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Research / Araştırma

Effects of Methylphenidate Treatment on Quality of Life in Adolescents

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ABSTRACT

Effects of methylphenidate treatment on quality of life in adolescents

Objective: Attention-deficit hyperactivity disorder (ADHD) is one of the most common childhood mental disorders. Improvement in quality of life is observed with the treatment of ADHD which is a chronic disorder that disrupts the quality of life. In this study, it was aimed to investigate the changes in symptoms of anxiety and depression associated with ADHD and quality of life of adolescents after methylphenidate treatment.

Method: Fifty patients between 13-18 years old, who admitted to Mersin University Medical Faculty Hospital Pediatric and Adolescent Psychiatry Outpatient Clinics; were diagnosed with ADHD; received methylphenidate treatment for the first time; and continued with the treatment for three months; were included in the study. Pretreatment and 3rd month results of Children's Depression Inventory (CDI), State-Trait Anxiety Inventory for Children (STAI-CH), and adolescent and parent forms of Pediatric Quality of Life Inventory™ 4.0 (PedsQL™ 4.0) were assessed by retrospectively screening of patient charts.

Results: After methylphenidate treatment, quality of life scores were improved, except for physical functioning. Quality of life scores were higher in adolescent reports, compared to parents. Male adolescents scored their quality of life more positively than girls before and after the treatment. In addition, anxiety symptoms improved after methylphenidate treatment.

Conclusion: It is important to determine the changes in quality of life with the treatment of ADHD in terms of emphasizing the importance of ADHD treatment, evaluating treatment outcomes, and establishing effective and sophisticated treatment plans.

Keywords: Attention-deficit hyperactivity disorder, methylphenidate, quality of life

ÖZ

Ergenlerde metilfenidat tedavisinin yaşam kalitesi üzerine etkisi

Amaç: Dikkat eksikliği hiperaktivite bozukluğu (DEHB) çocukluk çağında en sık görülen ruhsal bozukluklardan birisidir. Yaşam kalitesini bozan süreğen bir bozukluk olan DEHB'nin tedavisi ile yaşam kalitesinde iyileşme gözlenmektedir. Bu çalışmada metilfenidat tedavisi ile ergenin yaşam kalitesindeki ve DEHB'ye sıklıkla eşlik eden kaygı ve depresyon belirtilerindeki değişikliklerin incelenmesi amaçlanmıştır.

Yöntem: Mersin Üniversitesi Tıp Fakültesi Hastanesi Çocuk ve Ergen Ruh Sağlığı ve Hastalıkları Polikliniğine başvuran hastalardan DEHB tanısı almış 13-18 yaş arası, ilk kez metilfenidat başlanmış ve 3 ay tedavisi devam etmiş olan 50 olgu çalışmaya dahil edildi. Olguların arşiv dosyaları taranarak tedavi öncesinde ve 3 ay sonrasında uygulanan Çocuklar İçin Depresyon Ölçeği (ÇİDÖ), Çocuklar İçin Sürekli Kaygı Ölçeği (ÇİSKÖ), Pediyatrik Yaşam Kalitesi Envanteri™ (PedYK™ 4.0) ergen ve ebeveyn formları değerlendirildi.

Bulgular: Metilfenidat tedavisi sonucunda fiziksel işlevsellik puanı hariç yaşam kalitesi puanlarında yükselme gözlendi. Ergen ve ebeveyn formu karşılaştırıldığında, ergen formunda yaşam kalitesi puanlarının daha yüksek olduğu saptandı. Tedavi öncesinde ve sonrasında erkek ergenlerin kızlara kıyasla yaşam kalitesini daha olumlu puanladıkları gözlendi. Aynı zamanda, metilfenidat tedavisi ile kaygı belirtilerinde de iyileşme olduğu gözlendi.

Sonuç: DEHB'nin tedavisi ile yaşam kalitesindeki değişiklikleri saptamak, DEHB tedavisinin önemini vurgulamak, tedavi sonuçlarını değerlendirmek ve etkin, çok yönlü tedavi planları oluşturmak açısından önemli bir yer tutmaktadır.

Anahtar kelimeler: Dikkat eksikliği hiperaktivite bozukluğu, metilfenidat, yaşam kalitesi

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In this study, the data of the residency thesis of Canan Kuygun Karci was used.

INTRODUCTION

Attention-deficit hyperactivity disorder (ADHD) is a developmental disorder characterized by more frequent, persistent, or severe attention deficit and/or hyperactivity-impulsivity symptoms, compared with individuals of similar developmental status (1).

ADHD is one of the most common and most frequently investigated disorders in the field of child mental health. It has been reported that the frequency in school-age children varies from 3% to 8% and it is more common among males (2). ADHD leads to cognitive, academic, social, and emotional impairment (3).

As the perspective of "improving health" rather than "maintaining life" emerged as a treatment conception, assessment of quality of life has become increasingly important in improving both physical and mental health (4). From this point of view, there are a number of studies investigating the effects of ADHD symptoms, on quality of life (5-7). It has been reported that quality of life is impaired due to ADHD and it is improved with the treatment of ADHD symptoms (8). Assessment of ADHD treatment by quality of life is useful in assessing the psychosocial consequences of this disorder that are difficult to capture by evaluating only clinical manifestations (9). At the same time, symptom severity and the presence of co-morbid mental disorders also affect the quality of life (10).

There are a number of studies investigating the changes in the quality of life with medical treatment of ADHD symptoms. Most of these studies have been conducted with atomoxetine, whereas studies with methylphenidate (MPH) are fewer.

This study was planned in the light of the literature showing that quality of life improved in parallel with the treatment of ADHD symptoms. The aim of the study–that gives its originality–is to assess the effect of ADHD treatment with MPH on the quality of life of in adolescent sample.

METHOD

The sample of the study consisted of 50 patients between 13-18 years of age who applied to the Child and Adolescent Psychiatry Outpatient Clinic of Mersin University Medical Faculty between June and October 2012, who were diagnosed with ADHD according to DSM-IV-TR criteria and have received MPH treatment for the first time. The subjects who have maintained the treatment regularly for at least 3 months were included in the study. Psychosis, pervasive developmental disorder, and mental retardation patients were excluded from the study. ADHD and co-morbidity diagnoses were made according to DSM-IV diagnostic criteria via clinical interviews conducted by a child and adolescent psychiatrist. Mersin University Ethics Committee approved the study (10.05.2012/2012-192). Sociodemographic and clinical data were obtained by retrospective screening of patient files. Scores of the scales that were filled in by the subjects and their parents at the beginning of the treatment and at the end of the third month were included in the analysis.

Measures

State-Trait Anxiety Inventory for Children (STAI-CH): The State-Trait Anxiety Inventory developed by Spielberger consists of two 20 item subscales that measure consistent and state anxiety. Turkish validity and reliability study of the scale was made by Ozusta (11). The scale is answered by the child or the adolescent. The items of both subscales are scored from 1 to 3. Only the Trait Anxiety Inventory (TAI) was used in our study. Scores of TAI ranges from 20 to 60 points. Higher scores indicate higher anxiety levels (12).

Children's Depression Inventory (CDI): It was prepared by Kovacs (13) based on the Beck Depression Scale. Turkish validity and reliability study of the scale was made by Oy (14). The scale is answered by the child or the adolescent. The scale consists of 27 items. The subject is asked to choose best fit from 3 options in each item. Each item is scored as 0, 1, or 2. Total score ranges between 0-54 points. Cut-off point is 19 or above (13).

Pediatric Quality of Life Inventory™ 4.0 (PedsQL™ 4.0): It is a general quality of life scale, developed by Varni (15), that assesses the physical and psychosocial experiences of children and adolescents aged 2-18 years. The Turkish validity and reliability study of the 13-18 year old adolescent form, which is used in our study, was done by Memik et al. (16). The scale consists of a total of 23 items in 4 sub-parts: physical functioning, social functioning, emotional functioning, and school functioning. Each item is scored as 100 if "never" is marked; 75 if "almost never" is marked; 50 if "sometimes" is marked; 25 if "often" is marked; and 0 if "almost always" is marked. Finally the Physical Health Summary Score and the Psychosocial Health Summary Score–which is the sum of the social, emotional, and school functioning scores–were obtained. The subscale and total scores are obtained by dividing the scores with the number of filled items. The higher the scale score is the better the quality of life is assumed. We chose PedsQL™ 4.0 to use in our study because it includes adolescent and parental reporting. The possibility of evaluating the level of agreement between adolescent and parent about adolescent's quality of life increases the importance of the scale (17,18).

Statistical Analysis

SPSS 11.5 software (IBM) package was used to analyze the data. Mean and standard deviation values of the scale scores are presented as descriptive statistics. Number and percentage values were calculated for categorical variables. Shapiro Wilk test was used to evaluate normal distribution of continuous variables and it was seen that all the scale scores were not normally distributed. Scale scores of the two independent groups were compared with non parametric Man-Whitney U test. Non parametric Wilcoxon test was used to evaluate the differences between pre and post-treatment scale scores. Chi-square Test was used to compare the differences between categorical variables. Correlations between scale scores were calculated by Pearson's Correlation Test. p values smaller than 0.05 were considered statistically significant.

RESULTS

The ages of participants were 13-18 years with a mean age of 14.54±1.69 years. Sixty-four percent (n=32) of the cases were middle school students, while 36% (n=18) of them were high school students.

Table 1: Comparison of pre- and post treatment STAI-CH and CDI scores

	Pre-treatment		Post-treatment		
	Mean	SD	Mean	SD	p
STAI-CH					
Total	37.2	6.7	33.8	7.3	<0.001
Female	40.3	6.7	38.5	7.8	0.276
Male	35.5	6.2	31.2	5.7	<0.001
CT	36.8	6.5	33.3	7.2	0.005
PI	38.8	7.6	35.9	7.7	0.061
With comorbidity	37.1	6.8	34.3	7.6	0.043
Without comorbidity	37.3	6.8	33.5	7.2	0.009
CDI					
Total	12.2	7.8	10.5	7.5	0.067
Female	15.8	9.4	13.2	9.5	0.066
Male	10.1	6.1	9.0	5.8	0.231
CT	11.8	7.5	10.5	7.9	0.173
PI	13.3	9.1	10.6	6.4	0.044
With comorbidity	13.1	18.8	10.6	7.5	0.072
Without comorbidity	11.5	7.1	10.5	7.7	0.263

STAI-CH: State-Trait Anxiety Inventory for Children, CDI: Childhood Depression Inventory, CT: Combined type, PI: Predominantly Inattentive type, SD: Standard deviation

Of the 50 patients diagnosed with ADHD according to the DSM-IV diagnostic criteria, 78% were classified as combined type (CT) (n=39; girls n=13, 72.0%; boys n=26, 81.3%) and 22% were classified as Predominantly Inattentive type (PI) (n=11; girls n=5, 27.8%; boys n=6, 18.8%). We have not observed any case of Predominantly hyperactive-impulsive type in our study. In 42% of the cases (n=21) at least one psychiatric disorder accompanied the diagnosis of ADHD, while in 8% (n=4) more than one comorbidity was found. The most common comorbid psychiatric disorder was anxiety disorder (14%, n=7), followed by behavioral disorder (10%, n=5), nocturnal enuresis (6%, n=3), and specific learning difficulty (4%, n=2). There were 9 patients (18%) that have a physical disease in addition to ADHD.

All participants have been prescribed long-acting MPH for the treatment of ADHD, with an average MPH dose of 0.95±0.16mg/kg/day (0.7 to 1.4mg/kg/day). There were 10 patients (20%) who received a second drug treatment in addition to MPH.

When pre-treatment and third month scale scores were compared, there was a statistically significant change in the STAI-CH scores of the total group, in the boys group, and in the combined type group after the treatment, whereas the changes observed in the PedsQL™ 4.0 scores were significant in the PI sub-type (Table 1). The changes in scores of the whole sample

Table 2: Comparison of pre- and post-treatment PedsQL™ 4.0 adolescent and parental form scores

	Adolescent					Parent						
	QL-1		QL-2			QL-1		QL-2				
	Mean	SD	Mean	SD	p^{*P}	Mean	SD	Mean	SD	p^{*A}	p^{**}	p^{***}
PFS	76.3	18.0	70.4	21.2	0.042	71.4	7.7	67.1	18.7	0.136	0.061	0.182
EFS	70.6	19.0	70.9	20.9	0.896	72.0	17.4	69.6	22.2	0.378	0.056	0.001
SFS	84.3	15.6	88.1	13.7	0.112	77.7	18.1	84.1	16.4	0.034	0.521	0.003
SchoolFS	55.3	22.0	67.2	21.4	<0.001	47.2	18.7	63.3	17.9	<0.001	0.033	0.002
PSFS	68.5	18.4	75.4	15.9	0.001	65.4	14.4	72.5	16.1	0.001	0.608	<0.001
QoL-TS	72.3	14.0	74.0	15.7	0.283	67.5	13.6	70.8	15.0	0.093	0.221	<0.001

PedsQL™ 4.0: Pediatric Quality of Life Inventory™ 4.0, PFS: Physical functioning score, EFS: Emotional functioning score, SFS: Social functioning score, SchoolFS: School functioning score, PSFS: Psychosocial functioning score, QoL-TS: Quality of life total score, QL-1: Quality of Life Pretreatment, QL-2: Quality of Life Posttreatment, *Comparison of mean of QL1-2 scores between ^{A}: Adolescent, ^{P}: Parent groups (Related samples test; Wilcoxon), p**: comparison of adolescent QL-1 and parent QL-1, p***: comparison of means of adolescent QL-2 and parents QL-2 scores (independent group tests; Man Whitney U), SD: Standard deviation

Table 3: Comparison of pre- and post-treatment PedsQL™ 4.0 scores with regard to gender groups

	Pre-treatment					Post-treatment						
	Female		Male			Female		Male				
	Mean	SD	Mean	SD	p^{1}	Mean	SD	Mean	SD	p^{2}	p^{F}	p^{M}
Adolescent												
PFS	74.2	19.3	77.5	17.4	0.546	63.3	21.9	74.4	20.0	0.074	0.026	0.813
EFS	60.0	20.2	76.5	15.7	0.002	58.3	23.3	77.9	15.9	0.004	0.686	0.339
SFS	77.7	20.5	87.9	10.7	0.063	84.4	12.1	90.1	14.3	0.160	0.162	0.254
SchoolFS	45.2	22.5	60.9	19.8	0.014	58.8	23.9	71.8	18.6	0.039	0.014	0.001
PSFS	56.8	22.4	75.1	11.7	0.004	67.1	16.2	80.1	13.9	0.004	0.067	0.003
QoL-TS	65.8	15.9	75.9	11.6	0.013	67.2	16.8	77.8	13.9	0.021	0.845	0.114
Parents												
PFS	70.4	17.0	71.9	18.2	0.780	64.9	20.6	68.4	17.7	0.529	0.306	0.258
EFS	67.7	19.1	74.3	16.3	0.203	61.3	23.4	74.2	20.4	0.049	0.146	0.867
SFS	81.6	17.4	75.4	18.4	0.252	81.1	17.2	85.7	15.9	0.339	0.930	0.012
SchoolFS	51.1	22.7	45.0	15.9	0.323	56.1	18.6	67.3	16.4	0.032	0.162	<0.001
PSFS	66.0	16.5	65.0	13.4	0.809	66.5	16.5	76.0	15.1	0.046	0.924	<0.001
QoL-TS	68.0	14.0	67.2	13.5	0.859	66.8	17.0	73.1	13.4	0.152	0.948	0.017

PedsQL™ 4.0: Pediatric Quality of Life Inventory™ 4.0, PFS: Physical functioning score, EFS: Emotional functioning score, SFS: Social functioning score, SchoolFS: School functioning score, PSFS: Psychosocial functioning score, QoL-TS: Quality of life total score, p^{1}: comparison of pretreatment scores of male and female cases, p^{2}: comparison of post-treatment QL scores (Independent samples tests; Mann Whitney U), p^{F}: Female cases, p^{M}: Male cases, comparison of pre-treatment and post-treatment scores (Related samples test; Wilcoxon), SD: Standard deviation

before and after treatment are shown in Table 1.

When we evaluated the effect of treatment on quality of life with PedsQL™ 4.0; there was a significant difference in physical functioning score (PFS), school functioning score (SchoolFS) and psychosocial functioning score (PSFS) of the adolescent form; whereas there was a significant difference in social functioning score (SFS), and PSFS of the parental form before and after treatment (Table 2).

When parental and adolescent statements about the effect of ADHD on quality of life were compared, it was found that adolescents rated their own quality of life significantly more positive than parents in all fields except in SchoolFS before treatment and PFS after treatment (Table 2).

Table 4: Comparison of pre- and post-treatment PedsQL™ 4.0 scores according to subtypes

	Pre-treatment				Post-treatment					
	CT		PI		CT		PI			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p^{CT}	p^{PI}
Adolescent										
PFS	77.0	15.7	73.8	25.5	73.1	18.2	68.4	24.1	0.170	0.306
EFS	70.2	17.2	71.8	25.5	70.6	19.3	71.8	26.9	0.740	0.944
SFS	85.2	13.2	80.9	22.7	88.0	14.4	88.1	11.4	0.171	0.246
SchoolFS	55.9	21.9	53.1	23.0	65.2	21.7	74.0	19.5	0.003	0.003
PSFS	70.4	13.3	61.6	30.5	74.7	15.6	78.0	17.6	0.043	0.003
QoL-TS	72.8	11.7	70.4	20.9	73.9	14.8	74.2	19.5	0.434	0.139
Parent										
PFS	71.7	17.6	70.1	18.5	67.3	19.6	66.4	15.5	0.161	0.475
EFS	69.7	17.7	80.0	14.3	69.4	22.7	70.0	21.2	0.934	0.091
SFS	75.7	17.9	84.5	18.3	84.7	17.1	81.8	13.8	0.010	0.592
SchoolFS	46.4	17.9	50.0	21.7	62.9	17.6	64.5	19.8	0.001	0.045
PSFS	63.7	14.6	71.3	12.8	72.7	16.2	71.9	16.8	0.001	0.824
QoL-TS	66.6	13.8	70.9	12.6	70.9	15.1	70.7	15.0	0.053	0.624

PedsQL™ 4.0: Pediatric Quality of Life Inventory™ 4.0, PFS: Physical functioning score, EFS: Emotional functioning score, SFS: Social functioning score, SchoolFS: School functioning score, PSFS: Psychosocial functioning score, QoL-TS: Quality of life total score, p^{CT}: Combined type, p^{PI}: Predominantly Inattentive type Comparison of QoL-1 and 2 scores (Related group analysis; Wilcoxon), CT: Combined type, PI: Predominantly Inattentive type, SD: Standard deviation

Table 5: Comparison of the effect of comorbidity on PedsQL™ 4.0 scores before and after treatment

	Pre-treatment				Post-treatment					
	Comorbidity present		Comorbidity absent		Comorbidity present		Comorbidity absent			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	p^{P}	p^{A}
Adolescent										
PFS	75.5	23.2	76.9	13.5	73.6	18.4	68.1	23.0	0.254	0.223
EFS	68.3	22.1	72.2	16.7	64.5	22.6	75.5	18.7	0.381	0.206
SFS	86.4	16.0	82.7	15.4	83.3	17.2	91.5	9.3	0.332	0.003
SchoolFS	54.7	26.6	55.6	18.4	65.7	24.0	68.2	19.7	0.011	0.001
PSFS	65.9	24.8	70.4	12.1	71.1	18.5	78.5	13.2	0.192	0.003
QoL-TS	71.8	19.0	72.6	9.2	70.4	19.5	76.6	12.0	0.709	0.057
Parent										
PFS	70.0	19.1	72.3	16.8	63.5	16.7	69.7	19.8	0.109	0.414
EFS	68.3	17.3	74.6	17.3	61.9	23.5	75.1	19.8	0.123	0.879
SFS	75.2	18.8	79.4	17.8	77.6	16.6	88.7	14.8	0.597	0.042
SchoolFS	44.7	22.2	48.9	15.8	56.6	20.9	68.1	13.9	0.021	<0.001
PSFS	62.8	15.9	67.2	13.3	66.0	18.2	77.3	12.9	0.198	0.003
QoL-TS	65.3	14.4	69.1	12.9	65.2	16.1	75.0	12.8	0.444	0.054

PedsQL™ 4.0: Pediatric Quality of Life Inventory™ 4.0, PFS: Physical functioning score, EFS: Emotional functioning score, SFS: Social functioning score, SchoolFS: School functioning score, PSFS: Psychosocial functioning score, QoL-TS: Quality of life total score, p^{P}: Cases have comorbidity, p^{A}: Cases without comorbidity Comparison of QoL-1 and -2 scores (Related group tests; Wilcoxon), SD: Standard deviation

When the effect of gender on the quality of life was evaluated; both the pre-treatment and post-treatment PedsQL™ 4.0 subscale and total scores except for SFS and PSS were found to be significantly lower in female adolescents than in males (Table 3). The findings of the adolescent and parental pre- and post-treatment PedsQL™ 4.0 scores according to gender are shown in Table 3.

When the relationship between ADHD subtypes and quality of life was examined; there was no significant difference in terms of subtypes either before or after treatment in the adolescent and parent forms of PedsQL™ 4.0 (Table 4). However, there was a significant increase in some subscale scores of the PedsQL™ 4.0 before and after treatment (Table 4).

When the impact of the presence of mental illness accompanying ADHD on the quality of life was assessed; in cases with co-morbidities, significant elevation was observed only in the SchoolFS, whereas in cases without a co-morbidity, there was a significant increase with treatment in total scores and in all subscales of PedsQL™ 4.0 except emotional functioning score (EFS) and PFS (Table 5).

DISCUSSION

In our study it has been shown that MPH treatment has positive effects on both quality of life and symptoms of anxiety and depression in adolescents with ADHD. The vast majority of the studies in the literature evaluating the effect of ADHD treatment on quality of life are made with atomoxetine, whereas studies with MPH are rare (19). In addition, it has been observed that the age range is wider in the sample of these studies. Cognitive levels, which may vary between age groups, may have an impact on the perception of quality of life; therefore, an assessment to be made within the same age group is considered to be healthier. Our study, which was planned in the light of this need in the literature, is the first study evaluating the quality of life of adolescents with ADHD who take MPH treatment.

When the quality of life studies in the literature were examined, the cases with ADHD have generally been compared with healthy controls or those with other chronic diseases (5-7,10); and the quality of life scores were found to be lower in ADHD, especially in the psychosocial domain (15,19-21). Studies investigating changes in quality of life with atomoxetine treatment have shown a significant increase in post-treatment psychosocial subscale scores compared to placebo (22,23). In a study comparing atomoxetine and MPH, it was determined that improvement in the quality of life was achieved with treatment in both groups, there was more improvement in the group receiving atomoxetine. According to the authors, this difference is due to the permanent effects of atomoxetine, less fluctuating characteristics, and its effect on additional symptoms such as anxiety or tic (24).

In the quality of life studies performed with MPH, there was a significant increase in the total scores and subscale scores except the PFS after MPH treatment (25,26). It is thought that, the side effects such as decreased appetite and abdominal pain play a role in the decrease in PFS (26-29). Consistent with the literature, our study also found a significant decrease in post-treatment PFS and it is considered to be the result of associated side effects. However, SchoolFS and PSFS were significantly increased by MPH treatment in both adolescent and parental reports. It is thought that controlling the core symptoms of ADHD with MPH leads to this positive effect on quality of life (30,31).

It looks like evaluating parent and child/adolescent forms simultaneously would be more reliable in assessing quality of life. The level of consistency between the child/adolescents and the parental assessment is also important in this evaluation. There are studies in the literature showing that parental and child/adolescent assessments in ADHD are fairly consistent except for SchoolFS (25,32,33) on the other hand there are others showing that the child/adolescent reporting is more positive (34-36). Factors affecting parental reporting include; comparison of the development of their children with other children or their peers, the expectations from the child, the responsibility of caring, family functions, parent's own

mental state and well-being (17,37,38). In addition, children/adolescents with ADHD may have reported their performances more positively than their real capacities (39).

In our study, post-treatment total and all subscale scores were higher in the adolescent report than in the parental report; and the differences except the PFS were statistically significant. These differences are thought to be: because the adolescent tends to score higher on his or her own functioning and have positive bias (39) and because of the higher level of consensus with the parent about physical health (7,40) since physical health is more objectively observable than psychosocial health (7,40).

When the gender effect on the quality of life in ADHD is examined, post-treatment EFS, SchoolFS, PSFS, and scale total scores in adolescent form and EFS, SchoolFS, and PSFS scores in the parental form were significantly higher in male adolescents. Significant decrease in PFS and significant increase in SchoolFS scores were observed in female adolescents after treatment, while significant increase in SchoolFS and PSFS scores was observed in male adolescents. Previous studies have also reported that female ADHD adolescents rated their own quality of life more negatively (41,42), but that gender did not affect parental rating (42). Unlike our study there is a study in the literature showing that gender has no effect on changes in quality of life with MPH treatment (43). The small size of our sample and the fact that, variables such as co-morbidity, additional drug use, and symptom severity have not been assessed, may have led to these differences from the literature.

In studies comparing the quality of life of ADHD subtypes, it was observed that all subtypes had lower scores compared to controls, especially with lower PFS scores in ADD subtype (44). However, there are also publications showing that the effect of ADHD subtypes on quality of life is similar (42). In our study, there were no significant differences in either adolescent or parental quality of life total and subscale scores in terms of ADHD subtypes before and after treatment. Our findings support the idea that ADHD may lead to similar impairment without regard to the subtype (42). However, the fact that our small sample size is small makes it difficult to compare and comment on.

Contrary to the publications (10,23) that reports the presence of comorbidity negatively affects quality of life in ADHD, there was no significant difference in pretreatment quality of life scores between the patients with and without comorbidity in our study. Small sample size of our study and the imbalanced comorbidity distribution with the literature can be considered as the cause of the dissimilarity. After the treatment there were improvements in more fields of life quality in the group without comorbidities. It is possible that the presence of comorbidity can also deteriorate the response to treatment therefore, improvement is observed in fewer fields of life quality (9,34).

In opposition to publications (45,46) in the literature that suggest that the use of MPH in patients with ADHD may aggravate anxiety (45,46), there are also studies showing that anxiety decreases with MPH (47-49). In the study of Gurkan et al. (26) 8-14 years old children and adolescents with ADHD were treated with an average of 24.2mg/day MPH dose for 3 months. Anxiety and depression scores of the subjects have been reported to decrease significantly. Similarly, there was a significant decrease between pre-treatment STAI-CH scores and 3 months after treatment in our study. The reduction in anxiety scores can be supposed to be secondary to the improvement of the core symptoms of ADHD and to improvements in social, academic, and behavioral areas rather than direct effect of MPH on anxiety symptoms. Another possibility is that depression and anxiety scores may also decrease as the mood dysregulation, which is considered as a part of ADHD, improves with MPH, as shown in adult ADHD studies (50,51). Another possible factor is, in our study 20% of adolescents were using another drug (antidepressant, antipsychotic) additional to MPH. However, it may be misleading to make an explicit comment on the effect of this condition on scale scores since additional drug use was not taken into consideration when comparing the change in anxiety and depression scores with treatment.

The sample size is one of the limitations of our study. For this reason, there is a need for larger sample studies on adolescents. Another limitation is that ADHD and co-morbidity diagnoses are via clinical interviews based on DSM-IV criteria rather than using structured scales. The presence of patients receiving additional drug treatment for MPH is also a limitation of our study because it can affect quality of life, anxiety, and depression scores.

ADHD which has a very important place in childhood psychiatric diseases, causes physical, academic, social, and emotional disturbances as well as serious disruptions in daily life and family functioning (52). It affects the quality of life negatively, especially in the psychosocial domain. The evaluation of the clinical manifestations of ADHD and the efficacy of treatment with the quality of life seems to be very important as it will allow for individual interventions in functionality which is a more problematic field.

Contributions category	Authors name
Development of study idea	C.K.K., F.T.
Methodological design of the study	C.K.K., F.T.
Data acquisition and process	C.K.K.
Data analysis and interpretation	C.K.K., F.T., A.Y.T., O.M.
Literature review	C.K.K.
Manuscript writing	C.K.K., A.Y.T., O.M.
Manuscript review and revision	C.K.K., A.Y.T., O.M., F.T.

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