



# The Impact of Depression, Personality, and Mental Health on Outcomes of Total Knee Arthroplasty

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**Background:** Precise assessment of preoperative mental health and psychological determinants may be useful in identifying patients at risk for poor postoperative outcomes of total knee arthroplasty (TKA). The aim of this study was to investigate the influence of psychological status and physical and mental health on the outcome of patients undergoing TKA.

**Methods:** Fifty-two patients undergoing unilateral TKA were assessed preoperatively with Oxford Happiness Inventory, Eysenck Personality Inventory, 12-item short form health survey (SF-12), and Knee Injury and Osteoarthritis Outcome Score (KOOS) for evaluating depression, personality traits, physical and mental health, and function, respectively. At 1 year after surgery, health-related quality of life (HRQL) and function were assessed using the SF-12 and KOOS.

**Results:** HRQL and function of all personality traits increased significantly after TKA, without significant difference among them. Extroversion and neuroticism did not have significant correlation with subjective well-being, HRQL, and function before and after surgery. Subjective well-being and the baseline physical and mental health scores were correlated strongly and directly with postoperative physical component summary, mental component summary, and KOOS scores and their improvement. Among many factors that significantly affected the outcomes of TKA, the only independent predictor of physical, mental, and functional outcome was depression.

**Conclusions:** Outcomes of surgery were not significantly different among diverse personality traits. Patients with less depressive symptoms and higher baseline mental and physical scores had significantly greater improvement in HRQL after surgery. The only independent factor affecting the physical, mental, and functional outcome was depression.

**Keywords:** Total knee replacement, Outcome, Personality, Depression, Mental health

Despite great advances in total knee arthroplasty (TKA) implants and techniques in recent years, approximately 20% of patients have reported little or no postoperative improvement in pain, physical function, and quality of life

(QOL).<sup>1,2)</sup> These results could not be explained completely by surgical and physical characteristics. Recent studies have demonstrated that preoperative psychological factors may play a role in postoperative dissatisfaction of patients.<sup>3)</sup> Vissers et al.<sup>2)</sup> demonstrated that patients with a better preoperative self-reported mental health score were more often satisfied. Giurea et al.<sup>4)</sup> showed significant influence of 4 personality traits on patient satisfaction: life satisfaction, performance orientation, somatic distress, and emotional stability. In an investigation about the relationship between patients' diverse personalities and

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clinical outcomes of TKA, a statistically significantly positive relationship was seen between outcome scores and extraversion levels in rating scales. Also, there was a negative relationship between outcome scores and neuroticism subscale scores.<sup>5)</sup>

Assessment of personality, preoperative mental health, and psychological status may be helpful in better patient selection and decreased postoperative dissatisfaction of patients. However, there are few studies about the influence of preoperative psychological condition and diverse personalities on TKA outcome. Therefore, our knowledge is still limited. We hypothesized that preoperative physical and mental health, personality traits, and depression would be related to improvement of health-related quality of life (HRQL) and functional outcome of TKA.

## METHODS

### Ethical Consideration

The study received ethical approval from the Institutional Review Board of Iran University of Medical Sciences (IR.IUMS.REC 1395.27063). Written informed consent was obtained from all patients prior to the surgery.

### Study Design

The current study is a prospective, cross-sectional survey (level of evidence III), which was conducted on patients who underwent unilateral TKA between March 2016 and October 2016.

### Patient Selection

A total of 67 patients underwent TKA, but only 62 patients met the following inclusion criteria: (1) unilateral TKA due to severe degenerative osteoarthritis (OA), (2) no history of previous knee surgery, (3) no psychiatric history, and (4) no history of surgery within the last 3 months. Patients were excluded after surgery if (1) complications occurred, (2) they needed surgery for another reason, or (3) they did not return for follow-up within 1 year. Two patients were excluded because of deep venous thrombosis, 1 patient had surgery for intertrochanteric fracture, 1 patient underwent cardiac surgery, and 6 patients did not complete the follow-up. The remaining 52 patients (38 women and 14 men) were evaluated and completed the follow-up.

### Surgical Procedure

All surgical procedures were carried out through a standard midline incision and medial parapatellar approach. All implants were cemented. One day after surgery, pa-

tients started walking with a walker and began range of motion (ROM) exercises with the assistance of a continuous passive motion machine. The postoperative protocol was similar for all patients. They were discharged 2 or 3 days after surgery with instructions of home exercise program. Follow-up visits were done at 2 weeks, 1 month, 3 months, 6 months, and 12 months.

### Data Collection and Measurement Tool

Demographic characteristics of patients including age, gender, educational status, and medical history were collected during interviews. Educational status was evaluated by asking the patients to state their highest level of educational achievement and was grouped into 3 categories: (1) illiterate, (2) primary school education, (3) high school education or higher. Patients were asked to complete the following questionnaires before surgery.

### Knee Injury and Osteoarthritis Outcome Score (Iranian Version)

The Knee Injury and Osteoarthritis Outcome Score (KOOS) is a self-administered questionnaire designed to assess both short-term and long-term consequences of OA and includes 42 items in 5 separately scored subscales; pain, other symptoms, function in daily living, function in sport and recreation (Sport/Rec), and knee-related QOL. It is a valid, reliable, responsive self-administered instrument and has been validated for several orthopedic interventions such as TKA<sup>6)</sup> and for Iranian population.<sup>7)</sup>

### Twelve-Item Short Form Health Survey (Iranian Version)

Twelve-item short form health survey (SF-12) is the brief version of the 36-item short form health survey (SF-36). It was developed as an applicable instrument for measuring HRQL.<sup>8)</sup> It includes a general mental health scale, which has been found to correlate with depression and trait anxiety in patients undergoing joint replacement.<sup>9)</sup> Although SF-12 gives estimates of all 8 domains (physical functioning, role limitations due to physical problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and mental health), it is more applicable to focus on 2 distinct overall health concepts known as physical component summary (PCS) and mental component summary (MCS).<sup>10)</sup>

### Eysenck Personality Inventory (Iranian Version)

The Eysenck Personality Inventory (EPI) is a self-report instrument designed to measure 2 central dimensions of personality, extroversion and neuroticism. This instrument is composed of 57 yes/no items (extroversion, 0-24;

neuroticism, 0-24; lie, 0-9). Raw scores are converted to norm-based scores from 1 to 99. Based on the Eysenck theory, greater scores of extroversion scale (more than 50) show the extrovert personality and lower scores (lower than 50) demonstrate the introvert personality. People with neuroticism scale scores greater than 50 are emotionally unstable, and scores lower than 50 show emotionally stable personality. Individuals are generally classified as high or low on the 2 dimensions. Persons high in extroversion are seen as social, carefree, and optimistic, while low scorers are generally quiet, introspective, and reserved. Individuals classified as high in neuroticism are prone to emotional distress/instability, while those low in this dimension are generally calm and emotionally stable.<sup>11)</sup>

### Oxford Happiness Inventory (Iranian Version)

The Oxford Happiness Inventory (OHI) is a 29-item instrument. Each item contains 4 options, which are constructed to reflect incremental steps defined as follows: unhappy or mildly depressed, a low level of happiness, a high level of happiness, and mania. Scores range from 0 to 87 with the normal values being 40–42. The internal reliability and construct and concurrent validity of the OHI have been confirmed for Iranian population.<sup>12)</sup> Pa-

tients completed the KOOS and SF-12 questionnaires at 12 months postoperatively to evaluate the improvement in function and HRQL.

### Statistical Analysis

Analysis was performed using the SPSS ver.18 (SPSS Inc., Chicago, IL, USA). The independent variables were age, gender, level of education, and EPI and OHI scores. Paired *t*-test was used to evaluate differences between SF-12 and KOOS scores before and after surgery. To analyze the differences between means, *t*-test was used for 2 independent groups and one-way analysis of variance was applied for more than 2 groups. Post-hoc testing for significant differences was done by Tukey test. Pearson's correlation coefficients were calculated to examine the correlation of age, OHI, and EPI scores with changes in SF-12 and KOOS score. A *p* < 0.05 was considered statistically significant.

## RESULTS

Fifty-two patients, including 38 women (73.1%) and 14 men (26.9%) with a mean age of 67.19 years (standard deviation [SD], 7.68 years; range, 50–82 years), participated in the study. All patients had nearly full active extension

**Table 1.** Questionnaire Scores and Differences between Male and Female Patients

Score	All participants	Male (n = 14)	Female (n = 38)	<i>p</i> -value
Mean age (yr)	67.19 ± 7.68	68.29 ± 8.31	66.79 ± 7.51	0.538
Range of motion (°)	123.46 ± 8.08	125 ± 4.8	122.89 ± 8.98	0.410
OHI score	39 ± 12.39	44 ± 15.78	37.16 ± 10.56	0.077
Lie score	54.54 ± 18.19	50.21 ± 17.83	56.13 ± 18.29	0.303
Extroversion score	51.73 ± 21.39	50.86 ± 21.34	52.05 ± 21.64	0.860
Neuroticism score	69.29 ± 25.41	73.21 ± 17.64	67.74 ± 27.79	0.504
SF-12 score				
Preoperative	26.67 ± 5.28	27.64 ± 5.02	26.32 ± 5.39	0.427
Postoperative	35.71 ± 6.99*	39.79 ± 4.63*	34.21 ± 7.17	0.013*
Improvement	9.04 ± 3.64*	12.14 ± 2.88*	7.89 ± 3.22	0.000*
KOOS score				
Preoperative	33.29 ± 6.11	33.71 ± 6.38	33.13 ± 6.09	0.765
Postoperative	68.25 ± 9.82*	73.71 ± 7.09*	66.24 ± 9.98	0.013*
Improvement	34.96 ± 9.99*	40.00 ± 10.02*	33.10 ± 9.45	0.026*

Values are presented as mean ± standard deviation.

OHI: Oxford Happiness Inventory, SF-12: 12-item short form health survey, KOOS: Knee Injury and Osteoarthritis Outcome Score.

\*Significant (2-tailed) at the 0.05 level.

and at least 100° of active flexion and walked independently at 1 year after surgery. The mean postoperative ROM was 123.4 (SD, 8.08°; range, 100°–140°). The postoperative ROM was not significantly different among patients with different educational levels, personality types, and sex.

The average OHI score ( $39 \pm 12.39$ ) for all patients was around the normal limits (40–42) without significant difference between men and women. Among all participants, the overall extroversion score was 51.73. The average neuroticism score was 69.29 in all patients, which indicates emotional instability was more common among the participants. The lie scale shows the validity of answers (a score higher than 50 shows the participant is trying to lie about his/her personality). The average lie score among our patients was 55, which is a little above the normal limit but still valid. The SF-12, PCS, MCS, and KOOS scores improved significantly after TKA in both men and women ( $p < 0.05$ ). The SF-12, MCS, and KOOS scores were significantly greater in men than women after TKA ( $p < 0.05$ ). Results are shown in Table 1.

The OHI score was significantly higher among participants with a high school or university degree, which may demonstrate that higher education results in greater

well-being. SF-12, PCS, MCS, and KOOS scores after arthroplasty improved significantly in all education levels ( $p < 0.05$ ), and the improvement was significantly greater in patients with high school or university degrees than patients with lower education levels ( $p < 0.05$ ). Results are shown in Table 2.

The most common personalities were unstable-extrovert and unstable-introvert. No significant difference in personality type was found between men and women among the 3 educational levels. SF-12, PCS, MCS, and KOOS scores increased significantly in all groups, which means patients experienced higher QOL and better function after TKA regardless of personality type. Patients with stable-introvert personality had significantly greater improvement than others in HRQL ( $p = 0.038$ ). Table 3 demonstrates the results.

Finding the correlation of age and preoperative OHI, SF-12, PCS, MCS, and KOOS with postoperative SF-12 and KOOS might help to estimate the outcomes of TKA better with higher reliability. Also, we could better exclude the patients who were mentally or physically not suitable for surgery and could have poorer outcomes. OHI had a strong and direct correlation with preoperative SF-

**Table 2.** Questionnaire Scores and Differences among Participants Based on Educational Status

Score	Educational status			p-value
	Illiterate (n = 14)	Primary school (n = 24)	High school or higher (n = 14)	
Mean age (yr)	70.29 ± 9.06	65.79 ± 6.97	66.50 ± 7.00	0.206
Range of motion (°)	120.36 ± 9.89	124.38 ± 7.98	125 ± 5.55	0.240
OHI score	33.86 ± 7.05	36.12 ± 11.58	50.79 ± 10.64*	< 0.001*
Lie score	56.50 ± 17.86	52.25 ± 19.19	56.50 ± 17.59	0.711
Extroversion score	59.07 ± 19.63	46.96 ± 21.46	52.57 ± 22.11	0.241
Neuroticism score	68.07 ± 22.5	70.79 ± 24.92	67.93 ± 30.31	0.928
SF-12 score				
Preoperative	27.36 ± 4.75	25.08 ± 5.26	28.71 ± 5.33	0.104
Postoperative	35.36 ± 5.75	32.63 ± 6.81	41.36 ± 4.99*	< 0.001*
Improvement	8.00 ± 3.66	7.54 ± 2.67	12.64 ± 2.59*	< 0.001*
KOOS score				
Preoperative	34.93 ± 3.32	32.63 ± 7.63	32.79 ± 5.34	0.510
Postoperative	65.29 ± 6.91	65.75 ± 11.42	75.50 ± 4.69*	0.004*
Improvement	30.36 ± 6.44	33.12 ± 10.56	42.71 ± 7.69*	0.001*

Values are presented as mean ± standard deviation.

OHI: Oxford Happiness Inventory, SF-12: 12-item short form health survey, KOOS: Knee Injury and Osteoarthritis Outcome Score.

\*Significant (2-tailed) at the 0.05 level.

**Table 3.** Questionnaire Scores and Differences among Participants Based on Personality

Score	Personality				p-value
	Stable-extrovert (n = 7)	Stable-introvert (n = 4)	Unstable-extrovert (n = 23)	Unstable-introvert (n = 18)	
Mean age (yr)	66.14 ± 7.29	73.50 ± 7.72	65.65 ± 7.53	68.17 ± 7.76	0.261
Range of motion (°)	120.71 ± 11.34	122.5 ± 2.89	126.52 ± 7.45	120.83 ± 7.33	0.105
OHI score	41.86 ± 9.05	37.75 ± 6.89	39.13 ± 12.43	38.00 ± 14.81	0.917
Lie score	60.71 ± 15.59	52.25 ± 12.58	51.87 ± 17.53	56.06 ± 21.27	0.697
SF-12 score					
Preoperative	30.14 ± 5.84	23.50 ± 2.52	27.39 ± 3.71	25.11 ± 6.49	0.054
Postoperative	37.86 ± 7.90	37.00 ± 5.86	36.74 ± 5.52	33.28 ± 8.34	0.332
Improvement	7.71 ± 2.56	13.50 ± 4.51*	9.35 ± 3.42	8.17 ± 3.52	0.038*
KOOS score					
Preoperative	34.43 ± 4.65	35.53 ± 1.58	31.78 ± 6.47	34.28 ± 6.61	0.460
Postoperative	68.71 ± 8.38	67.75 ± 5.12	69.00 ± 8.27	67.22 ± 13.01	0.952
Improvement	34.29 ± 8.99	32.23 ± 6.11	37.22 ± 9.34	32.94 ± 11.77	0.537

Values are presented as mean ± standard deviation.

OHI: Oxford Happiness Inventory, SF-12: 12-item short form health survey, KOOS: Knee Injury and Osteoarthritis Outcome Score.

\*Significant (2-tailed) at the 0.05 level.

12, PCS, and MCS and postoperative SF-12, PCS, MCS, and KOOS ( $p < 0.01$ ). Preoperative SF-12, PCS, and MCS were correlated strongly and directly with postoperative SF-12, PCS, MCS, and KOOS ( $p < 0.01$ ). Preoperative KOOS only had a significant direct correlation with postoperative KOOS ( $p < 0.05$ ). Extroversion (Eysenck E) had a direct but not significant correlation with pre- and postoperative SF-12, MCS, and PCS, and postoperative KOOS. Also, neuroticism (Eysenck N) was inversely correlated with pre- and postoperative SF-12, PCS, MCS, and KOOS, but the correlation was not statistically significant. These results are demonstrated in Tables 4 and 5. After applying regression analysis, the only independent predictor for postoperative function and HRQL (postoperative SF-12 and KOOS) was OHI ( $p < 0.001$ ).

## DISCUSSION

Results of this study demonstrated the significantly positive effect of higher educational levels and subjective well-being on the outcomes of surgery. Diverse personality traits did not have significant influence on outcome. Patients with higher functional capacity and physical and mental HRQL had significantly better results and satisfaction after TKA.

In this study, no significant difference was found

between men and women preoperatively, but SF-12, MCS (mental health), and KOOS scores were significantly greater in men than women after TKA. Factors that were not measured such as obesity, osteoporosis, and poorer social support may have resulted in these differences. This finding is in agreement with some studies, which have reported that women have poorer outcomes than men,<sup>13,14</sup> possibly due to multiple preoperative factors such as obesity combined with poorer preoperative pain, function, and mental health.<sup>15</sup> Mehta et al.<sup>15</sup> suggested consideration of TKA when pain and function are less severe to improve outcomes for women. In contrast, some studies have shown that sex does not affect TKA outcomes.<sup>16,17</sup> The relationship between age and factors associated with TKA outcome evaluated postoperatively. Despite some studies showing that older age negatively influences the clinical outcome,<sup>16,18</sup> we found no significant correlation between age and functional and mental HRQL after TKA.<sup>19,20</sup>

Our findings in accordance with some other studies supported the hypothesis that the lower educational status could result in poorer outcomes.<sup>9,21</sup> Significant disparities in postoperative function and QOL were present between patients with high school or university degrees and those with lower educational levels. Patients with higher educational status also had significantly higher scores for happiness and less depression before surgery.

**Table 4.** Correlation between Age, OHI, SF-12, PCS, MCS, KOOS, and Eysenck Scores

Variable	OHI	Preoperative				Postoperative				Difference			
		SF-12	PCS	MCS	KOOS	SF-12	PCS	MCS	KOOS	SF-12	PCS	MCS	KOOS
Age	-0.162*	-0.109	-0.018	-0.173	0.039	-0.096	-0.035	-0.125	-0.144	-0.026	-0.075	0.022	-0.165
	0.251 <sup>†</sup>	0.441	0.901	0.220	0.784	0.500	0.808	0.376	0.309	0.857	0.598	0.879	0.242
OHI	1	0.527 <sup>‡</sup>	0.372 <sup>‡</sup>	0.504 <sup>‡</sup>	-0.076	0.643 <sup>‡</sup>	0.504 <sup>‡</sup>	0.672 <sup>‡</sup>	0.705 <sup>‡</sup>	0.470 <sup>‡</sup>	0.242	0.521 <sup>‡</sup>	0.739 <sup>‡</sup>
		0.000	0.007	0.000	0.590	0.000	0.000	0.000	0.000	0.000	0.084	0.000	0.000
Eysenck extroversion	0.064	0.221	0.099	0.253	-0.060	0.241	0.191	0.251	0.073	0.143	0.148	0.098	0.109
	0.654	0.116	0.486	0.071	0.671	0.085	0.175	0.072	0.607	0.311	0.294	0.487	0.443
Eysenck neuroticism	-0.104	-0.052	-0.021	-0.061	-0.024	-0.101	-0.060	-0.117	-0.020	-0.118	-0.061	-0.131	-0.005
	0.461	0.714	0.882	0.667	0.863	0.478	0.671	0.409	0.889	0.405	0.670	0.355	0.975

OHI: Oxford Happiness Inventory, SF-12: 12-item short form health survey, PCS: physical component summary, MCS: mental component summary, KOOS: Knee Injury and Osteoarthritis Outcome Score.

\*Pearson correlation. <sup>†</sup>Statistically significant (2-tailed). <sup>‡</sup>Significant correlation at the 0.01 level (2-tailed).

**Table 5.** Correlation between Preoperative and Postoperative SF-12, PCS, MCS, and KOOS

Variable		Postoperative				Difference			
		SF-12	PCS	MCS	KOOS	SF-12	PCS	MCS	KOOS
Preoperative	SF-12	0.860*	0.787*	0.830*	0.534*	0.203 <sup>†</sup>	0.095	0.232	0.517*
		0.000	0.000	0.000	0.000	0.150 <sup>‡</sup>	0.505	0.098	0.000
	PCS	0.635*	0.754*	0.505*	0.407*	0.074	-0.238	0.304 <sup>§</sup>	0.352 <sup>§</sup>
		0.000	0.000	0.000	0.003	0.604	0.089	0.028	0.011
	MCS	0.804*	0.610*	0.853*	0.489*	0.244	0.312 <sup>§</sup>	0.120	0.505*
		0.000	0.000	0.000	0.000	0.081	0.024	0.396	0.000
	KOOS	0.021	0.073	0.013	0.282 <sup>§</sup>	0.024	0.001	0.036	-0.334 <sup>§</sup>
		0.880	0.606	0.928	0.043	0.866	0.996	0.800	0.015

SF-12: 12-item short form health survey, PCS: physical component summary, MCS: mental component summary, KOOS: Knee Injury and Osteoarthritis Outcome Score.

\*Significant correlation at the 0.01 level (2-tailed). <sup>†</sup>Pearson correlation. <sup>‡</sup>Statistically significant (2-tailed). <sup>§</sup>Significant correlation at the 0.05 level (2-tailed).

There are many different questionnaires and questions used to assess psychological symptoms such as depression and anxiety. Therefore, evidence for their influence on TKA outcome can be less convincing.<sup>2)</sup> Some researchers found that overall knee scores in patients with anxiety or depression did not improve as much as those in patients without anxiety and depression.<sup>22,23)</sup> In our study, an inverse significant correlation was found between postoperative physical and mental health status and depression, educational status, and baseline physical and mental health status. Also, patients with less depressive symptoms

had greater improvement in mental health (Pearson correlation coefficient = 0.506,  $p < 0.001$ ). Our findings are in contrast with these hypotheses that preoperative depression has no influence on outcome<sup>2)</sup> or patients with preoperative depression appear to obtain higher level of satisfaction after TKA than those without.<sup>24)</sup>

There is still controversy about the relationship between personality as a comprehensive reflection of stable psychological state and outcome of TKA. Ramaesh et al.<sup>25)</sup> reported poorer general health in patients with stable-extrovert and unstable-introvert types. However, personal-

ity was not an independent predictor of outcome following TKA in their study. Gong and Dong<sup>5)</sup> found patients with extroverted personality were more satisfied than those with introverted or anxious personality after TKA. In a prospective controlled clinical study, dissatisfied and satisfied participants showed different levels of personality traits. The study suggested that personality traits may be a useful predictive measure for postoperative satisfaction after TKA.<sup>4)</sup> In our study, patients with stable-extrovert personality had significantly higher QOL before surgery. They also had fewer depressive symptoms than others, but the difference was not significant. HRQL and function of all groups improved significantly after TKA, regardless of personality type, and patients with stable-introvert personality had greater but not statistically significant improvement than others. Extroversion had a direct and neuroticism had a negative correlation with subjective well-being, HRQL, and function before and after surgery. None of them were significant. These findings are in agreement with those of Gong and Dong.<sup>5)</sup>

Mental health status and QOL are increasingly addressed in surgical outcomes research. The effect of baseline mental health on postoperative function is the matter of debate. Heck et al.<sup>26)</sup> found an improvement in the level of patient function (PCS) in patients with better baseline mental health (MCS). Also, in other studies, patients with lower baseline MCS had less improvement in functional scores postoperatively.<sup>2,27)</sup> Among our patients, baseline physical and mental health (PCS and MCS) were correlated strongly and directly with postoperative PCS, MCS, KOOS, and their improvement ( $p < 0.01$ ), which means patients with higher baseline mental and physical scores had greater improvement. Baseline KOOS only had significant direct relationship with postoperative KOOS. Patients with lower KOOS preoperatively had greater improvement after TKA (Pearson correlation coefficient =  $-0.324$ ,  $p = 0.017$ ), which is in contrast with Smith and Zautra's findings.<sup>27)</sup> Among many factors that significantly

affect the outcome of TKA, the only independent predictor of physical, mental, and functional outcome was depression (OHI score).

There were some limitations in the present study. The study population was recruited from an academic tertiary care hospital in which patients were usually from low socioeconomic status with a low education level. However, some studies demonstrated that there was no difference in outcome following primary TKA between tertiary and community hospitals.<sup>28)</sup> In addition, the relatively small study population, relatively short follow-up period, and low proportion of males may limit the generalizability of research findings. There are also some factors that were not taken into account such as preoperative body mass index and muscle strength and postoperative social support. However, the significance of this study can be found in the fact that this is the first investigation in an Iranian population to assess the relationship between psychological factors and TKA outcome, using the prospective design and strict criteria to decrease the effects of confounding variables.

Mental, physical, and functional health status and QOL were significantly improved in all patients after TKA. Also, patients with higher baseline mental and physical scores had greater improvement. Outcome of surgery was not significantly different among diverse personality traits. However, because of the diversity of personality categorization and measurement tools, it was difficult to determine its influence on TKA outcome. Patients with greater well-being had significantly greater improvement in mental health. Finally, the only independent predictor of physical, mental, and functional outcome was depression. Further multicenter research with a larger sample size is needed.

## CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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