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Original Article

Facial Emotion Recognition and Discrimination Deficit in Idiopatic Parkinson Patients

İdiopatik Parkinson Hastalığında Yüzde Duygu Tanıma ve Ayırt Etme Bozukluğu

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Summary

Objective: Motor symptoms are the primary focus in diagnosis and treatment of idiopathic Parkinson disease (IPD). But facial emotion recognition disorder, one of non-motor symptoms of the disease, reduces quality of life significantly by disrupting social interaction. Facial emotion recognition and discrimination ability is an important part of social interaction. Neuroimaging studies highlight amigdala as the locus of facial emotion recognition disorder in IPD. The aim of this study is to investigate the relationship between clinical features and impairments in facial emotion recognition and discrimination ability.

Materials and Methods: This study involves 41 patients followed with IPD in neurology outpatient clinic and 38 healthy controls. Facial Emotion Identification Test (FEIT) and Facial Emotion Discrimination Test (FEDT) were carried out for both groups. Clinical and demographic features of patient and control groups were recorded. Hoehn-Yahr (H and Y) scale was used for staging of disease and Unified Parkinson's Disease Rating Scale (UPDRS) was used for assessment of clinical severity. The results of both groups were compared with Kruskal Wallis and Pearson's Chi Square tests.

Results: Average of FEIT and FEDT in patients with IPD are 12.64±5.55 and 17.84±4.94, respectively. When these values were compared with control group, they were worse than control group ($p<0.01$). This impairment was correlated with H and Y and UPDRS stages. The most impaired one among facial exogenous sensations was fear sensation with 2.29±1.26.

Conclusion: This study shows that patients with IPD have more difficulty than normal population in recognition and discrimination of facial exogenous emotions. This difficulty was correlated with stage and clinical severity of disease. We hope that these findings will be an important step in regulation of impaired social intercourse and functionality in IPD and will help determining rehabilitation targets. (Turkish Journal of Neurology 2015; 21:16-21)

Key Words: Parkinson disease, emotion, face, recognition

Conflicts of Interest: The authors reported no conflict of interest related to this article.

Özet

Amaç: İdiopatik Parkinson hastalığının (İPH) tanı ve tedavisinde motor belirtiler önem taşır. Üzerinde daha az durulan motor olmayan semptomlardan olan yüzlerde duygu tanıma bozukluğu, sosyal ilişkileri ve dolayısıyla yaşam kalitesini engeller. Nörogörüntüleme çalışmaları İPH'deki yüz ifadesi tanıma bozukluğundan amigdalanın sorumlu olduğuna işaret etmektedir. Çalışmamızda, sosyal ilişkilerin önemli bir parçası olan yüzlerde duygu tanıma ve ayırt etme yetisinin İPH'deki bozulmasıyla hastalığın klinik özellikler arasındaki ilişkiyi araştırmayı amaçladık.

Gereç ve Yöntem: Çalışmaya nöroloji polikinliğinde İPH tanısı ile takip edilen 41 İPH hastası ve 38 sağlıklı kontrol dahil edildi. Her iki gruba da Yüzde Dışavuran Duyguların Tanınması Testi (YDTT) ve Yüzde Dışavuran Duyguların Ayırt Edilmesi Testi (YDAT) uygulandı. Hasta ve kontrol grubunun klinik ve

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demografik özellikleri kayıt edildi. Hastalığın evrelendirmesi Hoehn-Yahr (H ve Y) skalası ile, klinik bulguların derecelendirilmesi ise Birleşik Parkinson Hastalığı Değerlendirme Ölçeği (BPHDÖ) ile belirlendi. Gruplar yüzde dışavuran duyguyu tanıma ve ayırt etmedeki becerileri açısından birbirleriyle karşılaştırıldı.

Bulgular: İPH hastalarında YDTT ortalaması 12,64±5,55, YDAT ortalaması 17,84±4,94 olarak bulundu. Bu testlerin ortalaması kontrol grubu ile kıyaslandığında, hasta grubunda istatistiksel olarak anlamlı şekilde daha bozuk olarak saptandı. Bu bozukluk H ve Y evresi ve BPHDÖ ile korele bulundu. Yüzde dışa vuran duygulardan ise en bozuk olanı 2,29±1,26 ile korku duygusu idi.

Sonuç: Bu çalışmanın sonuçları İPH hastalarının yüzlerde dışa vuran duyguları tanımada ve ayırt etmedeki yaşadığı güçlüklerin normal popülasyona göre daha fazla olduğunu gösterdi. Bu fark hastalığın evresi ve klinik ciddiyet derecesi ile de korele bulundu. Bu verilere göre İPH hastalarında bozulmuş olan toplum içi ilişkilerin ve işlevselliğin düzenlenmesi, tedavi ve rehabilitasyon hedeflerinin oluşturulmasında da önemli bir adım olacaktır. (Türk Nöroloji Dergisi 2015; 21:16-21)

Anahtar Kelimeler: Parkinson hastalığı, duygu, yüz, tanıma

Çıkar Çatışması: Yazarlar bu makale ile ilgili olarak herhangi bir çıkar çatışması bildirmemiştir.

Introduction

Idiopathic Parkinson Disease (IPD) is a progressive movement disorder (1). It is essentially characterized by the nigrostriatal dopaminergic neuron loss. Bradykinesia, rigidity, resting tremor and postural instability are its cardinal motor findings and it is the second most common neurodegenerative disease after Alzheimer's disease (2,3). The motor symptoms in IPD are well known and the treatments have focused primarily on this area. However, other less emphasized non-motor symptoms affect cognitive capabilities including personality and mood, social functions and quality of life (4,5).

Facial recognition and the detection of emotional expressions is a sophisticated cortical function that is of great importance for people. In IPD, it was shown that facial recognition impairment is due to basal ganglia and the dopaminergic system involvement. Pathophysiological and neuroimaging studies on face recognition and discrimination disorders in IPD indicated abnormalities in amygdala (7,8).

The ability to accurately detect other people's feeling is a critical component of the non-verbal communication system. It is a necessary component of adaptation and interaction with the environment. Maintaining correct and successful relationships rely on the correct interpretation of non-verbal cues (9). Facial expressions provide information about a person's inner state and tendencies, playing a key role for the social interaction and adaptation (10). Emotions are mostly process reflected in facial expressions (11).

The facial emotion identification deficit in IPD has been documented by many studies but the underlying causes have not been identified (11). In the light of this information, we aimed to investigate relationship between the clinical properties of facial emotion recognition and discrimination skills in people with IPD, and their social functioning.

Materials and Methods

Our study included a total of 41 patients, 26 men and 15 women, who came to our hospital's neurology outpatient clinic, and 38 age and sex-matched controls. Control group was selected among neurology outpatient clinic patients who did not have any mental, physical and psychological disorders as a result of any systemic or neurological diseases.

For all patients, age, disease duration, drugs usage, concomitant diseases, the initial symptom (resting tremor, bradykinesia, etc.), level of education, treatment duration and disease onset lateralization were recorded. Patients with previously diagnosed dementia, psychiatric disorders, acute psychosocial stress factors that will affect the test results, as well as those with hearing and visual impairment were not included in the study.

In order to assess emotional identification and discrimination skills, Facial Emotion Discrimination (FEDT) and Facial Emotion Identification Tests (FEIT), which were both validated and standardized for the Turkish population, were used (12).

Disease staging was done with Hoehn-Yahr scale (HY) and the grading of the clinical findings was done with Unified Parkinson's Disease Rating Scale (UPDRS) (13,14).

Facial Emotion Identification Tests

Facial Emotion Identification Test was developed by Kerr and Neale in 1993 (15). It is a slide presentation which includes 19 black and white photos showing different emotional facial expressions. Photos convey six main emotions (joy, sadness, anger, fear, confusion, shame). The test was designed to show each photo for 15 seconds in order, with 10 seconds time interval between each presentation. The subject is given an answer sheet containing 6 options for each of the 19 trials. The subject is asked to mark the most appropriate emotion that corresponds to each image. Correct answers receive 1 point while incorrect answers receive 0 points. The maximum score of the test is 19. The validity and reliability studies of the test were conducted by Erol et al. (12).

Facial Emotion Discrimination Test

Facial Emotion Discrimination Test was developed by Kerr and Neale in 1993 (15). It includes 30 black and white photo pairs that show six main emotions (joy, sadness, anger, fear, confusion, shame). Photo pairs show either the same or different emotions. This test is also arranged in the form of the slide presentation. Each pair is presented for 15 seconds with an 10 seconds time interval between each presentation. The subject is asked to indicate whether the faces in the photo pairs show the same or different emotion. The answer key has "same" and "different" options for every question. The subject is asked to choose one of the options for each question. Correct answers receive 1 point while incorrect answers receive 0 points. The maximum score of the test is 30. The validity and reliability studies of the test were conducted by Erol et al. (12).

Statistical Analysis

Data analysis was done using SPSS version 16.0 package program. Shapiro-Wilk test was used to test if the continuous variables follow normal distribution. In the descriptive statistics, continuous variables were expressed as mean ± standard deviation and the categorical variables were expressed as number of cases (%). The difference of the means of the groups and the magnitude of these differences were tested with t-test and one-way analysis of variance (One-way ANOVA), followed by Tukey test and post-hoc analysis conducted to further investigate which subgroups cause the differences. Categorical variables were examined using Pearson's Chi-square test. Pearson correlation was used to investigate any meaningful relationship between numerical variables; $p<0.05$ was considered statistically significant.

Results

Our study included 15 women (mean age: 69.20±5.11) and 26 men (mean age: 70.34±9.46), totaling up to 41 cases (mean age 69.92±8.08). Control group included 38 healthy volunteers composed of 28 male and 10 female, with a mean age of 68.21±7.19. In the patient group, 9 patients were middle school graduates, 27 people elementary school graduates and 5 people were illiterate, the average education duration being 3.95 years (Table 1).

The mean onset age of the disease was found to be 63.41±8.53 and the average duration of the treatment was 6.51±4.11 years. The most common initial complaint was resting tremor with 43.9% (18 patients), while the most common onset side of the complaints was determined to be the left with 70% (30 patients). 92.7% of the patients (38 patients) were mostly right handed.

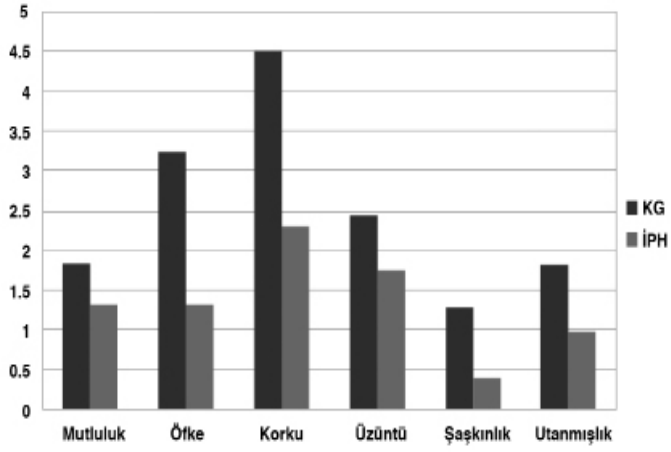
In terms of HY disease stages, 19.5% (8 patients) were stage 1, 46.3% (19 patients) were stage 2, 26.8% were stage 3 and 7.3% were stage 4. The UPDRS mental state score used to evaluate the clinical severity of the disease was 2.95±2.42 points, daily living activities score was 13.73±7.88 points, motor subscales were 19.12±8.38 points and UPDRS total score was 39.53±21.29 points.

In the patient group, the mean score for FEDT and FEIT were 12.64±5.55 and 17.84±4.94 respectively. In the control group, these scores were 16.57±2.04 and 27.02±3.9 and this difference was statistically significant ($p<0.001$, $p<0.001$) (Table 2).

When the patient group was compared to the control group in terms of the correct answers they gave for facial emotion recognition (happiness, anger, fear, etc.), performance for all emotions was statistically lower. Among these emotions, the most impaired one was fear (Graphic 1).

In the analyses utilizing FEDT and FEIT scores and HY stages, it was found that patients with more advanced diseases stages had more severely impaired facial emotion recognition and identification deficits (Table 3).

The UPDRS scores used to assess the severity of the IPD was compared to the FEDT and FEIT scores. As the mean FEDT scores decreased, all but treatment complications scores seemed to improve in a statistically significant way. There was also a statistically significant positive correlation between mean FEIT scores and all other scores except treatment complications and clinical fluctuations (Table 4).



Graphic 1. İdiopatik Parkinson hastalarında yüzde dışa vuran duyguları tanıma ortalamasının, kontrol grubu ile karşılaştırılması

In the IPD group, there was a statistically significant negative correlation between FEIT and FEDT scores, meaning that the scores of both tests decreased as the age increased (Table 5).

Table 1. Demographics of patient and control groups

Demographics	Control (n=38)	Patient (n=41)	p
Age	68.21±7.19	69.92±8.08	0.72
Sex (Male/female)	28/10 (73.7%/26.3%)	26/15 (63.4%/36.6%)	0.97
Education level/year	4.10±2.71	3.95±1.63	0.11

Table 2. Comparison of Facial Emotion Identification (FEIT) and Discrimination Tests (FEDT) between patient and control groups

Tests	Control (n=38)	Patient (n=41)	p
FEIT	16.57±2.04	12.64±5.55	<0.001*
YDAT	27.02±3.9	17.84±4.94	<0.001*

FEDT: Facial Emotion Discrimination Test, FEIT: Facial Emotion Identification Test

Table 3. Comparison of Facial Emotion Identification Test (FEIT) and Facial Emotion Discrimination Test (FDTT) with H and Y stages in idiopathic Parkinson patients

		FEDT		FEIT	
HY stage	n	Mean±SD	p*	Mean±SD	p
1	8	11.12±2.23	0.001**	22.62±3.42	0.003**
2	19	7.10±2.74	0.001**	16.00±3.23	0.003**
3	11	8.09±1.70	0.001**	18.63±6.37	0.003**
4	3	4.33±0.57	0.001**	14.00±1.00	0.003**

FEDT: Facial Emotion Discrimination Test, FEIT: Facial Emotion Identification Test Post-hoc Tukey test significance value, **: Statistically significant

Discussion

In this study, we compared the facial emotion discrimination and identification capacity in individuals with idiopathic Parkinson disease. According to the results, compared to the control group, the IPD group's recognition and discrimination more impaired. This deficit was found to be correlated with the disease stage and the clinical severity.

Due to its disruptive effects on a person's daily life, the burden it imposes on the patient's relatives, IPD has become an important neurological concern causing loss in productivity, personal and economical problems, high healthcare costs and reduced life expectancy (16). Even though the motor symptoms of IPD have been identified to sufficient detail, the non-motor symptoms of the disease have been overlooked and they often affect the patient in all stages of the disease as much as the motor symptoms, if not more (17). Recognition and discrimination of facial emotional expressions is a core component of basic socio-cognitive skills. Perceiving the mental and emotional states of other individuals is an inevitable requirement of social relationships. In the recent years, researchers have turned their attention to the topic of social relations in IPD and begun to question to what extent would such deficits affect social functioning in IPD (18,19).

Emotional processes as the building blocks of our cognitive faculties are an integral part of our everyday lives. This way, perceptual and reasoning processes become parts of very comprehensive and complex processes such as memory. It was shown that the speed of emotional recognition and discrimination are slower in people with IPD than healthy controls (20). Since the years following the first identification of IPD, limited emotional expression capacity has been accepted as an important property of the disease. On the other hand, numerous studies investigated the emotional perception processes in IPD and they reported difficulties in facial and emotional recognition (21,22). According to a study by Hipp et al., recognition of facial emotions was impaired compared to controls. In addition, it was found that "fear" was the most severely impaired emotion among all of them. They reasoned that these findings explain the social withdrawal (11). In support of this study, our study also found impaired recognition and discrimination of facial emotional expressions, "fear" being the most severely impaired one.

According to another study by Suzuki et al., older IPD patients had bigger impairments compared to younger patients with IPD. This was associated with the cognitive involvement and dopamine function (23). We also found that facial emotion identification and discrimination performance decrease with increased age and UPDRS-mental subsection score. In addition, we found that this deterioration is associated with the disease duration.

In 12 IPD cases who had undergone deep brain stimulation (DBS), Aiello et al. found deficits in facial emotion identification and discrimination performance in the pre and post-operative states, and that the deficits did not improve after the surgery. Even though DBS seemed promising for alleviating the deficits in facial emotion identification and discrimination, the resulting microlesions possibly prevent that from happening. Also in the same study the patients were divided into two groups: the first group stopped dopamine treatment 12 weeks before the surgery while the second group kept receiving the dopamine treatment before and after the surgery. There were no differences found between the two groups in terms of facial emotion identification and discrimination, leading to the conclusion that dopamine is not a determining factor in these capabilities (24). In contrast,

Table 4. The relationship between Unified Parkinson Disease Rating Scale (UPDRS) subscale scores and Facial Emotion Discrimination Test (FEDT) or Facial Emotion Identification Test (FEIT) in IPD

	UPDRS score	FEIT score			FEDT score		
	Mean±SD	Mean±SD	p	Correlation coefficients	Mean±SD	p	Korelasyon katsayıları
UPDRS total score	39.53±21.29	17.84±4.94	0.013*	-0.817	12.64±5.55	0.02*	-0.715
UPDRS subscales							
Mental state	2.95±2.42	17.84±4.94	0.007*	-0.875	12.64±5.55	0.03*	-0.890
Daily living activities	13.73±7.88	17.84±4.94	0.009*	-0.843	12.64±5.55	0.01*	-0.911
Motor examination	19.12±8.38	17.84±4.94	0.046*	-0.676	12.64±5.55	0.038*	-0.780
Treatment complication	1.43±1.93	17.84±4.94	0.188	-0.125	12.64±5.55	0.434	-0.129
Clinical fluctuations	1.46±1.71	17.84±4.94	0.037*	-0.781	12.64±5.55	0.112	-0.231
Other complications	0.82±1.02	17.84±4.94	0.011*	-0.837	12.64±5.55	0.44*	-0.517

FEDT: Facial Emotion Discrimination Test, FEIT: Facial Emotion Identification Test Post-hoc Tukey test significance value, **: Statistically significant

Table 5. The relatinship between age and Facial Emotion Discrimination Test (FEDT) and Facial Emotion Identification Test (FEIT) scores in idiopathic Parkinson patients

Tests	Yaş	p
FEDT	-0.217	0.04**
YDTT	-0.284	0.02**

FEDT: Facial Emotion Discrimination Test

Mondillon et al. found that pharmacological dopamine treatment does improve facial emotion identification and discrimination (24).

The presence of impairments in facial emotion recognition has been documented by numerous studies, but the underlying cause of the defects still remains unknown. Neuroimaging studies showed that facial emotion processing is regulated by a circuitry involving inferior frontal area projecting onto prefrontal and temporo-parietal cortices (24,26). Especially right hemisphere amygdala and basal ganglia play a key role in emotional processing (27). Since the aminergic neurotransmitters affected by the IPD pathology operate on this frontal-subcortical circuits and basal ganglia, abnormalities in mood states, cognition and motor functions may present themselves (28).

Martinez et al. showed that cognition, bradymimia, education, age and apathy affect facial emotion identification and discrimination. Idiopathic Parkinson patients with or without apathy were compared in terms of facial emotion identification and those without apathy were found to have a less severe deficit compared to the other group and healthy controls. In the study, mean performances for facial emotion identification and discrimination capabilities were found to be lower than the control group, with the mean age being 65, 67 and the education level being 9 years. We found the impairment to be less severe compared to this study. We reason that the difference may be due to the higher mean age and lower mean education level.

Saenz et al. used Ekman and Freisen photo dataset and tested six main emotions (anger, disgust, fear, happiness, sadness and surprise). Despite the difference in materials and methodology, their results were similar to ours (8).

Even though patients with dementia were excluded from the study at the beginning, it would have been beneficial to utilize MINI mental state examination to evaluate any cognitive abnormalities and to assess their severity, if any. This is one of the limitations of our study. Another limitation is the small size of our sample. Therefore, there is need for further studies using larger sample sizes and neuropsychological and neuroimaging measurement tools.

Conclusion

Facial emotion identification and discrimination in IPD, which causes social isolation, has attracted increasing attention in the recent years. In this study, we also documented the facial emotion identification and discrimination difficulties in IPD by comparing patients to healthy controls. Demonstrating the link between the disease stage and clinical severity, and the deficits in identification and discrimination, we emphasized the impairments in emotional processing capabilities in Parkinson patients. A correct understanding of emotional processing and the restoration of the impaired societal and interpersonal relationships of IPD patients will guide the treatment and rehabilitation approaches.

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