

# Effect of refractive error on temperament and character properties

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## Abstract

• **AIM:** To determine the effect of refractive error on temperament and character properties using Cloninger's psychobiological model of personality.

• **METHODS:** Using the Temperament and Character Inventory (TCI), the temperament and character profiles of 41 participants with refractive errors (17 with myopia, 12 with hyperopia, and 12 with myopic astigmatism) were compared to those of 30 healthy control participants. Here, temperament comprised the traits of novelty seeking, harm-avoidance, and reward dependence, while character comprised traits of self-directedness, cooperativeness, and self-transcendence.

• **RESULTS:** Participants with refractive error showed significantly lower scores on purposefulness, cooperativeness, empathy, helpfulness, and compassion ( $P < 0.05$ ,  $P < 0.01$ ,  $P < 0.05$ ,  $P < 0.05$ , and  $P < 0.01$ , respectively).

• **CONCLUSION:** Refractive error might have a negative influence on some character traits, and different types of refractive error might have different temperament and character properties. These personality traits may be implicated in the onset and/or perpetuation of refractive errors and may be a productive focus for psychotherapy.

• **KEYWORDS:** astigmatism; character; hyperopia; refractive error; temperament

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## INTRODUCTION

Refractive error refers to the limited ability of the eye's optical system to focus light rays properly on the retina. Refractive errors are common in the population with a prevalence rate of up to 60%<sup>[1,2]</sup>. There are three main types of refractive errors: myopia, hyperopia, and astigmatism. For myopia, the most common cause is that the eyeball's axial length is slightly longer than normal, which results in parallel light rays focused in front of the retina. For hyperopia, in which light rays are focused behind the retina, the most common cause is that the eyeball's axial length is shorter than normal. Lastly, for astigmatism-the eye's inability to sharply focus a point object on the retina-is caused by the difference of degree of refraction in different meridians of the cornea or lens.

To analyze the personality in seven dimensions, a dimensional approach for determining the psychobiological model of personality dependent on temperament and character was developed by Cloninger *et al*<sup>[3]</sup>. While the traits of novelty-seeking, harm avoidance, reward dependence, and persistence constitute temperament in this model, the traits of self-directedness, cooperativeness, and self-transcendence constitute character. The model has a strong relationship with adult character dimensions that mature during adulthood<sup>[3]</sup>, and the homogeneity and independence from others makes Cloninger's<sup>[4]</sup> a strong approach for evaluating character and temperament.

Regarding the four traits of temperament, novelty seeking refers to a heritable tendency toward intense exhilaration or excitement in response to novel stimuli. Another heritable tendency-harm avoidance-refers to reacting intensely to average stimuli that result in behavioral inhibition in order to avoid punishment. Yet another heritable trait-reward dependency-means to react intensively to reward signals in order to preserve or withstand the elimination of any new behavior connected to rewards or relief from punishment. Meanwhile, among traits the constitute character, self-directedness refers to being a mature, autonomous strong, self-sufficient, responsible, reliable, goal-oriented,

constructive, and well-integrated person; these self-determinant people have the willpower to overcome problems and meet predetermined aims. Cooperativeness refers to collaborating, empathizing, and having compassion as results of being socially tolerant, virtuous, and scrupulous. People willing to cooperate are empathic, tender, complaisant, scrupulous, and virtuous. Lastly, a person with self-transcendence can be described as unpretentious, satisfied, patient, creative, selfless, idealistic, and spiritual<sup>[4,5]</sup>.

Though refractive error is common, only a few studies have investigated psychiatric disorders in patients with refractive errors<sup>[6]</sup>. To the best of our knowledge, temperament and character properties in patients with refractive errors have not yet been studied. In this study, we thus aimed to evaluate temperament and character properties in patients with different types of refractive errors and to compare them with normal patients.

### SUBJECTS AND METHODS

Once approved by the institutional ethics committee of Atatürk Training and Research Hospital at Yildirim Bayezid University, this study recruited a sample of volunteer patients either with or without refractive errors. The study followed the tenets of the Declaration of Helsinki and was approved by the local ethics committee. All participants received oral and written information about the study and, prior to participating, each provided written informed consent. Participants were asked to complete the Turkish Temperament and Character Inventory (TCI) questionnaire, which comprises 240 self-report, true-or-false questions. Ultimately, the TCI evaluates seven higher-order temperament and three higher-order character traits. Temperament traits of novelty seeking, harm-avoidance, and reward dependence each have four lower-order traits; the character traits of self-directedness and cooperativeness each have five lower-order traits; and self-transcendence has three lower-order traits. Normative data and factorial structure analyses of the Turkish TCI index were performed by Köse *et al*<sup>[7]</sup>.

Statistical analysis was performed with the statistical package for social sciences (SPSS v. 16 for Windows; SPSS Inc., Chicago, IL, USA). Continuous variables were stated as mean  $\pm$ SD, while categorical variables were shown as percentages (%). Age and scale ratings between groups were compared by using a Student's *t*-test, while the differences between groups in categorical variables were measured using a Chi-square test. One way variance analysis (ANOVA) was used to determine the difference between the refractive statuses based on scale rating, and Scheffé's method was used for post hoc analysis. A *P* value of less than 0.05 was considered to be statistically significant.

**Table 1 Socio-demographic data of subjects with refractive error and emmetropics**

Parameters	Refractive error (n=41)	Emmetropics (n=30)	<i>P</i>
Age (a)	31.2 $\pm$ 6.5	29.8 $\pm$ 4.5	0.333
M/F <sup>b</sup>	19/22	19/11	0.156
Marital status <sup>b</sup>			0.372
Single	6 (14.6%)	7 (23.3%)	
Married	31 (75.6%)	18 (60.0%)	
Widow/divorced	4 (9.8%)	5 (16.7%)	
Education <sup>b</sup>			0.252
Primary	16 (39.0%)	8 (26.7%)	
Secondary	18 (43.9%)	12 (40.0%)	
College	7 (17.1%)	10 (33.3%)	

<sup>a</sup>Independent samples *t*-test; <sup>b</sup>Chi-square test.

### RESULTS

A total of 71 healthy patients, 41 with and 30 without refractive errors, were recruited for this study. As the sociodemographic features of the participants shown in Table 1 reveal, the two groups were similar according to age, sex, marital status, and highest level of education attained.

Analysis showed that participants with refractive errors had higher means for the high- and low-order traits of novelty seeking, shyness with strangers, and self-acceptance, though none were statistically significant. Participants with refractive errors showed statistically significant lower rates in all other types of high- and low-order scales. Compared to normal patients, those with refractive errors had statistically significant lower rates in the low-order traits of purposefulness, cooperativeness, empathy, helpfulness, and compassion (*P*<0.05, *P*<0.01, *P*<0.05, *P*<0.05, and *P*<0.01, respectively). The comparison of high- and low-order character trait rates in different kinds of refractive errors are shown in Tables 2 and 3.

Among participants with refractive errors, 12 had hyperopia, 12 had myopic astigmatism, and 17 had myopia. Dependence showed statistically significant lower rates (*P*<0.05) in participants with myopia compared to those with myopic astigmatism. A comparison of temperament-related high- and low-order trait rates in different kinds of refractive errors appears in Table 4. Self-directedness-a high-order trait of character-showed statistically lower rates in participants with myopia compared to those with myopic astigmatism (*P*<0.05). Additionally, myopic participants showed statistically significant lower rates than those with hyperopia in congruent second nature (*P*<0.05). Myopic-astigmatic participants revealed statistically significant higher rates than those with hyperopia (*P*<0.01) and myopia (*P*<0.05) in empathy and helpfulness, respectively. A comparison of character-related high- and low-order trait rates in different kinds of refractive errors is shown in Table 5.

## Temperament and character in refractive errors

**Table 2 High and low order trait rates of temperament in subjects with refractive error (Group I) and emmetropia (Group II)<sup>a</sup>**

Heritable tendency	Group I (n=41)	Group II (n=30)	P
Novelty seeking	22.0±3.6	20.7±3.5	0.121
Exploratory excitability	5.0±1.5	4.7±1.4	0.410
Impulsiveness	6.1±1.6	5.9±1.6	0.645
Extravagance	4.8±1.6	4.1±1.7	0.077
Disorderliness	6.2±1.8	6.1±1.7	0.714
Harm avoidance	16.3±3.8	16.8±3.8	0.644
Anticipatory worry	4.2±1.6	4.5±1.8	0.540
Fear of uncertainty	2.7±1.5	3.3±1.4	0.106
Shyness with strangers	4.2±1.5	3.7±1.3	0.152
Fatigability and asthenia	5.2±1.6	5.3±1.5	0.834
Reward dependence	12.1±3.3	12.7±2.3	0.405
Sentimentality	2.1±1.4	2.8±1.2	0.036
Attachment	3.8±1.4	3.7±1.3	0.798
Dependence	3.6±1.4	3.5±1.3	0.590
Persistence	2.5±1.4	2.7±1.6	0.671

<sup>a</sup>Independent sample *t*-test.

**Table 3 High and low order trait rates of character in subjects with refractive error (Group I) and emmetropia (Group II)<sup>a</sup>**

Characters	Group I (n=41)	Group II (n=30)	P
Self-directedness	17.2±4.1	17.6±5.5	0.699
Responsibility	4.0±1.5	4.2±2.0	0.540
Purposefulness	2.0±1.2	3.0±1.6	0.011 <sup>b</sup>
Resourcefulness	1.5±1.0	1.6±1.2	0.817
Self-acceptance	5.7±2.1	5.2±1.9	0.250
Congruent second nature	3.8±1.5	3.5±1.8	0.524
Cooperativeness	12.4±5.3	15.9±4.1	0.004 <sup>b</sup>
Social acceptance	2.0±1.4	2.6±1.4	0.074
Empathy	2.0±1.1	2.6±1.2	0.044 <sup>b</sup>
Helpfulness	3.0±1.3	3.7±1.3	0.044 <sup>b</sup>
Compassion	2.3±1.3	3.8±1.7	0.006 <sup>b</sup>
Integrated conscience	2.9±1.3	3.1±1.3	0.635
Self-transcendence	11.7±4.8	13.1±4.4	0.207
Self-forgetfulness	4.5±2.4	4.6±1.8	0.835
Transpersonal identity	3.0±1.9	4.1±2.1	0.032
Spiritual acceptance	4.2±1.9	4.5±1.9	0.587

<sup>a</sup>Independent sample *t*-test; <sup>b</sup>Statistically significant.

**Table 4 High and low order trait rates of temperament in subjects with different kind of refractive errors<sup>a</sup>**

Heritable tendency	Hyperopia (n=12)	Myopic-astigmatism (n=12)	Myopia (n=17)	P
Novelty seeking	22.6±3.0	21.9±2.2	21.7±4.7	0.782
Exploratory excitability	4.4±1.0	4.7±1.1	5.5±1.9	0.111
Impulsiveness	6.9±1.5	5.8±1.3	5.5±1.7	0.084
Extravagance	4.0±1.3	5.5±1.1	4.7±2.0	0.108
Disorderliness	7.2±1.8	5.8±1.3	5.7±1.8	0.054
Harm Avoidance	16.5±3.2	14.7±3.8	17.3±4.0	0.200
Anticipatory worry	3.9±1.6	4.3±1.6	4.4±1.8	0.731
Fear of uncertainty	2.5±1.7	2.1±1.2	3.2±1.4	0.131
Shyness with strangers	4.5±1.4	3.4±1.5	4.4±1.4	0.110
Fatigability and asthenia	5.4±1.4	4.9±1.5	5.2±1.8	0.739
Reward dependence	11.9±2.8	12.6±2.9	12.1±4.0	0.878
Sentimentality	2.2±1.6	2.0±1.6	2.1±1.3	0.922
Attachment	3.7±1.1	3.9±1.2	3.8±1.8	0.958
Dependence	3.3±1.3	4.6±1.3 <sup>b</sup>	3.2±1.2	0.015 <sup>c</sup>
Persistence	2.5±0.9	2.0±0.9	2.8±1.8	0.305

TCI: Temperament and Character Inventory. <sup>a</sup>One way analysis of variance: Results of Scheffe test; <sup>b</sup>Myopic-astigmatism>Myopia, *P*<0.05; <sup>c</sup>Statistically significant.

## DISCUSSION

This study aimed to evaluate the differences in temperament and character properties in patients either with or without refractive errors. Compared to normal patients, those with refractive errors had low rates for purposefulness, as well as low-order scale of self-directedness, empathy, helpfulness, compassion, and cooperativeness.

The temperament and character inventory-which analyze personality-has been used to assess psychiatric and neurologic diseases such as epilepsy [5,8]. It was also used to determine effect of other diseases on character properties, such as ankylosing spondylitis, cancer, chronic obstructive pulmonary disease, fibromyalgia, and psoriasis [9-13]. However,

very few studies have addressed the relationship between refractive error and temperament and character properties, and most of these are anecdotal [14]. Lanyon and Giddings [15] stated that myopic patients are more introverted, embarrassed, and egocentric, as well as less outgoing in social relationships; they also tend to have fewer friends, to prefer indoor activities to outdoor activities, and to participate in intellectual activities more often than other people. Lauriola [6] evaluated five different character properties-introversion, agreeableness, conscientiousness, neuroticism, and mental openness-and found that the more short-sighted the patient, the more he or she tended toward conscientiousness, introversion, and mental closeness. In a

**Table 5 High and low order trait rates of character in subjects with different kind of refractive errors<sup>a</sup>**

Characters	Hyperopia (n=12)	Myopic-astigmatism (n=12)	Myopia (n=17)	P
Self-directedness	17.2±2.5	19.7±4.0 <sup>b</sup>	15.4±4.3	0.018 <sup>c</sup>
Responsibility	4.1±1.4	4.3±1.3	3.7±1.7	0.560
Purposefulness	1.8±1.3	2.4±0.9	2.0±1.3	0.508
Resourcefulness	1.2±0.9	1.8±0.5	1.6±1.3	0.296
Self-acceptance	5.5±1.6	7.0±2.3	5.1±2.1	0.058
Congruent second nature	4.5±1.1 <sup>c</sup>	4.2±1.5	3.1±1.5	0.021 <sup>c</sup>
Cooperativeness	10.5±4.7	15.3±46.2	11.8±4.5	0.067
Social acceptance	1.4±1.3	2.5±1.2	2.1±1.6	0.137
Empathy	1.5±1.0 <sup>d</sup>	2.8±0.9	1.8±0.9	0.007 <sup>c</sup>
Helpfulness	3.1±0.9	3.8±1.2 <sup>b</sup>	2.5±1.4	0.045 <sup>c</sup>
Compassion	1.5±1.4	3.6±3.0	2.1±2.0	0.052
Integrated conscience	3.1±1.2	2.6±1.7	3.1±1.1	0.508
Self-transcendence	11.1±4.4	10.3±4.4	13.1±5.3	0.292
Self-forgetfulness	4.1±2.4	4.1±2.4	5.0±2.5	0.546
Transpersonal identity	2.3±1.7	2.8±1.8	3.6±1.9	0.151
Spiritual acceptance	4.8±1.7	3.4±1.5	4.5±2.2	0.209

<sup>a</sup>One way analysis of variance: Results of Scheffe test; <sup>b</sup>Myopic-astigmatism>Myopia,  $P<0.05$ ; <sup>c</sup>Hyperopia>Myopia,  $P<0.05$ ; <sup>d</sup>Hyperopia<Myopic-astigmatism,  $P<0.05$ ; <sup>e</sup>Statistically significant.

twin study with a large sample ( $n=2128$ ), openness was found to be a weak predictor of myopia. Being a predictor of myopia, openness and characteristics of being open are also characteristics of those with higher IQ. In 189 optometry students with personality differences determined by the Eysenck Personality Inventory (EPI) to be psychoticism, extraversion, and neuroticism, no relationship was found between refractive status and personality differences [16]. Also with the EPI, Cooke *et al* [17] found no association between personal characteristics in patients with myopia ( $n=75$ ) and keratoconus ( $n=118$ ). In a more recent study, myopic patients reported having less significant childhood stress than emmetropic patients, which suggests a different processing of stress between groups [18]. Using a Rorschach Test, Rosanes [19] evaluated patients either with or without refractive errors and reported that both patients with myopia and hyperopia showed significantly less expression of non-specific anxiety and hostility in comparison to healthy subjects. That study also found that the manner of expressing anxiety covertly in patients with myopia was a decrease in motor activity and in patients with hyperopia as an increase.

In our study, patients with refractive errors had low purposefulness, especially in goal-setting and goal-directed behaviors, and low cooperativeness properties compared to healthy controls. These results suggest that patients with refractive errors are less compassionate and more self-centered. The present study also showed that myopic-astigmatic patients are more dependent, helpful, and self-directed than simple myopic patients, while patients with hyperopia have more strongly compatible secondary characteristics and are weaker in empathy. These findings suggest that temperament and character are influenced not

only by presence of refractive error but also by the type of refractive error.

Regarding how psychological factors are related to refractive errors, Seidler [20] hypothesized that myopia is a result of a defense mechanism to tension that makes extraocular muscles tighten that eyeball, which directly causes refractive errors. Furthermore, tension causes a break in the separation-individuation process in which myopic patients undergo separation anxiety that results their sense of inability to cope with the world. Interestingly, patients with myopia have more castration anxiety than those with emmetropia [20]. At the same time, significant improvement in the visual acuity of nine myopic patients under direct hypnotic and posthypnotic suggestion was reported [21] and by extension, Sheehan *et al* [22] reported a significant increase in visual acuity in myopic patients 15min after such suggestion. In our study, myopic patients were found to have less expressed temperament and character than emmetropic ones, results which can be used in the treatment of refractive errors.

To the best of our knowledge, this study is the first to evaluate the effects of refractive error on temperament and character. Patients with refractive errors scored lower on cooperativeness than healthy patients. However, a major limitation of this study is its small sample, which makes it impossible to identify the relationship between refractive errors and properties of temperament and character. A larger sample would facilitate an improved assessment of any possible relationships, and a longitudinal study of the effects of temperament and character in adolescence on refractive status in adulthood would particularly provide better information.

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