Research Article

Comparison of disability and quality of life between patients with pediatric and adult onset paraplegia

Hanife Duzgun Celik¹, Ayla Cagliyan Turk², Fusun Sahin³, Figen Yilmaz⁴, Banu Kuran⁴

¹Private Konak Medical Center, Department of Physical Medicine and Rehabilitation, Sakarya, Turkey, ²Hitit University Training and Research Hospital, Department of Physical Medicine and Rehabilitation, Corum, Turkey, ³Pamukkale University, Faculty of Medicine, Department of Physical Medicine and Rehabilitation, Denizli, Turkey, ⁴Hamidiye Sisli Etfal Training and Research Hospital, Department of Physical Medicine and Rehabilitation, Istanbul, Turkey

Objective: To investigate the factors that affect disability and quality of life in patients with spinal cord injuries (SCIs) and to compare the degree of disability and quality of life in patients with SCI according to over and under 18 years of age when their injury occurred.

Design: Cohort study.

Setting: Two academic hospitals in Istanbul, Turkey.

Participants: Forty patients with SCI were included in this study. Group 1 included 20 patients with SCI who were younger than 18 years of age when their injury occurred, Group 2 included 20 patients who were older than 18 years of age when their injury occurred.

Outcome Measures: Patients' demographics, duration of SCI and degree of disability were assessed using the Craig Handicap Assessment and Reporting Technique (CHART). Quality of life was assessed using the World Health Organization Quality of Life Scale Short Form (WHOQOL-Bref). Depression was assessed using the Beck Depression Inventory (BDI).

Results: Although there was no significant difference between the BDI scores and CHART scores of the two groups, environment domain scores in the WHOQOL-Bref were significantly higher in Group 2 than in Group 1 ($P < 0.05$). No significant correlation was found between age of SCI onset, disease duration, ASIA scores, depression scores, total CHART scores for all patients.

Conclusion: Adaptation to environment was significantly better in those who suffered SCI during adulthood than in pediatric patients with SCI. Disability level was not associated with age of disease onset, disease duration, neurological status, depression level.

Keywords: Spinal cord injury, Pediatric onset, Adult onset, Quality of life

Introduction

A spinal cord injury (SCI) is an injury of the spinal cord neural elements accompanied by motor and sensory loss at various levels and autonomic and intestinal or bladder problems.¹ The most frequent causes of traumatic SCI across the world are motor vehicle accidents and falls.²⁻⁴ Traumatic SCI leads to an abrupt change in a person's life, affecting quality of life and the ability to live independently, due to the irreversible restriction of functional movement associated with

SCIs. SCIs also have a significant impact on population health services and economics.^{5,6} Over the last 50 years, there have been significant improvements in social integration and better quality of life of people who suffered from SCI.⁷

An SCI that occurs at an age younger than 18 years is called 'pediatric-onset SCI'. Some research has suggested that people with pediatric-onset SCI are more affected by the injury than adult-onset SCI.⁸ The age at which patients with pediatric-onset SCI experience their injury is a period when many are finishing their education, beginning a profession or starting a romantic relationship, all of which briefly provide

Correspondence to: Ayla Cagliyan Turk, MD, Department of Physical Medicine and Rehabilitation, Hitit University, Training and Research Hospital, 19200, Corum, Turkey. Email: drayla1976@hotmail.com

status within the community. According to the opinion of some authors, the occurrence of SCI at this critical period leads to a serious trauma in patients that can negatively affect them for the rest of their lives.^{9,10} According to another opinion, the occurrence of an SCI at this age could make adapting to and coping with SCI easier for patients.¹¹ Patients with SCI who are starting a profession or continuing their education and who are following a good rehabilitation program may develop habits of an active life, and the degree to which their disability affects their lives may be less significant and their future quality of life may be better than patients who experience an SCI at a later age.¹² However, due to a lack of clinical studies in this area, the impact of pediatric-onset SCI on persons' professions, degree of disability and quality of life is still unknown.^{13,14}

The participation and quality of life of older persons with SCI are related to several factors such as chronological age, injury age and duration of injury. Post *et al.* suggested that poor independence outcomes for persons with SCI could be associated with increasing age and SCI at advanced age. Although prolonged post-SCI period can provide better adaptation, the effect of age on adaptation is not known.¹⁵

The aim of this study is to determine and compare the effect of SCIs that occur at an age younger than 18 years and older than 19 years on disability and quality of life; to evaluate the degree of disability and quality of life as they relate to physical mobility, transport in patients' external environments, psychological adaptation, education, profession and economics; and to investigate the factors that affect the disability of these patients.

Materials and methods

Patients with SCI with eligible inclusion criteria who were already recorded in the outpatient clinics Şişli Etfal Research and Training Hospital Physical Treatment and Rehabilitation Clinic and Istanbul 70th Year Physical Treatment and Rehabilitation Hospital were enrolled in the study. The patients were invited by phone call and the questionnaires were completed when they attended the outpatient clinics.

The study included patients with paraplegia and paraparesis who were > 18 years old with an injury duration > 1 year. The exclusion criteria were the existence of pregnancy, head injury, SCI leading to tetraplegia or tetraparesia, alcohol or any other drug addiction, or tumoral, infectious, neurological, cardiovascular (excluding mild hypertension), metabolic and endocrine disease.

Patients were assigned to two groups. Group 1 included 20 patients who experienced SCI at an age younger than 18 years (all patients were over 18 years old during time of interview), and Group 2 included 20 patients who experienced SCI at an age older than 19 years. Consent to be included in the study was obtained from all patients. A neurological examination of the patients was performed, and the patients were classified according to the 2002 ASIA scale. A systemic examination of the patients was conducted to find any systemic disease. Each patient's record form was filled by face-to-face interview.

The following information about each patient was recorded: sex (male, female); age (in years); marital status (married, single, divorced, other); etiology (traffic accident, falling from a high level, plunging, gun injury, other); income status (yes, none); duration of SCI (in years); profession before SCI (employee, non-working); current profession (employee, nonworking); continuation or discontinuation of education or work (yes/no); caregiving person (yes/no); if yes, the relationship of this person to the patient (mother/father/sibling, spouse/children, caregiver outside the family, him/herself); other people living with the patient (mother/father/sibling, spouse/children, caregiver outside the family, alone); change of marital status following SCI (no change, divorced, married); and work and income status (yes, none).

Patients were asked to rate the following functions according to their significance; walking independently, normal urination, normal defecation, normal sexual activity and working to gain money.

Patients' disability levels were assessed according to the short form Craig Handicap Assessment and Reporting Technique (CHART-sf) inquiry. The CHART is a measurement form of daily activities intended to evaluate parameters such as physical and cognitive independence, mobility, social adaptation, work and economic independence. It measures activity and contribution levels according to International Classification of Functioning (ICF). The CHART evaluates a person's social role using measurable criteria, rather than subjective comments. Each parameter is scored between 0 and 100. A maximal score of 100 represents the social contribution of a person without any disability. The total CHART score is the sum of scores for 6 parameters. Physical and cognitive independence, economic independence, social adaptation and mobility were evaluated by the CHART-sf.¹⁶

Quality of life was evaluated by the World Health Organization Quality of Life Scale Short Form

(WHOQOL-Bref). The WHOQOL-Bref includes 26 questions intended to evaluate a person's general perception of their quality of life. The WHOQOL-Bref version of the scale consists of 27 questions, adding a national question based on Turkish validation studies. Responses to questions were required reflect the latest 15 days. Physical health, mental health, social area and environmental area and total scores were calculated separately. WHOQOL-Bref is scored between 0 and 20 points, with higher points showing a higher quality of life.¹⁷

Depression was evaluated by the Beck Depression Inventory (BDI). In total, the BDI includes 21 questions, and each question consists of four sentences. These sentences are ranked from neutral status (0 points) to most-severe status (3 points). The possible highest point value on the BDI is 63. Depression is absent at 0 to 13 points, there is moderate depression at 14 to 24 points, and there is severe depression when a patient's score totals over 25 points.¹⁸ The validity and reliability of the scale in a Turkish setting has been shown.¹⁹

Statistical analysis

In addition to descriptive analysis, a t test was used to compare the mean values of the quantitative data of the two groups, and an χ^2 test was used to rank the comparison of the qualitative data. A univariate ANOVA (F test) test was used to compare the mean values of the quantitative data of more than two independent groups. In addition, Pearson's correlation coefficient was used to determine the correlation between two sets of quantitative data within each group. A P value of $P < 0.05$ was accepted as the significance level for the tests.

Results

The mean age was 23.9 ± 5.83 (18–44) years in Group 1 and 43.85 ± 12.77 (30–79) years in Group 2. The mean disease duration was 9.35 ± 6.06 (3–29) years in Group 1 and 8.7 ± 7.95 (1–31) years in Group 2. The mean age at SCI onset was 14.6 ± 2.8 years in pediatric onset patients and 33.1 ± 16.6 years in adult patients. The male/female ratio was 13/7 in Group 1 and 10/10 in Group 2.

According to the ASIA classification, 50% of patients (n:10) were ASIA A, 15% (n:3) were ASIA B, 15% (n:3) were ASIA C and 20% (n:4) were ASIA D in Group 1. In Group 2, 60% of patients (n:12) were ASIA A, 5% (n:1) were ASIA B, 25% (n:5) were ASIA C and 10% (n: 2) were ASIA D. There was no significant difference between the groups with regard to their ASIA classification ($P > 0.05$).

The etiological, socio-demographical and clinical properties of the cases are shown in Table 1. The etiological causes of the patients' SCI were not different between the groups. The most frequent causes of the patients' SCI were traffic accidents and falls. No patients continued to pursue the education they had been pursuing before their injury in Group 2, while only 50% of patients went to school in Group 1; therefore, there was no difference between the two groups with regard to education at the time of assessment ($P > 0.05$).

In terms of marital status, 10% of patients (n:2) in Group 1 were married following their SCI, and 5% of patients (n:1) were divorced following their SCI in Group 2. There was no significant difference between the groups with regard to change in marital status following SCI ($P > 0.05$).

In Group 1, 10% of patients were married, and there was no change for other patients. In Group 2, unmarried patients did not become married after their SCI.

Patients who experienced their SCI at an age younger than 18 years were living with their mother, father and siblings, and patients with SCI at age older than 19 years were living with their spouse and children. This factor was significantly different ($P < 0.0001$).

Approximately 20% of patients who were working before their SCI stopped working after their SCI in both groups. No difference was present between the two groups with regard to the working/nonworking ratio before and after the occurrence of SCI ($P > 0.05$). There was no difference in income between the two groups; 55% of Group 1 patients had income and 75% of Group 2 patients had income.

When patients were asked to rank walking independently, normal urination, normal defecation, normal sexual function and working to have an income according to each factor's significance for them, the ability to walk was ranked highest and normal sexual function was ranked lowest (Table 2).

There was no significant difference in the mean and total CHART-sf scores ($P > 0.05$) between the two groups (Table 3).

In the WHOQOL-Bref measure, only environmental area scores were significantly higher in Group 2 than Group 1 (Table 4).

There was no difference between BDI scores of the two groups, and 79% of patients in both groups were within a normal range ($P > 0.05$).

The factors affecting the disability levels of patients were also assessed using the CHART-sf. The total CHART-sf scores were not correlated with the ASIA scores, complete/incomplete status of patients,

Table 1 Overall characteristics of cases.

		Group 1	Group 2	P-value
Cause of spinal cord injury (SCI)	Traffic accident	5 (25%)	9 (45%)	> 0.05
	Falls	5 (25%)	7 (35%)	
	Plunging	3 (15%)	0	
	Violence	4 (20%)	0	
	Other	3 (15%)	4 (20%)	
Education level	None	2 (10%)	0	> 0.05
	Primary- Secondary school	12 (60%)	10 (50%)	
	High school	5 (25%)	10 (50%)	
	College	1 (5%)	0	
Education before SCI	Student	10 (50%)	0	< 0.0001
	Not student	10 (50%)	0	
Marital status	Not married	18 (90%)	4 (20%)	< 0.0001**
	Married	2 (10%)	11 (55%)	
	Divorced	0	3 (15%)	
	Widow	0	2 (10%)	
Change in marital status following SCI	None	18 (90%)	19 (95%)	> 0.05
	Divorced	0	1 (5%)	
	Married	2 (10%)	0	
People that the patient lives with	Parents, siblings	18 (90%)	3 (15%)	< 0.0001**
	Spouse, children	2 (10%)	15 (75%)	
	Caregiver	0	1 (5%)	
	Alone	0	1 (5%)	
Caregiver (who helps with daily activities)	Parents, siblings	16 (80%)	2 (10%)	< 0.0001**
	Spouse, children	2 (10%)	15 (75%)	
	Caregiver	0	1 (5%)	
	Him/her self	2 (10%)	2 (10%)	
Employment status before SCI	Working	8 (40%)	11 (55%)	> 0.05
	Unemployed	12 (60%)	9 (45%)	
Current employment status	Working	5 (25%)	7 (35%)	> 0.05
	Unemployed	15 (75%)	13 (65%)	
Income	Yes	11 (55%)	15 (75%)	> 0.05
	None	9 (45%)	5 (25%)	

depression level and disease duration in both Group 1 and Group 2 ($P > 0.05$). Although this is statistically significant, the correlation between patients' total CHART-sf scores and disease duration was negative in Group 1 ($r = -0.248$) and positive in Group 2 ($r = 0.412$).

There was positive, but not significant, correlation ($r = 0.197$) between the age of SCI onset and the total

CHART-sf scores in all study populations (Group 1 and Group 2).

Discussion

In this study, the impact of SCIs on disability levels and quality of life of those who experienced SCI an age younger than 18 years compared to those who

Table 2 Ranking of walking, micturition, defecation, sexual relationship and working status according to the importance attributed to them by the patients.

	Walking	Micturition	Defecation	Sexual relationship	Return to job
1st rank					
Group 1	45%	20%	10%	10%	15%
Group 2	50%	15%	5%	15%	15%
2nd rank					
Group 1	15%	30%	25%	20%	10%
Group 2	20%	35%	35%	5%	5%
3rd rank					
Group 1	20%	25%	35%	5%	15%
Group 2	15%	30%	30%	20%	5%
4th rank					
Group 1	15%	20%	20%	20%	25%
Group 2	15%	10%	25%	15%	35%
5th rank					
Group 1	5%	5%	10%	45%	40%
Group 2	0%	10%	5%	45%	35%

Table 3 Comparison of CHART-sf scores.

CHART-sf	Group 1	Group 2	P-value
PHYSICAL	94.85±5.03	94.55±5.14	> 0.05
COGNITIVE	99.45±2.45	98.70±5.81	> 0.05
MOBILITY	87.45±16.56	75.75±21.97	> 0.05
WORKING STATUS	63.93±38.96	44.31±32.60	> 0.05
SOCIAL ADAPTATION	98.12±6.41	94.37±11.16	> 0.05
ECONOMICS	16.25±18.62	23.75±24.96	> 0.05
TOTAL SCORE	460.06±14.46	431.43±64.55	> 0.05

experienced SCI at an age older than 19 years was investigated. No significant difference between the two groups was detected, except in the patients' marital status, their use of caregivers, the people who were living with the patients and the patients' WHOQOL-Bref environmental area scores.

The environment where the patients live and the people who care for the patients are among the main problems for patients with chronic conditions which can change depending on the patients' age. For example, it was reported that spouses, women and younger family members assume the care of older patients.²⁰ Studies suggest that 49–77% of adult patients are living with their spouse, 12% live with their mother/relatives, 20% are alone and 2% are living at nursing homes.^{21,22} In our study, in Group 1 90% of the patients were living with their mother, father and/or sister/brother in Group 1, and in Group 2, 75% of patients were living with their spouse and/or children and 15% were living with their mother, father and/or sister/brother. One possible reason that more patients with pediatric-onset SCI were living with their mother, father and/or sister/brother could be that SCI impeded their ability to get married. The traditional structure of Turkish community and family support could be the reason that a lower proportion of patients in this study were living with caregivers and at nursing houses than the proportion stated in the literature. Another explanation could be that the pediatric onset SCI sample had not yet reached an age where marriage is as common.

According to the results of the National Spinal Cord Injury Statistical Center in USA, 51% of patients were

single at the time of their SCI, 33% were married and 9% were divorced, while 10 years later, 41% of them were single, 34% were married and 19% were divorced.²³ In our study, 90% of patients in Group 1 were never married and 10% were married. In Group 2, 20% of patients were never married, 55% were married and 15% were divorced. In Group 1, 10% of patients were married following their SCI, while 5% of patients in Group 2 were divorced following their SCI. There was a statistically significant difference between the marital status of two groups. Results suggest that sexual relationships and marriage may be affected in patients who develop a severe disability like SCI at an age younger than 18 years. Marital status may be affected by many factors, such as patients' degree of disability, economical income and social conditions. In our study, the relations between marital status and the disability level detected by CHART-sf was assessed, there was no statistically significant difference between marital status and total CHART-sf scores in both groups. In the literature, there is no study evaluating the relationship between CHART scores and marital status.

According to the State Statistics Institute's recent data, the overall unemployment rate is 10.7% in Turkey and is 19.1% in people 15–24 years old.²⁴ The unemployment rate in both groups studied was much higher than this value, but no significant difference in unemployment was present between the two groups. The employment rate in adult patients with SCI has been suggested to be 30–35%.^{22,25} This rate is 51% in pediatric patients with SCI.⁸ Meade *et al.* reported that employment rates in adult patients with pediatric-onset SCI was higher than patients with adult SCI.²⁶

Table 4 Comparison of WHOQOL-Bref scores.

	Group 1	Group 2	P-value
PHYSICAL AREA	13.91±2.31	12.51±2.42	> 0.05
MENTAL AREA	14.46±2.87	14.33±2.92	> 0.05
SOCIAL AREA	15.60±3.06	14.93±3.68	> 0.05
ENVIRONMENTAL AREA	11.64±1.50	12.97±2.11	< 0.05

According to Tozato *et al.*, earlier injury age, disease duration and high educational level are indicators of a patient with SCI's likelihood to return to his or her job.²⁷ In Anderson *et al.*'s study, a higher working rate was associated with greater education, better neurological levels, a younger age at the onset of injury, a longer period with SCI and a better capacity to live independently.⁸ In a study of patients with pediatric-onset SCI, the patients' working situation was relatively stable, but changes in working situation were correlated with education, secondary health status and psychosocial wellness.²⁸ In Turkey, a study by Gündüz *et al.* found an employment rate of 21% in patients with SCI.²⁹ This study detected a correlation between female sex, younger age at the time of injury, a long period of time since the injury, higher educational level and continuation of education following the injury and membership in a social association and employment rate, while level and severity of the SCI were not correlated with employment. In our study, although there was no statistically significant difference between the two groups, the employment rate was 35% in Group 2, which was similar to rates reported in the literature, and this rate was lower in Group 1 (25%). This result showed that experiencing an SCI at an age younger than 18 years did not favourably or unfavourably affect future profession and having job compared to experiencing an SCI at an age older than 19 years.

According to the State Statistics Institute's data, in Turkey, 12% of the population has not graduated from any school, 27% have graduated from primary school, 26% have graduated from secondary school, 21% have graduated from high school and 11% have graduated from college.³⁰ In a long-term follow-up study of patients with SCI by Yilmaz *et al.*, 25% of patients had not completed any education, 60% had graduated from primary school, and 15% had graduated from high school.³¹ The educational level of our study group contained fewer graduates of high school than the State Statistics Institute's data. There was no statistically significant difference between the distribution of education of the two groups in our study. This shows that the occurrence of SCI at an age younger than 18 years did not affect education. However, when considering the increasing educational level in Turkey, under normal conditions, a better education level could be expected of pediatric-onset SCI group, since they were younger. This may indicate that Group 1 had a lower level of education than others without an SCI of the same age. In addition, the fact that only 3 of 20 patients in Group 1 were attending school supports the idea that pediatric-onset SCI affects education. Following an SCI,

in addition to health and socioeconomic problems, the insufficient architectural organization in our country may also be a restriction for the education of young patients.

According to our study's results, disability scores were not associated with neurological status (ASIA scores), disease duration, age of onset of disease or depression. Other studies have reported similar results to our study. A study that used a CHART-sf scale in patients with SCI reported that SCI duration was not an indicator of CHART-sf scores.³² However, in a study conducted on adult patients with SCI, progression of disability was faster in older patients and slower in young patients.³³ In their study, Saikkonen *et al.* assessed the physical independence of 77 patients with SCI using the Functional Independence Measurement (FIM) and the patients' depression levels using the BDI, and there was no significant correlation between the FIM and BDI scores.³⁴ Kreuter *et al.* did not detect a correlation between time after injury (disease duration) and psychological and functional outcomes in patients with SCI.³⁵ In Kannisto *et al.*'s study, no difference was detected between the psychological functions of patients with pediatric-onset SCI and patients with adulthood-onset SCI.³⁶ In our study, as indicated in study by Kannisto, no difference was detected between the psychological functions of patients with pediatric-onset SCI and patients with adulthood-onset SCI.

Better quality of life was correlated with younger age.³⁷ However, there was no correlation between quality of life and injury severity, physical wellbeing, injury age, independent living and education in patients with pediatric-onset SCI.³⁸ Putzke *et al.* used the FIM, Short Form 12, CHART and Satisfaction With Life Scale (SWLS) in patients with SCI, and they detected a slight reduction of scores in all scales with age.³⁹ In our study, quality of life was the same in both groups. However, the environmental adaptation of patients with SCI who were 19 years or older when the injury occurred was significantly better than patients with pediatric-onset SCI.

In our study, when patients were asked to rank the importance of certain functions that they lost following SCI, both groups of patients ranked normal walking first, followed by normal urination, defecation, professional life and normal sexual relationships second, third, fourth and fifth, respectively. These rankings were ordered the same way in both groups. This finding shows the importance that these patients place in independent mobility. Normal walking is associated with an independent life for these patients. Normal urination and defecation's placement at the second and third rank

Figure 1 Classification of groups according to Beck Depression Inventory scores A: Normal; B: Mild depression; C: Severe depression.

show the patients' need to complete these functions without any physical support from others. Professional life was ranked fourth, which may show that patients believe that they can have a job when they need either minimal family support or no support to survive. Patients gave the lowest importance to normal sexual relationships, which may be because patients were not willing to reveal their thoughts on this subject openly, due to their timidity. In a study conducted by Martha *et al.*, 132 patients with SCI described their quality of life as good, relating their quality of life with their marriage, their significant and productive role in the family, and their successful social relationships and social adaptations.⁴⁰ Hammel *et al.* showed that quality of life was correlated with health, social status, social contribution, mobility, control over one's own life, marital status (being married), relationship success and having a job in all degrees of patients with SCI.⁴¹ In a study conducted on pediatric-onset SCI, injury age, social mobility, marital status, mental health and lack of medical complications were considered to be indicators for life success.⁴²

The effects caused by stressors that change the life and well-being of humans also cause important changes in the course of one's life. Especially the events that cause a change in social roles and the time when these events occur are important for the dynamics of these changes. Differences between people in terms of social and economic characteristics also affect the role of the family in a person's life. The future quality of life and life expectations of especially young patients and their families might change according to their coping strategies. Young patients with SCI who have predominantly physical disabilities and who are included in the definition of quotidian stressor advanced by Pearlin and Skaff might increasingly face problems as they grow older. It is considered more appropriate to evaluate patients with SCI who are facing a lifelong condition within the age limits that the assessments were made.⁴³

The major limitation of our study is that it was carried out with a small number of patients. Having a larger number of patients would provide an opportunity for more distinctive features to emerge. Also, a longer follow-up duration could reveal more striking differences.

In our study, no significant difference were detected between patients with an SCI that occurred after 18 years of age and patients with pediatric-onset SCI with respect to sociodemographic characteristic, disability level and quality of life assessments. In our study sample, the mean age at SCI onset was 14.6 ± 2.8 years in patients with pediatric-onset SCI and 33.1 ± 16.6 years in patients with adult-onset SCI. We think that this difference provides an opportunity to compare the two groups. When evaluating this conclusion, the roles of not only medical but also social and cultural factors should be considered. Although our study provides some explanation of the impact of age at SCI on quality of life and disability levels, studies comparing the quality of life and disability levels of patients with SCI and healthy people are needed to reach a precise conclusion.

Disclaimer statements

Contributors None.

Funding None.

Conflict of interest None.

Ethics approval None.

Each of the authors has contributed to, read, and approved this manuscript. None of the authors has any conflict of interest, financial or otherwise.

References

- Mehrholtz J, Kugler J, Pohl M. Locomotor training for walking after spinal cord injury. *Spine* 2008;33(21):768–77.

- 2 Ho CH, Wuermser LA, Priebe MM, Chiodo AE, Scelza WM, Kirshblum SC. Spinal cord injury medicine. 1. Epidemiology and classification. *Arch Phys Med Rehabil* 2007;88(1):49–54.
- 3 Gur A, Kemaloglu MS, Cevik R, Sarac AJ, Nas K, Kapukaya A, et al. Characteristics of traumatic spinal cord injuries in south-eastern Anatolia, Turkey: a comparative approach to 10 years' experience. *Int J Rehabil Res* 2005;28(1):57–62.
- 4 Karamehmetoglu SS, Unal S, Karacan I, Yilmaz H, Togay HS, Ertekin M, et al. Traumatic spinal cord injuries in Istanbul, Turkey. An epidemiological study. *Paraplegia* 1995;33(8): 469–71.
- 5 Celik B, Gultekin O, Beydogan A, Caglar N. Domain-specific quality of life assesment in spinal cord injured patients. *Int J Rehabil Res* 2007;30(2):97–101.
- 6 Unalan H, Celik B, Sahin A, Caglar N, Esen S, Karamehmetoglu SS. Quality of life after spinal cord injury: the comparison of the SF-36 health survey an its spinal cord injury modified version in assesing the health status of people with spinal cord injury. *Neurosurg Q* 2007;17(3):175–79.
- 7 DeLisa JA, Hammond MC. The history of the subspecialty of spinal cord injury medicine. In: Kirshblum SC, Campagnolo D, DeLisa JE, editors. *Spinal cord medicine*. Philadelphia, PA: Lippincott Williams &Wilkins, 2002:1–4.
- 8 Anderson CJ, Vogel LC. Employment outcomes of adults who sustained spinal cord injuries as children or adolescents. *Arch Phys Med Rehabil* 2002;83(6):791–801
- 9 Anderson CJ, Vogel LC, Betz RR, Willis KM. Overview of adult outcomes in pediatric-onset spinal cord injuries: implications for transition to adulthood. *J Spinal Cord Med* 2004;27(1):98–106
- 10 Vogel LC, Anderson CJ. Spinal cord injuries in children and adolescents: a review. *J Spinal Cord Med* 2003;26(3):193–203
- 11 Anderson CJ, Vogel LC, Chlan KM, Betz RR. Coping with spinal cord injury: strategies used by adults who sustained their injuries as children or adolescents. *J Spinal Cord Med* 2008;31(3): 290–96
- 12 Vogel LC, Chian KM, Zebracki K, Anderson CJ. Long-term outcomes of adults with pediatric-onset spinal cord injuries as a function of neurological impairment. *J Spinal Cord Med* 2011;34(1): 60–8
- 13 Hallin P, Sullivan M, Kreuter M: Spinal cord injury and quality of life measures: a review of instrument psychometric quality. *Spinal Cord* 2000;38(9):509–23.
- 14 Hammell KW: Quality of life among people with high spinal cord injury living in the community. *Spinal Cord* 2004;42(11):607–20.
- 15 Post MW, Reinhardt JD. Participation and life satisfaction in aged people with spinal cord injury: does age at onset make a difference? *Top Spinal Cord Inj Rehabil* 2015; 21(3):233–40.
- 16 Whiteneck GG, Charlifue SW, Gerhart KA, Overholser JD, Richardson GN. Quantifying handicap: a new measure of long-term rehabilitation outcomes. *Arch Phys Med Rehabil* 1992;73 (6):519–26.
- 17 Dunder P, Fidaner C, Fidaner H, Oral A, Eser S, Atman UC, et al. Comparing the Turkish versions of WHOQOL-BREF and SF-36. Convergent validity of WHOQOL-BREF and SF-36. *Hippokratia* 2002;6(1):37–43.
- 18 Beck AT, Steer RA. Internalconsistencies of the original and revised Beck Depression Inventory. *J Clin Psychol* 1984;40(6):1365–67.
- 19 Hisli N. Beck Depresyon Envanterinin gecerligi üzerine bir calisma. *Psikoloji Dergisi* 1988;6(22):118–22.
- 20 Skaff MM, Pearlin LI. Caregiving: role engulfment and the loss of self. *Gerontologist* 1992;32(5):656–64.
- 21 Krause JS, Crewe NM. Chronological age, time since injury, and time of measurement: effect on adjustment after spinal cord injury. *Arch Phys Med Rehabil* 1991;72(2):91–100.
- 22 Hirsh AT, Molton IR, Johnson KL, Bombardier CH, Jensen MP. The relationship of chronological age, age at injury, and duration of injury to employment status in individuals with spinal cord injury. *Psychol Inj Law* 2009;2(3–4): 263–75.
- 23 National Spinal Cord Injury Statistical Center: spinal Cord Injury: Facts and Figures at a Glance 2015. Birmingham, University of Alabama at Birmingham, 2015.
- 24 Haber Bülteni Ana Sayfası. Available at: <http://www.tuik.gov.tr/PreHaberBultenleri.do?id=21576>. Accessed on 16 December 2016.
- 25 Trenaman L, Miller WC, Querée M, Escorpizo R; SCIRE Research Team. Modifiable and non-modifiable factors associated with employment outcomes following spinal cord injury: a systematic review. *J Spinal Cord Med* 2015;38(4):422–31.
- 26 Meade MA, Lewis A, Jackson MN, Hess DW. Race, employment, and spinal cord injury. *Arch Phys Med Rehabil* 2004;85(11): 1782–92.
- 27 Tozato F, Tobimatsu Y, Wang C, Iwaya T, Kumamoto K, Ushiyama T. Reliability and validity of the Craig handicap assessment and reporting technique for Japanese individuals with spinal cord injury. *Tohoku J Exp Med* 2005;205(4):357–66.
- 28 Hwang M, Zebracki K, Chlan KM, Vogel LC. Longitudinal employment outcomes in adults with pediatric-onset spinal cord injury. *Spinal Cord* 2014;52(6):477–82.
- 29 Gunduz B, Erhan B, Bardak AN. Employment among spinal cord injured patients living in Turkey: a cross-sectional study. *Int J Rehabil Res* 2010;33(3):275–78.
- 30 Türkiye'de Eğitim ve Teknolojinin Durumu. Available at: http://aibu.sosyalbilgiler2014-2015bahar.blogspot.com.tr/2015/04/turkiyede-egitim-ve-teknolojinin-durumu_38.html. Accessed 16 December 2016.
- 31 Yilmaz F, Sahin F, Aktug S, Kuran B, Yilmaz A. Long term follow-up patients with spinal cord injury. *Neurorehabil Neural Repair* 2005;19(4):332–37.
- 32 Charlifue S, Gerhart K. Community integration in spinal cord injury of long duration. *Neuro Rehabilitation* 2004;19(2):91–101.
- 33 Rodakowski J, Skidmore ER, Anderson SJ, Begley A, Jensen MP, Buhule OD, et al. Additive effect of age on disability for individuals with spinal cord injuries. *Arch Phys Med Rehabil* 2014;95 (6):1076–82.
- 34 Saikkonen J, Karppi P, Huusko TM, Dahlberg A, Mäkinen J, Uutela T. Life situation of spinal cord injured persons in Central Finland. *Spinal Cord* 2004;42(8):459–65.
- 35 Kreuter M, Siösteen A, Erholm B, Byström U, Brown DJ. Health and quality of life of persons with spinal cord lesion in Australia and Sweden. *Spinal Cord* 2005;43(2):123–29.
- 36 Kannisto M, Merikanto J, Alaranta H, Hokkanen H, Sintonen H. Comparison of health-related quality of life in three subgroups of spinal cord injury patients. *Spinal Cord* 1998;36(3):193–99.
- 37 Leduc BE, Lepage Y. Health-related quality of life after spinal cord injury. *Disabil Rehabil* 2002;24(4):196–202.
- 38 Chen Y, Anderson CJ, Vogel LC, Chlan KM, Betz RR, McDonald CM. Change in life satisfaction of adults with pediatric-onset spinal cord injury. *Arch Phys Med Rehabil* 2008;89(12):2285–92.
- 39 Putzke JD, Barrett JJ, Richards JS, DeVivo MJ. Age and spinal cord injury: an emphasis on outcomes among the elderly. *J Spinal Cord Med*. 2003;26(1):37–44
- 40 Chapin MH, Miller SM, Ferrin JM, Chan F, Rubin SE. Psychometric validation of a subjective well-being measure for people with spinal cord injuries. *Disabil Rehabil* 2004;26(19):1135–42.
- 41 Hammell K.W: Exploring quality of life folowing spinal cord injury: a review and critique. *Spinal Cord* 2004;42:491–502.
- 42 Anderson CJ, Krajci KA, Vogel LC. Life satisfaction in adults with pediatric-onset spinal cord injuries. *J Spinal Cord Med* 2002;25(3): 184–90.
- 43 Pearlin LI, Skaff MM. Stress and the life course: a paradigmatic alliance. *Gerontologist* 1996;36(2):239–47.