Poor hand function in diabetics

Its causes and effects on the quality of life

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ABSTRACT

الأهداف: إيجاد الأسباب الممكنة والتعرف على التقييم الذاتي لتأدية وظيفة اليدين عند المرضى المصابين بمرض السكري وتأثيرها على نوعية الحياة جسدياً ونفسياً.

الطريقة: لقد تم إجراء البحث على 71 مريضاً مصاباً بمرض السكر من نوع I وII ممن أُتوا إلى عيادة الغدد الصماء ومرض السكري والطب الباطني التابعة لجامعة الطب في مدينة بياوي ستوك، بولندا وذلك خلال الفترة من مارس إلى ديسمبر 2009م. ولقد قمنا باستخدام فحص الموصلة العصبية في العصب المتوسط والبحث الاستطلاعي (AIS, HADS للفاعلية الوظيفية ونوعية الحياة SF-36v2 and QLI) ومقياس القلق والاكتئاب (HADS).

النتائج: أشارت نتائج الدراسة إلى معاناة المرضى المصابين بتضرر في الكمونية النهائية في اليد اليمنى (p=0.05) وفي اليد اليسرى (p=0.004) من صعوبات في رفع الأشياء. وكانت نوعية الحياة فيما يتعلق بالصحة (SF-36v2) عند المرضى المصابين باضطرابات باليدين أقل بصورة واضحة من الناحية الإحصائية بالمقارنة مع المرضى الذين لا يعانون من هذه الحالات المرضية. كما وكان لهذه الاضطرابات تأثير جوهري سلبي على حالة AIS وتأثير جوهري على نشوء أعراض القلق (p=0.001) وكذلك على الحالة الوظيفية السيئة عند المرضى الذين تم فحصهم (p=0.001).

خاتمة: أظهرت الدراسة بأن الاضطراب في فاعلية عمل اليدين تؤثر سلباً على تقبل المرض وعلى نشوء القلق والاكتئاب، كما وتقلل من نوعية الحياة عند هؤلاء المرضى في جميع النواحي.

Objectives: To find the possible causes of limited hand functions, and to investigate the subjective evaluation of hand functioning in patients with diabetes and its impact on the quality of life (QoL) in the physical and mental dimensions.

Methods: This study was conducted on 71 patients with type 1 and type 2 diabetes attending the Department of Endocrinology, Diabetes and Internal Diseases, Medical University of Bialystok, Poland from March to December 2009. Median nerve conduction and a questionnaire survey (Acceptance of Illness Scale, Hospital Anxiety and Depression Scale, functional capacity, and QoL SF-36v2 and Quality of Life Index) were employed for this study.

Results: Patients with damaged distal latency in the right (p=0.05) and left hand (p=0.004) had difficulty lifting objects. The QoL in relation to health (SF-36v2) and Quality of Life Index in patients with hand dysfunctions were significantly statistically lower compared with patients not experiencing these symptoms. These disorders also had a significant negative impact on Acceptance of Illness Scale, the incidence of depressive symptoms (p=0.001), and the patient's functional status (p=0.001).

Conclusions: Impaired hand function affects lower acceptance of the disease, the occurrence of depression, and reduces patient's QoL.

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Diabetes mellitus (DM) is a chronic disease causing many health complications, with a significant impact on patient life satisfaction.[1] In clinical practice and in the literature, much attention is devoted to the diabetic foot, while less is focused on hand functioning in diabetes patients.[2] There are few studies evaluating the effect of median nerve conduction on the health status and quality of life (QoL) of diabetic patients. Padua et al[3] researched the QoL of diabetic patients and conducted neurophysiological tests on the sural, peroneal, and ulnar nerves, but not the median nerve. Several studies assessed QoL of diabetic neuropathy patients using QoL, depression and pain questionnaires.[4-6] Researches on hand functioning in diabetic patients have generally concentrated on tests such as touch and temperature perception,[7] finger dexterity, Dupuytren's contracture,[8] and Carpal tunnel syndrome,[9] as well as impact on activities of daily living,[10] but without further analysis of patient QoL. It is the functioning of hands and the patient's ability to self-care that affects coping with the disease, performing everyday activities, preparing and eating meals, administering insulin injections, measuring blood glucose levels, as well as overall QoL.[7,11] Through systematic evaluation of the diabetic patient's QoL, valuable information can be obtained in the areas of functioning, in which changes are needed.[12,13] Diabetes and its complications diminish patient's QoL in the physical and psychological dimensions. Understanding the subjective evaluation of hand function, as well as the clinical parameters and electrophysiological values (EMG) may be useful in improving patient QoL, acceptance of the disease, and in preventing the occurrence of anxiety and depression associated with chronic disease. The aim of our study was to find the possible causes of limited hand function, and to investigate the subjective evaluation of hand functioning in patients with diabetes, and its impact on the QoL in the physical and mental dimensions.

Methods. This study was conducted among 71 patients at the Department of Endocrinology, Diabetes and Internal Diseases, Medical University of Bialystok, Poland in patients with type 1 (21 patients) and type 2 (50 patients) diabetes from March to December 2009. The study inclusion criteria were: type 1 and 2 diabetes, age under 80 years, blood glucose profile of approximately 90-140 mg% on the day before, and on the day of the study. Patients with pacemakers and neurological diseases other than diabetic neuropathy were excluded from the study.

Data collection. All patients fulfilling the study criteria were asked to participate. A researcher explained the aim of the conducted study, procedure, and the interview/questionnaire. The patients signed written informed consent forms. We carried out nerve conduction tests of the median nerve of both hands, interviews to collect demographic data, subjective hand function assessment and questionnaire studies encompassing health related quality of life (HRQoL, Quality of Life Index [QLI]), Acceptance of Illness Scale [AIS], Barthel Index (BI), and the Hospital Anxiety and Depression Scale (HADS). Confidentiality and anonymity of all the obtained patient data were maintained. All subjects were informed regarding the purpose of the study, and voluntarily agreed to participate in the survey. The study was conducted according to the principles of the Declaration of Helsinki, and approved by the Bioethics Committee of the Medical University of Bialystok.

Nerve conduction studies. Motor nerve conduction studies of the median nerve (distal motor latency [DML], and conduction velocity [CV]) were performed according to the standard techniques by means of Keypoint equipment for all individuals.[14] All the tests were carried out at an ambient room temperature of 22-25°C. The median nerve was stimulated with a bipolar electrode (9013L0361), and median motor onset latency was recorded at the elbow and wrist levels. Distal latencies greater than 3.8 ms, and conduction velocities in excess of 50 m/s were taken as diagnostic for median nerve neuropathy, according to the normal reference values established in our laboratory.

Measurement. The HRQoL was measured using the SF-36v2 scale, consisting of 8 subscales. The construction of the SF-36v2 allows isolating the calculation of aggregate results in 2 dimensions: physical functioning (physical component summary [PCS]) and mental functioning (mental component summary [MSC]). The scale has good psychometric characteristics.[15] Ferrans and Powers QLI version III for diabetes assess 4 areas: health and functioning; socioeconomic; psychological and spiritual; and family. The overall score across the 4 domains ranges from 0-30, with higher scores indicating a better QoL.[16,17] The internal consistency coefficient, (Cronbach's α) for the original version of the QLI is 0.93.[16] Psychometric studies for the Polish language version of the QLI have also demonstrated good internal consistency for the scale (Cronbach's α = 0.88).[17] The

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degree of acceptance of the disease was studied using the AIS containing statements describing the negative consequences of bad health. The score of the scale ranges from 0-40, wherein the higher the score, the better the acceptance of the disease. The inner compliance of the scale is 0.85.[18]

The HADS consists of 2 subscales: anxiety and depression, each of which contains 7 statements. Each statement can receive from 0-3 points, the maximum number of points in each subscale is 21. In interpreting the results, it was assumed that 8-10 points mean that the existence of depressive and/or anxiety disorders is suspected,[11] and more points mean that there is a possibility of a depressive and/or anxiety disorder. The higher the score, the greater the severity of the disorders: 11-14 points - moderate intensity; and 15-21 points - significant intensity. Internal consistency of the scale for anxiety is 0.93, and 0.90 for depression.[16,19] The BI was used in order to obtain an assessment of functional performance in patients. The scale is scored from 0-100, higher scores being indicative of better functional performance. The BI is a reliable and widely used instrument designed to measure the degree of independence in activities of daily living, and covers the following 10 areas of functioning: eating meals; ability to go from bed to chair; ability to take care of personal hygiene needs; ability to use the toilet and bath; independence in moving across flat surfaces and use of stairs; and control and self care in the elimination of urine and feces. The internal consistency coefficient for BI has been reported as ranging between 0.87 and 0.90 in a variety of studies, and the convergent validity for the scale in relation to other scales is between 0.65 and 0.69.[16]

Statistical analysis. Data analysis was performed using the Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) version 17.0 for Windows. Statistical dependencies were tested using non-parametric tests including the Mann-Whitney and Chi-square tests. The Bonferroni correction for multiple comparisons was used.[20] A $p<0.05$ was accepted as statistically significant values.

Results. This study included 71 patients who were asked regarding subjective perceptions associated with hand function in the following areas: identification of the shape of objects; holding small objects; and lifting objects. The average age of the patients was 54.6 ± 14.3 years (range from 18-80 years). For the 37 women participating in the study, the mean age was 56.1 ± 14.4 years, and for the 34 men the mean age was 53.0 ± 14.3. The mean duration time of diabetes for women was 9.9 years, and 18.2 years for men. The clinical characteristics are presented in **Table 1**, in which age, gender, diabetes type and duration, body mass index (BMI) and glycosylated hemoglobin (HbA1c) values are discussed according to their impact on the functional state of the hands in the opinion of the studied patients. We observed that age has a significant effect ($p=0.003$) on the sense of inability to identify the shape of objects held in hands (IISO) and difficulty lifting objects (DLO). Type 2 diabetes also causes difficulties in holding small objects, which may also be associated with age since this type of diabetes usually occurs among the middle-aged and the elderly. The duration of the disease, as well as HbA1c and BMI values did not have a significant effect on the occurrence of hand dysfunctions. Analyzing the neurophysiological parameters such as distal latency and sensory conduction velocity in the left and right median nerve, and their impact on the analyzed hand functions (**Table 2**), it can be concluded that patients with damaged distal latency in the left hand have impaired hand functions in the range of IISO ($p=0.05$) and DLO ($p=0.004$). Whereas, lower conduction velocity in the left median nerve has a significant effect on all the studied variables (IISO [$p=0.05$]; DLO [$p=0.04$]; and DHO [$p=0.001$]). Distal latency in the right hand significantly affects only the DLO ($p=0.05$) and lower conduction velocity has no significant effect on the subjective feeling of this hand's state by the patients. Patients with damaged distal latency in the right ($p=0.05$) and left hand ($p=0.004$) had DLO ($p=0.004$). **Table 3** shows the effect of hand function on the state of physical functioning, mental health, and QoL of the studied patients. Due to numerous comparisons in the table, we used the Bonferroni correction, after which the level of significance is $p=0.007$. Significance above this value is not statistically significant. We observed lower acceptance of the disease in patients with abnormal IISO ($p=0.001$), DLO ($p=0.001$), and DHO ($p=0.004$). We also found that depression symptoms were statistically more frequently observed in patients with abnormal IISO ($p=0.001$), DLO ($p=0.001$), DHO ($p=0.001$). Anxiety symptoms occurred statistically significantly more often in patients with abnormal IISO ($p=0.001$). According to BI, the functional state of these patients was worse, which caused that they had limitations in hand functioning statistically significantly more often (IISO; $p=0.001$, DLO; $p=0.001$, DHO; $p=0.001$). The QoL in relation to health (SF-36v2) in patients with dysfunctions was statistically significantly lower compared with patients not experiencing these symptoms. In physical functioning (PCS), the IISO

Table 1 - Clinical characteristics of the studied patients divided into the functional abilities of the hands conducted at the Department of Endocrinology, Diabetes and Internal Diseases, Medical University of Bialystok, Poland.

Variables	IISO		DLO		DHO	
	Yes (N=15)	No (N=56)	Yes (N=17)	No (N=54)	Yes (N=17)	No (N=54)
Age (years)	63.9 ± 7.9	52.0 ± 14.7	63.5 ± 7.0	51.7 ± 14.9	59.53 ± 7.0	53.0 ± 15.7
P-value	0.003		0.003		0.12	
95% CI	(-19.67 - -3.88)		(-19.28 - -4.26)		(-14.37 - 1.38)	
Gender						
Women	8 (53.3)	29 (51.8)	9 (52.9)	28 (51.9)	6 (35.3)	31 (57.4)
Men	7 (46.7)	27 (48.2)	8 (47.1)	26 (48.1)	11 (64.7)	23 (42.6)
P-value	0.91		0.94		0.11	
95% CI	(-0.31 - 0.28)		(-0.29 - 0.27)		(-0.05 - 0.49)	
Type of diabetes						
Type 1	1 (4.8)	20 (95.2)	2 (9.5)	18 (90.5)	2 (9.5)	18 (90.5)
Type 2	14 (28.0)	36 (72.0)	15 (30.0)	35 (70.0)	15 (30.0)	35 (70.0)
P-value	0.03		0.06		0.06	
95% CI	(-0.55 - -0.31)		(-0.48 - 0.01)		(-0.48 - 0.01)	
Duration of diabetes, years	17.3 ± 11.6	13.24 ± 9.9	17.2 ± 11.9	13.1 ± 9.7	14.76 ± 10.7	13.90 ± 10.3
P-value	0.21		0.21		0.71	
95% CI	(-10.02 - 1.97)		(-9.87 - 1.59)		(-6.67 - 4.95)	
BMI (kg/m²)	29.6 ± 5.3	28.7 ± 11.6	29.6 ± 5.1	28.8 ± 11.8	29.4 ± 4.5	28.9 ± 11.9
P-value	0.11		0.07		0.07	
95% CI	(-6.92 - 5.44)		(-6.70 - 5.14)		(-6.34 - 5.51)	
HbA1C	8.8 ± 1.9	8.9 ± 2.0	9.3 ± 2.1	8.8 ± 1.9	9.6 ± 2.1	8.7 ± 1.9
P-value	0.74		0.36		0.16	
95% CI	(-1.09 - 1.31		(-1.71 - 0.58)		(-2.03 - 0.27)	

Data were expressed as Mean±SD and number and percentage (%). IISO - sense of inability to identify the shape of objects held in hands, DLO - difficulty lifting objects, DHO - difficulty holding small objects, HbA1C= c-fraction of glycosylated hemoglobin, CI - confidence interval. The Mann Whitney U-test and chi-square test were used for group comparisons, *P*-values are expressed if <0.05.

Table 2 - Neurophysiological parameters (distal latency, conduction velocity) of the median nerve and the functional abilities of the hands.

Variables	Distal latency						Conduction velocity					
	Left hand			Right hand			Left hand			Right hand		
	Correct N=30 Mean=3.4 ms	Damaged N=41 Mean=4.6 ms	*P*-value (95% CI)	Correct N=22 Mean=3.4 ms	Damaged N=49 Mean=4.9 ms	*P*-value (95% CI)	Correct N=48 Mean=54.5 m/s	Slowed N=23 Mean=46.1 m/s	*P*-value (95% CI)	Correct N=41 Mean=53.0 m/s	Slowed N=30 Mean=49.6 m/s	*P*-value (95% CI)
IISO, n (%)												
No	27 (90.0)	29 (70.7)	0.05	20 (90.9)	36 (73.5)	0.09	41 (85.4)	15 (65.2)	0.05	35 (85.4)	21 (70.0)	0.12
Yes	3 (10.0)	12 (29.3)	(-0.38 - 0.01)	2 (9.1)	13 (26.5)	(-0.38 - 0.03)	7 (14.6)	8 (34.8)	(-0.40 - 0.00)	6 (14.6)	9 (30.0)	(-0.35 - -0.04)
DLO, n (%)												
No	28 (93.3)	26 (63.4)	0.004	20 (90.9)	34 (69.4)	0.05	40 (83.3)	14 (60.9)	0.04	33 (80.5)	21 (70.0)	0.31
Yes	2 (6.7)	15 (36.6)	(-0.49 - -0.10)	2 (9.1)	15 (30.6)	(-0.43 - 0.00)	8 (16.7)	9 (39.1)	(-0.43 - -0.01)	8 (19.5)	9 (30.0)	(-0.31 - 0.10)
DHO, n (%)												
No	26 (86.7)	28 (68.3)	0.07	19 (86.4)	35 (71.4)	0.17	42 (85.7)	12 (52.2)	0.001	32 (78.1)	22 (73.3)	0.64
Yes	4 (13.3)	13 (31.7)	(-0.38,0.02)	3 (13.6)	14 (28.6)	(-0.36 - 0.07)	6 (12.3)	11 (47.8)	(-0.55 - 0.15)	9 (21.9)	8 (26.7)	(-0.25 - 0.16)

IISO- sense of inability to identify the shape of objects held in hands, DLO- difficulty lifting objects, DHO- difficulty holding small objects, ms - milliseconds, m/s - meters per second. Data are presented as n and % and confidence interval (CI) values are presented. The chi square test was used for group comparisons. *P* values are expressed if <0.05.

Table 3 - Effect of hand function on the state of physical functioning, mental health, and quality of life of the studied patients.

Variables	IISO			DLO			DHO		
	Yes N=15	No N=56	*P*-value (95 % CI)	Yes N=17	No N=54	*P*-value (95 % CI)	Yes N=17	No N=54	*P*-value (95 % CI)
AIS	22.7 ± 7.1	32.2 ± 7.5	0.001 (5.21 - 13.85)	23.8 ± 7.7	32.1 ± 7.6	0.001 (4.13 - 12.58)	24.8 ± 7.8	31.9 ± 7.8	0.004 (2.68 - 11.40)
HADS-D	9.5 ± 4.4	4.1 ± 4.0	0.001 (-7.75 - -2.99)	8.8 ± 4.3	4.1 ± 4.2	0.001 (-6.97 - -2.30)	8.6 ± 4.7	4.3 ± 4.1	0.001 (-6.70 - -1.95)
HADS-A	9.9 ± 4.9	4.6 ± 4.1	0.001 (-7.82 -2.76)	8.1 ± 5.2	4.9 ± 4.5	0.013 (-5.78 - -0.59)	8.2 ± 5.1	4.9 ± 4.5	0.013 (-5.93 - -0.76)
Barthel Index	88.4 ± 14.4	98.2 ± 4.6	0.001 (5.35 - 14.27)	88.6 ± 13.5	98.5 ± 4.4	0.001 (5.73 - 14.12)	89.1 ± 13.7	98.3 ± 4.5	0.001 (4.86 - 13.45)
SF-36v2 PCS	33.6 ± 10.1	47.9 ± 9.3	0.001 (8.78 - 19.78)	34.7 ± 10.6	48.1 ± 9.2	0.001 (8.07 - 18.68)	36.1 ± 12.1	47.6 ± 9.2	0.001 (5.94 - 17.05)
SF-36v2 MCS	29.6 ± 9.1	43.7 ± 11.0	0.001 (7.89 - 20.27)	33.2 ± 9.7	43.1 ± 11.8	0.003 (3.53 - 16.17)	31.7 ± 11.3	43.5 ±10.9	0.001 (5.65 - 17.90)
QLI, total	18.1 ± 3.6	21.9 ± 3.9	0.001 (1.52 - 6.03)	19.5 ± 4.1	21.6 ± 4.1	0.06 (-0.07 - 4.44)	18.4 ± 3.6	21.9 ± 3.9	0.002 (1.36 - 5.69)

IISO - sense of inability to identify the shape of objects held in hands, DLO - difficulty lifting objects, DHO - difficulty holding small objects, AIS - Acceptance of Illness Scale, HADS-A and HADS-D-Hospital Anxiety and Depression Scale, SF-36v2 PCS - physical component summary, SF-36v2 MCS - mental component summary, QLI - Quality of Life Index for Diabetes Version III. Data are presented as mean ± SD and confidence interval (CI), the Mann-Whitney U-test was used for group comparisons. Due to numerous comparisons the Bonferroni correction was applied, after which the level of significance is $p<0.007$, therefore values above this are not statistically significant.

(p=0.001), DLO (p=0.001), DHO (p=0.001), and mental functioning (MCS), the IISO (p=0.001), DLO (p=0.003), DHO (p=0.001) were statistically significantly lowered QoL. However, only 2 of the studied variables (IISO (p=0.001) and DHO (p=0.002)), had a significant impact on lower QoL in relation to diabetes' QLI.

Discussion. In this study, the results show a statistically significant effect of age on subjective evaluation of hand function in the studied patients who had difficulties holding small objects and were unable to identify the shape of objects. Studies by Wray et al[21] suggest that age is a strong predictor of disability among elderly patients with type 2 diabetes. Other studies[9] characterize abnormalities in hand functioning, which were related with the duration of diabetes, however, there was no link with metabolic control of diabetes. The complications of diabetes are associated with poor metabolic control and duration of diabetes.[22] In another study in adult patients with diabetes,[2] hand disability was associated with impaired muscle function and carpal tunnel syndrome. Obesity, dexterity, and overall physical functioning affected hand disability especially in women.[2] In the present study, there was no effect on gender on hand dexterity, and obese patients did not report problems in hand functioning. Redmond et al[2] showed that hand grip strength in patients with diabetes was lower than in a control group of similar age. The authors also believe that the hands of patients with diabetes should be taken care of, as much as the feet.[2] Savas et al[23] suggested that Dupuytren's disease, trigger finger, and limited joint mobility (LJM) did not cause functional disability of the hand, but low hand strength was found to cause functional disability of the hands of type 2 diabetic patients.

In this study, we observed the reported hand dysfunctions statistically more often in patients with type 2 diabetes. Generally, type 2 diabetes occurs later in life and reduces patient QoL.[1] In patients with type 2 diabetes and normal mobility at the start of treatment, a loss of mobility after 4.6 years was observed, and in nearly one-fifth of the group new difficulties in basic ADLs developed at the same time. However, most people developed minor physical deficits.[24] Cederlund et al[7] evaluated the hand functions and dysfunctions, and the activities of daily living (ADL) in older men with type 2 diabetes, and observed feeling and vibration disorders in the right hand fingers of all the studied patients. In our studies, worse neurophysiological parameters (distal latency and conduction velocity) were observed more frequently on the right side, while statistically

significant differences show the studied disorders (IISO, DLO, DHO) more often affect the left hand. Perhaps this can be explained by the fact that the right hand is more trained, and can better cope with abnormalities than the left hand.

Poor metabolic control in young patients with type 1 diabetes has a negative effect on nerve conduction velocity and is an independent risk factor for perpendicular bisector of distal diabetic neuropathy.[25] In studies conducted among patients with type 1diabetes, in whom the effect of nerve conduction, sense of touch, vibration perception threshold, and muscle strength on the QoL of patients were investigated, the authors found that disturbances in the functioning of peripheral nerves resulted in poorer QoL in the physical, but not mental dimension.[3] Our studies show that disturbances in the functioning of the hands had a statistically significant impact on HRQOL in both PCS and MCS spheres, as well as QLI. It is believed that the electrophysiological assessment is a more objective method of identifying subclinical and clinical neuropathy. Diabetic polyneuropathy diagnosed by EMG has a negative impact on patient's QoL. Mixed and sensorimotor polyneuropathy worsen QoL to a larger extent. This leads one to think that the level of polyneuropathy affects QoL.

The EMG is important for early diagnosis of diabetic neuropathy. The authors suggest that particularly patients with clinical neuropathy, microalbuminuria, long-term diabetes, and females should have a specific purpose for neurophysiological assessment, glycemic control, and a plan for reducing chronic complications of diabetes, which will be helpful in improving QoL.[26] It is believed that a balanced lifestyle and good QoL are essential for the physical and psychological well-being of patients with diabetes.[27]

Several studies have confirmed that diabetic patients had poorer QoL than patients with other serious chronic diseases. The duration and type of diabetes had no close connection with QoL, but the complications of diabetes are important determinants of patient 's QoL.[28,29] Treatment with insulin and satisfaction with treatment have an effect on better QoL.[28] Low quality of life is related with negligence in self care and shows a patient's individual ability in terms of self care.[27] In our study, we found that patients who had abnormal IISO, DLO, DHO accept their illness less (AIS). Psychological adaptation to the disease and maintaining good QoL is dependent on the individual characteristics of each person. Chronic diseases, such as diabetes have a significant impact on the patient's individual life plan, as well as his spouse, family, and others. The acquisition of skills to cope with stress and being immune has positive effects on emotional well-being, and thus on physical health. Patients with good family support have better QoL, and are less often depressed.[27,30] Among subjects of the study with impaired hand function, anxiety and depression (HADS) were significantly more frequent. In studies by de Groot et al,[31] a significant association between the occurrence of depression and increasing severity, and presence of diabetes complications was confirmed. The prevalence of depression coexisting with diabetes was significantly higher in women than in men.[32] Effective treatment of depression can improve glycemic control, effective insulin treatment and other clinical parameters, as well as reduce the risk of cardiovascular system disease, and thus result in improved QoL.[33]

The limitations of the study are the small study group resulting from the nature of the nerve conduction test and the inclusion of patients with type 1 and 2 diabetes. It would be more valuable to include patients with only one type of diabetes. The present study suggests the necessity of evaluating the functional abilities of the hands in patients with diabetes, and assessing the effect on mood and QoL. The study included young and old DM patients, which may confound variables (for example, patients may have cognitive and depressive problems related to age). This should be avoided in future studies. The age factor, therefore, may explain some variances in the study.

In conclusion, the impaired hand function in patient's opinion affects lower acceptance of the disease, occurrence of depression, and reduces patient QoL. Assessment of hand dexterity is important because it affects activities of daily living, QoL, and diabetes-related complications.

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