malocclusions. However, further research is necessary to confirm and explain the mechanisms of this finding.

No other study was found in the orthodontic literature that tested a similar hypothesis in an adolescent patient sample. Nevertheless, Clijmans et al.[4] investigated the moderating effects of basic personality dimensions on the OHRQoL in an adult patient sample from Belgium. The authors reported significant associations between certain personality traits and OHRQoL. However, they concluded that there was no evidence supporting the moderation effects of personality traits on the association between orthodontic treatment need and OHRQoL. The disagreement between the current results and Clijmans et al.[4] could be caused by differences between the samples' ages, cultures, or the use of different measures for orthodontic treatment need and OHRQoL.

Additionally, the results demonstrated once again that orthodontic treatment need is weakly associated with OHRQoL and its emotional and social well-being dimensions in adolescents. This finding is consistent with previous studies,[27–30] and can be explained by (1) the general motivation of orthodontic patients to improve their appearance and (2) the exceptional functional and symptomatic problems reported by patients who have common malocclusions. The weakness of these associations highlights the importance of orthodontic treatment decisions for individual patients. According to the results of the present study, subjective impact of malocclusion results from the interactions of clinical and personal factors. Therefore, use of self-reported quality of life measures during orthodontic consultations may facilitate OHRQoL improvements for future orthodontic patients.

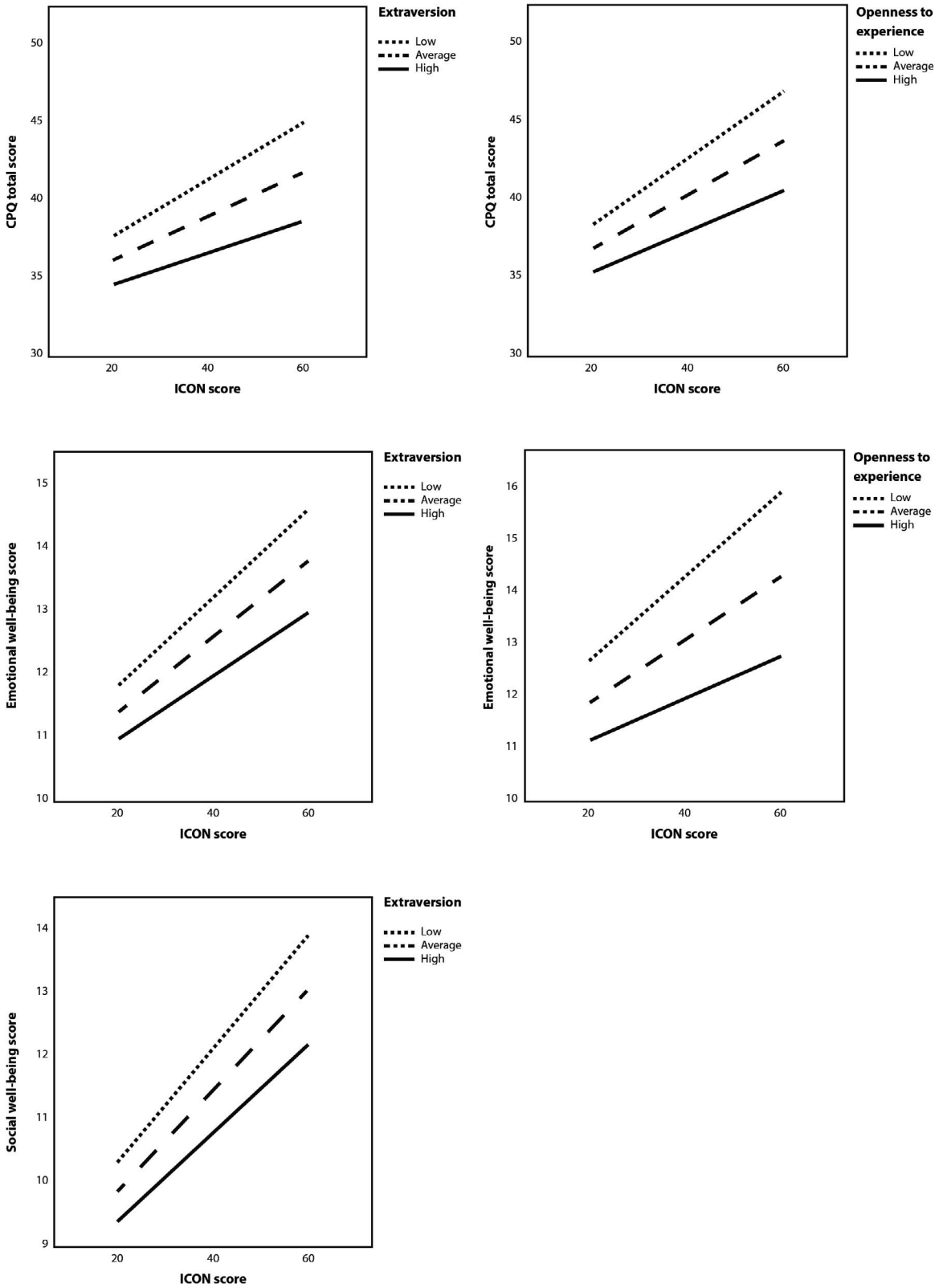

Figure 1. ICON score relationships showing that children with lower levels of extraversion and openness to experience reported greater CPQ 11–14, social well-being, and emotional well-being scores (worse OHRQoL).

CONCLUSIONS

- OHRQoL is associated with extraversion, openness to experience, neuroticism, and optimism disposition in adolescents.
- Extraversion and openness to experience seem to have protective effects on the OHRQoL, social well-being, and emotional well-being against malocclusion severity.

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