

# The Impact of Psychological Factors on Device Removal Surgery

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## Abstract

**Background:** Implant removal is a common procedure in orthopedic surgery which can be associated with many complications such as scar formation, hematoma, nerve injury, infection, and refracture. Indications for orthopedic implant removal have declined in recent years. Most studies have considered orthopedic hardware removal as an unnecessary procedure in the absence of severe complications such as nonunion. Some studies have reported the complications of orthopedic hardware removal to be 24% to 50% dependent on their types and locations as well as on other factors such as patient's condition and the orthopedist's experience. **Objectives:** The present study surveyed possible mental and psychological causes among patients who asked for removal procedures in spite of orthopedic surgeons' advice and being aware of complications.

**Patients and Methods:** Patients who had undergone plating for the treatment of radius and ulna fractures from 2011 to 2013, were told that it is not necessary to remove the plate and they were warned of all the risks of removal surgery, such as anesthesia, possible nerve or vascular damage, and the cost of surgery. Then, their tendency to remove the plate was examined based on evaluation criteria scores. Patients were divided into two groups: patients who insisted on surgery despite all the risks and patients who had little tendency or gave up after explanations. Both groups were given visual analog pain scale (VAS), symptom checklist-90 (SCL-90), and pain catastrophizing scale (PCS) questionnaires. The questions were explained for patients by an expert trained in the clinic and in case of ambiguity further explanations were given to the patients. The data were then entered into statistical package for the social science (SPSS) version 20 for analysis.

**Results:** A total of 29 patients with plates were enrolled. The first group consisted of 16 male and 13 female patients. In the control group (group II), there were 30 patients with no tendency for plate removal. In this group, 15 patients were male and 15 were female. The mean age of the first group was  $38.25 \pm 11.12$  years and for the second group it was  $36.82 \pm 12.01$  years. There was no significant difference between the two groups in terms of age and gender. Mean discomfort of patients was  $7.75 \pm 1.74$  in the first and  $3.96 \pm 1.90$  in the second group, indicating a statistically significant difference ( $P = 0.000$ ). Mean VAS score was  $3.96 \pm 1.20$  in the first group and  $3.80 \pm 1.15$  in the second group, which was not statistically significant ( $P = 0.593$ ). Mean daily pain and discomfort was  $10.62 \pm 3.09$  hours in the first and  $4.86 \pm 2.23$  hours in the control group, indicating a statistically significant difference ( $P = 0.000$ ). Linear regression analysis results demonstrated a significant correlation between increased VAS scores in the first group ( $P = 0.000$ ), but it was not significant in the second group ( $P = 0.083$ ). The results also showed that increase in time of daily pain and discomfort had a linear relationship with increased discomfort score in both groups ( $P = 0.00$ ). Mean pain catastrophizing scale (PCS) score was  $10.13 \pm 3.62$  in the first and  $9.56 \pm 3.07$  in the second group, which was not statistically significant. Mean somatization score was  $52\% \pm 6.53\%$  and  $47.96\% \pm 7.17\%$  in the first and second groups, respectively, which showed no significant differences ( $P = 0.013$ ). Obsessive compulsive score was  $54.63 \pm 5.34$  in the first and  $46.63 \pm 4.49$  in the second group, which was statistically significant ( $P = 0.000$ ).

**Conclusions:** Mental and psychological backgrounds can affect the severity of discomfort of the implant. Given that so far the present study is the only study investigating the relationship between mental criteria and tendency of patients for implant removal, further studies with larger sample sizes seem warranted.

**Keywords:** Psychological Factors, Device Removal, Surgery

## 1. Background

Implant removal is a common procedure in orthopedic surgery (1, 2) which can be associated with many complications such as scar formation, hematoma, nerve injury,

infection, and refracture (2, 3). Indications for orthopedic implant removal have declined in recent years. Most studies have considered orthopedic hardware removal as an unnecessary procedure in the absence of severe complica-

tions such as nonunion (3). Some studies have reported the complications of orthopedic hardware removal 24% - 50% depending on their types and locations and other factors such as patient's condition and the surgeons experience (4). Although orthopedic surgeons are aware of the complications and risks of hardware removal, this procedure is very common. A major reason is patient's request to remove the hardware. Some studies have reported that patients have asked for implant removal despite being aware of complications of implant removal (1, 2) and orthopedic surgeons' explanation. Several studies have indicated pain and discomfort, and even untrue fear of neoplasm occurrence at the hardware site (2, 3, 5) to be the causes of their insistence on removing the implant.

## 2. Objectives

Implant removal can lead to significant complications and most studies have reported lack of cost-benefit. The present study surveyed possible mental and psychological causes in patients who asked for removal procedures, in spite of orthopedic surgeons' advice to the contrary.

## 3. Patients and Methods

This cross-sectional study assessed patients who had undergone plating for the treatment of radius and ulna fractures from 2011 to 2013 in Poursina hospital. The exclusion criteria was cases with mal-union and nonunion and patients with open growth plates. In the last follow-up, they were told that it is not necessary to remove the plate and they were warned of all the risks of removal surgery such as anesthesia risks, possible nerve or vascular damage, and cost of surgery. Then, their tendency to remove the plate was evaluated based on numerical rating scale (from 0 to 10). Patients were divided into two groups: patients who insisted on surgery despite all the risks and patients who had little tendency or gave up after the explanations. Both groups were given visual analogue scale (VAS), symptom checklist-90-revised (SCL-90-R), and pain catastrophizing scale (PCS) questionnaires.

SCL-90-R is a questionnaire widely used for self-report of psychological distress and multiple aspects of psychopathology.

SCL-90-R can be applied for individuals 13 years and older. It consists of 90 items and takes 12 - 15 minutes to fill. This test has 90 items on a five-degree Likert scale (0 = none, 1 = slight, 2 = somewhat, 3 = high, 4 = extreme), yielding nine scores along primary symptom dimensions and three scores among global distress indices. The primary symptom dimensions that are assessed are somati-

zation, obsessive-compulsive disorder, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. A number of studies have been conducted demonstrating the reliability, validity, and use of the instrument (6).

The pain catastrophizing scale (PCS) with a 13-item self-report for measuring pain catastrophizing feature was rated on a five-point scale: 0 (not at all) to 4 (all the time) (7, 8).

Patients' discomfort feeling was evaluated with numerical rating scale from 0 to 10 (discomfort score) and they were asked in which time of day they had discomfort feelings. The questions were explained for patients by an expert trained in the clinic and in case of unclear questions further explanations were given to the patients. The data were then entered into statistical package for the social science (SPSS) version 20.0 for analysis. T-test was used for statistical analysis of parameters with normal distribution and chi-squared test was used for parameters with non-normal distributions. Linear regression analysis was used for comparison of linear relationship between the parameters of the study.

## 4. Results

A total of 29 patients with plate removal tendency were enrolled. The first group consisted of 16 male (55.17%) and 13 female patients. In the control group (group II) there were 30 patients with no tendency for plate removal. In this group, 15 patients were male (50%) and 15 were female. Mean age in the first group was  $38.25 \pm 11.12$  years and for the second group it was  $36.82 \pm 12.01$  years. There was no significant difference between the two groups in terms of age and gender. Mean discomfort of patients in the first group was  $7.75 \pm 1.74$  and in the second group  $3.96 \pm 1.90$ , indicating a statistically significant difference ( $P = 0.000$ ). Mean VAS score was  $3.96 \pm 1.20$  in the first and  $3.80 \pm 1.15$  in the second group, which was not statistically significant ( $P = 0.593$ ). Mean daily pain and discomfort was  $10.62 \pm 3.09$  hours in the first and  $4.86 \pm 2.23$  hours in the control group, indicating a statistically significant difference ( $P = 0.000$ ). Linear regression analysis results demonstrated a significant correlation ( $R = 0.418$ ,  $R^2 = 0.175$ ) between increased VAS scores in the first group ( $P = 0.000$ ), but it was not significant in the second group ( $P = 0.083$ ) (Figure 1). The results also showed that the increase in time of daily pain and discomfort had a significant linear relationship ( $P = 0.000$ ) with increased the discomfort score in both groups (group I:  $R = 0.840$ ,  $R^2 = 0.707$ ; group II:  $R = 0.800$ ,  $R^2 = 0.640$ ) (Figure 2). Mean PCS score was  $10.13 \pm 3.62$  in the first and  $9.56 \pm 3.07$  in the second group, which was not statistically significant (Table 1). Mean somatization score was

52 ± 6.53% and 47.96 ± 7.17% in the first and second groups, respectively, which showed no significant differences ( $P = 0.013$ ). Obsessive compulsive score was 54.63 ± 5.34 in the first and 46.63 ± 4.49 in the second group, which was statistically significant ( $P = 0.000$ ). The scores of SCL-90 questionnaire for all the criteria and other results are presented in Tables 2 - 5.

**Table 1.** Mean Pain Catastrophizing Scale Score in the Two Groups

| PCS            | Mean ± SD         | P Value |
|----------------|-------------------|---------|
| <b>Group 1</b> | 10.1379 ± 3.62259 | 0.512   |
| <b>Group 2</b> | 9.5667 ± 3.07025  | 0.512   |

Abbreviation: PCS, pain catastrophizing scale.

## 5. Discussion

Orthopedic hardware removal is a common operation that should not turn into a routine practice. Although some recent studies have recommended orthopedic hardware removal in certain cases, they do not support it as a routine (3, 9). Despite orthopedic surgeons' advice about high incidence of complications, yet patients' demand to remove hardware is considered as one of the primary reasons for orthopedic hardware removal (3).

Ochs BG et al. evaluating the risk of refracture in the process of long bone implant removal reported that risk of complications due to implant removal cannot be completely eliminated (10).

Previous studies (1-4) have reported the incidence of significant complications such as neurological complications, scar, infection, and refracture after radius plates removal same as those in this study. In addition, patients had no serious symptoms at the plate site and they simply demanded because they felt they had to remove the plate.

Brown, investigating impact of pain resulted from surgical pin placement in ankle fractures on functional outcomes, reported that pin removal generally would reduce pain in patients, but pin removal had no significant influence on functional outcomes of patients (11).

Kirchhoff et al. stated the effectiveness of locking plate removal in reducing pain, but given the surgical complication rates and overall costs, plate removal was not recommended (12).

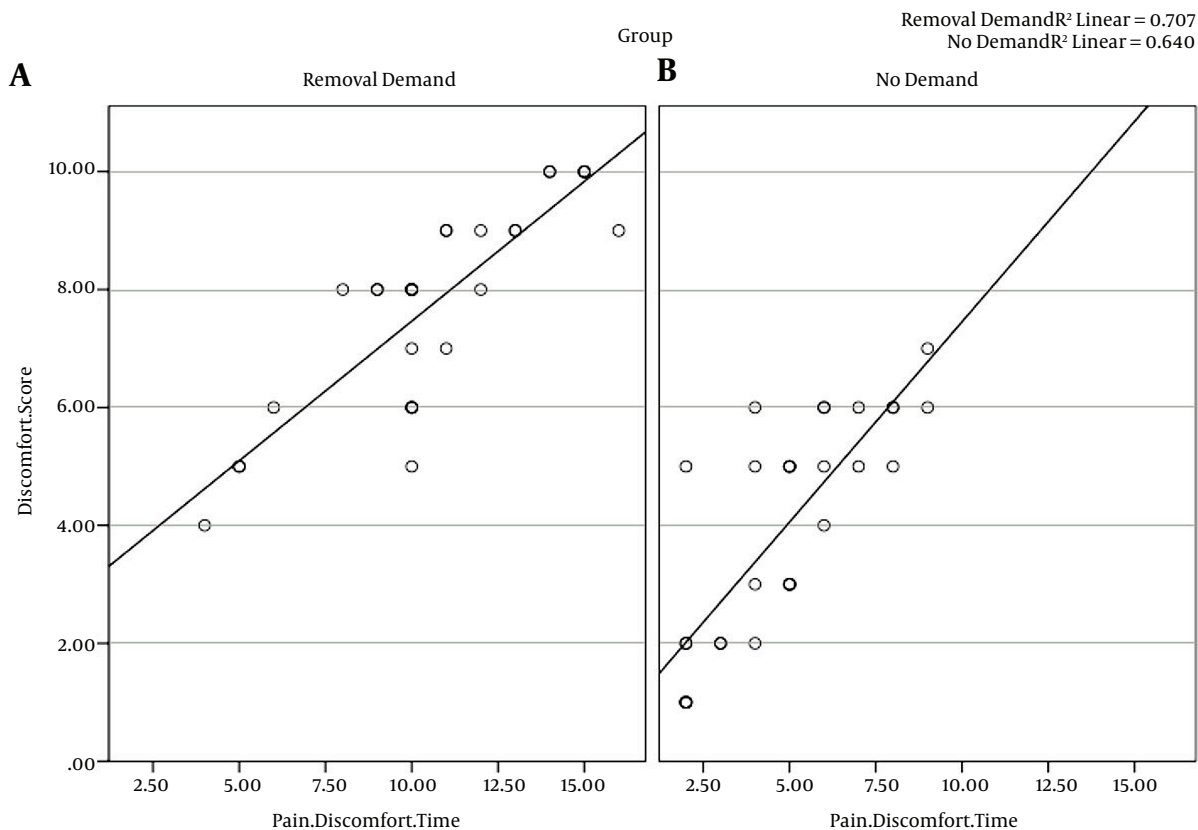
Our study results showed that as expected, the mean score of discomfort was significantly higher in patients with tendency for implant removal (group I) than the control group (group II). Although most patients' major complaint was pain at the implant site and for this reason they

**Table 2.** The Scores of Symptom Checklist-90 Questionnaire for All the Criteria

| SCL-90/Group                         | Mean (SD)         | P Value |
|--------------------------------------|-------------------|---------|
| <b>Somatization</b>                  |                   | 0.013   |
| 1                                    | 52.5517 (6.53336) |         |
| 2                                    | 47.9667 (7.17507) |         |
| <b>Obsessive compulsive disorder</b> |                   | 0.000   |
| 1                                    | 54.6552 (5.34038) |         |
| 2                                    | 46.6333 (4.49891) |         |
| <b>Interpersonal sensitivity</b>     |                   | 0.155   |
| 1                                    | 43.6207 (5.58323) |         |
| 2                                    | 41.6000 (5.18353) |         |
| <b>Depression</b>                    |                   | 0.696   |
| 1                                    | 55.4828 (4.02333) |         |
| 2                                    | 55.0333 (4.73056) |         |
| <b>Anxiety</b>                       |                   | 0.281   |
| 1                                    | 46.0000 (3.49489) |         |
| 2                                    | 44.9333 (4.00804) |         |
| <b>Hostility</b>                     |                   | 0.900   |
| 1                                    | 37.4138 (4.46028) |         |
| 2                                    | 37.5667 (4.80433) |         |
| <b>Phobic anxiety</b>                |                   | 0.159   |
| 1                                    | 22.4483 (3.01882) |         |
| 2                                    | 21.3667 (2.79758) |         |
| <b>Paranoid ideation</b>             |                   | 0.310   |
| 1                                    | 36.1379 (3.13647) |         |
| 2                                    | 35.2667 (3.39303) |         |
| <b>Psychoticism</b>                  |                   | 0.876   |
| 1                                    | 25.1379 (2.21560) |         |
| 2                                    | 25.0333 (2.84645) |         |

Abbreviation: SCL-90, symptom checklist-90.

demanded implant removal, mean of VAS score was negligible in the two groups. However, pain and discomfort endurance mean at implant site was significantly higher in the first group. In fact, patients of both groups had significant levels of pain and discomfort at implant site, but patients of the second group experienced pain fewer hours per day, which seemed to be the main reason of disinclination for implant removal. In group I, the relationship between mean of VAS score and mean of general discomfort score had steeper gradient than the control group based on linear regression analysis (Figure 1). However, the gradient of the relationship between mean hours of pain endurance per day was almost identical with mean score of



**Figure 1.** The Relation Between Pain Discomfort Time and Discomfort Score in Both Groups. A, Removal demand; B, No demand

**Table 3.** Model Summaries

| Model | R                  | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|--------------------|----------|-------------------|----------------------------|
| 1     | 0.840 <sup>a</sup> | 0.707    | 0.696             | 0.96199                    |
| 2     | 0.800 <sup>a</sup> | 0.640    | 0.627             | 1.16146                    |
| 3     | 0.418 <sup>b</sup> | 0.175    | 0.145             | 1.61414                    |
| 4     | 0.017 <sup>b</sup> | 0.011    | -0.024            | 1.92516                    |

<sup>a</sup>Predictors: (constant) pain discomfort time.

<sup>b</sup>Predictors: (Constant) VAS.

pain and discomfort in both groups (Figure 2), indicating that increase in hours of pain and discomfort endurance in both groups can identically cause general discomfort.

Based on linear regression analysis of the relationship between changes in VAS score in the first group, the correlation with discomfort score changes were not significant statistically, but in the second group, significant statistical correlation was found that according to  $R = 0.418$  (Pearson's correlation coefficient), represents a moderate correlation,  $R^2 = 0.175$  (coefficient of determination), suggesting

that VAS changes can determine 17.5% of discomfort score changes, which is not very high. Between “time of pain and discomfort in the day” and “discomfort score” in patients, linear regression analysis showed a significant correlation in both groups. According to Pearson's correlation coefficient, a strong correlation in the first group ( $R = 0.840$ ) and second group ( $R = 0.800$ ) was shown and coefficient of determination ( $R^2$ ) was calculated for each; this can determine 70.7% of discomfort score changes in the first group and 64% in the second group; that is a significant percent-

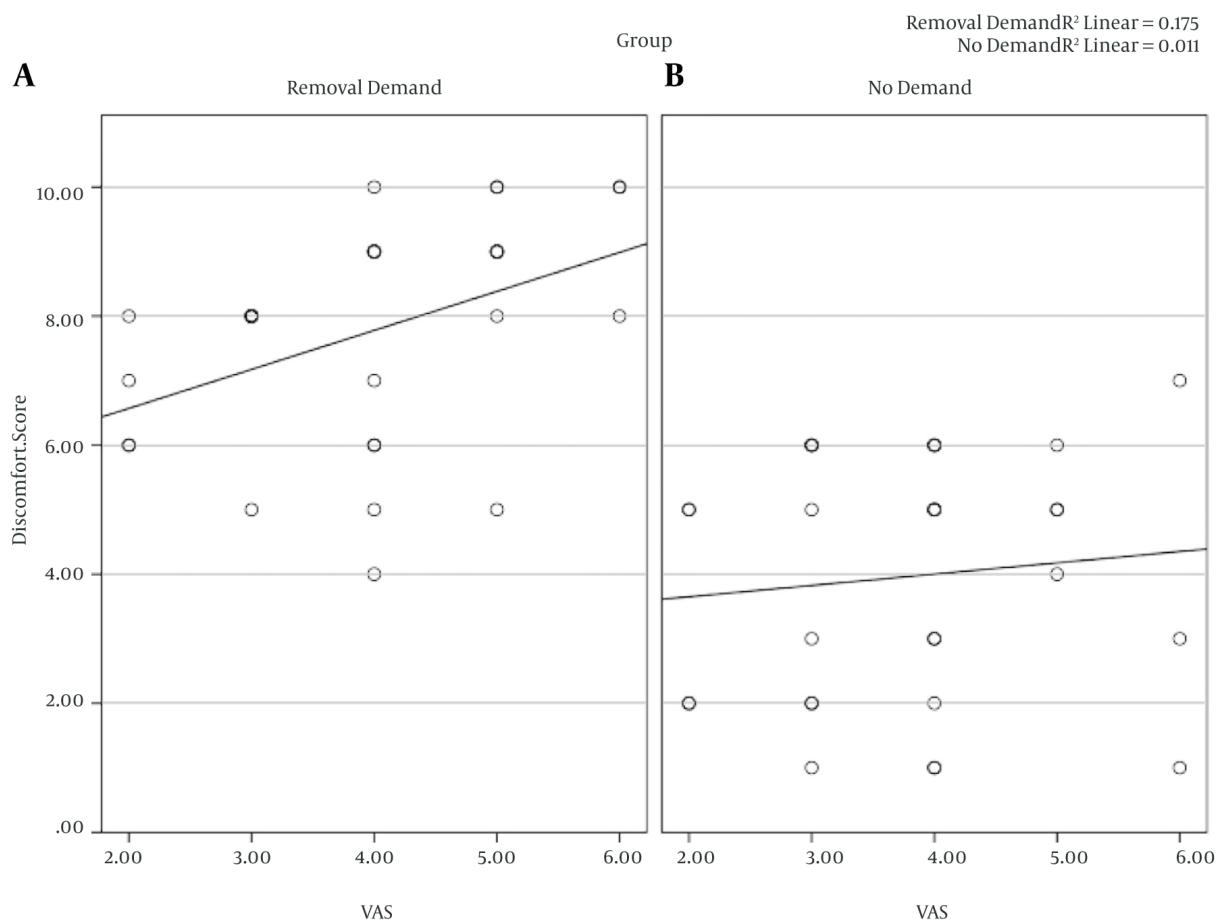
**Table 4.** Analysis of Variance<sup>a</sup>

| Model      | Sum of Squares | df | Mean Square | F      | P Value            |
|------------|----------------|----|-------------|--------|--------------------|
| <b>1</b>   |                |    |             | 65.185 | 0.000 <sup>b</sup> |
| Regression | 60.324         | 1  | 60.324      |        |                    |
| Residual   | 24.987         | 27 | 0.925       |        |                    |
| Total      | 85.310         | 28 |             |        |                    |
| <b>2</b>   |                |    |             | 49.811 | 0.000              |
| Regression | 67.195         | 1  | 67.195      |        |                    |
| Residual   | 37.772         | 28 | 1.349       |        |                    |
| Total      | 104.967        | 29 |             |        |                    |
| <b>3</b>   |                |    |             | 5.743  | 0.024 <sup>c</sup> |
| Regression | 14.964         | 1  | 14.964      |        |                    |
| Residual   | 70.347         | 27 | 2.605       |        |                    |
| Total      | 85.310         | 28 |             |        |                    |
| <b>4</b>   |                |    |             | 0.322  | 0.575 <sup>c</sup> |
| Regression | 1.192          | 1  | 1.192       |        |                    |
| Residual   | 103.775        | 28 | 3.706       |        |                    |
| Total      | 104.967        | 29 |             |        |                    |

<sup>a</sup>Dependent Variable: discomfort score.<sup>b</sup>Predictors: (Constant) pain discomfort time.<sup>c</sup>Predictors: (Constant) VAS.**Table 5.** Linear Regression of of Results<sup>a</sup>

| Model                | Coefficients <sup>b</sup>   |            |                           | T     | P Value |
|----------------------|-----------------------------|------------|---------------------------|-------|---------|
|                      | Unstandardized Coefficients |            | Standardized Coefficients |       |         |
|                      | B                           | Std. Error |                           |       |         |
| <b>1</b>             |                             |            | 0.841                     |       |         |
| Constant             | 2.728                       | 0.648      |                           | 4.208 | 0.000   |
| Pain Discomfort Time | 0.474                       | 0.059      |                           | 8.074 | 0.000   |
| <b>2</b>             |                             |            | 0.800                     |       |         |
| Constant             | 0.659                       | 0.514      |                           | 1.281 | 0.211   |
| Pain Discomfort Time | 0.680                       | 0.096      |                           | 7.058 | 0.000   |
| <b>3</b>             |                             |            | 0.419                     |       |         |
| Constant             | 5.352                       | 1.044      |                           | 5.136 | 0.000   |
| VAS                  | 0.604                       | 0.252      |                           | 2.396 | 0.024   |
| <b>4</b>             |                             |            | 0.107                     |       |         |
| Constant             | 3.301                       | 1.226      |                           | 2.692 | 0.012   |
| VAS                  | 0.175                       | 0.309      |                           | 0.567 | 0.575   |

<sup>a</sup>The relation between pain discomfort time and discomfort score in the first and second groups, and the relation between VAS and Discomfort score in the first and second groups.<sup>b</sup>Dependent variable: discomfort score.



**Figure 2.** The Relation Between Visual Analogue Scale and Discomfort Score. A, Removal demand; B, No demand.

age.

The results of SCL-90 questionnaire showed that patients of the first group had higher scores than the control group for obsessive compulsive disorder. In fact, this increase in score could not prove the existence of obsessive compulsive personality disorder in patients. However, evidence somehow showed similar behavior of those with this disorder in patients. Accordingly, it might be possible to explain higher incidence of daily pain and discomfort in the first group. In fact, the extent to which the patients paid attention to foreign body can account for their higher overall discomfort and pain endurance per day. Furthermore, somatization score indicated higher scores in the first group, which can be explained by the results obtained from the VAS criteria and overall discomfort score.

Normally in a society, different people in terms of personality, behavior, and action-reaction in different conditions can be close to a variety of personality disorders with-

out really suffering from one. On the other hand, many people with personality disorders may never be recognized due to the severity of the disorder. In general, regarding the results of this study, it can be concluded that mental and psychological backgrounds can affect the severity of the discomfort of implant. Given that so far the present study has been the only study investigating the relationship between mental criteria and tendency of patients for implant removal, further studies with larger sample sizes may provide more insight into this field. However, with respect to extremely high complications for implant removal, cooperating with a psychologist to counsel or prescribe medications as the last step before operating can reduce the tendency for removal surgery.

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## Footnote

**Authors' Contribution:** Study concept and design, acquisition of data, administrative, technical, and material support: Ahmadreza Mirbolook; analysis and interpretation of data: Mirmostafa Sadaat; drafting of the manuscript: Amirmohammad Gholizadeh; critical revision of the manuscript for important intellectual content: Fatemeh Noughani; statistical analysis: Sadegh Abedi; study supervision: Mohammadreza Golbakhsh.

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